Exhibit 11

Boundary Hydroelectric Project (FERC No. 2144)

Fish and Aquatics Management Plan

Seattle City Light

March 2010

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List of Acronyms and Abbreviations

DOI	U.S. Department of the Interior
DOT	Washington Department of Transportation
Ecology	Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
FAMP	Fish and Aquatics Management Plan
FAWG	Fish and Aquatics Work Group
fps	Feet Per Second
HPA	Hydraulic Project Approval
I&E	Interpretation and Education
ILP	Integrated Licensing Process
IRA	Integrated Resource Analysis
JARPA	Joint Aquatic Resources Permit Application
LWD	Large Woody Debris
MOU	Memorandum of Understanding
NWRU	Northeast Washington Recovery Unit
PLP	Preliminary Licensing Proposal
PM&E	Protection, Mitigation, and Enhancement
PRM	Project River Mile
PUD	Public Utility District
RRMP	Recreation Resources Management Plan
SEPA	State Environmental Policy Act
USACOE	U.S. Army Corps of Engineers
USFS	USDA Forest Service
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife

Fish and Aquatics Management Plan

Boundary Hydroelectric Project (FERC No. 2144)

INTRODUCTION

This Fish and Aquatics Management Plan (FAMP or plan) has been prepared in support of a new Federal Energy Regulatory Commission License for Seattle City Light's (SCL) Boundary Hydroelectric Project (Project) (FERC No. 2144). The Project is located on the Pend Oreille River in Pend Oreille County, Washington. The Project was constructed in the mid-1960s and operates under a license administered by the Federal Energy Regulatory Commission (FERC). The current license for the Project expires on September 30, 2011, and in accordance with FERC regulations, SCL filed an application for a new license by September 30, 2009. Following submittal of the license application, SCL and Fish and Aquatic Work Group (FAWG) members signed a Boundary Settlement Agreement (Boundary SA) supporting FERC issuance of a new license.

As part of a comprehensive protection, mitigation, and enhancement (PM&E) program, SCL, in consultation with FAWG, has prepared this FAMP to describe the measures that shall be implemented over the Project license period to protect and enhance fish and aquatic resources. With limited exception these measures are non-operational. Under the new FERC license, SCL shall operate the Project as it is currently licensed, but with the formalization of two currently voluntary operational measures: forebay water surface elevation restrictions for summer recreation enhancement and turbine unit sequencing to reduce TDG production during non-spill conditions. Native salmonids in Boundary Reservoir are affected by Boundary Project operations, warm water temperatures during the summer, low primary productivity, and the presence of introduced predatory sportfish. As part of the comprehensive Boundary SA, the settling parties have agreed that PM&E efforts should be primarily directed at Boundary Reservoir tributaries. This maintains the power generation benefits of the Boundary Project while providing the best opportunity for native salmonid protection and recovery.

SCL shall implement the final FAMP in consultation with a FAWG, whose initial members include SCL and representatives from the U.S. Fish and Wildlife Service (USFWS), Bureau of Indian Affairs, Kalispel Tribe of Indians, U.S. Forest Service (USFS), Washington Department of Fish and Wildlife (WDFW), Washington Department of Ecology (Ecology), and the Selkirk Conservation Alliance or the Lands Council as an alternate participant, on behalf of the Hydropower Reform Coalition.

This introductory chapter of the FAMP provides general information on Project facilities and operations, the Project's environmental setting and a brief summary of Project effects (Section 1.1). It also describes the purpose, scope, and organization of the FAMP (Sections 1.2 and 1.3).

1.1. Description of Project Area, Facilities, and Operations

The Project is located in the northeast corner of Washington State, one of eleven hydroelectric and storage projects in the Clark Fork-Pend Oreille River basin. The dam is located approximately one mile south of the U.S.-Canada border and 16 miles west of the Idaho border. The dam is at PRM 17.0 on the Pend Oreille River. The upstream end of Boundary Reservoir extends to Box Canyon Dam at PRM 34.5. Overall, there is relatively little development along the reservoir. Land along the reservoir is owned by SCL, the USFS, U.S. Department of Interior (DOI), U.S. Bureau of Land Management (BLM), Washington State Department of Natural Resources (WDNR), Pend Oreille County, Public Utility District (PUD), the towns of Metaline and Metaline Falls, and private entities. The communities of Metaline Falls and Metaline are located midway along the reservoir, on its east and west sides, respectively. Both sides of the northern portion of the reservoir, from Metaline Falls to Boundary Dam, are relatively inaccessible by road and are bordered mostly by land in federal ownership. Lands along the southern portion of the reservoir are a mixture of private and publicly owned parcels, including SCL's Boundary Wildlife Preserve (BWP). The western side of the reservoir south of Metaline is bordered by U.S. Highway 31.

1.1.1. Project Facilities

Boundary Dam is a 340-foot-high, variable-radius concrete arch dam situated in a narrow canyon. The dam impounds the Pend Oreille River and forms Boundary Reservoir which extends approximately 17.5 miles south from Boundary Dam upstream to the Box Canyon Dam tailrace. The underground power plant was excavated within the massive rock forming the left abutment of the dam. Six turbine-generator units are installed in the underground machine hall and discharge a maximum flow of about 56,000 cfs into the Pend Oreille River. Power from the Project is transmitted to a Bonneville Power Administration (BPA) interconnection via a 0.5-mile-long, 500-kilovolt (kV) transmission line. At its normal maximum water surface elevation, Boundary Reservoir has a surface area of approximately 1,794 acres and a shoreline length of roughly 47 miles. The Boundary Project was built without fish passage facilities. Anadromous fish access to the Upper Columbia River basin, including access to the Pend Oreille River, was blocked in 1942 by construction of Grand Coulee Dam 164 miles downstream.

1.1.2. Project Environmental Setting

The Project is located in the Selkirk Mountains, a western extension of the Rocky Mountains. The topography surrounding the Project is relatively rugged, with nearby mountains rising more than 6,500 feet in elevation and intervening valleys ranging from approximately 2,000 to 2,400 feet. The Pend Oreille River bisects the Selkirk Mountains and cuts through the Metaline Limestone and Ledbetter Slate formations. These two formations predominate along Boundary Reservoir downstream of Metaline Falls and confine the reservoir to a narrow canyon. The adjacent area is characterized by cliffs, rock talus, and steep slopes (SCL 2006). In contrast, the area upstream of Metaline Falls consists predominantly of unconsolidated glacial sediments and river alluvial deposits. The river channel in this area is broader and the surrounding topography more moderate (SCL 2006).

The total average inflow to Boundary Reservoir between 1987 and 2005 was estimated to be 24,100 cfs (SCL 2008a). About 98.1 percent of this volume results from flow releases from Box Canyon Dam. One percent of the inflow comes from Sullivan Creek (the largest tributary to the Pend Oreille River between Box Canyon Dam and Boundary Dam). The remaining twenty-seven tributaries and groundwater together contribute about 0.9 percent of the inflow.

Near the middle of the 17.5 mile Boundary Reservoir, the Pend Oreille River passes through Metaline Falls, a bedrock-controlled, channel constriction (elevation 1,970.6). Water depths in the reach upstream of Metaline Falls typically range from 10 to 25 feet; water depths downstream of Metaline Falls gradually increase, reaching up to 270 feet deep immediately upstream of Boundary Dam.

For pre-licensing study purposes, analyses of the Project area was divided into three reaches above Boundary Dam and a tailrace reach (Figure 1.1-1) (2009a):

Boundary Reservoir (Above Boundary Dam)

- Forebay Reach—Boundary Dam to downstream end of Z-Canyon (PRM 17.0–18.0)
- Canyon Reach—Downstream end of Z-Canyon to Metaline Falls (PRM 18.0–26.8)
- Upper Reservoir Reach— Metaline Falls to Box Canyon Dam (PRM 26.8-34.5)

Boundary Tailrace (Below Boundary Dam)

- Tailrace Reach—Boundary Dam downstream to Red Bird Creek confluence with the Pend Oreille River, British Columbia (PRM 17.0–13.9)

The Boundary Reservoir portion of the Pend Oreille River is considered to have good water quality overall; however, Ecology has identified temperature, total dissolved gas, and pH exceedances. During the summer months, mainstem water temperatures often exceed 20°C and can reach 25°C; too warm to provide high quality habitat for native salmonids. Inflow from Sullivan, Slate and several other tributaries provide cold water refugia at tributary confluences with the mainstem reservoir.

1.1.3. Project Fish and Aquatic Resources

Boundary Reservoir and tributaries supports warm, cool and coldwater fish species of native or hatchery origin. No anadromous fish are found in Boundary Reservoir, but some fish may move between reservoir and tributary habitats. The reservoir fish community below Metaline Falls is dominated by largescale suckers, northern pikeminnow, peamouth, yellow perch, and smallmouth bass. Since 2001, hatchery-reared, sterile, rainbow trout were planted in the reservoir as part of a SCL-sponsored recreational fishing program (Solonsky 2009). After 2009, WDFW will not allow triploid trout to be stocked into Boundary Reservoir due to concerns about potential competition with native salmonids, low catch rates, poor trout habitat conditions and low survival and retention in the reservoir. Cutthroat and bull trout are rarely found in mainstem habitats below Metaline Falls, but various species of trout have been captured near the mouths of tributary streams when cool tributary inflow provides refugia from warm summer water temperatures (see Fish Distribution, Timing and Abundance Report, Study No. 9, SCL 2009a).

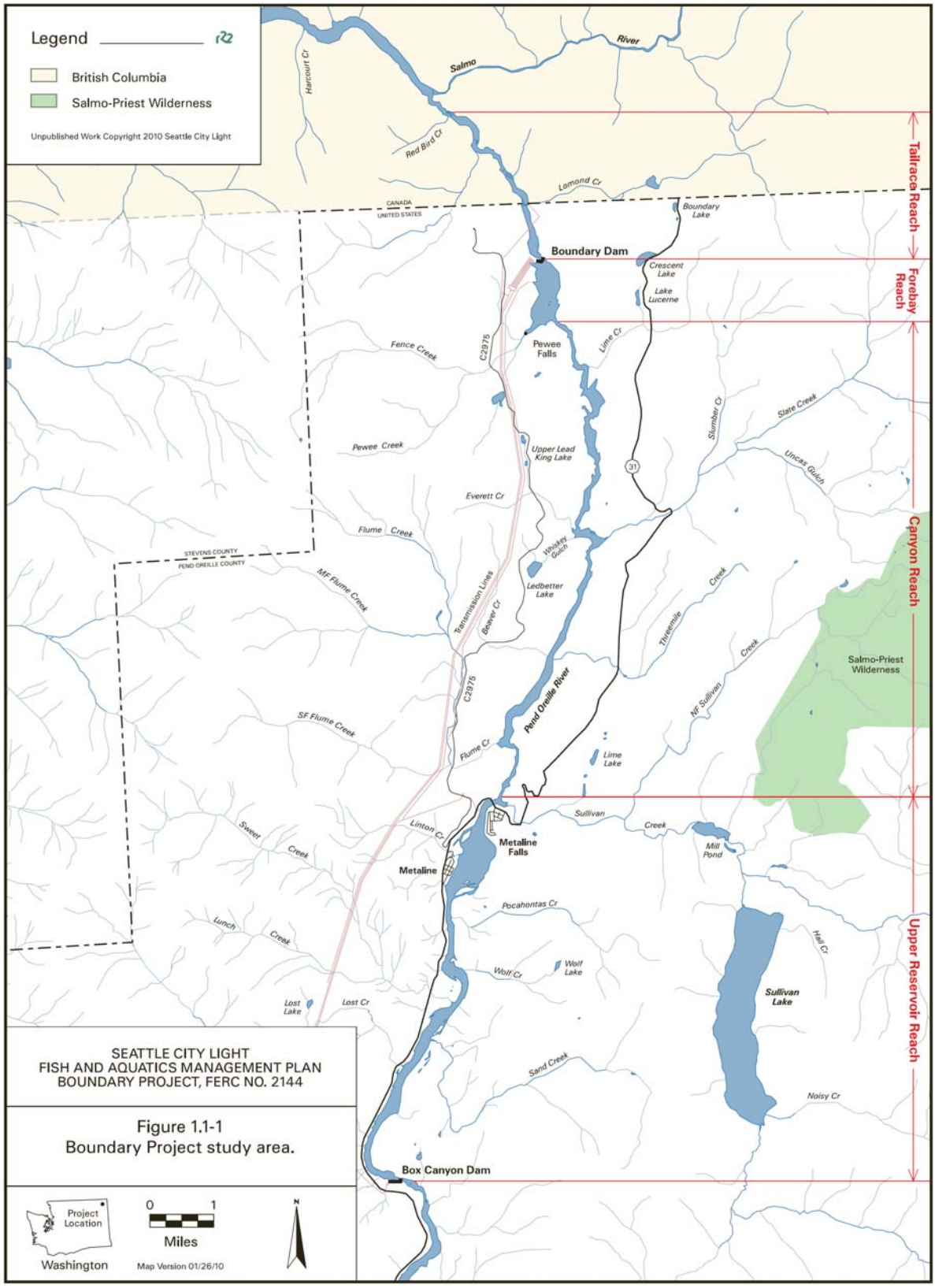

Figure 1.1-1. Boundary Project Study Area.

Fish species diversity is higher in the Upper Reservoir Reach than in deeper reservoir habitats downstream of Metaline Falls. The fish community in the Upper Reservoir Reach is dominated by minnows, suckers, tench, smallmouth bass, pumpkinseed and brown bullhead. Yellow perch and mountain whitefish are found in greater abundance in the Upper Reservoir Reach than below Metaline Falls. Nonnative northern pike and walleye, neither of which had been recorded previously in the Upper Reservoir Reach, were captured in 2007, and are being captured with increasing frequency in the reservoir (see Fish Distribution, Timing and Abundance Report, Study No. 9, SCL 2009a). The varial zone in the Upper Reservoir Reach provides off-channel and slough habitat, often with dense aquatic macrophyte beds in summer. These areas provide spawning and young-of-the-year rearing habitat for a variety of species. Young-of-the-year sunfish, minnows, perch, and suckers are abundant, especially during the summer months.

Cutthroat trout and rainbow trout young-of-the-year were captured exclusively in tributary streams, whereas some mountain whitefish, smallmouth bass, and cyprinid species young-of-the-year were captured in the reservoir (SCL 2009a). Although not abundant, trout in the reservoir show a summertime preference for habitat in tributary deltas, because the relatively low temperatures of the tributary inflows provide thermal refugia from warmer water in the mainstem reservoir (SCL 2009a). Most salmonids in the vicinity of the Project occur in the tributaries. The dominant sportfish in tributaries are westslope cutthroat trout, eastern brook trout, rainbow trout, and to a lesser extent brown trout and mountain whitefish (SCL 2006).

The fish community in the Tailrace Reach below Boundary Dam is also dominated by minnows and suckers including northern pikeminnow, largescale sucker, redside shiner, and peamouth. Smallmouth bass are the most abundant sportfish. Mountain whitefish and both wild and hatchery-reared rainbow trout have been observed in the tailrace and three bull trout were captured in the Boundary Dam tailrace during 2007-2008 pre-licensing studies. The results of genetic analyses identified that two of the captured bull trout had originated more than 70 miles upstream in tributaries to Lake Pend Oreille, and one bull trout had originated downstream in the Salmo River. A fourth bull trout, radio-tagged as part of BC Hydro's Salmo River bull trout telemetry study, was detected by a receiver in the Boundary Dam tailrace in 2008. Suckers, smallmouth bass, and triploid rainbow trout accounted for nearly 85 percent of the shallow water catch during 2007 and 2008 sampling in the Tailrace Reach (SCL 2009a). Suckers and hatchery-origin rainbow trout dominated the open water catch. Large northern pikeminnow were also commonly encountered in the deep waters of the spillway pools and afterbay. Aside from suckers and northern pikeminnow, no young-of-the-year fish were captured or observed in the Tailrace Reach.

During initial study plan development, relicensing participants identified bull trout, westslope cutthroat trout, and mountain whitefish as species of interest. Bull trout are listed as a Threatened species under the ESA within the Northeast Washington Unit (NWU). Boundary Reservoir, Sullivan Creek, and portions of Slate and Sweet creeks have been proposed as critical habitat for the recovery of bull trout (Federal Register Vol. 75, No. 9, January 14, 2010). Bull trout have rarely been observed in Boundary Reservoir between the years 1980 to 2008. Over the 29-year period, only 21 bull trout were captured or observed, and all of these were greater than 218 millimeters (8.6 inches) in length. Bull trout recovery goals have been identified for

Sullivan Creek (600 to 850 adult fish) and Slate Creek (25 to 75 adult fish), the largest two tributaries to Boundary Reservoir (USFWS 2002).

Westslope cutthroat trout are found in Boundary Reservoir, but their abundance is very low. In contrast, westslope cutthroat trout are found in nearly all of the larger tributaries that drain into Boundary Reservoir. Along with rainbow trout and brook trout, cutthroat trout of both westslope and Yellowstone genetic origin have been extensively stocked in tributaries to Boundary Reservoir (McLellan 2001). Genetic testing of cutthroat trout suggests that pure strains of westslope cutthroat trout occur in North Fork Sullivan Creek above the Town of Metaline Falls water supply diversion dam and relatively pure strains occur in Harvey Creek upstream of Sullivan Lake. In comments on SCL's Preliminary Licensing Proposal (PLP), the USFS reported that genetically pure westslope cutthroat trout can also be found in Sweet, Slate and Pewee creeks. The USFWS (1999) stated that westslope cutthroat trout are usually found in the cooler upper extents of tributaries, but suggested this use was more likely driven by competition from other trout such as rainbow trout and brook trout that are less tolerant of cooler, higher gradient streams, rather than by habitat preference.

Mountain whitefish spawning and incubation in the Project area occurs from mid-October through mid-January, with peak activity occurring in November and December. Mountain whitefish are the most frequently observed or captured native salmonid in Boundary Reservoir. Nevertheless, based on abundance (167 fish) in the samples during 2007 and 2008, they represent less than 1 percent of the fish community in the Project area. Tributary surveys suggest that mountain whitefish are present in Sullivan Creek and Sweet Creek (McLellan 2001; R2 Resource Consultants 1998a; SCL 2009c). Passive and active sampling in Boundary Reservoir during 2007 and 2008 suggested that most mountain whitefish reside in the Upper Reservoir Reach. Ripe female and milt-flowing male mountain whitefish have been observed in Boundary Reservoir immediately downstream of Box Canyon Dam and whitefish eggs were collected on egg mats in the Box Canyon Dam tailrace during winter 2008/2009 (SCL 2009b). Whitefish eggs were also collected on egg mats at the mouth of Sullivan Creek in winter 2008/2009.

1.1.4. Project Operations and Effects on Aquatic Resources

The Boundary Project is operated in a load-following mode that shapes available water to deliver power during peak-load hours and reduces generation during off-peak hours. Daily water surface elevation fluctuations range from 11.5 feet to 18.02 feet in the forebay, and from 0.42 feet to 4.80 feet in the Box Canyon Dam tailrace. The normal maximum reservoir water surface varies from elevation 1,994 feet at the forebay to 1,999 feet at the Box Canyon tailrace. The reservoir has a small active storage capacity (about 40,843 acre-feet) relative to mean daily flow; retention time of water in Boundary Reservoir averages less than 2 days. The Project is operated within the maximum drawdown of 40 vertical feet of active storage authorized under the license. From Labor Day weekend to Memorial Day weekend, the Project is operated with forebay water surface elevations generally fluctuating within 20 feet of full pool (1,994 feet to 1,974 feet NAVD 88) and only occasionally below 1,974 feet. The magnitude of water surface elevation fluctuations in the Boundary forebay are replicated up through the base of the hydraulic control at Metaline Falls. Metaline Falls attenuates or dampens water surface elevation fluctuations for the upper reservoir area upstream of Metaline Falls.

SCL maintains the summer forebay water surface elevations to facilitate recreational access and use. From Memorial Day weekend through Labor Day weekend, forebay water surface elevations are maintained at or above 1,984 feet NAVD 88 from 6:00 am through 8:00 pm. During nighttime hours, forebay water surface elevations are maintained at or above elevation 1,982 feet NAVD 88.

1.1.4.1. Project Effects on Mainstem Reservoir Habitats

Aquatic biota and habitats immediately upstream and downstream of Boundary Dam are influenced by Project operations, hydrologic conditions, and releases from upstream hydroelectric and water storage projects. The effects of Project operations on aquatic habitat were assessed using a Physical Habitat Model to generate indices reflecting habitat conditions within Boundary Reservoir, Boundary Dam tailrace, and select tributary deltas.

SCL developed a suite of models and analyses to support the evaluation of Existing Conditions and alternative operations. These models and analyses included the Scenario Tool, Hydraulic Routing Model (HRM), mainstem habitat model, trapping and stranding models, mainstem sediment transport model, and tributary delta habitat models (see Mainstem Aquatic Habitat Modeling Report, Study No. 7, SCL 2009a). The Scenario Tool optimized Project energy production using historic hydrologic data and resource criteria input to provide a consistent foundation for the comparison of resource impacts or benefits. Simulation by the Scenario Tool allowed the output (water surface elevation and flows) to be readily used as input data to the HRM. The HRM was used to translate hourly changes in forebay water surface elevations to locations upstream and downstream of Boundary Dam. The HRM computes water surface elevations, average velocities, and timing of water surface fluctuations at locations throughout Boundary Reservoir and Boundary Dam tailrace.

The mainstem habitat model used water surface elevations and average velocities from the HRM, along with specific velocity measurements within habitat cells at various habitat transects, to determine depths and velocities for each habitat cell for each hour of simulated operation. In addition to depth and velocity, substrate and cover were incorporated into the habitat model and compared to Habitat Suitability Indices/Criteria for lifestages and fish species of interest (native salmonids, smallmouth bass, and forage species) and other aquatic organisms (macrophytes, periphyton, and benthic macroinvertebrates). The integration of hydraulic, channel morphology, and biological response data was used to calculate the relative amount of potential habitat, termed Weighted Usable Area (WUA), at each transect for lifestages and species of interest for each hour of simulated Project operation. The mainstem habitat model was also used to track the effect of fluctuating water surface elevations on potential mountain whitefish and smallmouth bass spawning areas to evaluate which cells of potential spawning habitat remain inundated through the subsequent incubation period.

Aquatic habitat modeling was supported by field studies of fish, macrophyte, periphyton, and benthic macroinvertebrates. The Upper Reservoir Reach generally has a higher diversity and abundance of these fauna because it contains more shallow and complex habitat, a wider variety of substrate types, and is less affected by fluctuations in water surface elevation. In contrast, the Canyon Reach and Forebay Reach are deep, with narrow strips of shallow water habitat adjacent to the shorelines, relatively coarse substrates, and fluctuations in water surface elevation that

occur frequently and can be substantially larger than those in the Upper Reservoir Reach. The Canyon Reach affords smallmouth bass a variety of habitat conditions in the form of boulders, bedrock ledges, and attendant velocity shears. The amount of WUA for forage fish is fairly low in the Forebay and Canyon Reaches as a result of the scarcity of shallow depths and low water velocities preferred by the smaller fish. Habitat in the Tailrace Reach is similar to the upper 1 mile of the Upper Reservoir Reach (i.e., Box Canyon Dam Tailrace), except that tailrace habitat is more affected by fluctuations in water surface elevations as a result of operations at Boundary Dam and BC Hydro's downstream Seven Mile Dam.

The Upper Reservoir Reach has over 86 percent of the shallow water habitat in the Boundary Reservoir. Within this 7.7-mile reach, variable habitat conditions are provided by several islands, back channels, and near-shore aquatic vegetation. Many of the off-channel areas away from the mainstem currents contain widespread and seasonally dense concentrations of submerged aquatic vegetation. These areas serve as both spawning and rearing habitat for various fish species present in the reach. Near-shore areas within the more confined, steeper portions of the reach provide gravel and cobble bed habitats, often in conjunction with velocities that are more representative of riverine systems supportive of native salmonids. The shallow water zone is quite extensive under most flow conditions.

Due to the presence of low-gradient bars and side channels, Boundary Project operations have the greatest stranding and trapping effect in the Upper Reservoir Reach. The Upper Reservoir Reach also has about 90 percent of the submerged aquatic macrophyte cover, which increases the potential for stranding and trapping of juvenile fish. Trapping indices are substantially higher during dry years when load-following operations increase the frequency and magnitude of pool level fluctuations. Field studies conducted in 2007 and 2008 confirm that the Upper Reservoir Reach poses the greatest risk of trapping and stranding in the Project Area. Large numbers of minnow fry were observed stranded during major downramping events during the summer. Few fish were observed in areas prone to trapping and stranding during the winter months.

The results of aquatic habitat modeling are best used as a relative index of potentially suitable fish habitat. Abundance of native salmonids and other target species in the Project area are limited by factors other than microhabitat variables (see Exhibit E of the License Application Section 4.5.3.2.1). For example, during an average year there is about 33 percent more WUA for adult cutthroat trout in Boundary Reservoir than WUA for adult smallmouth bass. However, smallmouth bass represented about 10.5 percent of the fish community during surveys conducted in 2007 and 2008 while cutthroat trout represented less than 0.1 percent.

1.1.4.2. Project Effects on Tributary Delta Habitats

Tributary deltas are transition areas between the tributaries and reservoir that provide a variety of ecological functions. Fish may congregate at the tributary confluence to feed on organisms transported in the tributary flow, may use the deltas as temperature refugia, or may stage in delta habitats prior to spawning. Because of the nature of the processes that form the tributary deltas, much of a delta's surface lies within the range of elevations that are subjected to water level fluctuations resulting from Project operations. Analyses of Project effects on tributary delta habitats focused on the distribution and quality of physical habitat conditions (e.g., water depth, cover) and the presence and persistence of thermal plumes at the seven largest tributary deltas

(see Sediment Transport and Boundary Reservoir Tributary Delta Habitat Report, Study No. 8, SCL 2009a).

The effect of historic Project operations on tributary delta habitat quality varied in relation to whether the delta was located upstream or downstream of the Metaline Falls hydraulic control. Below Metaline Falls, the Slate and Flume Creek tributary deltas experience the full range of water level fluctuations associated with load-following operations. The five tributary deltas upstream from the Metaline Falls hydraulic control do not experience the full range of water surface elevation fluctuations associated with Project operations. Physical habitat conditions in the inundated portion of the deltas are of low quality; however, salmonids from the reservoir seek out the cold-water inflow from the tributaries.

Thermal plumes at the tributary deltas provide refugia during the summer when mainstem water temperatures rise above the levels suitable for salmonids. Thermographs installed along the thalweg of the stream channels flowing across the seven tributary deltas indicated that thermal plumes persisted throughout the rising and falling of the pool levels. The thermographs at all seven tributary deltas showed a gradient in temperature progressing from the warmer mainstem water to cooler water across the delta to the coldest water in the upstream tributary inflow. Project operations that maintain low reservoir water surface elevations will expose riverine habitat area on the tributary deltas. The quality of this riverine habitat in the delta is lower than riverine habitat in the tributary channels upstream of the deltas. The lower habitat quality of the delta channels is due to the lack of stable bedforms, small substrate particle sizes, sparse cover (e.g., boulders, large woody debris (LWD)), few pools, and shallow channel depths.

1.1.4.3. Project Effects on Fish Entrainment

When inflow to the Project is less than the total powerhouse capacity (approximately 56,000 cfs), the Project is operated as a load-following facility. Because of the large total powerhouse capacity relative to normal flows in the Pend Oreille River, spill generally occurs only during spring runoff. During the period 1987 through 2006, spill conditions averaged 578 hours a year. Infrequent spill conditions results in turbine passage being the primary pathway for fish to move downstream through the Project.

During studies conducted as part of the Integrated Licensing Process (ILP), SCL conducted hydroacoustic and fyke net sampling at Boundary Dam to estimate the number, size, species, and timing of fish that may be entrained within the Project turbine intakes and spillways (see Fish Entrainment and Habitat Connectivity Report, Study No. 12, SCL 2009c). Hydroacoustic target entrainment data were collected and analyzed using split-beam target tracking techniques, and fyke nets were deployed in the Unit 54 draft tube gatewell downstream of the turbine unit. Results of the two techniques were combined using statistical methods derived by Dr. John Skalski at the University of Washington. The hydroacoustic sampling, which provided a continuous measure of relative entrainment at all operating turbines and spill gates, was used to scale the fish entrainment rates measured by the fyke net sampling at Unit 54. A total of 54,597 ±5,176 fish (90 percent confidence interval) was estimated to have been entrained through all operating turbines and spill gates at the Project over the one-year period between March 2008 and February 2009. Suckers, pumpkinseed, and yellow perch dominated the fyke net catch in the draft tube of turbine Unit 54.

As part of the comprehensive Boundary SA, estimated mortality rates for fish passing through the turbines and spillways at Boundary Dam were developed. Based on a review of available literature and office-based, turbine survival modeling, fish passage mortality through the existing turbines at Boundary Dam was estimated to vary with the turbine units and fish size. In general, smaller fish were anticipated to have the lowest turbine mortality (5% to 15%), while turbine mortality was expected to increase with fish size (i.e., 23% to 65% for larger fish). After reviewing the results of studies conducted at other dams concerning the effects of shear forces on fish, it was assumed that at low spill flow rates there would be near 100 percent mortality of fish that plunged onto rock instead of falling into the open water of the Boundary tailrace. At spill rates where the flow directly reaches the tailrace pool, the mortality rate will depend on the size of fish and whether the fish remains entrained in the flow jet or freefalls in the air before reaching the tailrace pool (R2 Resource Consultants 2006).

In the comprehensive Boundary SA changes to Boundary Project operations are found to be costly and to provide limited improvement in reservoir habitat conditions. Relicensing participants also acknowledged that, if after non-operational entrainment reduction measures are implemented, Project effects from entrainment are less than the agreed upon targeted juvenile and adult salmonid species survival standard, Project operational changes could be considered. Warm summer water temperatures, low primary productivity, and the presence of non-native predatory sportfish suggest that changes to Project operations would not restore native salmonid populations. As part of the comprehensive Boundary SA some PM&E measures are identified to address dam and reservoir conditions, but the majority of aquatic PM&E measures are focused in the tributaries where opportunities to protect and recover native salmonid populations have the greatest likelihood of success.

2 FAMP PURPOSE AND SCOPE

The FAMP establishes the goals, program objectives, tasks, and schedule for implementing the non-operational aquatic PM&E measures included in the Project license. This FAMP provides information about how SCL shall implement these PM&E measures, conduct monitoring, and report on the progress of their implementation. Information regarding the estimated costs for implementing the measures is provided in Exhibit D of the March 2010 Amended License Application.

The PM&E measures described in this plan are an integrated package of non-operational mainstem and tributary measures designed to benefit native salmonid populations and their habitat. The FAMP is divided into the following elements:

- Mainstem Fish Community and Aquatic Habitat Measures (License Article 9(A))
    - Gravel augmentation below Box Canyon Dam
    - Channel modifications of mainstem trapping pools at Project RM 30.3
    - Mainstem LWD placement at tributary deltas
    - Boundary Reservoir fish community monitoring and evaluation of salmonid predation at select tributary deltas
- Upstream Fish Passage (License Article 9(B))
- Reduction of Project Related Entrainment Mortality (License Article 9(C))
- Tributary Non-native Trout Suppression and Eradication (License Article 9(D))
- Tributary Fish Community and Aquatic Habitat Measures (License Article 9(E))
    - Riparian improvement and stream channel enhancement in Sullivan Creek RM 0.30 to RM 0.54
    - Stream and riparian improvements in Sullivan Creek RM 2.3 to RM 3.0 and NF Sullivan Creek
    - LWD placement and road improvements in Sullivan Creek and selected tributaries upstream of the confluence with Outlet Creek
    - Culvert replacements and LWD placement in tributaries to Boundary Reservoir
    - Riparian planting, culvert replacement and channel reconstruction in Linton Creek RM 0.00 to RM 0.24
    - Riparian and channel improvements in Sweet Creek RM 0.0 to RM 0.6
    - Habitat improvement in Tier-2 tributaries to Boundary Reservoir
    - Closure and restoration of Sullivan Creek dispersed recreation sites
- Mill Pond Dam Site Monitoring and Maintenance (License Article 9(F))
- Native Salmonid Conservation Program (License Article 9(G))
- Recreational Fish Stocking Program (License Article 9(H))

2.1. Mainstem Aquatic Habitat Measures

Relicensing studies indicated that production of native salmonids in Boundary Reservoir is limited by warm water temperatures during the summer, low primary and secondary productivity, and the presence of non-native predatory sportfish species (SCL 2009a). Non-native predators of particular concern include smallmouth and largemouth bass, walleye and a small, but likely expanding population of northern pike. Because of the limitations in Boundary Reservoir and the low likelihood that operational measures could improve these conditions sufficiently to mitigate for the continuing Project effects to aquatic resources, as part of the comprehensive Boundary SA restoration and enhancement measures will primarily be implemented in tributaries to Boundary Reservoir. However, pre-licensing studies did identify several non-operational measures to benefit mainstem habitats.

Mountain whitefish are a native salmonid species thought to spawn in the Boundary Upper Reservoir Reach immediately below Box Canyon Dam. Gravid and milt-flowing mountain whitefish were captured by boat electrofishing during surveys in the Upper Reservoir Reach and

egg mats were used to successfully collect several eggs believed to be mountain whitefish. The area immediately below Box Canyon Dam has water depths and velocities appropriate for use by spawning whitefish, but much of the substrate is larger than the gravel size preferred by mountain whitefish. SCL shall place 1,500 yd^3 of gravel among boulder groupings near suspected mountain whitefish spawning areas to increase the amount and quality of potential spawning habitat.

Project operations can cause pool levels to rise and fall on a daily basis, causing fish to become stranded or trapped as pool levels decline. Depressions and pools along the shoreline may become exposed as pool levels drop causing juvenile fish to become trapped and subject to injury and mortality. During the wet, average and dry modeled hydrologic years, 90 percent of exposed trapping area within the Project area occurred in the Upper Reservoir Reach. While nearly all of the trapped fish observed during 2007 and 2008 were suckers, perch, or smallmouth bass fry, these trapping mechanisms could also potentially adversely affect native salmonids if they are present in the trapping areas when water surface elevations decline. An area referred to as the "Cobble Sisters" at PRM 30.3 within the Upper Reservoir Reach was identified as an area with a high occurrence of trapping. The pools and depressions at the site are the result of aggregate mining that occurred prior to completion of the Project and represent about 21 percent of the trapping area within the upper reservoir. The excavated depressions have persisted since construction of the Project, which suggests the area is geomorphically stable. To reduce the incidence of trapping and stranding at the site, SCL shall excavate a channel connecting the pools with the mainstem flow and minimize the risk of fish becoming trapped in isolated pools.

