US Army Corps of Engineers®
Seattle District

City of Mountlake Terrace

Lake Ballinger Aquatic Ecosystem Restoration Project, Mountlake Terrace, Washington

Appendix B

Environmental Documentation

JULY 2020

From:	Mary Root
To:	Scuderi, Michael R CIV USARMY CENWS (US)
Cc:	Brad Thompson; Curtis Tanner; Emily Teachout; Molly Good
Subject:	[Non-DoD Source] FWCA Coordination for Lake Ballinger Section 206 Ecosystem Restoration project - USFWS Response
Date:	Friday, October 11, 2019 10:06:42 AM
Attachments:	fwdexternalrequestforfishandwildlifecoordinationa.zip

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Hi Mike:

I reviewed the enclosed materials and information describing the Lake Ballinger Section 206 Ecosystem Restoration Project and proposed alternatives along with my staff, Molly Good. Overall, we are in support of the Corps and City of Mountlake Terrace's plan to investigate the feasibility of restoring riparian areas in and around Hall Creek, starting at Lake Ballinger. Improving both the quantity and quality of riparian, floodplain, and wetland habitats here will likely yield benefits to native plants and animals (including perhaps Federal trust species, migratory birds, threatened and endangered species, etc.) that use and live in the area.

Enhancing the riparian community, improving channel diversity, and enhancing the wetland community are effective approaches to aquatic ecosystem restoration. We appreciate the use of the USFWS' Habitat Suitability Index Models to evaluate the anticipated restoration benefits for species such as yellow warbler, marsh wren, and cutthroat trout. Thus, we agree that of the 7 proposed alternatives, Alternative 5 - Upper and Lower Channel Work (i.e., the Tentatively Selected Plan) outlines an appropriate path forward in regard to broad restoration for riparian and wetland areas near Lake Ballinger.

Since the purpose and need of the proposed action calls for restoration for the benefit of native habitats (including potentially ~14.4 acres of enhanced habitat), fish, and wildlife, then we do not see a reason to develop additional conservation recommendations or measures in a Fish and Wildlife Coordination Act Report.

Thank you for coordinating with the USFWS. With this response, please consider your coordination requirements under the Fish and Wildlife Coordination Act, fulfilled.

Mary E. Root

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Lake Ballinger Aquatic Ecosystem Restoration Project
Mountlake Terrace, Washington
Substantive Compliance for Clean Water Act, Section 404(b)(1) Evaluation

1. Introduction. The purpose of this document is to record the evaluation and findings regarding this project pursuant to Section 404 of the Clean Water Act (CWA). The following action is covered by this document: The restoration of degraded ecosystem structures, functions and processes at Lake Ballinger Park, Mountlake Terrace, Washington.

The Seattle District, U.S. Army Corps of Engineers (USACE) and the Sponsor (City of Mountlake Terrace) have identified a number of problems resulting in ecosystem degradation and is proposing to implement aquatic ecosystem restoration of Hall Creek and associated habitats within Ballinger Park. The proposed Federal action would be within Ballinger Park, consistent with the Sponsor's Master Plan. The Corps has a unique opportunity to address problems in the study area by implementing the following restoration actions which are covered by this document:

- Invasive Plant Removal – Acres are listed in the Feasibility Report/Environmental Assessment (FR/EA)
- Riparian Planting – Area is detailed in FR/EA
- Overstory Planting
- Topographic modification (creation of hummocks)
- Physical Exclusion (including fencing and boardwalks)
- Removal of Impervious Surfaces (i.e., the tennis court, approximately 7,255 sq ft
- Channel Diversity Improvements – Length is detailed in FR/E
- Armor Removal – Volume is listed in FR/EA
- Off-Channel Connectivity—Side channels
- Channel Substrate Modification (gravel placement) – Depth specified in the FR/EA
- Instream Habitat Diversity-Large Woody Debris (LWD)
- Instream Habitat Diversity-Boulders
- Creation of Shallow Water Fringe Habitat
- Wetland Planting—Ponds
- Public Outreach and Education

The information contained in this document reflects the findings of the project record. Specific sources of information included the following:

a. Feasibility Report and Environmental Assessment – Lake Ballinger Aquatic Ecosystem Restoration Project, Mountlake Terrace, Washington.
b. City of Mountlake Terrace Ballinger Park Master Plan – August 28, 2015
c. CWA, 404(b)(1) Evaluation (see below)
d. Public Interest Review (see below)

This document addresses the substantive compliance issues of the CWA 404(b)(1) Guidelines [40 CFR §230.12(a)] and Public Interest Factors [33 CFR §320.4(a)] under the Regulatory Program of the Corps of Engineers, for application to Civil Works projects by analogy.

2. Description of the Proposed Discharge. The Lake Ballinger Aquatic Ecosystem Restoration Project includes the following fill actions into waters of the United States:

A soil plug consisting principally of native material is proposed along approximately 160 feet of the existing channel and will serve as the diversion point between the old and new Channel. This plug will include a notable amount of LWD and rock structure to ensure its long term stability and function. An excavator and dozer would be used to move the material into place.

The creation of shallow water fringe habitat in the four ponds is proposed and would consist of placing native excavated material in sections of the ponds to create a 10:1 slope. The placement of material would be via slow release from an excavator and the bucket would then be used to tamp and shape the slope. Silt curtains will be placed around the deposition areas to control turbidity. The specific amount of material to be placed will be developed during the detailed design phase. Approximately 0.31 acres of shallow water habitat will be created in the 4 ponds in the project area.

The placement of appropriately sized instream habitat diversity boulders is proposed throughout Hall Creek. Boulders would be clean and placed directly in the river on the upper reach of Hall Creek and would be placed in the dry at the lower channel prior to the diversion of water.

Removal of armor stone.

3. Project Need. The need for the proposed Federal action arises from the significant degradation of natural structures and processes that sustain ecological functions of the watershed such as: Hall Creek channelization and lost latitudinal connectivity to floodplain, in-stream habitat simplification, and altered floodplain and wetland vegetation.

4. Project Purpose. The purpose for the proposed Federal action is to work within the defined study area to enact solutions within the Corps' authority to restore ecosystem process, structure and function in the aquatic environment by addressing the problems identified during the feasibility study. Effort toward improving the aquatic ecosystem included addressing lack of wetland connectivity, removal of invasive plants, side channel connections, increasing channel complexity, increasing large woody debris, enhancing ponds and restoring degraded riparian conditions. Restoration of ecosystem structures, functions, and processes will benefit nationally and regionally significant resources in the study area.

5. Evaluation of Alternatives to Meet the Project Purpose. The final array of alternatives evaluated for this project are described below. Note, that alternatives 4 and 7 were not carried forward.

a. *Alternative 1 (No Action)*. The No-Action alternative is synonymous with the "Future Without-Project Condition". No project would be implemented by the Corps to achieve the planning objectives. Evaluation of the No Action Alternative is required by Corps Planning guidance and by NEPA. As described within the Feasibility Report/Environmental Assessment, Hall Creek will remain degraded under the No-Action Alternative. Habitat availability, quality, complexity, and connectivity will continue to deteriorate. The overall condition of the channel is anticipated to remain severely degraded.

b. *Alternative 2 – Riparian Enhancement / Lower Channel Armor Removal.* Alternative 2 is focused on improving habitat along the upper and lower reaches of Hall Creek through invasive removal and planting of native vegetation, and through removal of armor rock known to constrain channel productivity. These measures were identified as having the potential to provide high ecological lift in the proposed footprint without significant site alterations or structural components. Alternative 2 also includes public educational signage to help protect newly restored sensitive areas.

c. *Alternative 3 – Lower Channel Meander / LWD.* Alternative 3 includes measures focused on upper and lower reach restoration of Hall Creek to a more natural condition including all measures identified in previous alternatives. This alternative includes site alteration measures including a meandering new channel complete with LWD and substrate. The new channel is isolated from the old Hall Creek channel through use of a soil plug. A new channel crossing is included to maintain access to the park. Excavation material from the new channel will be added with imported soil to create hummocks to support diverse vegetation and direct surface water where needed. The existing Hall Creek channel would remain connected to the new channel at the lower end serving as a long vegetated off channel habitat. These measures were the primary features needed to completely address lost productivity in Hall Creek.

d. *Alternative 5 – Upper and Lower Channel Work with Pond Enhancement.* Alternative 5 includes measures focused on upper and lower reach restoration of Hall Creek to a more natural condition including all measures identified in previous alternatives. In addition, this alternative includes an emphasis on important pond habitat contributions to the overall site restoration. Addition of pond productivity improvements and associated wetland community establishment provides a full suite of main restorative function at the site

e. *Alternative 6 – Upper and Lower Channel Work with Pond Enhancement, Off channel Connectivity and Topographic Modifications.* Alternative 6 includes measures focused on upper and lower reach restoration of Hall Creek to a more natural condition including all measures identified in previous alternatives. In addition Alternative 6 would create and emphasis wetland habitats in the upper and lower reaches. This alternative includes construction of a wetland complex in the upper reach near the tennis court location to maximize wetland benefits. The constructed wetland includes physical exclusion measures like fencing to protect the vegetation. The alternative also includes construction

of dendritic channel(s) in the lower reach to emphasis wetland production and off channel habitat.

Findings. Please refer to chapter 3 of the FR/EA for details USACE rejected Alternative 1 because it would not meet the project purpose and need. Although alternatives 2 and 3 were best buy plans and cost effective, they were not selected because they would not meet the completeness criterion per the Council for Environmental Quality (CEQ). Although alternative 6 met the completion criteria for completeness, effectiveness, and efficiency was not selected because it did not met the criterion for acceptability due to the higher costs than other options and technical concerns over sustainability of specific measures included in this alternative. Alternative 5, Upper and Lower Channel Work with Pond Enhancement, was selected because it was a best buy plan, was determined to be cost effective, and met all CEQ selection criteria.

