Biological Assessment

In-Water and Overwater Structures Removal Project Camas Mill, Camas, WA

January 2023

Prepared for

Georgia-Pacific

Georgia-Pacific Consumer Operations, LLC
Camas, WA

Prepared by

TETRA TECH

19803 North Creek Pkwy
Bothell, WA 98011

EXECUTIVE SUMMARY

Georgia-Pacific Consumer Operations LLC (GP) is planning to abate, remove, and demolish several structures associated with prior operations of Camas Mill in the city of Camas and in unincorporated areas of Clark County, Washington. The structures to be removed are located in and/or overwater on the Columbia River and Camas Slough and are located within the City of Camas or Clark County Shoreline Management Zones.

Wood Environment and Infrastructure Solutions, Inc. (Wood) prepared the Draft Biological Assessment (BA) in January 12, 2021, which addressed the In-Water and Overwater Structures Removal Project (Project) as proposed at that time; this report has been updated by Tetra Tech to reflect the current planned Project.

The purpose of this report is to provide a biological and habitat assessment for the proposed Project and identify any potential effects of the Project on threated and endangered species. The proposed activities include placement of fill within waters of the U.S. that are known to provide habitat to fish species listed under the Endangered Species Act.

This report provides the following:

- An analysis of available site information;
- The results of a field investigation to determine the presence of suitable habitat for listed species; and
- A habitat assessment to determine the effects of the action on species listed as Priority Species by the Washington Department of Fish and Wildlife and species protected under the Endangered Species Act.

This report also includes an analysis of potential effects of the proposed activities.

The proposed Project will result in unavoidable impacts on six protected species and their critical habitat. The six listed species with potential to occur or be affected by the Project are: bull trout (*Salvelinus confluentus*), Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), steelhead (*O. mykiss*), and Pacific eulachon (*Thaleichthys pacificus*). All six species have critical habitat identified within the action area.

Impacts during removals are expected to be temporary and transient and primarily result in behavioral effects and are not likely to result in mortality. Because the Project removes riverbed obstructions, creosote-treated piles, and structures shading the river, the effects would be beneficial to habitats and species.

Based on this conclusion and the implementation of best management and conservation measures during Project construction, and assuming compliance with all other permit conditions, it is anticipated that the proposed Project is unlikely to have adverse effects on listed species, designated critical habitat, or Essential Fish Habitat. Pursuant to the Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1966, an Essential Fish Habitat evaluation of impacts is included in **Appendix A**.

Effects determinations are summarized by species in **Table ES-1**.

Table ES-1. Summary of Effect Determinations

Species	Listing Status	Effect Determination
Bull trout (*Salvelinus confluentus*) Critical habitat; in action area	Threatened	May affect, but not likely to adversely affect.
Chinook salmon (*Oncorhynchus tshawytscha*) Lower Columbia River ESU Critical habitat; in action area	Threatened	May affect, but not likely to adversely affect.
Chum Salmon (*Oncorhynchus keta*) Columbia River ESU Critical habitat; in action area	Threatened	May affect, but not likely to adversely affect.
Coho Salmon (*Oncorhynchus kisutch*) Lower Columbia River ESU Critical habitat; in action area	Threatened	May affect, but not likely to adversely affect.
Pacific Eulachon (*Thaleichthys pacificus*) Southern DPS Critical habitat; in action area	Threatened	May affect, but not likely to adversely affect.

Abbreviations:
DPS = Distinct Population Segment
ESU = Evolutionarily Significant Unit

Appropriate minimization measures and best management practices (BMPs) for this Project are designed to avoid, minimize, and mitigate Project impacts on listed species during Project activities.

Such measures may include:

- Conducting riverbank demolition activities during low river stages so that the work site will likely be under dry conditions (“in the dry”);
- Conducting in-water work only during approved in-water work windows that are ultimately approved for this Project;
- Identifying appropriate numbers and locations of stockpiling and staging areas prior to demolition;
- Containing and protecting all stockpile and staging areas with best mangment approaches, for example, implementing erosion control measures, such as silt fencing or straw bales, or requiring stockpiles be covered if inclement weather is forecasted;
- Peforming all mechanical fueling and servicing at approved and proected locations at least 150 feet from surface waters, and inspecting all vehicles daily for fluid leaks. Spill response equipment will be on-site for potential fluid leakage;
- Using only vegetable-based oils in hydraulic lines for equipment operating in water to the greatest extent possible; and
- Performing routine inspections of erosion control and sediment control and other best practices, as well as implementing any maintenance needed.

Table of Contents

List of Figures

List of Tables

List of Appendices

List of Acronyms and Abbreviations

°C	degrees Centigrade
°F	degrees Fahrenheit
BMP	best management practice
dB	decibel
CFR	Code of Federal Regulations
COC	constituent of concern
CRD	Columbia River Datum
DMA	dredged materials management area
DNR	Washington Department of Natural Resources
DPS	distinct population segment
Ecology	Washington State Department of Ecology
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FR	*Federal Register*
IPaC	Information for Planning and Consultation
LCR	Lower Columbia River
mg/L	milligrams per liter
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
OHWM	ordinary high water mark
OHW	ordinary high water
PAH	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCE	primary constituent element
PHS	Priority Habitats and Species
Project	In-Water and Overwater Structures Removal
RM	river mile
RMS	root mean square
SF	square foot/feet

SMS	Sediment Management Standards
SPCC	spill prevention, control, and countermeasures
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
Wood	Wood Environment & Infrastructure Solutions, Inc.
WSDOT	Washington State Department of Transportation

1.0 INTRODUCTION

Georgia-Pacific Consumer Operations LLC (GP) plans to abate, remove, and demolish several structures that are located in and/or over water on the Columbia River and Camas Slough. The In-Water and Overwater Structures Removal Project (Project) footprint includes areas along the shoreline within the main Mill site, and several other locations in the Camas Slough and extending approximately 3 miles downriver from the Mill.

The in-water and overwater structures to be removed include:

- A warehouse,
- Five docks/piers,
- Conveyor housings,
- An aboveground storage tank,
- A crane foundation, and
- Approximately 3,000 dolphins and pilings.

Dredging will occur, as needed, to remove overburden, to allow access to piers.

A detailed Project description has been developed as a separate document that contains:

- Photographs of structures,
- Details on demolition methods, and
- Other Project details.

This Draft Biological Assessment (BA) provides a discussion of the Project, focusing on activities that may have potential to affect species or habitats present. Pursuant to the Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1966, an Essential Fish Habitat evaluation of impacts is included in **Appendix A**. Structures to be removed are located adjacent to the riverbank or entirely or partly below the ordinary high water mark[1] (OHWM) of the Camas Slough or lower Columbia River. They are located within either the City of Camas Shoreline Management Zone or Clark County's Shoreline Management Zone. Many of the structures (dolphins and pilings) to be removed are located on State-owned land leased by GP through the Washington Department of Natural Resources (DNR).

GP is the sole organization responsible for maintaining, developing, and removing structures and all actions described here.

1. Identification of the ordinary high water mark location in the Project area is described in the In-water/Overwater Removals Project Shoreline Report (Wood 2020; Tetra Tech 2023).

2.0 PROJECT LOCATION AND DESCRIPTION

2.1 Project Location

Camas Mill is located in Camas, Washington. The Project footprint includes areas along the shoreline and several other locations in the Camas Slough, on the riverbank area of Lady Island, and extending approximately 3 miles downriver from the Camas Mill. **Figure 1** shows the Project location along the lower Columbia River. **Figures 2A through 2E** provide detailed aerial views of the structures proposed for removal within the Action Area. Note that figures are presented following the text in this BA.

The Project area lies within Township 1 North, Range 3 East, Sections 8, 9, 10, 11, 15, and 16 Willamette Meridian.

The proposed Project would occur on property owned or leased by GP, and on property controlled by Clark County and the State of Washington (**Table 1**). The Project area lies within the City of Camas, Washington, except one dolphin to be removed on the Columbia River is within unincorporated Clark County, Washington. Lady Island lies between the Camas Slough and Columbia River main channel and is owned in its entirety by GP. As stated, GP has an established State aquatic lands lease and several easements from the DNR in Camas Slough and the Columbia River.

Table 1. Parcels Included in the Project Area

Assessor Parcel Number	Owner[1]	Tax Parcel Type Description/Zoning/location
08370-0000	Fort James Camas, LLC (GP)	Manufacturing—paper products/Heavy Industrial/ Lady Island
09104-4013	Georgia-Pacific Corporation	Manufacturing—lumber and wood products/ Heavy Industrial
09104-4015	Fort James Camas, LLC (GP)	Manufacturing—paper products/Heavy Industrial/ Main Mill Parcel
09104-4027	Specialty Minerals Inc.[2] (GP)	Storage warehouse/Heavy Industrial
50090-1000	Fort James Camas, LLC (GP)	Tidelands/Water
50090-2000	Fort James Camas, LLC (GP)	Tidelands/Water
50090-3000	Fort James Camas, LLC (GP)	Tidelands/Water
50090-4000	Fort James Camas, LLC (GP)	Tidelands/Water
50081-4000	Fort James Camas, LLC (GP)	Tidelands/Water
50081-4001	Fort James Camas, LLC (GP)	Tidelands/Water
50081-7000	Fort James Camas, LLC (GP)	Tidelands/Water
50081-8000	Fort James Camas, LLC (GP)	Tidelands/Water

Notes:
The previous corporate name, Fort James Camas LLC, is shown on the County's tax parcel information.
Specialty Minerals was a part of Fort James Camas.

2.2 Project Purpose and Need

GP plans to abate, remove, and demolish structures that are located in-water and/or overwater on the Columbia River and Camas Slough and located within the city of Camas and in unincorporated areas of Clark County, Washington. The structures were associated with prior pulp and paper mill operations and are no longer used. No new structures of any type are proposed by this Project. The need for the Project is to reduce liability associated with unused structures and remove structures from state lands enabling termination of a State Aquatic Lands lease and several State Aquatic Lands easements.