The tributary deltas are important transition zones between mainstem and tributary habitats and coldwater tributary plumes offer thermal refugia to native salmonids during warm summer months. The tributary deltas are characterized as containing poor habitat features due to the lack of stable bedforms, small substrate particle sizes, sparse cover (e.g., boulders, LWD) and few pools. SCL shall enhance tributary delta habitat by providing additional cover for salmonids holding in the coldwater refugia at tributary mouths. LWD jams shall be placed and maintained in the thalweg in the upper delta regions of four tributaries to Boundary Reservoir, including delta regions of Sullivan and Slate creeks which are proposed as critical bull trout habitat.

Both salmonids and predatory sportfish have been observed holding at the confluence of tributaries to Boundary Reservoir and the influence of introduced sportfish predators on salmonid populations is unclear. SCL shall conduct fish community surveys in Boundary Reservoir to monitor changes in salmonid and major predatory sportfish population abundance and size structure. The goal of the mainstem reservoir fish community monitoring is to provide federal, state, and tribal agencies with demographic and population information on fish species inhabiting the Project area to inform future management decisions. SCL shall also conduct a study to evaluate predation on outmigrating native salmonids at select tributary deltas. The objective of the study will be to quantify the proportion of outmigrating native salmonids that are being consumed by predatory fish within selected tributary deltas. Monitoring and evaluation of salmonid and predatory sportfish populations will help guide future native salmonid recovery efforts.

2.2. Upstream Fish Passage

Boundary Dam was built without fish passage facilities because downstream power and water storage projects, such as Grand Coulee and Chief Joseph dams, blocked anadromous fish migrations to the Upper Columbia Basin. Without upstream fish passage facilities, any potential gene flow by native salmonids can only occur in a downstream direction by fish that survive entrainment. However, declines in populations of native salmonids have increased attention on protecting resident fish movements. The USFWS Bull Trout Draft Recovery Plan, for example, currently calls for upstream passage at Albeni Falls (U.S. Army Corps of Engineers (USACOE)), Box Canyon Dam (Pend Oreille PUD (POPUD)) and Boundary Dam (Seattle City Light). POPUD is planning to construct upstream fish passage facilities at Box Canyon Dam targeting upstream passage of bull trout, westslope cutthroat trout, and mountain whitefish.

As part of relicensing activities, SCL and a team of fish passage experts evaluated options for bypassing upstream migrating fish around Boundary Dam (McMillen 2009). As part of the Boundary SA upstream fish passage will be addressed with a traditional trap and haul fishway based on NMFS criteria. A trap and haul facility is appropriate due to comparatively low population sizes of native salmonids and physical site constraints in the tailrace. While agreement has been reached on the preferred alternative, there is uncertainty regarding an appropriate site within the tailrace for the fixed trap-and-haul facility. In addition, because of the low numbers of native salmonids captured or observed in the Boundary Dam tailrace, there is little direct information regarding movement patterns of bull trout, cutthroat trout, or mountain whitefish in the Boundary tailrace.

Consistent with the Boundary SA, the process for developing the trap and haul fishway includes a 2-year study design and planning effort and an 8-year research and development phase to evaluate site specific conditions and biological traits of the target species in the Project area. Details of the research and development phase shall be confirmed after license issuance in consultation with the FAWG, but a conceptual plan was developed that includes multi-year biotelemetry studies and attraction flow tests in multiple tailrace locations (Tables 2.2-1 and 2.2-2).

Since few target fish were captured in the tailrace during pre-licensing studies, fishway attraction effectiveness shall be evaluated using target species from upstream sources or that demonstrate upstream migration behavior. For instance, in consultation with the FAWG and appropriate agencies, SCL may collect bull trout from Lake Pend Oreille, insert radio and/or acoustic tags, release the fish into the Boundary tailrace, and use micro-telemetry studies of those fish to identify an effective fishway entrance location and design.

Table 2.2-1. Initial Conceptual Schedule of Post-licensing Tasks for Upstream Fishway Development.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Initial study design	X	X													
Stock status and genetic analysis	Conducted as part of the entrainment reduction research and monitoring effort														
Capture, radio-tag and track target species in tailrace				X	X	X	X	X							
Test tailrace attraction by releasing tagged Lake Pend Oreille bull trout in tailrace				X	X	X	X	X							
Tailrace micro biotelemetry			X	X	X	X	X	X							
Design and construction of attraction water at two or three tailrace locations		X	X	X	X	X	X	X							
Construction of fish trap at preferred fish attraction site(s)					X	X	X	X							
Tailrace hydraulic measurements				X					X						
Compile all results – Evaluate alternatives									X						
Tailrace physical model (if needed)				X	X	X	X								
FAWG decision point on fishway location										X					
Conceptual design of upstream fishway										X	X				
FAWG approval of fishway design											X				
Permitting, design and construction of upstream fishway												X	X	X	
Upstream fishway operational															**X**

Table 2.2-2. Conceptual Description of Post-licensing Research, Monitoring and Development Tasks for the Upstream Fishway.

Initial study design	Develop and describe 14-year study program in consultation with and subject to approval of the FAWG. This study program will outline study requirements and objectives, scope the areas of TAC involvement, identify task relationships to other fishway tasks and other PMEs, and describe the detailed scope of work and study plans for year 2-3 studies
Stock status and genetic analysis	Sample and analyze target species in tailrace to identify stock status and genetics.
Capture, radio-tag and track target species in tailrace	Electrofishing and other methods conducted to put radio tags in target fish species in the tailrace
Test tailrace attraction by releasing tagged Lake Pend Oreille bull trout in tailrace	Obtain approvals and transport bull trout to tailrace from Lake Pend Oreille. Implant radio tags in bull trout for analysis of upstream passage behavior
Tailrace micro biotelemetry	Detailed receiver grid in tailrace to assess and evaluate movement and behavior of radio-tagged target species
Design and construction of attraction water at two or three tailrace locations	Release attraction water in the tailrace at two or three locations to evaluate target species response and behavior. This program may include pumping water from the tailrace, gravity flow from the forebay, and potentially evaluating the use of cold water to attract target species.
Construction of fish trap at preferred fish attraction site	Design and construction of fish trap(s) at locations where target species are attracted to attraction water in micro biotelemetry studies.
Tailrace hydraulic measurements	Measurements in the tailrace to support fish passage facility design and potential physical model development.
Tailrace physical model (if needed)	A physical model of the tailrace may be necessary/advantageous to assist in designing and/or understanding target species behavior.
FAWG decision point on fishway location	In year 10, it will be necessary to get FAWG approval of the location and amount of attraction flow to be used for the permanent fish passage facility. It is expected that the TAG will assist with this decision.
Conceptual design of upstream fishway	Efforts to design the permanent facility.
FAWG approval of fishway design	FAWG approval of final designs for permanent upstream fishway.
Permitting, design and construction of upstream fishway	It is assumed that this will consist of some lead time to permit the facility, obtain all necessary approvals and construct the permanent facility. It is expected that the facility will go on-line in year 14 or 15.
Upstream fishway operational	An upstream fishway will be operational by post-licensing year 15. During the interim period, target species captured will be released upstream per handling protocols to be developed in consultation with the FAWG and appropriate agencies.

2.1. Reduction of Project Related Entrainment

Boundary Dam was built without entrainment reduction facilities. As fish pass downstream through Boundary Dam facilities, they are exposed to potential injury and mortality, with the level of mortality depending on the pathway, flow rate, and size of fish. A total of about 55,000 fish was estimated to have been entrained through all Project turbines and spill gates at the Project over a one-year period (SCL 2009a). Suckers, pumpkinseed, and yellow perch dominated the catch in fyke nets installed in the draft tube of turbine Unit 54. Although native salmonids were not captured as part of the turbine Unit 54 fyke net fishing effort, evidence of downstream movement of native salmonids was provided by the capture of two bull trout in the Boundary tailrace identified through genetic analysis as originating upstream in the Lake Pend Oreille basin. Although the number of native salmonids entrained through Boundary Dam may be small, the influence of entrainment on recovery of native salmonid populations is uncertain.

As part of relicensing activities, a team of fish passage experts evaluated alternate entrainment reduction concepts at Boundary Dam including fixed full flow screens, modular inclined screens, and floating or fixed surface collectors (McMillen 2009). The results of the evaluation determined that a floating surface collector concept would provide the most flexibility and potentially the highest incremental increase in fish protection. The estimated incremental increase in survival was 0 to 2 percent for 4-inch fish, -1 to 9 percent for 10-inch fish, and 8 to 21 percent for 24-inch fish. Since little is known about the migration depth of bull trout, westslope cutthroat trout, and mountain whitefish, the efficacy of a floating surface collector concept to reduce entrainment of the target species is uncertain.

Due to uncertainty regarding the effects of entrainment on target fish populations, and uncertainty regarding the efficacy of available entrainment reduction options, SCL shall implement an entrainment reduction program including an evaluation phase to assess the effects of Project entrainment on target species. During Years 1-18, SCL shall develop and implement studies (see Tables 2.2-3 and 2.2-4) sufficient to quantify the effects of entrainment on target species and to determine whether any population of target fish species (i.e., a unique population that constitutes a substantial percentage of fish in the Project area or that has a unique evolutionary niche that requires special protection) or a substantial number of target fish are affected by Project entrainment.

Successful implementation of the Entrainment Reduction Program (ERP) shall mitigate for the effects of entrainment on target species (bull trout, westslope cutthroat trout, and mountain whitefish) by either: (1) preventing entrainment at the Project; (2) reducing entrainment at the Project and mitigating for the remaining effects; or (3) fully mitigating for the effects of entrainment through other measures. The decision as to whether entrainment is best addressed through options 1, 2 or 3 as defined above, shall be made by the FAWG based on site specific information developed under this program. SCL shall work collaboratively with the FAWG in all aspects of this program and all decisions regarding this program made by SCL and the FAWG are subject to the approval of USFS, Ecology, and DOI.

Table 2.2-3. Initial Conceptual Schedule of Entrainment Reduction Tasks (Years 1-18).

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Study design	X	X																
Mainstem/Tributary project survival																X	X	X
Tributary fyke netting				X	X	X	X	X	X	X	X	X	X	X	X	X		
Sullivan screw trap					X	X	X	X	X	X	X	X	X	X	X	X		
Metaline Falls screw trap									X	X	X	X	X	X	X	X		
Tributary stock status/genetics		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Forebay/trashrack screw trap												X	X	X	X	X		
Tailrace screw trap										X	X	X	X					
Reservoir boat electrofishing				X	X	X	X	X	X	X	X	X	X	X	X	X		
Trib delta and mainstem macro biotelemetry											X	X	X	X	X			
Tailrace macro biotelemetry											X	X	X	X	X			
Forebay micro biotelemetry																X	X	X
Forebay hydraulic measurements														X	X			
Forebay CFD modeling															X	X	X	
Downstream conceptual design																X	X	X
Turbine/spillway mortality												X	X	X	X			
Forebay hydroacoustics															X	X	X	X

Table 2.2-4. Description of Initial Conceptual Entrainment Reduction Tasks (Years 1-18).

Study design	Develop 18-year study program in consultation with and subject to approval of the FAWG
Project effects of entrainment	Programmatic review of Project entrainment effects, including life cycle models and other tools to evaluate benefits of entrainment reduction facilities or alternate strategies to improve Project survival
Tributary fyke netting	5 creeks: Sullivan/Slate/Linton/Sand/Sweet, Mar-Nov, configured and deployed to trap upstream and downstream movement of fish> 4 inch, deployed 4 days per week, not manned on 24-hour basis but checked daily or more frequently during expected high debris events, 2 person crew , include trap efficiency tests (upstream and downstream), in addition to species, length, weight, etc, collect tissue samples, insert PIT >4 inch target species
Sullivan screw trap	Small screw trap operated Apr-Jun, Oct-Nov (high flow when delta fyke net less effective), 4 days per week, located in deep turbulent slot in lower reach, include trap efficiency tests (high initial cost of trap purchase but lower operating costs when also deploying fyke nets)
Metaline Falls screw trap	Large screw trap with robust mods, operated Mar-Nov except spill, 4 days per week, pick up PIT tags from trib trapping efforts
Tributary stock status/genetics	Collect and analyze DNA tissue samples of target species from reservoir and tributary reaches
Forebay screw trap	Large screw trap with robust mods, operated downstream of trashrack to evaluate efficacy of potential floating surface collector,
Tailrace screw trap	Large screw trap with robust add-ons, located in turbine outfall turbulence, operated Mar-Nov except during spill
Reservoir fish surveys	Electrofishing /other sampling gear to support Project survival evaluations in addition to Reservoir Fish Community Monitoring
Trib delta and mainstem macro biotelemetry	Fixed receivers established upstream of trib mouths and at mainstem reservoir locations to track seasonal movements, CART tags needed for deepwater areas, include multiple acoustic receivers below Metaline Falls, mouth of Canyon and Forebay
Tailrace macro biotelemetry	Fixed receivers located in tailwater and at US/Canada border to detect downstream movement through area
Forebay micro biotelemetry	Multiple acoustic receiver array in Forebay to track movement of fish during various generation and flow conditions, info used to assess facility design, location and potential efficacy
Forebay hydraulic measurements	Transect measurements in vicinity of trashrack during various generation and flow conditions, multiple tracks using ADCP set at shallow (0-50 ft) and full depth velocity readings
Forebay CFD modeling	Detailed hydraulic modeling to support conceptual design of entrainment reduction facility
Entrainment reduction facility conceptual design	Engineering design to be developed under TAC oversight
Turbine/spillway mortality	Use Hi-Z tags or other methodology to confirm mortality estimates
Forebay hydroacoustics	Deployment may be dependent on technology improvements

2.2. Tributary Aquatic Habitat

Based on the results of extensive modeling, monitoring, and analyses of Project effects, which indicated limited opportunity to recover native salmonid populations through mainstem habitat improvement, many of the Boundary aquatic PM&E efforts focus on implementing measures in Boundary tributaries (SCL 2009a). Most of the tributaries to Boundary Reservoir have been stocked with non-native salmonids such as brook trout, brown trout, and hatchery rainbow trout from out-of-basin stocks. The presence of non-native trout, especially brook trout, is a serious threat to native salmonids as a result of interbreeding (with bull and westslope cutthroat trout) and competition for habitat and food resources. The USFWS (1999) stated in its status review that westslope cutthroat trout are usually found in the cooler upper extents of tributaries, but suggested this use was more likely driven by competition from other trout such as rainbow trout and brook trout that are less tolerant of cooler, higher gradient streams, rather than a preference for that habitat type. Habitat in the tributary reaches has been degraded by blocking culverts, roads constructed in riparian zones, and past logging practices which reduced LWD recruitment. SCL shall implement biological and habitat treatments in tributaries to Boundary Reservoir to benefit native salmonids, followed by monitoring and adaptive management to increase performance of the measures.

The objective of the tributary aquatic habitat program is to establish self-sustaining, naturally reproducing native stocks of fish and provide access to and improve habitat conditions in tributaries draining to Boundary Reservoir to offset an estimated 304 acres of reservoir habitat affected by the Boundary Project. Fish population and habitat condition goals are needed to guide these restoration efforts. Prior to implementing tributary treatments, a Tributary Management Plan shall be developed that includes a schedule and scope of treatments for each tributary to ensure that treatments are complementary to the population and habitat goals. For instance, removal of culverts that block tributary access might be delayed until after brook trout suppression efforts to reduce the risk of brook trout recolonization. Biological treatments shall include suppression or eradication of non-native fish in tributary reaches and selected lakes draining to Boundary Reservoir. Backpack electrofishing shall be the technique used to capture non-native fish (primarily brook trout) during suppression efforts. Details of the suppression program, including the disposition of captured non-native fish, shall be determined during post-license planning. Eradication of non-native fish shall involve multiple applications of an approved fish toxicant in select water bodies.

Habitat treatments shall consist of a variety of measures designed in response to the site specific conditions. Removal or replacement of blocking culverts will restore access to habitats. Logjams and LWD pieces will be placed to increase channel complexity, retain gravel and support pool formation. Riparian plantings and streamside road improvements will benefit tributary habitat conditions by reducing fine sediment runoff, increase shade and canopy cover to reduce water temperatures, and increase the long-term recruitment of LWD to the streams. Where possible, easements shall be purchased to reduce development and other impacts to the riparian areas and provide long-term protection to native salmonid habitat. Additional details of the location, scope and schedule of biological and habitat treatments are in the main body of the FAMP.

During studies conducted as part of the ILP process, SCL categorized tributaries flowing into Boundary Reservoir according to habitat availability for native salmonids and the potential opportunity to improve conditions through habitat manipulation (see Assessment of Factors Affecting Aquatic Productivity in Tributary Habitats, Study No. 14, SCL 2009a). Twenty-eight tributaries were categorized as primary, secondary, or excluded according to the extent to which habitat improvement action would likely benefit native salmonids. The majority of tributary treatments are directed at primary or secondary reaches (i.e., Tier-1) that provide the greatest potential to influence native fish resources. As part of the comprehensive Boundary SA the settling parties have agreed that, SCL should also implement measures to improve aquatic habitat conditions in low priority tributaries (i.e., Tier-2) that because of their small size and limited adfluvial habitat were previously assumed to have a low potential to benefit native salmonids. The over-riding criterion is that the Tier-2 tributary must have, or potentially have, useable native salmonid habitat that could be effectively improved through habitat improvement or protection.

Suppressing or eradicating non-native fish from tributary reaches and implementing habitat treatments will provide the opportunity for population recovery if there is sufficient recruitment of native salmonids. Currently, no self-reproducing bull trout populations occur in any tributaries to Boundary Reservoir. Outplanting of early lifestage, locally adapted, native salmonids spawned and reared in an appropriate facility may support rapid population response to biological and habitat treatments.

2.3. Mill Pond Restoration, Site Monitoring and Maintenance

Mill Pond, located at RM 3.9 on Sullivan Creek, was created when a log crib dam was constructed in 1909 by the Portland Cement Company. An un-gated concrete dam was built in 1921 just below the log crib dam. The concrete dam is 134 feet long and about 55 feet high and maintains the water surface elevation of Mill Pond at approximately 2,520 feet NAVD 88.

Mill Pond Dam is a complete barrier to the upstream movement of resident fish (SCL 2009). The impoundment has altered natural stream processes in Sullivan Creek by interrupting the downstream transport of all bedload material and some LWD. The dam has created a condition where Sullivan Creek downstream of Mill Pond Dam is sediment depleted (USFS 1996). The sediment transport capacity downstream of the dam exceeds the sediment supply, which has resulted in extensive armoring of the bed surface and a lack of gravels for use by spawning salmonid populations. The Mill Pond impoundment has also slowed water velocities and increased summer water temperatures in lower Sullivan Creek.

POPUD has agreed to remove Mill Pond Dam and restore the site as part of its surrender of the Sullivan Creek Project license. The Mill Pond Decommissioning Plan submitted by POPUD to FERC as part of its surrender application requires removal of both the concrete and log crib dams and artificial foundations to facilitate natural stream functions. Existing sediments that have accumulated behind Mill Pond Dam shall be managed to facilitate dam removal and stream channel restoration. Following dam removal, the Sullivan Creek stream channel, from upstream of Mill Pond Dam site to Outlet Creek shall be restored to a self-functioning system consistent with the Sullivan Creek channel upstream and downstream of Mill Pond. New stream channel

banks shall be stabilized with keyed-in logs with root wads and large boulders, and then planted with native herbaceous and woody riparian species.

Benefits of Mill Pond Dam removal and associated site restoration will include elimination of the man-made barrier to upstream fish passage, an increase in the quantity and quality of habitat for native salmonids, restoration of downstream transport of coarse sediment and LWD, and benefits to water quality in the form of reduced summer water temperatures due to reductions in water surface area and increases in water velocity in the area of Mill Pond Reservoir.

Following completion of the restoration effort and after FERC jurisdiction over the site through the Sullivan Creek Project license ends, the New License for Boundary shall require SCL to monitor and maintain the site to ensure that the stream channel and floodplain are functioning in accordance with the design criteria, that riparian and upland vegetation is becoming established and to control non-native plant species.

2.4. Native Salmonid Conservation Program

Outplanting of native salmonids produced from an approved facility can complement brook trout suppression and habitat improvement activities and assist the rapid recruitment and colonization of underutilized tributary habitats. No self-reproducing bull trout populations occur in any tributaries to Boundary Reservoir and artificial propagation of bull trout could be used to seed currently unoccupied habitat (see Assessment of Factors Affecting Aquatic Productivity in Tributary Habitats, Study No. 14, SCL 2009a; USFWS 2002).

SCL shall fund the design, construction, operation and maintenance of a native fish conservation facility for the production of native salmonids to supplement tributaries draining into Boundary Reservoir. The facility shall be designed to produce eyed eggs, fry, and fingerlings and support multiple age class broodstock. The facility shall be designed to simultaneously propagate two species of fish and several life stages including but not limited to westslope cutthroat trout and bull trout. Selection of species, stocks, and lifestages to be produced shall be determined as part of post-license planning in consultation with and subject to approval of the FAWG. Locally adapted, multiple age class broodstock shall be used to maintain long-term fitness traits and the facility shall be operated to minimize genetic divergence from local, naturally spawning stocks. Annual production shall be commensurate with the need to outplant fish in tributaries draining into Boundary Reservoir.

The facility shall be designed to incorporate techniques to increase fish fitness and survival after release. Design considerations for outdoor rearing facilities shall consist of a naturalized, sinuous channel lined with cobble and gravel substrate similar to Boundary drainages, feeding system, natural shading, and instream woody habitat. The primary distribution of fish is assumed to be fingerlings, but may include stream-side incubators or artificial redds to minimize potential domestication.

SCL, in consultation with and subject to approval of the FAWG, USFS, and Ecology, shall establish measurable goals for the Conservation Program by determining appropriate tributary target fish populations and establishing self-sustaining native stocks of fish. Optimal outplanting strategies for achieving desired goals shall be identified by monitoring and evaluating multiple

outplanting strategies that consider appropriate fish sizes, outplanting densities, frequency and timing. SCL shall monitor the initial success of outplanted native salmonids and conduct periodic monitoring until population goals are achieved.

2.5. Recreational Fish Stocking Program

Boundary Project operations impact mainstem and tributary delta habitats, and cause loss of fish through entrainment and increased predation on salmonids associated with the reservoir environment (SCL 2009a). Since 2001, SCL has voluntarily stocked sterile rainbow trout in the Boundary Reservoir to increase recreational fish opportunities. As of 2010, SCL will discontinue stocking triploid trout in Boundary Reservoir since WDFW will not permit the activity citing concerns regarding potential competition with native trout and poor trout habitat conditions in the reservoir.

As part of an ongoing WDFW program, fry and fingerling trout are routinely stocked in Washington lakes during the spring and fall where they grow on natural food until the following spring when they are large enough to be harvested. Where fry survival is low, or where there is intense fishing pressure, catchable size trout, 8 inches or larger, are stocked to improve recreational opportunities. In addition to fertile rainbow and cutthroat trout, sterile and hybrid trout are sometimes planted in select lakes. If provided with an abundant food supply, sterile triploid and hybrid trout have the potential to quickly grow to trophy size. Sterile trout are also planted in areas where natural reproduction could adversely affect native species.

To provide recreational fishing opportunities, SCL shall stock trout in 18 lakes within a fifteen-mile area around the Project. Trout species stocked in these lakes may consist of westslope cutthroat, rainbow, rainbow triploid, or tiger trout, and may include fall fry, fingerlings, spring fry and catchable-size fish. These fish shall be annually produced and planted by WDFW; however, fish may be obtained from a commercial production facility if fish are unavailable from WDFW. Approximately 11,678 pounds of fish shall be stocked annually. SCL shall monitor and evaluate lakes receiving the stocked fish. The number, size, and species of fish to be stocked in the selected lakes each year may be modified in response to the information developed through annual monitoring.

2.6. Fund for Habitat Improvements in Tributaries to Sullivan Lake

In addition to the previously described fish and aquatic PM&E measures, SCL shall implement an additional measure governed by License Article 9(I) that is expected to benefit native salmonids in the Project area but that is not addressed in detail by the FAMP.

Sullivan Lake supports a naturally-reproducing, self-sustaining population of kokanee (*Oncorhynchus nerka*) that is a recreational fishery of regional importance (Baldwin and McLellan 2005). Kokanee are a landlocked form of sockeye salmon that rear in Sullivan Lake but spawn in lower Harvey Creek draining to Sullivan Lake. SCL shall help pay for improvements to aquatic habitat conditions in Harvey, Noisy and Jungle creeks that flow into Sullivan Lake through habitat treatments to be implemented under a $2.5 million fund. Improving aquatic habitat conditions in these tributaries will benefit the Sullivan Lake kokanee population and reduce recreational fishing pressure on Boundary tributary streams. In addition,

genetic testing of cutthroat trout suggests that relatively pure strains of westslope cutthroat trout occur in Harvey Creek upstream of Sullivan Lake. Improving habitat conditions in Harvey Creek will increase protection to a westslope cutthroat trout population in the Boundary drainage. The Sullivan Lake Upper Tributary Fund is not addressed in the FAMP since SCL's responsibilities are limited to establishing the fund which shall be administered by the FAWG.

2.7. Conclusion

This FAMP shall be the principal guiding document for the planning, implementation, monitoring, adaptation and reporting of PM&E measures for fish and aquatic resources affected by or related to the Project. The FAMP includes specific goals for fish and aquatic resources, as well as clearly defined objectives for achieving the goals.

SCL shall implement the FAMP in consultation with a FAWG. The FAWG shall consist of representatives from SCL and the federal, state, tribal, and local entities having jurisdiction over, or interest in, the implementation of the Project license articles related to fisheries and aquatic resources. At the discretion of the FAWG, technical advisory committees (TACs) shall be created for specific issues, such as upstream passage or hatchery design and operating protocols.

Details regarding consultation, decision making, communications and documentation related to the FAWG are addressed in Section 8 of the Boundary SA and included as Appendix 1 to this FAMP.

In accordance with License Article 9 and the procedures in Appendix 1, SCL shall prepare any proposed amendments to the FAMP in consultation with the FAWG and subject to approval by the United States Forest Service, DOI, and Ecology prior to filing with the Commission.

3 REGULATORY REFERENCE AND DEFINITIONS

Implementation of the FAMP will be conducted following regulatory guidance as identified in various federal, state, and local policy documents and permitting requirements for specific PM&E measures. Depending on the final design of the PM&E measures and implementation methods, it is anticipated that some or all of the permits described in the following sections may be required.

3.1. Federal Authority and Reference

Federal permits and other requirements that may be needed to implement components to the FAMP include:

- USDA Forest Service Special Use Permit.
- USACOE Section 10 and 404 Permits. This permitting is usually considered as part of the Joint Aquatic Resources Permit Application (JARPA). A Section 10 permit is needed for working in, over, or under navigable waters of the United States. A Section 404 permit is needed for dredging or filling in waters of the United States.

- National Historic Preservation Act Review. A review is necessary for any ground-disturbing activity. All cultural resource issues will be addressed by the Cultural Resources Work Group.
- Endangered Species Act Section 7 Review. If specific projects are not covered under the broader Section 7 review conducted as part of Project relicensing, they will need review by the USFWS. This review is generally covered as part of the JARPA process.
- Environmental analysis is necessary for any activity that would be proposed for implementation on federal land ownership. This analysis would need to comply with requirements under the National Environmental Policy Act (NEPA).

A wide variety of documents outline federal policy for the various agencies that could be pertinent to the FAMP. Federal agency staff is responsible for understanding the policies of their respective agencies and alerting the FAWG to policies pertinent to implementing the FAMP.

3.2. Washington State Authority and Reference

State permits that may be needed to implement components of the FAMP include:

- Hydraulic Project Approval (HPA) (WDFW). The HPA permit is needed for any instream activity and is generally included in the JARPA process.
- Aquatic Use Authorization (WDNR). This permit is triggered by use of state owned lands such as shore lands and beds of navigable waters. The Use Permit is generally included in the JARPA process, but may be required if in-water work is required as part of plan development.
- Critical Area Review and State Environmental Policy Act (SEPA). This process is usually considered as part of the JARPA. It is needed when work is considered in or near waterways. There is no required review period; time required for permitting depends on issues identified and the amount and type of additional information that may be required. A SEPA checklist will be required if the JARPA process is not approved or if HPA is not required.
- Shoreline Substantial Development/Conditional Use Permit. The streamlined HPA process generally provides an exemption from the County Conditions Use Permit process.
- Water Quality Certification (Ecology).

Similar to federal regulations, a wide variety of documents outline state policy for the various agencies that will be members of the FAMP. State agency staff is responsible for understanding the policies of their respective agencies and alerting the FAWG to policies pertinent to implementing the FAMP.

3.3. Local Authority and Reference

County or City Regulations will also be followed, and any permits will be obtained for implementing the plan. Examples could be:

- Grading and clearing permits.
- Sensitive Area Ordinance; review occurs as part of the JARPA process.
- Pend Oreille County Shoreline Master Program; review occurs as part of the JARPA process.

3.4. Definitions

To ensure a common understanding of terms used in the FAMP, the following definitions apply:

JARPA: Joint Aquatic Resources Permit Application. This is a combined application for obtaining the following permits:

- Section 404 and Section 10 (USACOE)
- ESA Consultation (USFWS)
- Section 9 Bridge Permit (Coast Guard; not applicable for PM&Es)
- 401 Water Quality Certification (Ecology)
- Hydraulic Project Approval (WDFW)
- Shoreline (Local Government)
- Substantial Development (Local Government)
- Conditional Use (Local Government)
- Permit Variance, Exemption, or Revision (Local Government)
- Floodplain Management (Local Government)
- Critical Areas Ordinance (Local Government)

Engineered logjam: A structure constructed of logs built within the channel or floodplain of a stream and designed according to standard engineering principles (Saldi-Caromile et al. 2004).

Key piece: A piece of LWD that is sufficiently large to be relatively stable. This size is dependent upon stream size and follows classification identified in Fox and Bolton (2007). For streams greater than 98.4 feet in width, a key piece must have an attached rootwad.

LWD: Existing instream woody debris or woody debris that is placed partially or entirely within the ordinary high water mark of the stream. Size is dependent upon stream size and follows classification identified in Fox and Bolton (2007).

Riparian buffer: A buffer on each side of a stream measured from the ordinary high water mark. For the purposes of the FAMP riparian buffers widths are specific to each measure and depend on stream size, geomorphic characteristics, adjacent land ownership, and the presence of roads and other infrastructure.

Riparian plants: Native plants commonly found in riparian zones of the Boundary Project and its tributaries (Table 3-4-1).

Riparian planting density: Planting density for trees and shrubs during restoration of a riparian buffer. Low density is approximately 440 plants per acre (1 plant per 100 square feet spacing). Medium density is approximately 870 plants per acre (1 plant per 50 square feet spacing). High density is approximately 4,360 plants per acre (1 plant per 10 square-feet spacing).

Native salmonids: Bull trout (*Salvelinus confluentus*), westslope cutthroat trout (*Oncorhynchus clarki lewisi*), and mountain whitefish (*Prosopium williamsoni*).

Relicensing participants (RPs): Collectively, the Federal (EPA; through Ecology, USFS, USFWS, Bureau of Indian Affairs, State (WDFW, Ecology), Kalispel Tribe and Selkirk Conservation Alliance (SCA) on behalf of the Hydropower Reform Coalition were active participants in the relicensing process.

Substrate size: Bedload substrate size classifications follow those in WDFW and Ecology (2003).

Compliance monitoring: Monitoring that is conducted to determine if a measure has been implemented according to the planned design.

Effectiveness monitoring: Monitoring that is conducted to determine if a measure is functioning as designed. A measure can be functioning properly and not achieve all biological objectives for the measure. For example, aquatic habitat can be improved, but not used by target species.

Biological monitoring: Monitoring that is conducted to obtain baseline and trend data for organisms. Examples of data include species composition, abundance, and size information collected at one or more locations and time periods.

Research monitoring: Monitoring that is conducted to answer specific scientific questions, such as validating assumptions, reducing uncertainty, or identifying relationships between physical and biological factors. Research monitoring may use the results of biological monitoring for retroactive analysis; however, research monitoring typically identifies specific hypotheses for testing prior to designing a monitoring program and collecting data.

Adaptive management: For the purposes of the FAMP, adaptive management is the periodic adjustment made to the implementation of a PM&E measure over the course of the license based on the results of monitoring or other information. The adaptive management of PM&E measures will occur in collaboration with the FAWG.

Tier 1 Tributaries: All named tributaries draining into Boundary Reservoir categorized as primary (high opportunity for restoration or enhancement of native salmonid habitat) in SCL (2009) plus one tributary categorized as secondary (moderate opportunity for restoration or enhancement). Tier 1 tributaries include Sullivan Creek, Slate Creek, Sweet Creek, Linton

Creek, Sand Creek, Lime Creek, Pewee Creek, Flume Creek, Pocahontas Creek, and their associated drainages.

Tier 2 Tributaries: Tributaries categorized as secondary (from moderate to no opportunity for restoration or enhancement of native salmonid habitat) in SCL (2009). Tier 2 tributaries include Everett Creek, Whiskey Gulch, Beaver Creek, Threemile Creek, Wolf Creek, Lost Creek, and 13 unnamed tributaries.

Culvert Replacements: Culverts replaced on fish-bearing waters designed to meet fish passage criteria in WDFW (2003) design of road culverts for fish passage or current applicable WDFW criteria. Culverts replaced on non-fish-bearing waters will be designed to allow to pass a 100-year flood event.

Table 3.4-1. Common Plants Suitable for Riparian Restoration in the Boundary Project Area and its Tributaries.

Common Name	Scientific Name	Habitat Notes
Mountain alder	*Alnus incana*	high water table, close to streams
red-osier dogwood	*Cornus stolonifera*	wetland and riparian zones, tolerant of fluctuating water table
Douglas spiraea	*Spiraea douglasii*	high water table, close to streams
Sitka alder	*Alnus sinuata*	high water table, close to streams
Native willow species	*Salix* spp.	rivers and streambanks, wetlands; often along backwaters
Black cottonwood	*Populus balsamifera spp. tricocarpa*	fast growing, pioneer species on alluvial soils
Black hawthorn	*Crataegus douglasii*	understory to Populus, moist to mesic sites

3.5. Other Relevant Articles of the License

This will be completed after reviewing final FERC license articles. For example, articles regarding aquatic vegetation management or water quality may be pertinent to the FAMP.

