# Biological Assessment
# Mackey Creek Enhancement Project

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# 1 INTRODUCTION

This Biological Assessment (BA) has been prepared for the Mackey Creek Enhancement Project. The City of Redmond is proposing to enhance Mackey Creek and its associated riparian and wetland habitats within the City-owned Farrel-McWhirter Park (Figure 1). Key features include removal of fish passage barriers, reduced sediment deposition/erosion problems and restoration of more diverse stream habitats, management of invasive species, and enhanced native plant communities. The project is located along the mainstem of Mackey Creek approximately ½ mile upstream of its confluence with Bear Creek and also includes enhancement of the two forks of Mackey Creek and an unnamed tributary (all within Farrel-McWhirter Park). The project site is located in Section 31, Township 26N, and Range 06E.

This BA also addresses potential effects on essential fish habitat (EFH) as required under the Magnuson-Stevens Fishery Conservation and Management Act.

# 2 PROJECT PURPOSE AND BACKGROUND

The City of Redmond is currently developing a Master Plan for Farrel-McWhirter Park. An early stage in the planning process was the identification of critical areas in 2014 to inform future park development and conservation strategies. As part of the critical areas mapping, a number of habitat issues and concerns were identified associated with Mackey Creek and its floodplain wetlands. Key problems include: 1) fish passage barriers (shallow channel depths, drops that exceed 12 inches and barrier culverts); 2) excessive sediment deposition in the mainstem of Mackey Creek, primarily caused by very dense reed canary grass, that is causing the channel to braid into multiple small channels or sheet flow and likely creating fish passage barriers; 3) no defined channel for the intermittent tributary to Mackey Creek due to very dense reed canary grass; 4) low diversity stream habitats (i.e. lack of wood and channel incision); and 5) dominance of invasive species along Mackey Creek. The City is proposing to address these problems and enhance Mackey Creek and its associated riparian and wetland habitats in advance of any further development in the park to ensure fish passage and improve the quality of the habitats.

In the 1930s, the McWhirter family of Seattle purchased the property for use as a summer home. Mrs. Elise McWhirter was an avid horse owner who raised and trained her horses here. The single family home located on parcel 312606-9017 was built in 1936. In 1971, the 68-acre parcel was bequeathed to the City of Redmond for use as a park. It took several years to make improvements to the property so that it was suitable for public use. It was opened to the public as a park and educational facility in 1978.

Currently, this unique park provides a diversity of public resources and activities including a children's animal farm in the center of the park, a horse arena with trailer parking in the northwest corner, covered picnic shelters with electricity and running water, multi-use trails that connect to the Puget Sound Energy/City of Redmond Trail, an orienteering course, tire swings, and nature trail system. Numerous farm animals live and are cared for at the park. Farm infrastructure is present within the park and is well maintained for the animals and public. Typical park features are also present, as listed above, but also include large maintained areas of lawn. The nature trail system is spread throughout the park. Approximately one-third of the park is used for farm-related activities; the remaining two-thirds of the park is natural area. Natural areas include mature coniferous forest in the uplands and Mackey Creek, its two forks, and thirteen wetlands, including several spring-fed or seep wetlands (Figures 2 and 3).

Juel Community Park
Avondale Road Northeast
196th Avenue Northeast
Northeast Redmond Road
Northeast 109th Street
Farrel McWhirter Park
Upland Loop Trail
Woodland Trail
Northeast 106th Street
Little Bit Therapeutic Riding
Lower Bear Creek Natural Area
186th Court Northeast
Northeast 103rd Street
Northeast Redmond Road
Northeast 106th Place
The Overlake School
Northeast Novelty Hill Road
Bear Creek
Northeast 95th Street
Coho Lane
Pilchuk Street
Quinalt Way
Waptoto Drive
The Bear Creek School Valley Campus
Perrigo Park
Evans Creek Trail
Cadmann Quarry
Legend
Project Location
0
1,300
2,600
Feet
N
Kirkland
Redmond
Bellevue
Mercer Island
Lake Sammamish
405
520