6. Significant Degradation, Either Individually or Cumulatively, to the Aquatic Environment

a. *Impacts on Ecosystem Function*. There will be some construction impacts on water quality at several stages of the restoration. A short-term pulse of elevated turbidity is expected during the initial redirection of water into the newly constructed channel. Turbidity could lower dissolved oxygen concentrations. However, due to the small scale of the project, it is expected that the impacts from turbidity resulting from the new channel would quickly pass through. A temporary turbidity plume is expected to move into Lake Ballinger but would dissipate as less turbid water moves into the system. No ESA listed species occur in the Hall Creek or Lake Ballinger, and therefore would not be affected. Localized shifting of sediments could continue after construction as the new channel adjusts. High flows during the winter and spring following construction may continue to mobilize sediments in the project area, potentially contributing to a small increase in turbidity. Excavation of the new channel will occur in the dry and the connection of to the newly constructed channel would occur during the established fish window of July 1 through September 30 Turbidity monitoring will occur during any sediment generating activities to ensure that the project does not exceed state standards. If samples indicate that water quality standards for turbidity are not achieved, work will be halted and modified so that standards can be met. Additional short-term turbidity impacts are expected as a result of Armor removal and boulder placement. Localized and short-term turbidity increases are also expected during the pond enhancement measure when material is placed to create suitable fringe habitat. The placement of material would be via slow release from an excavator and the bucket would then be used to tamp and shape the slope. Silt curtains will be placed around the deposition areas to control turbidity.

b. *Impacts on Recreational, Aesthetic, and Economic Values*. Recreational opportunities will be improved in the project area. The restored floodplain will improve fish and wildlife habitat, which in turn would enhance the recreation and aesthetic experience.

Short-term disruption to traffic and recreation would only occur during construction. Access to the site by visitors will be prohibited in all active construction areas for safety and security reason until construction is complete. The increased local traffic associated with construction will be localized and short in duration and would have no lasting impacts. Proper signage and flagmen will be used to address safety concerns and move traffic through the area as quickly as possible.

Findings. USACE has determined that there would be no significant adverse effects to aquatic ecosystem functions and values, nor to recreational, aesthetic, and economic values. The restoration will result in an increase of wetlands in the project area. Based on the analysis of the proposed work, the aquatic environmental restoration project will not have a significant environmental impact.

7. Appropriate and Practicable Measures to Minimize Potential Harm to the Aquatic Ecosystem

a. *Impact Avoidance Measures*. The primary avoidance measures in this aquatic ecosystem restoration project is the construction of the new channel in the dry by delaying the connection to Hall Creek, and in-water work would only occur during the established fish window.

b. *Impact Minimization Measures*. USACE would minimize impacts by ensuring the following Best Management Practices (BMPs) are adhered to:

- Work area is restricted to the footprint delineated on the project drawings.
- No net loss of wetland or sensitive aquatic sites.
- BMPs such as stormwater runoff prevention will be used to ensure that no unnecessary damage to the environment occurs.
- Connecting the newly excavated restored reach with the existing Hall Creek will occur during established in-water work windows (1 July through 15 September).
- During inlet/outlet construction and watering of the new channel, appropriate turbidity control measures (temporary coffer dam, silt curtains, or similar) would be used to isolate construction from Hall Creek and to minimize turbidity impacts.
- Fish Rescue measures will be employed in areas where direct disturbance in confined areas is anticipated.
- Utilization of marsh mats / swamp pads or temporary rock placement will be used to minimize impacts to wetland soils, as needed.
- Work will be done in the dry, to the extent practicable.
- All required de-watering activities during construction would use appropriate devices (i.e. pumps, sand bags, sumps). All water removed from the site would be discharged in a vegetated upland location, a de-siltation basin, or location that would not incur damage due to water discharge.
- Drive trains of equipment would not operate in the water.
- All equipment would be cleaned prior to in-water construction work.
- No refueling would occur near Hall Creek or Lake Ballinger.

- Construction equipment shall be regularly checked for drips or leaks.
- All temporary access roads and staging areas will be return to their natural condition upon completion of work.

c. *Compensatory Mitigation Measures*. There would be no compensatory mitigation measures because the work is an aquatic ecosystem restoration project, with the overall effect of enhancing floodplain, wetland, and aquatic habitat.

Findings. USACE has determined that all appropriate and practicable measures have been taken to minimize potential harm to the environment.

8. Other Factors in the Public Interest.

a. *Fish and Wildlife*. The USACE has found that there are minimal impacts to salmonid species, including Essential Fish Habitat (EFH) while no critical habitat is designated in the project area. The project is designed to provide long-term benefits to the species although some short-term negative impacts are expected to occur during initial construction. Minor short term impacts to wildlife are expected from the work occurring in the area. Disturbance will likely occur to wildlife during construction but these impacts would be temporary in nature. Overall, fish and wildlife will benefit from the improved ecological function of the site.

b. *Water Quality*. The USACE has concluded that this project would not violate Washington State Water Quality Standards. There would be a pulse of sedimentation following the connection of the newly constructed channel with Hall Creek, resulting in a short-term turbidity increase as the streambed adjusts to new flows. Localized shifting of sediment could continue after construction as the new channel adjusts to equilibrium. Small amounts of turbidity may also be generated by the removal of armor stone and the placement of habitat diversity boulders. Turbidity monitoring would occur during all work that is likely to increase sedimentation and would be slowed to counter these effects. The addition of shallow water fringe habitat in the ponds are also likely to generate turbidity. The placement of material would be via slow release from an excavator and the bucket would then be used to tamp and shape the slope. Silt curtains will be placed around the deposition areas to control turbidity. Long-term impacts of the project will be beneficial for water quality through the increased connection to the floodplain and improved riparian habitat. Increasing native vegetation and meandering Hall Creek would improve Lake Ballinger water quality by allowing for biofiltration and infiltration of runoff before entering the lake.

c. *Historic and Cultural Resources*. The Corps has coordinated its environmental review of impacts on cultural resources for NEPA with its responsibilities to take into account

effects on historic properties[1] as required by Section 106 of the National Historic Preservation Act (NHPA). The Corps has determined and documented the area of potential effect (APE) for both direct and indirect effects, as required at 36 C.F.R § 800.4 of the regulations implementing Section 106. The APE includes all proposed alternatives and staging and access areas. The Washington State Historic Preservation Officer (SHPO) agreed with our determination of the APE on 11 June 2019. We also notified the Tribes about the project on 10 June 2019 to identify properties to which they may attach religious or cultural significance or other concerns with historic properties that may be affected. The Tribes did not comment on the proposed project.

The Corps has conducted a records search and literature review of the Washington Information System for Architectural and Archaeological Records Data (WISAARD). The literature review and records search revealed that there are no properties listed in the National Register of Historic Places (NRHP) or the Washington State Historic Site Register in the project area, and no cultural resources have been recorded within the APE. The Corps completed inventory of the APE in July 2019, conducting pedestrian survey, and 31 shovel probes and one auger probe. One archaeological site (LB-1) was identified within shovel probe 27. Due to the presence of cultural materials Corps archaeologists monitored geotechnical boring within the APE in October 2019 and no cultural materials were observed.

The Corps has made a reasonable and good faith effort to identify historic properties that may be affected by the proposed project. The Corps has applied the NRHP evaluation criteria and determined site LB-1 not eligible for listing on the NRHP. Due to the lack of diagnostic artifacts, lack of contextual information, and the disturbed context of the surrounding area evident from the subsurface investigation, site LB-1 is not likely to yield information important to history or prehistory; it is not associated with events that have made a significant contribution to the broad patterns of our history; nor is it associated with the lives of persons significant in our past. Further, site LB-1 does not represent the work of a master or possess high artistic values. Based on this information and the extensive cultural modification of the APE due to the creation of Ballinger Lake Park, the Corps has determined site LB-1 not eligible for listing on the NRHP. Based on the cultural resources investigation within the project APE as well as the determination of site LB-1 not eligible for listing on the National Register, the Corps has found there would be no historic properties affected by the proposed project. The Corps notified the SHPO of our finding of No Historic Properties Affected on 13 December 2019. The SHPO concurred on 16 December 2019.

d. *Activities Affecting Coastal Zones*. USACE concludes the Lake Ballinger Aquatic Ecosystem Restoration Project is substantively consistent with the enforceable polices of

[1] Historic properties are those cultural resources that are eligible for inclusion or listed on the National Register of Historic Places.

the City of Mountlake Terrace Shoreline Master Program and will provide documentation of this consistency determination to WDOE for their review.

e. *Environmental Benefits*. This project will provide environmental benefits through the number of measures that will be implemented:

Channel diversity measures (i.e. armor removal, off-channel connectivity, channel substrate modification, LWD, boulders) are intended to provide benefits to the ecosystem through improvements in the quality and quantity of the channel including the bankline and substrate. Expected benefits would be a significant increase in hydraulic diversity and structures (LWD/boulders) within Hall Creek, which improve delivery of food sources for wildlife and resident fish and conditions appropriate for invertebrates and migratory birds. In-stream cover and refuge habitat for all organisms is provided. Future anadromous salmonid use in Hall Creek will also benefit from these improvements.

Riparian measures (i.e. invasive plant removal, riparian community enhancement, overstory planting, installing fencing & signage) are intended to provide benefits to the ecosystem through improvements in the quality and quantity of riparian vegetation. Benefits are delivered through significant increases in nutrient delivery to Hall Creek (e.g. insect drop), sustaining diverse habitat for food sources for wildlife and resident fish and visual and thermal cover for migratory birds during all seasons.

Wetland enhancement measures (i.e. creation of shallow water fringe habitat, wetland community enhancement, off-channel connectivity, removal of fill) are intended to provide benefits to the ecosystem through improvements in the quality and quantity of wetland vegetative conditions focused largely around pond habitats. Benefits are delivered through significant increases in nutrient uptake, water quality and organic delivery to wetland communities within the footprint. Wetlands will ensure diverse habitat for food sources for amphibians, resident wildlife and food for reptiles and migratory birds during all seasons.

Public outreach measures are intended to ensure sustainability and long-term benefits to the restoration project. Measures will focus on maximizing connectivity between the natural environment and humans within the footprint to enhance interpersonal connections and stewardship. Physical measures are intended to ensure sustainability of restoration features in light of on-going human presence, particularly for sensitive wetland and riparian plant communities.

f. *Navigation*. No adverse effects to navigation will occur as a result of the proposed work. The proposed project is not in designated navigable waters as defined by Section 10 of the Rivers and Harbors Act.

Findings. USACE has determined that this project is in the public interest based on review of the public interest factors.

9. Conclusions. Based on the analyses presented in the Feasibility Report and Environmental Assessment for the Lake Ballinger Aquatic Ecosystem Restoration, as well as the following 404(b)(1) Evaluation and General Policies analysis, USACE finds that this project complies with the substantive elements of Section 404 of the CWA.