4 PLAN DEVELOPMENT PROCESS

4.1. Federal, State, and Tribal Coordination

The FAMP is the culmination of more than two years of discussion with federal, state, and tribal agencies and implementation of a number of studies conducted by SCL investigating physical and biological processes within the Project area and tributaries to Boundary Reservoir. Following FERC's ILP, SCL developed study plans and reports that were reviewed by relicensing participants. Numerous meetings were held to discuss proposed study plans and the interim and final results of the studies. Following completion of the studies a PLP was drafted by SCL, which included a set of preliminary PM&E measures. Relicensing participants prepared

comments on the PLP and included proposed PM&E measures. SCL met with relicensing participants to discuss the effects of the Project as part of an Integrated Resource Analysis (IRA). Throughout the process SCL and relicensing participants have achieved a better understanding of each other's goals and objectives for the management of the Project and the aquatic community in the reservoir and its tributaries (for greater detail regarding RP consultation, see Section 3 of Exhibit E of the License Application).

4.2. Provisions for Further Development and Modification of the FAMP

SCL anticipates that some aspects of the FAMP will require further development and modification. For example, many of the PM&E measures, such as components upstream fish passage, are currently conceptual. To implement specific mitigation or enhancement projects, additional field data and planning will be needed to prepare specific designs. The FAWG will be responsible for providing guidance in the further development and modification of the FAMP and associated fish and aquatics resource PM&E measures.

5 PLAN IMPLEMENTATION

5.1. Mainstem Fish Community and Aquatic Habitat Measures

PM&E measures described in this section of the FAMP shall be governed by License Article 9(A).

5.1.1. Gravel Augmentation below Box Canyon Dam

5.1.1.1. Scope

SCL shall place a total volume of 1,500 cubic yards (yd^3) of screened gravels to increase potential mountain whitefish spawning habitat in the upper reservoir. The gravels will be of a size distribution suitable for use by spawning mountain whitefish and will be placed at up to six sites between PRM 29.1 and Box Canyon Dam. Tentative sites have been identified at PRM 33.7 (0.8 mile below Box Canyon Dam) (Figure 5.1-1), but final site selection will be approved by the FAWG. Up to 25 percent of the gravel/cobble volume (375 yd^3) will be replenished every 5 years. Implementation planning shall be completed within 3 years following license issuance and will be developed in consultation with and approved by the FAWG. Implementation planning will identify depth, velocity, existing substrate, vicinity to existing mountain whitefish spawning areas and other criteria deemed necessary for final site selection. In an effort to increase gravel retention at the placement sites, SCL shall install up to 189 tons of 3-4 ft diameter boulders in weirs or other structural designs. Up to 25 percent of the boulders (about 47 tons) will be replenished every ten years as needed to increase gravel retention. Construction of the boulder weirs and gravel placement will occur in two steps; up to four of the sites will be constructed in Year 4 following license issuance, and the remaining sites will be constructed in Year 10 following license issuance or as otherwise determined by the FAWG. The design and location of the Year 10 gravel augmentation sites will be approved by the FAWG and will consider the effectiveness of sites constructed in Year 4.

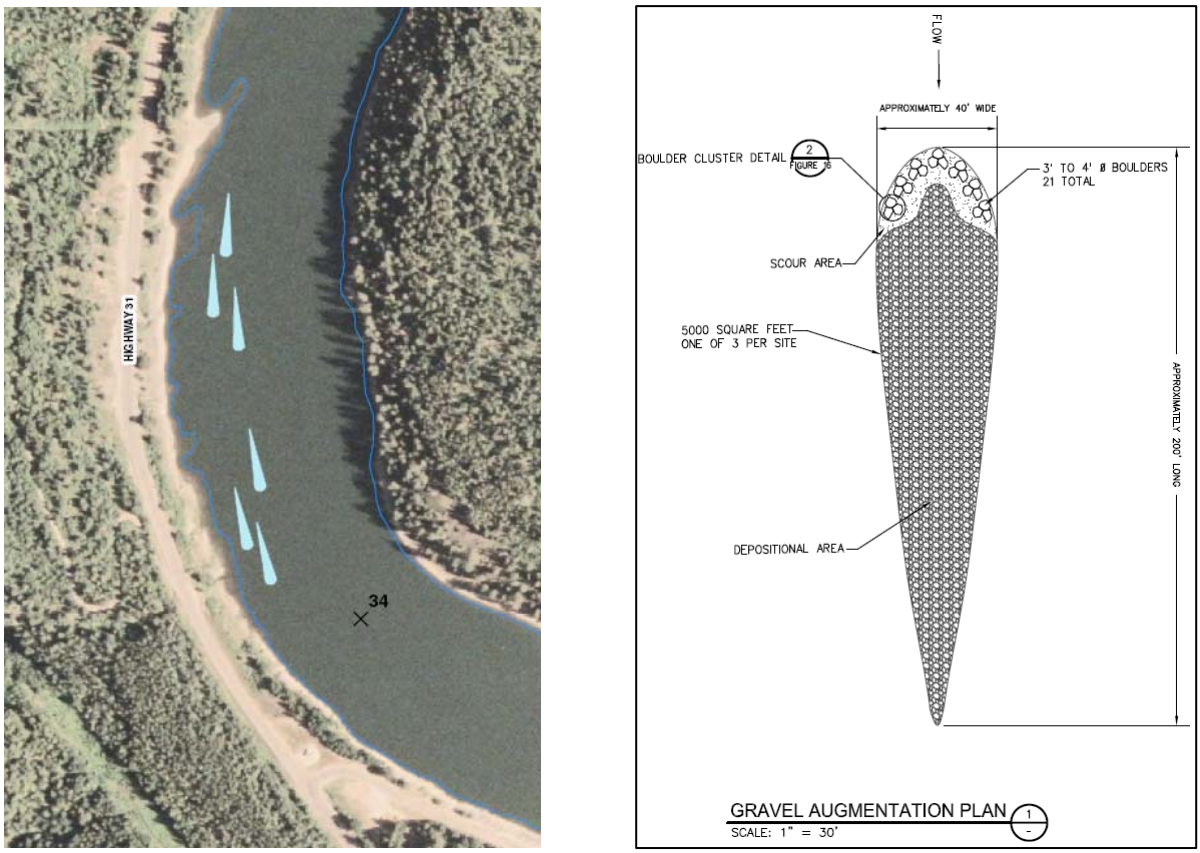

Figure 5.1-1. Tentative location of gravel augmentation sites near PRM 33.7 (left). Conceptual design of boulder cluster and augmented gravel (right) (McMillen 2009).

5.1.1.2. Background Information

Available information from relicensing studies suggests that mountain whitefish spawn in the Box Canyon Dam tailrace area. Standard monthly electrofishing surveys and targeted surveys to locate staging mountain whitefish congregations and individuals ripe for spawning were conducted between February 2007 and December 2008. In addition, egg mats were deployed at a number of locations during November 2008 and January 2009 to better understand the timing of mountain whitefish spawning. The catch of gravid and milt-flowing mountain whitefish by boat electrofishing during these surveys in the Upper Reservoir Reach generally supported the hypothesis that mountain whitefish spawn in the Upper Reservoir Reach during November and December (SCL 2009b). Furthermore, egg mats were used to successfully collect several eggs believed to be mountain whitefish based on egg size, timing, and location and method of egg collection.

A literature review provided information on mountain whitefish spawning habitat suitability criteria (i.e., depth, velocity, and substrate preferences) for use in habitat modeling; these data are pertinent to identifying potential gravel augmentation sites. Mountain whitefish spawning habitat criteria were identified in the Mainstem Aquatic Habitat Modeling Study Final Report

(SCL 2009a). Suitable depths range from 1.5 to 10.0 feet and suitable velocities range from 1.3 to 3.6 feet per second (fps). Substrate types commonly used by spawning mountain whitefish include medium to large gravel and small cobbles.

5.1.1.3. Procedures

SCL shall complete implementation planning within 3 years of license issuance. The specific scope of the planning will be developed in consultation with and approved by the FAWG. The objectives of the implementation planning study are to identify:

- The specific site(s) for gravel augmentation.
- The size and amount of gravel and small cobble to be placed at each site.
- Depth and velocity criteria to support potential mountain whitefish spawning habitat.
- A specific design for boulder placement to increase gravel retention.
- The expected residence time for delivered gravel under a range of flow conditions.
- Specific monitoring protocols.

Potential sites should have depths and velocities within the range of suitable habitat criteria during spawning (November and December) and incubation (through January) periods for mountain whitefish. Preferably, water velocity at the potential site following gravel placement will rarely exceed the critical velocity that results in transport of medium- to large-sized gravel particles. The existing bathymetry and distribution of substrate sizes can affect the transportability of spawning gravels. Large boulders that are currently present, or placed at the site, can help to retain spawning gravels. Potential sites should be dominated by large cobble or larger substrate sizes that can be enhanced by providing substrate within the suitable size range.

Baseline monitoring at the proposed augmentation sites will be conducted to provide information on pre-treatment site conditions. Gravel placement at up to four sites will occur within 4 years of license issuance. Boulders will be used to construct weirs or other structures and placed at sites approved by the FAWG. The method for delivering gravel and boulders to the selected sites and distributing the material within the augmentation area will be determined by SCL, subject to approval of environmental permitting agencies. A compliance report will be prepared following gravel and boulder placement to confirm compliance with design specifications. The remaining gravel placement sites will be constructed in Year 10 for a total of up to six sites for combined Year 4 and Year 10 construction. A compliance report will be conducted following gravel placement (Year 10) and physical and biological monitoring will be conducted to guide future replenishment efforts.

Boulder weirs are expected to increase gravel retention and reduce the frequency of gravel replenishment. However, up to 375 yd^3 of gravels (i.e., 25% of original volume) will be available every 5 years based on the rate of gravel loss observed at the placement sites. If additional boulders are needed to enhance gravel retention at the existing sites, up to 47 tons (i.e., 25% of original volume) will be available for replenishment every 10 years.

5.1.1.4. Compliance, Effectiveness, and Adaptive Management

Prior to the initial gravel and boulder placement effort, physical measurements of the sites will be conducted to identify site conditions to support design specifications and replenishment procedures. The baseline monitoring efforts will include measurements of gravel depth, gravel area, sediment size distribution, number and size of boulders, and water depth and velocity to evaluate whether augmented gravel sites provide potential mountain whitefish spawning habitat. Physical measurements of the Year 4 gravel placement sites will be conducted for three consecutive years (i.e., Years 5, 6, 7) to provide information on the effects of hydrologic conditions on gravel placement sites. In addition, physical measurements of all six sites will be conducted for three consecutive years (i.e., Years 11, 12, 13) to provide information on the relationship between hydrologic conditions and the rate of gravel loss.

Physical effectiveness monitoring will be conducted beginning in Year 9 and every 5 years thereafter to assess the need for gravel and boulder replenishment. Monitoring procedures will be approved by the FAWG, but it is expected that information such as the surface area and depth of gravel, water depths and velocities will be used to evaluate whether the measure is continuing to function as designed.

Biological monitoring will also be conducted for three consecutive years starting in each year of construction and gravel placement at new sites. In addition, biological monitoring will occur at all sites at years 15, 20 and 25. Biological monitoring, using egg mat frames similar to those employed during relicensing studies and a level of effort comparable to the 2008 whitefish egg mat surveys conducted in Box Canyon tailrace, will be conducted following a FAWG approved plan. Information obtained from the physical and biological monitoring will used to guide the design of the Year 10 gravel placement sites and gravel and boulder replenishment. Based upon the physical and biological effectiveness monitoring, the FAWG may determine remediation measures within the specified limits of the gravel augmentation measure.

Compliance monitoring will provide documentation that the gravel and boulder placement and monitoring activities were implemented as specified in the measure. Protocols for demonstrating measure compliance will be identified as part of implementation planning to be approved by the FAWG. At a minimum, compliance monitoring will include documentation collected during implementation, such as survey data, records of purchased materials (gravel, boulders, etc), and photographs of each site before and after augmentation.

5.1.1.5. Reporting and Schedule

The reporting and implementation schedule for mainstem gravel augmentation is summarized in Table 5.1-1.

Table 5.1-1. Reporting and implementation schedule for mainstem gravel augmentation.

PM&E Measure Activity	Schedule
Implementation planning	Within three years of license issuance
Baseline monitoring	Within three years of license issuance
Initial construction of up to four sites	In the fourth year following license issuance
Construction of remaining gravel sites	In the tenth year following license issuance
Gravel/boulder replenishment	In the tenth year following license issuance and every 5 years thereafter, as needed, based on FAWG determination
Compliance reporting	Following gravel placement or replenishment (In the fourth and tenth years following license issuance, and every five years thereafter)
Post-treatment physical monitoring	In the fifth, sixth, seventh, 11th, 12th, and 13th years following license issuance
Pre-replenishment physical monitoring	In the ninth and 14th years following license issuance and every 5 years thereafter
Biological monitoring	In the fourth, fifth, sixth, tenth, 11th, 12th, 15th, 20th and 25th years following license issuance

5.1.1.6. Consistency with Other Plans and PM&E Measures

There are no conflicts between this measure and other resource management plans. Gravel augmentation under this measure could potentially occur near a large cobble bar, locally known as the "Cobble Sisters," near Project river mile 30.3. A channel will be excavated at the Cobble Sisters area to connect mainstem flows to isolated pools to reduce the risk of fish trapping (see PM&E: Channel Modifications of Mainstem Trapping Pools at Project RM 30.3). Implementation planning for these two measures will be coordinated to avoid channel excavations at Cobble Sisters area damaging gravel augmentation sites.

5.1.2. Channel Modifications of Mainstem Trapping Pools at Project RM 30.3

5.1.2.1. Scope

SCL shall excavate a channel to connect mainstem flow to several isolated pools at a large cobble bar near PRM 30.3 to reduce the risk of fish becoming trapped during declining water surface elevations. SCL will excavate a 1,800-foot channel to an elevation below 1,979 feet NAVD 88[1] to connect trapping pools 10-009, 10-013, and 10-016 to mainstem flows. Spoils from excavation will be used to fill Pool 10-016 near the channel margin (Table 5.1-2, Figure 5.1-2). The objective of this measure will be to maintain a wetted connection to mainstem flows in the constructed channel to reduce the risk of fish of being trapped in the pools during periods of declining flow and reservoir water surface elevations.

[1] Elevation values are in datum NAVD 88 unless otherwise noted.

Table 5.1-2. Pools proposed for modification in trapping and stranding Region 10 ("Cobble Sisters").

Pool Number	Current Outlet Elevation	Maximum Depth (ft)	Pool Area (ft^2)
10-008	1989	8.7	48,447
10-009	1990	2.4	9,702
10-013	1991	0.3	1,881
10-016	1992	0.8	7,290
Total			67,320

Figure 5.1-2. Location of trapping pools (left) and conceptual plan (right) for modification at Cobble Sisters.

5.1.2.2. Background Information

Relicensing studies during 2007 and 2008 identified that fry and young-of-year fish become trapped in pools isolated from the mainstem flow during periods of declining reservoir water surface elevations and under some conditions may suffer injury or mortality during these events. While nearly all of the trapped fish observed during 2007 and 2008 were non-salmonids, such as suckers, perch, or smallmouth bass fry, these trapping mechanisms could also potentially adversely affect native salmonids if they are present in the trapping areas when water surface elevations decline.

During 2008, Stranding and Trapping Region 10 at PRM 30.3 along the east bank within the Upper Reservoir Reach (commonly referred to as "Cobble Sisters") was identified as an area with a high occurrence of trapping (SCL 2009a). The pools and depressions at the site are the result of aggregate mining that occurred prior to completion of the Project. The excavated depressions have persisted since construction of the Project, which suggests the area is geomorphically stable. SCL is proposing to excavate connecting channels at the Cobble Sisters because these channel features are man-made and stable.

5.1.2.3. Procedures

SCL shall conduct implementation planning, subject to approval of the FAWG, within 3 years following license issuance. Implementation of site modifications will occur within 5 years of license issuance. Implementation planning will provide design specifications for the channel excavation and dispersal of spoils based on field surveys at the Cobble Sisters. The design will include drawings that specify the current and planned topography and shape of the site. The thalweg of the excavated channel will be at an elevation below 1,979 feet NAVD 88 and will result in the excavated channel remaining inundated under all but the most extreme combination of reservoir drawdown and low inflow. Excavation of the channel below elevation 1979 feet will allow fish egress to the mainstem under nearly all flow and operating conditions.

Observations during relicensing studies suggested the risk of stranding was relatively low when shoreline gradients were greater than 4 percent (SCL 2009a). Consequently, channel banks will be graded to a target gradient greater than 4 percent but not so steep as to slough during high flow conditions. Some areas of the channel may not be able to meet the target gradient because of engineering constraints that become apparent during detailed planning and a survey of the site. Excavated substrate used to fill Pool 10-0016 will be contoured to reduce the risk of stranding. The design of the excavated channel will also consider conditions (primarily water velocity) to reduce the likelihood of fine sediment deposition which could contribute to macrophyte growth in the constructed channels. Scalping the tops of islands adjacent to the excavated channel may also be considered for reducing back-eddies and velocity shadows that may contribute to settlement of fine substrate materials and colonization of macrophytes.

5.1.2.4. Compliance, Effectiveness, and Adaptive Management

Compliance monitoring by SCL shall occur within one year following implementation of the measure. Protocols for collecting compliance information will be identified as part of implementation planning to be approved by the FAWG. At a minimum, compliance monitoring will include documentation collected during implementation, such as survey data and photographs of the site before excavation. Measurements of the excavated channel will include the thalweg elevation, thalweg slope, excavated channel width, side slope, channel substrate, and distribution and density of macrophytes. Physical measurements to evaluate whether the site modifications continue to function as designed will be repeated every 10 years following construction and in the event of flows greater than a flood event having a 25-year recurrence interval. During the year following each physical monitoring effort, the FAWG will determine if remediation measures are needed to ensure site modifications continue to satisfy design specifications. SCL shall implement the required measures to satisfy design objectives.

5.1.2.5. Reporting and Schedule

The reporting and implementation schedule for channel excavation at the Cobble Sisters is summarized in Table 5.1-3.

Table 5.1-3. Reporting and implementation schedule for channel excavation at the Cobble Sisters.

PM&E Measure Activity	Schedule
Implementation planning	Within three years of license issuance
Implementation	Within five years of license issuance
Compliance Report	Within six years of license issuance
Physical Monitoring	Every ten years following construction, and following flows exceeding a 25-year recurrence interval
Monitoring Report	Within one year of physical monitoring

5.1.2.6. Consistency with Other Plans

There are no conflicts between this measure and other resource management plans. Gravel augmentation to provide mountain whitefish spawning habitat could potentially occur near the Cobble Sisters area (Section 5.1.1). Implementation planning for this measure and mainstem gravel augmentation will be coordinated to avoid channel excavations at Cobble Sisters area damaging gravel augmentation sites.

5.1.3. Mainstem Large Woody Debris at Tributary Deltas

5.1.3.1. Scope

SCL shall enhance tributary delta habitat by providing additional cover for salmonids holding in the coldwater refugia at tributary mouths. LWD jams will be placed and maintained in the thalweg in the upper delta regions of four tributaries to Boundary Reservoir. Two LWD jams will be placed at the Sullivan Creek delta and one LWD jam will be placed at the deltas of Sweet, Slate, and Linton creeks (total of 5 LWD jams). The Sullivan Creek logjams will have a total volume of not less than 1,700 ft^3, while each logjam in Slate, Sweet and Linton creeks will have a volume of not less than 530 ft^3.

The specific location and design of the LWD jams will be determined during implementation planning by SCL in consultation with and subject to approval of the FAWG. LWD jams will be located in the upper end of tributary deltas to minimize use by non-salmonids. Orientation and construction of each LWD jam will be based on site-specific hydraulic and channel conditions.

Compliance and effectiveness monitoring will be implemented for each LWD jam. SCL shall conduct compliance monitoring and will provide documentation to the FAWG and the FERC that the measure has been implemented as specified. Effectiveness monitoring will evaluate the need for LWD jam repair or replenishment and will involve snorkeling to evaluate use of logjams by salmonids and predatory non-salmonids. The procedures for defining and evaluating effectiveness will be determined during implementation planning and approved by the FAWG. In the event that LWD placement is determined to be ineffective, the FAWG will identify and SCL shall implement alternative measures with a commensurate schedule and level of effort.

5.1.3.2. Background Information

Relicensing studies indicate that native and non-native salmonids use tributary deltas during summer to take advantage of coldwater refugia (SCL 2009b). Deltas also serve as transition areas between the reservoir and tributary and must be used by fish moving between these two habitat types. Habitat studies indicated that there are scarce amounts of LWD (e.g., Figure 5.1-3) or other forms of cover in these tributary delta habitats (SCL 2008).

Figure 5.1-3. Downstream view of Sweet Creek in the upper delta area (left) and looking upstream at Sullivan Creek during early September 2007.

5.1.3.3. Procedures

SCL shall conduct implementation planning with final design specifications to be approved by the FAWG. Implementation planning will identify:

- Specific locations for LWD jams at selected deltas;
- LWD jam design specifications for each location; and
- Specific monitoring protocols.

As part of implementation planning, SCL shall identify LWD jam locations and specifications. General locations of LWD jams are depicted in Figures 5.1-4 and 5.1-5; but final selection of target tributaries and design of LWD placement will be developed during post-licensing implementation planning and approved by the FAWG. Construction of the LWD jams will be completed within 10 years following license issuance. Orientation and construction of the LWD jams will be tailored to each individual site, will be based on the specific hydraulic conditions of each location, and will follow WDFW guidelines (WDFW 2003, Saldi-Caromile et al. 2004). Logjams will be built sufficiently high in the delta to minimize their potential use by non-salmonid predators at typical summer flow levels. Construction access for Sullivan and Linton creeks will be from the shoreline, while access to Sweet and Slate creeks will be from floating barge. The schedule for initial construction of the Sullivan Creek delta logjams may be dependent on upstream Mill Pond Dam removal activities. If permitting, landowner permission, or other issues prevent implementation within 10 years after license issuance, SCL will

determine, with approval of the FAWG, alternate locations for installing LWD jams, or will identify and implement alternative measures to provide additional cover in the tributary deltas with a commensurate schedule and level of effort.

Figure 5.1-4. Possible areas for LWD placement in the upper deltas of Sullivan (left) and Linton (right) creeks.

Figure 5.1-5. Possible areas for LWD placement in the upper deltas of Sweet (left) and Slate (right) creeks.

All LWD structures will be appropriately anchored through the use of pilings, boulder ballast, and cabling, or other methods to prevent transport of the large wood. Priority will be given to logs with attached root wads. The LWD structures will be maintained according to design criteria through the term of the license.

5.1.3.4. Compliance, Effectiveness, and Adaptive Management

A compliance report will be prepared within one year following implementation or repair of a LWD structure. Protocols for collecting compliance information will be determined during implementation planning with approval of the FAWG. A compliance report will include documentation collected during construction, repair or replenishment of the LWD jam such as survey data, records of purchased materials (LWD pieces, ballast, etc), and photographs of each site before and after LWD jam placement or repair.

Protocols for collecting effectiveness information will be determined during implementation planning with approval of the FAWG. Physical effectiveness monitoring will occur the ninth year following the construction of a structure and at 10 year intervals thereafter. In addition, physical effectiveness monitoring to determine continued compliance with design specifications will occur following major flood events (i.e., flows greater than a flood event having a 25-year recurrence interval). Physical effectiveness monitoring will evaluate the condition of structures and will include a count of the number, size, and condition of the wood pieces in each jam as well as photos. The main purpose of the physical effectiveness monitoring will be to determine if the structure needs repair or replenishment of the logs in the structure. Repair or replenishment of the LWD jams will occur within one year following physical effectiveness monitoring.

Three consecutive years of biological effectiveness monitoring will occur within the first 10 years following construction. Biological effectiveness monitoring will also be conducted concurrent with physical effectiveness monitoring from License Year 10 through the term of the license. The procedures for defining and evaluating effectiveness will be determined during implementation planning with approval of the FAWG. The results of the effectiveness monitoring will be used to support adaptive management and adjustments to the PM&E measure during repair or log replenishment of a structure. Based upon the physical and biological effectiveness monitoring, the FAWG may devise remediation measures within the specified limits (as described in Section 5.1.2.1 Scope) for the repair and log replenishment of the structures.

5.1.3.5. Reporting and Schedule

The reporting and implementation schedule for mainstem large woody debris at tributary deltas is summarized in Table 5.1-4.

5.1.3.6. Consistency with Other Plans

There are no conflicts between this PM&E measure and other resource management plans. The schedule for initial construction of the Sullivan Creek delta logjams may be dependent on upstream Mill Pond Dam removal activities.

Table 5.1-4. Reporting and implementation schedule for mainstem LWD placement at tributary deltas.

PM&E Measure Activity	Schedule
Implementation	Completed within ten years of license issuance, except Sullivan Creek delta which at the direction of the FAWG may be after the tenth year depending on the influence of Mill Pond Dam removal
Compliance Reporting	Within one year following construction, repair or replenishment of LWD structures
Physical Effectiveness Monitoring	In the ninth year following implementation and every 10th year thereafter; and after flows exceeding a 25-year recurrence interval.
Biological Effectiveness Monitoring	Three consecutive years between initial construction and first scheduled repair/replenishment, and then concurrent with physical effectiveness monitoring
Monitoring Report	Within one year following physical or biological effectiveness monitoring

5.1.4. Boundary Reservoir Fish Community Monitoring and Evaluation of Salmonid Predation at Select Tributary Deltas

5.1.4.1. Scope

5.1.4.1.1. Boundary Reservoir Fish Community Monitoring

SCL shall conduct fish community surveys in Boundary Reservoir beginning in year 5 after license issuance and at five-year intervals thereafter. The objective of the surveys will be to monitor changes in fish population abundance and size structure of focal species over time. Focal species will be westslope cutthroat trout, bull trout, mountain whitefish, smallmouth bass, northern pikeminnow, and northern pike and may include other species as identified by the FAWG. Surveys will be at a level of effort commensurate with the reservoir fish survey portion of the McLellan (2001) study. Study planning shall be completed during the calendar year prior to conducting the field surveys and a summary report will be completed within 1 year of completion of the field surveys. The study design, schedule, implementation, and reporting activities shall be developed in consultation with and subject to approval of the FAWG.

5.1.4.1.2. Evaluation of Salmonid Predation at Select Tributary Deltas

SCL shall conduct a study to evaluate predation on outmigrating native salmonids at select tributary deltas. The objective of the study will be to quantify the proportion (percent by number and biomass) of outmigrating native salmonids from select tributaries that are being consumed by predatory fish within the selected tributary deltas, and determine consumption rates of select predators consistent with the general methods described in Baldwin et al. (2003). The level of effort of the Boundary tributary delta predation study will be commensurate with labor efforts expended by researchers in Baldwin et al. 2003. SCL shall conduct the tributary delta predation study during year 4 and year 15 following license issuance. Study planning will be completed during the calendar year prior to conducting the field surveys and a summary report will be

completed within 1 year of completion of the field surveys. The study design and implementation schedule will be subject to approval of the FAWG.

5.1.4.2. Background Information

Trend information on fish communities in the Project area is important for resource management agencies so they can identify any necessary changes in management direction. One example of how trend information could be useful relates to the apparent establishment of a northern pike population in Boundary Reservoir. During 2000, McLellan (2001) observed no northern pike in the reservoir, but during relicensing studies conducted in 2007 and 2008 both adult and juvenile northern pike were observed in areas containing suitable spawning habitat. Although northern pike numbers in Boundary Reservoir are currently low, a self-reproducing population has been established in the Pend Oreille River system, and there is the potential for future population increases. If substantial increases in the abundance of introduced predator fish occur in the Project area, they could become a threat to the already uncommon native salmonids and could affect proposed recovery efforts for these species. Trend information could help management agencies in the development of strategies for the recovery of native salmonids and the setting of priorities and schedules for implementing these strategies. Trend information could also be helpful in the adaptive management of PM&E measures being implemented by SCL as part of the new license.

5.1.4.3. Procedures

5.1.4.3.1. Boundary Reservoir Fish Community Monitoring

In consultation with, and subject to approval of the FAWG, SCL shall complete a fish community monitoring study plan in the calendar year prior to each fish community monitoring field season. The reservoir fish community surveys will follow a consistent format to maintain comparability of results over time, but can be modified at the direction of the FAWG. The survey techniques and periods will be appropriate for the focal species and size, and designed to provide precise metrics (e.g., catch-per-unit-effort) that can be analyzed for spatial and temporal trends. Number, species identification, length and weight information shall be collected for all fish sampled in order to allow assessment of size structure (e.g., Proportional Size Distribution). The level of effort of fish community monitoring will be commensurate with the reservoir fisheries surveys component of McLellan (2001); that is, not including the trophic status, reservoir productivity, and tributary assessment components of the McLellan study. Within a year following completion of the surveys SCL will prepare a survey completion report that summarizes the results of the survey effort and will include a discussion of trends in the focal fish species relative to previous surveys.

5.1.4.3.2. Evaluation of Salmonid Predation at Select Tributary Deltas

In consultation with, and subject to approval of the FAWG, SCL shall complete study planning prior to each field season for the tributary delta predation study. The tributary delta predation study will consist of six components that will be implemented at three selected tributaries. The tributaries to be selected for study, the defined delta region for each tributary, and study methods

of the six components will be determined during post-license planning and will be subject to approval of the FAWG. The six components will consist of the following:

a. Quantify the abundance of out-migrating native salmonids from the selected tributaries during peak out-migration timing. For example, if peak westslope cutthroat trout out-migration occurs during the first two weeks of July, then the study period would be defined as, and abundance estimates would be needed for, those two weeks as well as a week or two following in case salmonids are not consumed immediately upon their entrance in to the reservoir, yet they stay within the defined tributary delta region. Abundance estimates for native salmonid outmigrants should be determined by juvenile trapping and established methods to relate trap efficiency with discharge and ultimately lead to an estimate of the total number of salmonids migrating to the reservoir during the study period. Biomass will be calculated by applying mass (grams) data to the abundance values. Outmigration abundance estimates will be developed as part of the Entrainment Reduction Years 1-18 Research and Monitoring Study (Section 5.1.4), and will be used to supply the needed information for this component.

b. Predator abundance within the selected tributary deltas will be estimated using mark-recapture methods. Boat electrofishing and horizontal gill nets will be used to collect predators at the mouth of select tributaries. Predator sampling will be conducted within a level of effort commensurate with Baldwin et al. (2003); that is, effort will not exceed nine 8-hour boat electrofishing efforts and not to exceed 73 gill net sets, each gill net set for approximately 6 hours soak time. Sampling design, schedule, and protocol will be developed in consultation with and subject to approval of the FAWG. The objective of this component is to generate reasonable abundance estimates for selected predator species. By reasonable, it is meant that covariance (ratio of the standard error of the estimate to the estimate [SE/N]) must be lower than 0.50. A covariance between 0.25 and 0.50 is considered adequate for the tributary delta predation study. The abundance estimate must occur during the study period and within the selected tributary deltas. Thus, if the study is conducted during peak out-migration then the predator abundance estimate must be generated concurrently. All predators will be marked during the study; however, it is recognized the numbers of marked and/or recaptured fish may be inadequate to obtain reasonable abundance estimates for some predator species that are not commonly found in tributary deltas. The predator abundance estimate must address and evaluate the assumptions used to ensure unbiased estimates.

c. Predator growth rates will be determined from scale analysis of fish captured as part of the reservoir fish community monitoring.

d. Water temperatures will be monitored over the field sampling period using a temperature recorder placed within each selected tributary delta. If appropriate mainstem Boundary reservoir water temperature data are not available from other sources, a water temperature recorder will be placed immediately upstream of the confluence of one of the selected tributary deltas to record mainstem reservoir water temperature. The location and deployment protocol for monitoring water temperature

to be used in the bioenergetics model will be developed in collaboration with and subject to approval of the FAWG.

e. Laboratory diet analysis will be conducted on all predator species with reasonable abundance estimates and an adequate sample size of non-empty stomachs. Minimum sample size and stomach content sampling protocols to obtain reasonable estimates of diet proportions will be determined during planning and subject to approval of the FAWG. Stomach contents of predators collected within the defined delta regions will be analyzed in the laboratory using methods similar to those of Baldwin et al. (2003).

f. If native salmonids are a significant proportion of the diet and adequate predator growth information results from sampling, the "Wisconsin" bioenergetics model (Fish Bioenergetics 3.0; Hanson et al. 1997), in collaboration with the FAWG will be used to estimate consumption rate, number, and biomass of native salmonids consumed by predator species with reasonable population estimates in the selected tributary deltas. The model will use site-specific water temperature history, predator growth information, and diet proportions. Literature values will be used for all species-specific metabolic parameters, predator energy density parameters, and diet energy density parameters.

If the results of the investigation identify that a significant proportion of native salmonids are consumed by predators at tributary deltas, potential non-operational measures including predator control could be implemented under the Entrainment Reduction program (Section 5.1.4) to improve native salmonid survival.

5.1.4.4. Compliance, Effectiveness, and Adaptive Management

Compliance with this PM&E measure will be documented via the Survey Completion Reports. There is no effectiveness monitoring associated with this PM&E. Within the limits of the level of effort outlined above, the FAWG has the discretion to modify the study design to achieve objectives.

5.1.4.5. Reporting and Schedule

5.1.4.5.1. Boundary Reservoir Fish Community Monitoring

Unless otherwise directed by the FAWG, the fish community monitoring study will be conducted in year 5 of the new license and at five-year intervals thereafter. Planning for the fish community monitoring study component shall be completed during the calendar year prior to study implementation, and a summary report of field activities will be completed within 1 year of the field surveys. The reporting and implementation schedule for fish community monitoring is summarized in Table 5.1-5.

Table 5.1-5. Reporting and implementation schedule for Boundary Reservoir fish community monitoring.

PM&E Measure Activity	Schedule
Fish community study plan	Within four years of license issuance and every fifth year thereafter
Conduct fisheries survey	In the fifth year following license issuance and every fifth year thereafter
Survey completion report	In the sixth year following license issuance and every fifth year thereafter

5.1.4.5.2. Evaluation of Salmonid Predation at Select Tributary Deltas

The tributary delta predation study will be conducted in year 4 and 15 of the new license unless otherwise directed by the FAWG. A FAWG-approved study plan will be completed during the calendar year prior to study implementation, and a summary report of field activities will be completed within 1 year of the field surveys. The reporting and implementation schedule for biological monitoring is summarized in Table 5.1-6.

Table 5.1-6. Reporting and implementation schedule for the tributary delta salmonid predation study.

PM&E Measure Activity	Schedule
Tributary delta predation planning	By end of calendar year prior to conducting delta predation study
Conduct tributary delta predation study	In the fourth and 15th years following license issuance
Tributary delta predation study report	Within one year following tributary delta predation field surveys

5.1.4.6. Consistency with Other Plans

There are no conflicts between this PM&E measure and other resource management plans prepared for the Project. Outmigration abundance estimates (see component 1 of the predation study) will be developed as part of the Entrainment Reduction Years 1-18 Research and Monitoring Study (Section 5.3.3).

