Appendix U

Alternatives

2.4.4.6 Recreation Facilities

Changes to the recreation facilities surrounding the existing reservoirs would be the same as those in the Proposed Action (see Table 2-14).

2.4.4.7 Keno Transfer

The Partial Facilities Removal of Four Dams Alternative would include the transfer of Keno Dam as a connected action in the same fashion as for the Proposed Action. The description of the transfer presented in Section 2.4.3.7 characterizes how the transfer would be executed under the Partial Facilities Removal of Four Dams Alternative.

2.4.4.8 East and Westside Facilities – Programmatic Measure

The Partial Facilities Removal of Four Dams Alternative would include decommissioning the East Side and Westside Facilities in the same fashion as the Proposed Action. The description of the facility decommissioning presented in Section 2.4.3.8 characterizes how decommissioning would be completed under the Partial Facilities Removal of Four Dams Alternative.

2.4.4.9 City of Yreka Water Supply Pipeline Relocation – Programmatic Measure

The Partial Facilities Removal of Four Dams Alternative would include the relocation of the City of Yreka Water Supply Pipeline in the same fashion as the Proposed Action. The description of the relocation presented in 2.4.3.9 characterizes how the relocation would be completed under the Partial Facilities Removal of Four Dams Alternative.

2.4.4.10 KBRA – Programmatic Measures

The Partial Facilities Removal Alternative would include implementation of the KBRA in the same fashion as the Proposed Action. The description of the KBRA presented in Section 2.4.3.10 characterizes the plans, programs, and actions that would be pursued under the Partial Facilities Removal of Four Dams Alternative.

2.4.5 Alternative 4: Fish Passage at Four Dams

Alternative 4 would provide upstream and downstream fish passage at the Four Facilities. The Fish Passage at Four Dams Alternative would not satisfy the KHSA; consequently, the KBRA would not be implemented (although ongoing restoration activities in the No Action/No Project Alternative may continue). For the purposes of this analysis, alternatives that would not result in full implementation of the KHSA do not include the KBRA as a connected action to the alternative. Additionally, the transfer of Keno Dam to DOI would not move forward as a connected action.

The description of Alternative 4 uses information from the *United States Department of the Interior's Filing of Modified Terms, Conditions, and Prescriptions (Klamath Hydroelectric Project, No. 2082)* (DOI 2007) and from the *National Marine Fisheries Service Modified Prescriptions for Fishways and Alternatives Analysis for the Klamath Hydroelectric Project (FERC Project No. 2082)* (NOAA Fisheries Service 2007). These fishway prescriptions and mandatory conditions were developed during the FERC

relicensing process. Issues of Material Fact associated with the prescriptions and mandatory conditions were challenged; the resulting Administrative Law Judge decision found that PacifiCorp failed to meet its burden of proof on most factual issues in dispute. Attachment B of Appendix A includes the full list of prescriptions and mandatory conditions; several of the prescriptions include studies to determine if features are necessary (such as spillway and tailrace modification).

For the purposes of analysis in this EIS/EIR, however, Alternative 4 has been developed with some assumptions regarding details and feature designs for purposes of this analysis that are not included or not yet determined for the fishway prescriptions and do not reflect any final decision by NOAA Fisheries Service or USFWS regarding any differences from the express text of the fishway prescriptions or how any decision may be made under the terms of the fishway prescriptions. Alternative 4 thus includes some specific fishway facility design and construction details beyond what are specifically required in the prescriptions and are based on designs of similar fishway facilities used at other hydroelectric facilities. For example, the prescriptions include spillway modification at Copco 1 Reservoir; Alternative 4 includes a fish screen at the power intake and a fish collection device to divert fish from the spillway. Prior to advancing to feasibility-level of design, the Hydropower Licensee must obtain concurrence from NOAA Fisheries Service and USFWS related to proposed modifications for each independent facility, or any major feature of a facility (DOI 2007; NOAA Fisheries Service 2007).

Flows within the Hydroelectric Reach would change compared to the No Action/No Project Alternative because of the mandatory conditions related to releases from J.C. Boyle Dam and Powerplant. A key 4(e) condition requires at least 40 percent of J.C. Boyle inflow to be released into the Bypass Reach. Under this alternative, the J.C. Boyle Powerhouse would produce peaking power only one day a week to coincide with recreation releases. This alternative would generate less power than current production because of the change in peaking operations and the flow requirements for the J.C. Boyle Bypass Reach. Flows downstream from Iron Gate Dam, however, would be similar to those in the No Action/No Project Alternative (see Figure 2-7).

This alternative would be implemented through FERC licensure including 401 certifications to an entity that would operate the Four Facilities (the “Hydropower Licensee”). Inflows to Upper Klamath Lake, and outflows from Iron Gate Dam are assumed to be the same under the Fish Passage at Four Dams Alternative as described above for the No Action/No Project Alternative. The ongoing resource management activities, TMDLs, biological opinions, and other regulatory conditions described under the No Action/No Project Alternative would also occur under this alternative.

This section describes general information about the fish passage facilities that would be constructed, and the following sections discuss aspects unique to each facility. Typical upstream fish passage facilities at each dam would consist of pool and weir type fish ladders to provide the safe, timely, and effective upstream passage of Chinook and coho salmon, steelhead trout, Pacific lamprey, and redband trout. This type of fish ladder is

generally constructed from reinforced concrete and occasionally uses metal or wood hardware for adjustable components. In order to meet the prescribed fish passage criteria (DOI 2007; NOAA Fisheries Service 2007), the fish ladders would use 6-inch steps between each weir that would result in an overall structure slope of 4 and 6 percent. At a minimum, each ladder bay would measure 8 feet long by 6 feet wide by 5 feet deep to meet the minimum pool requirements (NOAA Fisheries Service 2008), which would drive the structure slope of 4 to 6 percent. The FERC Final EIS identified a 10 percent slope, but that slope would not meet current requirements for fish ladders. Figure 2-22 shows an example of a cast-in-place pool and weir fish ladder that is similar to that proposed for upstream fish passage at the Four Facilities under this alternative. Final design of these structures would likely exceed this minimum pool dimension by 50 to 100 percent in order to meet all regulatory criteria and minimize turbulence in the ladder bays. Table 2-24 provides a minimum footprint for each upstream fish ladder.