404(b)(1) Evaluation [40 CFR §230]

Potential Impacts on Physical and Chemical Characteristics (Subpart C)

1. **Substrate [230.20]** The construction will move substrate around within the project area. The material excavated to create then new channel will be reused where possible (i.e. creation of shallow water fringe habitat in the ponds, and hummocks). Additionally, the bottom of the channel, in the lower channel portions, will be lined with gravels to facilitate invertebrate colonization and microbial prey resource colonies to improve diversity within the channel. Depth of the gravels will vary but range between 1 and 2 feet. The gravels will be delivered from off-site approved sources and placed mechanically following the channel construction. These gravels are not intended to serve as long term spawning habitat for anadromous salmon as they do not currently spawn in the creek. Further, there is a lack of long-term source of gravels upstream so this measure is primarily intended to facilitate faster channel maturation and improved ecological diversity for wildlife and resident fish. Areas of gravel placement are anticipated to shift over time and would be expected to accumulate in areas of moderate velocity and adjacent to instream structures where hydraulic conditions serve to disrupt fine sediment accumulation.

2. **Suspended Particulate/Turbidity [230.21]**. Minimal turbidity is expected curing construction as a result of the implementation of best management practices (BMPs) for sediment control. There will be a pulse of sedimentation following the opening and connection of the new channel, resulting in short-term turbidity increases as the streambed adjusts the new flow. Small amounts of turbidity may also be generated as a result of construction activities such as boulder placement, LWD placement, and armor removal. Turbidity monitoring will occur during these sediment generating activities. Localized shifting of sediments could continue sporadically after construction as the new stream and floodplain adjusts. High flows during the winter and spring could potentially mobilize sediments in the project area and could create small increases in turbidity over what is normally seen during high flow events. Construction of the new channel will occur in the dry to limit turbidity and appropriate turbidity control measures will be implemented when watering the new channel (temporary cofferdam, silt curtains, or similar). Localized and short-term turbidity increases are also expected during the pond enhancement measure when material is placed to create suitable fringe habitat. The placement of material would be via slow release from an excavator and the bucket would then be used to tamp and shape the slope. Silt curtains will be placed around the deposition areas to control turbidity.

3. **Water Quality [230.22].** Pervasive water quality issues (nutrients, DO, metals) are documented in the basin. In response to the flooding and chronic water quality problems in Lake Ballinger the jurisdictions in the basin have formed an Interlocal Agreement to develop a Strategic Action Plan to identify strategies to address flood and water quality issues in the basin. Only temporary and localized impacts to water quality are expected as a result of the construction phase. Work is not expected add any nutrients to the water that could affect the clarity, color, odor, or aesthetic value of the water, or that could reduce the suitability of Hall Creek for aquatic organisms or recreation. Long-term impacts of this project are likely to

result in an improvement to water quality by means of reconnection to floodplain and improved riparian habitat. The reconnected floodplain and associated wetlands will remove excess nutrients, suspended sediment, metals, and bacteria and would help moderate the temperature of the water. Plants would filter receding floodwaters, trapping fine-grained sediments and would capture pollutants. The increased floodplain connections and inundation would also result in increased groundwater recharge and subsequent discharge that could provide cooler water to the creek during low flows.

4. **Current Patterns and Water Circulation [230.23]** The project will change currents and water circulation within Hall Creek. The purpose of the aquatic ecosystem restoration project is to restore natural processes of current patterns and circulation at the project site due to degradation from channel incision and bank armoring that have simplified creek features. Changes in Hall Creek would include more diverse flow as a result of added LWD and diversity boulders. Reconnecting the floodplain would significantly alter the hydrology and hydraulics, restoring natural function. Creating the new channel with varying bank features and increased sinuosity would also restore natural function by adding habitat diversity and stream length.

5. **Normal Water Fluctuations [230.24]** None of the components of this project would affect the hydrologic regime of Hall Creek.

6. **Salinity Gradients [230.25]** The project would have no effect to salinity gradients in Hall Creek.

Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D)

1. Threatened and Endangered Species [230.30] The Corps evaluated potential effects to threatened and endangered species and made a determination of no effect for Chinook salmon, steelhead, bull trout, yellow-billed cuckoo, streaked horned lark, gray wolf, North American wolverine, Oregon spotted frog, southern resident killer whale, and marbled murrelet. This determination was made due to these species sensitivities to human presence, lack of suitable habitat, or because their presence is so transitory that any temporal affects to these species from construction activities would not be perceived as unusual, cause disruption of behavior or lead to measureable reduction in their prey base. Chinook and steelhead were previously in the system, but continued habitat degradation and blockage of access to the watershed have resulted in no naturally sustaining populations being present in Hall Creek.

2. Aquatic Food Web [230.31]. Negative impacts to aquatic invertebrates will be negligible due to the small footprint and the short duration of the project. The long-term improvement sot the project site are expected to benefit communities of prey items that are present.

3. Wildlife [230.32] Minor short-term impacts are expected as a result of the restoration activities. Disturbance will likely occur to wildlife during the construction phase but these effects would be temporary in nature. Vegetation clearing would result in some disruption to nesting birds. Impacts to nesting will be minimized by conducting clearing before nesting

season (April 1 to August 1). Long-term benefits to wildlife can be expected due to improved riparian conditions and a greater diversity of habitat.

Potential Impacts to Special Aquatic Sites (Subpart E)

1. **Sanctuaries and Refuges [230.40]**. There are no marine protected areas or sanctuaries at or near the project location.

1. **Wetlands [230.41]** No negative impacts are expected as a result of the aquatic ecosystem restoration project. Removal of impervious surfaces, and the reconnection of the creek to its floodplain is expected to create new wetlands and improve current conditions in existing wetlands. Wetlands would be created as a result of this project. No net loss of wetlands in the project area is expected. Refer to the FR/EA for the specific acreage of wetlands to be created.
2.
3. **Mudflats [230.42]** No mudflats are present at the project site.

4. **Vegetated Shallows [230.43]** This project includes the creation of shallow water fringe habitat within the ponds and is expected to result in a net benefit.

5. **Coral Reefs [230.44**] Not applicable.

6. **Riffle and Pool Complexes [230.45]** The project area currently lacks riffle pool complexes and has become simplified over time. The restoration would increase the number of riffle pool complexes and is expected to improve habitat conditions, amount, and complexity.

Potential Effects on Human Use Characteristics (Subpart F)

1. **Municipal and Private Water Supplies [230.50]** There will be no impact to on municipal or private water supplies as a result of this project.

2. **Recreational and Commercial Fisheries [230.51]** Recreational opportunities will be improved in the project area. The restored floodplain and creation of instream channel diversity would improve fish and wildlife habitat, which would enhance recreation and aesthetic experiences available to visitors.

3. **Water-related Recreation [230.52]**. The project would likely improve water related recreation due to fish and bird habitat improvements.

4. **Aesthetics [230.53]**. Aesthetics are expected to slightly change due to the new channel, plantings, and restored floodplain connectivity.

5. **Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves [230.54]**. There will be no impacts to any parks,

National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves.

Evaluation and Testing (Subpart G)

1. **General Evaluation of Dredged or Fill Material [230.60]** In general, the material for the creation of hummocks in the uplands and shallow water fringe habitat in the ponds would be reused and reworked from the new channel excavation. The bottom of the channel, in the lower channel portions, will be lined with gravels to facilitate invertebrate colonization and microbial prey resource colonies to improve diversity within the channel. Depth of the gravels will vary but range between 1 and 2 feet. The gravels will be delivered from off-site approved sources and placed mechanically following the channel construction.

2. **Chemical, Biological, and Physical Evaluation and Testing [230.61]**. No contaminated material will be used in the proposed action.

Action to Minimize Adverse Effects (Subpart H)

1. **Actions Concerning the Location of the Discharge [230.70]** The effects of the discharge are minimized by the work timing (period of low flows). The materials to be discharged would come from an approved site and would be clean. Material will also be reused from the new channel excavation to create hummocks and shallow water fringe habitat in the ponds.

2. **Actions Concerning the Material to be Discharged [230.71]** The amount of fill material will be restricted to the amount needed to adequately complete the restoration. The discharged material in the channel and the ponds will be clean, native material of varying size that would be re-used from the new channel excavation. Excess material will be taken offsite to an approved disposal location.

3. **Actions Controlling the Material after Discharge [230.72]** Turbidity monitoring will occur during sediment generating activities and BMPs will be in place to limit the impact to the creek. Localized shifting of sediments could continue sporadically after construction as the new channel adjusts. High flows during the winter and spring following construction may continue to mobilize sediment in the entire project area, potentially contributing to small increases in turbidity over what is normally seen during high flow events.

4. **Actions Affecting the Method of Dispersion [230.73]**. Localized and short-term turbidity increases are also expected during the pond enhancement measure when material is placed to create suitable fringe habitat. The placement of material would be via slow release from an excavator and the bucket would then be used to tamp and shape the slope. Silt curtains will be placed around the deposition areas to control turbidity. Additionally, the diversion of flow onto the floodplain would restore natural erosional, depositional, and successional processes

important for creating and sustaining riparian habitat such as pool riffle complexes, bars, shallow water, bars, and deep water off channel wetlands.

5. **Actions Related to Technology [270.74]** Appropriate machinery and methods of transport of the material for discharge will be employed. All machinery will be properly maintained and operated. No specific actions to minimize effects related to technology are needed.

6. **Actions Affecting Plant and Animal Populations [270.75]** Coordination with federal resource agencies to minimize impacts to fishery and wildlife resources has occurred. USACE has concluded there would only be temporary disturbance as a result of construction and no long-term effects to plant, fish, and wildlife resources.

7. **Actions Affecting Human Use [230.76]** The restoration project would not result in damage to aesthetic features of the aquatic landscape nor human uses. The Corps has taken all appropriate and practicable steps to assure minimal impacts to human use, safety and general appreciation of the area. A traffic control plan will be developed and implemented to minimize traffic impacts during construction. Construction would occur during daylight hours to minimize noise impacts to nearby houses.

8. **Other actions [230.77]** BMPs will be used during the proposed construction to ensure that no unnecessary damage to the environment occurs.

General Policies for the Evaluation of Public Interest [33 CFR §320.4, used as a reference]

2. **Public Interest Review [320.4(a)]** USACE finds this aquatic ecosystem restoration to be in compliance with the 404(b)(1) guidelines and not contrary to the public interest.

3. **Effects on Wetlands [320.4(b)]** No negative effect on wetlands is expected as a result of this project. Removal of impervious surfaces, and the reconnection of the creek to its floodplain is expected to create new wetlands and improve current conditions in existing wetlands. Wetlands would be created as a result of this project. No net loss of wetlands in the project area is expected. Refer to the FR/EA for the specific acreage of wetlands to be created.

4. **Fish and Wildlife [320.4(c)]** USACE has found that this project is not expected to result in long-term impacts to fish and wildlife. Any effects would be temporary and minimal.