As stated in the introduction, the In-water and Overwater Structures Removals Project will remove one building, five unused docks/piers, conveyor housings, an aboveground storage tank, a crane foundation, and approximately 3,000 dolphins and pilings, and some of the associated utilities.

It should be noted that GP is still working to determine which structures will be needed for the future operation of the site. As those decisions are still being made, GP is working to permit the removal of all structures. If certain structures are determined to be needed for future operations, those structures will not be removed from the site, and GP will continue to maintain leases and easements where necessary. Work activities would occur during the approved in-water work windows for the Camas Slough and Columbia River. Agencies with jurisdiction over in-water and overwater work activities would provide approved work windows.

The currently published federal in-water work window for this reach of the lower Columbia River is November 1 to February 28, in any year (USACE 2010). The Washington Department of Fish and Wildlife (WDFW) provides information on when protected fish species are most likely to be present in the reach and indicated the period of August 1 to August 31 in any year, which aligns with species accessing the Washougal River (WDFW 2018).

2.3 River Hydrograph and Project Timing

The Columbia River, and thus the Project location, experiences an annual river hydrologic cycle driven by snowpack melt and precipitation patterns with peak flows, or about 60% of the natural runoff, occurring in May through June (NRCS 2020; FWEE 2020). Low river stages occur in the drier summer and early fall months. River stage fluctuates from approximately +2.0 feet (Columbia River Datum; CRD) or lower at low stages, with ordinary high water (OHW) at approximately +16.5 feet CRD. Camas Slough is a side-channel of the Columbia River. The Washougal River's confluence is at the Slough's eastern extent and receives all the Washougal River discharge, where flows regularly exceed 1,000 cubic feet per second from November to April, and typically fall below 100 cubic feet per second in late summer (LCFRB 2010).

The river is tidal in the Project area. However, the tidal prism is narrow, with an average annual diurnal tidal prism of about 1.5 feet. Diurnal tidal influence can be observed at low river stages but is masked during the six to eight months of high river stages (generally October through June) in most years. Though tidal, the river waters are fresh due to the lack of salinity at this location 120 river miles (RM) upriver of the Pacific Ocean. Further details on the aquatic setting are presented in Section 5.0, Environmental Baseline.

Due to the numbers of structures to be removed, the Project is anticipated to likely span three or more open in-water work periods. Actual work timing would depend on weather conditions, river flows, contractor logistics, equipment availability, and potentially other regulatory constraints. Timing of the different aspects of the Project would be sensitive to river stage. Proposed activities along the riverbanks may be conducted when river stage elevations are low, thus enabling activities to occur "in the dry."

In-water work that would require use of river barges and other vessels to access structures for removal would most effectively occur when river stages are at elevations deep enough to prevent vessel grounding. Upland Project work would be independent of river stage and so will occur year-round. Upland work activities include establishment of on-site staging areas and construction access, demolition of other structures not over water within the Project footprint, and maintenance of general stormwater control measures.

2.4 Work Schedule

Work activities below OHWM would occur during the approved construction work window for the Camas Slough and Columbia River. Input from agencies with jurisdiction will be incorporated from the permitting process into Project requirements.

The published in-water work window for this reach of the Columbia River is November 1 to February 28, in any year. However, regulatory agencies (WDFW, U.S. Fish and Wildlife Service [USFWS], and National Oceanic and Atmospheric Administration [NOAA], National Marine Fisheries Service [NOAA Fisheries]) will coordinate to establish the allowed in-water and overwater work windows.

The work windows proposed for this Project are shown in **Table 2**.

Table 2. Proposed Open Work Windows

Proposed In-Water Work Windows	Allowed Activity during the Work Window
Year-round, provided work does not violate water quality standards	
	Extract pilings using vibratory equipment or direct pulling, except for concrete piles.
	Structure demolition conducted overwater or below the OHWM, but outside the wetted perimeter of the river (in-the-dry).
	Excavation/dredging for riverbank reshaping, but outside the wetted perimeter of the river (in-the-dry).
	Fill placement for riverbank/riverbed shaping, but outside the wetted perimeter of the river (in-the-dry).
	Fill placed at upland locations (e.g., North and South Wood Chip Area)
	Above OHWM miscellaneous debris removal activities
August 1 to February 28	
	Extraction of concrete piles at the Dock Warehouse piers
	Riverbed dredging
	Below OHWM miscellaneous debris removal activities
	Riverbank fill placement in the wet
	Berger Crane foundation demolition
November 1 to February 28	
	Riverbed filling—new riverbed at Berger Crane foundation

Abbreviations:
OWHM = ordinary high-water mark

These work windows would reduce repeated reentry while accomplishing removals and simultaneously would be cognizant of biologically sensitive periods for given activities. In-water work to remove piles will use vibratory pile removal, which is known to not cause injurious levels of underwater noise. Therefore, pile removal activities are proposed to be conducted year-round. Work conducted below the OHWM, but outside the wetted perimeter of the river (i.e., “in the dry”), is not expected to result in significant impacts on aquatic species or resources, and as such these activities would be conducted year-round.

The proposed dredging window is designed to begin early enough in the season to allow these removal activities to begin on schedule, while avoiding the bulk of the peak juvenile salmonid outmigration in the spring/summer, and the peak run timing for Pacific eulachon in the late winter/early spring. This window also allows for river access prior to the time when the lowest river stages are reached at the end of the summer.

A structure removal window starting as early as August will minimize the need for these activities to be extended into the late winter/early spring timeframe. For this reason, an early start timeframe for structure removals below the OWHM will not result in adverse effects to any fish or other aquatic species.

Ultimately construction crews and methods will be influenced by weather, river stage, timing, and available equipment, as well as the regulatory allowable timeframe. Implementation of BMPs and minimization measures (see Section 2.7) to minimize impacts to aquatic species, habitats, and water quality would enable Project activities to occur within the proposed work windows.

With these allowances, Project duration to complete the removals is anticipated to span a minimum of three years. At the time of this document development, demolition was expected to begin in summer 2022 following receipt of all Project permits and approvals.

2.5 Structures to be Removed

Removal of the in-water and overwater structures would occur in a manner that is not disruptive to ongoing operations at the Mill. Demolition of in-water and overwater structures is anticipated to occur in approximately the following order:

1. In-water piles and dolphin removals
2. Dredging for access to, and demolition of Dock Warehouse piers
3. Berger Crane Foundation demolition and riverbed shaping
4. Dock warehouse upper stories demolition
5. PECO Dock and Dock Warehouse lower floor and foundation demolition
6. Truck Dock demolition
7. Riverbank shaping to final grades and placement of stable final riverbed and riverbank surfaces

Table 3 provides details regarding proposed removal methods for structures that will be in-water or below the OWHM only, and Sections 2.5.1 through 2.5.9 describe the structures to be removed.

Table 3. Proposed Demolition Methods by Structure Type

Structure to be Removed	Work Description
Piles and dolphins	• Demolition would be accessed from river barges. • Piles would be removed following best management practices for derelict piling removals (DNR 2017; EPA 2016) • Extracted piles and attached sediment would be contained on the barge deck until off-loaded to an upland location, per state requirements for creosote pile and best management practices. • All tire bumpers would be removed to the barges and disposed of at an approved upland location.
Dock Warehouse Piers	• Demolition would be conducted from river barges for most of the removal. • Riverbed dredging would be required to enable demolition barge access to the piers. • All utilities and miscellaneous supporting materials from the piers would be removed. • Pier decking would be cut, rigged, and removed, then piling caps would then be rigged and removed, followed by pile removal.
Berger Crane foundation	• Due to the massive nature of this strong foundation, demolition may require more than a single method. • Methods may include a mechanical approach using demolition claws and/or expanding demolition grouts, for example. • Access would be either from land or from barge or both and would be up to the contractor to determine best approach. • Demolition is planned to reduce structure down to the extant river water stage level at the time of demolition, which is estimated to be at approximately +2 feet CRD. • Every effort will be made to ensure that demolition debris is confined to the foundation removal location and removed from the site. • Retaining the foundation's lower columns in place would avoid excessive disturbance to riverbed sediment. • Fill would be used to cover the retained lower columns, creating bottom contours that match the adjacent natural riverbed in this previously dredged location. • Clean fill materials will be specified at the minimum size, coarse enough to be stable for this location.
Three Adjacent Riverbank Structures: Truck Dock, Dock Warehouse, and PECO Dock	• Demolition would be staged primarily from the riverbank, but some pilings at the westernmost extent may be removed using by barge access. • Miscellaneous materials would be removed prior to beginning structure demolition: • For the Truck and PECO Dock, asphalt and concrete decking would be cut or broken and removed, followed by removing piling caps. • Support beams would then be rigged and lifted for removal. • For the Dock Warehouse, demolition would occur starting from the upland-facing side toward the riverbank, leaving the riverside wall to last to reduce the risk of materials falling toward the river. • Pilings below and between structures along the riverbank would be removed by access from the riverbank. • The riverbank would be reshaped to shallower slopes (5 to 1 and 4 to 1 H:V), grading to steeper slopes to match existing grades. • Final surfacing materials would be specified as the finest materials, coarse enough to remain stable in this location. • Final surfaces would be sampled and analyzed for compliance with the State of Washington's anti-degradation standards.

Abbreviations:
BMP = best management practice
CRD = Columbia River Datum
OHWM = Ordinary high water mark
H:V = Horizontal:Vertical

2.5.1 Dolphins and Piles

Approximately 3,000 piles and dolphins made of wood and carbon steel pipe would be removed from locations in the Camas Slough and extending approximately 3 miles downriver from the Mill to RM 117 (**Figures 2A–2E**). These features were previously used for log rafting.

Dolphins are groups of 3, 5, 7, or 9 piles individually installed at an angle and all bound together to create a sturdy structure for mooring or providing protection to an adjacent structure from potential impacts.

Table 4 lists the locations and approximate number of dolphins and piles proposed for removal.

