

**2022 PRE-TREATMENT AND MANAGEMENT PLAN
FOR UPPER FLUME CREEK, PEND OREILLE
COUNTY, WASHINGTON**



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1.0 INTRODUCTION

Westslope Cutthroat Trout (WCT) *Oncorhynchus clarki lewisi* are native to the Pend Oreille River watershed in Washington, but have declined in abundance and range. On March 20, 2013, the City of Seattle (hereafter Seattle City Light; SCL) was awarded a 42-year Federal Energy Regulatory Commission (FERC) license for operation of the 1,040-megawatt Boundary Hydroelectric Project (FERC No. 2144), located on the Pend Oreille River in Pend Oreille County, Washington. The license stipulates that SCL shall implement measures under License Article 9 to protect and enhance fish and aquatic resources within the designated FERC boundary, especially in support of native salmonid recovery in tributaries (US-FERC 2013). In consultation with stakeholders that comprise the Fisheries and Aquatic Workgroup (FAWG), formed to oversee implementation of license requirements, SCL developed a Fish and Aquatics Management Plan (FAMP; SCL 2010) to guide measures implemented under the current license. The presence of non-native fish species, particularly Brook Trout *Salvelinus fontinalis*, is a serious threat to persistence and/or recovery of native salmonids in the Pend Oreille Basin through interbreeding or competition for habitat and food resources (Andonaegui 2003). License Article 9(D) and FAMP section 5.4.2 describe measures for the suppression or eradication of non-native fish species, including eradication through piscicide treatments (SCL 2010; US-FERC 2013). Cooperative efforts between Washington Department of Fish and Wildlife (WDFW), SCL, and the Kalispel Tribe of Indians Natural Resource Department (KNRD) are underway in Pend Oreille County to eradicate non-native fish from and restore native WCT to selected stream sections.

Flume Creek is located in northeastern Washington approximately 14 km south of the US-Canadian Border and 27 km west of the state border with Idaho (Figure 1).