Figure 2-22. Example of cast-in-place pool and weir fish ladder.

Table 2-24. Minimum Structure Footprint and Dimensions for Fish Ladders at Each Dam

Dam	Vertical Drop (feet)	Min. Number of Pools	Min. Structure Length (feet)	Min. Structure Footprint (square feet)
J.C. Boyle	61	122	1,089	8,712
Copco 1	124	249	2,241	17,928
Copco 2	22	44	396	3,168
Iron Gate	157	314	2,826	22,608

Vertical Drop Source: CH2M Hill 2003

The J.C. Boyle and Copco 2 fish ladders are well within typical pool and weir fish ladders being designed today to meet fish passage criteria for the vertical drop. The Copco 1 and Iron Gate fish ladders are substantially longer and have a bigger elevation differential; however, there are two successful examples in Oregon where bigger elevation differentials have been overcome with pool and weir fish ladders for upstream fish passage. The two examples are the Faraday/North Fork ladder on the Clackamas River (196 feet tall, 1.9 miles long) and the Pelton ladder on the Deschutes River (230 feet tall, 2.8 miles long) (Ratliff et. al. 1999). The Pelton ladder was shut down in 1968 primarily due to downstream juvenile passage and not upstream passage.

Fishway prescriptions require two downstream entrances and associated entrance pools for each fish ladder (DOI 2007; NOAA Fisheries Service 2007). All fish ladders would require an auxiliary water supply (AWS) to ensure adequate attraction flows at the downstream and to draw fish into the fish ladder and moderate water temperatures. The AWS would consist of a pipeline or intake that draws water from the reservoir and releases it in the fish ladder and near the fishway entrance pools. To accommodate increased flows, the downstream bays of the fish ladder would be larger than upstream bays in the fish ladder.

Downstream fish passage facilities would vary at each dam. Generally, the facilities would include fish screens and collection facilities to screen the fish away from the intake structures for the power generation facilities and the spillways (if they are unsuitable for downstream passage). Table 2-25 summarizes the fish passage facilities that would be required at each dam under this alternative.

Table 2-25. Fish Passage Improvements under the Fish Passage at Four Dams Alternative

Dam	Upstream Fish Passage	Spillway Modifications[1]	Tailrace Barrier[1]	Fish Screens & Bypass
J.C. Boyle	New fish ladder over dam with auxiliary water supply (AWS) for attraction	Spillway modification to provide smooth transition	Extend river bank and install cutoff screen	New fish screen with bypass
Copco 1	New fish ladder over dam with AWS	Collection device	Extend river bank and install cutoff screen	New fish screen with bypass
Copco 2	New fish ladder over dam with AWS	Spillway modification to provide smooth transition	Extend river bank and install cutoff screen	New fish screen with bypass
Iron Gate	New fish ladder over dam with AWS, observation and sorting station in fish ladder	Spillway modification to provide smooth transition		New fish screen with bypass

Notes:

1. For the purposes of analysis in this EIS/EIR, Alternative 4 includes some specific fishway facility design and construction details that are beyond those required in the prescriptions. The modified prescriptions provide that the applicant is allowed to perform site-specific studies to determine if spillway modifications and tailrace barriers are necessary at the developments where these are prescribed. However, the modified prescriptions provide that spillway modifications and tailrace barriers shall be constructed and operated unless and until USFWS and NOAA Fisheries Service determine based on any such site-specific studies that any prescribed spillway modifications or tailrace barriers are unnecessary.

2.4.5.1 Construction Details

Construction of fish ladders represents the bulk of the work under this alternative. The Hydropower Licensee would construct the ladders from reinforced concrete using construction methods typical for civil infrastructure work.

Table 2-26 shows estimated quantities of concrete for each facility.

Table 2-26. Estimated Minimum Amount of Reinforced Concrete Necessary for Fish Ladder at Each Dam

Dam	Reinforced Concrete (yd^3)
J.C. Boyle	2,800
Copco 1	5,800
Copco 2	1,000
Iron Gate	7,000

The Hydropower Licensee would need to control water and isolate the work area from flowing water and aquatic organisms throughout the duration of construction. Control mechanisms would be installed prior to starting work for each dam removal. The Hydropower Licensee could control water in most areas using gravity diversions; however, pumps could be required to dewater isolated ponding. Dewatering would require electric, gasoline, or diesel powered pumps, along with flexible hosing to convey water. Pumps would discharge water away from the river into upland areas to prevent discharge of fine sediments to waterways.

The Hydropower Licensee would work in wet conditions in areas that cannot be dried. For in-water work, the Hydropower Licensee would use physical barriers of a type and in a manner similar to that used under the dam removal alternatives.

The following sections provide a detailed description of necessary fish passage facilities for each dam under the Fish Passage at Four Dams Alternative.

2.4.5.1.1 J.C. Boyle Fish Passage Facilities[6]

The J.C. Boyle site has the best access for construction equipment and staging for construction. Equipment and materials could be brought into the site on existing gravel access roads and temporary access roads where necessary.