Table 4. Locations of Dolphins and Piles for Removal

Location	In-water or Overwater	Approximate Number of Pilings[1/]
Open-water dolphins and pilings	In-water	250
One downriver dolphin in unincorporated Clark County	In-water	9
Pilings at riverbank associated with in-water structures[2/]	In-water	200
Pilings associated with overwater structure foundations[3/]	Overwater	2,500
Estimated Total Numbers of Piling		**Approximately 3,000**

Notes:
1/ Numbers of pilings are estimates and the total estimated number has been rounded up.
2/ In-water pilings include pilings associated with mooring dolphins, remnant riverbank pilings, sheet pilings, pilings supporting the Dock Warehouse Piers.
3/ Overwater pilings include pilings along the riverbank associated with the foundations supporting the Dock Warehouse, PECO Dock, and Truck Dock.

2.5.2 Dock Warehouse Piers

Three piers servicing the warehouse extend approximately 175 feet from the warehouse into the Camas Slough (**Figure 2E**). The piers are decked with concrete and are supported by 54 octagonal, solid concrete piles, along with 21 concrete-filled carbon steel pipe piles with concrete pile caps. Most of the piles are protected with truck tires that function as bumpers. Dredging of sediments in the vicinity of the piers will be required to enable a demolition crane barge to access the piers for removal.

2.5.3 Berger Crane Foundation

The Berger crane foundation is located approximately 1,000 feet west of the PECO Dock in Camas Slough (**Figure 2E, 3, and 4**). The foundation is a remnant from a previously demolished dock initially built in 1948. This 90-foot-long, concrete foundation stands completely within the river approximately 40 feet from the top of the riverbank.

This wall-like structure previously supported a large crane that lifted logs from the river to a wood mill. The dock and wood mill were demolished in 2002 or shortly thereafter, but the large foundation was retained. Several concrete piers are pocketed into the bedrock below the riverbed to provide stability for the foundation.

The approximately 300-square-foot (SF) foundation would be demolished down to river stage. Approved clean suitable fill material would be used to cover the retained lower columns, create bottom contours that match the natural riverbed in this previously dredged location, and create river habitat.

2.5.4 Riverbank Structures

Together the Truck Dock, Dock Warehouse, and PECO Dock cover approximately 1,055 continuous feet of riverbank with about 12,100 SF of total area currently perched overwater. Following removal, approximately 40,450 SF of riverbank would no longer have structures.

Following removals, the riverbank would be reshaped to 5 to 1 and 4 to 1 slopes transitioning to about 2 to 1 and slightly steeper to match existing grades. The final riverbank surface would be covered with the finest material that is coarse enough to be stable for the location. The eastern extent of this location is largely behind a small peninsula and is known to be an area of river deposition, while the western extent protrudes into the river and would be subject to more river currents than the eastern extent and require coarser material.

A portion of the completed riverbank above OHW would be revegetated with native plant species.

2.5.5 Truck Dock

This approximately 3,700 SF flat, asphalt- and concrete-covered area provides truck access to the loading bays on the east end of the Dock Warehouse (**Figure 2E**). This dock is supported by approximately 320 pilings constructed from wood and pipe along approximately 350 feet of the riverbank. The dock is protected by a 100-foot-long marginal sheet-pile bulkhead at the water's edge. Following removal, approximately 1,140 SF of overwater area would be uncovered.

Elevated conveyors formerly conveyed materials between buildings. The product conveyor housings in the vicinity of the Dock Warehouse would be removed, starting from the building and moving to a support at an inland location that allows for the remaining portions of the housing to be retained.

2.5.6 Dock Warehouse

Situated between the Truck Dock and the PECO Dock on the Riverbank (**Figure 2E**), the Dock Warehouse is a 23,500 SF, three-story (lower/loading dock, first, and second floors) concrete and wooden structure. The Dock Warehouse covers approximately 400 lineal feet of riverbank. It is supported by approximately 1,020 pilings, with cement pier foundations along the upper riverbank and upland side.

Originally constructed in 1934 at the site of a previous dock, the building was used to house paper shipped through the Mill. The concrete and wooden building was covered with exterior sheet metal siding in 1980. Following demolition, approximately 7,041 SF of overwater shading will have been removed.

2.5.7 PECO Dock

The PECO Dock is located west of the Dock Warehouse and was constructed in 1983 (**Figure 2E**). This 305-foot-long marginal dock structure was built largely overwater to support a 9-ton crane (manufactured by PECO) and used to offload wood chips from river barges. The dock is approximately 13,200 SF in area and supported by approximately 170 carbon steel H-pilings. Approximately 450 dilapidated wood pilings from a previous structure are also beneath the dock. An additional 200 to 300 wood and steel pipe pilings along the riverbank between and around the PECO Dock and Dock Warehouse would also be removed.

2.5.8 Aboveground Oil Storage Tank

A decommissioned 40,000-gallon steel aboveground oil storage tank located approximately 100 feet east of the Truck Dock and 150 feet north of the shoreline would be deconstructed and removed down to slab level. The tank was decommissioned and cleaned in 2015. The tank and its associated pipes and utilities would be removed, while the slab and earthen containment berm would be retained.

2.5.9 South Wood Chip Storage Area and Wood Chip Conveyor Housings

There are two distinct previously used wood chip storage areas, the South Wood Chip Storage Area and the North Wood Chip Storage Area. The South Wood Chip Storage Area was previously used to store wood chips for pulping at the Mill. Currently most of the wood chips have been removed with only minor amounts remaining. The removal resulted in a depression that would be backfilled to design grades with clean structural materials. Work activities include demolition of the overhead conveyor housing, removal of remaining chips, and filling the resulting depression to design grade. Elevated conveyors formerly conveyed wood chips from the PECO Dock to the South Wood Chip Storage area. The conveyor housings would be removed and the foundations for the supports would remain.

The North Wood Chip Storage Area was also previously used to store wood chips for pulping at the Mill. This area is located outside of the shoreline zone but would be part of the overall grading and reclamation plan that will include the entire wood chip storage area (i.e., north and south). As this area will no longer be considered a location at the mill with industrial activity, this area will be designed to allow drainage to naturally flow back to Camas Slough.

2.6 Dredging and Material Reuse

As stated, as part of this Project, dredging will be required and includes:

- Reshaping the Camas Slough riverbank following the removal of overwater structures.
- Deepening an 1,800 SF area surrounding the Dock Warehouse Piers to -10 feet (CRD) to enable access for demolition barges.

Dredge prisms will not be refilled following removals. In-water reuse and other upland reuse of dredge materials is preferred by GP for any material determined to be suitable. Dredged materials not suitable for in-water reuse or otherwise reused would be disposed at the Lady Island dredged materials management area (DMA) located at the western extent of Lady Island (**Figure 1**). Dredged materials have routinely been disposed of at the Lady Island DMA.

2.7 Impact Avoidance and Minimization Measures

To minimize risks of potential impacts on the Columbia River during construction, GP will follow relevant BMPs included in the Washington Department of Ecology (Ecology) *2019 Stormwater*

Management Manual for Western Washington (Ecology 2019). In addition, BMPs for pile removal and disposal (DNR 2017) and BMPs for Piling Removal and Placement in Washington State (EPA 2016) will be used as additional guidance.

The BMPs and minimization measures listed in this section are designed to avoid, minimize, and mitigate Project impacts on listed species.

2.7.1 General Conditions

The Project will adhere to the following general BMPs:

- In-water work will be conducted during the approved in-water work windows.
- Appropriate debris management areas and general staging areas will be identified and approved prior to construction.
- Established staging areas used for fueling, servicing, construction and demolition, and temporary equipment storage will be located in a manner that will prevent contaminants from entering aquatic areas.
- Limits of work will be clearly established.
- Disturbance to riverbank vegetation will be limited to the minimum amount needed to remove infrastructure.
- Drive mechanisms of equipment operated waterward of the OHWM will be prevented from entering water .
- Appropriate stormwater and temporary erosion and sediment control plans will be developed and will comply with the City of Camas erosion-control standards and state requirements.
- Erosion-control measures, such as silt fencing, will be utilized where appropriate to protect aquatic areas from sedimentation.
- Project activities will be completed in compliance with Washington State Water Quality Standards (Washington Administrative Code [WAC] 173-201A), including those listed below:
  - Petroleum products, fresh cement, chemicals, or other toxic or deleterious materials will be prevented from entering surface waters .
  - Fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc., will be checked regularly for leaks, and materials will be maintained and stored properly to prevent spills.
- A site-specific or activity-specific spill prevention, control, and countermeasures (SPCC) plan appropriate for the Project activities will be developed.
- Routine inspections and maintenance of erosion-control and sediment-control BMPs will be performed.

2.7.2 Overwater Demolition

Overwater demolition activities will adhere to the following BMPs:

- Excess or waste materials will not be disposed of or abandoned waterward of the OHWM or allowed to enter waters of the state. Waste materials will be disposed of in an appropriate manner consistent with applicable local, state, and federal regulations.

2.7.3 Piling Removal

Pilings will be removed in adherence to the following BMPs:

- Pilings will be removed following BMPs that primarily use a vibratory driver to loosen piles initially. Pilings to be removed in this Project are made from one or more materials including: round steel pipe, H-pile steel, reinforced concrete, concrete-filled steel pipe, untreated wood, or treated wood.
- Prior to commencement of work, the contractor will assess the condition and location of the piling and identify whether the piling will be removed with access from a barge or using upland equipment accessed from the riverbank.
- Where river currents allow, the contractor will surround the structure to be removed with a floating surface boom to capture floating surface debris.
- The contractor’s work plan will include procedures for extracting and handling pilings that break off during removal. In general, complete extraction of pilings is always preferable to partial removal.
- When possible, removal of treated wood pilings will occur in the dry or during low water conditions. Doing so increases the chances that the piling will not be broken (greater visibility by the operator) and increases the chances of retrieval in the event that pilings are broken.
- The crane operator will remove the piling slowly to minimize turbidity as well as sediment disturbance.
- The contractor will minimize overall damage to pilings during removal. In particular, treated wood pilings must not be broken off intentionally by twisting, bending, or other deformation. This practice will help reduce the release of wood-treating compounds and wood debris to the water columns and sediments.
- Upon removal from the substrate and water column, the piling shall be moved into the containment area for processing.
- The piling shall not be shaken, hosed-off, stripped or scraped off, left hanging to drip, or subjected to any other action intended to clean or remove adhering material from the piling. Any sediment associated with the removed piling must not be returned to the river.
- The operator shall make multiple attempts to remove a pile before resorting to cutting off the pile.
- If the pile is intractable or breaks, the pile will be cut off below the mudline, with consideration given to the mudline elevation, slope, and stability of the site.