5.2. Upstream Fish Passage

5.2.1. Scope

This PM&E measure shall be governed by License Article 9(B). SCL shall install, operate, maintain and monitor a single upstream trap-and haul fishway facility (upstream fishway, or fishway) in the Boundary Project tailrace. The purpose of this fishway is to provide safe, timely, and effective passage for bull trout, cutthroat trout, and mountain whitefish (target fish species) in the Project area for the license term and any subsequent annual licenses. The fishway will include a fixed entrance(s) and a release location(s) at least one mile upstream of the Boundary

Dam. The release location(s) shall be determined by the FAWG subject to the approval of the USFS, Ecology, and DOI. Provided the fishway is constructed according to a design that has been approved by the FAWG and by the USFS, Ecology, and DOI and is operated consistent with an approved installation, operation and maintenance plan, and subject only to such minor modifications as are described in Section 5.2.3.4 below, the fishway will satisfy all applicable upstream fish passage requirements.

SCL shall design and construct this upstream fishway using the best available scientific information, including but not limited to the NMFS 2008 Anadromous Salmonid Passage Facility Design Manual (Design Manual), taking into account the site specific conditions at the Project, biological information specific to the target species, and other relevant information. In no case shall attraction flows exceed 1,650 cfs (3% of maximum generation discharge). SCL must demonstrate that any departures from the Design Manual will be effective at achieving the purposes of the facility in providing safe, timely and effective passage for target species. The final design will be subject to the approval of the USFS, Ecology, and DOI.

SCL shall undertake a research and development phase of up to 12 years to evaluate the fishway entrance design, entrance location, and attraction flow volumes that will achieve the purposes of the facility. Within 12 years of license issuance (2 planning years, 8 research years and 2 design years), SCL shall file with FERC for approval, a plan to install, operate and maintain an upstream trap and haul fishway. SCL shall complete construction of the upstream fishway within 2 years of receiving FERC approval and shall monitor fishway operations for the term of the license and any annual licenses issued for the Project.

SCL shall work in consultation with the FAWG in all aspects of the fishway development and implementation processes.

5.2.2. Background Information

Boundary Dam was built without fish passage facilities because downstream power and water storage projects, such as Grand Coulee and Chief Joseph dams, blocked anadromous fish migrations to the Upper Columbia Basin. However, declines in populations of the target fish species have increased focus on migrating resident fish. The USFWS Bull Trout Draft Recovery Plan, for example, currently calls for upstream passage at Albeni Falls (USACOE), Box Canyon Dam (POPUD) and Boundary Dam (Seattle City Light).

As part of relicensing activities, SCL and a team of fish passage experts evaluated myriad options for bypassing upstream migrating fish around Boundary Dam. They developed physical, biological and operational criteria to assist in narrowing potential alternatives, eventually settling on fixed and floating trap and haul facilities, and various manual methods, for bypassing fish around the Project.

During subsequent relicensing negotiations, the Parties agreed to the concept of a more traditional trap and haul fishway based on NMFS criteria. A trap and haul facility was determined appropriate due to comparatively low population sizes of native salmonids and physical site constraints in the tailrace. While agreement was reached on the preferred alternative, there was uncertainty regarding an appropriate site within the tailrace for the fixed

trap-and-haul facility. In addition, because of the low numbers of native salmonids captured or observed in the Boundary Dam tailrace, there is little direct information from the Project tailrace regarding seasonal movement patterns of bull trout, cutthroat trout, or mountain whitefish.

Consistent with the Design Manual, the process for developing the trap and haul fishway includes an 8-year research and development phase to evaluate site specific conditions and biological traits of the target species in the Project area. With the support of a TAC, the Parties will collaborate throughout the research and development phase to design appropriate studies, evaluate site specific conditions, and integrate information into a final fishway design.

5.2.3. Procedures

5.2.3.1. Fishway Development Plan

Within 2 years of license issuance, SCL shall file with FERC a Fishway Development Plan (FDP) for collecting site-specific biological and engineering information required to site, design, and install the upstream trap and haul fishway. Implementation of the FDP shall continue for up to 8 years. The FDP shall include methods for identifying, among other things:

a. Site-specific hydraulic conditions in the tailrace of Boundary Dam, under all operating scenarios;

b. Proper location of the upstream fishway and entrance(s) given site specific considerations of the Boundary Dam spillway, sluiceway, powerhouse, and tailrace area;

c. Information on swimming performance, behavior, and migratory pattern of target fish species downstream of the dam sufficient to determine the appropriate location of the fishway entrance(s) under all operating scenarios and related environmental cues, including but not limited to temperature, total dissolved gas, water velocity and lighting; fishway attraction effectiveness shall be evaluated using target species from upstream sources or that demonstrate upstream migration behavior;

d. Structures, devices and measures to allow adjustment of the fishway entrance(s) and auxiliary flow as necessary to effectively attract target fish species into the upstream fishway including the influence of cooler attraction flow water if incorporated into the facility;

e. Structures, devices, and measures to allow adjustment of water flow, water velocity and water surface elevations within the upstream fishway as needed to effectively convey target fish species into the fish trapping device;

f. Provisions for counting and evaluating fish passage through the upstream fishway; and

g. Provisions for transport and release of fish upstream of the dam.

Studies conducted pursuant to the FDP will use the most appropriate technology available, including mark and recapture methods, as determined by the FAWG in consultation with a TAC. The TAC will assist SCL and the FAWG with the design of upstream fish passage studies and analysis of study results. Target fish species being evaluated will represent the size distribution of migrating bull trout, cutthroat trout and mountain whitefish in the Project area.

SCL may evaluate prototype facilities within the 8-year FDP implementation phase.

5.2.3.2. Fishway Design and Construction Plan

Within 12 years of license issuance (2 planning years, 8 research years and 2 design years), SCL shall file with FERC for approval, a Fishway Design and Construction Plan (FDCP) to install, operate and maintain an upstream trap and haul fishway at the Boundary Dam. SCL shall complete construction of the upstream fishway within 2 years of receiving FERC approval on the FDCP.

The FDCP shall integrate the site specific and biological information developed during the FDP implementation phase and shall include, but not be limited to: (1) functional design drawings; (2) quantification of flows needed to operate the fishway; (3) a proposed operations and maintenance plan; and (4) a schedule for installing the facilities.

SCL shall develop the fishway design based upon the best available scientific information, including the Design Manual. Any departures from the Design Manual will be considered by the FAWG based on compelling evidence and in consultation with a TAC (see below). SCL must demonstrate that any departures from the Design Manual will be effective at achieving the purposes of the facility in providing safe, timely and effective passage for target species. The final design will be subject to the approval of the USFS, Ecology, and DOI.

The FDCP shall also include, but not be limited to, the fishway location, operational period, design flow range, trap holding pools, crowder and brail systems; sorting and transport provisions; and sample/anesthetic/recovery tanks. The FDCP will include structures, devices and measures to allow adjustment of auxiliary flow at the fishway entrance(s) as necessary to effectively attract target fish species into the upstream fishway.

Within 12 months of initial fishway operation, SCL shall file with FERC a Hydraulic Evaluation Report documenting compliance with all design specifications.

5.2.3.3. Consultation with FAWG

SCL shall develop all plans and the fishway design, and shall conduct all studies in consultation with the FAWG and subject to approval of the USFS, Ecology, and DOI. As described above, SCL shall convene a technical advisory committee (TAC) consisting of fish passage design experts to assist in developing all plans and designs. SCL will select the fish passage design experts in consultation with and subject to approval of the FAWG. The TAC will provide recommendations to the FAWG pertaining to the site, design and installation of the upstream fishway as well as determine whether development of a computational fluid dynamic or physical

scale model of the Boundary Dam and appurtenant facilities are necessary. Decisions regarding fish passage design and evaluation are subject to the dispute resolution provision of the SA.

SCL shall allow a minimum of 30 days for the FAWG to comment and make recommendations before filing any designs and plans with FERC. When filing designs and plans, SCL shall include documentation of consultation; copies of comments and recommendations; and specific descriptions of how comments and recommendations were accommodated by SCL. If SCL does not adopt a recommendation from the FAWG, the filing shall include its reasoning based on Project specific information.

Fishway design drawings (including drawings for any prototype or test facilities to be evaluated) shall be provided to the FAWG for review at the 30 percent (functional design), 50 percent and 90 percent completion stage and SCL shall consult with the FAWG at each stage.

5.2.4. Compliance, Effectiveness, and Adaptive Management

Within 13 years of license issuance, SCL shall file a Post Construction Evaluation Plan (PCEP) with FERC. The PCEP shall include methods for documenting fish passage efficiency, passage time, mortality, injury and fallback rates under a representative range of operating scenarios and environmental conditions. Implementation of the PCEP will begin no later than one year following completion of the Hydraulic Evaluation Report (see Section 5.1.3.3.2) and will continue until safe, timely and effective passage is demonstrated over a range of operating conditions within the first five years of operation. SCL shall modify the fishway based on results of the evaluations and reevaluate fishway effectiveness within this time frame and effort, as determined necessary by the FAWG. PCEP implementation costs including evaluation, planning, and study permitting shall not exceed $1,000,000.

The following limitations shall apply:

a. The need for any modifications shall be determined by the FAWG within 5 years of completing the Hydraulic Evaluation Report and shall be based on information collected from the PCEP.

b. For any fishway constructed pursuant to Design Manual criteria (e.g., a fishway that includes attraction flow of 1,650 cfs) and approved by the FAWG and USFS, Ecology, and DOI, SCL shall make minor modifications including permitting, design, and construction for increasing fishway effectiveness within an amount not to exceed 5 percent of facility construction costs.

c. For any fishway that includes departures from the Design Manual, SCL shall make minor modifications including permitting, design, and construction for increasing fishway effectiveness within an amount not to exceed 10 percent of facility construction costs.

Thirteen years after the PCEP evaluations and any required modifications have been completed, the FAWG shall determine the need and scope for reevaluating fishway performance (including fish passage efficiency, passage time, mortality, injury and fallback rates). The evaluations will

be conducted under typical project operations. If fishway performance has decreased when compared to the initial PCEP evaluations, SCL shall implement any corrective measures determined necessary by the FAWG to return performance to its previous level.

In addition, SCL shall implement one year fishway performance evaluation(s) at any time during the license term if substantive changes occur in project operations, structures, or tailwater bathymetry (caused, for example, by severe flow events). If performance has decreased when compared to the original PCEP evaluations, SCL shall implement any corrective measures determined necessary by the FAWG to return performance to its previous level.

5.2.5. Reporting and Schedule

As part of the upstream fish passage program, annual reports will be prepared summarizing information related to monitoring, operations, problems encountered, program status and results of activities during the previous 12 months. Once the fishway has been installed and is operational, annual reports will also quantify the number and condition of target fish species captured and transported, and the location of their release. The reports will also document fishway operations including tailrace water surface elevations, tailrace flow levels, fishway attraction flows, hours of fishway operation, and any maintenance or operational issues identified over the year and repairs implemented to resolve the issues.

SCL will provide the annual reports to the FAWG for a 30 day review. Comments and recommendations by the FAWG will be included in the annual report submitted to the FERC along with specific descriptions of how any comments are accommodated in the report. If recommendations are not adopted, the FERC filing will include SCL's explanations based on Project specific information.

The implementation schedule for the upstream passage program is summarized in Table 5.2-1.

Table 5.2-1. Implementation schedule for the upstream passage program.

PM&E Measure Activity	Schedule
Implementation plan	Within two years of license issuance
Fishway design research	In the third through the tenth years following license issuance
Fishway design	In the tenth through the 12th years following license issuance
Fishway design submittal to FERC	Within 12 years of license issuance
Fishway construction	Within two years of receiving FERC approval of fishway design
Fishway operation	Within two years of receiving FERC approval of fishway design
Status Report	Annually following license issuance

5.2.6. Consistency with Other Plans

There are no conflicts between this PM&E measure and other resource management plans prepared for the Project. Fish collection, transport, and release protocols will be consistent with management objectives developed by the USFS, Ecology, and DOI.

5.3. Reduction of Project Related Entrainment Mortality

5.3.1. Scope

This PM&E measure shall be governed by License Article (9C). To address Project entrainment, the following section describes a program to be implemented by SCL over the license term. Successful implementation of this program shall fully mitigate for the effects of entrainment on target species (bull trout[2], westslope cutthroat trout, and mountain whitefish) by either: (1) preventing entrainment at the Project; (2) reducing entrainment at the Project and mitigating for the remaining effects; or (3) fully mitigating for the effects of entrainment through other measures. The decision as to whether entrainment is best addressed through options 1, 2 or 3 as defined above, will be made by the FAWG based on site specific information developed under this program. SCL shall work collaboratively with the FAWG in all aspects of this program and all decisions made by SCL and the FAWG are subject to the approval of the USFS, Ecology, and DOI.

In Years 1-18, SCL shall develop and implement studies sufficient to quantify the effects of entrainment on target species and to determine whether any population of target fish species (i.e., a unique population that constitutes a substantial percentage of fish in the Project area or that has a unique evolutionary niche that requires special protection) or a substantial number of target fish are affected by Project entrainment. At the conclusion of the evaluation phase, the FAWG will determine whether a population of target species or a substantial number of target fish are affected by Project entrainment. This 18 year evaluation phase shall not exceed $23,000,000 (23 million dollars).

Starting in Year 19, if entrainment reduction measures are determined to be necessary, SCL shall make available up to an additional $47,000,000 (47 million dollars) through year 33 (plus any unexpended funds from the $23,000,000 allocated for studies during the 18 year evaluation phase) to either build facilities at the Project to improve Boundary Dam survival of target species or implement appropriate non-operational measures to improve survival of target species. The decision matrix is more fully defined in the Procedures section of this measure (Section 5.1.4.3). If a population or a substantial number of target species continue to be affected by year 34, SCL shall construct new facilities at the Project, expand existing facilities or implement operational changes to improve survival of target species as more fully explained in Section 5.1.4.3.

[2] Any reasonable and prudent alternatives or measures necessary to minimize the take of bull trout, that may be required by the USFWS pursuant to the Endangered Species Act, will be developed consistent with the Boundary SA to the maximum extent possible.

5.3.2. Background Information

Boundary Dam was built without entrainment reduction facilities. However, declines in native resident salmonid populations have placed increased emphasis on protection of migrating fish. If fish pass downstream through Boundary Dam facilities, they are exposed to potential injury and mortality, with the level of mortality depending on the pathway, flow rate, and size of fish. As part of relicensing activities, estimated ranges of fish mortality for existing entrainment routes at Boundary Dam were developed in collaboration with relicensing participants. Based on a review of available literature and turbine survival modeling (R2 2006), fish passage mortality through the existing turbines at Boundary Dam was estimated to vary with the turbine units and fish size (Table 5.3-1).

Table 5.3-1. Relationship between fish size and estimated turbine mortality at Boundary Dam.

Fish Size (Inch/mm)	Turbine Units 51-54	Turbine Units 55-56
4" (100 mm)	6 to 15%	5 to 12%
10" (250 mm)	13 to 33%	11 to 28%
24" (600 mm)	26 to 65%	23 to 59%

In general, smaller fish are anticipated to have the lowest turbine mortality (5% to 15%), while turbine mortality is expected to increase with fish size (i.e., 23% to 65% for larger fish).

Fish injury and mortality through Boundary Dam also depends on the passage route. Fish primarily pass downstream through the turbines, but may pass downstream through spillways or sluiceways when flow releases exceed turbine capacity (during the period 1987 through 2006, for example, spill occurred an average of 578 hours a year). Fish size, location that they are entrained in the water column, and tailrace conditions will all affect injury and mortality.

As part of relicensing activities, a team of fish passage experts evaluated entrainment reduction concepts at Boundary Dam including:

- Floating Surface Collector;
- Fixed Surface Collector;
- Fixed Full Flow Screen;
- Modular Inclined Screen (MIS);
- Eicher Screen;
- Screw Trap/Inclined Screen at Z Canyon;
- Skimmer Gate modifications; and
- Spillway Gate modifications.

During the initial brainstorming effort, criteria were developed to assist in evaluating entrainment reduction concepts. These criteria were selected to represent the range of physical, biological, and operational variables to be considered in estimating the overall effectiveness of potential entrainment reduction concepts.

The results of the evaluation determined that a floating surface collector concept would provide the most flexibility and potentially the highest incremental increase in fish protection. However, the estimated incremental increase in survival was 0 to 2 percent for 4-inch fish, -1 to 9 percent for 10-inch fish, and 8 to 21 percent for 24-inch fish (McMillen 2009). Since little is known about the migration depth of bull trout, westslope cutthroat trout, and mountain whitefish, the efficacy of a floating surface collector concept to reduce entrainment of the target species is uncertain.

Due to uncertainty regarding the effects of entrainment on target fish populations, and uncertainty regarding the efficacy of available entrainment reduction options, the entrainment reduction program includes an evaluation phase to assess the effects of Project entrainment on target species.

5.3.3. Procedures

All studies shall follow best available science and shall use the most appropriate techniques available at the time of the study. Studies shall be designed to achieve a high level of statistical rigor and precision, in consideration of fish available for study, satisfactory to the FAWG. If requested by the FAWG, SCL shall acquire the assistance of technical experts experienced in salmonid population theory, structure, and dynamics.

Efforts to evaluate and mitigate for Project entrainment will be conducted by SCL pursuant to the following post-licensing schedule:

a. Years 1-2: Peer reviewed development of Fish Behavior and Population Study Plan. Studies shall be developed by SCL, in consultation with the FAWG and subject to the approval of the USFS, Ecology, and DOI, as necessary to determine the swimming performance, behavior, and migratory pattern of target fish species in the Project area. In addition, studies shall be designed to provide sufficient information to determine whether any population of the target species or a substantial number of target fish are affected by Project entrainment and to determine the appropriate location of any entrainment reduction facilities that may be needed in the future. Studies will also quantify the abundance of outmigrating native salmonids from selected Boundary Reservoir tributaries.

b. Years 3-15: SCL shall implement the Fish Behavior and Population Study Plan. SCL in consultation with the FAWG shall review the plan every 3 years and shall make modifications to the study plan as appropriate based on data collection results. SCL shall prepare annual reports in consultation with the FAWG, and shall file final reports with FERC.

   Prior to year 16, SCL shall, in consultation with the FAWG and subject to approval of the USFS, Ecology, and DOI, develop a Dam Passage Survival study plan to be implemented in years 16 – 18 of license issuance. Dam survival shall be calculated as the survival of target species passing through the Boundary powerhouse, sluiceways and spillways. The study plan shall be developed under the guidance of a Technical Advisory Committee (TAC) that includes regional fish passage experts and shall use the most appropriate techniques available at the time of the study. SCL will select the

fish passage experts in consultation with and subject to approval of the FAWG. The study plan shall be designed to achieve a high level of statistical rigor and precision, in consideration of fish available for study, satisfactory to the FAWG.

SCL shall also, in consultation with the FAWG and subject to approval of the USFS, Ecology, and DOI; design a study plan to assess hydraulic conditions in the Boundary Dam forebay under all Project operations. The study plan shall include field measurements and may require development of a computational fluid dynamic, or physical scale model of the Boundary Dam and appurtenant facilities and shall be developed under the guidance of the TAC. This study plan will support the development of dam passage survival estimates under a wide range of operating scenarios and environmental conditions, and will assist in the development of entrainment reduction facilities if needed.

c. Years 16-18: SCL shall implement the Dam Passage Survival and Forebay Hydraulic studies.

d. Year 18 Decision Point: The FAWG shall determine, based on information developed during the evaluation phase, whether a population (i.e., a unique population that constitutes a substantial percentage of fish in the Project area or that has a unique evolutionary niche that requires special protection) or a substantial number of target fish, continue to be affected by Project entrainment. A decision on downstream entrainment measures will be made at the conclusion of the evaluation phase by the FAWG in consultation with the TAC and subject to the approval of the appropriate agencies.

e. Years 19-33: Starting in Year 19, if entrainment reduction measures are determined to be necessary at the year 18 decision point based on Project specific information, SCL shall make available up to an additional $47,000,000 (47 million dollars) through year 33 (plus any unexpended funds from the $23,000,000 allocated for the Years 1-18 Fish Behavior and Population Study) to take one of the following actions.

    i. If Boundary Dam survival of target species > 4 inches is less than 60 percent, SCL shall design, build, operate, maintain, monitor, and, as needed, modify facilities to improve Boundary Dam survival of target species. Facilities shall be developed in consultation with the FAWG and the TAC, and shall be subject to approval of the USFS, Ecology, and DOI.

    The licensee shall file a plan for installation, operation, maintenance, and evaluation of the facilities with the Commission for approval within two years of the License Year 18 Decision Point. Facility designs shall include, but are not limited to: (1) functional design drawings of the facilities, (2) a preliminary operations and maintenance plan, (3) a schedule for installing the facilities, (4) a post construction evaluation plan, and (5) provisions for short and long-term monitoring and adaptive management.

    ii. If Boundary Dam survival of target species > 4 inches is greater than 60 percent, SCL shall implement non-operational measures to improve Project survival commensurate with the Project's effects on a target species. Non-operational measures shall be identified, prioritized, implemented and

monitored by SCL in consultation with the FAWG and subject to approval of the USFS, Ecology, and DOI. The licensee shall submit a plan and schedule for implementing these measures within one year of the License Year 18 Decision Point.

f. Year 34 Re-evaluation of Project Entrainment Effects: Based upon the monitoring conducted by SCL between years 19-33, the FAWG in consultation with the TAC, shall re-evaluate information regarding Project entrainment effects; that is, the FAWG shall determine whether a population or a substantial number of target fish continue to be affected by Project entrainment. Based upon the results of the re-evaluation, SCL shall take one of the following actions.

   i. If Boundary Dam survival of target species > 4 inches is less than 60 percent, SCL will construct a new facility, expand the existing facility, or make operational changes to improve Boundary Dam survival only if it has been determined by the FAWG, in consultation with the TAC and subject to the approval of the appropriate agencies that (1) a population (i.e., a unique population that constitutes a substantial percentage of fish in the Project area or that has a unique evolutionary niche that requires special protection) or a substantial number of target fish, continue to be affected by Project entrainment; and (2) the proposed facility or operational change has a high likelihood of reducing entrainment effects on a unique population or a substantial number of target fish. Any facility will be developed by SCL in consultation with the FAWG and the TAC and shall be subject to approval of the USFS, Ecology, and DOI. The FAWG may determine that continuing Project effects are better addressed through alternative forms of mitigation that shall be implemented by SCL at a level of effort commensurate with the Project's effects on a target species (i.e., on a unique population or a substantial number of target fish).

      If a new facility or expansion of an existing facility is required, the licensee shall file a plan for the installation, operation, maintenance, and evaluation of the facilities with the Commission for approval within two years of the License Year 34 Decision Point. Facility designs shall include, but are not limited to: (1) functional design drawings of the proposed facilities, (2) a preliminary operations and maintenance plan, (3) a schedule for installing the facilities, (4) a post construction evaluation plan, and (4) provisions for short and long-term monitoring and adaptive management.

      If operational changes are determined appropriate, the licensee in consultation with the FAWG and subject to the approval of DOI, USFS, and Ecology, shall file a plan for timing, frequency, and magnitude of proposed operational changes within two years of the License Year 34 Decision Point. Any operational changes would not be implemented until they received Commission approval.

   ii. If Boundary Dam survival of target species > 4 inches is greater than 60 percent, SCL will implement new or continuing non-operational measures as needed to address Project effects with a level of effort commensurate with the

Project's effects on a unique population or a substantial number of target fish. Such non-operational measures shall be determined in consultation with the FAWG and subject to the approval of the USFS, Ecology, and DOI.

If at any time during this process, SCL is required to develop entrainment reduction facilities, design drawings shall be provided to the FAWG for review at the 30 percent (functional design), 50 percent, and 90 percent completion stage and SCL shall consult with the FAWG at each stage. SCL shall allow a minimum of 30 days for the FAWG to comment and make recommendations before filing any designs and plans with the FERC. When filing designs and plans, SCL shall include documentation of consultation; copies of comments and recommendations; and specific descriptions of how comments and recommendations were accommodated by SCL. If SCL does not adopt a recommendation from the FAWG, the filing shall include its reasoning based on Project specific information.

5.3.4. Compliance, Effectiveness, and Adaptive Management

Compliance with this entrainment reduction program will be documented by SCL in annual reports describing program activities conducted during the previous year. If entrainment reduction facilities are constructed, a hydraulic evaluation report will be completed within 12 months of initial facility operation. The hydraulic evaluation report will be submitted to the FAWG and will identify compliance with design specifications. Provisions for short and long term monitoring, and provisions for modifying the facility as needed to achieve the design parameters will be developed in consultation with the FAWG and subject to approval of the USFS, Ecology, and DOI.

5.3.5. Reporting and Schedule

As part of the entrainment reduction program, annual reports will be prepared summarizing information related to study design, monitoring, operations, problems encountered, program status and results of activities during the previous 12 months. If an entrainment reduction facility is constructed, the annual report will quantify the number and condition of target fish species captured and transported and the location of their release. It will also document operations including forebay flow and water surface elevations, facility flows, hours of facility operation, and any maintenance or operational issues identified over the year and repairs implemented to resolve issues. SCL will provide the annual reports to the FAWG for a 30 day review. Comments and recommendations by the FAWG will be included in the annual reports submitted to the FERC along with specific descriptions of how any comments were accommodated in the report. If recommendations are not adopted, the FERC filing will include SCL's explanations based on Project specific information.

The implementation schedule for the entrainment reduction program is summarized in Table 5.3-2.

Table 5.3-2. Implementation schedule for the entrainment reduction program.

PM&E Measure Activity	Schedule
Research and monitoring study plan and initiation of study components	Within two years of license issuance
Conduct research and monitoring	In the third through 15th years following license issuance
Calculate dam survival	In the 16th through 18th years following license issuance
Hydraulic evaluations and conceptual facility design	In the 16th through 18th years following license issuance
Entrainment reduction measure decision	In the 18th year following license issuance
Implement non-operational measures or Design, build, operate, monitor and modify facilities	In the 19th through 33rd years following license issuance
Re-evaluate project entrainment	In the 34th year following license issuance
Implement non-operational measures or Construct new facility, expand existing facility, or implement operational measures	Beginning in the 34th year following license issuance and thereafter through remaining license term
Status Report	Annually following license issuance

5.3.6. Consistency with Other Plans

There are no conflicts between this PM&E measure and other resource management plans prepared for the Project.

5.4. Tributary Fish Community and Aquatic Habitat Measures

5.4.1. Introduction

The objective of the tributary aquatic habitat program is to establish self-sustaining, naturally reproducing native stocks of fish, provide access to, and improve the habitat condition and function of tributaries draining to Boundary Reservoir to offset an estimated 304 acres of reservoir habitat affected by the Boundary Project. This section describes nine PM&E measures to be implemented as part of this program. Each of the measures is designed to improve aquatic habitat, reduce on-going impacts to aquatic habitat, or improve access to aquatic habitat for native salmonids. Implementation of the measures is spread out over the first 25 years following issuance of a new license with a specific schedule to be determined as part of post-license planning and subject to approval of the FAWG. Within 12 months of license issuance SCL shall submit to the FERC an integrated schedule that has been approved by the FAWG for the completion of the nine tributary aquatic habitat PM&E measures described in this section. The integrated schedule shall prioritize the measures and include milestones for completing the environmental analysis, design, consultation, regulatory review, permitting, and construction for each measure. The integrated schedule will also coordinate with the schedules of other inter-related PM&E measures that could affect their potential effectiveness.

As part of the process for developing an integrated schedule, SCL in consultation with the FAWG shall develop a Tributary Management Plan (TMP) that will include a subsection for each tributary where PM&E measures will be implemented. The TMP is an extension of the FAMP that will provide additional details and a coordinated approach for attaining the over-arching goals, objectives, and direction for treatments to be implemented in tributaries to Boundary Reservoir. The TMP will have a number of objectives:

- Establish an appropriate target fish population size and species for each tributary;
- Establish an appropriate habitat condition objective for each tributary;
- Compile and summarize the available reach-specific tributary habitat and fish community information;
- Coordinate treatments to be implemented in each tributary; and
- Conduct the planning needed for preparation of the integrated schedule.

One objective of the TMP is to ensure that treatments are coordinated, sequenced and complementary to the overall objective for that tributary or other tributaries, and scheduled appropriately. The suite of treatments that could be applied to a tributary will derive from a variety of PM&E measures that may include among other things:

- Non-native trout suppression and eradication;
- Native salmonid outplanting;
- Genetic testing of native salmonids;
- Studies to evaluate the numbers and timing of native salmonid outmigration;
- Studies to evaluate the numbers and biomass of outmigrating native salmonids lost to predation in tributary deltas;
- Channel restoration and stabilization;
- Riparian improvement;
- LWD and LWD jam placement;
- Native salmonid habitat improvement;
- Culvert removal or replacement; and
- Road improvements to reduce sediment delivery to streams.

The appropriate scale (e.g., each length or location) and timing for the implementation of treatments will be described in the TMP for each tributary. For instance, removal of culverts that block tributary access might be scheduled to occur after brook trout suppression efforts in order to reduce the risk of brook trout recolonization. Another example is consideration of the timing for habitat improvements in Sullivan Creek downstream of Mill Pond Dam relative to Mill Pond Dam removal efforts.

The specific treatments to be conducted in tributaries will be determined by, and subject to, the approval of the FAWG and based upon the FAMP, the TMP, and the site-specific plans to be developed for implementing the PM&E measures. One of the major objectives of the TMP is to coordinate these activities with a high level of detail, including site-specific conceptual plans, for

activities conducted in Years 1-10 of the license, so there is an efficient use of effort and high likelihood that implemented measures will be successful. Coordination will also occur with any other watershed restoration and management efforts being conducted in the tributaries by federal, state, tribal, local, and non-governmental organizations.

The FAWG will have a minimum of 30 days to review and approve the integrated schedule and TMP prior to submission to the FERC. It is anticipated that the TMP will be periodically updated or appended with new information on tributary habitat and fish community information that becomes available, as determined necessary by the FAWG. A formal update to the TMP will occur at 10 year intervals following license issuance.

Scheduled measures to be implemented will be reviewed annually with the FAWG to allow the opportunity to recommend any desired changes in the upcoming year's efforts, including identifying possible replacement measures. Following FAWG approval of the implementation schedule, SCL shall develop specific plans, permitting, and environmental reviews according to the schedule, including any updated milestones.

The following summarizes the requirements pertaining to all tributary habitat and suppression and eradication PM&Es and follows the general planning process in Figure 5.4-1. Requirements for the decision making process and dispute resolution are provided in the Boundary SA Section 8.2 and Section 9.

SCL shall develop specific plans for each measure pursuant to the integrated schedule described above. Each plan shall include specific goals, objectives, cost estimates, anticipated restoration techniques, maintenance requirements, and monitoring plans and methods. Specific, measureable, success criteria shall also be developed by SCL in consultation and subject to approval by the FAWG and included for each measure in this plan. For each measure that includes a construction component, the plan will include final construction drawings. Where applicable, measures should be addressed on a programmatic basis.

SCL shall develop all site-specific implementation plans in consultation with the FAWG and subject to approval of the USFS, WDFW, and Ecology depending upon specific jurisdiction. Collaboration will also occur with permitting agencies to ensure that required Best Management Practices and other measures, such as timing restrictions, required to obtain permits are incorporated in the plans. For PM&E measures to be implemented on NFS lands, plans will include sufficient information for SCL to conduct any required NEPA analysis on behalf of the USFS. SCL shall allow a minimum of 30 days for the FAWG to comment and make recommendations on the PM&E measure implementation plans.

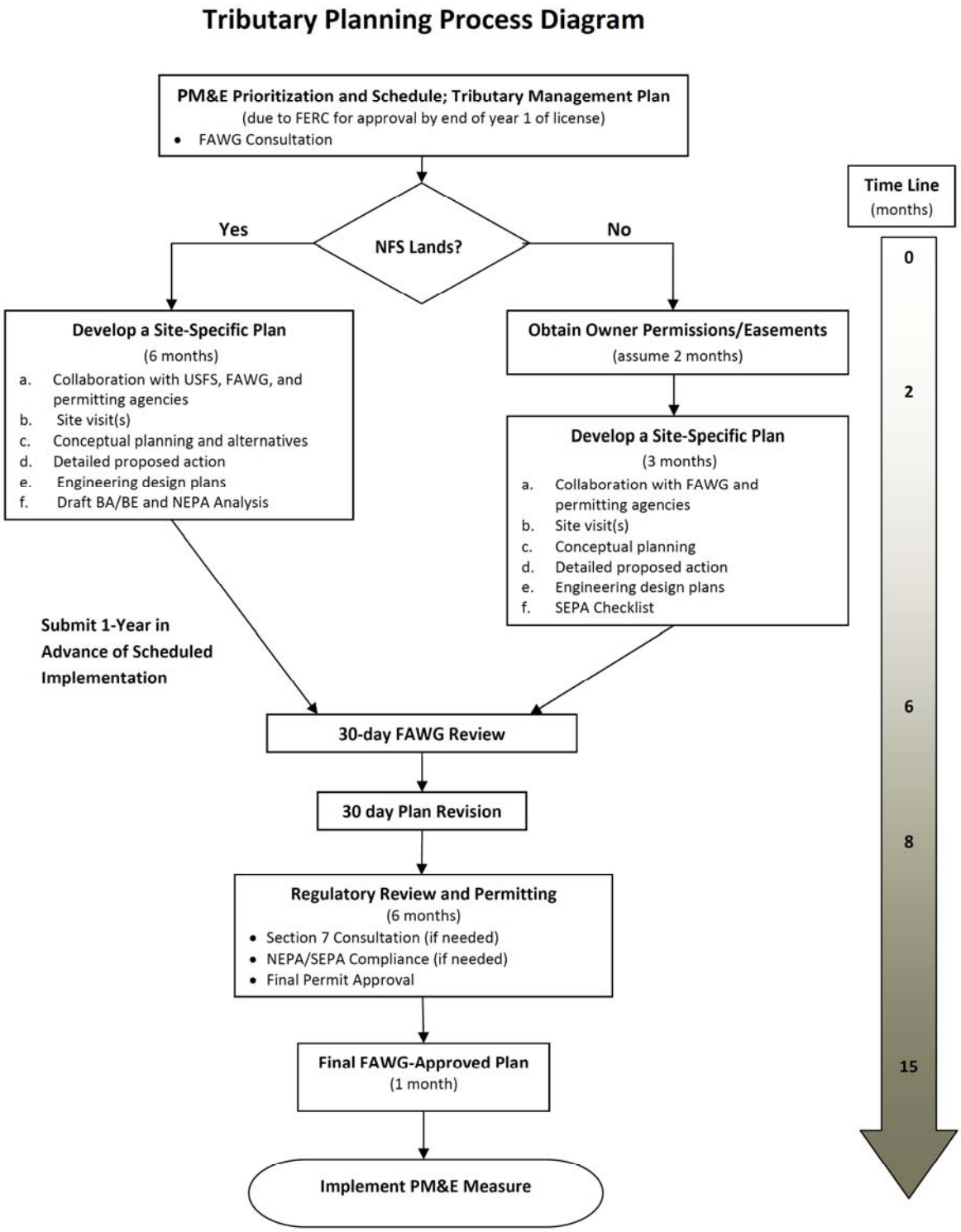

Figure 5.4-1. Tributary Planning Process.