5. **Water Quality [320.4(d)]** The project would involve a discharge of fill material into waters of the United States. USACE does not issue permits for its own activities. Nevertheless, USACE will comply substantively with Section 404 of the CWA and USACE has concluded that the project meets the conditions for general certification under Section 401 fo the CWA by means of functional analogy under Nationwide Permit (NWP) 27, and would obtain a water quality certification under Section 401 prior to construction. When project drawings are advanced in the design phase, the Corps will provide these along with a functional analogy memorandum to the Washington State Department of Ecology to certify that the

action would not violate established water quality standards. USACE will adhere to all state water quality criteria during installation. The project construction footprint exceeds one acre, therefore, Section 402 of the CWA applies and the USACE would ensure the permit is obtained prior to the start of construction.

6. **Historic, Cultural, Scenic, and Recreational Values [320.4(e)]** The Corps has coordinated its environmental review of impacts on cultural resources for NEPA with its responsibilities to take into account effects on historic properties[2]as required by Section 106 of the National Historic Preservation Act (NHPA). The Corps has determined and documented the area of potential effect (APE) for both direct and indirect effects, as required at 36 C.F.R § 800.4 of the regulations implementing Section 106. The APE includes all proposed alternatives and staging and access areas. The Washington State Historic Preservation Officer (SHPO) agreed with our determination of the APE on 11 June 2019. We also notified the Tribes about the project on 10 June 2019 to identify properties to which they may attach religious or cultural significance or other concerns with historic properties that may be affected. The Tribes did not comment on the proposed project.

   The Corps has conducted a records search and literature review of the Washington Information System for Architectural and Archaeological Records Data (WISAARD). The literature review and records search revealed that there are no properties listed in the National Register of Historic Places (NRHP) or the Washington State Historic Site Register in the project area, and no cultural resources have been recorded within the APE. The Corps completed inventory of the APE in July 2019, conducting pedestrian survey, and 31 shovel probes and one auger probe. One archaeological site (LB-1) was identified within shovel probe 27. Due to the presence of cultural materials Corps archaeologists monitored geotechnical boring within the APE in October 2019 and no cultural materials were observed.

   The Corps has made a reasonable and good faith effort to identify historic properties that may be affected by the proposed project. The Corps has applied the NRHP evaluation criteria and determined site LB-1 not eligible for listing on the NRHP. Due to the lack of diagnostic artifacts, lack of contextual information, and the disturbed context of the surrounding area evident from the subsurface investigation, site LB-1 is not likely to yield information important to history or prehistory; it is not associated with events that have made a significant contribution to the broad patterns of our history; nor is it associated with the lives of persons significant in our past. Further, site LB-1 does not represent the work of a master or possess high artistic values. Based on this information and the extensive cultural modification of the APE due to the creation of Ballinger Lake Park, the Corps has

[2] Historic properties are those cultural resources that are eligible for inclusion or listed on the National Register of Historic Places.

determined site LB-1 not eligible for listing on the NRHP. Based on the cultural resources investigation within the project APE as well as the determination of site LB-1 not eligible for listing on the National Register, the Corps has found there would be no historic properties affected by the proposed project. The Corps notified the SHPO of our finding of No Historic Properties Affected on 13 December 2019. The SHPO concurred on 16 December 2019.

7. **Effects on Limits of the Territorial Sea [320.4(f)].** Not applicable.

8. **Consideration of Property Ownership [320.4(g)].** Federal involvement in ecosystem restoration is supported in law and Executive Order.

9. **Activities Affecting Coastal Zones [320.4(h)].** USACE concludes that the aquatic ecosystem restoration is consistent with the applicable policies and regulations specified in the Mountlake Terrace Shoreline Master Program.

10. **Activities in Marine Sanctuaries [320.4(i)].** Not applicable.

11. **Other Federal, State, or Local Requirements [320.4(j)].**

a. National Environmental Policy Act. USACE has determined that an Environmental Assessment is the appropriate level of documentation for NEPA. The action is not categorically excluded and environmental impacts are not likely to be significant which would require an Environmental Impact Statement (EIS).

b. Endangered Species Act. The Corps evaluated potential effects to threatened and endangered species and made a determination of no effect for Chinook salmon, steelhead, bull trout, yellow-billed cuckoo, streaked horned lark, gray wolf, North American wolverine, Oregon spotted frog, southern resident killer whale, and marbled murrelet. This determination was made due to these species sensitivities to human presence, lack of suitable habitat, or because their presence is so transitory that any temporal affects to these species from construction activities would not be perceived as unusual, cause disruption of behavior or lead to measureable reduction in their prey base. Chinook and steelhead were previously in the system, but continued habitat degradation and blockage of access to the watershed have resulted in no naturally sustaining populations being present in Hall Creek.

c. Clean Water Act. The Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) is more commonly referred to as the Clean Water Act (CWA). This act is the primary legislative vehicle for Federal water pollution control programs and the basic structure for regulating discharges of pollutants into waters of the United States. The CWA was established to “restore and maintain the chemical, physical, and biological integrity of the nation’s waters.” The CWA sets goals to eliminate discharges of pollutants into navigable waters, protect fish and wildlife, and prohibit the discharge of toxic pollutants in quantities that could adversely affect the environment.

The Corps does not issue Section 404 permits to itself for its own civil works activities, but must comply with the substantive requirements of Section 404 and 401 under the CWA. The Corps has concluded the proposed project is functionally analogous to the General, Regional and State conditions for Nationwide Permit 27 (Environmental Restoration) and complies with Sections 404 and 401 of the CWA.

Since the project footprint is greater than 1 acre, the Corps will have to secure a National Pollutant Discharge Elimination System (NPDES) permit from EPA. As part of the permit documentation, a Stormwater Pollution Protection Plan (SWPPP) will be developed for the care and management of stormwater flows coming from the construction site as part of the Design and Implementation Phase.

d. Coastal Zone Management Act. The Coastal Zone Management Act of 1972 (CZMA), as amended, requires Federal agencies to carry out their activities in a manner that is consistent to the maximum extent practicable with the enforceable policies of the approved Coastal Zone Management Program. The proposed action is considered consistent to the maximum extent practicable with the State Program. USACE will provide documentation of this consistency determination to WDOE for their review.

e. Marine Protection, Research, and Sanctuaries Act. Section 102 of the Marine Protection, Research, and Sanctuaries Act authorizes the EPA to promulgate ocean dumping criteria and designate ocean disposal sites. This project will not involve ocean disposal of dredged material.

f. National Historic Preservation Act. Section 106 of the NHPA (16 U.S.C. 470f) requires that Federal agencies evaluate the effects of Federal undertakings on historical, archeological, and cultural resources and afford the Advisory Council on Historic Preservation opportunities to comment on the proposed undertaking if there is an adverse effect to an eligible Historic Property. The lead agency must examine whether feasible alternatives exist that will avoid eligible cultural resources. If an effect cannot reasonably be avoided, measures must be taken to minimize or mitigate potential adverse effects.

The Corps has coordinated its environmental review of impacts on cultural resources for NEPA with its responsibilities to take into account effects on historic properties[3]as required by Section 106 of the National Historic Preservation Act (NHPA). The Corps has determined and documented the area of potential effect (APE) for both direct and indirect effects, as required at 36 C.F.R § 800.4 of the regulations implementing Section 106. The APE includes all proposed alternatives and staging and access areas. The Washington State Historic Preservation Officer (SHPO) agreed with our determination of the APE on 11 June 2019. We also notified the Tribes about the project on 10 June 2019 to identify properties to which they

[3] Historic properties are those cultural resources that are eligible for inclusion or listed on the National Register of Historic Places.

may attach religious or cultural significance or other concerns with historic properties that may be affected. The Tribes did not comment on the proposed project.

g. Fish and Wildlife Coordination Act. The Fish and Wildlife Coordination Act (FWCA) (16 USC 470) requires that wildlife conservation receive equal consideration and be coordinated with other features of water resource development projects. A FWCA Report is not required for the aquatic restoration project as the project purpose is restoration for the benefit of fish and wildlife and fully meets the intent of the FWCA.

12. Safety of Impoundment Structures [320.4(k)]. Not applicable.

13. Floodplain Management [320.4(l)]. The project is in compliance. USACE considered alternatives to reduce hazards and risks associated with floods and to minimize the impacts of floods on human safety, health and welfare, and restoring and preserving the natural and beneficial values of the base floodplain. Disposal operations would not alter any floodplain areas.

13. Water Supply and Conservation [320.4(m)]. There would be no impact to water supply and conservation.

14. Energy Conservation and Development [320.4(n)]. Not applicable.

15. Navigation [320.4(o)]. Not applicable

16. Environmental Benefits [320.4(p)]. This project will provide environmental benefits through the number of measures that will be implemented:

Channel diversity measures (i.e. armor removal, off-channel connectivity, channel substrate modification, LWD, boulders) are intended to provide benefits to the ecosystem through improvements in the quality and quantity of the channel including the bankline and substrate. Expected benefits would be a significant increase in hydraulic diversity and structures (LWD/boulders) within Hall Creek, which improve delivery of food sources for wildlife and resident fish and conditions appropriate for invertebrates and migratory birds. In-stream cover and refuge habitat for all organisms is provided. Future anadromous salmonid use in Hall Creek will also benefit from these improvements.

Riparian measures (i.e. invasive plant removal, riparian community enhancement, overstory planting, installing fencing & signage) are intended to provide benefits to the ecosystem through improvements in the quality and quantity of riparian vegetation. Benefits are delivered through significant increases in nutrient delivery to Hall Creek (e.g. insect drop), sustaining diverse habitat for food sources for wildlife and resident fish and visual and thermal cover for migratory birds during all seasons.

Wetland enhancement measures (i.e. creation of shallow water fringe habitat, wetland community enhancement, off-channel connectivity, removal of fill) are intended to provide benefits to the ecosystem through improvements in the quality and quantity of wetland vegetative conditions focused largely around pond habitats. Benefits are delivered through significant increases in nutrient uptake, water quality and organic delivery to wetland communities within the footprint. Wetlands will ensure diverse habitat for food sources for amphibians, resident wildlife and food for reptiles and migratory birds during all seasons.

Public outreach measures are intended to ensure sustainability and long-term benefits to the restoration project. Measures will focus on maximizing connectivity between the natural environment and humans within the footprint to enhance interpersonal connections and stewardship. Physical measures are intended to ensure sustainability of restoration features in light of on-going human presence, particularly for sensitive wetland and riparian plant communities.