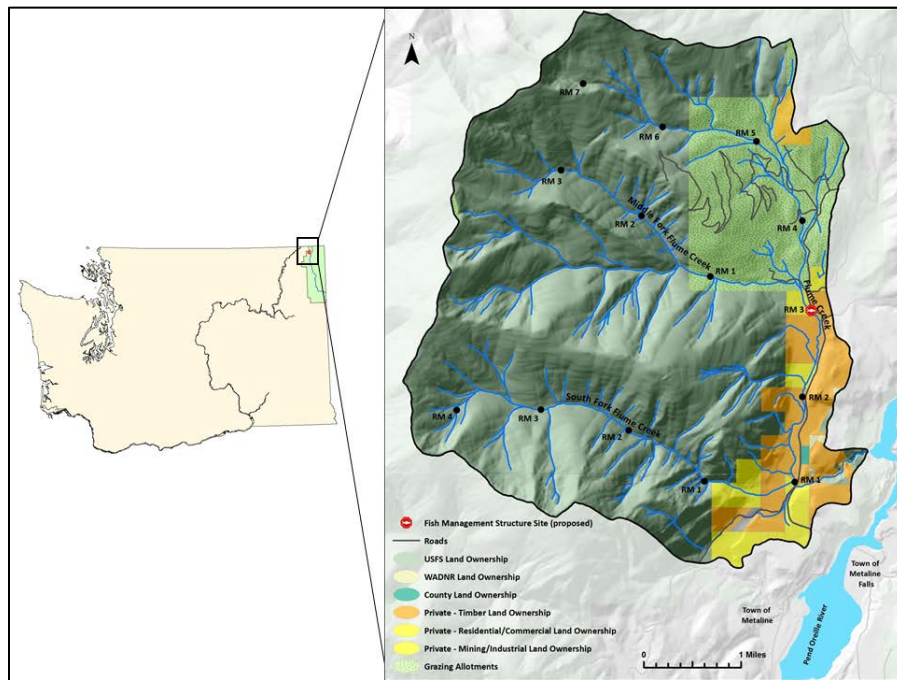


Figure 1. Flume Creek Project Area key features and location of Flume Creek in Washington State. Flume Creek drains about 50.5 km² and joins Boundary Reservoir from the west near Metaline, Washington. A large cascade and 43-foot vertical waterfall at RM 0.30 isolates the drainage from the reservoir (Walker et al. 2015). Sampling in the Flume Creek watershed by WDFW (McLellan and O'Connor 2001) and KNRD revealed a simple fish community consisting of Brook Trout and WCT. Sculpin *Cottus spp.* were reported by West Fork Environmental (WFE) in lower Flume Creek above the falls (WFE 2012), but the report may have been in error as Sculpin have not been observed in other surveys (R2 1998; McLellan and O'Connor 2001; Terrapin 2017) or recent focused attempts to collect them (KNRD unpublished data, WDFW unpublished data). The salmonid species occupying the drainage are geographically partitioned, with Brook Trout inhabiting most of the watershed and WCT limited to headwater areas above Brook Trout distribution. Flume Creek was stocked with Brook Trout by Pend Oreille County in 1916 (Darwin 1917) and Washington Department of Game between 1933–1944 and in 1981 (WDFW unpublished data). No stocking records were found for WCT in the basin (WDFW unpublished data); however, genetic sampling of WCT in the Flume Creek watershed in 2012 revealed a high degree of relatedness between Flume Creek WCT and the WDFW Kings Lake WCT broodstock (WFE 2012; Small et al. 2015; Small et al. 2017). Whether WCT are endemic to the Flume Creek drainage is unknown, but genetic data suggests that undocumented stockings of Kings Lake-origin WCT likely occurred in the Flume Creek watershed at some point in the past.

The Flume Creek watershed is well-suited to nonnative fish eradication via piscicide treatment due to the presence of a complete upstream fish passage barrier and geographic isolation of native species in the drainage above non-native fish distribution. Washington Department of Fish and Wildlife, in partnership with KNRD and SCL, began conducting annual piscicide

treatments using rotenone to remove Brook Trout from the Flume Creek drainage above the waterfall in August 2019 (Baker and Walker 2019), with subsequent treatments completed in 2020 and 2021 (Baker and Walker 2020; 2021). A temporary fish management structure (tFMS) was constructed on mainstem Flume Creek in October 2019 approximately 0.25 miles downstream of the confluence with Middle Fork Flume Creek to facilitate effective treatment of the watershed (Figure 2). Treatment of the portion of the watershed above the proposed tFMS (hereafter, Project Area) will be completed first, with non-native fish eradication proceeding below the tFMS following confirmation of Brook Trout removal above the structure. Reintroduction of native WCT will occur in treated areas following eradication of Brook Trout.

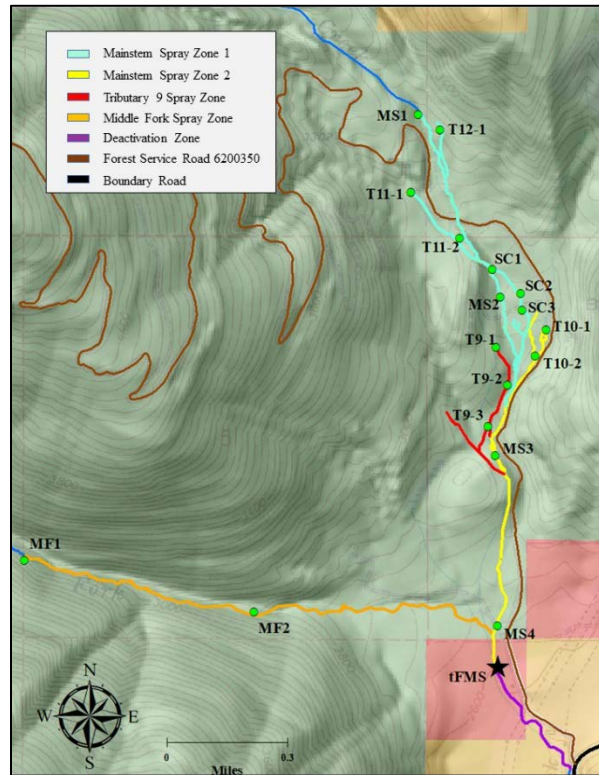


Figure 2. Drip station (green dots) and spray team zones for the proposed rotenone treatment in the Flume Creek watershed.