Upstream Passage

J.C. Boyle Dam has an existing pool and weir concrete fish ladder on the north side of the spillway, but it does not meet current design criteria and must be replaced because of its

[6] Feature design has been provided in this EIS/EIR to support effects analysis. If the Klamath Hydroelectric Project is relicensed, the licensee would be required to obtain concurrence from USFWS and NOAA Fisheries Service regarding fishway design and construction plans for each facility prior to advancing to feasibility-level of design (NOAA Fisheries Service 2007; DOI 2007).

configuration and poor structural condition. The Fish Passage at Four Dams Alternative would include removal of the existing fish ladder structure and construction of a new pool, weir, and reinforced concrete fish ladder on the north side of the dam spillway, at or near the same location as the existing fish ladder (see Figure 2-23).

Figure 2-23. Conceptual Layout of J.C. Boyle Fish Passage Facilities.

The overall difference in water levels from the downstream river to J.C. Boyle Reservoir ranges from 55 to 61 feet, depending on reservoir pool elevation. The new fish passage facilities would have multiple openings into the reservoir to accommodate the reservoir pool fluctuation while maintaining continual upstream passage. The new ladder would have two entrances to accommodate low flow and high flow conditions.

An AWS would be necessary for temperature and attraction flow mitigation. The AWS would draw water from the reservoir through a screened inlet and variable height intake structure to provide water temperature control. The AWS would pipe water into the fish ladder at two locations.

Construction of these facilities would begin with demolition and removal of the existing fish ladder using mechanical means (such as hydraulic shears or hoe-ram). The Hydropower Licensee would then install the new reinforced concrete fish ladder by constructing concrete forms, laying the reinforcement, and pouring concrete. The Hydropower Licensee would construct a cofferdam around the area where the fish ladder enters the reservoir to allow construction in dry conditions.

Downstream Fish Passage – Water Intake

The existing water intake has a design flow of 3,000 cfs, which requires a minimum fish screen of 7,500 square feet based on an approach velocity of 0.4 feet per second (ft/s). The Fish Passage at Four Dams Alternative would include a conventional fish screen at the J.C. Boyle water intake. The fish screen would terminate in a 36 inch diameter fish bypass pipe (approximately 40 cfs) that would run from the water intake to a bypass facility for recording downstream migrating fish and then continuing on to a controlled outfall in the river downstream from the dam. The fish screen would be stainless steel and the fish return pipe would be standard steel with concrete and steel support structures along the length of the pipe.

The fish screen would be fabricated offsite and installed by a crew of skilled workers using light equipment. This phase of construction would require extensive dewatering and work isolation effort in order to provide a dry or partially isolated work area. Dewatering could require reservoir water level manipulation or construction of coffer barriers with pumps to dewater the work area around the water intakes.

Downstream Fish Passage – Spillway

Radial gates regulate discharge over the J.C. Boyle Dam's concrete spillway section that terminates in an abrupt drop onto bedrock. Modifications to the spillway would likely include removing the drop at the downstream end of the spillway by building a cast-in-place concrete transition and minor channel modifications. This design would likely reduce fish mortality on the rock outcrop below the spillway and provide a smooth transition for downstream passage. Construction would involve a small amount of demolition and concrete placement; methods would be similar to the work on the new fish ladder.

Tailrace Barrier

The power generation turbines at J.C. Boyle Powerhouse are several miles downstream from the dam with a large outlet bay, or tailrace area, that flows into the Klamath River (see Figure 2-2). This tailrace has the potential for false attraction waters and needs a barrier. The Fish Passage at Four Dams Alternative would include extension of the bank of the Klamath River and installation of a stainless steel, wedge-wire cutoff screen.

2.4.5.1.2 Copco 1 Fish Passage Facilities[7]

The Copco 1 Dam site has difficult site access because of steep canyon terrain. The Fish Passage at Four Dams Alternative would include construction of temporary roads for site access and other special provisions to move materials, such as a tower crane or aerial tramway.

Upstream Passage

Fish Passage at Four Dams Alternative would include a new pool and weir fish ladder on the right side of Copco 1 Dam for upstream fish passage. The fish ladder would have an AWS plumbed into it at two locations to moderate water temperatures, flow in the fishway, and attraction flows at the downstream end of the fishway. The downstream entrance of the fish ladder would have two entrances for low water and high water conditions, as shown in Figure 2-24. The upstream end of the fish ladder that enters the reservoir area would also have multiple openings to accommodate water level fluctuations. Construction would require installation of the cast-in place concrete ladder and isolation of the area where the ladder connects to the reservoir.

Figure 2-24. Copco 1 Fish Ladder Configuration, Fish Screen, and Collection Device.

[7] Feature design has been provided in this EIS/EIR to support effects analysis. If the Klamath Hydroelectric Project is relicensed, the licensee would be required to obtain concurrence from USFWS and NOAA Fisheries Service regarding fishway design and construction plans for each facility prior to advancing to feasibility-level of design (NOAA Fisheries Service 2007; DOI 2007).

Downstream Fish Passage

The existing facilities at Copco 1 Dam are not conducive to downstream fish passage because the juvenile salmonids travelling downstream would flow through the intake to the power generation facility or over the dam spillway during high flows. The Fish Passage at Four Dams Alternative would include a fish screen as the primary measure to ensure safe downstream passage (DOI 2007; NOAA Fisheries Service 2007).

Depending on the frequency of spill, a collection facility may also be necessary to prevent fish from moving toward the spillway area. For the purposes of this analysis, the Fish Passage at Four Dams Alternative includes construction of a collection facility that is integrated with the fish screen for Copco 1 Reservoir. The collection facility would protect the entire spillway area. The collection device would be fabricated off-site and shipped to the site using standard flatbed trucks. The Hydropower Licensee would assemble the pieces on-site. Once the structure was assembled, it would be put in place near the water intake area and secured.