17. Economics [320.4(q)]. No impacts to economics are anticipated.

18. Mitigation [320.49(r)]. No compensatory mitigation is required for the project.

BALLINGER PARK
ECOSYSTEM RESTORATION
SNOHOMISH COUNTY, WASHINGTON

APPENDIX B-3

Ecosystem Outputs

December 2019

Integrated Feasibility Report and Environmental Assessment

US Army Corps
of Engineers®
Seattle District

BALLINGER PARK SECTION 206

ECOSYSTEM RESTORATION PROJECT

HABITAT BENEFITS MODEL

December 2019

US Army Corps
of Engineers®
Seattle District

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HABITAT EVALUATION PROCEDURE (HEP) METHODS AND RESULTS

1.0 INTRODUCTION

In order to evaluate measures and formulate alternatives for this project the Habitat Evaluation Procedure (HEP) model was used to assess habitat benefits. Details about the model are provided below. This model was used as a method for comparing existing and future without-project habitat conditions to those conditions that would result from proposed restoration alternatives (with- project conditions).

A HEP is a tool for comparing existing and proposed future habitat conditions for a species or assemblage of species in a particular geographic area. A HEP is comprised of one or more Habitat Suitability Indices (HSI), which are models for calculating the habitat suitability of an area for a single species or assemblage of species. A set of variables that represent the life requisites for the species (e.g. percent cover, water depth, tree height) is combined into a mathematical model. The variables are then measured in the field and their corresponding index values are inserted into the model to produce a score that describes existing habitat suitability. The value is an index score between 0 and 1. The mathematical models used for this HEP are derived from existing models, developed by the USFWS, and are certified by the Corps of Engineers for use as planning models in Corps projects.

Selection of species to include in the HEP model is based on several criteria. First and foremost, the species geographic range must include the project vicinity. The species selected must also utilize the habitat type or types that are currently present, or are proposed for restoration. Species with existing HSI models are preferred because the existing models have been extensively peer reviewed. Suitable HSI models must include habitat variables for which data collection is possible, given the availability of time and resources. Finally, variables must also show a change in score between the existing and proposed condition. If the project does not affect the suitability index score for a species, it will not be possible to quantify an effect.

The HEP for this project is directed at the riparian, pond, and aquatic species habitats. The project area was divided into polygons representing the three habitat types found in the project area. (riparian, stream and pond). Although only a few species have been selected out of the many that could be present in the project area, the selected species are representative of guilds that currently do or could utilize habitats in the project area, or are representative of species of concern in the project area.

The individual HSIs for various habitat parameters for each species are combined to yield an overall index score for the species. Scores for each species can be used individually or combined to yield an overall index score for a site for multiple species or species assemblages.

For each habitat type assessed for the proposed project an HSI score is developed for both the Future without project and for the project alternatives. The HSI values are multiplied by the acreage of each habitat polygon to produce a value for habitat units (HU) for each polygon. For this analysis, HUs are assumed to be equal in value between the different habitats.

2.0 EXISTING HABITATS AND SELECTED MODEL SPECIES

The HEP model used for this project is a community-based model with multiple species selected to represent other species that function similarly in habitats found in the project area. The three
species selected for the model are expected to be indicators of habitat conditions for a wide variety of additional species. The models selected are certified by the U.S. Army Corps of Engineers for use in evaluating the benefits of Aquatic Ecosystem Restoration Projects. Table 1 provides a summary of species selected for the model, as well as references.

Table 1 Selected representative species and references for model development.

Habitat	Common Name	Scientific Name	Model Source
Riparian Habitat	Yellow Warbler	*Dendroica petechia*	Schroeder 1982
Pond Habitat	Marsh Wren	*Cistothorus palustris*	Gutzwiller and Anderson 1987
Aquatic Habitat	Cutthroat Trout	*Oncorhynchus clarkii*	Hickman and Raleigh 1982

Three species were chosen to represent the riparian , pond, and aquatic communities for the HEP analysis, including yellow warbler (*Dendroica petechia*), Marsh Wren (*Cistothorus palustris*), and Cutthroat trout (*Oncorhynchus clarkii*). These species were chosen as there are existing models developed for each of them. In addition, each of these species represents a particular niche or guild of species that utilize these habitats in the project area. The yellow warbler represents migratory neotropical birds that utilize riparian scrub-shrub habitat for nesting. Marsh Wren is a bird species dependent on pond fringe structure for food and habitat. Cutthroat trout is a salmonid species that inhabits Hall Creek in the Ballinger Park basin.

2.1.1 Yellow Warbler

The yellow warbler was selected to represent neotropical migratory birds that may use the riparian habitat in Ballinger Park. Yellow warblers are a breeding bird throughout the U.S. The existing model and habitat requirements are described in Schroeder (1982). The yellow warbler prefers riparian habitats composed of abundant, moderately tall, deciduous shrubs ranging in height from 1.5 to 4 meters. Shrub densities between 60 and 80% are considered optimal and coniferous areas are avoided. Greater than 90% of prey are insects and foraging takes place primarily on small limbs in deciduous foliage. Nests are generally located 0.9 to 2.4 meters

above the ground in willows, alders, and other hydrophytic shrubs and trees, including box elders and cottonwoods. Male yellow warblers have greater mating success in shrubs less than 3 meters tall.

2.1.2 Marsh Wren

Marsh Wren was selected to represent species that may use the pond habitat of Ballinger Park. Marsh Wren are bird species found throughout North America wherever suitable freshwater and saltwater wetland habitats occur. The existing model is described in Gutzwiller and Anderson (1987) is summarized below. The model covers reproductive and cover requirements for marsh wren. Marsh Wren nest in dense fringe emergent vegetation adjacent to open water. The birds are insectivores, gleaning insects from surrounding vegetation , the marsh floor and flycatching.

2.1.3 Cutthroat Trout

The Cutthroat trout model was selected to represent native fish habitat of Hall Creek which runs through Ballinger Park. The existing model and habitat requirements are described in Hickman and Raleigh (1982). Optimal Cutthroat trout Riverine habitat is characterized by clear, cold water; a silt-free rocky substrate in riffle-run areas; an approximately 1:1 pool-to-riffle ratio with areas of slow, deep water; well-vegetated stream banks; abundant instream cover; and relatively stable water flow, temperature regimes, and stream banks (Raleigh and Duff 1980).

3.0 MODEL PARAMETERS

3.1.1 Yellow Warbler

The HSI for yellow warbler includes the following

variables: V_1 = % deciduous shrub cover *(Schroeder 1982)*

Percent Cover	SI
0	0
25	0.4
50	0.75
60	1.0
80	1.0
90	0.8
100	0.6

V_2 = Average height of deciduous shrub canopy height *(Schroeder 1982)*

Canopy Height (meters)	SI
0	0
1	0.5

2+	1.0

V_3 = % canopy comprised of hydrophytic shrubs *(Schroeder 1982)*

Percent Hydrophytic Shrubs	SI
0	0.1
25	0.3
50	0.55
75	0.8
100	1.0

3.1.2 Marsh Wren

The HSI model for Marsh Wren includes the following cover and reproduction variables:

V_1 = Growth form of emergent hydrophytes. Ordinal scale dependent upon type of emergent vegetation *(Gutzwiller and Anderson 1987)*

Growth form of emergent hydrophytes	SI
cattails, cordgrasses, bulrushes	1.0
bluejoint reedgrass, reed canarygrass, sedges	0.5
buttonbush, mangrove	0.1
Other growth forms not listed	0.0

V_2 = Percent canopy cover of emergent herbaceous vegetation *(Gutzwiller and Anderson 1987)*

Percent canopy cover of emergent herbaceous vegetation	SI
0	0.2
50	0.1
80 to 100	1.0

V_3 = Mean water depth (cm) *(Gutzwiller and Anderson 1987)*

Mean water depth (cm)	SI
0	0
10	0.6
15	1.0

V_4 = Percent canopy cover of woody vegetation *(Gutzwiller and Anderson 1987)*

Percent canopy cover of woody vegetation	SI
100	0
50	0.5
0	1.0

3.1.3 Cutthroat Trout

The HSI model for optimal riverine cutthroat trout was used (Model 1) which is an acceptable alternative to main model in Cutthroat model documentation. Model 1 includes the following variables:

V_1 = Clear cold water with an average maximum summer temperature of < 22 C

Temp (°C)	Suitability Index
>22	0
<22	1.0

V_2 = An approximate 1:1 pool-riffle ratio *(Hickman and Raleigh 1982)*

Pool-Riffle ratio	Suitability Index
Not 1:1	0
Approx 1:1	1.0

V_3= Well Vegetated, stable stream banks *(Hickman and Raleigh 1982)*

Bank Vegetation	Suitability Index
Not well vegetated	0
Well vegetated	1.0

V_4= greater or equal to 25% of stream area providing cover *(Hickman and Raleigh 1982)*

Instream cover	Suitability Index
<25%	0
>25%	1.0

V_5 = Relatively stable water flow regime, < 50% annual fluctuation from average annual daily flow *(Hickman and Raleigh 1982)*

Stream fluctuation	Suitability Index
>50%	0
<50%	1.0

V_6= Relatively stable summer temperature regime, averaging about 13 C ± 4 C *(Hickman and Raleigh 1982)*

Temp (°C)	Suitability Index
>13 C ± 4 C	0
<13 C ± 4 C	1.0

V_7 = Relatively silt free rock substrate in riffle-run areas *(Hickman and Raleigh 1982)*

Substrate	Suitability Index
Not silt free	0
Silt free	1.0

This model was chosen over the main model detailed in the HEP documentation because of several factors. First, data was not readily available a number of the variables in the main model. Second, model 1 covered the main factors important to cutthroat trout life history. Finally, interpretation of which project measure would result in a change in HSI variables was clearer with the use of model 1. The ECO-PCX verified the use of model 1, provided an explanation of the model application was provided (Nate Richards, per. com.. 20 February 2019).

4.0 MODEL UTILIZATION

The HEP model is a function of the results of the individual species HSIs. Table 2 provides the mathematical equation for calculating the HSIs for each species.

Table 2 HEP model.

Yellow Warbler: Breeding/Nesting Habitat	V_1 = Percent deciduous shrub crown cover V_2 = Average height of deciduous shrub canopy V_3 = Percent of shrub canopy comprised of hydrophytic shrubs (willow, etc.) $HSI_{Yellow\ Warbler} = (V_1 + V_2 + V_3)/3$

Marsh Wren: Cover Reproduction	V_1 = Percent tree canopy closure V_2 = Percent of trees in 2.5 to 15.2 cm dbh size class V_3 = Percent shrub crown cover V_4 = Average height of shrub canopy $HSI_{Marsh\ Wren} = (V_1 x\ V_2 x\ V_3)^{1/3} x\ V_4$
Cutthroat: Adult and Juvenile	V1 = Clear cold water with an average maximum summer temperature of < 22 C V2 = An approximate 1:1 pool-riffle ratio V3 = Well Vegetated, stable stream banks V4= greater or equal to 25% of stream area providing cover V5= Relatively stable water flow regime, < 50% annual fluctuation from average annual daily flow V6= Relatively stable summer temperature regime, averaging about 13 C ± 4 C V7 = Relatively silt free rock substrate in riffle-run areas $HSI_{Cutthroat} = (V_1 + V_2 + V_3 + V_4 + V_5 + V_6 + V_7) /7$

To assess existing conditions, input data for the model was collected at the proposed measure sites and by the use of existing reports, modeling, aerial photographs, GIS analysis, and best professional judgment. The input data required varies substantially from one HSI to another. Measured variables were then assigned an SI value (unitless number from 0 to 1) based on the suitability curve or discreet suitability values or thresholds developed in the model.