2.0 WATER DESCRIPTION

1. **WATER:** Upper Flume Creek and tributaries
2. **COUNTY:** Pend Oreille
3. **LOCATION:** T39N, R43E, S04, S05, and S09; and T40N, R43E, S32 and S33. The terminus (most-downstream point) of the Project Area is located at 48.89639N, -117.38128W.
4. **STREAM DESCRIPTION:** The Project Area includes mainstem Flume Creek and all Brook Trout-bearing tributaries upstream of the tFMS (48.90152N, -117.38509W). Total stream length to be treated is 5.13 miles. Stream widths vary from 18 inches (tributaries) to 12 feet (Flume Creek). Discharge ranges from 0.1 cfs (tributaries) to 5 cfs (Flume Creek) at base flow.

5. **WATER WITHDRAWALS:** No known water withdrawals or water rights within the Project Area.
6. **OUTLET:** Tributary to Boundary Reservoir (Pend Oreille River)
7. **STREAM:** Yes. This is a tributary stream rehabilitation.
8. **PUBLIC ACCESS:** Yes
9. **LAND OWNERSHIP:** Public 95% (USFS), 5% Private (SCL)
10. **ESTABLISHED RESORTS:** None
11. **TARGET SPECIES:** Brook Trout
12. **DATE LAST REHABILITATED:** 8/23/2021
13. **PROPOSED TREATMENT DATE RANGE:** 08/15/2022 – 09/15/2022
14. **RE STOCKING DATE:** Estimated fall 2023
15. **SPECIES:** Westslope Cutthroat Trout
16. **CATCHABLES:** N/A

FRY/FINGERLINGS: N/A

Approximately 3,000 WCT via translocation from Slate Creek and/or stocking from the SCL Native Fish Conservation Hatchery Facility will be introduced to the Project Area following Brook Trout eradication.

3.0 TOXICANT(S) AND DEACTIVATION

1. **TOXICANT(S):** Rotenone Powder Fish Toxicant (powder formulation; EPA Reg. #89459-32) and CFT Legumine Fish Toxicant (liquid formulation; EPA Reg. #655-899).
2. **TOXICANT CONCENTRATION (ppm):** up to 4.0
3. **TOXICANT AMOUNT (gal of liquid and lbs of powder rotenone product @ 5% active ingredient; ai):** up to 10 gal liquid and 15 lbs powder.
4. **METHOD OF TOXICANT APPLICATION:** Drip can, backpack sprayer, and rotenone/gelatin/sand mixture.
5. **DEACTIVATION (OXIDIZER):** Potassium permanganate (KMnO₄; free flowing formulation; EPA Reg. #'s 7722-64-7 and 1344-00-7).
6. **OXIDIZER CONCENTRATION (ppm):** up to 5.0
7. **OXIDIZER AMOUNT (lbs of powder):** up to 750 lbs
8. **METHOD OF OXIDIZER APPLICATION:** Free-flowing powdered potassium permanganate is mixed in 400-gal tanks and applied to the stream as a 1% solution via 0.83 hp chemical-resistant pump (March Pump, Glenview, IL) powered by a Honda EU2000 generator. Flow is calibrated hourly to ensure sufficient potassium permanganate is added to the stream to neutralize rotenone and satisfy biological oxygen demand with a small residual remaining (0.0 – 1.0 ppm).

4.0 PURPOSE

Historically widespread and abundant throughout the lower Pend Oreille River Basin, WCT have experienced significant constriction of range and abundance within the last 100 years. Removal of non-native Brook Trout followed by restoration of WCT in Flume Creek is consistent with WDFW's goal to "conserve and protect native fish and wildlife". This work would aid in restoring ecosystem function, provide source stocks of genetically pure WCT for the future, and act as a buffer against future petitioning of WCT under the Endangered Species Act (ESA).