**Figure 1. Project Vicinity Map.**

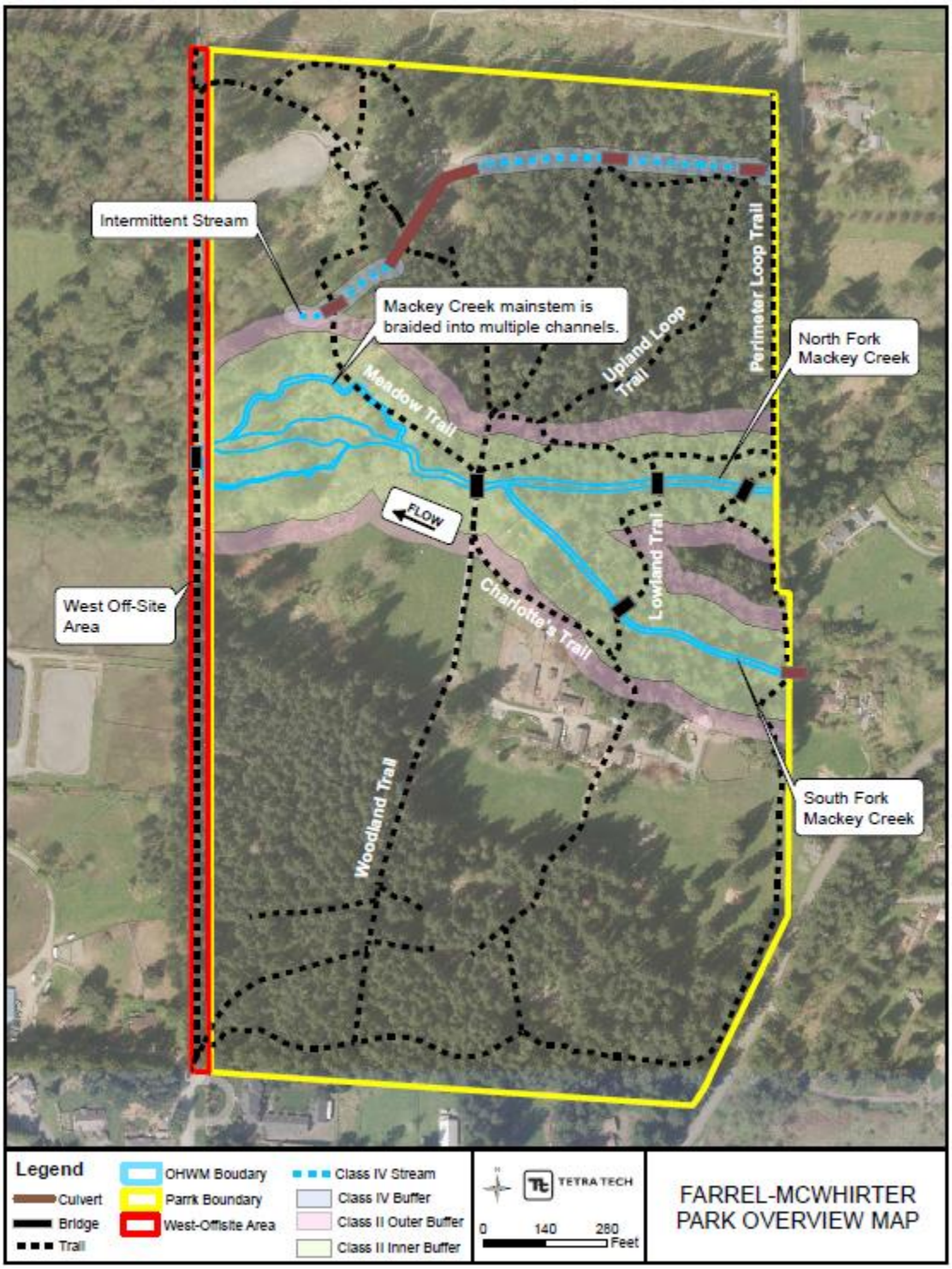


**Figure 2. Mackey Creek Overview Map.**

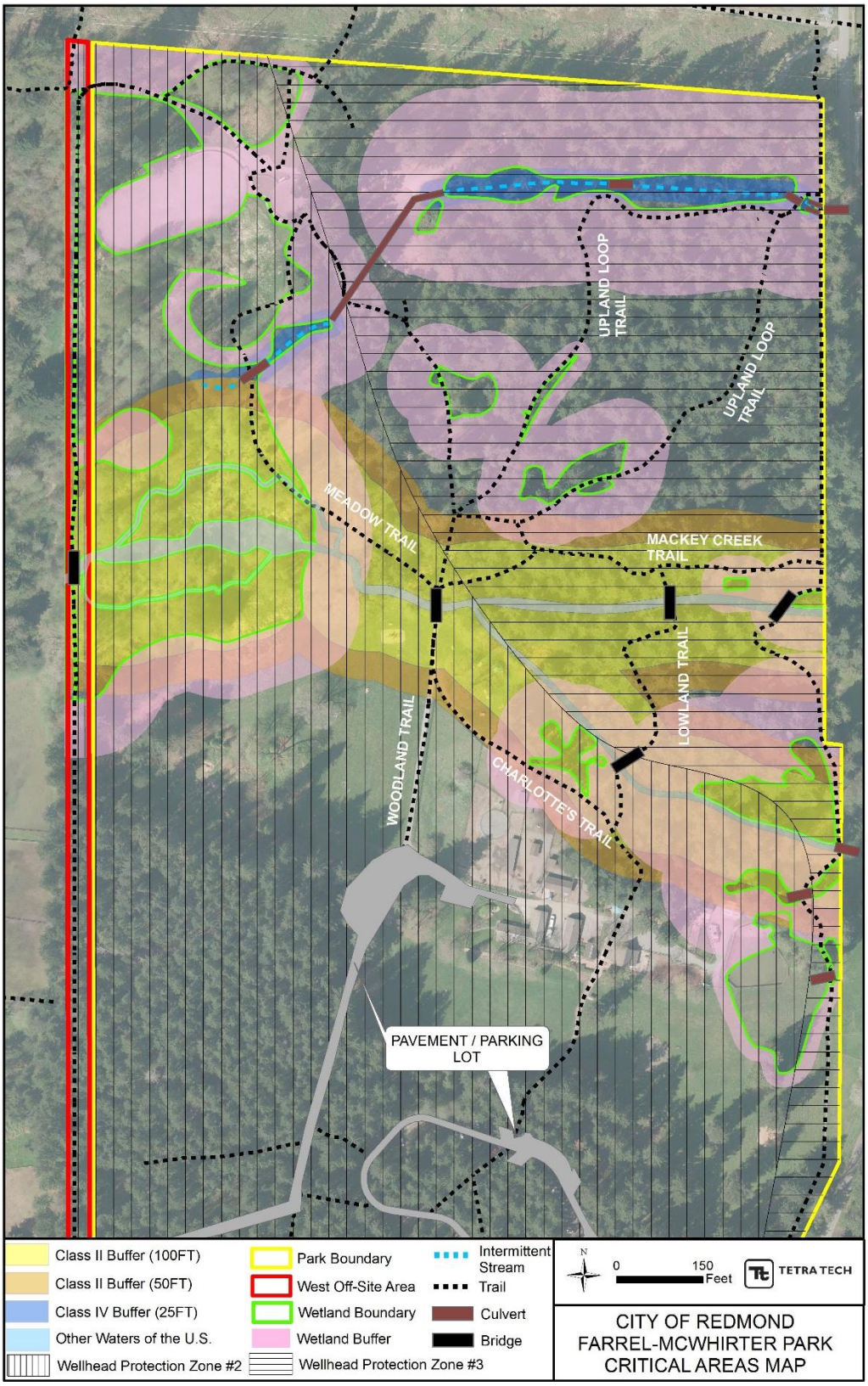


**Figure 3. Project Area Map with Streams and Wetlands.**

# 3 DESCRIPTION OF PROPOSED ACTION

The proposed enhancement project consists of the following primary project elements:

1) Removal of fish barrier culverts on the South Fork of Mackey Creek, at the Perimeter Loop Trail (three parallel culverts, one 18-inch concrete and two 12-inch corrugated metal) and a 12-inch culvert within King County's right-of-way immediately upstream of the park;
2) Installation of an 11-foot span concrete pedestrian/equestrian bridge to replace culverts at the Perimeter Loop Trail;
3) Excavation of a new channel for the mainstem of Mackey Creek to eliminate braiding caused by reed canary grass infestation and to naturally transport sediment;
4) Excavation of a new channel for the intermittent tributary to Mackey Creek to provide seasonal access for fish and reduce off-site sheet flow;
5) Reuse of excavated material to create planting mounds and reduce risk of channel avulsion (i.e. by filling in upper ends of braided channels);
6) Installation of large wood in Mackey Creek, its two forks, and the intermittent tributary to enhance stream habitat diversity and reduce channel incision and drops greater than 12 inches;
7) Management of invasive species (primarily reed canary grass) on approximately 3 acres of the floodplain wetland associated with Mackey Creek; and,
8) Revegetation with native riparian and wetland plant species.

## 3.1 Action Area

The action area for this project includes all areas to be affected directly or indirectly by the action. The action area includes Mackey Creek and its floodplain and two forks within Farrel-McWhirter Park, the intermittent tributary to Mackey Creek, and Mackey Creek downstream to the confluence with Bear Creek.

## 3.2 Interrelated and Interdependent Actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. The City of Redmond will be implementing park improvements based on the results of the master planning process and may raise the Charlotte's Trail bridge and the Lowland Trail bridge to reduce the potential for backwatering and sediment deposition.

## 3.3 Construction Phasing and Sequencing

The project will occur in two phases:

Phase 1 will install large wood in the North and South Forks of Mackey Creek to reduce channel incision, trap sediment, enhance connectivity of the creek with its floodplain, enhance fish habitat, and reduce drops to allow fish passage. This work will be conducted in 2017 using Washington Conservation Corps (WCC) crews using small equipment, such as trenchers and bobcat type excavators and hand labor to install primarily large wood that is found in the floodplain and spanning the creeks. All work will occur within or immediately adjacent to the creek channels. The likely sequence of work is:

a. Clear, flag, and fence staging area and access route(s); close trail and provide detour signage.
b. Mobilize equipment to site.
c. Temporarily remove fencing at culvert site.
d. Remove tree at King County ROW culvert and, only as needed, trim and remove shrubs.
e. Install coffer dam/gravity water diversion.
f. Salvage fish as necessary.
g. Remove culverts and haul to recycler/landfill.
h. Excavate for bridge footings and install foundation bedding.
i. Minor grading of channel and banks at culvert sites and install stream substrate.
j. Install bridge footings and abutments.
k. Place precast concrete bridge and fastenings.
l. Concurrently with culvert/bridge work, WCC crews to chainsaw on-site large wood to appropriate sizing and position for installation.
m. Install minor coffer dams or water diversions as needed for large wood installation.
n. Dig trenches for large wood installation.
o. Install large wood and backfill with stream substrate and boulders.
p. Backfill trenches.
q. Final grading and/or hand finishing all sites.
r. Seed and mulch disturbed areas.
s. Reopen trails and remove staging areas and access fencing.
t. Plantings of native trees/shrubs in disturbed areas.

Phase 2 will include excavation of a new mainstem Mackey Creek channel to adequately transport sediment naturally and to remove drops over compacted till, excavation of the intermittent tributary channel, installation of large wood in both new channels, removal of reed canary grass in a 1.6 acre perimeter around the new channels, placement of excavated materials as vegetation planting mounds and to extend a low berm to prevent channel avulsion into the maintained park areas, plantings of native herbaceous, shrub, and tree species (including salvaged willows and cottonwoods), removal of two fish passage barrier culverts on the South Fork of Mackey Creek (to be replaced with one pedestrian bridge), and reconstruction of the channel through the eastern end of the park and King County unimproved right-of-way (approximately 60 linear feet). This work will be conducted in 2018 by a construction contractor using traditional equipment including excavators and dozers and trucks to haul material. All work will occur within the creek channels and wetlands. The 100-year floodplain is not mapped in this area (too small to map), but all work will occur within the creeks or their floodplains. The likely sequence of construction will be:

a. Clear, flag, and fence staging area and access route(s); close trail and provide detour signage.
b. Mobilize equipment to site.
c. Clear and grub excavation sites – chip and compost vegetation within park, salvage willow and cottonwood stakes/poles for later plantings.
d. Install coffer dam/gravity water diversion.
e. Salvage fish as necessary.
f. Excavate channels and place fill for planting mounds, fill in upper braided channels, and to extend short berm.
g. Import or use on-site large wood of appropriate sizing and position for installation.
h. Dig trenches for large wood installation.
i. Install large wood and backfill with stream substrate and boulders.

j. Backfill trenches.
k. Install beaver dam analogs using cottonwood poles and willow stakes.
l. Final grading all sites.
m. Seed and mulch disturbed areas.
n. Reopen trails and remove staging areas and access fencing.
o. Plantings of native trees/shrubs in disturbed areas.

### 3.4 Conservation Measures

Several conservation measures are proposed to avoid and minimize effects on listed species during construction.

1. In-Water Work Window. All in-water construction will occur during the designated WDFW fish window for Bear Creek from August 1 through 31, with a request for an extension of fifteen days at both the beginning and end of the window to extend the work window to July 15 to September 15.

2. Work Area Isolation and Fish Removal. The construction area will be isolated from Mackey Creek and its tributaries by installation of a temporary dam with a gravity-flow pipe around the work zone. Fish and wildlife will be removed/salvaged from the work areas, if any are observed to be present. Any groundwater present in the excavation area will be pumped and treated via sediment bags and/or infiltration prior to discharge back to waterbodies.