Acreages for the model were developed by mapping the areas where measures were both implementable and would have an effect on habitat quality. The acreage for with- and without project conditions is the same to ensure an objective comparison of habitat values before and after implementation of restoration measures.

A basic assumption of variable scoring for vegetation cover was that invasive species don't provide habitat quality in the purest sense. If invasive species dominated a particular vegetation cover then a score of zero was given for that variable. This change was coordinated with the ECO-PCX (Nate Richards, per. com.. 15 January 2019).

Assumptions for scoring the no-action alternative were based on the projection of the site if no restoration measures were implemented. The vegetation in the Park would show little improvement in function and habitat quality, with invasive species spreading over time. Both tree and shrub cover and height would show little improvement. The amount of off-channel habitat would remain the same.

Assumptions for scoring the HEP model under with-project conditions were based on the

restoration of riparian, pond and aquatic habitat resulting from implementation of the proposed measures. Proposed measures include invasive plant removal, riparian planting, emergent planting, modifying shallow water pond habitat, and improving stream characteristics.

5.0 HABITAT UNITS

The HSIs are multiplied by the area of forested, shrub, or aquatic habitat, respectively that may be affected by a measure. This final score is called a Habitat Unit (HU). HUs for each habitat type were summed to identify the total amount of HUs for each measure footprint. The future with- and without-project HUs are compared to determine the net difference (either positive or negative) between measures. Depending on the management measures implemented, benefits may or may not be realized immediately. To account for these differing accumulations of benefits over the 50 year planning period, the benefits were scored in the following increments: 0-5, 6-10, 11 to 25, and 26-50. Years 0-5 represent the initial response to project implementation including establishment of vegetation in disturbed areas that are reconnected to the floodplain. It is expected shrubs and trees will continue to mature in years 6-10, followed by mature vegetation in years 21-50. These values are averaged creating an output of average annual HUs. Table __summarizes the average annual habitat units assigned to each measure. It should be noted that the average annual HUs listed represent the net increase in output above and beyond the without-project condition (i.e., the no-action alternative). The net values were compared to costs via cost effectiveness/incremental cost analysis (CE/ICA) for evaluation and alternatives formulation. For this analysis habitat types can change due to restoration measures. For the analysis it is assumed that HUs for each habitat type are directly comparable.

Lake Ballinger Park Habitat Areas

6.0 REFERENCES

Gutzwiller, K.J., and S.H. Anderson. 1987. Habitat suitability index models: marsh wren. U.S. Dept. Int., Fish Wildl. Serv. FWS/OBS-882/10.139. 13 pp.

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Lake Ballinger Aquatic Ecosystem Restoration Project Monitoring & Maintenance Plan

February 2020

Watershed, WRIA #8

Prepared by:

Mike Scuderi[1]

Jeffrey F. Dillon[1]

[1] *US Army Corps of Engineers, Seattle District*

Project funded by Army Corps of Engineers, City of Mountlake Terrace

Construction Anticipated 2022-2023

Monitoring Year 1: 2023

Monitoring Year 3 2025

Monitoring Year 5: 2027

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APPENDIX A

Monitoring Locations for Selected Activities
(To be developed during the Design and Implementation Phase)

Project Summary

The study is being conducted under the Authority of Section 206 of the Continuing Authorities Program (CAP), which is to:

"Develop aquatic ecosystem restoration projects that improve the quality of the environment, are in the public interest, and are cost effective consistent with the current policies and procedures governing projects of the same type which are specifically authorized by Congress."

Refer to the Feasibility Report and Environmental Assessment for additional information.

1.1. Location and Setting

The study area is located in the city of Mountlake Terrace, Washington (Figure 1). The specific areas of focus for this study are Hall Creek, which runs north-south, and Ballinger Park, which are located in the Lake Ballinger/McAleer Watershed. Ballinger Park was once a public golf course but is now a passive park used for low intensity recreation. The City of Mountlake Terrace, which owned the golf course, allowed this park to return to a more natural condition starting in 2012. Hall Creek runs through Ballinger Park to where the creek enters the north end of Lake Ballinger via an outlet structure operated by Mountlake Terrace.

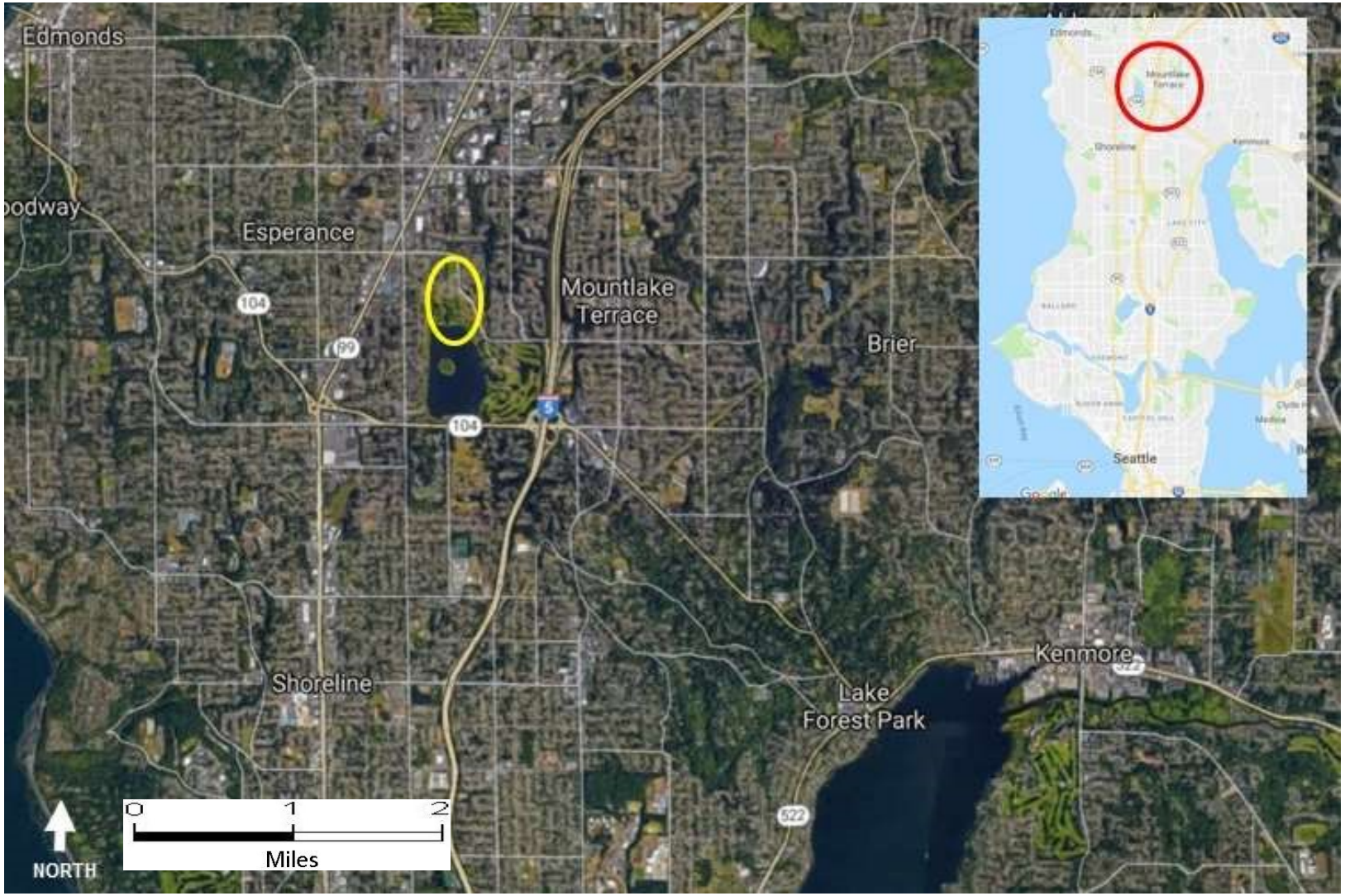

Figure 1. Study Area

Lake Ballinger and Ballinger Park are located in the city of Mountlake Terrace, approximately 14 miles northeast of downtown Seattle, WA (see inset – red circle indicates general project location relative to Seattle and neighboring cities and waterways). The study area is circled in yellow in the main figure (Source: Google Earth).

1.2. Project Purpose, Objectives and Goals

The purpose for the proposed Federal action is to work within the defined study area to enact solutions within the US Army Corps of Engineer's (USACE's) authority to restore ecosystem process, structure and function in the aquatic environment by addressing the primary problems identified during the feasibility study. Effort toward improving the aquatic ecosystem should include addressing lack of wetland connectivity and removal of invasive plants, side channel connections, increasing channel complexity, increasing large woody debris, increasing pond depths and restoring degraded riparian conditions. Restoration of ecosystem structures, functions, and processes will benefit nationally and regionally significant resources in the study area.

Based on the problems identified in the study area, planning objectives include the following and consist of an effect, subject, location and timing per engineering Regulation (ER) 1105-2-100:

- Restore degraded ecosystem function and processes to a more natural condition within Ballinger Park for the 50-year period of analysis.
- Improve the quality, and complexity of ponds and wetland function within Ballinger Park for the 50-year period of analysis.
- Decrease effects of urbanization and improve wetland function in the study area for the 50-year period of analysis.
- Reconnect and restore the quantity, quality, and complexity of native riparian and floodplain habitats within Ballinger Park for the 50-year period of analysis.

The overall goal of this project is to contribute to long term habitat restoration by focusing on site specific objectives at the scale of the project footprint. The goals include creation of a high functioning system of habitats with measurable environmental benefits to the local wildlife and resident fish as well as migratory species that can be a source of appreciation by the local residents. An additional goal is also to provide a landscape consistent with functional anadromous fish habitat in the event of future salmonid colonization and use. These goals are consistent with the Sponsor's long-term, community-supported restoration planning goals in the Ballinger Park Master Plan. See Table 1 for more detail on project goals.