5.0 DESCRIPTION OF FISH SPECIES TO BE ERADICATED AND HOW DMP ACTION THRESHOLDS ARE MET

The fish species targeted for eradication is Brook Trout. Significant declines in WCT abundance have been documented throughout the western United States over the past 100 years, due in large part to competition with, and displacement by, non-native Brook Trout (Shepherd et al. 2003).

The Discharge Management Plan for the State of Washington Department of Ecology (DOE) Fishery Resource Management General National Pollutant Discharge Elimination System (NPDES) Permit No. 0041009 stipulates (Section B, subsection 2, item b and in Section C, subsection 1, item b) that the presence of non-native fish in a waterbody with suitable habitat for native species is a threshold that justifies rehabilitation (Bolding et al. 2015). Brook Trout are present in the Project Area (R2 1998, McLellan and O'Connor 2001, Terrapin 2017, Bean et al. 2019), a priority watershed for native WCT restoration (R2 2014).

6.0 INTENDED OUTCOME/MEASURE OF SUCCESS

This project has two objectives:

1. Eradicate non-native Brook Trout from the Project Area.
2. Re-establish WCT throughout the Project Area.

Objective 1 will be achieved when non-native Brook Trout are functionally extirpated from the Project Area. Follow-up environmental DNA (eDNA) sampling and electrofishing will be utilized to confirm eradication of Brook Trout. Reproducing populations of WCT, expanding both in population size and spatial distribution, will indicate completion of Objective 2. Achievement of Objective 2 may take multiple years.

7.0 RESOURCE IMPACTS

1. The target species population, Brook Trout, will be eradicated.
2. Regional Lands, Habitat, Wildlife and Non-Game managers have been apprised of the proposed Flume Creek rehabilitation. No unmitigated concerns have been expressed regarding the potential impacts to non-targeted species.
3. Rotenone is highly toxic to gill-breathing organisms because it is absorbed directly into the bloodstream through the gill epithelium. According to Bradbury (1986), the effects of rotenone on benthos are variable, depending on rotenone concentration and species. Crustaceans are most tolerant while smaller insects are most affected. Immediate reduction of populations averages 25%, and survival doubles when access to bottom sediments exists. Benthic communities generally recover to at least pre-treatment levels within two months. Zooplankton are more severely impacted, and communities generally take twelve to twenty-four months to fully recover (McGann and Strecker 2018). Risk to amphibians is dependent on life stage. Obligate gill-breathing stages (tadpoles) experience mortality rates similar to fish, while lung-breathing adults are not negatively affected. Mortality of transitional stages is directly related to the proportion of oxygen obtained via gills (Grisak et al. 2007, Billman et al. 2012). Amphibians native to Washington metamorphose to adulthood by late summer, so the timing of lake

rehabilitations (fall) results in minimal impact to those species. Rotenone concentrations applied in piscicide treatments are essentially non-toxic to lung-breathing organisms (birds, mammals, reptiles, and adult amphibians) because the primary route of exposure is through ingestion, and natural enzymes in the digestive tract are effective at neutralizing rotenone (Ling 2003). In addition, rotenone does not concentrate in fish tissue and is quickly broken down in the environment (Ling 2003).

4. Application of rotenone under this proposal has been determined “not likely” to affect threatened and/or endangered species or their habitat by the United States Fish and Wildlife Service (USFWS 2012, Behan 2017) because:

- Treatment will occur in locations where no aquatic endangered species are present (e.g., Bull Trout *Salvelinus confluentus*).
- Terrestrial species (e.g., Canada Lynx *Lynx canadensis*, Grizzly Bear *Ursus arctos*, Yellow-billed Cuckoo *Coccyzus americanus*, etc.) are unlikely to be present.
- No designated critical habitat is present within the Project Area.
- Negative impacts to aquatic habitats are temporary.
- Treatment will not impact terrestrial habitats.
- Disturbance associated with treatment activities is temporary and short in duration.
- Rotenone will be contained within the project area.
- Routes of entry for lung-breathing aquatic or terrestrial organisms are limited; thus, direct mortality from ingesting water or fish containing rotenone is very unlikely.
- Reductions of prey (fish or aquatic invertebrates) due to treatment are temporary.