- Debris, splintered wood, or sediment removed during pile removal must be placed in a containment area.
- Keep all equipment (e.g., bucket, steel cable, vibratory hammer) out of the water, grip piles above the waterline, and complete all work during low water and low current conditions.

2.7.4 Barge Use

Work from barges will adhere to the following BMPs:

- Any barge used as a work platform to support construction will be:
  - Large enough to remain stable under foreseeable loads and adverse conditions;
  - Inspected by the contractor before arrival to ensure the vessel and ballast are free of invasive species; and
  - Secured, stabilized, and maintained as necessary to ensure no loss of balance, stability, anchorage, or other condition that can result in the release of a contaminant or construction debris.
- The work surface on the barge deck will include a containment basin for all treated materials and any sediment removed during piling removal so that creosote is prevented from draining to the river. Uncontaminated river water runoff can return to the river.
- Barge operations will focus on areas where water depths are sufficient to avoid groundings and minimize prop-wash and resulting turbidity.
- Vegetable-based oils will be used in hydraulic lines for equipment operating in the water, to the greatest extent possible.

2.7.5 Dredging and Dredged Material Management

Dredging will be conducted to prevent impingement of juvenile salmonids by dredging equipment. Regular observation of sediment aboard the barge or at the placement areas will be conducted. If impingement occurs, equipment will be adjusted (slowed) or modified to increase the opportunity for juveniles to escape the area. For example, if a hydraulic dredge is used, it will be lowered deeper into the sediment to reduce water entrainment.

Appropriate BMPs will be employed to minimize sediment loss and turbidity generation during dredging. BMPs may include, but are not limited to, the following:

- Smooth closure of the bucket when at the riverbed,
- Maintaining suction head of any hydraulic dredge in the riverbed to the extent practicable,
- Using a buffer plate or other means to reduce flow energy of the hydraulic dredge at the placement area, and
- Other conditions, as specified in the Project's Water Quality Certification or other approvals.

When dredged material is placed on a barge for delivery to the placement area, no spill of sediment back to the water from the barge will be allowed. The barge will be managed such that the dredged sediment load does not exceed the capacity of the barge. The load will be placed in the barge to maintain an even keel and avoid listing.

A *Dredging and Dredged Materials Management Plan* will be developed prior to the start of dredging and will likely include the following BMPs:

- Hay bales and/or filter fabric may be placed over the barge scuppers to help filter suspended sediment from the barge effluent if needed based on sediment testing results.
- The contractor will use a tightly sealing bucket and monitor for spillage during transfer operations.
- Visual water quality monitoring and, if necessary, follow-up measurements will be conducted around the barge to confirm that material is not being released.
- BMPs will be employed as appropriate to control runoff and erosion at the stockpiling area and would likely include:
  - Installing silt fences, straw bales, and/or containment berms;
  - Managing runoff water; and
  - Routine inspection of the off-load and stockpile areas to verify that BMPs are functioning properly.

2.7.6 Riverbank Reshaping

Riverbank reshaping activities would adhere to the following BMPs:

- Minimize the size of disturbed areas in access routes, staging areas, and during operations to avoid unnecessary impacts to soils and vegetation.
- Use only approved materials for fill.
- Use native seed mixes and plants for replanting.
- Riverbank shaping will be limited to the extent shown on approved grading plans.

3.0 ACTION AREA DEFINITION

"Action area" means all areas that will be affected either directly or indirectly by the action, and not merely the immediate area involved in the action (Title 50 of the Code of Federal Regulations [CFR] Part 402.02). The action area is typically considered to be the farthest potential reach of the mechanisms that may lead to impacts on listed species (**Figures 2A to Figure 2E**).

Project activities that could affect endangered and threatened species and designated critical habitat include in-water and terrestrial construction activities that result in increased noise levels, and/or turbidity. Thus, the action area includes:

- The Project footprint (i.e., the physical envelope of Project disturbance including, but not limited to, demolition, dredging, staging areas, and other temporary disturbances);
- Parts of the Columbia River and Camas Slough subject to temporary water quality effects from in-water construction-related activities that may cause turbidity or have the potential to spill contaminants; and
- Parts of the Columbia River and Camas Slough subject to temporary underwater noise during removal of concrete and pilings.

Of the construction activities described above, the associated impacts that typically carry beyond the construction footprint are demolition noise, water quality effects, alteration of terrestrial and aquatic environments, and human disturbance. These elements are briefly discussed in the following sections to help define the action area for this evaluation.

3.1 Construction-Related Noise

3.1.1 Terrestrial Noise

A terrestrial noise action area was not calculated for this Project because terrestrial species listed under the Endangered Species Act (ESA) or terrestrial state-listed or sensitive species are known to not be present within the vicinity of the Project site (Section 4).

3.1.2 Underwater Noise

The proposed construction will involve steel, pipe, and timber pile removal using vibratory hammers, and concrete foundation and pile removal using hoe-rams and concrete saw cutting. These activities produce noise levels exceeding thresholds for fish disturbance and injury (**Table 5**).

Additionally, noise produced by demolition activities would have an impact on marine mammals such as sea lions and seals. However, these species are not ESA listed and are transient through the action area and would likely avoid the area entirely during demolition. Therefore, the Project will adhere to the Marine Mammal Protection Act to prevent any take of marine mammals unless authorization is approved.

Table 5. Fish Injury and Disturbance Thresholds for Underwater Construction Activity

Functional Group	Underwater Noise Threshold	
	Injury Threshold	Disturbance Threshold
Fish less than are equal to 2 grams	187 dB cumulative SEL	150 dB RMS
Fish greater than 2 grams	183 dB cumulative SEL	
Fish All Sizes	206 dB peak	

Abbreviations:
SEL = sound exposure level
RMS = root mean square
dB = decibel

The Washington State Department of Transportation (WSDOT) guidance and calculator were used to estimate the distances away from each of the construction activities to be used during the Project where noise levels would attenuate to the noise threshold levels (WSDOT 2019).

Equation (1) was used to estimate the extent of construction-related noise:

$$D = Do\ x\ 10^{\left(\frac{construction\ noise - background\ noise}{\alpha}\right)} \quad (1)$$

Where:
D = the distance from the noise source, in meters
D_o = the reference measurement distance (10 meters in this case), and
α = 15 for transmission loss underwater. This alpha (α) constant value assumes 4.5-decibel reduction per doubling distance.

Background sound levels were determined by WSDOT guidance (WSDOT 2019):

- Assumed to be 150 decibels, which was determined to be the “effective quiet;”
- The level at which a single strike would attenuate underwater; and
- Established based on the limit of the maximum distance from which injury to fish is expected.

Both vibratory pile removal, hoe-ram operation, and concrete saw cutting would create elevated noise levels in the Columbia River and Camas Slough (**Table 6**).

Table 6. Underwater Distance-to-Noise Thresholds for Pilings and Concrete Removal

Pile Size/Material and Action		Fish Injury Threshold			Fish Disturbance Threshold (RMS)
		Peak	Cumulative SEL		
			Fish less than or equal to 2 grams, 187 dB	Fish greater than 2 grams, 183 dB	
		206 dB			150 dB
		Distance (m) From Action			
	Concrete Removal by Hoe-Ram Operation	206 dB	171 dB	171 dB	186 dB
	No attenuation	10 m	125 m	230 m	2,512 m
	Concrete Removal by Saw cutting	159 dB	152 dB	152 dB	140 dB
	No attenuation	0 m	0 m	0 m	2 m
12” timber	Vibratory Pile Removal				150 dB
	No Attenuation	-	-	-	10 m
12” steel pipe	Vibratory Pile Removal				155 dB
	No Attenuation	-	-	-	22 m
24” steel pipe	Vibratory Pile Removal				164 dB
	No Attenuation	-	-	-	86 m
12” steel H-pile	Vibratory Pile Removal				153 dB
	No Attenuation	-	-	-	16 m
24” sheet pile	Vibratory Pile Removal				165 dB
	No Attenuation	-	-	-	100 m

Source: All received level values taken from or estimated using Table 7-16, Table 7-17, and Table 7-19 from WSDOT guidance document (WSDOT 2019).
Abbreviations:
dB = decibel
m = meters
RMS = root mean square
SEL = sound exposure level

The data in **Table 6** were used to determine the Project action area based on the distance from specific Project activities where noise levels would attenuate to levels below the fish injury and disturbance thresholds cited in **Table 5**.

A vibratory hammer would be used to remove pilings throughout the Project area and would result in various noise levels, depending on the type of piling to be removed, as shown in **Table 6**. Maximum sound levels would be below the injury threshold for all types of pilings. However, the vibratory hammer activities would exceed the fish disturbance threshold (150 decibels [dB] root mean square [RMS]) for all types of piles. Most of the pilings to be removed are made of wood or steel, and therefore for most of the Project the disturbance noise threshold would be exceeded for a maximum distance of 86 meters (282 feet) (**Table 6**).

However, a small number of sheet piling structures are to be removed, and vibratory hammer extraction for these types of pilings produce noise levels of 165 dB RMS, which would create noise levels above the disturbance threshold for a maximum distance of 100 meters (328 feet) (**Table 6**). As such, given the uncertainty in the specific equipment that would be used, it is assumed that the maximum potential for fish disturbance due to noise from vibratory extraction of pilings would be 100 meters (as shown on **Figures 2B through 2E**).

Removal of 54 concrete piers associated with the dock warehouse would be accomplished by directly pulling the concrete piers from the bedrock, if possible. However, if the pier were to break during this process or if they cannot be removed by direct pull, then a concrete saw cutting blade would be used to cut the pilings below the mudline as determined by mudline elevation, slope, and stability of the site.