3. Erosion Control. The contractor will be required to obtain and comply with a Construction NPDES permit through the Washington Department of Ecology. All areas that will be cleared or graded will be treated with erosion control best management practices to prevent the runoff of sediment laden stormwater into Mackey Creek. Methods could include the installation of silt fencing, placement of straw bales, straw mulching, or other features.

4. Staging Area. The staging area(s) may be located within 150 feet of the waterbodies, but will be fenced and contained to prevent the runoff of sediment or pollutant laden stormwater into the creek or wetlands.

5. Pollutant Minimization. Equipment will be checked daily for leaks and any visible oils or greases will be removed prior to beginning operations each day. A fueling area will be located more than 150 feet from the creeks and will be contained to prevent runoff of any spill that may occur.

## 4 STATUS OF THE SPECIES

In accordance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended, federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed and proposed threatened or endangered species. Six proposed or listed threatened or endangered species may occur in the action area (Table 1; USFWS 2016a). The following sections briefly summarize relevant life history information on the protected species and their presence and utilization of the project and action area.

**Table 1. Listed and Proposed Species that may occur in the Project Vicinity.**

| Species | Listing Status | Critical Habitat |
|---|---|---|
| Marbled murrelet<br>*Brachyramphus marmoratus* | Threatened | Designated<br>Not in Action Area |
| Streaked horned lark<br>*Eremophila alpestris strigata* | Threatened | Designated<br>Not in Action Area |
| Yellow-billed cuckoo<br>*Coccyzus americanus* | Threatened | N/A |
| Bull trout<br>*Salvelinus confluentus* | Threatened | Designated<br>Not in Action Area |
| Puget Sound Chinook salmon<br>*Oncorhynchus tshawytscha* | Threatened | Designated<br>Not in Action Area |
| Puget Sound Steelhead trout<br>*Oncorhynchus mykiss* | Threatened | Designated<br>Not in Action Area |

## 4.1 Marbled Murrelet, Threatened

The marbled murrelet was federally listed as threatened on October 1, 1992 (57 FR 45328). Critical habitat was designated on May 24, 1996 (61 FR 26256) and revised on October 5, 2011 (76 FR 61599). Critical habitat in Washington is located on federal lands designated as Late Successional Reserves as part of the Northwest Forest Plan, some areas of state lands, and extremely limited areas of private land. In King County, the only areas designated as critical habitat are located in the Cascades in the eastern part of the county.

Marbled murrelets are small seabirds of the family Alcidae that occur along the north Pacific coast from the Aleutian Islands and southern Alaska south to central California. Murrelets feed on small fish and invertebrates usually within 2 miles of shore in open but somewhat sheltered marine waters, such as bays or sounds where water depth is less than 330 feet (Carter 1984). The nesting period begins around the end of March and continues through mid-September (Hamer and Nelson 1995). Nest sites are restricted to stands of mature and old-growth forest (Carter 1984). Because of the scarcity of such stands, it is common for murrelets to fly inland many miles to nest; over 40 miles in some studies (Cooper et al. 2006, 2007). Marbled murrelets only fly to and from their nest sites during crepuscular hours, spending their diurnal hours foraging. The loss of old growth forests is the main cause for the decline of this species. In addition, it is believed that forest fragmentation forces nests closer to forest edges making them vulnerable to predation by jays, crows, ravens, and great horned owls. Other threats to this species include fishing nets and oil spills.

### 4.1.1 Utilization of the Action Area

There is no designated critical habitat in the action area. Marbled murrelets require old growth forest to nest and proximity to marine areas for feeding. The park includes mature coniferous forest patches, but is not old growth forest. Marbled murrelets are not known to be present in the action area and due to the small patches of forest, significant human use of the park, and surrounding residential land uses, it is unlikely that marbled murrelets would occur in the action area.

## 4.2 Streaked Horned Lark, Threatened

The streaked horned lark was listed as a threatened species on October 3, 2013 (78 FR 61452) and critical habitat was designated on the same day (78 FR 61502). In Washington, critical habitat was

designated in Grays Harbor, Pacific, and Wahkiakum counties. Critical habitat does not occur in the action area.

The streaked horned lark is a subspecies of the horned lark and is endemic to the Pacific Northwest. They are small songbirds that are ground-dwelling and nest in short-grass habitats; preferring large open patches (i.e. 300 acres or more) with sparse trees (USFWS 2016b). Their current range in Washington includes the south Puget Sound prairies, the Washington coast, and dredged material spoils sites along the Columbia River. They winter along the coast and the lower Columbia River in larger flocks.

### 4.2.1 Utilization of the Action Area

Critical habitat is not located in the action area or in the Puget Sound region. There are no known occurrences of streaked horned lark in the action area and the habitat within the park is likely to be unsuitable as there are no large open patches with short-grass habitat.

## 4.3 Yellow-billed Cuckoo, Threatened

The western distinct population segment of the yellow-billed cuckoo was listed as threatened on October 3, 2014 (79 FR 59992). Critical habitat was proposed on August 15, 2014 (79 FR 48548) and does not include any areas in Washington. Yellow-billed cuckoos are migratory medium-sized brown birds that breed in North America and winter in Central and South America. They nest and use willow and cottonwood riparian forests with a dense closed-canopy. They feed on caterpillars and other insects and small fruits (Csuti et al. 2001).

### 4.3.1 Utilization of the Action Area

Yellow-billed cuckoo are not known to be present in the action area and suitable habitat is not present.

## 4.4 Bull Trout, Threatened

The co-terminus U.S. population of bull trout was listed as threatened on November 1, 1999 (64 FR 58910) and critical habitat was finalized on October 18, 2010 (75 FR 63898)**.** Critical habitat does not include the Lake Washington basin.