Table 1. Project Goals

Specific Goals	***Measures***	***Objectives***	***Indicators***
Provide low-velocity rearing, foraging, and refuge areas for resident fish,	Channel Diversity Improvements Off-Channel Connectivity—Side channels; Large Woody Debris	Create areas of deeper, lower velocity water capable of sheltering resident fish, amphibians and invertebrates	Resident fish usage and diverse invertebrate communities. Presence of native amphibians and other riverine species
Improve Riparian habitat; exclude invasive plants, provide wood, nutrients, terrestrial insects for fish and wildlife	Riparian Planting Overstory Planting	Establish a continuous vegetated buffer of various width in new channel and along existing channel, and additional plantings outside the buffer.	Buffer extent and condition. Reduction in invasive vegetation
Improve Pond Habitat; exclude invasive plants; improve pond buffer, create shallow water habitat	Wetland Planting; Creation of Shallow Water Fringe Habitat	Enhance buffer around pond and create shallow water habitat	Reduction in invasive vegetation, Buffer extent and condition; persistence of shallow water areas.

These sensitive issues also warrant special attention:

- Water elevations on adjacent properties
- Sediment effects on pools, channel, dendrites, and riparian vegetation
- Invasive vegetation not allowed to flourish

Selected indicators of project performance and sensitive issues will be monitored and compared to performance targets, as appropriate. No performance standards were established in the permit conditions by regulatory agencies. Instead, performance targets were established by the design team, in cooperation with monitoring biologists and ecologists. Table 2 lists indicators and performance targets, with the timing for monitoring and a descriptions of anticipated concluding conditions.

Table 2. Project Objectives and Performance Standards

Indicator	Performance Target	Timing (Year)	Conclusion
Riparian cover	Average width of riparian forest canopy exceeds 80-feet and cover averages 70% or more. No dead areas exist larger than 20sqft. Native plant survival exceeds 80%. Based on NWS observations of restoration plant growth on several of restoration projects in the immediate area, canopy cover is a suitable measure to use.	Corps: 2023 2024 2026	Riparian forests are established. Some die off is good in that snags will be created.
Invasives	Extent of invasive plants is significantly lower than before the project (ideally less than ten (10) % aerial coverage for specific problem species). Noxious weeds will be dealt with on a case by case basis. Reed canary grass will be expected to be suppressed but not eliminated from project area.	Corps: 2023 2024 2026	Weed control is effective
Invertebrate prey presence	Invertebrate prey organisms are present in the stream channel and in any remnant or distributary channels during spring and summer	Corps: 2023 2024 2026	Benthic invertebrate population is diverse and increasing at the site
Channel condition	Channel is dynamic and more sinuous than before the project, and remains within the project area. It does not threaten adjacent property. Adequate flow velocity and depth at low flow. Instream structures not impeding function or passage. Document using photo points and aerial photos	Corps: 2023 2024 2026	Stream complexity is increased
Amphibians/Reptiles	Habitat that is suitable for Sensitive native amphibians and reptiles is present in the stream channel and in any remnant or distributary channels during spring and summer. This would include areas of native emergent vegetation in shallow water, LWD	Corps: 2023 2024 2026	Amphibians and reptiles contribute to stream and wetland habitat diversity and are indicators of

	suitable for basking, and shallow areas that seasonally dry out.		aquatic ecosystem health

If performance targets are not met, then adaptive management responses may be warranted (see Section 5).

2. Monitoring Methods

USACE will conduct Post Construction Monitoring in years 1, 2 and 4 (2023, 2024, and 2026) and will consist of visually monitoring percent cover (especially over new channel), as well as surveying to monitor culvert. Permanent photo points will be established to document vegetation reestablishment. After 5 years the project will be assessed by USACE to see if restoration goals are being met and if the trajectory of the project is progressing as anticipated. If project goals are being met, then monitoring will be complete. The local sponsor will then be responsible for yearly inspection of the project features (see section 4). If monitoring determines that restoration goals are not being met then adaptive management measures to be taken by USACE will be considered to correct deficiencies.

2.1. Baseline Conditions

Biologists from USACE were present on-site during all stages of the construction to ensure the project was properly implemented. Biologists and engineers from USACE also reviewed the 'as-built' site conditions – including elevations, number and species of installed plants, and photo points, and condition of the new stream channel and structural features (stream crossing/boardwalks) – immediately after construction to document baseline or 'as-built' conditions.

2.2. Indicator 1: Riparian vegetation cover

The aerial coverage and general condition (e.g., survival, vigor) of riparian vegetation will be evaluated during the growing season in the field with annotated maps and repeatable photo points. The focus will be on identifying large patches of dead or stressed plantings for the purpose of informing re-planting and maintenance needs. Vegetation transects will be set at after project construction. At least one of transect will be upstream of the Senior Center. Once transects are established in year 1, Geographical Positioning System (GPS) endpoints will be recorded and archived for use in future transect surveys. , Transects and photo points should be mapped GPS points recorded using the ESRI ArcGIS collector application. See appendix A for approximate photo point locations.

Riparian vegetation establishment will also be assessed using aerial photos.

2.3. Indicator 2: Invasive Plant Species

The riparian vegetation monitoring for indicator 1 will also note the percentages of invasive species in the project area. The extent of invasive plants, especially State and County listed noxious weeds will be evaluated for the purpose of informing maintenance needs. See the Snohomish County Noxious Weed List for Class A weeds that require complete eradication versus Class B and C weeds that should be controlled. Plant surveys should be mapped.

2.4. Indicator 3: Channel condition

Document channel condition through the use of photo points. Photopoints will be mapped into GIS. (Collector App).

2.5. Indicator 4: Pond Habitat Function

Monitor for presence of basking logs, benches, and emergent vegetation will be documented seasonally between March and September to qualitatively document habitat structure critical sensitive indicator species. The primary method used will be water depth measurements, visual assessment surveys of vegetation and photos.

2. Maintenance and Adaptive Management Plan

After the monitoring period, the project sponsor is responsible for assuring that the project features are operating to meet project objectives. Since the project is designed to essentially be self-sustaining and to a certain extent dynamic, the major maintenance responsibilities will be focused on the following:

- Making sure that no instream structures have shifted in Upper Hall Creek so as to cause potential flood hazard to adjacent residences
- Assisting as needed in the establishment of Native Riparian vegetation and removing invasive plant species as needed during plant establishment. Invasive species presence will be examined on a case-by-case-basis before remedies are applied, In some cases, removal of invasive plants will not be accomplished if overstory cover is well established.
- Inspecting the site on an annual basis

4.1. 2022-2023

The contractor was responsible for replacement of dead plants during the first year post-construction of each phase; including substitution of unsuccessful species. Established trees and shrubs that die over time will not be removed unless they pose a direct threat to safety of people or property.

4.2. 2023-2027

Army Corps of Engineers/Mountlake Terrace cost share periodic (2023, 2025 2027) monitoring/adaptive management in accordance with this plan.

4.3. 2028 and beyond

After the initial post-construction monitoring, the City of Mountlake Terrace (as the local sponsor) will be responsible for the long-term maintenance and adaptive management of the site. This will mainly be yearly visual inspections of the site, combined with reviewing aerial photos for possible changes in the project. The bridge Stream crossing, boardwalk and fencing monitoring will be accomplished by the city as necessary. City of Mountlake Terrace Sensitive Area signage will be placed at public access points along the outer perimeter of the site to identify the area sensitive landscape feature.

4.3.1. Invasive Species Treatment

Invasive species will be treated as needed each year, at the appropriate times for each invading species. Species such as Himalayan and cut leaf blackberry, purple loosestrife, English ivy, butterfly bush, Scot's broom, and Japanese knotweed will be controlled using manual methods and approved herbicide as appropriate. Reed canary grass – a very strong invader – is likely to persist and re-invade the project site from all sides, but efforts will be made to suppress it enough to allow the establishment of planted riparian trees and shrubs. Based on the success at other restoration projects, the plant mix used at Ballinger Park will rapidly provide shade and reduce the reed canary grass in the understory to a tolerable level not requiring removal. The sponsor should still be cognizant of invasive establishment on the edges of the buffer which left unchecked over time could result in loss of native buffer vegetation.

4.3.2. Plant Care

This project does not anticipate any active plant watering because the area is already frequently inundated. Dead plants will be replaced if an area exceeding 20 square feet becomes devoid of native vegetation.

4.3.3. Evidence of Flooding

The sponsor will monitor if flooding of adjacent properties is increasing at the site,

4.3.4. Stream Crossing

The sponsor will periodically check the condition of the stream crossing and boardwalk to assess its structural stability.

4.3.5. Channel Conditions

The sponsor shall visually survey the project site or examine recent aerial photos to determine if there are any blockages impeding fish passage or causing flooding of adjacent properties.

4.3.6 Pond Conditions

The sponsor will visually survey the project area and determine if there are changes occurring to the vegetation structure in the ponds.

4.3.7 Sight Lines

The sponsor will visually survey designated sight lines in areas planted for "Riparian open understory." If sight lines are being diminished, then maintenance will occur as specified in the O&M manual.

5. Adaptive Management

Contingency measures (i.e., adaptive management actions) may be implemented if conditions of concern are observed (Table 3), if performance targets are not being met, or unexpected geomorphic changes are posing risks to adjacent properties, or to the project itself. In that case, USACE and the City of Mountlake Terrace, in coordination with regulatory and funding agencies, would assess the situation and initiate a cost-shared effort to implement corrective actions.

In general, the plan is to address concerns in an incremental manner. The guiding principles are to 1) to mitigate risks with the least 'invasive', yet effective solutions, and 2) to choose actions that are also cost-effective. The responses taken will depend on the nature of the need, and will be developed and implemented in cooperation with stakeholders (e.g., the Washington Department of Fish and Wildlife, tribes, regulatory agencies, and others). Any problems will be resolved in a way that considers project goals and relevant policies, ordinances, and laws. The time needed to evaluate and implement adaptive management measures will vary depending on the complexity and immediacy of the problem or hazard. Immediate action may be needed to address off-site flooding.

For non-federal projects, a Department of the Army permit, issued by USACE, is required for the discharge of fill (including grading) in waters of the U.S. This would include the placement of permanent or temporary fill in special aquatic sites and jurisdictional wetlands.