Both the peak (159 dB) and cumulative sound exposure level (152 dB) for underwater saw cutting of concrete are below the threshold for risk of injury to fish (**Tables 5 and 6**). As such, the only possible risk that could occur due to saw cutting would be fish disturbance, which would occur a maximum of 2 meters (6 feet) from the pier (**Table 6 and Figure 2E**).

Hoe-ram operations would be limited to the area where concrete exists near the Berger crane foundation and dock warehouse piers. Part of the Berger crane foundation lies below +2 feet CRD, which is below the OHWM, and therefore some demolition activities may be conducted in-water, below the OHWM. Use of hoe-ram operations with no attenuation for the concrete removal would result in noise levels that exceed the disturbance threshold for fish up to a distance of 2,512 meters (8,241 feet) away from the concrete removal activity (**Table 6 and Figure 2E**).

As such, the action area (**Figure 2A to Figure 2E**) related to underwater noise was defined as an area radiating out from the Berger crane foundation and dock warehouse concrete piers for a distance of 2,512 meters or to the nearest shoreline, whichever is closer (**Figure 2E**). Because the majority of the action area is located within the Camas Slough near Lady Island, shorelines are encountered prior to 2,512 meters in nearly all directions. However, some of the action area resides outside of Camas Slough, and within the Columbia River; therefore, in those cases where pilings are to be removed, the area of noise effect would extend the maximum 100 meters possible.

Other potential sources of underwater noise that could occur as a part of this Project include dredging activities and barge use. However, mechanical and hydraulic dredges produce underwater sounds that are strongest at low frequencies, and these frequencies rapidly attenuate in shallow water. Although the noise levels from large vessels may exceed those from dredging, single vessels usually do not produce strong noise in one area for a prolonged time (Richardson et al. 1995). Additionally, fish respond to lower frequency sounds by displaying an avoidance response, not by habituating to the sound despite repeated exposure (Dolat 1997; Knudsen et al. 1997). These findings, combined with the requirement that work be conducted only during specific in-water work windows to avoid sensitive life stages as determined by the agencies, these activities would have no significant effect on aquatic species.

3.2 Water Quality

The action area also includes those portions of Camas Slough and the Columbia River upstream and downstream of the demolition area that could be affected by increased suspended sediment and turbidity from demolition activities.

The temporary turbidity mixing zone standards of WAC 173-201A-400 were used to estimate the potential zone of sediment/turbidity impacts during the Project. As outlined in WAC 173-201A-400(7)(a), the maximum size for mixing zones in rivers and streams is 300 feet downstream and 100 feet upstream from the point of discharge.

3.2.1 Temporary Turbidity due to Upland Disturbance

Upland demolition and vegetation removal could lead to erosion causing indirect temporary and localized turbidity that potentially could reach levels that adversely affect fish. However, upland sources of erosion would be limited since very little below surface disturbance is proposed. Potential sediment from upland sources would be contained using the erosion control and sediment detention BMPs described in the Project's *Temporary Erosion and Sediment Control (TESC) Plan*. Erosion control measures would be inspected frequently to maintain a continuous barrier between ground-disturbing activities and Camas Slough and Columbia River. Therefore, the indirect turbidity effects due to the upland demolition would not extend the action area within the aquatic zones of the Project.

3.2.2 Temporary Turbidity due to In-water and Overwater Activities

In-water activities could generate localized and short-duration turbidity events associated with disturbance of the riverbed. **Table 7** summarizes sources and extent of potential turbidity in Camas Slough and the Columbia River.

Table 7. Potential Sources of Turbidity from In-water and Overwater Activities

Activity	Likely greatest extent of downstream turbidity	Approximate Duration of Effect (hours per workday)	Approximate Number of Proposed Workdays
Operate stationary and moving barges	Less than 300 feet	Varies	Up to 98 days per year
Remove piles	Less than 25 feet	8 to 10 hours	300
Demolish in-water structures, including pier removal	Less than 25 feet	8 to 10 hours	30
Demolish overwater structures, below OHWM	Less than 25 feet	8 to 10 hours	235
Dredging (sediment removal)	300 feet	10 to 16 hours	180
Riverbank reshaping, below OWHM (in the wet)	300 feet	8 to 10 hours	30

It is anticipated that most of the in-water structure removal work expected is to use vibratory hammers for pile removal, and it can be assumed that turbidity caused by these activities would be minimal. This has been documented by other studies that showed the magnitude or extent of turbidity resulting from pile removal. Examples included water quality monitoring performed by Washington State Ferries for:

1. Pile removal at Friday Harbor Ferry Terminal in 2004, which showed that turbidity levels did not exceed 1 Nephelometric turbidity unit above background levels, and

2. Pile removal of steel and creosote timber piles at Eagle Harbor Maintenance Facility in 2005, which showed turbidity levels of no more than 0.2 nephelometric turbidity unit above background levels (WSF 2019).

Given that the Columbia River has a very high dilution capacity due to large water volumes and high current, along with coarse sediment materials (approximately 80 percent sand) it is expected that turbidity generated by removal of piles will localized to about a 25-foot radius around the pile.

Sediment removal by dredging and placing fill material are the aspects of in-water work likely to generate the most turbidity. As stated, dredging would occur within Camas Slough. Dredging would likely generate elevated turbidity up to about 300 feet of the Project site. The Project area comprises coarse-grained materials that do not remain in suspension due to their size and settle out quickly, limiting both the extent and duration of turbidity when disturbed. Dredging would be performed using a mechanical dredge and at a slow, controlled pace to minimize turbidity.

Barges and other vessels operating in shallow water have the potential to produce turbidity in the Columbia River and Camas Slough. Shallow water operations could occur in some cases in Camas Slough due to low water levels, especially in the late summer and fall. Shallow water operations are limited to the near-shore locations in the Columbia River.

Barges generally have a draft depth of about 10 to 12 feet. Draft of other vessels varies. Where drafts are shallow, propellers on tugboats moving barges may produce turbulence causing sediments to become suspended. In addition to the equipment barge, one or two barges would be used to transport removed structures and dredged materials. These barges would make trips as needed. However, compared to the existing energy generated by high-velocity flow in the action area, turbidity due to disturbance of sediment by tugboat propellers is expected completely settle to background within 300 feet downstream of the initial disturbance. Therefore, it is assumed that activities including piling removal, pier removal, in-water demolition, and demolition below the OHWM of the action area would have a 25-foot downstream extent where water quality could be impacted. The exception would be that when dredging, fill, or barge activities are occurring then a 300-foot downstream extent is likely to occur. Additionally, impact avoidance and minimization measures described in Section 2.7 would also be utilized to prevent extensive turbidity from dispersing into the wider environment. In any case, turbidity would not exceed the levels, distance, or duration specified by the permits.

3.3 Alteration of Aquatic Environments

Temporary alteration of areas aquatic environments would occur because of demolition and dredging of sediment. Anticipated impacts on aquatic habitat would be limited to the area immediately adjacent to the Project site, along the shoreline of Lady Island, and within the immediate surrounding area of the piles that would be removed along the northern shoreline. Anticipated impacts on terrestrial habitat would be limited to the upland vegetation located within the Project area where demolition is to occur above OHWM. The zone of influence for environmental alteration is restricted to the Project limits (footprint) of demolition and dredging activities.

3.4 Human Disturbance

During demolition, dredging and riverbank reshaping an increase in human activity, traffic, and equipment would cause associated temporary increases in noise, automobile emissions, and dust. These temporary construction-related effects would be minimized by adhering to appropriate erosion control BMPs and conservation measures implemented during soil-disturbing activities. While there would be a temporary increase in the level of human activity or traffic in the Project area, it would not extend the action area that is defined in Section 3.5. Additionally, human activity or traffic would not increase the Project area following demolition activities and actually would diminish the human footprint within the environment due to the reduction in riverfront industrial activities.

3.5 Action Area Summary

The impacts with the largest associated areas for this Project are temporary increase in underwater noise disturbance and water quality effects due to a temporary increase in turbidity. Therefore, the action area for this Project comprises the underwater noise and water quality impacts extents and is depicted in **Figure 2A to Figure 2E**. The Action Area does not include terrestrial portions of the Project as stated in Section 3.1.1.

The action area for this Project includes all of the following:

- The Project's aquatic footprint.
  - The underwater extent, starting from the activity location and extending outward up to the underwater noise maximum propagation distance, for the following:
    - 2,512 meters (8,241 feet) during hoe-ram operation with no attenuation, for concrete removals.
    - 100 meters (328 feet) during removal of pilings and dolphins that are wood or steel using a vibratory impact hammer, which would be the case during most of the demolition.
    - 2 meters (6 feet) for saw cutting, where needed, when a piling breaks during extraction.
  - The maximum extent at which water quality could be affected: up to 300 feet during dredging and fill activities.
- Indirect effects during activities in the Project's terrestrial footprint.
  - The terrestrial extent includes access roads, staging areas, and upland demolition areas. The area is almost entirely paved and located on GP property. Except for riverbank shaping, very little below ground disturbance would occur in the terrestrial footprint since demolition is to the slab level.

4.0 LISTED SPECIES AND HABITAT INFORMATION

Information on species listed under Section 7 of the ESA that are potentially present in the action area was obtained from the USFWS Information for Planning and Consultation (IPaC) online tool (USFWS 2020a, 2022) and from NOAA Fisheries list of ESA threatened and endangered species (NOAA Fisheries 2020). The WDFW Priority Habitats and Species (PHS) website and SalmonScape interactive mapper were also searched for priority habitats and ESA-listed species potentially occurring in the Project action area (WDFW 2020a, 2020b).[2]

4.1 Species and Critical Habitats Addressed

Most of the Project work includes in-water and overwater work that is primarily located within Camas Slough and the Columbia River; therefore, most of the species listed under the ESA are aquatic which includes five species identified by NOAA fisheries and one species identified by USFWS (**Table 8**).