Bull trout have specific cold-water requirements and are rarely found in waters with temperatures above 64°F (USFWS 2016c). They may also exhibit four different life history types: anadromous, adfluvial, fluvial, and resident. Bull trout spawn from late summer through December, typically when water temperatures drop below 48°F (Wydoski & Whitney 2003). Juvenile bull trout feed on insects and then transition to small fish. Larger bull trout prey predominantly on fish.

### 4.4.1 Utilization of the Action Area

Bull trout are present in the upper Cedar River watershed above the dams and have very rarely been observed in other parts of the basin. They are not known to be present in the action area.

## 4.5 Puget Sound Chinook Salmon, Threatened

The Puget Sound Chinook salmon was listed as a threatened species on June 28, 2005 and recently updated on April 14, 2014 (79 FR 20802). Critical habitat was designated on September 2, 2005 (70 FR 52698) and only includes the Cedar River and Lake Washington within the Lake Washington basin. The fall run of Chinook is present in the Lake Washington basin.

Chinook in the Lake Washington basin are fall run and adults enter the basin from June through November. Spawning generally occurs from September through October and depending on water temperature during incubation, fry typically emerge from January through March. For most ocean-type Chinook, juveniles may rear in tributary streams, larger rivers, lakes, or estuaries for one to six months before migrating into saltwater. Peak smolt outmigration typically occurs at the locks from June through August, but smaller numbers migrate earlier as fry or somewhat later through September. (USACE and King County 2002) Chinook spawn in a wide range of streams and rivers, as small as six feet in width up to the mainstem Columbia River. Spawning generally occurs in areas of medium to large gravels (1 to 4 inches; Bjornn & Reiser 1991), but subgravel flow is likely an important element for egg survival, with spawning occurring at the heads of riffles or in pools below log jams that may force subgravel flow (Healey 1991).

The recent 5-year status review of Puget Sound Chinook indicated that while population abundance has been highly variable since the 1980s, there appears to be an overall decline in most wild spawning populations in recent years, including the Cedar and Sammamish river runs (NFSC 2015), with the fraction of the naturally spawning population for the Sammamish River basin declining in natural origin fish.

### 4.5.1 Utilization of the Action Area

Puget Sound Chinook salmon are known to be present in Mackey Creek and in Bear Creek. Suitable spawning habitat may be available upstream of the park, but due to the fish passage barriers, including the shallow, dispersed flow of the mainstem through the park, access may be precluded for Chinook.

## 4.6 Puget Sound Steelhead Trout, Threatened

Puget Sound steelhead trout were listed as a threatened species on May 11, 2007 (72 FR 26722) and recently updated on April 14, 2014 (79 FR 20802). Critical habitat was finalized on February 24, 2016 (81 FR 9252), but only includes the Cedar River within the Lake Washington basin.

Steelhead trout are anadromous salmonids that unlike most other salmonids are iteroparous and can spawn several times, starting in their fourth or fifth year and continuing until reaching a maximum age of approximately 11 years (PSP 2007; NMFS 2011a). Puget Sound steelhead smolts tend to migrate to the ocean to mature after spending two years in freshwater (PSP 2007; NMFS 2011). Spawning occurs in small streams and large rivers over medium sized gravels (0.25 to 4 inches; Bjornn & Reiser 1991).

The recent 5-year status review did not review the Lake Washington basin population, but Puget Sound stocks in general show substantial declines in recent years (NFSC 2015).

### 4.6.1 Utilization of the Action Area

The steelhead population in the Lake Washington basin has been so low in recent years that it is not known if they still occur in the North Lake Washington basin. They could occur in the action area, but have not been observed in recent years.

# 5 ENVIRONMENTAL BASELINE

The environmental baseline describes the impacts of past and ongoing human and natural factors leading to the present status of the species and its habitat within the action area. The environmental baseline provides a "snapshot" of the relevant species' health at a specified point in time. The environmental baseline includes past and present impacts from all federal, state, private, and other human activities in the action area.

## 5.1 Hydrology and Hydraulics

Mackey Creek is a 2.65 mile long perennial stream (WDFW 1975) and joins Bear Creek at river mile (RM) 3.15. Many of the tributaries to Bear Creek are highly influenced by spring flows and this includes Mackey Creek. Mackey Creek has a watershed area of 2.1 square miles. The action area is along the mainstem and tributaries to Mackey Creek in the lower mile of the creek. An analysis of streamflows conducted for this project indicates that flows range from a low of 3 - 5 cubic feet per second (cfs) to a 2-year flow of 33 cfs and 100-year flow of 79 cfs on the mainstem creek. The North Fork conveys the majority of flow to the mainstem, with the South Fork having flows less than 10 cfs at most flows.

The stream shows evidence of channel incision in the two forks, although the bed is stabilized by large wood in some locations. However, drops greater than 12 inches occur at several of the logs in both the forks. Channel slopes are approximately 4-5% in the eastern half of the park, reducing to approximately 2% in each of the forks as they reach the confluence. The mainstem of Mackey Creek flows through a flatter floodplain through the western half of the park, with slopes of 1 - 2%.

In recent years, the mainstem within the park has become infested with a very dense growth of reed canary grass. The grass traps sediment coming from upstream and has built up the channel elevation and causes frequent channel avulsions or braiding throughout the western half of the park. An estimation of the volume of sediment deposited in this area is approximately 5,500 CY. Since the critical areas survey of the park in January 2014, the channels have changed locations several times. Sheet flow across the grass also occurs both north and south of the primary creek corridor, and either floods over the Nicholl's Trail at a low spot north of the creek (Nicholl's Trail is an elevated horse trail located immediately west of the park boundary) or flows through a secondary culvert under the Nicholl's Trail and returns via a ditch to Mackey Creek downstream of the park.

## 5.2 Water Quality

Mackey Creek is spring-influenced and numerous springs/seeps are present in the park. However, Mackey Creek is listed on the 303(d) list of water-quality impaired waterbodies for temperature and dissolved oxygen from its confluence with Bear Creek up to the east boundary of the park (River mile 0 to 1; Ecology 2016). Elevated water temperatures may be caused by the shallow water in the multiple channels through the reed canary grass that are exposed to solar heating.