Site specific implementation plans will be attached to the annual reports filed with the FERC. Among other things, annual reports will include a summary of actions implemented during the previous calendar year, a summary of the actions SCL plans to implement for the current calendar year, and a summary of ongoing planning efforts for measures to be implemented in out-years. When submitting an annual report, SCL shall include documentation of consultation; copies of comments and recommendations; and specific descriptions of how comments and recommendations were accommodated by SCL. If SCL does not adopt a recommendation, the annual report shall include their reasoning based on Project specific information. If SCL files a plan without obtaining necessary agency approvals, they shall include specific reasons for doing so.

Most tributary PM&E measures will require landowner permission or one or more permits in addition to FAWG approval to be implemented. Despite SCL's best efforts, a tributary measure or portion of a tributary measure may not be implemented because of the inability to obtain landowner permission or a needed permit, or because initial implementation of a measure suggests the benefits to native salmonids will be less than anticipated. With a few exceptions, which will be described in the specific PM&E measures below, if a tributary PM&E measure, or a portion of a measure cannot be implemented or is determined to be ineffective, any unallocated funds can be redirected to other PM&E measures to be implemented in tributaries to Boundary Reservoir. Reallocation of a PM&E measure's funds will require the approval of the FAWG. The process for reallocating funds will be as follows:

1) The FAWG will determine the amount of funds that would have been spent for the remaining portions of a PM&E measure.

2) SCL shall track the total amount of funds available for reallocation from all unapproved portions of tributary PM&E measures. SCL shall also track the amount of funds spend on alternative PM&E measures. As part of the comprehensive Settlement Agreement an escalation factor will be applied to funds that cannot be immediately reallocated to an alternative measure.

3) Alternative PM&E measures must be implemented in tributaries to Boundary Reservoir.

4) Reallocation of funds will be determined by the FAWG for alternatives analysis, planning, surveys, NEPA/SEPA activity, permitting and design efforts, and for implementing, monitoring, and maintaining alternative PM&E measures.

5) The process for determining the reallocation of funds will be developed by the FAWG and include at a minimum:
   - Identification of resource objectives
   - Evaluation of measures to achieve resource objectives
   - Documentation that the work to be funded is likely to achieve agreed upon resource objectives
   - A schedule for implementation

- Proper documentation in support of any disbursements (including qualifications of proposed recipients and requirements relating to accounting for expenditures).

6) Alternative PM&E measures must be used to protect and/or enhance native fish populations or their habitat. Alternative PM&E measures may expand the level of effort or spatial extents of an existing PM&E measure or may be new PM&E measures that include one or more of the following activities:
   - Riparian planting
   - Streambank stabilization
   - LWD placement
   - Large boulder placement
   - Non-native fish suppression/eradication
   - Conservation easements
   - Culvert replacement
   - Reduction of sediment delivery to a stream (e.g., landslide control or road improvements)

Additional planning details specific to each PM&E measure are provided in their respective subsections below and, with the exception of non-native trout suppression and eradication, shall be governed by License Article 9(E).

5.4.2. Tributary Non-native Trout Suppression and Eradication

5.4.2.1. Scope

This PM&E measure shall be governed by License Article 9(D). SCL shall implement non-native trout suppression or eradication activities in portions of 23 Boundary watershed waterbodies following the schedule identified in Table 5.4-1. Within 12 months of license issuance SCL shall submit to the FERC an integrated schedule that has been approved by the FAWG for the completion of non-native fish suppression and eradication activities that is coordinated with tributary enhancement activities and native trout supplementation activities (Section 5.6). The integrated schedule shall prioritize activities and include milestones for completing the design, consultation, regulatory review, permitting, and implementation. The general schedule identified in Table 5.4-1 will guide the specific integrated schedule to be filed with the FERC.

The type of treatment, number of treatment miles, and treatment schedule in Table 5.4-1 identifies the total treatment effort to be expended during implementation of this PM&E measure. Suppression and eradication treatments include associated permitting and monitoring activities. As part of post-license monitoring and adaptive management, SCL in collaboration with and subject to approval of the FAWG, may reallocate suppression and eradication effort provided the total level of effort is commensurate with activities described in Table 5.4-1. The level of effort for suppression may vary among stream reaches but will be consistent with an average of six electrofishing efforts per reach every 10 years from the start of implementation through the remaining term of the license. Each effort will consist of one to three electrofishing

passes to be determined during post-license planning and approved by the FAWG. Eradication of non-native salmonids will be consistent with a level of effort associated with three chemical treatment applications assuming the use of antimycin, rotenone or an equivalent fish toxicant.

Table 5.4-1. Boundary watershed waterbodies identified for suppression or eradication activities.

Waterbody	Schedule (License Year)	Anticipated Action[1]	Treatment Miles[1]	Comment
Sullivan Cr	1-10	Suppression	15.0	All of mainstem
Outlet Cr	1-10	Suppression	0.5	
NF Sullivan Cr	1-10	Suppression	0.3	To NF Sullivan Dam
Pass Cr	1-10	Suppression	0.5	Lowest reach
Rainy Cr	1-10	Suppression	0.1	
Thor Cr	1-10	Eradication	0.2	Mouth to FS Rd 300
Kinyon Cr	1-10	Suppression	0.2	Mouth to Sullivan Cr Rd
Gypsy Cr	1-10	Suppression	0.1	
Copper Cr	1-10	Suppression	0.1	
Deemer Cr	1-10	Suppression	0.5	
Leola Cr	1-10	Suppression	0.1	
Stony Cr	1-10	Suppression	0.5	
Johns Cr	1-10	Suppression	0.3	
Mankato Cr	1-10	Eradication	0.1	
Fireline Cr	1-10	Eradication	0.1	
Sweet Cr	1-20	Eradication	3.0	All of watershed (except Lunch Cr)
Slate Cr	11-15	Suppression	6.5	All of mainstem
Uncas Gulch	11-15	Suppression	2.0	All of tributary
Flume Cr	11-15	Eradication	6.2	All of mainstem
Pewee Cr	16-20	Suppression	1.8	All of watershed
Lime Cr	16-20	Eradication	1.5	All of watershed
Lake Lucerne	16-20	Eradication		
Sand Cr	16-20	Eradication	0.3	Mouth to County Rd 3669
Tier 2 Tribs	20-25	Eradication	See Section 3.4 [2]	

1) At the direction of the FAWG, suppression or eradication treatments may be adjusted as part of post-license monitoring and adaptive management provided the total level of effort is consistent with Table 5.4-1.

2) Tier 2 tributaries are defined as all tributary reaches identified in Relicensing Study 14: Assessment of Factors Affecting Aquatic Productivity in Tributary Habitats (SCL 2004a) that were not categorized as primary restoration opportunities.

5.4.2.2. Background Information

Most of the tributaries to the Pend Oreille River, including Boundary Reservoir, have been stocked with non-native salmonid species such as brook trout, brown trout, and rainbow trout (McLellan 2001). The presence of nonnative trout, especially brook trout, has been identified as a serious threat to native salmonids as a result of interbreeding (with bull trout) and competition for habitat and food resources (Andonaegui 2003). The USFWS (1999) stated in its status review that westslope cutthroat trout are usually found in the cooler upper extents of tributaries, but suggested this use was more likely driven by competition from other trout such as rainbow

trout and brook trout that are less tolerant of cooler, higher gradient streams, rather than a preference for that habitat type.

Sullivan Creek and Slate Creek have been identified as streams important to the recovery of bull trout in the Northwest Recovery Unit and reduction of non-native fish species as a priority action (POSRT 2005). Surveys by McLellan (2001), R2 Resource Consultants (1998), and the USFS (1998) have documented the presence of brook trout. Rainbow trout have also been documented in Slate Creek downstream of the chute and falls barrier located at RM 0.75, but it is unclear if they are native redband trout or descendents of hatchery rainbow trout stocked in the creek because no genetic tests have been conducted on rainbow trout sampled from Slate Creek. Tests of a small number of rainbow trout captured in Boundary Reservoir suggest that some had genetic characteristics similar to other native inland rainbow trout stocks, but the small sample size and lack of a baseline genetic library from nearby native redband trout populations precluded comparisons and, therefore, unequivocal conclusions (Small and Von Bargen 2009). A variety of non-native species are also present in Sullivan Creek, particularly downstream of Sullivan Lake. In addition to brook trout and rainbow trout, brown trout and kokanee are also present downstream of Sullivan Lake.

5.4.2.3. Procedures

As described in Section 5.4.1, within 12 months of license issuance SCL shall submit to the FERC an integrated schedule that has been approved by the FAWG for the completion of non-native fish suppression and eradication measures described in this section of the FAMP. The integrated schedule shall prioritize the measures and include milestones for completing the design, consultation, regulatory review, permitting, and implementation of suppression and eradication activities. Scheduled activities will be reviewed annually with the FAWG to allow the opportunity to recommend any desired changes in the upcoming year's efforts, including identifying possible replacement suppression and eradication measures. Following FAWG approval of the implementation measures, SCL shall proceed with the development of specific plans, permitting and environmental reviews according to the schedule, including any updated milestones.

Backpack electrofishing will be the technique used to capture non-native salmonids (primarily brook trout) during suppression efforts. All non-native and cutthroat trout, or an appropriate subsample as determined by the FAWG, will be identified, weighed, and measured, and scale samples will be taken from each fish. Any other incidentally captured fish or aquatic organisms will be released unharmed near its capture location. Details of the suppression program, including the disposition of captured non-native trout, will be determined during post-license planning subject to approval of the FAWG. The level of effort for this PM&E measure (up to 3 passes, average of 6 times per 10 years for the miles of stream identified) is based on the recommendations of Peterson et al. (2008) that electrofishing suppression of brook trout involve a cycle of three consecutive years of removal, followed by no more than two years of no suppression to achieve substantial benefits to cutthroat trout. Furthermore, the modeling by Peterson et al. (2008) suggested that a single pass of electrofishing was generally more cost effective than a double pass, unless habitat conditions made efficient electrofishing difficult, or brook trout immigration rates were high. Sheppard and Nelson (2004) recommend conducting at least six removal treatments of two to three passes per treatment within two to three years,

targeting mature adults during the first year, trampling nonnative redds, conducting at least one removal during late fall or early winter period, and eradicating adults first, then focusing on the smaller fish (age-0 and age-1). Sheppard and Nelson (2004) also recommended that fish barriers be installed at lower boundaries of treatment areas to prevent re-invasion of nonnative fish. During implementation planning, the FAWG may direct SCL to conduct suppression using a different on/off cycle, vary the number electrofishing passes up to 3 passes, or strategically select the scheduling of subreaches. However, the overall level of effort will not exceed up to 3 passes, an average of 6 times per 10 years for the miles of stream identified.

Eradication efforts will use a chemical toxicant such as antimycin or rotenone. Details of the suppression program, including the specific chemicals to be used, their concentration, and the number of treatment and detoxification stations will be determined during post-license planning subject to approval of the FAWG.

5.4.2.4. Compliance, Effectiveness, and Adaptive Management

Non-native salmonid eradication and suppression will be adaptively managed in consultation with and subject to FAWG approval based on reach-specific conditions and objectives. Compliance will be documented in annual reports. The annual reports will describe the activities relating to non-native salmonid eradication and suppression that were completed during the year and identify any variances from the study plan. Variances will be discussed with the FAWG as well as any needed modifications to the plan for the following year.

Peterson et al. (2008) based their suppression model and management recommendations on demographic parameters (e.g., fecundity, age of maturity, annual survival, immigration etc.) for populations of brook and cutthroat trout they studied in headwater streams of Colorado. Because of the sensitivity of their model to these demographic parameters, they also recommended that monitoring was important for fine-tuning a suppression program. Because the frequency of and scope of electrofishing effort for suppression activities is relatively high in the proposed waterbodies, no additional monitoring effort is proposed. However, as part of post-license planning the FAWG may determine methods for assessing effectiveness from the catch information collected as part of the suppression activities.

For effectiveness monitoring and adaptive management of eradication activities, a 328-foot segment will be delineated per mile of stream treated and designated as a monitoring reach. If less than one mile of stream will be treated, the monitoring segment will be at least 164 feet in length. Each treatment reach will have at least one monitoring reach to be sampled within one year following each treatment. The distribution of the monitoring reaches and specific fish handling protocols will be determined as part of post-license planning and subject to approval of the FAWG. SCL anticipates that blocking nets will be placed above and below each monitoring reach and three complete electrofishing passes will be conducted in the year following treatment to obtain an estimate of non-native trout and cutthroat trout population size (if supplementation occurs) and will allow an evaluation of the effectiveness of the eradication treatment under the prevalent stream conditions. All non-native and cutthroat trout, or an appropriate subsample as determined by the FAWG, will be identified, weighed, and measured, and scale samples will be taken from each fish. Results of the monitoring will be used to revise future eradication efforts.

5.4.2.5. Reporting and Schedule

The reporting and implementation schedule for non-native trout suppression and eradication is summarized in Table 5.4-2.

Table 5.4-2. Reporting and implementation schedule for the non-native trout suppression program.

PM&E Measure Activity	Schedule
Implementation Schedule	Within one year of license issuance
Implementation Planning	One to two years in advance of the scheduled implementation year for each waterbody
Implementation in Sullivan Creek and Tributaries	Begins within one to ten years of license issuance
Implementation in Sweet Creek	Begins within 20 years of license issuance
Implementation in Slate Creek, Uncas Gulch, and Flume Creek	Begins within 11 to 15 years of license issuance
Implementation in Pewee Creek, Lime Creek, Lake Lucerne, and Sand Creek	Begins within 16 to 20 years of license issuance
Annual Reports	Following each year suppression or eradication efforts occur
Eradication effectiveness monitoring and reporting	Within one year following treatment activities

5.4.2.6. Consistency with Other Plans

There are no conflicts between this PM&E measure and other resource management plans prepared for the Project. The schedule for implementing non-native trout suppression and eradication measures will be coordinated with tributary habitat enhancement measures described in the remainder of Section 5.4.

5.4.3. Riparian Improvement and Stream Channel Enhancement in Sullivan Creek RM 0.30 to RM 0.54

5.4.3.1. Scope

This PM&E measure shall be governed by License Article 9(E). This measure has two components to be implemented in Sullivan Creek from RM 0.30 to RM 0.54 (downstream of the Highway 31 Bridge and Sullivan Creek Hydroelectric Project boundary). The riparian improvement and stream channel enhancement to be completed within 10 years after license issuance are described separately. The schedule for implementation of these activities may be dependent on upstream Mill Pond Dam removal activities. If permitting, landowner permission, or other issues prevent implementation of this measure over portions of the reach within 10 years after license issuance, funds equivalent to what would have been expended will be allocated to other tributary PM&E measures as determined in consultation with the FAWG and subject to the approval of the USFS if they occur on NFS lands.

5.4.3.1.1. Riparian Improvement

The objective of this component is to implement riparian improvements along the left bank for up to 1,200 feet of stream to improve riparian functions (shade, potential instream LWD, and erosion control). Activities in some sections of the reach would depend on obtaining easements from non-SCL landowners. Selection of specific plant species and planting locations will be determined as part of post-license planning and design work to be approved by the FAWG and following WDFW guidelines in Saldi-Caromile et al. (2004). It is anticipated that plants will be a mix of native coniferous and deciduous trees, shrubs, and herbaceous plants or ground cover.

5.4.3.1.2. Stream Channel Enhancement

The objective of this component will be to improve instream spawning and rearing habitat and channel conditions along 1,200 feet of stream by LWD placement (15 to 20 pieces), large boulder placement (5 to 10 boulders), and channel modification. Addition of structural elements will contribute to pool formation, retention of LWD, and retention of coarse sediment suitable for salmonid spawning. Structural elements along the left bank would help stabilize the streambank, protecting downstream property owners and decreasing bank erosion. LWD is wood greater than 4 inches in diameter and 6.6 feet in length. Selection of specific structural elements and their placement will be determined as part of post-licensing implementation planning and subject to approval of the FAWG and generally following WDFW guidelines in Saldi-Caromile et al. (2004).

SCL anticipates that LWD may need replenishment because of loss due to transport or degradation. LWD replenishment will occur on an eight-year basis throughout the term of the license.

5.4.3.2. Background Information

Sullivan Creek is the largest tributary draining into Boundary Reservoir. Biological surveys conducted during relicensing indicated the delta region and lower reaches of Sullivan Creek are used for rearing by cutthroat trout, brown trout, and rainbow trout. It has also been identified as a location of known mountain whitefish spawning. Although few bull trout have been observed in Sullivan Creek, the mainstem of Sullivan Creek is proposed as "critical habitat" by the USFWS.

A channel assessment from RM 0.47 to RM 0.68 was conducted during mid-July 2008. The habitat conditions in the surveyed reach were described as poor for fish migration, rearing, and overwintering. Spawning conditions are poor because appropriate sized gravel is lacking, and during high flows it is likely that any redds are scoured. The bed conditions of the reach have been influenced by suction dredge mining and the Highway 31 Bridge. The dominant habitat types were riffles and rapids. LWD was infrequent throughout the surveyed reach and primarily present above the water surface at the time of the survey, so it is only an active component of fish habitat at higher flows. LWD functions relative to channel conditions observed during the survey primarily included bank stability and small pool scour. No logjams were present during surveys conducted in July 2008. The riparian zone was composed of young (< 40 years old) mixed vegetation. Current riparian conditions are variable, with some portions devoid of

riparian trees or brush (i.e., very sparse), some having a moderate density of mixed brush, herbaceous plants, and hardwoods with some conifers (moderately sparse), and some having a relatively dense hardwood forest cover with some conifers (sparse). Several riparian sections within this reach are currently not forested, and other sections have patches dominated by low brush and herbaceous vegetation (Figure 5.4-2).

Figure 5.4-2. Sullivan Creek downstream of Highway 31 Bridge.

5.4.3.3. Procedures

Following the schedule filed with FERC described in Section 5.4.1, SCL shall conduct implementation planning subject to consultation and approval of the FAWG for the riparian improvement and stream channel enhancement components of this PM&E measure. At a minimum, the planning will include:

- A description of any field surveys conducted and summary of results.
- A native vegetation list to be used for riparian planting.
- The target size and source(s) for riparian plants.
- Description of planting techniques and density.
- A map or aerial photo with a planting plan.
- Listing of the type, number, and location of instream structures.
- Engineering drawings of any proposed major instream structures (e.g., LWD jams, groins, boulder clusters, etc.).
- Anticipated source(s) of wood and boulders to be used.

SCL shall be responsible for obtaining all applicable permits, environmental reviews (e.g., NEPA), and approvals from Federal and State agencies. Within one year of completing the FAWG approved planning and obtaining any needed permits, SCL shall implement the enhancement activities.

5.4.3.4. Compliance, Effectiveness, and Adaptive Management

SCL shall conduct compliance monitoring within one year following implementation of the PM&E measure. Protocols for collecting compliance information will be developed as part of implementation planning and subject to consultation and approval of the FAWG. At a minimum, compliance monitoring will include documentation collected during implementation of the PM&E measure, such as survey data, records of purchased materials (LWD pieces, ballast, etc), and photographs of each site before and after LWD or boulder placement or plantings.

SCL, in consultation with the FAWG, shall develop effectiveness monitoring protocols. Effectiveness monitoring will be conducted 3 years after planting to determine whether planting success criteria have been achieved. For riparian areas suitable for establishing vegetation, mitigation planting success and any remedial measures shall achieve at least 80 percent survival of trees and shrubs and 50 percent canopy cover of native species at the end of 3 years from the date of planting. Grasses, forbs, shrubs, and trees shall be planted to achieve the desired structure and function for site-specific habitat conditions.

SCL shall conduct additional effectiveness monitoring at eight-year intervals following implementation and will include evaluation of the condition of riparian areas where plantings occurred, LWD and boulder placed in the stream, and any streambank or channel modifications. The main purpose of the effectiveness monitoring will be to assess structure condition to determine if any structure falls below the success levels established during implementation planning and approved by the FAWG and will be used to support adaptive management and adjustments to the PM&E measure at eight year intervals. If a treatment falls below established success levels, SCL shall develop a plan for remediation within 60 days, for approval of the FAWG, to correct the deficiencies. SCL shall begin implementing these remediation measures within 30-days of permit approval or as determined appropriate by the FAWG. Subsequent compliance monitoring will occur as determined by the FAWG.

In addition to the 8 year effectiveness monitoring SCL shall annually, and following major (25-year) flood events, visit measures for routine inspection/maintenance to ensure that no substantive adverse impacts have occurred. No formal reports will be required for these visits although brief written updates shall be provided by SCL upon request by the FAWG.

5.4.3.5. Reporting and Schedule

The reporting and implementation schedule for protection, riparian planting, and stream channel enhancement in Sullivan Creek is summarized in Table 5.4-3.

Table 5.4-3. Reporting and implementation schedule for habitat protection, riparian improvement, and stream channel enhancement in Sullivan Creek RM 0.3 to RM 0.54.

PM&E Measure Activity	Schedule
Planning and Implementation	According to schedule submitted to FERC
Implementation	Within ten years of license issuance
Compliance Monitoring and Reporting	Within one year following implementation
Effectiveness Monitoring	Every eighth year following implementation
Effectiveness Monitoring Report	Within one year following monitoring

5.4.3.6. Consistency with Other Plans

There are no conflicts between this and other resource plans developed by SCL. The schedule for implementation of the activities identified in this PM&E measure may be dependent on upstream Mill Pond Dam removal activities

5.4.4. Stream and Riparian Improvements in Sullivan Creek RM 2.3 to RM 3.0 and NF Sullivan Creek

5.4.4.1. Scope

This PM&E measure shall be governed by License Article 9(E). This PM&E measure affects Sullivan Creek from approximately 265 feet downstream of the confluence of Sullivan Creek and North Fork Sullivan Creek to RM 3.0 and is focused primarily on streambank and channel enhancement, but also includes riparian planting in conjunction with the streambank enhancement. The objective will be to decrease bank erosion on the right bank, provide instream structure to create pools and enhance deposition and retention of spawning gravel, decrease the channel width-to-depth ratio, and promote the riparian buffer along the right bank within 10 years of license issuance. The schedule for implementation of these activities may be dependent on upstream Mill Pond Dam removal activities. If permitting or other issues prevent implementation of this measure over portions of the reach within 10 years after license issuance, funds equivalent to what would have been expended will be allocated to other tributary PM&E measures in tributaries to Boundary Reservoir as determined in consultation with the FAWG and subject to the approval of the USFS for activities that occur on NFS lands.

A brief site visit that included biologists and engineers from the USFS and the SCL relicensing team suggested that conceptually the objectives could be achieved through road relocation/reconstruction or stream channel diversion. Stream channel diversion could be accomplished through the addition of log jam structures, rock barb structures and large woody debris. The log jam and the barbs are anticipated to move the thalweg of Sullivan creek at least 10 feet towards the center of the channel and create at least a 10-feet wide vegetative riparian zone. This action would promote deposition of stream sediment along the existing bank; thus, reducing bank angles and providing a low lying bench appropriate for natural regeneration or riparian planting of willows and other native woody plants. SCL shall undertake additional post-license planning to add substance and detail to the conceptual plan developed in the field and to

ensure that modifications do not cause adverse downstream impacts. This plan will be developed in consultation with the FAWG and subject to approval of the USFS. Implementation of this plan will result in completion of the following activities within 10 years after license issuance between RM 2.3 and 3.0:

- Design and construction of seven engineered logjams (1,100 cubic feet volume each)
- Placement of 10 to 20 boulders (average of 3 feet in diameter)
- Channel modifications
- Riparian plantings
- Streambank modifications at two locations (475 feet long and 317 feet long) where Sullivan Lake Road is hydrologically connected to the Creek. Modifications will include decreasing the bank angle through flow redirection, structural, and/or biotechnical techniques
- Either road relocation/reconstruction or stream channel diversion at one site on Sullivan Creek (county rd. 9345 in SCL segment 4; RM 2.5-3.0)

Boulders would primarily be used in boulder clusters, but could also be used to anchor LWD pieces. Selection of specific structural elements and their placement will be determined as part of post-license planning and design work and generally following WDFW guidelines in Saldi-Caromile et al. (2004) and will require approval of the FAWG prior to implementation.

SCL shall also replace the culvert at the Sullivan Lake Road stream crossing of North Fork Sullivan Creek and place LWD in North Fork Sullivan Creek from the mouth to the North Fork Sullivan Creek Dam (RM 0.25) by License Year 15. Instream LWD placement will include 70 pieces of LWD. Of these pieces, at least 6 shall be 12 inches or greater in diameter and a minimum of 35 feet in length. The final number and size of LWD to be placed into North Fork Sullivan Creek will be approved by the FAWG and consider site-specific conditions.

5.4.4.2. Background Information

Two sub-reaches within this PM&E reach, Reach 2 from RM 2.30 to 2.60 and Reach 3 from RM 2.74 to 3.02, underwent channel assessments as part of relicensing studies (Figure 5.4-3) (SCL 2009a). Surveys were also conducted along five segments of Sullivan Lake Road to assess potential effects to Sullivan Creek (Figure 5.4-4). Habitat quality was described as low for salmonid spawning in both survey reaches, moderate for migration and rearing habitat in both survey reaches, low for overwintering habitat in Reach 2, and moderate for overwintering habitat in Reach 3. The reaches were described as being adversely impacted by the presence of Mill Pond Dam, which reduces transport into the reach of coarse substrate and LWD, and the presence of Sullivan Lake Road along its right bank, which is hydraulically connected in several locations along Road Segments 3 and 4, limits lateral movement of the channel, and reduces riparian function (Figure 5.4-5). LWD density was 17.7 and 25.0 pieces per 1,000 feet in Reach 2 and Reach 3, respectively. No logjams were observed in Reach 2 and one logjam was observed in Reach 3. Riparian vegetation was described as a mixture of hardwoods and conifers, with the left bank having both young (< 40 years old) and mature trees (40-80 years old), while vegetation on the right bank was primarily young. Channel morphology was described as plane-

bed, with few pools over about half of Reach 2 and throughout Reach 3. McLellan (2001) surveyed the reach from North Fork Sullivan Creek to Mill Pond Dam and observed low numbers of cutthroat trout (less than 1 fish/100 square meters [119.6 square yards]) and rainbow trout (1 fish/100 square meters).

Two fish migration barriers have been identified on North Fork Sullivan Creek. These include the North Fork Sullivan Dam located at RM 0.25 (Andonegui 2003) and the Sullivan Lake Road culvert at the mouth of the stream (USFS (2002) (Figure 5.4-6). Genetic studies of westslope cutthroat trout captured in North Fork Sullivan Creek suggested the population had no introgression from non-native cutthroat trout historically stocked in the region and was substantially divergent from cutthroat collected in Mill Creek and LeClerc Creek (Shaklee et al. 2003). Cool water present within North Fork Sullivan Creek may provide thermal refugia to salmonids during warm summer periods.

5.4.4.3. Procedures

SCL shall conduct planning and design work consistent with the schedule submitted to FERC and subject to approval of the FAWG prior to implementation. At a minimum, the plan will include the following elements:

- The results from any field surveys conducted.
- A list of native plant species to be used for riparian planting.
- The target size and source(s) for riparian plants.
- Planting techniques and density.
- A map or aerial photo with a planting map.
- Listing of the type, number, and location of instream structures.
- Engineering drawings of major instream structures (e.g., LWD jams, groins, boulder clusters, etc.).
- Engineering drawings of the culvert replacement at the mouth of North Fork Sullivan Creek.
- Engineering drawings of road relocation/reconstruction or stream channel diversion along Sullivan Lake Road in Road Segment 4.
- Anticipated source(s) of wood and boulders to be used.

SCL shall be responsible for obtaining all applicable permits, environmental reviews (e.g., NEPA), and approvals from Federal and State agencies. For each LWD and ELJ placement action, the size and number of pieces of LWD will be determined by the FAWG. Site-specific characteristics will need to be considered. The design-life for engineered log structures and wood placed in streams is anticipated to be five to 10 years; consequently, SCL commits to repairs or log replenishment if determined necessary following each eight year monitoring event. If riparian plantings, instream structures, the North Fork Sullivan Creek culvert replacement, or LWD placement cannot be implemented because of permitting or some other issue, equivalent funding would be reallocated to other PM&E measures to be implemented in tributaries to Boundary Reservoir as determine in consultation with the FAWG.

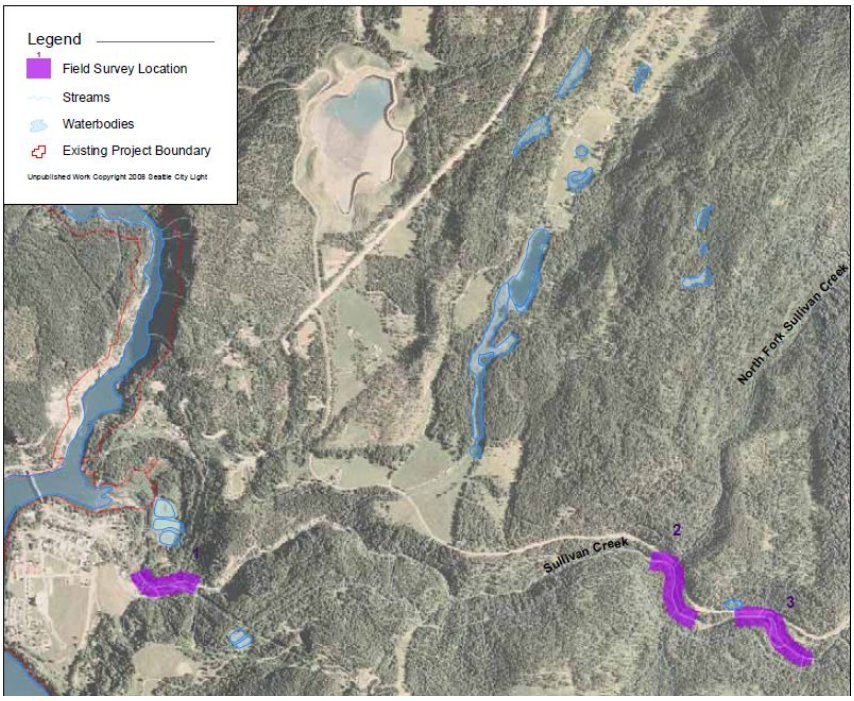

Figure 5.4-3. Reaches of Sullivan Creek surveyed during 2008.

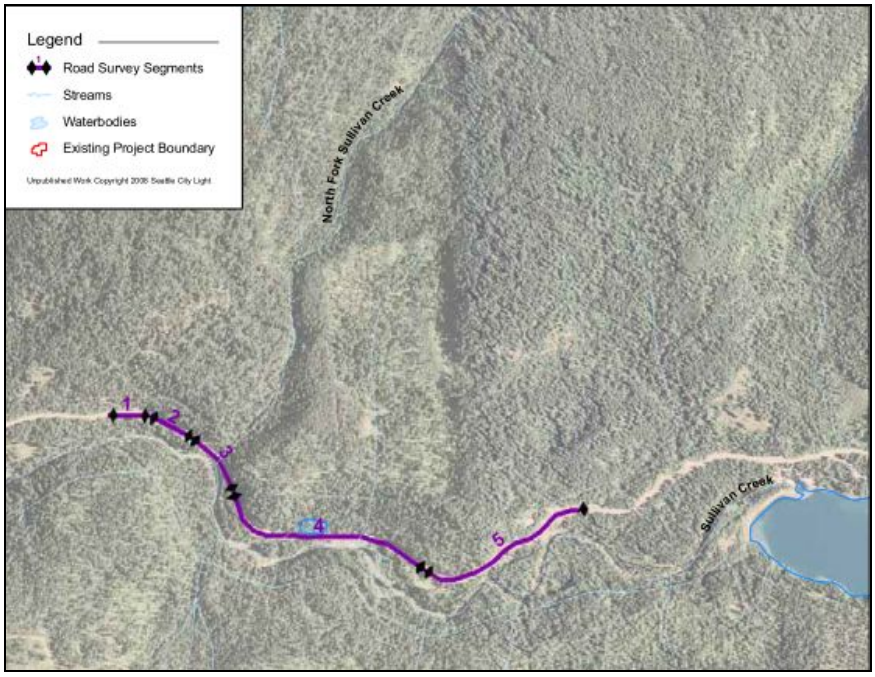

Figure 5.4-4. Sullivan Lake Road Segments surveyed during 2008.

Figure 5.4-5. Section of Sullivan Lake Road hydraulically connected to right bank of Sullivan Creek.

Figure 5.4-6. Outlet of culvert under Sullivan Lake Road draining NF Sullivan Creek.

5.4.4.4. Compliance, Effectiveness, and Adaptive Management

SCL shall conduct compliance monitoring will occur within one year following implementation of the PM&E measure and any repairs that are needed during the term of the license. Protocols for collecting compliance information will be determined during implementation planning and subject to consultation and approval of the FAWG. At a minimum, compliance monitoring will

include documentation collected during implementation of the PM&E measure, such as survey data, records of purchased materials (LWD pieces, ballast, etc), and photographs of each site before and after measures or repairs are implemented.

SCL, in consultation with the FAWG, shall develop effectiveness monitoring protocols. Effectiveness monitoring will be conducted 3 years after planting to determine whether planting success criteria have been achieved. For riparian areas suitable for establishing vegetation, mitigation planting success and any remedial measures shall achieve at least 80 percent survival of trees and shrubs and 50 percent canopy cover of native species at the end of 3 years from the date of planting. Grasses, forbs, shrubs, and trees shall be planted to achieve the desired structure and function for site-specific habitat conditions.

SCL shall conduct additional effectiveness monitoring beginning in the eighth year following implementation and every eight years thereafter. The purpose of the effectiveness monitoring will be to assess the PM&E measure's condition to determine if structural repairs, log replenishment, additional plantings, or non-native plant removal is needed to maintain the measure's designed functions. Criteria for determining whether a PM&E measure needs remediation will be determined during post-license planning and is subject to approval of the FAWG. The results of the effectiveness monitoring will be used to support adaptive management and adjustments to the PM&E measure at eight-year intervals. If a treatment falls below established success levels, SCL shall develop a plan for remediation within 60 days, for approval of the FAWG, to correct the deficiencies. SCL shall begin implementing these remediation measures within 30-days of permit approval or as determined appropriate by the FAWG. Subsequent compliance monitoring will occur as determined by the FAWG.