Eleven additional ESA-listed species were identified by USFWS (2020a, 2020b, 2022) as potentially present within the Project area are not expected to occur and thus are not evaluated further in this report. These species and their reason for exclusion from further evaluation are listed and summarized in **Table 9**. Other species of potential concern that have no ESA listing status or have no critical habitat in the Project area are further described in **Appendix B**.

In the Columbia River, NOAA Fisheries has listed 14 fish populations as threatened or endangered under the ESA. In the lower Columbia River reach, five ESA-listed fish species may occur in the action area (NOAA Fisheries 2020). These five species are: Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), steelhead (*O. mykiss*), and Pacific eulachon (*Thaleichthys pacificus*) (**Table 8**). While the other nine listed NOAA salmonid species could potentially migrate through the action area, it is unlikely they would use Camas Slough as a navigational channel and would primarily use the main channel to migrate upstream to other subbasins within the middle and upper Columbia River outside of the action area. Therefore, these species are not addressed specifically, but these species are similar to the those are addressed within this report. Additionally, the USFWS IPaC indicated the presence of bull trout (*Salvelinus confluentus*) in the action area (USFWS 2022). No other listed species including birds, fish, mammals, reptiles, amphibians, or plants were determined to be likely present within the action area.

Designated Critical Habitat for each of the ESA-listed species is present in the action area.

Table 8. ESA-listed Species that May Occur in the Action Area

Species	Listing Status[1]	Critical Habitat	Spawning Habitat	Comments
Bull Trout (*Salvelinus confluentus*)	Threatened	Designated; within the action area	Specific spawning requirements not	Critical habitat located within the Columbia River and Camas Slough; sea-run populations could migrate through the area.

2 The PHS database was queried again in 2022 by Tetra Tech, and no additional species were found in the area beyond those found in the 2020 query conducted by Wood. The 2020 PHS query conducted by Wood can be found in Appendix F of the Shoreline Report (Tetra Tech 2023).

Species	Listing Status[1]	Critical Habitat	Spawning Habitat	Comments
			met within action area.	
Chinook Salmon (*Oncorhynchus tshawytscha*) Lower Columbia River ESU	Threatened	Designated; within the action area	Specific spawning requirements not met within action area.	Documented as occurring within the action area. Migrate through the area during spawning migration. Critical habitat located within the Columbia River and Camas Slough.
Chum Salmon (*Oncorhynchus keta*) Columbia River ESU	Threatened	Designated; within the action area	Specific spawning requirements not met within action area.	Documented as occurring within the action area. Migrate through the area during spawning migration. Critical habitat located within the Columbia River and Camas Slough.
Coho Salmon (*Oncorhynchus kisutch*) Lower Columbia River ESU	Threatened	Designated; within the action area	Specific spawning requirements not met within action area.	Documented as occurring within the action area. Migrate through the area during spawning migration. Critical habitat located within the Columbia River and Camas Slough.
Steelhead (*Oncorhynchus mykiss*) Lower Columbia River DPS	Threatened	Designated; within the action area	Specific spawning requirements not met within action area.	Documented as occurring within the action area. Migrate through the area during spawning migration. Critical habitat located within the Columbia River and Camas Slough.
Pacific Eulachon (*Thaleichthys pacificus*) Southern DPS	Threatened	Designated; within the action area	Specific spawning requirements not met within action area.	Documented as occurring within the action area. Migrate through the area during spawning migration. Critical habitat located within the Columbia River and Camas Slough.

Notes:
ESA Listing status and critical habitat obtained from USFWS (2020a) and NOAA Fisheries (2020).
Abbreviations:
ESU = Evolutionarily Significant Unit
DPS = Distinct Population Segment

Table 9. Listed Species Not Known to Occur in the Action Area Excluded from Further Evaluation

Species	Listing Status[1]	Critical Habitat[1/]	Rationale for Exclusion Comments
Columbian White-tailed Deer (*Odocoileus virginianus*)	Threatened	None	The action area is outside the known distribution of the species, which is limited to a series of river islands located in Clatsop and Columbia Counties in Oregon and Cowlitz, Wahkiakum, Clark Counties in WA downstream of the Project (Azerrad 2016).
Gray Wolf (*Canis lupus*)	Endangered	None	The action area is outside of known pack or pack use areas (USFWS 2020c; WDFW et al. 2019).
Northern Spotted Owl (*Strix occidentalis caurina*)	Threatened	Designated; outside the action area	Northern spotted owls live in forests characterized by the dense canopy of mature and old-growth trees, abundant logs, standing snags, and live trees with broken tops (USFWS 2020c). Nearly all spotted owls are currently found in the Cascade Range and on the Olympic Peninsula (Buchanan 2016). Because the action area does not reside within the Cascade Range or on the Olympic Peninsula or within an old-growth forest, the northern spotted owl is known to not occur within the action area.

Species	Listing Status[1]	Critical Habitat[1/]	Rationale for Exclusion Comments
Streaked Horn Lark (*Eremophila alpestris strigata*)	Threatened	Designated; outside the action area	This ground-nesting bird is migratory within the same breeding region (USFWS 2020a). The WDFW PHS data do not indicate presence of streaked horned lark in the action area (WDFW 2020a). The species is currently restricted to areas of sparsely vegetated shorelines, agricultural fields, drying seasonal wetland mudflats, sparsely vegetated edges of grass fields, grazed pastures, gravel roads, or airports (Pearson and Altman 2005; WDFW 2020c). Nesting habitat generally requires 300 acres or more of preferred habitat (USFWS 2020d). Given the lack of suitable habitats present in the action area; this species is not expected to occur in the action area.
Yellow-billed Cuckoo (*Coccyzus americanus*)	Threatened	Proposed; outside the action area	A migratory bird with the last confirmed breeding records in Washington dating from 1923; other recent observation records are from eastern Washington in Walla, Stevens, and Okanogan Counties. Nesting habitat requires large (usually exceeding 40 hectares in size), wide (over 100 meters) patches of shrubby/forested riparian vegetation with high canopy closure and density, typically dominated by cottonwoods (*Populus* spp.) and willows (*Salix* spp.), which may be mixed with ash (*Fraxinus* spp.), walnut (*Juglans* spp.), mesquite (*Prosopis* spp.), tamarisk (*Tamarix* spp.) and others (Wiles and Kalasz 2017). Given the lack of observations in the action area, this species is not expected to occur in the action area. Further, no Project activities will occur in forested, riparian habitats.
Bradshaw's Desert-parsley (*Lomatium bradshawii*)	Endangered	None	Once believed to be endemic only to Oregon, two populations of the species were discovered in Clark County, Washington in 1994 (USFWS 2010). The species is restricted to wet prairie habitats inundated during the winter months. The action area does not include the preferred habitat for Bradshaw's desert-parsley.
Golden Paintbrush (*Castilleja levisecta*)	Threatened	None	Golden paintbrush does not tolerate shade from nearby trees, shrubs, or even tall nonnative grasses. This species is considered extirpated in most areas and only 11 known populations are currently known to exist in Washington and British Columbia, none of which occur in Clark County (USFWS 2020e). The action area does not include the preferred habitat for golden paintbrush, nor are there any known populations within the action area.
Kincaid's Lupine (*Lupinus sulphureus spp. Kincaidii*)	Threatened	Designated; outside the action area	Kincaid's lupine is typically found in native upland prairie with the dominant species being red fescue (*Festuca rubra*) and/or Idaho fescue (*Festuca idahoensis*) but is occasionally found on steep, south-facing slopes and barren rocky cliffs (65 FR 3875). The action area does not include the preferred habitat for Kincaid's lupine.
Nelson's Checker-mallow (*Sidalcea nelsoniana*)	Threatened	None	Nelson's checker-mallow occurs in various sunny habitats, including margins of sloughs, drainage ditches, stream-sides, roadside ditches, fence rows, swales, and wetter portions of native prairie remnants. It is often found where prairie remnants or disturbed grasslands meet woodland habitats (NRCS 2010). Although occasionally occurring in the understory of Oregon ash (*Fraxinus latifolia*) woodlands or among woody shrubs, it usually occupies open habitats supporting early seral plant species (USFWS 2010). The action area does not include the preferred habitat of Nelson's checker-mallow.

Species	Listing Status[1]	Critical Habitat[1/]	Rationale for Exclusion Comments
Water Howellia (*Howellia aquatilis*)	Threatened	None	Water howellia is an aquatic plant species that generally grows in shallow (less than 3 feet) stagnant waters, freshwater wetlands, ephemeral glacial pothole ponds, or former river oxbows, in sites that dry out in summer months (USFWS 2020f; 59 FR 34860). These wetland habitats are typically filled by spring rains and snowmelt run-off. Plants typically root in bottom sediments of firm consolidated clay and organic sediments that occur in wetlands associated with ephemeral glacial pothole ponds and former river oxbows, and most of the individual plant is submerged below the water surface. The action area is located within and along active channels of Columbia River and Camas Slough, with no oxbows or ponded water areas present. Wetland habitats within the action area are limited to small areas where natural riverbank conditions occur, at which shallow slopes below OHW are generally comprised of sand, silt, and fine gravel. Wetland habitats occur in these areas where some organic deposition has occurred. Given the action area lacks areas of ephemeral wetlands, glacial pothole, or river oxbow habitats underlain by firm consolidated clay and organic sediments; and the historic dredging activities and hydrologic influence of the Bonneville Dam, the action area does not provide suitable habitat for water howellia. Additionally, the only known occurrences of the species within Clark County is located within the Ridgefield National Wildlife Refuge (USFWS 1996) located at RM 90.
Willamette Daisy (*Erigeron decumbens*)	Endangered	Designated; outside the action area	The primary constituent element of critical habitat is early seral upland prairie, wet prairie, or oak savanna habitat with a mosaic of low-growing grasses, forbs, and spaces to establish seedlings or new vegetative growth; absence of dense canopy vegetation; and undisturbed subsoils (USFWS 2010). The action area does not include the preferred habitat for Willamette daisy.