## 5.3 Fish Passage and Habitat Access

In the Lake Washington watershed, major changes to rivers and their routes have had major effects on anadromous fish populations, including creation of the Lake Washington Ship Canal and Locks that rerouted all drainage from the basin, operation of lake levels to maintain higher summer conditions and lower winter conditions, straightening and dredging the Sammamish River. High water temperatures are

a concern in the Sammamish River, Lake Washington and the Ship Canal and may cause migration delays and mortality.

In the action area, during the critical areas survey of the park, several likely fish passage barriers were identified including drops greater than 12 inches, shallow channels and sheet flow, and the small culverts with drops on the South Fork of Mackey Creek. Figures 4 to 6 show these conditions. These fish passage barriers may preclude salmonid access into the park and to upstream reaches.

**Figure 4. Logs with plunging overflow in upper segment of Mackey Creek.**

**Figure 5. Upper end of braided segment of Mackey Creek.**

**Figure 6. Drop over glacial till of North Braided Channel near western survey boundary.**

The South Fork is dominated by fine substrate with only small patches of gravel. The North Fork has gravel and cobble dominance, although it is also embedded by sands. At the confluence, the creek begins transitioning to sand dominance in the braided reach. No areas within the park are likely suitable for spawning by salmonids. Large wood is present in and along both forks; however, much of the wood present is spanning the channels above the OHWM and does not provide in-stream habitat. The aquatic habitat is dominated by riffles and there are essentially no pools present. The lack of pools is likely due to three factors: 1) fairly resistant bed (glacial till) that resists scour, 2) high sediment load that fills in any scoured areas; and 3) lack of wood in the wetted channel to promote scour. No off-channel habitats were identified, although upstream of the confluence the channels are more confined and unlikely to migrate substantially. In the braided reach, off-channel habitats could form or wetlands could provide high flow refugia, but the dominance by reed canary grass tends to fill in any aquatic areas quickly, reducing refugia and potentially contributing to stranding of any fish that may be present.

# 6 EFFECTS OF THE PROPOSED ACTION

The project is intended to have long-term beneficial effects on listed species, primarily salmonids. However, there are also likely to be temporary adverse effects associated with the construction of the project. The types of effects associated with construction of the various habitat features are described below.

Construction will have direct physical effects on the environment including vegetation clearing; construction staging areas, and materials storage areas; water diversion and pumping, excavation, fill, and grading; followed by site restoration such as revegetation, placement of topsoil and other substrates and other actions to restore habitats and ecosystem processes. These construction activities can temporarily disrupt or reduce the natural vegetative and fluvial processes at a project site, such as sediment and nutrient deposition and groundwater recharge (NMFS 2008a). Water tables are likely to be temporarily reduced allowing an increase in dust. During wet weather, cleared areas can erode and suspend sediments in runoff and also potentially increase the volume and frequency of runoff. This can elevate turbidity in receiving waterbodies and adversely affect aquatic habitats (i.e. by filling in pools) as well as incrementally increasing volumes into streams during runoff events. Heavy equipment can compact soils and reduce suitability for plant growth and reduce infiltration. The use of heavy equipment also creates a risk of spills of fuels, lubricants and other contaminants. A spill into a waterbody would likely cause short-term lethal toxicity to fish and invertebrates in the vicinity.

However, these effects would be short-term (slightly more than one month each in 2017 and 2018). Turbidity from in-water placement of diversion dams or rewatering the new channels is likely to abate very quickly (within a few minutes). Direct mortality from extremely high levels of suspended sediment has been documented at concentrations far above those typically caused by construction projects. Mortality may occur to juvenile salmonids exposed to 1,000 mg/L or higher concentrations at durations longer than a day (Wilber and Clarke 2004). Laboratory studies of lethal concentrations indicated that the 96-hour median lethal concentration (LC50) ranged from about 500 mg/L to 1,200 mg/L (Noggle 1978; Stober at al. 1981). Suspended sediment can also cause other effects including clogging of fish gills, causing a cough response or causing protective mucus to be excreted coating the gills and reducing their capability for oxygen exchange (Bash et al. 2001). Servizi and Martens (1992) found that gill damage occurred in underyearling sockeye salmon exposed to concentrations of suspended sediments of 3,148 mg/L (similar to normal suspended-sediment concentrations in a highly glacial system such as the Fraser River). Cough response was observed at sediment concentrations of 240 mg/L (Servizi and

Martens 1992). Behavioral responses to elevated levels of suspended sediment include avoidance, reduced foraging, predator avoidance, and effects on homing and migration (Bash et al. 2001). Sigler et al. (1984) found that juvenile steelhead and coho avoided areas of turbidity of 167 NTU and higher. Servizi and Martens (1992) found the threshold for avoidance by juvenile coho at 37 NTU.

The direct physical effects of the habitat features once constructed are beneficial. All cleared or disturbed areas will be revegetated with native species by seeding and planting shrubs and trees. This will reduce soil erosion and increase infiltration. It also will restore suitable riparian and wetland conditions to allow the long-term natural delivery of large wood to the floodplain and creek, improve bank stability, increase insect and detrital organic matter inputs into the creek, reduce sediment deposition, and improve shading and cover conditions. The proposed project is also likely to benefit Bear Creek by maintaining a cold-water tributary. The removal of fish passage barriers will allow volitional access for both adult and juvenile salmonids and other native fish to the project area and upstream reaches of Mackey Creek, and the placement of wood will increase aquatic habitat diversity and improve cover.

The effectiveness of and scale of beneficial effects from fish habitat restoration actions is less well documented than adverse effects from development (NMFS 2008a). However, it is expected that the proposed restoration and enhancement actions will contribute at least incrementally to the restoration of natural processes in the creek and its floodplain by allowing a more natural conveyance of sediment and reducing channel incision that has likely increased as a result of watershed development.