The fish screen would be a steel structure using a typical fish screen configuration. The existing power generation water intake has a design flow of 3,200 cfs, which requires a minimum fish screen of 8,000 square feet based on an approach velocity of 0.4 ft/s. The fish screen would be at the intake structure on the right side of the dam. The fish screen would be anchored to the existing rock and concrete dam structure to ensure stability. The screen would direct fish to an approximately 36 inch diameter bypass pipe with a capacity of more than 60 cfs.

Tailrace Barrier

The Copco 1 Powerhouse tailrace configuration is similar to the Iron Gate facility. For the purposes of analysis, this analysis of Alternative 4 includes a tailrace barrier.[8]

2.4.5.1.3 Copco 2 Fish Passage Facilities[9]

The Copco 2 site has difficult access because of the narrow canyon and relatively steep road access into the site. The existing access road would require upgrades such as gravel surfacing and grading.

Upstream Fish Passage

The Fish Passage at Four Dams Alternative includes a concrete pool and weir fish ladder with 6-inch drops to provide volitional fish passage at Copco 2 Dam. The overall difference in water levels from the downstream river to Copco 2 Reservoir is about 20 to

[8] The modified prescriptions provide that the applicant is allowed to perform site-specific studies to determine if spillway modifications and tailrace barriers are necessary at the developments where these are prescribed. However, the modified prescriptions provide that spillway modifications and tailrace barriers shall be constructed and operated unless and until USFWS and NOAA Fisheries Service determine based on any such site-specific studies that any prescribed spillway modifications or tailrace barriers are unnecessary.

[9] Feature design has been provided in this EIS/EIR to support effects analysis. If the Klamath Hydroelectric Project is relicensed, the licensee would be required to obtain concurrence from USFWS and NOAA Fisheries Service regarding fishway design and construction plans for each facility prior to advancing to feasibility-level of design (NOAA Fisheries Service 2007; DOI 2007).

25 feet, depending on reservoir pool elevations. The new fish passage facilities would accommodate the reservoir pool fluctuation while maintaining continual upstream passage. Construction would require installation of the cast-in place concrete ladder and isolation of the area where the ladder connects to the reservoir.

The pool and weir fish ladder would be on the right side of the concrete spillway structure in the earth embankment. An AWS would be necessary for temperature and attraction flow mitigation. The AWS would draw water from the reservoir through a screened inlet. Figure 2-25 shows a conceptual layout for a fish ladder at Copco 2 Dam.

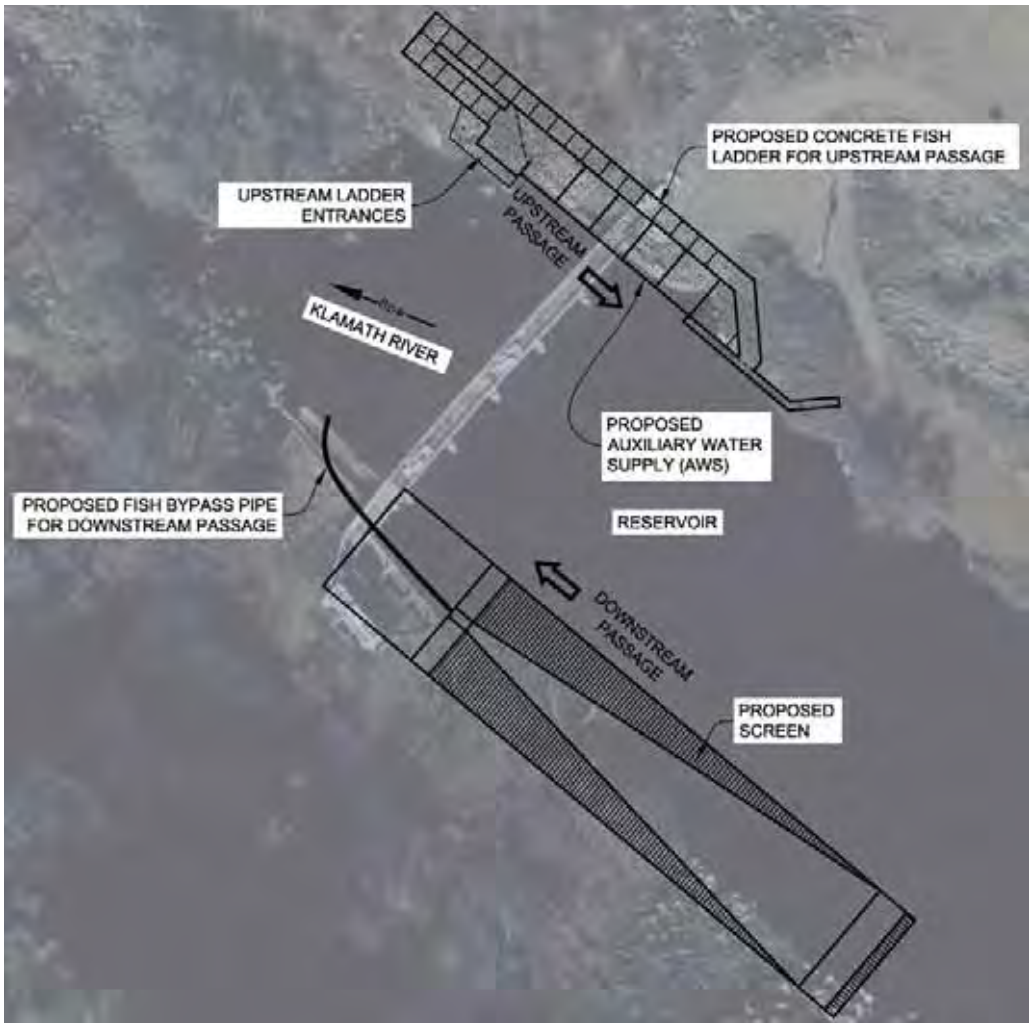

Figure 2-25. Copco 2 Fish Ladder and Fish Screen, along the left side of the river, for power water diversion.