In addition to the 8 year effectiveness monitoring SCL shall annually, and following major (25-year) flood events, visit measures for routine inspection/maintenance to ensure that no substantive adverse impacts have occurred. No formal reports will be required for these visits although brief written updates shall be provided by SCL upon request by the FAWG.

5.4.4.5. Reporting and Schedule

The reporting and implementation schedule for riparian planting and stream channel enhancement in Sullivan Creek from RM 2.3 to RM 3.0 and in NF Sullivan Creek is summarized in Table 5.4-4.

5.4.4.6. Consistency with Other Plans

There are no conflicts between this and other resource plans developed by SCL.

Table 5.4-4. Reporting and implementation schedule for riparian planting and stream channel enhancement in Sullivan Creek RM 2.30 to RM 3.00.

PM&E Measure Activity	Schedule
Implementation Schedule	Within one year of license issuance
Implementation	Within ten years of license issuance
Compliance Monitoring and Report	Within one year of implementation or repairs
Effectiveness Monitoring	Eight years after implementation and every eighth year thereafter
Effectiveness Monitoring Report	Within one year of effectiveness monitoring

5.4.5. Large Woody Debris Placement and Road Improvements in Sullivan Creek and Selected Tributaries Upstream of the Confluence with Outlet Creek

5.4.5.1. Scope

This PM&E measure shall be governed by License Article 9(E). This PM&E measure affects Sullivan Creek and selected tributaries upstream of the confluence with Outlet Creek at RM 5.3. SCL shall place LWD in Sullivan Creek by Year 10 after license issuance in the following amounts:

- Outlet Creek to Rainy Creek – 681 pieces of which 136 are greater or equal to 12 inches in diameter and 35 feet in length.
- Rainy Creek to Gypsy Creek – 330 pieces of which 46 are greater or equal to 12 inches in diameter and 35 feet in length.
- Gypsy Creek to end of fish bearing waters – 728 pieces of which 76 are greater or equal to 12 inches in diameter and 35 feet in length.

Engineered logjams will account for a portion of LWD placement. The number of logjams will be determined as part of post-license planning and subject to approval of the FAWG.

SCL shall undertake the following road improvements along the 12 miles of Sullivan Creek Road (FS Road 2200) between the mouth of Outlet Creek and Leola Creek:

- Sullivan Creek Road – Approximately 6.5 miles of road (described in Table 5.4-5) shall be reconstructed, including resurfacing with 4 inches of gravel, re-grading to divert storm water to the inside ditch, and the replacing of deficient/adding up to 35 new storm water ditch relief culverts including sediment traps or energy dissipaters as needed to reduce delivery of road-related erosion to streams. Two cutslope slides located approximately 1.5 and 1.7 miles, respectively from the junction with Sullivan Lake Road (MP 12) (described in Table 5.4-5), shall be stabilized by removing slumped material installing drainage, re-vegetating, and installing retaining structures while maintaining road width.

- Kinyon Creek – Replace FS Road 2220 culvert with a fish passable structure.
- Stony Creek – Replace FS Road 2200 culvert with a fish passable structure.
- Unnamed creek downstream of Cascade Creek– Replace culvert with a multi-plate arch structure.

Table 5.4-5 identifies road lengths using GIS. Preliminary estimates identify 34,190 ft be regarded. These estimate will be verified during the planning phase prior to implementation.

Table 5.4-5. Preliminary estimate of Sullivan Creek road segments to be graded and provided with stormwater relief culverts.

Road Segment	Location (Lat., Long., WGS84)		Length (Feet)
	(Start)	(End)	
1	48.838701, -117.265967	48.838421, -117.262782	780
2	48.836344, -117.255665	48.833116, -117.249742	2,005
3	48.833099, -117.244231	48.833400, -117.243151	340
4	48.834759, -117.240511	48.835612, -117.235806	1,240
5	48.835079, -117.232928	48.836011, -117.226659	1,550
6	48.836930, -117.221959	48.837002, -117.218439	860
7	48.837701, -117.213904	48.838381, -117.212464	430
8	48.839229, -117.211475	48.840201, -117.211448	375
9	48.841995, -117.208698	48.842334, -117.207501	300
10	48.842622, -117.206403	48.842971, -117.205463	260
11	48.843382, -117.203629	48.843138, -117.200233	820
12	48.843299, -117.196963	48.845333, -117.190788	1,830
13	48.847663, -117.187558	48.848771, -117.185592	650
14	48.849650, -117.180512	48.853351, -117.168071	3,850
15	48.870465, -117.146005	48.871429, -117.145339	400
16	48.871903, -117.142637	48.898605, -117.083586	18,500
Cutslope Slide 1	48.836233, -117.254667		200
Cutslope Slide 2	48.838031, -117.258158		200

SCL shall undertake the following road and habitat improvements in the Sullivan Creek basin upstream of Outlet Creek:

- Johns Creek – Remove the FS Road 2200 505 culvert and implement streambank restoration within the road imprint. Replace FS Road 2200 500 culvert with a fish passable structure.
- Rainy Creek – Remove fish barrier at the mouth of the creek.
- Streambank stabilization near Cascade Creek – Create 3 engineered logjams from LWD currently causing bank instability; supplement with boulders and rock barbs/vanes.
- Channel and weir rehabilitation near mouth of unnamed creek downstream of Cascade Creek – Augment existing log weirs and redirect flows to the thalweg of the channel.

5.4.5.2. Background Information

The Sullivan Creek Watershed Assessment (USFS 1996) identified roads, dispersed recreation, mining, and riparian harvest as anthropomorphic activities contributing to an altered sediment regime, channel straightening, unstable streambanks, and low LWD levels in some areas of Sullivan Creek. The report also suggested that LWD removal from streams may have occurred as part of road building, harvest activities, and to prevent lateral migration of the stream into Sullivan Creek Road. Based upon channel type and current conditions, the USFS described most of the tributaries to Sullivan Creek as being at low risk, in good condition, and providing most of the spawning habitat for the watershed. In contrast, most high risk reaches were located in the mainstem of Sullivan Creek and lack of LWD contributed to low levels of sediment storage, channel instability, and poor spawning habitat conditions. Timber harvest activities that peaked in the mid-1970s in combination with fire suppression have resulted in many overstocked middle structural stage stands. However, changes in forest management practices coupled with natural forest succession are gradually putting stands on a trend towards the historic range of variability.

Fish passage barriers in need of removal or replacement, road repairs, and landslide stabilization projects have been identified by the USFS as part of relicensing discussions.

5.4.5.3. Procedures

SCL will conduct planning and design work consistent with the schedule submitted to FERC and subject to approval of the FAWG prior to implementation. At a minimum, the planning effort will describe:

- The results from any field surveys conducted.
- Listing of the type, number, and location of instream structures.
- Engineering drawings of major instream structures (e.g., LWD jams, groins, etc.).
- Engineering drawings for culvert replacements in Kinyon, Stony, and Johns Creek.
- Engineering drawings of road reconstruction segments.
- Engineering drawings of landslide stabilization.
- Anticipated source(s) of wood and boulders to be used.

For each LWD and ELJ placement action, the size and number of pieces of LWD will be determined by the FAWG. Site-specific characteristics will be considered. SCL shall obtain all applicable permits, environmental reviews (e.g., NEPA), and approvals from Federal and State agencies. The design-life for engineered log structures and wood placed in streams is anticipated to be five to 10 years; consequently, SCL shall repair or replenish logs if determined necessary following each eight year monitoring event. If the activities described in this PM&E measure cannot be implemented because of permitting or some other issue, equivalent funding would be reallocated to other PM&E measures in tributaries to Boundary Reservoir in consultation with the FAWG.

5.4.5.4. Compliance, Effectiveness, and Adaptive Management

SCL shall conduct compliance monitoring within one year following implementation of the PM&E measure and any repairs that are needed during the term of the license. Protocols for collecting compliance information will be determined during implementation planning and subject to approval of the FAWG. At a minimum, compliance monitoring will include documentation collected during implementation of the PM&E measure, such as survey data, records of purchased materials (LWD pieces, ballast, etc), and photographs of each site before and after measures or repairs are implemented.

SCL, in consultation with the FAWG, shall develop effectiveness monitoring protocols. Effectiveness monitoring will occur beginning in the eighth year following implementation and every eight years thereafter. The purpose of the effectiveness monitoring will be to assess the PM&E measure's condition to determine if structural repairs or log replenishment is needed to maintain the measure's designed functions. Criteria for determining whether a PM&E measure needs remediation will be determined during post-license planning and is subject to approval of the FAWG. If a restoration measure falls below success levels as determined through 8-year compliance monitoring, SCL shall develop a plan for remediation within 60 days, for approval of the FAWG, to correct the deficiencies. SCL shall begin implementing these repairs within 30-days of permit approval or as determined appropriate by the FAWG. Subsequent compliance monitoring will occur as determined by the FAWG. The results of the effectiveness monitoring will be used to support adaptive management and adjustments to the PM&E measure at eight-year intervals.

Except for road-related and slide-related work on Sullivan Creek Road, in addition to the 8 year effectiveness monitoring SCL shall annually, and following major (25-year) flood events, visit measures for routine inspection/maintenance to ensure that no substantive adverse impacts have occurred. No formal reports will be required for these visits although brief written updates shall be provided by SCL upon request by the FAWG. SCL shall have no responsibility for 8 year effectiveness or annual monitoring or any maintenance of road-related or slide-related work on Sullivan Creek Road. Annual monitoring and maintenance of measures on Sullivan Creek Road, including slides shall be the responsibility of the Forest Service as part of its regular road maintenance activities. SCL shall be responsible for repairing failures in the work due to improper installation or failure to withstand a 100-year flood (design standard).

5.4.5.5. Reporting and Schedule

The reporting and implementation schedule for LWD placement in Sullivan Creek upstream of the confluence of Outlet Creek and related road improvements is summarized in Table 5.4-6.

5.4.5.6. Consistency with Other Plans

There are no conflicts between this and other resource plans developed by SCL.

Table 5.4-6. Reporting and implementation schedule for LWD placement and road improvements in Sullivan Creek upstream of the confluence with Outlet Creek.

PM&E Measure Activity	Schedule
Implementation Schedule	Within one year of license issuance
Implementation	Within ten years of license issuance
Compliance Monitoring and Reporting	Within 1 year of implementation or repairs
Effectiveness Monitoring	Eight years after implementation and every eighth year thereafter
Effectiveness Monitoring Report	Within 1 year of effectiveness monitoring

5.4.6. Culvert Replacements and LWD Placement in Tributaries to Boundary Reservoir

5.4.6.1. Scope

This PM&E measure shall be governed by License Article 9(E). SCL shall replace the 6 culverts identified in Table 5.4-7 with new stream crossings that meet Washington State and/or USFS criteria as applicable. SCL shall also place LWD (as defined in Section 3.4) in Lime, Flume, and Sand creeks at the levels identified in Table 5.4-8. The objective of this PM&E measure is to improve access to, and/or the habitat quality of, selected tributary reaches used by native salmonids. The culvert replacements will provide passage for juvenile, sub-adult, and adult salmonid lifestages at all design flows and access to suitable habitat located upstream of the culverts. The culvert replacements in Slumber and Styx creeks will also incorporate LWD as needed for bank stabilization and grade control at each site. A secondary objective of the culvert replacements is to improve downstream transport of LWD and reduce the risk of road failure during peak flow events.

Table 5.4-7. Culvert replacements in Slumber, Styx, Flume, and Pocahontas creeks.

Stream	Schedule (license year)	River Mile	Road	Comment
Slumber Creek	11 – 15	0.20	FS Rd 3155	Incorporate LWD placement as with culvert replacement as needed for bank stabilization and grade control
Styx Creek	11 – 15	0.10	FS Rd 3155	Incorporate LWD placement as with culvert replacement as needed for bank stabilization and grade control
Flume Creek	11 – 15	0.82	County Rd 2975	
Flume Creek	11 – 15	4.37	FS Rd 350	
Pocahontas Creek	16 – 20	0.34	Lehigh Hill Rd	Two culverts

Table 5.4-8. LWD placement in Lime, Flume, and Sand creeks**.**

Stream	Schedule (license year)	Miles of Stream	Number of Pieces	Comment
Lime Creek	11 – 15	1.3	284	No logjams needed
Flume Creek	11 – 15	1.0	140	Mouth to SF Flume Cr; at least 20 pieces >=12 inches in diameter and >=35 ft long; no logjams needed
Sand Creek	11 – 15	2.7	*	Use LWD to create 10 pools RM 4.1 to 6.8; no logjams needed
* To be determined by the FAWG				

5.4.6.2. Background Information

Slumber Creek and Styx Creek are tributaries to Slate Creek, with their confluences at RM 2.0 and 4.9, respectively. USFS Road 3155 crosses these tributaries near their mouths (RM 0.20 and 0.10, respectively). During 2008, habitat surveys were conducted upstream and downstream of these culverts for 492 feet in conjunction with evaluation of the culverts (SCL 2009a). Neither of the culverts was found to meet Washington State criteria for fish passage. The habitat survey results for Slumber Creek demonstrated that the habitat upstream of the culvert is slightly more suitable than that found downstream because the mean residual pool depth, mean thalweg depth, and volume of LWD were all greater upstream than downstream. Most notably, the volume of LWD downstream of the culvert in Slumber Creek was lower than the quantity upstream. The data from the habitat survey for Styx Creek suggested that channel complexity and water depth downstream of the culvert were greater than in the upstream section. Most of the habitat downstream and upstream of the culvert consisted of riffles. However, mean residual pool depth, mean thalweg depth, volume of LWD, and riparian structure and cover were all greater downstream of the culvert than upstream. LWD density in Styx Creek was 161 pieces per mile. The USFS reports that westslope cutthroat trout and eastern brook trout are present in both streams (USFS 1998).

McLellan (2001) described two culvert barriers located on Flume Creek. The culvert at County Road 2975 (also known as Boundary Road) was described as perched 8.2 feet above the downstream plunge pool while the culvert at FS Road 350 was described as perched nearly 5 feet with no downstream plunge pool. McLellan (2001) observed only eastern brook trout within Flume Creek, while R2 Resource Consultants, Inc. (1998) also observed a few cutthroat trout. McLellan (2001) did not observe any fish in the reach surveyed upstream from RM 4.14, but did observe brook trout (4 fish per 100 m^2 and 20 fish per 100 m^2) in two reaches between the culvert barriers. According to a habitat survey by McLellan (2001), the culvert at FS Road 350 lies in a high gradient reach (17%) with 595 pieces of LWD per mile, but no pool habitat. In contrast, the two reaches upstream of County Road 2975 surveyed by McLellan (2001) have relatively low gradient (10% and 3%), 611 and 338 pieces of LWD per mile, and more pool habitat (25% and 17% by occurrence). The reach downstream of County Road 2975 is relatively low gradient (3%), had 354 pieces of LWD per mile, but no pool habitat.

The twin culverts at Lehigh Hill Road for crossing Pocahontas Creek were surveyed as part of relicensing study efforts and found to be out of compliance with the Washington State

Administrative Code because water velocity would exceed criteria at the high fish passage design flow (SCL 2009). At the time of the survey, the culverts were also plugged with LWD that would also reduce their fish passage effectiveness. A 5.8 feet high falls and a series of step pools are present below the culverts and a 3.9 feet falls is present upstream of the culverts. These features may serve as partial passage barriers to some fish species and life stages depending upon flow levels (SCL 2009). Between the mouth and approximately RM 0.25 Pocahontas Creek becomes partially or completely dry during summer months when water levels are low. The Pend Oreille Salmonid Recovery Team (2005) indicates that cutthroat trout and rainbow trout are present in Pocahontas Creek.

McLellan (2001) conducted habitat surveys within three reaches on Lime Creek that were downstream of the Highway 31 stream crossing and documented a mean of 435 pieces of LWD per mile, mean gradient ranged from 3 to 10 percent, and pools accounted for between 0 and 25 percent of habitat units in the reaches. During the summer low flow period, Lime Creek flows subsurface for about 328 feet downstream of the Highway 31 stream crossing. Eastern brook trout is the only salmonid known to use the stream.

5.4.6.3. Procedures

Following the schedule filed with FERC described in Section 5.4.1, SCL, in consultation with the FAWG, shall develop a draft and final implementation plan for this PM&E measure consistent with the site specific planning requirements in the USFS Administrative Terms and Conditions. At a minimum, the planning effort will describe:

- A description of any field surveys conducted and summary of results.
- Engineering drawings of the culvert replacements.
- Listing of the type, number, and location of instream structures.
- Anticipated source(s) of wood to be used.

SCL shall be responsible for obtaining all applicable permits, environmental reviews (e.g., NEPA), and approvals from Federal and State agencies. For each LWD placement action, the size and number of pieces of LWD will be determined by the FAWG and based upon the best available science (e.g., Fox and Bolton 2007). Site-specific characteristics will need to be considered. The design-life for log structures and wood placed in streams is anticipated to be five to 10 years; consequently, SCL commits to repairs or log replenishment if determined necessary following each eight year monitoring event. If culvert replacement or LWD placement cannot be implemented because of permitting or some other issue, equivalent funding would be reallocated to other tributary PM&E measures in consultation with the FAWG following the process described in Section 5.4.1.

Routine maintenance of any culverts on NFS lands will be the responsibility of the USFS while maintenance on County roads will be the responsibility of Pend Oreille County.

5.4.6.4. Compliance, Effectiveness, and Adaptive Management

Compliance monitoring shall occur within one year following implementation of the PM&E measure and any repairs that are needed during the term of the license. Protocols for collecting compliance information will be determined during implementation planning and subject to approval of the FAWG. At a minimum, compliance monitoring will include documentation collected during implementation of the PM&E measure, such as survey data, records of purchased materials (LWD pieces, ballast, etc), and photographs of each site before and after measures or repairs are implemented.

Effectiveness monitoring shall occur beginning in the eighth year following implementation and every eight years thereafter. The purpose of the effectiveness monitoring will be to assess the PM&E measure's condition to determine if structural repairs or log replenishment is needed to maintain the measure's designed functions. Criteria for determining whether a PM&E measure needs remediation will be determined during post-license planning and is subject to approval of the FAWG. The results of the effectiveness monitoring will be used to support adaptive management and adjustments to the PM&E measure at eight-year intervals. If a structure falls below established success levels, SCL shall develop a plan for remediation within 60 days, for approval of the FAWG, to correct the deficiencies. SCL shall begin implementing these repairs within 30-days of permit approval or as determined appropriate by the FAWG. Subsequent compliance monitoring will occur as determined by the FAWG.

In addition to the 8 year effectiveness monitoring SCL shall annually, and following major (25-year) flood events, visit measures for routine inspection/maintenance to ensure that no substantive adverse impacts have occurred, with the exception that SCL shall have no responsibility for annual visits to, or providing routine maintenance of, measures (e.g., culvert improvements and road grading) on NFS roads. No formal reports will be required for these visits although brief written updates shall be provided by SCL upon request by the FAWG. It is understood that routine visits to and maintenance of measures on NFS roads (e.g., culverts and road improvements) shall be the responsibility of the Forest Service as part of its regular road monitoring and maintenance activities.

5.4.6.5. Reporting and Schedule

The reporting and implementation schedule for culvert replacements and LWD placement in Lime, Flume, Slumber, Styx, Pocahontas and Sand creeks is summarized in Table 5.4-9.

5.4.6.6. Consistency with Other Plans

There are no conflicts between this PM&E measure and other resource plans developed by SCL. Because instream structures may reduce the effectiveness of non-native trout suppression and eradication efforts, the schedule for these two PM&E measures should be coordinated within affected creeks.

Table 5.4-9. Reporting and implementation schedule for culvert replacements and LWD placement in Lime, Flume, Slumber, Styx, Pocahontas, and Sand creeks.

PM&E Measure Activity	Schedule
Implementation Schedule	Within one year of license issuance
Planning and Implementation	According to schedule submitted to FERC
Implementation for Lime, Slumber, Styx, Flume, and Sand creeks	Between 11to15 years following license issuance
Implementation for Pocahontas Creek	Between 16 to 20 years following license issuance
Compliance Monitoring and Report	Within one year following implementation
Effectiveness Monitoring	Every eighth year following implementation
Monitoring Report	Within one year following monitoring

5.4.7. Riparian Planting, Culvert Replacement and Channel Reconstruction in Linton Creek RM 0.00 to RM 0.24

5.4.7.1. Scope

This PM&E measure shall be governed by License Article 9(E). Linton Creek flows through the town of Metaline and enters the reservoir at Metaline Waterfront Park. This PM&E measure occurs downstream of the Highway 31 stream crossing (between RM 0.0 and 0.24) and replaces up to three culverts, reconstructs the stream channel, places 20 to 25 pieces of LWD, augments gravel substrate in numerous locations, and conducts riparian planting within a distance of up to 50 feet of the stream banks. The objective of this measure is to improve riparian functions, passage conditions at the stream crossings, and spawning and rearing habitat. Implementation of this PM&E measure would occur between Years 16 and 20 following issuance of the new license. Because the Metaline Waterfront Park is a multi-use public recreation area, specific objectives and measurable success criteria for this PM&E will be developed as part of post license planning and design work to be conducted in consultation with the FAWG and the City of Metaline and would need their approval prior to implementation. Restoration work would generally follow WDFW guidelines in Saldi-Caromile et al. (2004). It is anticipated that woody vegetation planting will be high density (approximately 4,360 plants per acre) consisting of regionally appropriate native riparian plant seed mixes and shrubs, as well as native tree saplings (e.g., Table 3.4-1) with the objective of achieving at least 80 percent survival and 50 percent vegetative areal cover of native species after 3 years from the date of planting. Implementation of this PM&E measure depends on permission from the City of Metaline. If permission is not obtained, the funds allocated for any elements of this measure that are not implemented would be allocated to other PM&E measures in tributaries to Boundary Reservoir as determined in consultation with the FAWG and subject to the approval of the USFS if they occur on NFS lands.

5.4.7.2. Background Information

A channel and habitat survey from RM 0.00 to 0.25 (SCL 2009a) indicated that habitat was predominantly low-gradient riffles, with an average channel slope of 2 percent (Figure 5.4-7).

Riparian conditions within the survey reach were found to be poor, stream bank conditions were determined to be fair, and LWD was poor, based on the number of pieces per mile and potential recruitment sources. Pool depth and pool frequency were found to be not properly functioning, but off-channel habitat was classified as fair, due to a wetland connected to Linton Creek upstream of the culvert at RM 0.20. Thirteen culverts are present on Linton Creek, including a major stream crossing at Highway 31 at RM 0.25. Three of the culverts downstream of Highway 31 have been surveyed and two do not meet WDFW passage criteria (SCL 2009a). Results of SCL (2009b) showed that cutthroat trout, rainbow trout, brown trout, brook trout, pumpkinseed, and largescale sucker used the tributary channel from July through September 2008.

Figure 5.4-7. Riparian and channel conditions in lower Linton Creek.

5.4.7.3. Procedures

Following the schedule filed with FERC described in Section 5.4.1, SCL, in consultation with the FAWG and the City of Metaline, shall conduct implementation planning for this PM&E measure. Because one of the three culverts downstream of the Highway 31 stream crossing currently meets WDFW passage criteria, the planning will include a determination of whether replacement of all three culverts, rather than just the two out-of-compliance culverts, is needed to meet the PM&E objectives. At a minimum, the planning effort will describe:

- The results of any field surveys conducted and summary of results.
- A list of native plant species to be used for riparian planting.
- The target size and source(s) for riparian plants.
- A map or aerial photo with a planting map depicting plant types and planting density.
- Listing of the type, number, and location of instream structures.
- Engineering drawings of culvert replacements, major instream structures, or channel reconstruction.

- Anticipated source(s) of wood, boulders, and gravel to be used.

WDFW guidance (Saldi-Caromile et al. 2004) indicates that appropriate planting densities are highly site dependent that requires consideration of the species to be planted, the plant material type (e.g., cuttings, containerized, bare-root, or seed), soil type, hydrologic conditions (e.g., depth to groundwater), and other factors. Although SCL anticipates that high density plantings will be required adjacent to Linton Creek because riparian vegetation currently consists almost entirely of grass and forbs, actual planting densities will be determined as part of implementation planning and subject to approval of the FAWG. Within one year following completion of the planning phase, any regulatory requirements, and acquisition of permits, SCL shall implement the PM&E measure.

5.4.7.4. Compliance, Effectiveness, and Adaptive Management

SCL shall conduct compliance monitoring within one year following implementation of the PM&E measure and any repairs that are needed during the term of the license. Protocols for collecting compliance information will be determined during implementation planning and subject to consultation and approval of the FAWG. At a minimum, compliance monitoring will include documentation collected during implementation of the PM&E measure, such as survey data, records of purchased materials (LWD pieces, boulders, gravel, etc), and photographs of each site before and after measures or repairs are implemented.

SCL, in consultation with the FAWG, shall develop effectiveness monitoring protocols. Effectiveness monitoring will be conducted 3 years after planting to determine whether planting success criteria have been achieved. For riparian areas suitable for establishing vegetation, mitigation planting success and any remedial measures shall achieve at least 80 percent survival of trees and shrubs and 50 percent canopy cover of native species at the end of 3 years from the date of planting. Grasses, forbs, shrubs, and trees shall be planted to achieve the desired structure and function for site-specific habitat conditions.

SCL shall conduct additional effectiveness monitoring beginning in the eighth year following implementation and every eight years thereafter. The purpose of the effectiveness monitoring will be to assess the PM&E measure's condition to determine if structural repairs, log replenishment, additional plantings, or non-native plant removal is needed to maintain the measure's designed functions. Criteria for determining whether a PM&E measure needs remediation will be determined during post-license planning and is subject to approval of the FAWG. The results of the effectiveness monitoring will be used to support adaptive management and adjustments to the PM&E measure at eight-year intervals. If a treatment falls below established success levels, SCL shall develop a plan for remediation within 60 days, for approval of the FAWG, to correct the deficiencies. SCL shall begin implementing the remediation measures within 30 days of permit approval or as determined appropriate by the FAWG. Subsequent monitoring will occur as determined by the FAWG.

In addition to the 8-year monitoring, SCL shall routinely visit restoration sites at least annually, following major flood events (25-year event), or as reasonably required by the FAWG, to ensure that no substantive adverse impacts have occurred at the restoration site. Formal reports will not

be required as a result of these routine visits, although brief written updates shall be provided by SCL to the FAWG upon request.

5.4.7.5. Reporting and Schedule

The reporting and implementation schedule for riparian planting along Linton Creek is summarized in Table 5.4-10.

Table 5.4-10. Reporting and implementation schedule for riparian planting, culvert replacement and channel reconstruction along Linton Creek RM 0.00 to RM 0.24.

PM&E Measure Activity	Schedule
Implementation Schedule	Within one year of license issuance
Planning and Implementation	According to schedule submitted to FERC
Implementation	Between 16 to 20 years following license issuance
Compliance Monitoring and Report	Within one year following implementation
Effectiveness Monitoring	Every eighth year following implementation
Monitoring Report	Within one year following monitoring

5.4.7.6. Consistency with Other Plans

There are no conflicts between this and other resource plans developed by SCL. Implementation of this PM&E measure is dependent on the willingness of the City of Metaline to allow SCL to conduct the activity. If the City of Metaline is unwilling to allow the activity or a portion of the activity, then funds allocated for unapproved elements of this PM&E measure would be allocated to other mitigation measures in tributaries to Boundary Reservoir as determined in consultation with the FAWG. Implementation of this PM&E measure should be coordinated with the placement of a LWD jam in the Linton Creek tributary delta (Section 5.1.6) to be implemented by license year 10 and implementation of boat launch and roadway access improvements completed by license year 5 described in the Recreation Resource Management Plan.

5.4.8. Riparian and Channel Improvements in Sweet Creek RM 0.0 to RM 0.6

5.4.8.1. Scope

This PM&E measure shall be governed by License Article 9(E). This PM&E measure has three components including: Riparian buffer protection and plantings, large woody debris placement, and Highway 31 culvert improvements. Each of these components is described below in greater detail.

5.4.8.1.1. Riparian Buffer Protection and Plantings

The objective of this component is to provide long-term protection for the relatively intact riparian zone of Sweet Creek downstream of the Highway 31 culvert. SCL shall pursue the acquisition or protective land easements for 11.8 acres within a 100-foot buffer (excluding

existing roads) on either side of Sweet Creek from the mouth to RM 0.50, which is the location of the Highway 31 culvert (Figure 5.4-8). In addition, SCL proposes to remove non-native vegetation and plant native brush and trees over a 0.3-acre area north of the access road near the high school football field with the objective of improving riparian functions such as shade and LWD and nutrient (i.e., leaf and needle) production. Implementation of the protective portion of this PM&E measure depends on the willingness of current owners (three private owners, the Selkirk School District, WDNR, and DOT) to sell a portion of their land or enter into easement agreements. Similarly, implementing riparian plantings would require permission from the Selkirk School District, even if long-term protection could not be provided. If owners are unwilling to sell or provide easements within the 100-foot buffer, then long-term protection would not be guaranteed. If owners do not grant permission for riparian plantings, then funds equal to the cost of these plantings would be reallocated to other PM&E measures in tributaries to Boundary Reservoir as determined in consultation with the FAWG and following the process described in Section 5.4.1.

5.4.8.1.2. Large Woody Debris Placement

The objective of this PM&E measure will be to increase channel complexity and gravel retention through LWD placement from the mouth of Sweet Creek to RM 0.60. The PM&E measure anticipates the amount of wood to be placed would include 166 pieces of LWD and of these pieces at least 12 shall be 12 inches or greater in diameter and a minimum of 35 feet in length. The bankfull width of Sweet Creek is approximately 33 feet in this reach, making it suitable for placement of channel-spanning LWD. As part of the LWD placement up to 10 channel-spanning structures will be installed over a 558-foot reach downstream of the Highway 31 culvert. Each structure will have one to three LWD pieces, of which at least one will be a key piece with a minimum volume of 88.2 cubic feet, preferably with a rootwad attached (Fox and Bolton 2007). Selection of the specific locations and design of the spanning structures and the actual amount, location, and size of the wood to be placed in Sweet Creek is dependent upon site-specific conditions and will be determined as part of post-license planning and design work that will generally follow WDFW guidelines in Saldi-Caromile et al. (2004), and is subject to approval of the FAWG. The presence of eroding stream banks will be considered during this process, and streambank reshaping could be implemented as part of structure placement to reduce erosion.

5.4.8.1.3. Highway 31 Culvert Improvements

The objective of this component is to improve upstream fish passage at the culvert located at RM 0.5 under Highway 31. Improvements may include the addition of baffles, weirs, and/or aprons on the downstream end of the existing culvert. The design of the improvements will occur in collaboration with the Washington Department of Transportation, WDFW, and the FAWG and require their approval.

Figure 5.4-8. Riparian buffer area adjacent to Sweet Creek proposed for protection.

5.4.8.2. Background Information

Sweet Creek is the fourth largest tributary draining into Boundary Reservoir with a drainage area of 11.1 square miles. A series of natural falls begins at RM 0.60 that is a complete upstream passage barrier to fish. The stream also passes through a large box culvert under Highway 31 at RM 0.50. The culvert does not meet WDFW criteria for fish passage (SCL 2009a), but the presence of a bull trout observed by McLellan (2001) upstream of the culvert indicates that the culvert is passable under some conditions. Cutthroat trout, mountain whitefish, rainbow trout, brown trout, and brook trout were also observed upstream of the culvert; however, only brook trout and cutthroat trout were observed above the series of falls (McLellan 2001). Fish habitat and channel surveys conducted from the mouth to the lowermost falls suggest that riparian and instream substrate and LWD conditions are relatively good; however, the reach is dominated by riffles and has relatively few pools (SCL 2009a; McLellan 2001). The culvert appears to block transport of LWD based on the buildup of wood and retention of gravel on the upstream side of the culvert, and streambank erosion is occurring downstream of the culvert (Figure 5.4-9) (SCL 2009a).

The cool water plume at the tributary delta to Sweet Creek has been identified as an important area for salmonids during warm summer months. Bull trout, westslope cutthroat trout, and mountain whitefish have all been observed in the lower reaches of Sweet Creek (SCL 2009b). While most of the riparian zone of Sweet Creek downstream of Highway 31 is in relatively good condition (SCL 2009a; McLellan 2001), several areas are devoid of riparian trees or brush (i.e., very sparse), have a moderate density of mixed brush, herbaceous plants, and hardwoods with

some conifers (moderately sparse), or have a relatively dense hardwood forest cover with some conifers (sparse) that could be improved through riparian planting, which would increase future shade and LWD recruitment potential. Protection of the existing good riparian habitat and improvement of some areas would benefit native salmonids within the stream channel and would help maintain coolwater temperatures in the tributary delta. The reach between Highway 31 and the impassable falls at RM 0.60 is currently used as an improved day use area and rest stop with paved trails.

Figure 5.4-9. Channel conditions downstream of the Highway 31 culvert at Sweet Creek. Note the eroding left bank and lack of instream large woody debris.

5.4.8.3. Procedures

Within one year following license issuance SCL will contact landowners to determine their willingness to sell the portion of their parcels that fall within the buffer, enter into conservation easements, or allow habitat improvement. Any lands that are purchased will be set-aside for protection in perpetuity.

Following the schedule filed with FERC described in Section 5.4-1, SCL, in consultation with the FAWG will conduct implementation planning for this PM&E measure. At a minimum, the planning effort will describe:

- A description of any field surveys conducted and summary of results.
- Listing of the type, number, and location of instream structures.
- Engineering drawings of major instream structures (e.g., drop structures, LWD jams, boulder clusters, etc.).
- Engineering drawings of improvements to the Highway 31 culvert.
- Anticipated source(s) of wood and boulders to be used.

- A list of native plant species to be used for riparian planting.
- The target size and source(s) for riparian plants.
- Description of planting techniques and density.
- A map or aerial photo with a planting plan.

WDFW guidance (Saldi-Caromile et al. 2004) indicates that appropriate planting densities are highly site dependent that requires consideration of the species to be planted, the plant material type (e.g., cuttings, containerized, bare-root, or seed), soil type, hydrologic conditions (e.g., depth to groundwater), and other factors. In areas where the additional vegetation is desirable, SCL anticipates that planting density would vary from low (approximately 440 plants per acre) to high (approximately 4,360 plants per acre) depending upon the location. Actual planting densities will be determined as part of implementation planning and subject to approval of the FAWG. Within one year following approval of the plan by the FAWG, completion of any regulatory requirements, and acquisition of permits, SCL shall implement the activities identified in the PM&E measure. If riparian plantings, instream structures, or culvert improvements cannot be implemented because of permitting, unwillingness of landowners, or some other issue, funds allocated to those elements would allocated to other tributary PM&E measures in consultation with the FAWG following the process described in Section 5.4.1.