The potential for process and functional recovery is affected by the watershed context and on-going land uses. The proposed action will occur where natural processes and habitat functions have been reduced due to agriculture, roads, development, and other means. Many of the existing land uses will continue in the watershed, with somewhat increased population and development over time, although the headwaters of Mackey Creek are protected in the Redmond Watershed Reserve. The proposed restoration plan is designed to provide improved habitat and fish access in the near-term with the potential that additional forested areas and upstream creek reaches could be enhanced in the future.

At the more individual level, construction may have direct adverse effects on individual fish when work is conducted in or immediately adjacent to the water where it can injure fish or block habitat access, or when pollutants enter the waterbody. Construction specifications will include the conservation measures identified in Section 3.4 for in-water work timing, sensitive area protection, fish removal/salvage, erosion and pollution control, and work area isolation in order to avoid or minimize these adverse effects. The work can primarily occur “in the dry” during low flows with work area isolation and provision of flow bypass.

## 6.1 Climate Change Considerations

Ongoing climate change will likely have effects on listed species in the Pacific Northwest. The recently published *State of Knowledge: Climate Change in Puget Sound* (Maugher et al. 2015) indicates that freshwater ecosystems in Puget Sound will experience continued increases in water temperatures as air temperatures continue to rise, more intense storms dominated by rainfall, decreasing summer low flows, and reduced wetland area. The potential increases in water temperatures will adversely affect all salmonids by increasing pre-spawning mortality, speeding up egg incubation, and requiring more

energy/food during rearing. More intense runoff and flooding events could cause scour of redds/eggs and flush juvenile salmonids downstream.

The proposed project may help reduce some of the potential adverse effects of climate change by conserving and restoring in-channel and floodplain habitats that will provide refuge and rearing habitats and help mitigate peak flows by allowing natural floodplain inundation. The project will also restore riparian vegetation to provide more shade, protect a spring-fed creek for thermal refugia, improve habitat diversity, and contribute to future wood recruitment to the creek system.

# 7 PRELIMINARY EFFECT DETERMINATIONS

## 7.1 Marbled Murrelet, Threatened

Because marbled murrelets are not known to occur in the action area, there would not likely be any effects to marbled murrelet from the project.

### 7.1.1 Effect Determination

The proposed project will likely have *no effect* on marbled murrelet because they are not expected to be found in the action area. There is no designated critical habitat within the action area for marbled murrelet, thus there will also be *no effect* on critical habitat.

## 7.2 Streaked Horned Lark, Threatened

Because streaked horned lark are not known to occur at the project site and there is no suitable short-grass habitat near the project site there would not likely be any effects to streaked horned lark from the project.

### 7.2.1 Effect Determination

The proposed project will likely have *no effect* on streaked horned lark because they are not expected to be found in the action area. There is no designated critical habitat within the action area for streaked horned lark, thus there will also be *no effect* on critical habitat.

## 7.3 Yellow-billed Cuckoo, Threatened

Because yellow-billed cuckoo are not known to occur at the project site and there is no closed canopy cottonwood riparian forest near the project site there would not likely be any effects to yellow-billed cuckoo from the project

### 7.3.1 Effect Determination

The proposed project will likely have *no effect* on yellow-billed cuckoo because they are not expected to be found in the action area. There is no designated critical habitat within the action area for yellow-billed cuckoo, thus there will also be *no effect* on critical habitat.

## 7.4 Bull Trout, Threatened

Bull trout have not been observed in the action area and are unlikely to occur in the Lake Washington basin below the dams on the Cedar River. Thus, there are unlikely to be any effects to bull trout from the project.

### 7.4.1 Effect Determination

The proposed project will likely have *no effect* on bull trout because they are unlikely to occur in the action area. There is no designated critical habitat within the action area for bull trout, thus there will be *no effect* on critical habitat.

## 7.5 Puget Sound Chinook Salmon, Threatened

The proposed project will have long-term beneficial effects on Chinook salmon present in the North Lake Washington population. The project will remove fish passage barriers and increase in-channel habitat diversity and cover. The project will restore riparian and floodplain vegetation to reduce solar heating and contribute to restoration of natural processes.

Short-term adverse effects are likely during construction. In-water work areas will need to be isolated and, if fish are identified in the isolated area, fish salvage will be performed by a qualified biologist. Temporary increases in turbidity are likely. Non-native vegetation species will be removed and native species will be replanted, but will take several years to provide sufficient cover. In order to reduce these effects, all construction activities will occur out of water or during the designated in-water work period determined by WDFW in order to minimize effects on salmonids. Additionally, the contractor will be required to infiltrate or otherwise treat any water pumped from the work zone so that turbidity standards are met throughout the construction duration.

### 7.5.1 Effect Determination

The proposed project *may affect, and is likely to adversely affect* Chinook salmon. The proposed project will have *no effect* on critical habitat designated for Chinook salmon. The proposed project will restore access to freshwater spawning and rearing sites and improve freshwater migration for Chinook salmon.

## 7.6 Puget Sound Steelhead Trout, Threatened

The proposed project will have long-term beneficial effects on steelhead trout, if any are still present in the North Lake Washington population. The project will remove fish passage barriers and increase in-channel habitat diversity and cover. The project will restore riparian and floodplain vegetation to reduce solar heating and contribute to restoration of natural processes.

Short-term adverse effects are likely during construction. In-water work areas will need to be isolated. Temporary increases in turbidity are likely. Non-native vegetation species will be removed and native species will be replanted, but will take several years to provide sufficient cover. In order to reduce these effects, all construction activities will occur out of water or during the designated in-water work period determined by WDFW in order to minimize effects on salmonids. Additionally, the contractor will be required to infiltrate or otherwise treat any water pumped from the work zone so that turbidity standards are met throughout the construction duration.

### 7.6.1 Effect Determination

Because Puget Sound steelhead are unlikely to be present in the action area during construction, the proposed project *may affect, but is not likely to adversely affect* Puget Sound steelhead trout. There is no designated critical habitat in the action area, thus there is *no effect* to critical habitat likely from the project.