In addition to the fish ladder, a transverse bedrock sill approximately 0.5 miles upstream of the Copco 2 Powerhouse in the Bypass Reach could create a fish passage barrier. A new FERC license would likely increase flows in the Bypass Reach and this barrier would not likely exist. As part of the license renewal process, a study would determine whether corrective measures would be needed at this barrier to provide fish passage.[10] According to the mandatory prescriptions, sufficient flow would need to be released into the Bypass Reach to attract upstream-migrating fish into the fishway entrance pools and ensure that flows are sufficient to attract fish at the point of confluence between the Bypass Reach and the downstream powerhouse discharges. The prescriptions do not specify a flow rate in the Bypass Reach, but modeling the recommendations indicates that minimum flows would be approximately 438 cfs.

Downstream Fish Passage – Water Intake

The existing power generation water intake at Copco 2 Dam is on the left side of the concrete spillway structure. The water diversion capacity is 3,200 cfs, which would require a minimum 8,000 square feet of screen. A conventional fish screen for the water intake would minimize the length of the screen. The fish screen would terminate in an approximately 36-inch fish bypass pipe that would flow over the dam and into the downstream river area. As with the fish screen for the J.C. Boyle Development, the screen would be fabricated off-site and installation would require dewatering and isolation to provide a dry or partially isolated work area.

Downstream Fish Passage – Spillway

The Copco 2 spillway is controlled with radial gates that regulate discharge over the concrete spillway section. The existing elevation difference between the spillway crest and water level on the downstream side of the dam is approximately 13 feet. Modifications to the concrete apron and spillway would minimize or eliminate rapid changes in direction and abrupt velocity changes at the spillway apron for downstream moving fish. A transitional ramp would be installed at the midpoint of the spillway to transition flows smoothly into the water conditions downstream from the concrete apron. The transitional ramp would be formed using cast-in-place concrete similar to the existing spillway construction.

Tailrace Barrier

The power generation turbines for Copco 2 are 1.4 miles downstream from the dam with a large tailrace area that flows back into the Klamath River. The water flowing out through this tailrace has the potential to attract fish to a false pathway. Alternative 4 includes a tailrace barrier extending the bank line of the Klamath River and installing a cutoff screen to prevent fish from straying into the tailrace area (see Figure 2-26).

[10] The prescriptions require modifications to the bedrock sill unless the licensee demonstrates through an evaluation approved by USFWS and NOAA Fisheries Service that indicates that it will not be a "barrier to fish passage under normal operating flows specified for the Copco 2 bypassed reach in the new license" (USFWS 2007; NOAA Fisheries Service 2007).

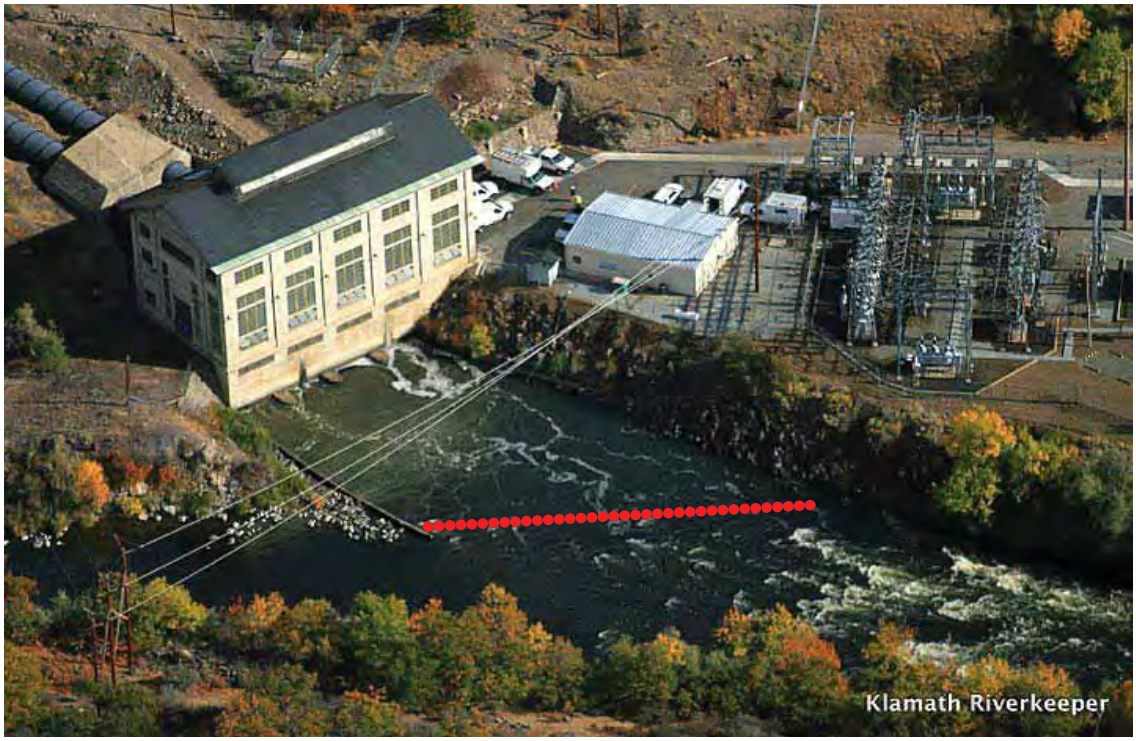

Figure 2-26. Modifications at the tailrace of the Copco 2 Powerplant would extend the bank and install a tailrace barrier screen (red dots).
(Source: Klamath Riverkeeper)

2.4.5.1.4 Iron Gate Dam Fish Passage Facilities[11]

The Iron Gate Development has difficult site access because of steep canyon terrain. It would require construction of temporary roads for site access and a tower crane or aerial tramway to move construction materials.