Note:
1/ ESA Listing status and critical habitat obtained from USFWS (2020a, 2020b, 2022).
Abbreviation:
FR = Federal Register
RM = river mile

4.2 Species Descriptions and Critical Habitat Occurrence

Of the federally protected species identified by the USFWS and NOAA Fisheries (see **Appendix C**), the following species and their critical habitat may occur in the action area:

- Bull trout (*Salvelinus confluentus*),
- Chinook salmon (*Oncorhynchus tshawytscha*),
- Chum salmon (*Oncorhynchus keta*),
- Coho salmon (*Oncorhynchus kisutch*),
- Steelhead (*Oncorhynchus mykiss*), and
- Pacific eulachon (*Thaleichthys pacificus*).

Fish use of the Columbia River represents a continuum based on run timing as upstream or downstream movement occurs during migration. Adult fish would be found at upstream reaches later than downstream reaches as they migrate upstream, and the opposite would be true for juvenile fish migrating downstream. In addition, juveniles may be found in the Columbia River estuary (downstream of the action area) for a significant portion of the year, as estuarine areas represent important rearing habitat for juveniles making the physiological transition from freshwater to saltwater.

ESA-listed fish at all life stages may be present in the action area in every month of the year and at all river stages, although specific salmonid fish stocks and life stages occur in runs at specific seasons. The timing of ESA-listed fish runs that may occur in the action area vary by species and life-stage, as shown in **Table 10**.

Table 10. Fish Run Timing in Lower Columbia River

Fish Run	Fish Run Timing[1/]											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fall Chinook Salmon												
Adults upstream migration												
Spawning												
Egg incubation												
Fry emergence/early rearing												
Fry migration/rearing												
Ocean entry												
Chum Salmon												
Adults upstream migration												
Spawning												
Egg incubation												
Fry emergence/early rearing												
Fry migration/rearing												
Coho Salmon												
Adults upstream migration												
Spawning												
Egg incubation												
Fry emergence/early rearing												
Fry migration/rearing				Outmigration								
Ocean entry												
Winter Steelhead												
Adults upstream migration												
Spawning												
Egg incubation												
Fry emergence/early rearing												
Fry migration/rearing			Outmigration									
Ocean Entry												
Summer Steelhead												
Adults upstream migration												
Spawning												
Egg incubation												

Fish Run	Fish Run Timing[1/]											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fry emergence/early rearing												
Fry migration/rearing			Outmigration									
Ocean Entry												
Bull Trout												
Adults upstream migration												
Spawning												
Egg incubation												
Fry emergence/early rearing												
Rearing	1–3 years prior to outmigration											
Outmigration												
Pacific Eulachon												
Adult upstream migration												
Larval downstream migration												

Note:
1/ ESA-listed fish run timings obtained from NOAA Fisheries (2020) and the Lower Columbia Fish Recovery Board (LCFRB 2010).

The river hydrology within the action area has been altered by development and includes altered water level fluctuations, altered seasonal and daily flow regimes, reduced water velocities, and reduced discharge volumes. Overall, these effects have had a major impact on juvenile salmonid migration behavior and potentially strand juveniles during their downstream migration (NOAA Fisheries 2000).

Altered flow regimes can affect the spawning success of mainstem Columbia River spawners salmonids such as chum salmon or fall chinook salmon. For example, fish may spawn in areas that are dewatered during the winter or spring, potentially resulting in complete egg mortality (NOAA Fisheries 2000). Additionally, low flow may also decrease the delivery of nutrients and dissolved oxygen to incubating eggs, thereby decreasing survival (LCFRB 2010).

Other factors that limit the possibility for spawning habitat to exist include increased temperatures. The Columbia River mainstem water temperatures at Washougal, Washington, range from approximately 6 degrees Centigrade (°C; 43 degrees Fahrenheit [°F]) in early spring to approximately 22°C (72°F) in late summer (USGS 2019). Most salmonids spawning occurs at temperatures between 39.2°F (4°C) and 57.2°F (14°C) (Reiser and Bjornn 1979; Spence et al. 1996). While temperatures may be viable in the mainstem, it is assumed that Camas Slough temperatures are likely as high as or higher than the main stem; therefore, it is unlikely that salmon would use it for spawning purposes. Especially as increased water temperatures can create migrational blockages for salmonids when water temperatures exceed 69.8°F (21°C) (ODEQ 1995).

In the last 120 years, the mainstem Lower Columbia River has (including Camas Slough) experienced floodplain loss and side channel loss due to diking and channelization associated with industrial, transportation, residential, mining, and agricultural activities. Additionally, activities such as maintenance dredging and filling have also reduced the habitat parameters that are required for successful spawning in these areas.

Additionally, fall Chinook, coho, chum, winter and summer steelhead are produced at two hatcheries in the vicinity: 1) the Washougal Hatchery and 2) Skamania Hatchery. These hatcheries currently release approximately 4.6 million fall Chinook, coho, and steelhead per year to the Washougal subbasin and another approximately 2.8 million chum, coho, and steelhead per year to other lower Columbia River subbasins (LCRFB 2010). Therefore, most adult fish migrating upstream through the action area are likely of hatchery-origin fish returning to the natal streams near these hatcheries. The only exception are chum which are all natural spawners in the Washougal River.

4.2.1 Bull Trout – Threatened

The PHS database (WDFW 2020a) and IPaC database (USFWS 2020a, 2022) indicate that bull trout are present throughout the lower Columbia River watershed. Bull trout exhibit resident, freshwater migratory (fluvial and adfluvial forms), and anadromous life history patterns (Rieman and McIntyre 1993). In the lower Columbia River, bull trout may exhibit resident or freshwater migratory life history patterns; anadromous bull trout have not been documented. Additionally, prior to hydroelectric facilities being built, the fluvial form was largely supported within the Columbia River, but now with many of the core areas in the watershed being fragmented or isolated, the adfluvial form is more commonly found. Bull trout have more specific habitat requirements than other salmonids, especially regarding spawning and rearing substrate and water temperatures. Cold-water temperature is one key specific requirement, and for bull trout habitat is generally considered to include water temperatures below 15°C or 59°F, particularly for spawning and rearing. Spawning and rearing habitat is not present within the action area.

Data regarding the extent to which bull trout use the mainstem lower Columbia River during various life history phases is generally lacking, but it is assumed that they would use the mainstem for overwintering and feeding (USFWS 2015). The Washougal River subbasin near the action area is not designated as being used by bull trout (LCFRB 2010).

Thus bull trout are assumed to be migratory through the action area, spawning in upriver tributary streams and migrating through the action area as juveniles or adults. Bull trout adult upstream migration generally occurs between April and September and juvenile outmigration is likely to occur between April to November, but could occur at any time as they spend about one to three years in their natal streams prior to emigration (LCFRB 2010).

Designated critical habitat for bull trout species has been established in the Mainstem Lower Columbia River Critical Habitat Unit, which extends from the mouth of the Columbia River to John Day Dam below the OHWM (75 *Federal Register* [FR] 63897). The designated habitat includes all of the mainstem Columbia River, including the action area. The primary use of the action area is for upstream and downstream migration.

Bull trout are opportunistic feeders that prey upon other organisms, feeding on terrestrial and aquatic insects, microzooplankton, and forage fish. Bull trout prefer complex forms of cover such as large woody debris, undercut banks, boulders, and pools. These cover elements are limited in the action area as riverbanks on the main mill parcel are built-up and covered by structures. Also the Columbia River is used as a navigation channel and is routinely dredged.

The USFWS identified nine primary constituent elements (PCEs) for bull trout critical habitat (75 FR 63897).

The action area contains features of four of these PCEs:

- Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.
- Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.
- An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
- Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

The remaining five PCEs for bull trout critical habitat are related to nearshore and marine habitats that do not occur within the action area:

- Water temperatures ranging from 2 to 15°C (36 to 59°F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.
- In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.
- A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.
- Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
- Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

4.2.2 Chinook Salmon – Threatened

The Lower Columbia River (LCR) Chinook salmon evolutionarily significant unit (ESU) was listed as threatened on March 24, 1999 (64 FR 14308). This status was reaffirmed on June 28, 2005 (70 FR 37160) and upheld in the five-year review on August 15, 2011 (76 FR 50448). Chinook are anadromous fish;

they are migratory in the action area and are present primarily as upstream migration of adults and downstream migration of juveniles. On their journey to marine habitats, juvenile salmonids may spend from a few days to several weeks in the mainstem Columbia River foraging prior to making their way to the estuary to acclimate to saline environments (70 FR 52630).

Recent spawning surveys indicate fall Chinook spawning in the Columbia River mainstem below Bonneville Dam; however, these fish are expected to be hatchery strays and the NOAA Fisheries does not consider them to be part of the lower Columbia River fall Chinook ESU (LCFRB 2010). Therefore, spawning habitat is likely not available in the action area; most spawning occurs in upstream portions of the Washougal River subbasin, or in other upriver subbasins such as the Lower Gorge, Wind, Little White Salmon, and Upper Gorge (LCFRB 2010).

This ESU exhibits spring-run, fall (tule), and late-fall (bright) life-history strategies. Spring stocks generally run from March through May, fall (tule) stocks generally run between August to September, and late-fall (bright) stocks run from August through October.

However, only the fall stock is the primary concern in the action area, because the Washougal River is immediately adjacent to the action area, and thus fall Chinook could use the action area to migrate to the Washougal River to spawn or return to upstream fish hatcheries (LCFRB 2010). This stock would result in peak adult migration occurring between August and October and peak juvenile outmigration between May to mid-August. While only the fall stock is the primary concern within the action area, all three stocks occur in the Columbia River and this would result in other potentially threatened ESUs to use the action area as they migrate upstream as adults to upper reaches of the Columbia River.

Designated critical habitat for the ESU has been established in the Lower Columbia River, which includes the mainstem Columbia River and major tributaries below the OHWM (70 FR 52630). The designated habitat includes the mainstem Columbia River, including the action area. The primary use of the action area is for upstream and downstream migration.

Chinook are opportunistic feeders that prey upon other organisms, feeding on terrestrial and aquatic insects, microzooplankton, and forage fish. Chinook require stream cover such as large woody debris, undercut banks, boulders, pools and side channels, or off-channel areas. However, these cover elements can be found upstream in the Washougal River, which provides spawning and rearing habitat.