5.4.8.4. Compliance, Effectiveness, and Adaptive Management

SCL shall conduct compliance monitoring within one year following implementation of the PM&E measure and any repairs that are needed during the term of the license. Protocols for collecting compliance information will be determined during implementation planning and subject to consultation and approval of the FAWG. At a minimum, compliance monitoring will include documentation collected during implementation of the PM&E measure, such as survey data, records of purchased materials (e.g., plants, LWD pieces, ballast, etc), and photographs of each site before and after measures or repairs are implemented.

SCL, in consultation with the FAWG, shall develop effectiveness monitoring protocols. Effectiveness monitoring will be conducted 3 years after planting to determine whether planting success criteria have been achieved. For riparian areas suitable for establishing vegetation, mitigation planting success and any remedial measures shall achieve at least 80 percent survival of trees and shrubs and 50 percent canopy cover of native species at the end of 3 years from the date of planting. Grasses, forbs, shrubs, and trees shall be planted to achieve the desired structure and function for site-specific habitat conditions.

SCL shall conduct additional effectiveness monitoring beginning in the eighth year following implementation and every eight years thereafter. The purpose of the effectiveness monitoring will be to assess the PM&E measure's condition to determine if structural repairs, log replenishment, additional plantings, or non-native plant removal is needed to maintain the measure's designed functions. Criteria for determining whether a PM&E measure needs remediation will be determined during post-license planning and is subject to approval of the FAWG. The results of the effectiveness monitoring will be used to support adaptive management and adjustments to the PM&E measure at eight-year intervals. If a treatment falls below established success levels, SCL shall develop a plan for remediation within 60 days, for

approval of the FAWG, to correct the deficiencies. SCL shall begin implementing these remediation measures within 30 days of permit approval or as determined appropriate by the FAWG. Subsequent compliance monitoring will occur as determined by the FAWG.

In addition to the 8 year effectiveness monitoring SCL shall annually, and following major (25-year) flood events, visit measures for routine inspection/maintenance to ensure that no substantive adverse impacts have occurred. No formal reports will be required for these visits although brief written updates shall be provided by SCL upon request by the FAWG.

5.4.8.5. Reporting and Schedule

The reporting and implementation schedule for channel improvements in Sweet Creek is summarized in Table 5.4-11.

Table 5.4-11. Reporting and implementation schedule for channel improvements in Sweet Creek RM 0.0 to RM 0.6.

PM&E Measure Activity	Schedule
Implementation Schedule	Within one year of license issuance
Planning and Implementation	According to schedule submitted to FERC
Implementation	Between one to 20[1] years following license issuance
Compliance Monitoring and Report	Within one year following implementation
Effectiveness Monitoring	Every eighth year following implementation
Effectiveness Monitoring Report	Within one year following monitoring

[1] The time period for these activities starts at year 1 to allow SCL to obtain any easements if and when they are available and to potentially reduce the cost of obtaining these at an early date.

5.4.8.6. Consistency with Other Plans

There are no conflicts between this and other resource plans developed by SCL. Implementation of this PM&E measure depends on the willingness of landowners adjacent to the stream. If landowners are unwilling to sell a portion of their lands or enter into conservation easements, then no long-term protection will be guaranteed to this portion of the riparian buffer. Improvements to the Highway 31 culvert will require approval from the Washington Department of Transportation (DOT).

5.4.9. Habitat Improvement in Tier-2 Tributaries to Boundary Reservoir

5.4.9.1. Scope

This PM&E measure shall be governed by License Article 9(E). As part of studies conducted during relicensing of the Boundary Project, SCL categorized tributaries flowing into Boundary Reservoir according to habitat availability for native salmonids and the potential opportunity to improve conditions through habitat manipulation. The results of the analysis were reported in Study 14: Assessment of Factors Affecting Aquatic Productivity in Tributary Habitats (SCL

2009a). Tributaries to Boundary Reservoir were categorized as primary (tributaries with high opportunity), secondary (tributaries with moderate opportunity), or excluded from evaluation (tributaries with little to no opportunity). PM&E measures designed to improve habitat conditions in primary tributaries and one secondary tributary (i.e., Pewee Creek), termed Tier-1 tributaries, are addressed in other Sections (5.4.2. to 5.4.8) of this FAMP. All other secondary and excluded tributaries, hereafter collectively referred to as Tier-2 tributaries, are listed in Table 5.4-12 and addressed in this PM&E measure. Maps showing the location of the Tier-2 tributaries are provided in SCL (2009a, Figures 3.1-1 and 3.4-1).

Under this PM&E measure, SCL, in consultation with the FAWG, shall implement measures to improve aquatic habitat conditions in Tier-2 tributaries commensurate with the resulting benefits to native salmonids. The following sections describe the process for identifying Tier-2 tributaries that provide opportunity for habitat improvement and identifying measures that SCL will implement to benefit native salmonids.

Table 5.4-12. Tier-2 tributaries to Boundary Reservoir.

Stream Name	Confluence with Boundary Reservoir at Project River Mile
Unnamed No. 1	17.2
Unnamed No. 2	17.9
Everett Creek	21.9
Whiskey Gulch	21.9
Beaver Creek	24.3
Threemile Creek	24.3
Unnamed No. 3	25.4
Unnamed No. 4	27.1
Unnamed No. 5	28.9
Unnamed No. 6	29.2
Unnamed No. 7	29.6
Unnamed No. 8	30.1
Wolf Creek	30.3
Unnamed No. 9	31.1
Lost Creek	32.2
Unnamed No. 10	33.5
Unnamed No. 11	33.6
Unnamed No. 12	34.0
Unnamed No. 13	34.3

5.4.9.2. Background Information

As noted above, SCL conducted Study 14: Assessment of Factors Affecting Aquatic Productivity in Tributary Habitats in support of relicensing of the Project (SCL 2009a). The objective of the study was to assess aquatic habitat conditions in tributaries to Boundary Reservoir upstream of their deltas. Twenty-eight tributaries to the reservoir were identified and categorized as primary, secondary, or excluded according to the extent to which habitat improvement action would likely benefit native salmonids (Table 5.4-13).

Habitat improvement measures, such as culvert replacement, non-native fish suppression and eradication, and LWD placement, were developed to address Tier-1 tributaries (see Sections 5.4.2 to 5.4.8). As part of the comprehensive Boundary SA parties will review those tributaries that were deemed low priority in Study 14. It is possible that some secondary or excluded stream reaches that currently appear to offer low potential salmonid habitat due to their short length or small drainage could benefit native salmonids through habitat manipulation or protection.

5.4.9.3. Procedures

5.4.9.3.1. Watershed Assessment

Tier-2 tributaries that are identified for habitat manipulation or improvement under this PM&E must contain potential habitat suitable for native salmonids. SCL shall conduct, in consultation with the FAWG, a watershed assessment to compile and obtain information necessary to determine which Tier-2 tributaries warrant habitat improvement measures. The watershed assessment will be initiated by compiling existing information on the biology and habitat conditions of the Tier-2 tributaries. Little information is currently available for Tier 2 tributaries; however, implementation of the this PM&E measure is scheduled to occur during Years 20-25 following license issuance and additional information may become available through the course of 20 years of post-licensing studies in the Boundary Basin. Information specific to each Tier-2 tributary that will be considered as part of the watershed assessment will include, but not be limited to:

- Watershed area;
- Summer stream water temperature;
- Presence of barriers to upstream fish migration;
- Length of stream accessible to adult adfluvial fish;
- Stream gradient;
- Existing instream and riparian habitat conditions; and
- Any factors potentially limiting salmonid production.

If site-specific data are insufficient SCL, in consultation with the FAWG, shall collect information needed to identify Tier-2 tributary streams that warrant further consideration. SCL shall complete a limiting factors assessment for each of the selected Tier-2 tributaries and identify in consultation with the FAWG the nature and extent of habitat manipulation or protection measures that will benefit native salmonids. The over-riding criterion is that the Tier-2 tributary must have, or potentially have, useable native salmonid habitat that could be effectively improved through habitat improvement or protection.

Table 5.4-13. Stream level of opportunity categorization and criteria (Study 14, SCL 2009a).

Category	Criteria	Reason
Primary (Tier-1)	Adfluvial habitat greater than 250 feet and watershed area is more than 1 square mile.	Streams of this size, at a minimum, have the greatest potential to influence Boundary Reservoir native adfluvial fish resources, and, therefore, if a limiting factor can be improved through human intervention, it may be considered as an opportunity. These streams have both a moderate to large basin to help increase flow and increase overall habitat quality in the reaches accessible to adfluvial fish with the ability to enhance more life stages and sizes of adfluvial species, as well the potential to enhance native fish species.
Secondary (Pewee Cr is Tier-1, all others Tier-2)	Containing either a watershed area greater than 1 square mile or adfluvial habitat length greater than 250 feet. If a tributary meets either of these criteria, and a natural barrier at the mouth is present and native salmonid species are known to occur in the basin, it will be included.	The larger basins, without adfluvial habitat, may be worth evaluating further because there may be potential for watershed improvements that could enhance native salmonid species populations. The smaller basins, with adfluvial habitat length greater than 250 feet, may have some potential for human-aided improvement, possibly improving available habitat for Boundary Reservoir native species. They are not considered prime streams because of the low amount of drainage area limiting overall habitat, and/or limited adfluvial stream length, restricting the potential to benefit adfluvial habitat through human intervention. Tributaries that have natural barriers occurring at the mouth, but have native salmonids known to be present in the basin, are included because these creeks may have opportunities to improve aquatic habitat without the need to supplement existing populations.
Excluded (Tier-2)	Less than 1 square mile and less than 250 feet adfluvial habitat. Has a natural barrier occurring at the mouth of the tributary and no native salmonid populations	These streams, because of their small size and very limited adfluvial habitat, have a low potential to benefit either adfluvial or resident trout under existing conditions, or with any human intervention to current conditions.

5.4.9.3.2. Identify Potential Habitat Improvement Measures

Following the collaborative determination by SCL and the FAWG regarding the type of habitat improvement measure(s) to be applied in each viable Tier-2 tributary, SCL shall prepare a site-specific habitat improvement plan that will be submitted to the FAWG for review and approval. The level of habitat manipulation or protection to be implemented for a selected Tier-2 tributary will be commensurate with potential benefits to native salmonids. During preparation of the habitat improvement plan, SCL, in consultation with the FAWG, shall conduct fieldwork necessary to support the planning effort. The types of measures that could be implemented in Tier-2 tributaries include:

- Riparian planting;
- LWD placement;
- Large boulder placement;

- Non-native fish suppression/eradication;
- Conservation easements; and/or
- Culvert replacement.
- Native Fish Supplementation

The habitat restoration plan will provide a schedule for implementation and describe success criteria for each habitat improvement or protection activity similar to those previously described for Tier-1 (i.e., primary) tributary improvement activities.

5.4.9.3.3. Implement Habitat Improvement Measures

Following FAWG approval of the site-specific habitat improvement plan for each selected Tier-2 tributary, SCL shall implement the measures according to the schedule identified in each plan. Implementation of measures in selected Tier-2 tributaries is scheduled to occur during post-licensing years 20-25. Implementation procedures will be consistent with those described for similar habitat improvement activities previously described for Tier-1 tributaries (see Sections 5.4.2 to 5.4.8), but adjusted for site-specific conditions associated with Tier-2 tributaries.

5.4.9.4. Compliance, Effectiveness, and Adaptive Management

SCL shall conduct compliance monitoring within one year following implementation of a habitat restoration measures in selected Tier-2 tributaries. Protocols for collecting compliance information will be determined during implementation planning and subject to consultation and approval of the FAWG. At a minimum, compliance monitoring will include documentation collected during implementation of the PM&E measure, such as survey data, records of purchased materials (LWD pieces, boulders, etc), and photographs of each site before and after measures or repairs are implemented.

SCL, in consultation with the FAWG, shall develop effectiveness monitoring protocols as part of implementation planning. If riparian planting is implemented on any of the Tier 2 streams, effectiveness monitoring will be conducted 3 years after planting to determine whether planting success criteria have been achieved. For riparian areas suitable for establishing vegetation, mitigation planting success and any remedial measures shall achieve at least 80 percent survival of trees and shrubs and 50 percent canopy cover of native species at the end of 3 years from the date of planting. Grasses, forbs, shrubs, and trees shall be planted to achieve the desired structure and function for site-specific habitat conditions.

SCL shall conduct physical effectiveness monitoring beginning in the eighth year following implementation and every eight years thereafter. The purpose of effectiveness monitoring will be to assess the PM&E measure's condition to determine if additional treatments are needed to maintain the measure's designed functions or intended purposes. Criteria for determining whether a PM&E measure needs remediation will be determined during post-license planning and will be subject to approval of the FAWG. The results of the effectiveness monitoring will be used to support adaptive management and adjustments to the PM&E measures at eight-year intervals. If a structure falls below established success levels, SCL shall develop a plan for remediation within 60 days, for approval of the FAWG, to correct the deficiencies. SCL shall

begin implementing these remediation measures within 30 days of permit approval or as determined appropriate by the FAWG. Subsequent effectiveness monitoring will occur as determined by the FAWG.

No fish population monitoring will be conducted in Tier-2 tributaries as part of this measure; however, monitoring may occur as appropriate for other PM&E measures.

In addition to the eight-year effectiveness monitoring, SCL shall annually, and following major (25-year) flood events, visit measures for routine inspection/maintenance to ensure that no substantive adverse impacts have occurred, with the exception that SCL shall have no responsibility for annual visits to, or providing routine maintenance of, measures (i.e., culvert improvements) on NFS roads. No formal reports will be required for these visits, although brief written updates shall be provided by SCL upon request by the FAWG. It is understood that routine visits to and maintenance of measures on NFS roads (i.e., culverts) shall be the responsibility of the Forest Service as part of its regular road monitoring and maintenance activities.

5.4.9.5. Reporting and Schedule

The reporting and implementation schedule for habitat restoration measures in Tier-2 tributaries is summarized in Table 5.4-14.

Table 5.4-14. Reporting and implementation schedule for habitat restoration measures in Tier-2 tributaries.

PM&E Measure Activity	Schedule
Watershed Assessment	Within 20 years of license issuance
Site Specific Habitat Improvement Plans	Between 21 to 25 years following license issuance
Implement on-ground Habitat Improvement Activities	Between 21 to 25 years following license issuance
Compliance Monitoring and Report	Within one year following implementation
Effectiveness Monitoring	Every eighth year following implementation
Monitoring Report	Within one year following monitoring

5.4.9.6. Consistency with Other Plans

This PM&E measure complements habitat improvement measures proposed for other tributaries, as described in Sections 5.4.2 to 5.4.8 of this FAMP. There are no conflicts between this PM&E measure and any other resource plans developed by SCL.

5.4.10. Closure and Restoration of Sullivan Creek Dispersed Recreation Sites

5.4.10.1. Scope

This PM&E measure shall be governed by License Article 9(E). The objective of this PM&E measure is to describe the process leading to the closure and restoration by SCL of up to 38 recreation sites located in riparian areas along Sullivan Creek to help restore fish habitat.

5.4.10.2. Background Information

According to the Sullivan Creek Watershed Assessment (USFS 1996), many of the dispersed campsites in the vicinity of Sullivan Creek are located in riparian areas. The dispersed sites receive heaviest use during the summer recreation season (Memorial Day weekend and the period from July 1 to Labor Day weekend), with a second high-use period occurring during the fall hunting season. At the time of the watershed assessment, only five dispersed sites were equipped with sanitary facilities (three sites along Sullivan Creek Road, one at Gypsy Meadows, and one at the Salmo Loop Trailhead).

Many of the dispersed sites received heavy or extreme impact ratings at the time of the watershed assessment (USFS 1996). Dispersed recreation has diminished the supply of LWD and resulted in a lack of shrubs and herbaceous cover in some riparian areas. The effects of dispersed recreation on fisheries were characterized in the watershed assessment as follows:

> Loss of bank vegetation is causing bank instability and sedimentation in localized areas. Loss of riparian vegetation has occurred at dispersed recreation sites with heaviest impacts occurring along portions of the stream between John's Creek and Cascade Creek.

5.4.10.3. Procedures

5.4.10.3.1. Initial Recreation Site Restoration Plan

SCL shall develop an Initial Recreation Site Restoration Plan (Initial Plan), in consultation with the FAWG and subject to the approval of the USFS. The Initial Plan shall describe, in sufficient detail for NEPA purposes, the recreation sites to be closed and restored and the site-specific measures for each site. The Initial Plan will form the basis for the proposed action under the USFS NEPA process.

The Initial Plan shall be based on a list of up to 38 sites provided by the USFS to SCL that identifies the potential sites to be closed.

The Initial Plan will describe some combination of the following measures to be implemented at each recreation site to be closed:

- Placement of boulders to occupy existing camping and fire ring locations
- Placement of boulders to prevent vehicle access
- Loosening of compacted soils
- Streambank stabilization measures

- Slope grading
- Revegetation with locally derived native trees and shrubs
- One-time suppression of invasive weed species, if feasible[3]
- Removal of fire pits
- Trash removal
- Removing pit toilets
- Public education regarding closure of dispersed sites and locations of new dispersed sites as part of the Multi-Resource Interpretation and Education (I&E) program

The Initial Plan shall also include draft biological evaluations or assessments including survey data as required by regulations applicable to habitat or ground-disturbing activities on NFS lands in existence at the time the Plan is prepared.

Upon completion of the Initial Plan, SCL shall provide it to the USFS for use in the NEPA process.

USFS will develop for use in the NEPA process a comparable level of information on potential replacement recreation opportunities, including but not limited to new sites and facilities to be opened.

5.4.10.3.2. NEPA Process

SCL shall fund the portion of the USFS NEPA process for the proposed action described in the Initial Plan to close and rehabilitate recreation sites. SCL will provide funds to the USFS through a reimbursable collection agreement, consistent with USFS policy and regulations at the time USFS NEPA process is initiated. The NEPA process conducted by the USFS will incorporate all required evaluations and assessments completed by SCL for ground disturbing activities related to closing and rehabilitating recreation sites.

Through the NEPA process, the USFS will also evaluate and identify replacement recreation opportunities, including but not limited to new sites and facilities, to help offset the loss of sites along Sullivan Creek.

5.4.10.3.3. Final Recreation Site Restoration Plan

Following the NEPA decision by the USFS to close and rehabilitate recreation sites and to open replacement recreation opportunities, including but not limited to new sites and facilities within the Sullivan Creek Drainage, SCL shall develop a Final Recreation Site Restoration Plan (Final Plan) in consultation with the FAWG and subject to the approval of the USFS. Based on the NEPA decision on which sites are to be closed SCL shall develop the site specific designs for the closure and restoration of recreation sites. These designs shall detail the exact methods and measures to be employed for site closure, site restoration, streambank stabilization, and all other activities. The Final Plan shall also contain an implementation schedule detailing the

[3] SCL would, if deemed appropriate and following USFS approval, eradicate invasive weeds existing within a given dispersed recreation site as a one-time measure during the restoration of the site.

contemporaneous closing of recreation sites, and opening of replacement recreation opportunities by the USFS.

5.4.10.3.4. Closure and Restoration

Following USFS approval of the Final Plan, SCL shall file the Final Plan with FERC as an amendment to the FAMP. SCL shall implement the Final Plan according to the schedule in the Final Plan, consistent with Section 5.2.7 and Table 5.2-1 below, upon FERC approval of the amendment and in conjunction with the USFS plans for providing replacement recreation sites within the Sullivan Creek Drainage.

SCL's commitment under this measure does not include an obligation to develop replacement recreation sites, or for providing amenities, e.g., sanitation facilities, at any replacement recreation sites. Public education regarding closure of dispersed sites and locations of replacement recreation sites will be provided as part of the Multi-Resource Information & Education program (see Recreation Resource Management Plan).

5.4.10.4. Compliance, Effectiveness, and Adaptive Management

SCL shall be responsible for compliance and effectiveness monitoring and maintenance at the closed and restored sites.

Once a restoration measure has been completed (i.e., the success criteria have been met), SCL shall evaluate the measure every eight years for the term of the license to ensure the measure is meeting the success criteria. If a restoration measure falls below success levels as determined through 8-year compliance monitoring, SCL shall within 60 days, develop a plan for repairs, for approval by the FAWG, to correct the deficiencies. SCL shall begin implementing these repairs within 30 days of permit approval or as determined appropriate by the FAWG. Subsequent monitoring will occur as determined by the FAWG.

SCL shall maintain each restoration measure as required in the plan. SCL shall also routinely visit each restoration site (at least annually, as well as following significant weather events, or as reasonably required by the FAWG) to ensure that no substantive adverse impacts have occurred at the restoration site. Formal reports will not be required as a result of these routine visits, although brief written updates shall be provided by SCL to the FAWG upon request.

5.4.10.5. Implementation Schedule

Closure and restoration of recreation sites along Sullivan Creek shall occur within ten years of license issuance, or as otherwise agreed to with the USFS.

The FAWG shall monitor activities by SCL and the USFS with regard to the closing of existing sites and opening of new recreation opportunities, including but not limited to new sites and facilities, to ensure that the opening of replacement opportunities by the USFS and the closure of existing sites by SCL is occurring on a contemporaneous basis. The implementation schedule will be adjusted by the FAWG, subject to approval by the USFS, as needed to maintain a balance between the closing of sites and opening of new opportunities.

Table 5.4-15. Implementation schedule for closure and restoration of dispersed recreation sites along Sullivan Creek.

PM&E Measure Activity	Schedule
SCL prepares the Initial Recreation Site Restoration Plan, based on a list of sites provided by the USFS, showing the planning level details for the closure and restoration of recreation sites in the Sullivan Creek watershed.	TBD by USFS; but starting no sooner than one year following license issuance
USFS completes NEPA analysis for closure and rehabilitation of existing sites, and opening of replacement opportunities.	TBD by USFS
SCL prepares Final Recreation Site Restoration Plan.	Within six months of USFS NEPA decision.
USFS approves the Final Recreation Site Restoration Plan.	Within 30 days of receiving the Final Recreation Site Restoration Plan.
SCL files Final Recreation Site Restoration Plan with FERC.	Within 30 days of USFS approval.
Implementation of closure and restoration measures	Initiate within one year following FERC approval of the Recreation Site Restoration Plan. Complete based on the approved Plan schedule.

5.4.10.6. Consistency with Other Plans

There are no conflicts between this PM&E measure and other resource plans developed by SCL.

5.5. Mill Pond Dam Site Monitoring and Maintenance

5.5.1. Scope

This PM&E measure shall be governed by License Article 9(F). SCL shall monitor the Mill Pond Dam site and maintain the site to remediation design specifications following completion of dam removal and restoration efforts. SCL shall monitor the Mill Pond Dam site to assess stream channel, floodplain, and upslope conditions to determine if any structures or plantings fall below the success levels established during implementation planning for the decommissioning of Mill Pond Dam. In consultation with the FAWG, SCL shall adaptively manage the site and adjust and implement stream restoration components to maintain remediation benefits.

As part of its surrender application for the Sullivan Creek Project, the POPUD will implement the Mill Pond Decommissioning Plan (Decommissioning Plan) which describes the decommissioning work to be performed at the Mill Pond Dam site. In general, the Mill Pond Decommissioning Plan covers removal and restoration work that will be completed within five years of FERC issuance of a surrender order for the Sullivan Creek Project. Upon FERC's determination that the work required by the Mill Pond Decommissioning Plan has been completed, and FERC's termination of its jurisdiction over the Mill Pond area, SCL shall monitor and maintain the Mill Pond Dam site as described in this measure.

5.5.2. Background Information

Mill Pond, located at RM 3.9 on Sullivan Creek, was created when a log crib dam was constructed in 1909 by the Portland Cement Company. The un-gated concrete dam, built in

1921 just below the log crib dam, is 134 feet long and about 55 feet high and historically maintained the water surface elevation of Mill Pond at approximately 2,520 feet NAVD 88. In 1956, the powerhouse was shut down because of maintenance problems with the wooden flume that conveyed water from Mill Pond to the powerhouse. In 1958, the Federal Power Commission, now FERC, licensed the Project as a non-generating project, with provisions for adding generating capabilities. In 1973, the supporting pillars were removed from the top of the dam creating an open spillway and establishing the current elevation at 2505.7 feet.

Mill Pond Dam has altered the natural sediment transport processes in Sullivan Creek by trapping all bedload material behind the dam (USFS 1996). This has created a condition where Sullivan Creek downstream of Mill Pond Dam is sediment depleted (USFS 1996). Therefore, the sediment transport capacity exceeds the sediment supply in the reach below the dam, which has resulted in a lack of appropriately sized spawning gravel for local trout populations and extensive armoring of the bed surface. Mill Pond Dam has also altered to some extent the downstream transport of LWD (USFS 1996) and is a complete barrier to the upstream movement of resident fish (SCL 2009).

Warm water temperatures, measured at approximately RM 1.7 by R2 Resource Consultants (1998), demonstrated the warming effect of Mill Pond Dam on waters discharged from Sullivan Creek and Sullivan Lake and flowing towards the mouth of Sullivan Creek. During the summer months, water temperatures can exceed 16 ºC, with Mill Pond Dam increasing water temperature by approximately 2.0 to 2.4 ºC (Doug Robison, WDFW, pers. comm. 2009).

Within five years of FERC's issuance of an order authorizing the surrender of the Sullivan Creek License, POPUD will remove Mill Pond Dam, manage sediment, and implement site restoration measures at the Mill Pond site. The POPUD will remove both the concrete and log crib dams and artificial foundations to facilitate natural stream functions in Sullivan Creek. The POPUD will also remedy any barrier to upstream fish passage caused by the construction, operation, or removal of Mill Pond Dam (not including any natural barriers that may be present at the site).

Benefits of Mill Pond Dam removal and associated site restoration will include elimination of the man-made barrier to upstream fish passage, an increase in the quantity and quality of habitat for native salmonids, restoration of downstream transport of coarse sediment and LWD, and benefits to water quality in the form of reduced summer water temperatures due to reductions in water surface area and increases in water velocity in the area of Mill Pond. Under this Mill Pond Dam Site Monitoring and Maintenance Measure, SCL shall monitor and maintain the site to ensure the natural resource benefits associated with the POPUD removing Mill Pond Dam continue through the term of the FERC License for the Boundary Project.

5.5.3. Procedures

Following completion of dam removal and restoration effort required of POPUD and after FERC jurisdiction over the site through the Sullivan Creek Project license ends, the new license for Boundary shall require SCL to monitor and maintain the site to ensure that the stream channel and floodplain continue to function in accordance with the design criteria, that riparian and upland vegetation is becoming established, and to control non-native plant species. SCL shall

develop plans and protocols for monitoring and maintenance of the Mill Pond Dam site in consultation with the FAWG and subject to approval by USFS and Ecology.

SCL shall conduct monitoring at the site during Years 2, 4, 6, and 10 following the end of FERC jurisdiction over the site through the Sullivan Creek Project license and then at eight-year intervals for the remainder of the Boundary license term to ensure that the stream channel is functioning in accordance with the design criteria and native vegetation is becoming established. For areas restored according to the Final Decommissioning Plan, SCL shall maintain plantings to achieve the desired structure and function for site-specific habitat conditions. If a treatment falls below success levels established in the Final Decommissioning Plan, within 60 days of monitoring SCL shall develop a plan for remediation, for approval by the FAWG, to correct the deficiencies. SCL shall begin implementing these repairs within 30 days of permit approval or as determined appropriate by the FAWG.

In addition to the eight-year effectiveness monitoring, SCL shall annually, and following major (25-year) flood events, visit the site for routine inspection/maintenance to ensure that no substantive adverse impacts have occurred. No formal reports will be required for these visits although brief written updates shall be provided by SCL upon request by the FAWG. In the event of flows greater than a flood event having a 100-year recurrence interval, SCL will not be responsible for repair of stream restoration measures that may have been damaged from such an event.

5.5.4. Compliance, Effectiveness, and Adaptive Management

SCL, in consultation with and subject to the approval by the FAWG, shall develop protocols for collecting compliance and effectiveness information. SCL shall demonstrate compliance with this measure by providing the results of monitoring and remediation activities. The main purpose of effectiveness monitoring will be to assess stream channel, floodplain, and upslope conditions to determine if any structures or plantings fall below the success levels established during implementation planning conducted by POPUD under the Decommissioning Plan. SCL shall identify in the monitoring plan, developed pursuant to this monitoring and maintenance measure, criteria by which decisions will be made to require the licensee to take corrective action if monitoring shows that any component of the restoration effort has been ineffective. The results of effectiveness monitoring will be used to support adaptive management, in consultation with the FAWG, and adjustments to the stream restoration components of Mill Pond decommissioning at eight year intervals.

5.5.5. Reporting and Schedule

The reporting and implementation schedule for Mill Pond Dam monitoring and maintenance is summarized in Table 5.5-1.

Table 5.5-1. Reporting and implementation schedule for Mill Pond Dam monitoring and maintenance.

PM&E Measure Activity	Schedule
Compliance and Effectiveness Monitoring Protocols	Within one year of FERC determination that POPUD has satisfied surrender conditions
Effectiveness Monitoring of Site Restoration	In the second, fourth, sixth, and tenth years following FERC determination and at 8 year intervals thereafter
Effectiveness Monitoring Report	Within 1 year following completion of effectiveness monitoring

5.5.6. Consistency with Other Plans

There are no conflicts between this PM&E measure and any other resource plans developed by SCL.

5.6. Native Salmonid Conservation Program

5.6.1. Scope

This PM&E measure shall be governed by License Article 9(G). SCL shall fund the design, construction and operation of a fish propagation facility for the production of native salmonids to outplant into tributaries draining into Boundary Reservoir. Implementation planning will be completed within 3 years of license issuance and the facility will be operational within 6 years of license issuance. Facility design and operational protocols are to occur in consultation and subject to approval of the FAWG and the WDFW prior to, and during, implementation. Facility operations will be conducted by qualified staff either contracted or hired by SCL. Staff qualifications will be developed by SCL in consultation with the FAWG. For a state-owned facility, facility design, staff qualifications and operational protocols are subject to completion of an operations agreement between SCL and WDFW. SCL shall outplant propagated native salmonids to supplement existing populations, or to introduce native salmonids into reaches where they are not currently present. Target release sites will include those reaches where non-native trout have been actively suppressed or where underutilized habitat is available in tributaries draining into Boundary Reservoir. Outplanting native salmonids in Boundary tributaries is expected to complement non-native trout suppression and stream habitat improvement activities.

The initial capacity for the facility will be up to 45,000 eyed eggs, fry, or fingerling (3 to 4 inch) fish per year and multiple age class broodstock (capacity of 1,000-2000 pounds). Annual production will be commensurate with the need to outplant fish in areas where non-native suppression/eradication has occurred in tributaries draining into Boundary Reservoir. The frequency of outplanting and number of fish to be planted in each tributary shall be determined based upon the specific population goal developed by the appropriate agencies for that tributary. Any changes to the outplanting schedule will be determined as a result of effectiveness monitoring and adaptive management to be reviewed by the FAWG and subject to approval of the appropriate agencies.

SCL will be open to partnering arrangements at no additional expense to SCL that would allow expansion and/or use of the facility to meet fish propagation needs beyond those of the Project. For any state owned facility, expansion or use of the facility beyond Boundary Project needs will be subject to WDFW approval. Expansion of the facility must not infringe upon the needs of the Project and maximum capacity of an expanded facility will be no more than 20,000 lbs.

The facility will be designed to incorporate techniques to increase fish fitness and survival after release. Design considerations for outdoor rearing facilities will consist of a naturalized, sinuous channel lined with cobble and gravel substrate similar to Boundary drainages, feeding system, natural shading, and instream woody habitat. Other design considerations not limited to outdoor rearing will be evaluated in consultation with the FAWG. Predator exclusion and protection systems will be incorporated into the facility. All water supplies will be alarmed. Broodstock holding and spawning facilities will consist of a naturalized pond designed to allow water drawdown and crowding, fish lift and spawning area. The facility will also include ponds or tanks to hold fish captured during suppression or eradication treatments for re-introduction to target reaches. A propagation building will house administrative offices, incubation room, and early rearing troughs. A pollution abatement facility incorporating Best Management Practices and All Known and Reasonable Technology (AKART) will be constructed on site. The facility will be designed to produce eyed eggs, alevins, fry and fingerling-sized fish. The primary distribution of fish is assumed to be fingerlings, but may include stream-side incubators or artificial redds to minimize potential domestication. Broodstock collection activities, appropriate marking of all outplanted fish for the purpose of identification during effectiveness monitoring, and distribution of eggs, fry and fingerlings shall be funded by SCL.

Westslope cutthroat trout will be the initial target species for propagation, but the facility must be designed to propagate bull trout or other native salmonids. The facility will be designed to simultaneously propagate two species of fish and several year classes (life stages); selection of species, stocks, and lifestages to be produced will be determined as part of post-license planning and subject to approval of the FAWG and WDFW. In addition, the facility will have the capacity to sustain the necessary numbers of broodstock fish to produce this number of eggs, fry, or fingerlings for the purposes of the supplementation program. Locally adapted, multiple age class broodstock will be used to maintain long-term fitness traits and the facility will be operated to minimize genetic divergence from local, naturally spawning stocks.

5.6.2. Background Information

The larger tributaries to Boundary Reservoir contain a variety of fish species, and most salmonid species in the Project vicinity occur in the tributaries (SCL 2006, SCL 2009b). Surveys conducted by the USFS (2005), WDFW (McLellan 2001), and CES (1996) showed that the dominant sport fish in tributaries are westslope cutthroat trout, eastern brook trout, rainbow trout, and to a lesser extent brown trout and mountain whitefish (SCL 2006). These surveys documented observations of bull trout (1 carcass, apparently left by an angler), kokanee, and burbot in Sullivan Creek, and one bull trout in Sweet Creek. The burbot and kokanee in Sullivan Creek were likely entrained from Sullivan Lake, where substantial sport fisheries exist for both species.

Currently, no self-reproducing bull trout populations occur in any tributaries to Boundary Reservoir. Nevertheless, the Northeast Washington Recovery Unit (NWRU) Team has identified Sullivan and Slate creeks as local bull trout populations under a recovered condition based on habitat survey data and professional judgment (USFWS 2002). The NWRU Team also suggested that artificial propagation of bull trout could be needed to seed currently unoccupied habitat, but urged caution and the need to address the threats affecting populations and their habitat before pursuing artificial propagation.