Upstream Fish Passage

The Fish Passage at Four Dams Alternative would include installation of a fish ladder on the left side of Iron Gate Dam near the existing penstock pipe, as shown in Figure 2-27. The fish ladder would have two entrances with entrance pools at the downstream end of the fish ladder. An AWS would feed water into the fish ladder at two locations to help with attraction flows and water temperatures. Multiple openings would be necessary where the fish ladder connects to the reservoir to allow for water level fluctuation. Construction would require installation of the cast-in place concrete ladder and isolation of the area where the ladder connects to the reservoir.

[11] Feature design has been provided in this EIS/EIR to support effects analysis. If the Klamath Hydroelectric Project is relicensed, the licensee would be required to obtain concurrence from USFWS and NOAA Fisheries Service regarding fishway design and construction plans for each facility prior to advancing to feasibility-level of design (NOAA Fisheries Service 2007; DOI 2007).

Figure 2-27. Conceptual fish passage facilities layout for Iron Gate Dam showing fish ladder, water intake screen, and spillway transition modifications.

Downstream Fish Passage – Water Intake

The existing power generation water intake structure at Iron Gate Dam is on the left side of the embankment dam. The water intake design flow is 1,735 cfs and would require a minimum fish screen of 4,340 square feet based on an approach velocity of 0.4 ft/s. A conventional fish screen would be the best option for screening the water intake to address the substantial size of the screen. The fish screen would terminate in a 36-inch-diameter fish bypass pipe (approximately 40 cfs) that would run from the water intake to a fish bypass facility for identification of downstream migrating juveniles and then continue downstream to the river below the dam. The fish screen would be stainless steel and the fish return pipe would be standard steel with concrete and steel support structures along the length of the pipe. As with the fish screen for the J.C. Boyle facility, the fish screen would be fabricated off-site and installation would require dewatering and isolation to provide a dry or partially isolated work area.

Downstream Fish Passage – Spillway

The Iron Gate spillway is an unregulated, free overflow from the reservoir area. Likely modifications to the spillway would include building a smoother transition at the downstream end using cast-in-place concrete to form an ogee-type drop structure that would connect the downstream river levels to the free flowing spill conditions. This modification would reduce fish mortality on the rock outcrop below the spillway. In addition, the Hydropower Licensee would use concrete to fill the area just upstream of the free outfall at the downstream end of the spillway to make a consistent hydraulic transition and reduce potential harm during downstream passage of primarily juvenile fish.[12]

2.4.5.2 Schedule

The schedule would likely follow the schedule prescribed in the FERC relicensing process. The prescriptions include a schedule for implementation and recommend that downstream facilities be installed prior to upstream passage facilities (DOI 2007; NOAA Fisheries 2007). Table 2-27 shows the schedule for implementation (including design, permitting, and construction) of the fish passage facilities at each dam, based on these constraints.

Table 2-27. Timetable for Implementation of Fish Passage Improvements at each Dam from Date of FERC License Renewal

Dam	Upstream Fish Passage	Spillway Modifications	Tailrace Barrier	Screens & Bypass
J.C. Boyle	4 years	4 years	4 years	4 years
Copco 1	6 years	6 years	8 years	6 years
Copco 2	6 years	6 years	8 years	6 years
Iron Gate	5 years	5 years	N/A	5 years

Key:
N/A: Not Applicable

2.4.5.3 Workforce

Table 2-28 shows the estimated workforce necessary for construction at each facility. Each facility would also have 5 to 10 on-site construction administrative personnel (e.g., inspectors, field engineers) for the duration of the project.

[12] The modified prescriptions provide that the applicant is allowed to perform site-specific studies to determine if spillway modifications and tailrace barriers are necessary at the developments where these are prescribed. However, the modified prescriptions provide that spillway modifications and tailrace barriers shall be constructed and operated unless and until USFWS and NOAA Fisheries Service determine based on any such site-specific studies that any prescribed spillway modifications or tailrace barriers are unnecessary.

Table 2-28. Estimated Average Construction Workforce for Fish Passage at Four Dams

Facility	Estimated Construction Workforce	Duration
J.C. Boyle	10 to 20 people	4-6 months
Copco 1	15 to 25 people	9 months
Copco 2	10 to 20 people	4-6 months
Iron Gate	15 to 30 people	12 months

2.4.5.4 Environmental Measures

The Fish Passage at Four Dams Alternative would incorporate standard measures to reduce environmental effects. These measures would be the same as those included in the Proposed Action (see Section 2.4.3).

2.4.5.5 Trap and Haul around Keno Impoundment – Programmatic Measure

NOAA Fisheries Service and DOI prescriptions include a measure to trap and haul fall-run Chinook salmon upstream and downstream around Keno Impoundment. The prescriptions call for seasonal trap and haul operations from June 15 to November 15 when water quality conditions are not suitable for fish (dissolved oxygen concentration less than 6 mg/l or temperature above 20 degrees Celsius) (DOI 2007; NOAA Fisheries Service 2007). Upstream operations would include construction of a collection and handling facility downstream from Keno Dam; these fish would be released upstream of Link River Dam. Downstream operations would include construction of a collection and handling facility at or adjacent to Link River Dam that would collect downstream migrating fish. These fish would be released downstream from Keno Dam. The exact details of the collection facilities, haul routes, or necessary road improvements are not yet defined; therefore, this measure is analyzed in this EIS/EIR at a programmatic level.