Table 3. Adaptive Management Scenarios

Indicator or Factor	Conditions of Concern (Scenarios)	Adaptive Mgmt Response
Water levels	Obvious increase in stage-discharge relationship that are resulting in increased flooding on adjacent parcels.	• No action, consult • Manage beavers and their dams if necessary • Explore options
Riparian cover	Poor growing conditions (e.g., excessive soil moisture) cause large areas (greater than 20 sq. ft.) of plantings to die or fail to thrive. As a result, the riparian buffer does not meet target. If climate change results in dryer conditions, the plant mix might need to be reassessed.	• No action, consult • Plant native plants suitable to site conditions • Expand buffer with new plantings elsewhere • Potentially change plant palette to reflect more drought tolerant plants.
Designated Sight Lines	Understory plants grow beyond expected heights blocking sight lines	• Implement pruning guidelines as specified in the O&M Manual • Consult

		• Implement planting of shade tolerant understory species such as salal and sword fern
Invasive Plants	Invasive plant species expand rapidly into stream buffer and appear to compete strongly with plantings. Class A Weeds (noxious weeds) present.	• No action, consult • Except remove any Class A Weeds • Increase treatment level • Explore alternative strategies for control
Channel conditions	Wood anchors fail, the wood floats downstream and is blocking or likely to block the culverts and interfere with drainage	• No action, consult • Remove or reposition wood
	Significant sedimentation and erosion resulting in greater than 20% change in the constructed channel geometry cross section.	• Resurvey channel and problem area and compare to as-built condition; assess and correct as needed
Pond conditions	Poor growing conditions (e.g., excessive soil moisture) cause large areas (greater than 20 sq. ft.) of plantings to die or fail to thrive. As a result, the emergent buffer does not meet target.	• No action, consult • Plant native plants suitable to site conditions • Expand buffer with new plantings elsewhere
Stream Crossing Boardwalk Fencing	Structures show evidence of possible failure	• No action, consult • Initiate repair • Construct replacement structure

6. Inputs and Activities

The city is responsible for yearly inspection of the project to assess if all project features are performing as anticipated. This inspection will mainly be a visual assessment of the project area, combined with

Maintenance Tasks (Specific to City of Mountlake Terrace)

- Inspections - The project features will be inspected on at least an annual basis after initial Corps monitoring is completed. Any significant changes in the project operation will be reported and discussed with the USACE Project Engineer or Project manager.
    - Stream crossing, boardwalk and fence maintenance - reportable to Corps Project Manager
- Riparian Plantings and Floodplain Plantings - reportable to USACE Project Manager
    - Visually inspect plantings (including natural recruitment) to assess growth and signs of stress.
    - Inspect riparian area for presence of invasive plants. Complete eradication of invasive plants is not feasible. However, the inspections should note the presence of large patches of invasive plants in the project area. Efforts should be made to control these areas before there is a significant spread of these invasive species to other parts of the project area. Invasive plants new to the area such as Japanese knotweed should be noted. The identification of Class A noxious weeds should immediately be dealt with. Plans for removal/control of these species should be discussed/coordinated with USACE.
- Stream Channel - reportable to Corps Project Manager
    - Any changes to the flow and alignment of the stream channel should be noted and reported.
    - LWD Structures might shift or dislodge. Report any changes to the USACE Project Manager. Typically, changes in the LWD structures will not require modifications/repairs.

The project sponsor is responsible for assuring that the project features are operating to meet project objectives. Since the project is designed to essentially be self-sustaining and to a certain extent dynamic, the major maintenance responsibilities will be focused on the following:

City of Mountlake Terrace will provide the following inputs to implement this plan:

- Responsive and timely communications with USACE

USACE will provide the following inputs to implement this plan:

- Responsive and timely communications with Auburn
- As-built information
- 2023, 2025, and 2027: Fieldwork and data collection, photo points, collection, entry, analysis, and reporting of any monitoring data.
- Recommendations for maintenance and adaptive management
- Reports and memorandums following any field-work done by USACE as well as project related status updates
- Review and provide input on Final Report.

APPENDIX A

MONITORING LOCATIONS FOR SELECTED ACTIVITIES

(To be completed during Design and Implementation Phase)

Table 1. AAHU Computations by Polygon

Polygon	Affected Area (Acres)	Without Project Average HSI	With Project Average HSI	Net HSI	AAHUs (Outputs or Benefits)
1a	0.77	0.00	0.572	0.572	0.440
1b	0.77	0.00	0.681	0.681	0.524
2a	0.43	0.43	0.542	0.112	0.048
2b	0.43	0.43	0.681	0.251	0.108
3a	0.85	0.43	0.542	0.112	0.095
3b	0.85	0.43	0.681	0.251	0.213
7a	0.18	0.57	0.681	0.111	0.019
7b	0.18	0.57	0.827	0.257	0.046
7c	0.18	0.57	0.968	0.398	0.072
9a	1.38	0.00	0.572	0.572	0.789
9b	1.38	0.00	0.968	0.968	1.336
10a	0.45	0.57	0.681	0.111	0.049
10b	0.45	0.57	0.827	0.257	0.116
10c	0.45	0.57	0.572	0.002	0.001
11a	2.05	0.27	0.286	0.016	0.033
11b	2.05	0.27	0.305	0.035	0.072
12a	1.20	0.00	0.572	0.572	0.686
12b	1.20	0.00	0.968	0.968	1.162
14a	0.80	0.57	0.681	0.111	0.089
14b	0.80	0.57	0.827	0.257	0.206
14c	0.80	0.57	0.572	0.002	0.002
15a	0.69	0.00	0.572	0.572	0.395
16a	0.65	0.24	0.256	0.016	0.010
16b	0.65	0.24	0.286	0.046	0.029
21a	1.27	0.11	0.376	0.266	0.338
21b	1.27	0.11	0.405	0.295	0.375
23a	2.47	0.11	0.115	0.005	0.012
23b	2.47	0.11	0.145	0.035	0.086

Table 2: AAHU Computations by Alternative

Polygon	Alt 1/ No Action	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
1	0.00	0.44	0.44	0.44	0.44	0.52	0.52
2	0.00	0.05	0.05	0.11	0.11	0.11	0.11
3	0.00	0.10	0.10	0.21	0.21	0.21	0.21
7	0.00	0.05	0.07	0.07	0.07	0.07	0.07
9	0.00	0.79	1.34	1.34	1.34	1.34	1.34
10	0.00	0.12	0.05	0.05	0.05	0.05	0.05
11	0.00	0.03	0.03	0.03	0.07	0.07	0.07
12	0.00	0.69	1.16	1.16	1.16	1.16	1.16
14	0.00	0.12	0.09	0.09	0.09	0.09	0.09

15	0.00	0.39	0.39	0.39	0.39	0.39	0.39
16	0.00	0.01	0.01	0.01	0.03	0.03	0.03
21	0.00	0.34	0.34	0.34	0.37	0.37	0.37
23	0.00	0.01	0.01	0.01	0.09	0.09	0.09
TOTAL AAHUs	**0.00**	**3.21**	**4.08**	**4.26**	**4.43**	**4.51**	**4.51**

Average Annual Habitat Units are calculated over the fifty year period of analysis. Habitat Suitability Index are assumed to be constant between years at the value that it was last estimated. For example from years 1-10 for Polygon 14a the HSI remain at .57, at which point it jumps to 0.71 for the remainder of the period of analysis. The HSI is then averaged over the whole 50 years to get the Average HSI, and multiplied by acreage of the polygon to return the Average Annual Habitat Units per polygon. Table 3 shows the HSI breakdown by year for each polygon and plan.

Table 3: Acerage and HSI by Year

Polygon	Affected Area(Acres)	Year 1	Year 5	Year 10	Year 25	Year 50	Average HSI
1 FWOP	0.77	0.00	0.00	0.00	0.00	0.00	0
1a	0.77	0.43	0.43	0.57	0.57	0.57	0.572
1b	0.77	0.57	0.57	0.71	0.71	0.71	0.681
2 FWOP	0.43	0.43	0.43	0.43	0.43	0.43	0.43
2a	0.43	0.43	0.43	0.57	0.57	0.57	0.542
2b	0.43	0.57	0.57	0.71	0.71	0.71	0.681
3 FWOP	0.85	0.43	0.43	0.43	0.43	0.43	0.43
3a	0.85	0.43	0.43	0.57	0.57	0.57	0.542
3b	0.85	0.57	0.57	0.71	0.71	0.71	0.681
7 FWOP	0.18	0.57	0.57	0.57	0.57	0.57	0.57
7a	0.18	0.57	0.57	0.71	0.71	0.71	0.681
7b	0.18	0.71	0.71	0.86	0.86	0.86	0.827
7c	0.18	0.86	0.86	1.00	1.00	1.00	0.968
9 FWOP	1.38	0.00	0.00	0.00	0.00	0.00	0
9a	1.38	0.38	0.59	0.59	0.59	0.59	0.572
9b	1.38	0.86	0.86	1.00	1.00	1.00	0.968
10 FWOP	0.45	0.57	0.57	0.57	0.57	0.57	0.57
10a	0.45	0.57	0.57	0.71	0.71	0.71	0.681
10b	0.45	0.71	0.71	0.86	0.86	0.86	0.827
10c	0.45	0.38	0.59	0.59	0.59	0.59	0.572
11 FWOP	2.05	0.27	0.27	0.27	0.27	0.27	0.27
11a	2.05	0.27	0.29	0.29	0.29	0.29	0.286
11b	2.05	0.30	0.31	0.31	0.31	0.31	0.305
12 FWOP	1.20	0.00	0.00	0.00	0.00	0.00	0
12a	1.20	0.38	0.59	0.59	0.59	0.59	0.572
12b	1.20	0.86	0.86	1.00	1.00	1.00	0.968
14 FWOP	0.80	0.57	0.57	0.57	0.57	0.57	0.57
14a	0.80	0.57	0.57	0.71	0.71	0.71	0.681
14b	0.80	0.71	0.71	0.86	0.86	0.86	0.827
14c	0.80	0.38	0.59	0.59	0.59	0.59	0.572
15 FWOP	0.69	0.00	0.00	0.00	0.00	0.00	0
15a	0.69	0.38	0.59	0.59	0.59	0.59	0.572
16 FWOP	0.65	0.24	0.24	0.24	0.24	0.24	0.24
16a	0.65	0.24	0.26	0.26	0.26	0.26	0.256
16b	0.65	0.27	0.29	0.29	0.29	0.29	0.286
21 FWOP	1.27	0.11	0.11	0.11	0.11	0.11	0.11
21a	1.27	0.36	0.38	0.38	0.38	0.38	0.376
21b	1.27	0.40	0.41	0.41	0.41	0.41	0.405
23 FWOP	2.47	0.11	0.11	0.11	0.11	0.11	0.11
23a	2.47	0.11	0.12	0.12	0.12	0.12	0.115
23b	2.47	0.14	0.15	0.15	0.15	0.15	0.145