Westslope cutthroat trout are widely distributed in the Project area and tributaries to Boundary Reservoir but threatened by the presence of non-native brook trout. Suppression of brook trout and habitat improvements in tributaries to Boundary Reservoir are proposed as a separate PM&E measure. Peterson et al. (2004) found the survival of age-0 and age-1 cutthroat trout at mid-elevation reaches (approximately 8,200 to 8,858 feet elevation) were 13 times and 2 times higher, respectively, when brook trout abundance was suppressed. Lower elevations similar to the area surrounding the Boundary Project were not sampled. SCL hypothesizes that outplanting of westslope cutthroat trout and habitat improvements in streams can complement brook trout suppression activities and result in higher recruitment to the cutthroat trout population than suppression alone.

5.6.3. Procedures

Preliminary planning suggests that the 40-acre WDFW parcel on Skookum Creek, that formerly included the Usk Hatchery, is a potential location for the propagation facility. In addition to withdrawing water from Skookum Creek, the site has a natural, cold water spring that could be used as a gravity-fed water supply. The water supply could require some passive and/or active heating to increase source water temperature, but the cold water source would be conducive to propagating native salmonids.

A multi-step approach will be used to implement this PM&E measure. Completion of each step will be in consultation with the FAWG and subject to approval of the USFS and Ecology. Prior to construction of the conservation facility, SCL shall prepare annual reports summarizing the activities during the previous year. The first step in the development of the native salmonid conservation facility will be to confirm the feasibility of the site. If the Usk facility proves to be infeasible, SCL will consider alternatives including purchase or funding of an alternate existing facility, or development at a new site with an appropriate source of water.

The second step will be to complete implementation planning that identifies the following:

- Goals and policies of federal and state agencies and the Kalispel Tribe regarding conservation facilities and native trout recovery.
- Risks and benefits of outplanting bull and/or westslope cutthroat trout in the Project area.
- Mitigation measures to be used to reduce risk (e.g., of spreading disease, domestication, etc.).
- A conceptual level description and engineering design for the facility, with specifications.

- Description of any off-site facilities or techniques that could be used as part of release strategies (e.g., acclimation and volitional release ponds, streamside or instream incubation of eyed eggs, etc.).
- Sources and techniques to be used for collecting broodstock.
- Target production levels by life stage.
- A hatchery genetics management plan will be developed.
- A monitoring program to evaluate the success of outplanted native salmonids.

The third step will be preparation of draft and final engineering plans for the facility, completing any required regulatory review (e.g., NEPA compliance) and obtaining any needed permits. Following approval of final design and permitting, SCL shall construct the facility and fund operation and maintenance for the license term.

If a feasible site cannot be identified, SCL shall re-direct mitigation efforts towards the purchase of suitable eggs, fry or fingerlings from another source or toward commensurate PM&E measures as determined in consultation with the FAWG and subject to approval of the USFS and Ecology.

5.6.4. Compliance, Effectiveness, and Adaptive Management

A construction compliance report shall be prepared within one year following construction of the facility that will document any variances from the implementation planning, engineering and construction steps. Prior to the fish conservation facility being operational, the licensee shall annually summarize activities of the previous 12 months. Once the facility is operational, the licensee shall annually summarize the following information: A) numbers, lifestages, size and species of fish produced; B) timing and locations of releases; C) percent survival between life stages; D) results of the effectiveness monitoring; E) substantial disease outbreaks, other problems and remedies that were implemented to reduce the risk of problems reoccurring; and G) effectiveness monitoring. Annual reports are anticipated to be brief and complementary to five-year status reports. Status reports will summarize the annual reports and provide more detailed analysis and assessment of trends in the data. The five-year status reports shall also describe any changes in production or release strategies developed with approval from the FAWG and appropriate agencies and the rationale for implementing the changes.

As part of the tributary management plan, SCL in consultation with and subject to approval of the FAWG will establish population goals for the Conservation Program by determining appropriate tributary target fish populations desirable for the purpose of establishing self-sustaining, native stocks of fish. Optimal outplanting strategies for achieving desired goals will be identified by monitoring and evaluating multiple outplanting strategies that consider appropriate fish sizes, outplanting densities, frequency, and timing. Each outplanting strategy will have independent markers/identifiers for analysis (e.g., otolith marks utilizing calceine, thermal, strontium chloride). SCL shall monitor the initial success of outplanted native salmonids and periodically monitor until population goals are achieved. The reproductive success of outplanted native salmonids will be monitored and evaluated to determine if measurable goals are met. In consultation with the FAWG, information required to evaluate the effectiveness of the Native Salmonid Conservation Program may be obtained from other

tributary program PM&E measures (such as suppression and eradication or habitat improvements), and stock status and genetics analyses conducted under the entrainment reduction research and monitoring fund. However, information developed under these PM&E measures may not satisfy all requirements to evaluate the success of the Conservation Program. Under this native salmonid conservation measure, SCL shall fund additional monitoring equivalent to approximately 0.5 FTE on an annual basis including necessary equipment and other associated expenses. The results of effectiveness monitoring will be included in the annual report and summarized in the five-year status reports.

5.6.5. Reporting and Schedule

The reporting and implementation schedule for the native salmonid conservation facility is summarized in Table 5.6-1. If the Usk site proves to be infeasible, and another potential existing facility cannot be identified within three years following license issuance, the FAWG will re-evaluate the compliance schedule for this PM&E.

Table 5.6-1. Reporting and implementation schedule for the native salmonid conservation facility.

PM&E Measure/Activity	Schedule
Complete Implementation Planning	Within three years of license issuance
Facility Draft and Final Engineering Plans	Within four years of license issuance
Facility Construction	Within six years of license issuance
Begin Operations	Within six years of license issuance
Construction Compliance Monitoring Report	Within seven years of license issuance
Annual Reports	Every year
Five-year Status Reports	Every fifth year

5.6.6. Consistency with Other Plans

There are no conflicts between this PM&E measure and other resource management plans prepared for the Project. The effectiveness of the native salmonid conservation program will be evaluated using the results of monitoring conducted under the measure and may be supported by information developed under the tributary improvement program and other fish and aquatic measures.

5.7. Recreational Fish Stocking Program

5.7.1. Scope

This PM&E measure shall be governed by License Article 9(H). SCL shall stock trout in 18 lakes within a fifteen-mile area around the Project (Table 5.7-1). Trout species stocked in these lakes will consist of westslope cutthroat, rainbow, rainbow triploid, or tiger trout, and may include fall fry, fingerlings, spring fry and catchable-size fish. These fish will be annually produced and planted by WDFW under a memorandum of agreement (MOA) to be negotiated with SCL; however, fish may be obtained from a commercial production facility if fish are

unavailable from WDFW. Approximately 11,678 pounds of fish will be stocked annually (Table 5.7-2) beginning no later than License Year 2.

The species stocked annually in these lakes can vary and will depend on whether the lake is a closed system or has connection to a tributary. The number, size and species of fish, planting schedule and location may be adjusted in consultation with and approved by WDFW.

SCL shall monitor and evaluate lakes receiving the stocked fish prior to the springtime opening day of trout season. The objective will be to annually conduct biological monitoring on a rotating subset of lakes. Site-specific conditions (i.e., lake ice, weather, and road access) may determine monitoring opportunities. At least six of the lakes receiving stocked fish will be monitored each year. Monitoring activities will consist of yearly fall or pre-Opening Day spring index gillnetting to evaluate recruitment of planted trout fry, trout growth rates, relative trout abundance, and detection of illegally introduced and/or undesirable fish species. Net specifications will be consistent with gill nets employed by WDFW regional biologists for index netting on lowland trout lakes. Nets will be set in each lake during the afternoon and retrieved the following morning allowing net soak times of 12-18 hours. Index net sample sites for each lake sampled will be selected in collaboration with WDFW and the number of sample sites will be dependent on lake surface area (Table 5.7-3).

All fish captured in gill nets will be identified to species and measured for length and weight. Scales will be collected from trout for age determination.

Opening day creel census will be performed on two lakes per year. Lakes to be creel-sampled will be selected each year in collaboration with the WDFW District 1 Fish Biologist. For each lake sampled, standard WDFW creel sampling protocols will be employed, including standardized angler interviews and angler utilization estimates (fishing pressure counts).

Table 5.7-1. Name, county, distance from Boundary Reservoir, and surface area (acres) of lakes to be stocked with salmonids to provide recreational fishing opportunities.

Lake	County	Approximate Distance from Boundary Res. (miles)	Approximate Surface Area (acres) [1]
Big Meadow Lake	Pend Oreille	7.4	4.0
Boundary Lake	Pend Oreille	2.1	10.0
Carls Lake	Pend Oreille	8.3	7.0
Cedar Lake	Stevens	11.4	6.0
Crescent Lake	Pend Oreille	1.2	22.0
South Deception Lake	Pend Oreille	5.0	3.8
Deep Lake	Stevens	9.5	66.0
Frater Lake	Pend Oreille	9.2	11.0
Gillette Lake	Stevens	12.8	47.0
Heritage Lake	Stevens	10.9	71.0
Lead King Lakes[2]	Pend Oreille	0.9	6.6
Leo Lake	Pend Oreille	9.9	39.0
Little Lost Lake	Pend Oreille	1.8	6.0
Nile Lake	Pend Oreille	9.0	23.0
Sherry Lake	Stevens	13.3	26.0
Sullivan Lake	Pend Oreille	3.8	1,291.0
Thomas Lake	Stevens	12.0	163.0
Yocum Lake	Pend Oreille	11.9	42.0

[1] Wolcott (1973); [2]Two neighboring lakes 4.2 and 2.4 acres in size.

Table 5.7-2. Species size, and number (by weight) of fish to be stocked annually under the recreational fish stocking program.

Species	Dominant Size Stocked	Pounds
Cutthroat trout	fall fry	105
	Fingerling	1,744
Rainbow	fall fry	2,660
	Fingerling	625
Rainbow (triploid)	catchable	3,400
	spring fry	317
Tiger trout	Fingerling	2,827
	Total	11,678

Table 5.7-3. Criterion for number of gill nets to deploy for pre-season monitoring of lakes stocked with trout.

Surface Area (acres)	No. of Nets Set
1-24	1
25-149	2
150-349	3
>350	4

An annual report will be prepared identifying the amount, size, species, timing and location of stocking efforts and the results of monitoring and evaluation activities. Any modifications to survey timing, location and protocol, and the location and protocol of Opening Day creel census activities will be developed in consultation with and approved by WDFW.

5.7.2. Background Information

The purpose of this measure is to mitigate for reduced or lost salmonid recreational fishing opportunities in Boundary Reservoir due to Project impacts on aquatic habitat, loss of fish through Project entrainment and predation. Fish stocking in Boundary Reservoir, as a traditional means of mitigating for these impacts, is not supported due to potential competition with native trout and poor trout habitat conditions. Therefore, this off-site mitigation measure was developed as an alternative.

As part of an ongoing WDFW program, fry and fingerling trout are routinely stocked in Washington lakes during the spring and fall where they grow on natural food until the following spring when they are large enough to be harvested (WDFW 2009). The survival rate of fry depends on conditions within the receiving lake. Where fry survival is low, or where there is intense fishing pressure, catchable size trout, 8 inches or larger, are stocked to provide recreational opportunities. In addition to rainbow and cutthroat trout, sterile and hybrid trout are planted in select lakes. Triploid trout are fish that have been sterilized by heat or pressure-treating the eggs after fertilization. Tiger trout are a hybrid cross between a male brown trout and a female brook trout. The tiger trout eggs are sterilized by heat treating the eggs. If provided with an abundant food supply and sufficient residence time, sterile triploid and tiger trout have the potential to grow to trophy size. Sterile trout are also planted in areas where natural reproduction could adversely affect native species.

5.7.3. Procedures

Within one year of license issuance and annually thereafter, SCL shall complete implementation planning to identify:

- Pre-stocking monitoring protocols;
- Source of fish;
- Number, size and species of fish, planting schedule and location; and

- Stocking protocols.

Annual implementation planning, monitoring and evaluation procedures, and stocking and reporting procedures will be developed in consultation with and approved by WDFW within the scope of the measure identified in Section 5.7-1.

5.7.4. Compliance, Effectiveness, and Adaptive Management

A compliance report shall be prepared each license year detailing activities within the previous calendar year. A compliance report will include documentation of the number, size, lifestage and species of fish stocked, fish condition, source of fish and cost of fish. Effectiveness of the fish stocking program will be identified through annual monitoring and evaluation. The number, size, and species of fish to be stocked in the selected lakes each year, under this mitigation program, may be modified, but will not exceed the overall pounds of production as identified in this measure.

5.7.5. Reporting and Schedule

SCL shall prepare annual reports summarizing information related to stocking, monitoring, problems encountered and results of activities during the previous calendar year. Each annual report will also identify activities planned for the upcoming year and highlight any proposed changes from previous protocols. SCL shall provide annual reports to the FAWG, and after a 30-day comment period will revise the annual report, as needed based on comments received, and prepare a final report. Comments and recommendations by the FAWG will be included in annual reports to the FERC with copies provided to the FAWG. The reporting and implementation schedule for the recreational fish stocking program is summarized in Table 5.74.

Table 5.7-4. Reporting and implementation schedule for the recreational fish stocking program.

PM&E Measure Activity	Schedule
Implementation planning	Within one year of license issuance
Fish stocking and monitoring	Annually, beginning no later than the second year following license issuance
Compliance and monitoring report	Annually

5.7.6. Consistency with Other Plans

There are no conflicts between this PM&E measure and other resource management plans. The recreational fish stocking program will be coordinated with the Recreational Resources Work Group.

6 REPORTING, COORDINATION, AND SCHEDULE

6.1. Reporting

Each of the PM&E measures described above has reporting requirements. For the convenience of preparing and reviewing this information, a single annual report shall be prepared by SCL and submitted to the FAWG. The annual report will contain subsections for each PM&E measure, with content dependent on the specific reporting requirement for the PM&E measure and the activities that occurred during the year. For example, during some years the content could include implementation plans while in others it could include the results and analysis of monitoring. The FAWG will have one month to review and provide comments on a draft annual report, and SCL will have one month to address comments and produce a final annual report for submittal to the FAWG and filing with FERC. Under some circumstances a document prepared for a PM&E measure (e.g., an upstream trap and haul facility design study) may require additional review and revision cycles that would take more time than what is available for the annual report, which will necessitate preparation on a schedule different from that of the annual report. Under these circumstances, stand-alone-reports or technical memoranda may be prepared as determined in consultation with the FAWG. A summary shall be provided in the annual report, and the stand-alone report or memorandum will be provided as an appendix.

In addition to plans and reports prepared as part of individual PM&E measures, meeting summaries will be prepared for all FAWG meetings and action items will be identified. SCL shall prepare follow-up memoranda to be circulated among the FAWG within one month following the meeting that identify how action items have been resolved.

6.2. Coordination

Details regarding consultation, decision making, communications and documentation related to the FAWG are addressed in Section 8 of the Boundary SA and included as Appendix 1 to this FAMP. The FAWG will consist of representatives from SCL and the federal, state, tribal, and local entities having jurisdiction over, or interest in, the implementation of fish and aquatics related Project license articles. At the discretion of the FAWG, subcommittees could be created to address specific issues, such as upstream fish passage, that draw on specialized expertise from the agencies represented on the FAWG, or other entities. The FAWG will be responsible for providing technical guidance for all license articles related to fish and aquatics resources, attempting to make recommendations based on reaching consensus in the group. Details regarding consultation, decision making, communications and documentation related to the FAWG are addressed in Section 8 of the Boundary SA and included as Appendix 1 to this FAMP.

In accordance with License Article 9 and the FAWG procedures in Appendix 1, SCL shall prepare any proposed amendments to the FAMP in consultation with the FAWG and subject to approval by the United States Forest Service, DOI, and Ecology prior to filing with the Commission.

6.3. Schedule

During the first 10 years following issuance of a new license it is anticipated that meetings of the FAWG would be relatively frequent because of the large number of PM&E measures to be planned and implemented. SCL anticipates that meetings would occur every other month for the first two years and quarterly for Years 3 through 5 to report on progress made on implementation planning and implementation, and to seek direction from the FAWG. Beginning in Year 6, SCL anticipates a single, one-day annual meeting of the FAWG would be needed to report activities from the previous year and two one-day or two-day meetings every five years to discuss any needed modifications resulting from adaptive management.

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Appendix 1: Boundary Resource Coordinating Committee and Work Groups (Section 8 of the Boundary Hydroelectric Project Relicensing Settlement Agreement)

8. Boundary Resource Coordinating Committee and Work Groups

8.1 Boundary Resource Coordinating Committee

8.1.1 Formation and Purpose

Within 90 days after issuance of the New License, the Licensee shall convene the BRCC to oversee on a broad scale the integrated and efficient implementation of the PM&E measures as specified in the Project Documents. The BRCC will: (1) be comprised of one representative from each signatory party; (2) meet annually to review a rolling three-year work plan that will include the preceding year, the current year, and the upcoming or "Out" year, consisting of a compilation of work plans of the individual Work Groups included in the annual reports (see Section 8.3.3.2); (3) ensure coordination among Work Groups; (4) review annual reports prepared by each Work Group; and (5) address issues affecting overall license implementation.

8.1.2 BRCC Membership

Each Party shall designate a primary representative to the BRCC at the initial meeting, or at any time thereafter with seven days notice. After the initial meeting, designation shall be by Notice to the Parties in accordance with Section 11.11 of the Settlement Agreement. Each member may name alternate representatives. A Party's failure to designate a representative shall not prevent the BRCC from convening or conducting its functions. Members of the BRCC may also serve on the Work Groups established in Section 8.2.1.

8.1.3 BRCC Initial Meeting

At the initial meeting, the BRCC shall establish:

8.1.3.1 Protocols for its annual meetings, including agenda development, timely distribution of materials, and location.

8.1.3.2 Common operating procedures for each Work Group (see Section 8.2), including agenda development (e.g., submission of agenda items), timely distribution of materials, location, and scheduling.

8.1.3.3 Procedures for each Work Group to review and approve the Licensee's implementation schedules that will describe on a month-to-month basis the specific actions that the Licensee plans to implement for the current year and actions planned for the following year (the "Out Year"). The schedule for the current year shall include a description of Project Documents, Work Products, or other materials that will be provided to the Work Groups. "Work Products" include the plans, study designs, reports, and facility designs required by the Project Documents to be filed with the Commission.

8.1.3.4 Protocols for documentation of PM&E measures implemented in the preceding year.

8.1.3.5 Each BRCC member shall also name its Work Group representatives.

8.1.4 BRCC Annual Meetings

BRCC annual meetings shall occur after all Work Group annual meetings and draft final annual reports (including the draft final rolling three-year work plan for that work group) but before the final annual work group reports are due to the Commission.

8.1.5 BRCC Meeting Minutes

The Licensee shall distribute minutes of the annual BRCC meetings, within 30 days of the meeting date, to BRCC members. Any comments, recommendations or questions raised during the annual meetings or in response to the meeting minutes shall be referred by the BRCC to the appropriate Work Group(s) for consideration and response.

8.1.6 BRCC Evaluation of Work Group Processes

The BRCC will evaluate the role, protocols and procedures of the Work Groups five years after issuance of the New License. The BRCC, with input from the Work Groups, will determine if protocols and procedures should remain the same, be modified or discontinued. The BRCC will re-evaluate Work Group roles and procedures periodically thereafter, throughout the term of the New License and any annual licenses.

8.1.7 Federal Advisory Committee Act

BRCC participation by state or federal agencies does not affect their responsibilities and authorities. Issues involving the exercise of agencies' specific authorities can be discussed, but decisions are not delegated to the BRCC. The BRCC does not provide consensus advice to any federal agency (consistent with the Federal Advisory Committee Act).

8.2 Work Groups

8.2.1 Work Group Formation and Purpose

The Licensee shall initially convene the Work Groups not later than 180 days after Commission issuance of the New License. Collaboration among the Parties on the specific requirements of the Project Documents will occur primarily through the Work Groups. At the initial meetings, each Work Group shall review the Project Documents, prioritize actions, and establish a list of tasks to be addressed over the current year and review and propose to the BRCC, as appropriate, revisions to the Work Group procedures established by the BRCC. The following Work Groups are hereby established with the voting members identified below:

8.2.1.1 FAWG Membership

The Licensee, USFWS, BIA, the Tribe, USFS, WDFW, Ecology, and SCA, or The Lands Council as an alternate participant, on behalf of the Hydropower Reform Coalition. The Licensee shall form a TAC when required by the FAMP. TAC members shall be chosen by the Licensee in consultation with and subject to the approval of the FAWG. TACs will be formed as

necessary and disbanded upon the completion of their technical advisory assignments from the Licensee and the FAWG.

8.2.1.2 TRWG Membership

The Licensee, USFWS, USFS, WDFW, Ecology, and SCA, or The Lands Council as an alternate participant, on behalf of the Hydropower Reform Coalition.

8.2.1.3 RRWG Membership

The Licensee, USFS and NPS.

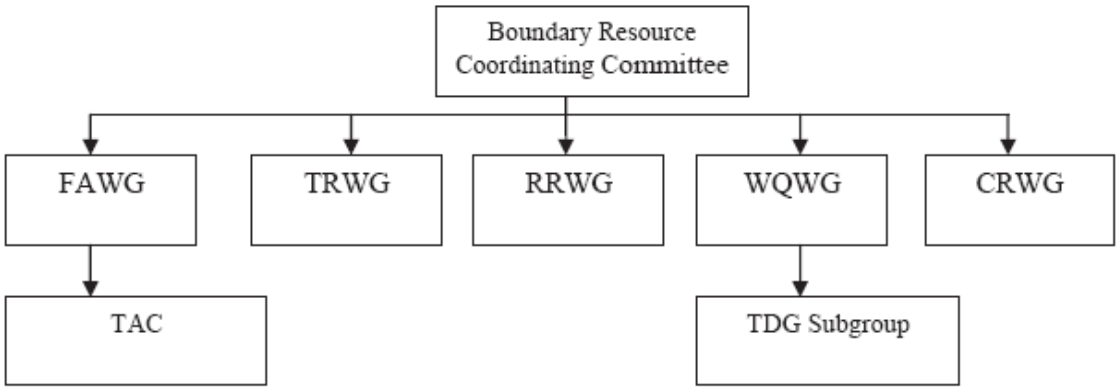
8.2.1.4 WQWG Membership

The Licensee, USFWS, BIA, the Tribe, USFS, WDFW, Ecology, and SCA, or The Lands Council as an alternate participant, on behalf of the Hydropower Reform Coalition. The WQWG will establish a TDG Subgroup, consisting of the Licensee, Ecology, WDFW, USFS and the Tribe to address progress on TDG.

8.2.1.5 CRWG Membership

The Licensee, BIA, the Tribe, and USFS. Washington Department of Archaeology & Historic Preservation and Bureau of Land Management will participate in the CRWG as defined by the Programmatic Agreement (Proposed License Article 7 in Settlement Exhibit 1).

Figure 1: Boundary Resource Coordinating Committee and Work Groups.



8.2.2 New Work Group Voting Members

Any Party may join any Work Group at any time during the term of the New License with 30 days Notice to the current members of the Work Group. Any organization with plan-level authority (as opposed to only permitting authority) over issues addressed by a Work Group that is not a Party to the Settlement Agreement may become a voting member of any Work Group with 30 days' Notice to the Parties if: (1) the organization becomes a signatory of this

Settlement Agreement; and (2) the organization agrees to abide by the protocols governing Work Group operations.

8.2.3 Work Group Non-Voting Members

Any other organization or a member of the public may volunteer to serve as a non-voting participant on a Work Group upon 30 days' Notice to the current members of the Work Group and with the approval of the voting members. To qualify, the organization or member of the public must: (1) identify an interest affected by the decisions of the Work Group; (2) agree to abide by consensus decisions of the voting members; and (3) agree to abide by the protocols governing Work Group operations. A non-voting participant has no decision-making authority within the Work Group (i.e., no voting rights or ability to elevate an issue to dispute resolution). Volunteer participants may be removed from a Work Group by consensus of the voting members with 30 days Notice.

8.2.4 Work Group Voting Member Representatives

Each Party shall designate primary representative(s) to the Work Groups at the initial meeting of the BRCC, or at any time thereafter with seven days notice. After the initial BRCC meeting, designation shall be by Notice to the Parties in accordance with Section 11.11 of the Settlement Agreement. Each member may name alternate representatives to the Work Groups. A Party's failure to designate a representative shall not prevent Work Groups from convening or conducting their functions.

8.2.5 Federal Advisory Committee Act

Work Group participation by state or federal agencies does not affect their statutory responsibilities and authorities. Issues involving the exercise of agencies' specific authorities can be discussed, but decisions are not delegated to the Work Groups. Work Groups do not provide consensus advice to any federal agency (consistent with the Federal Advisory Committee Act).

8.2.6 Work Group Coordination

Any Party may engage on any specific issue within a Work Group on a timely basis, regardless of whether that Party is a current member of the Work Group, and the Licensee shall treat all comments received from a Party under the same provisions that apply to Work Group members. All Work Groups will coordinate among one another if they identify issues through their deliberations that may be of interest to or affect another Work Group or Party.

8.2.7 Work Group Role

The Licensee shall consult with the Work Groups on all aspects of the Work Products. Work Groups will convene as needed to meet the consultation requirements of the Project Documents, but at least annually for the license term and any annual licenses (see Section 8.3.3).

8.2.8 Consensus Defined

Work Groups shall make decisions by consensus. Consensus is achieved when all voting members cast a supportive or neutral vote or have abstained from the decision. When any vote is taken at a meeting on a Work Product, the Licensee shall provide the results to and seek the vote of non-present members within three days. Work Group members not present must inform the Licensee and other Work Group members of their vote on the Work Product within 10 days after the meeting or they shall be deemed to have abstained from the decision.

8.2.9 Work Group Consultation Process

Where the Project Documents require consultation on a Work Product, the Licensee shall strive to, at a minimum, provide Work Group members with a draft Work Product for at least 30 days to review and comment (which the Licensee may reasonably extend upon request of a voting member if needed to facilitate consultation). At the conclusion of this review period, if needed, the Licensee shall convene at least one Work Group meeting to discuss the draft Work Product and attempt to reach consensus with Work Group members. If consensus is achieved, the Licensee shall file with the Commission the Work Product and documentation of all consultations with the Work Group, any concerns and responses thereto, and any other written comments provided to the Licensee. If the final Work Product has been modified in any substantive way by the Licensee in response to comments or otherwise, the Licensee shall provide a new final version to Work Group members 10 days before filing it with the Commission.

8.2.10 Elevation of Work Group Decisions to Dispute Resolution

If consensus is not achieved, any voting member may elevate the issue for dispute resolution as provided in Section 9. The voting member objecting to the Work Product must provide a rationale, supporting documentation, and a proposed resolution of the issue for review. This information shall be provided to the Licensee by the objecting member within 10 days of the Work Group meeting pursuant to the Notice provisions in Section 11.11 of the Settlement Agreement. The Licensee shall provide the information to voting members concurrent with its Notice of Issue Elevation.

8.2.11 Impact of Dispute Resolution and Agency Approval Process on FERC Filing Deadlines

If the dispute is not resolved prior to the date the Licensee is required to make a filing, the Licensee shall make the filing and shall describe to the Commission how the Licensee's filing accommodates any comments and recommendations of the Work Group members. If the Licensee's filing does not adopt a recommendation, the filing will include the Licensee's reasons based on Project-specific information. If any necessary agency approval has not been obtained, the Licensee also shall provide an explanation of why the approval was not obtained. The Licensee shall provide the Commission with a copy of any comments and recommendations provided by Work Group members during consultation. Work Group members may submit their own comments to the Commission.

8.2.12 Agency Approval

Prior to implementing a Work Product, the Licensee shall obtain any necessary Commission approval and any necessary agency approval. Where a Project Document identifies an agency with approval authority, the Licensee shall proceed in a manner consistent with the approval of that agency.

8.2.13 Agency Approval Process

When agency approval is required by the Project Documents, that approval must be provided in writing by the approving agency(s). The approving agency(s) will strive to ensure that written approvals are provided to the Licensee in advance of FERC filing deadlines. To facilitate this process, the Licensee shall provide all final Work Products requiring agency approval to the approving agency at least 30 days prior to the FERC filing deadline or as otherwise noted in the Project Documents, and shall identify whether consensus among Work Group voting members has been achieved. If consensus has not been achieved, the Licensee shall identify efforts taken to resolve the dispute and shall propose a resolution for consideration by the approving agency. Unless an extension would cause the Licensee to miss a FERC filing deadline, the Licensee shall, if requested by an agency with approval authority, grant a 30-day extension for completion of the agency approval process; provided, however, that in the event that granting such an extension delays the Licensee's ability to take action, the schedule for such action will be adjusted.

8.2.14 Agency Involvement in Work Groups

The position of other members does not override an agency's approval, which is an independent authority. The agency with such approval authority will convey its determination to the Licensee, the Work Group, and the Commission. Notwithstanding, agencies do not waive or relinquish in any respect any approval authorities under the Federal Power Act or other applicable law through their participation in the Work Group consensus process and any subsequent dispute resolution process. While the goal of the Work Groups is consensus decision-making where possible, nothing in the Settlement Agreement is intended to transfer legal authority or jurisdiction from any party to any other.

8.2.15 Work Group Member Withdrawal

Any member of any Work Group may withdraw from that Work Group upon Notice to the Licensee. The Licensee shall provide Notice to other Work Group members in the event of a member withdrawal. Any Party that withdraws from this Settlement Agreement shall be deemed to have withdrawn from all Work Groups.

8.3 Meeting Provisions

8.3.1 Work Group Chairs and Facilitators

The Licensee shall arrange, administer, and chair all meetings. Upon request of a majority of voting members in the Work Group(s), the Licensee shall provide a meeting facilitator(s).

Selection of a facilitator(s) will be done in consultation with and for approval by the affected Work Group voting members. The Licensee (either by its own submission or through the facilitator) shall provide no fewer than 10 days prior Notice of any meeting, unless otherwise agreed to by the members of the BRCC or Work Group(s), or required in order to meet a license deadline or an emergency circumstance.

8.3.2 Work Group Meeting Minutes

The Licensee (either by its own submission or through the facilitator) shall provide draft meeting minutes within 10 days after a meeting to members of the Work Group, who shall have 10 days to provide any comments. The Licensee shall distribute final meeting minutes within 30 days of the meeting. Meeting minutes will include Work Group action items, a summary of issues discussed, decisions reached, and member concerns. However, when agency or Work Group approvals of specific actions are required, as identified in the Project Documents, the Licensee shall follow procedures identified in Section 8.2.13. The Licensee shall provide Work Group meeting minutes and products to any Party upon request.

8.3.3 Work Group Annual Meeting

The Licensee shall convene annual Work Group meetings to review the previous year's actions and implementation status and to discuss planned activities for the current calendar year and the Out Year. The Licensee shall provide at least 30 days Notice for the annual meetings. An annual meeting may be cancelled by consensus of Work Group members or by the Licensee if no members of the Work Group respond to the Licensee's annual meeting Notice. However, to ensure continued communication and coordination, no more than two consecutive annual meetings of a Work Group may be cancelled.

8.3.3.1 Work Group Annual Reports

Prior to providing Notice for an annual Work Group meeting, the Licensee shall prepare a draft annual report. The Licensee shall provide the draft annual report to Work Group members no later than the time that it provides the 30-day Notice for the annual meeting. Work Group members shall submit any comments and recommendations on the annual report in writing to the Licensee at or before the annual meeting and may provide verbal comments at the meeting. If the Licensee makes substantive revisions to the annual report after the meeting, the Licensee shall circulate the revised report within 10 days of the meeting, and Work Group members may provide additional comments within 10 days of the Licensee's distribution of the revised report. Receipt of further comments does not trigger further circulation of drafts and solicitation of comments. The Licensee shall file with the Commission a final annual report and response to comments and recommendations on the draft report within 60 days after the annual meeting. A copy of the final report will be provided to the Work Group members.

8.3.3.2 Contents of Work Group Annual Reports

The Licensee shall include, at a minimum, the following information in the annual reports:

(a) A rolling, three-year work plan documenting the implementation of PM&E measures in the preceding year, a month by month description of the specific actions that the Licensee plans to implement for the current year and a summary of actions proposed in the Out Year. Specific elements of this plan include:

(i) A summary of the actions implemented during the previous calendar year; such as field testing and studies, compliance monitoring, design and construction, and other analyses.

(ii) Summaries of results of any monitoring or studies conducted during the previous year, conclusions that the Licensee draws from the results, and any proposed changes to the Project Documents based on the results.

(iii) The implementation schedule for the current year.

(iv) The implementation schedule for the Out Year.

(b) A discussion of any substantial differences between the actions required in the Project Documents and the actions that the Licensee implemented, including consultation comment letters, explanations and any necessary agency or Work Group approvals for any substantial differences.

(c) A discussion of any significant differences between the implementation schedule in the Project Documents and the schedule for the actions the Licensee plans to implement during the year, including an explanation for any significant differences.

(d) Documentation of consultation with the respective Work Groups and any required agency or Work Group approvals in the previous year.

(e) Identification of any issues or Project Document requirements that would benefit from coordination between Work Groups and discussion at the annual BRCC meeting.

8.3.4 Management Plan Review and Amendment

An amendment is any change to the text of a Management Plan. All amendments require FERC approval before they become effective.

8.3.4.1 Scheduled review

The Licensee in consultation with the Work Groups shall review the Management Plans and amend them if needed on the schedule established in each of the plans. The need for amending

the Management Plans will be discussed with the Work Group during the annual meeting in the year in which the review is scheduled to occur. If the Work Group determines an amendment to a Management Plan is not needed, this decision will be documented in the Rolling 3-Year Annual Report/Work Plan for the year in which the review is conducted.

The Licensee will compile a running list of potential changes to each management plan suggested by the Work Group. This list will be compiled from sources such as monitoring and be included in the Rolling 3-Year Annual Report/Work Plan for consideration during the next review/amendment cycle.

8.3.4.2 Unscheduled review

Amendments to Management Plans may be proposed based on changes in resource conditions resulting from unforeseen effects, from new or existing Project-related activities, or from natural events in the Project area. Amendments may also be warranted if monitoring or other observations indicate that resource objectives are not being met and/or it is determined that a specific PM&E measure is not providing the intended result. The proposed amended Management Plan will document the rationale for changes and the consultation process with the Work Group.

8.3.4.3 Amendment process

The Licensee will be responsible for preparing the draft and final proposed amended Management Plan, coordinating the review process and schedule with the Work Group, consulting with the Parties as set forth in Section 8.2.9, obtaining all necessary agency approvals as set forth in Section 8.2.13, and submitting the final proposed amended Management Plan to FERC. Failure of the approving agency to respond to a request for approval within 60 days shall be deemed to constitute approval.

8.3.5 Cost of Work Group Meetings

The Licensee shall bear all meeting room rental, materials, and similar costs associated with conducting BRCC and Work Group meetings. Each member or other participant will bear its own cost of attendance, unless otherwise agreed to by the Licensee.