2.4.6 Alternative 5: Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate

The Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative consists of the full removal of Iron Gate and Copco 1 facilities and installation of upstream and downstream fish passage facilities at both the J.C. Boyle and Copco 2 Dams. On Copco 2 and J.C. Boyle Dams, ladders would be less complex to construct and provide volitional fish passage because of dam height and reservoir length. Iron Gate and Copco 1 Dams also provide less power; therefore, removal would have less effect on power generation. Removing Iron Gate and Copco 1 Reservoirs, the two largest impoundments in the Hydroelectric Reach, would also address water quality problems driven by reservoir size, such as increased water temperature, low dissolved oxygen, and toxic algal blooms in the summer and fall.

In order to meet current criteria for volitional fish passage, J.C. Boyle and Copco 2 Dams would require new upstream and downstream fish passage facilities. The fish passage facilities at J.C. Boyle and Copco 2 Dams would be the same as in the Fish Passage at Four Dams Alternative; Section 2.4.5 describes these facilities in detail. Similar to the

Fish Passage at Four Dams Alternative, the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would incorporate most of the prescriptions from the FERC relicensing process related to fish passage at J.C. Boyle and Copco 2 Dams (see Attachment B of Appendix A for a list of prescriptions). Alternative 5 would not incorporate the prescriptions related to peaking power at J.C. Boyle and recreation releases. In Alternative 5, Copco 2 Dam would be the only dam remaining downstream from J.C. Boyle Dam. Copco 2 Reservoir is very small, and does not have adequate capacity to reregulate flows associated with peaking operations so that they are suitable for fish downstream. Therefore, Alternative 5 would not include peaking operations or recreation releases on any days at J.C. Boyle Dam.

Alternative 5 flows would be driven by releases from J.C. Boyle Dam because of the lack of downstream reregulation. The prescriptions would require 40 percent of J.C. Boyle releases to enter the Bypass Reach; therefore, these flows would be greater than the No Action/No Project Alternative. Flows at the Iron Gate Gauge would be generally similar to the No Action/No Project Alternative to maintain suitable flows for fish, although they may experience small variations because Iron Gate and Copco 1 Dams would not be in place to control flow patterns.

Removal of Iron Gate and Copco 1 Dams would be the same as in the Proposed Action; Section 2.4.3 describes the removal plans in more detail. Inflows to Upper Klamath Lake, and outflows from Copco 2 Dam and fish ladder and the Copco 2 Powerhouse are assumed to be nearly the same under the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative as described above for the No Action/No Project Alternative.

A Hydropower Licensee would implement this alternative through licensure by FERC and would be responsible for its long term operation and maintenance. Implementation of the KBRA is not included in the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative. The Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would not satisfy the KHSA; consequently, the KBRA would not be implemented (although ongoing restoration activities in the No Action/No Project Alternative may continue). For the purposes of this analysis, alternatives that would not result in full implementation of the KHSA do not include the KBRA as a connected action to the alternative. Additionally, the transfer Keno Dam to DOI would not move forward as a connected action. The ongoing resource management activities, TMDLs, biological opinions, and other regulatory conditions described under the No Action/No Project Alternative would also occur under this alternative.

2.4.6.1 Schedule

This alternative would follow a schedule similar to that of the Proposed Action, because two of the dams are being removed and fish passage would be necessary as soon as possible after dam removal. Similar to Alternative 4, downstream fishways at each site would be completed before upstream fishways. Figure 2-28 shows the schedule for construction of the fish passage facilities at two dams and for removal of the remaining two dams, based on these constraints.

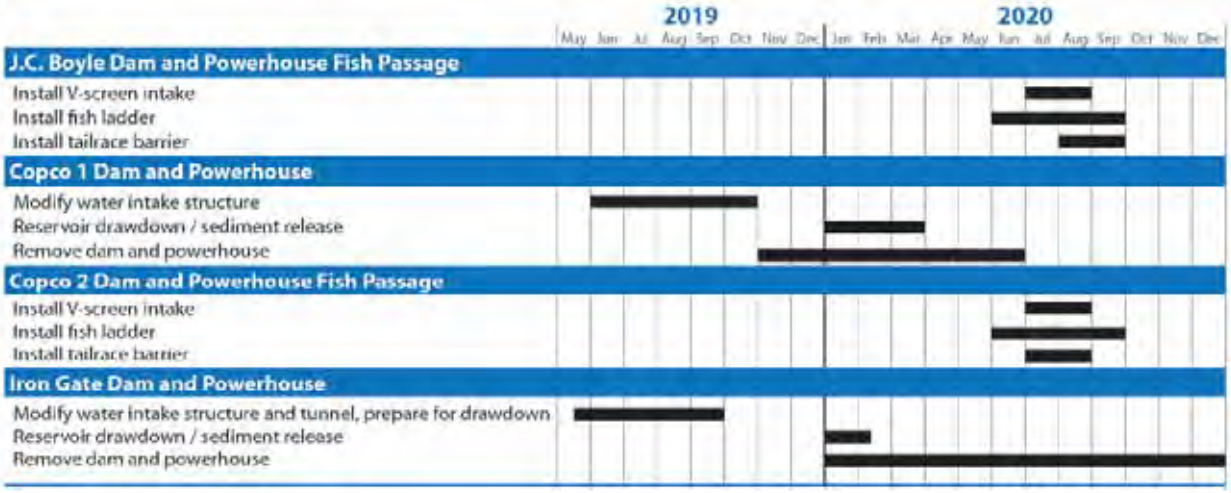

Figure 2-28. Anticipated schedule for Fish Passage at J.C. Boyle and Copco 2 Dams with Removal of Copco 1 and Iron Gate Dams.