# 8 CUMULATIVE EFFECTS

The populations of King County and the City of Redmond are likely to continue increasing over time. As the population grows, some increased pressure to develop residential areas will likely cause stormwater runoff to slightly increase. However, City and County regulations requiring stormwater management will likely minimize this concern. Climate change scenarios with increased rainfall predictions could also cause flood damages to increase.

King County and cities within the Lake Washington watershed are likely to continue to undertake restoration measures to improve habitats for listed species. These effects will result in improvements to fish population abundance, productivity, and spatial structure and result in some improvement to the condition of critical habitat. When considered together, these cumulative effects are likely to have a beneficial cumulative effect on listed species and critical habitats. The proposed project, in context of other actions to be undertaken to improve habitats is likely to have incremental beneficial cumulative effects.

# 9 ESSENTIAL FISH HABITAT

The objective of this Essential Fish Habitat assessment is to determine whether or not the proposed action "may adversely affect" designated EFH for relevant commercially-fished, federally-managed fish species within the proposed action area. This section provides a description and assessment of EFH in the project area; a description of the project and its potential impacts on these habitats; and describes conservation and mitigation measures proposed to avoid, minimize, or otherwise offset potential adverse effects to designated EFH resulting from the proposed action.

## 9.1 EFH Background

The Sustainable Fisheries Act of 1996 (Public Law 104-297) amended the Magnuson-Stevens Fishery Conservation and Management Act (now called the Magnuson-Stevens Act) to require federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH. The EFH guidelines (50 CFR §600.05-600.930) outline the process for federal agencies, NOAA Fisheries, and the Fishery Management Councils to satisfy the EFH consultation requirement under Section 305(b(2)-(4)) of the Magnuson-Stevens Act. As part of the EFH consultation process, the guidelines require federal action agencies to prepare a written EFH Assessment describing the effects of that action on EFH (50 CFR §600.920(e)(1)). This document has been prepared to satisfy that requirement.

EFH is defined as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C §1802(10). For the purpose of interpreting this definition of EFH: "*waters* include aquatic areas (marine waters, intertidal habitats, and freshwater streams) and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; *substrate* includes sediment, hard bottom, structures underlying the waters, and associated biological communities; *necessary* means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and *spawning, breeding, feeding, or growth to maturity* covers a species' full life cycle (50 CFR §600.10); *Adverse effect* means any impact that reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions" (50 CFR §600.810). The Magnuson-Stevens Act promotes the protection of these habitats through review, assessment, and mitigation of activities that may adversely affect these habitats.

The EFH mandate applies to all species managed under a Fishery Management Plan (FMP). In Washington, Oregon, and California, there are three FMPs covering groundfish, coastal pelagic species, and Pacific salmon. Federal agencies must consider the impact of a proposed action on all three types of EFH. The action area for this project only includes freshwater Pacific salmon EFH.

Pacific salmon EFH for the Pacific Coast Salmon FMP includes all streams, lakes, ponds, wetlands, and other water bodies currently and historically utilized by Pacific salmon within Washington, Oregon, Idaho, and California. Excluded are some areas upstream of certain impassable man-made barriers (e.g., dams as identified by the Pacific Fishery Management Council in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan), and longstanding, naturally-impassable barriers (e.g., natural waterfalls in existence for several hundred years) (PFMC 1997).

Based on the available life history information, freshwater EFH for Pacific salmon consists of four major components: 1) spawning and incubation, 2) juvenile rearing, 3) juvenile migration corridors, and 4) adult migration corridors and adult holding habitat (Roni *et al*. 1999). Important features of essential habitat for spawning, rearing, and migration include adequate: 1) substrate composition; 2) water quality (dissolved oxygen, nutrients, temperature, etc.); 3) water quantity, depth, and velocity; 4) channel gradient and stability; 5) food availability; 6) cover and habitat complexity (e.g., large woody debris, pools, channel complexity, aquatic vegetation, etc.); 7) space (habitat area); 8) access and passage; and 9) floodplain and habitat complexity. Potential threats to these habitat features and life history components include 1) direct (hydrologic modifications); 2) indirect (loss of prey or reduction of species diversity); 3) site-specific; or 4) habitat-wide impacts that are chemical, biological, and physical in nature and may result in individual, cumulative, or synergistic consequences (Wilbur and Pentony 1999).

## 9.2 Potential Adverse Effects of the Proposed Project

For this project, all of the effects of the action have already been discussed in the ESA effects analysis for bull trout, Chinook salmon and steelhead trout and their critical habitat and collectively these would apply to EFH. The effects of the action are short term and temporary turbidity increases during

construction. The proposed action will restore EFH components for juvenile rearing and both adult and juvenile migration. No long term adverse effects to EFH are expected to result from the action.

### 9.3 Proposed Action

The proposed action is detailed in Section 2 of this BA.

### 9.4 Effects of Proposed Action on EFH

As described in Section 7 of this BA, the proposed action may result in short- term adverse effects to a variety of habitat parameters important to salmonids including removal of vegetation, release of turbidity, water diversions/bypass, and overall disturbance. The long-term effects of the action are expected to be beneficial by providing access to potentially 2 miles of upstream habitats, providing increased quality and diversity of in-channel habitats and improved riparian and floodplain vegetation. Overall, this project is expected to have beneficial effects on EFH.

## 10 CONCLUSIONS

Table 2 summarizes the effect determinations made for each of the species potentially occurring in the action area.

**Table 2. Determination of Effects Summary Table**

| Species | Effect Determination | Critical Habitat Determination |
|---|---|---|
| Marbled murrelet | No effect | No effect |
| Streaked horned lark | No effect | No effect |
| Yellow-billed cuckoo | No effect | No effect |
| Bull trout | No effect | No effect |
| Puget Sound Chinook salmon | May affect, likely to adversely affect | No effect |
| Puget Sound steelhead trout | May affect, not likely to adversely affect | No effect |

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