8.0 MITIGATING FOR ADVERSE IMPACTS

1. Drinking water will be provided to landowners (who use stream water for drinking) downstream of the Project Area during the period of rotenone presence. Removal of the majority of dead fish is also planned; however, few fish remain following treatments that occurred in 2018-2021. Dead fish will be buried on USFS property.
2. Late summer/fall rehabilitation will not interfere with spring nesting of waterfowl or spawning of adult/rearing of juvenile amphibians.
3. Livestock use of the waters to be treated will not be significantly affected. The concentration of rotenone used in the treatment will be far below that considered harmful to mammals or birds. Landowners and the USFS grazing allotment permittee will be notified of the rehabilitation and potential exposure of livestock to rotenone.
4. Appropriate respirators and other personal protective equipment (PPE) will be utilized by staff involved with mixing and applying liquid and powder rotenone per the product label and American Fisheries Society Rotenone Standard Operating Procedure (SOP) manual (Finlayson et al. 2018).

5. The stream will be posted according to NPDES requirements, providing information about rotenone product(s) to be applied, application date(s), and public use and water use restrictions, as well as contact information for WDFW project lead(s) and the DOE NPDES permit manager (DOE 2015).

9.0 RECREATIONAL IMPACT

Flume Creek is managed under WDFW general fishing rules, including a standard stream fishing season (Saturday before Memorial Day–October 31) and statewide harvest rules for game fish. Statewide rules include no size restrictions or daily limit for Brook Trout. Recreational angling use of the Flume Creek drainage is limited. Few Brook Trout remain following treatments that occurred in 2018-2021. Most Brook Trout in the Project Area are small (4-6 inches), offering little recreational fishing value. Westslope Cutthroat Trout will provide limited angling opportunity following re-establishment of the population, but fish size will also be small. Hunting, wood gathering, berry picking, and hiking likely occur on or near Flume Creek, but should not be adversely affected by the treatment.

10.0 ECONOMIC IMPACTS

Economic impacts to the Project Area will be limited. Angling pressure is light in Upper Flume Creek and contributes little to the local economy. Cost to conduct pre-treatment data collection and the proposed 2022 treatment should total around \$15,000. The project will be funded primarily by SCL (FERC mitigation funds).

As noted previously, the re-establishment of WCT in Flume Creek is intended to provide some buffer against the listing of the species under the ESA. An ESA listing of WCT could impact area farming/ranching, logging, and mining operations, which comprise a portion of the Pend Oreille County economy.

11.0 RELATED MANAGEMENT ACTION

See Section 1.0 (INTRODUCTION) for post-treatment fish reintroduction information. Following establishment of WCT, periodic surveys will be conducted to monitor population abundance, spatial distribution, and genetic metrics.

12.0 PUBLIC CONTACT

Public meetings will be held May/June 2022 online and / or in Pend Oreille County and Olympia to explain WDFW 2022 rehabilitation proposals, garner public input, and address concerns.

13.0 PRE-TREATMENT ANALYTICAL METHODS USED FOR MONITORING

The following pre-treatment monitoring is required by DOE (2015).

13.1 Water Chemistry

WDFW must collect pre-treatment measurements of water chemistry, including water temperature, dissolved oxygen, and pH, at a representative location in the stream treatment area within 24 hours prior to treatment. Pre-treatment water chemistry data will be collected from Flume Creek at the tFMS site using a YSI multimeter (Yellow Springs International/Xylem; Yellow Springs, OH).

13.2 Potassium Permanganate Demand (PPD)

WDFW must collect a pre-treatment measurement of organic demand within 24 hours prior to treatment. Organic demand is measured as potassium permanganate demand (PPD). Two ml of 25 ppm KMnO_4 stock solution (25 mg KMnO_4 in 1,000 ml distilled water) is added to 8 ml of stream water in a sample vial and swirled to mix. Using a Hach DR900 colorimeter, an initial measurement of KMnO_4 concentration is collected immediately after combining stock solution and stream water, and a second measurement is made following 30 minutes of contact time in darkness. The second measurement is subtracted from the first, indicating the amount of KMnO_4 consumed by stream water organic and/or chemical demand during the 30-minute contact period. Pre-treatment PPD will be measured from Flume Creek at the tFMS site.