2.4.6.2 Workforce

Table 2-29 shows the estimated workforce necessary for each facility under this alternative. In addition to the average construction workforce, there would be 5 to 10 on-site construction management staff (e.g., inspectors, field engineers) at each site for the duration of the project. The deconstruction efforts at Copco 1 and Iron Gate Dams would constitute the bulk of the efforts in this alternative.

Table 2-29. Estimated Construction Workforce for Full Removal of Iron Gate and Copco 1 Dams with Fish Passage at Copco 2 and J.C. Boyle Dams

Facility	Estimated Average Construction Workforce	Duration	Estimated Peak Workforce	Peak Period
J.C. Boyle	10 to 15 people	4 to 6 months	15–20	Jul 2020–Sep 2020
Copco 1	30 to 35 people	12 months	50–55	Nov 2019–Apr 2020
Copco 2	10 to 15 people	4 to 6 months	15–20	Jul 2020–Sep 2020
Iron Gate	35 to 40 people	18 months	75–80	Jun 2020–Sep 2020

2.4.6.3 Environmental Measures

The Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would incorporate standard measures to reduce environmental effects. These measures would be the same as those included in the Proposed Action (see Section 2.4.3).

2.4.6.4 Recreation Facilities

Recreation facilities near J.C. Boyle Reservoir would stay intact, and the Copco 2 area does not have any developed recreation facilities. Recreation facilities at Iron Gate and Copco 1 (see Table 2-30) would be removed.

Table 2-30. Recreation Facilities under the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative

Site Name	Existing Facilities	Facilities Following Dam Removal
Sites at J.C. Boyle Reservoir (Oregon)		
Pioneer Park	Two day-use areas with picnic tables, fire rings, and portable toilets	This site would remain, there would be no improvements or changes
Topsy Campground	Campground, day-use area, boat launch	This site would remain, there would be no improvements or changes
Sites at Copco 1 Reservoir (California)		
Mallard Cove	Day-use picnic area and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Copco Cove	Picnic area and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Sites at Iron Gate Reservoir (California)		
Fall Creek Trail	Day-use area and trail	This site would remain, there would be no improvements or changes
Jenny Creek	Day-use area and campground	This site would remain, there would be no improvements or changes
Wanaka Springs	Day-use area, campground, boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Camp Creek	Day-use area, campground, boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Juniper Point	Primitive campground and boat dock	All facilities would be removed. Parking area would be regraded, seeded, and planted
Mirror Cove	Campground and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Overlook Point	Day-use area	All facilities would be removed. Parking area would be regraded, seeded, and planted
Long Gulch	Picnic area and boat launch	All facilities would be removed. Parking area would be regraded, seeded, and planted
Dutch Creek	Day-use area	All facilities would be removed. Parking area would be regraded, seeded, and planted
Iron Gate Fish Hatchery Public Use Area	Day-use area and boat launch	This site would remain, there would be no improvements or changes

Source: Reclamation 2011

2.4.6.5 Trap and Haul around Keno Impoundment – Programmatic Measure

The Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would include trap and haul measures to move fish around Keno Impoundment when

water quality is not suitable for fish. The measures would be the same as those described in the Fish Passage at Four Dams Alternative (see Section 2.4.5). The exact details of the collection facilities, haul routes, or necessary road improvements are not yet defined; therefore, this measure is analyzed in this EIS/EIR at a programmatic level.

2.4.6.6 City of Yreka Water Supply Pipeline Relocation – Programmatic Measure

The Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative would include the relocation of the City of Yreka Water Supply Pipeline in the same fashion as the Proposed Action. The description of the relocation presented in 2.4.3.9 characterizes how the relocation would be completed under the Fish Passage at J.C. Boyle and Copco 2, Remove Copco 1 and Iron Gate Alternative.

2.5 Preferred Alternative

Both Alternative 2 and Alternative 3 include removal of the Four Facilities and implementation of KBRA and both alternatives more fully meet the Purpose and Need (Sections ES.3 and 1.5.2.1). Some key benefits provided by implementation of Alternative 2 and Alternative 3 include (for a full discussion of the Alternatives, see Chapter 3):

- Provides optimal anadromous fish passage to and from at least 420 miles of historical habitat above Iron Gate Dam by creating a free flowing river in the Hydroelectric Reach in 2020
- Anadromous fish would access low gradient historical habitat of critical importance to spawning and rearing under Copco 1 and Iron Gate Reservoirs
- Provides for natural recruitment of spawning gravel and river processes within and below the Hydroelectric Reach through dam removal
- Largely eliminates in 2020 elevated late summer/fall water temperatures in and below the Hydroelectric Reach by removing the largest reservoirs
- Largely eliminates 2020 dissolved oxygen and pH problems produced in reservoirs in the Hydroelectric Reach and transported downstream
- Largely eliminates in 2020 algal toxins produced in the Hydroelectric Reach and transported downstream
- Reduces concentration of myxospores associated with carcasses accumulating below hatchery facilities, thus reducing disease

Removal of the Four Facilities and implementation of KBRA are important components of a durable, long-term solution for local communities and tribes regarding the development, administration, allocation, and advancement of water and native fishery resources of the Klamath Basins. Alternative 2 and Alternative 3 provide a greater opportunity for expanding restoration of salmonids, which, over time would improve