13.3 Volatile Organic Compounds (VOC)

If potable water rights/withdrawals are present in the Project Area AND liquid rotenone is applied, WDFW must collect a water sample to test for background levels of VOCs. These samples are sent to an accredited environmental laboratory within 48 hours for processing. Sample analysis for VOC's is conducted at the lowest-possible detection levels. There are no potable water rights/withdrawals in the Upper Flume Creek Project Area, so no VOC samples will be collected.

14.0 POST-TREATMENT ANALYTICAL METHODS USED FOR MONITORING

The following post-treatment monitoring is required by DOE (2015).

14.1 Water Chemistry

WDFW must collect post-treatment measurements of water chemistry, including water temperature, dissolved oxygen, and pH within 24 hours following treatment. Post-treatment water chemistry data will be collected at the tFMS site using methods described above (Pre-Treatment) except that PPD is not measured.

14.2 KMnO_4

Beginning 60 minutes after initiation of deactivation, in-stream measurements of KmnO_4 concentration must be conducted hourly downstream of the treatment terminus throughout the period of toxicity. Measurements of in-stream concentration of KmnO_4 will be conducted at 30- and 60- minutes stream travel time downstream of the tFMS using a Hach DR 900 colorimeter to allow for adjustment of the application rate of 1% KmnO_4 solution to the stream. An average residual concentration of 0.5–2.0 ppm KmnO_4 will be maintained at 30-minutes travel time downstream, and an average residual concentration of 0.0–1.0 ppm KmnO_4 will be maintained at 60-minutes travel time.

14.3 Trout Toxicity Bioassay

Beginning immediately prior to rotenone application, caged sentinel fish (triploid Rainbow Trout fingerlings) must be monitored for survival. Sentinel fish will be placed 5 m above the deactivation station at the tFMS, at 30-minutes stream travel time downstream, and at 60-minutes travel time downstream to determine rotenone toxicity

immediately above and within the deactivation zone. Deactivation must continue until sentinel fish, placed above the deactivation station, survive for 24 consecutive hours (100% of sentinel fish from a given cage must survive the 24-hr period).

14.4 Water Withdrawals

1. Potable Water Rights

Potable water withdrawals from the treated water body must cease prior to treatment and cannot resume until ***BOTH*** following conditions are met:

- **Rotenone concentration**

Potable water withdrawals within the Project Area may resume only after rotenone concentration in the treated waterbody falls below 40 ppb (active ingredient). Rotenone concentrations must be analyzed by methods listed in SOP 16 of the Rotenone SOP manual (Finlayson et al. 2018), which includes bioassay with salmonids. Bioassay must be conducted in locations representative of potable withdrawals within the Project Area, and result in 100% survival of bioassay fish at all locations before potable withdrawals may resume. Bioassay must be conducted at a minimum of three locations, or at the number of locations equal to 20% of the number of potable withdrawals within the Project Area, whichever number of locations is greatest. There are no potable water rights/withdrawals in the Upper Flume Creek Project Area.

- **Volatile Organic Compounds (VOC)**

Following treatment, WDFW will collect periodic water samples to test levels of VOCs. These samples will be sent to an accredited environmental laboratory within 48 hours for processing. Sample analysis for VOC's is conducted with minimum detection levels at or below 0.5 ppb. Potable water withdrawals may not resume until VOCs return to background (pre-treatment) levels or fall below 0.5 ppb.

- 2. Irrigation or Livestock Withdrawals:** WDFW must demonstrate that the treated waterbody meets standards applicable to crop irrigation and livestock watering required by the FIFRA label for the rotenone product used before withdrawals can resume. There are no irrigation or livestock watering water rights within the Upper Flume Creek Project Area. Currently, there are also no livestock watering restrictions for the rotenone or KMnO₄ products proposed for use in this treatment.

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