Six PCEs for LCR Chinook critical habitat were identified (70 FR 52630). The action area contains features of two of these PCEs:

- Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural covers such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival. These features are essential to conservation because without them juveniles cannot use the variety of habitats that allow them to avoid high flows, avoid predators, successfully compete, begin the behavioral and physiological changes needed for life in the ocean, and reach the ocean promptly. Similarly, these features are essential for adults because they allow fish in a non-feeding condition to successfully swim upstream, avoid predators, and reach spawning areas on limited energy stores.

- Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover.

The remaining four PCEs for LCR Chinook critical habitat are related to freshwater, nearshore and marine habitats that do not occur within the action area:

- Nearshore marine areas free of obstruction with water quality and quantity conditions and forage supporting growth and maturation, and natural cover.
- Freshwater spawning sites with water quantity and quality conditions and substrate supportive of spawning, incubation, and larval development.
- Estuarine areas free of obstruction with water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh and salt water and natural cover.
- Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

4.2.3 Chum Salmon – Threatened

The Columbia River chum salmon ESU was listed as threatened on March 25, 1999 (64 FR 14508). This status was reaffirmed on June 28, 2005 (70 FR 37160) and upheld in the five-year status review on August 15, 2011 (76 FR 50448). Chum are anadromous fish. They are migratory in the action area and are present primarily as upstream migration of adults and downstream migration of juveniles. While similar to other salmonids in many ways, chum salmon are different in that they spend more of their life history in marine waters and they usually spawn in the lower reaches of coastal river systems. This allows the juveniles to migrate to the ocean almost immediately after emerging from the redds, rather than spend months or years rearing in freshwater (63 FR 11774). Peak adult migration occurs between mid-October to November and peak juvenile migration occurs March through May.

Spawning and outmigration surveys have documented successful chum spawning in the lower mainstem Columbia River along the north bank near the I-205 bridge approximately 7 miles downriver of the Project action area. However, spawning habitat is likely not available in the action area, as run sizes in the Washougal subbasin area include only approximately 1,000 fish. It appears most natural spawning occurs in upstream portions of the Washougal River subbasin or in other subbasins which include Lower Gorge, Wind, and Upper Gorge further upstream (LCFRB 2010).

Designated critical habitat for this species has been established in the Lower Columbia River, which includes the mainstem Columbia River and major tributaries below the OHWM (70 FR 52630). The designated habitat includes all the mainstem Columbia River, including the action area. The primary use of the action area is for upstream and downstream migration.

Chum salmon are opportunistic feeders that prey upon other organisms, feeding on terrestrial and aquatic insects, microzooplankton, and forage fish. Chum salmon require stream cover such as large woody debris, undercut banks, boulders, pools and side channels, or off-channel areas; these elements are limited in the action area. Additionally, unlike other salmonids that rely on favorable freshwater conditions, juvenile chum salmon rely more on favorable estuarine and marine conditions for growth and development (63 FR 11774).

The same six PCEs for as for Chinook salmon apply to Columbia River chum salmon critical habitat (70 FR 52630). The two PCEs with features that occur within the action area and the four that do not apply to Chum, as they do for Chinook salmon.

4.2.4 Coho Salmon – Threatened

LCR coho salmon were identified as a separate ESU, which was listed as threatened on June 28, 2005 (70 FR 37160). Coho are anadromous fish; they are migratory in the action area and are present primarily as upstream migration of adults and downstream migration of juveniles. Prior to making the journey to marine habitats, juvenile Coho salmonids may spend upwards to a year or more in the mainstem Columbia River and its tributaries before rapidly entering the estuary to venture seaward (Sandercock 2001).

Coho salmon are known to spawn and rear in small tributaries associated with the lower Columbia River. Therefore, spawning habitat is not available in the action area; most spawning occurs in upstream portions of the Washougal River subbasin or in other smaller tributary subbasins (LCFRB 2010).

LCR coho are typically categorized into Early and Late-returning stocks. Early returning (Type S) coho enter the Columbia River in mid-August and begin entering tributaries in early September, with peak spawning from mid-October to early November. Late-returning (Type N) coho pass through the lower Columbia from late September through December and enter tributaries from October through January (LCRFB 2010). Most spawning occurs from November to January, but some spawning ranges to February and as late as March. Peak adult migration occurs between August to December and peak juvenile outmigration occurs between April to June.

Designated critical habitat for this species has been established in the Lower Columbia River, which includes the mainstem Columbia River and major tributaries below the OHWM (81 FR 9251). The designated habitat includes the mainstem Columbia River, including the action area. The primary use of the action area is for upstream and downstream migration.

Coho salmon are opportunistic feeders that prey upon other organisms, feeding on terrestrial and aquatic insects, microzooplankton, and forage fish. Coho salmon require stream cover such as large woody debris, undercut banks, boulders, pools and side channels, or off-channel areas; these elements are limited in the action area.

The six PCEs for LCR coho salmon critical habitat are identical to that of the Chinook salmon. The two PCEs with features that occur within the action area and the four that do not are identical to those for Chinook salmon.

4.2.5 Steelhead – Threatened

The LCR steelhead Distinct Population Segment (DPS) was listed as threatened on March 19, 1998 (63 FR 13347). This status was reaffirmed on January 5, 2006 (71 FR 833) and upheld in the five-year review on August 15, 2011 (76 FR 50448). Steelhead are known to spawn and rear in numerous small tributaries associated with the lower Columbia River. Spawning habitat is not available in the action area. Spawning may occur in upstream portions of the Washougal River subbasin or in other watersheds further upstream of the lower Columbia River (LCFRB 2010). Steelhead are present primarily as upstream migrating adults and downstream migrating juveniles.

Steelhead are iteroparous (capable of spawning more than once before death) however, it is rare, especially for females, to spawn more than once before dying (Nickelson et al. 1992). Prior to making the journey to marine habitats, juveniles may spend upwards of a year or more in the mainstem Columbia River and its tributaries before rapidly entering the estuary.

Both winter and summer steelhead stocks have been identified in the Columbia River watershed (NOAA Fisheries 2016). Summer steelhead stock runs generally occur from May through October, whereas winter stocks generally time runs from November through May (LCFRB 2010). Adult migration through the action area could occur anytime of the year, due to both winter and summer stocks run being identified in the Columbia River and Camas Slough and migrating through the action area at different times to reach the nearby Washougal River. However, it is most likely that for both stocks peak juvenile out migration occurs between March to June on the rising leg of the hydrograph.

Spawning habitat is not available in the action area; the nearest spawning is believed to occur in the nearby Washougal River subbasin due to fish being released by upstream fish hatcheries or in other subbasins further upstream (LCFRB 2010).

Designated critical habitat for this species has been established in the Lower Columbia River, and areas below the OHWM in the mainstem Columbia River and major tributaries (70 FR 52630). The designated habitat includes the mainstem Columbia River, including the action area.

Steelhead are opportunistic feeders that prey upon other organisms, feeding on terrestrial and aquatic insects, microzooplankton, and forage fish. Steelhead require stream cover such as large woody debris, undercut banks, boulders, pools and side channels, or off-channel areas; these elements are limited in the action area.

The six PCEs for LCR steelhead critical habitat are as for Chinook salmon (70 FR 52630). Both the two PCEs with features that occur within the action area and the four that do not are identical to those for Chinook salmon.

4.2.6 Pacific Eulachon – Threatened

The Southern DPS of Pacific eulachon was listed as threatened on March 18, 2010 (75 FR 13012). Pacific eulachon, also known as Columbia River Smelt or Hooligan. They are present from northern California to southwest Alaska and into the southeastern Bering Sea in the Northern Pacific Ocean. Pacific eulachon are an anadromous species, typically spending three to five years in saltwater before returning to freshwater to spawn in late winter through mid-spring (LCFRB 2010). Within the continental U.S., most Pacific eulachon production originates in the Columbia River basin. Most of the spawning occurs within the segment of the river influenced by tidal variations. Peak adult migration through the action area could occur anytime during February and March, but overall migration could occur between December and May (WDFW and ODFW 2001).

Pacific eulachon are broadcast spawners, releasing eggs over pea-sized gravel and coarse sand. Pacific eulachon prefer water temperature between 4°C and 10°C in the Columbia River for spawning (WDFW and ODFW 2001). High water temperatures are anticipated to lead to adult mortality and spawning failure (Blahm and McConnell 1971). Shortly after hatching, the larvae are carried downstream and dispersed by estuarine and ocean currents. Juveniles are reported to rear in nearshore marine waters (WDFW and ODFW 2001).

Designated critical habitat for this species has been established in the Lower Columbia River, which includes the mainstem Columbia River and major tributaries below the OHWM (76 FR 65324). The designated habitat includes the mainstem Columbia River, including the action area, up to the Bonneville Dam. The primary use of the action area is for upstream and downstream migration.

Pacific Eulachon are a cold-water species and are adapted to feed on a northern assemblage of copepods in the ocean during the critical transition period from larvae to juvenile (75 FR 13012). Pacific eulachon are an essential food source for a variety of predator species including salmon, sturgeon, dogfish sharks, halibut, whales, porpoises, seals, sea lions, and various marine birds (WDFW and ODFW 2001).

Three PCEs for Pacific eulachon critical habitat have been identified (76 FR 65324). The action area contains features of one:

- Freshwater and estuarine migration corridors free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted.

The remaining two PCEs for Pacific eulachon critical habitat for nearshore and marine habitats that do not occur within the action area:

- Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation.
- Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival.

5.0 ENVIRONMENTAL BASELINE

This section presents an analysis of the effects of past and on-going human and natural factors leading to the current status of listed species and their habitat (including designated critical habitat) within the action area.

5.1 General Setting

The Project area lies along a portion of the Columbia River and in Camas Slough, which runs between Lady Island and the City of Camas, Washington. Currently in the action area, the river is known to fluctuate across roughly 15 feet of elevation during the annual river hydrologic cycle. There are no river dikes adjacent to the action area.

Historically, the Lower Columbia River subbasin, including the action area, experienced frequent flooding, which contributed flow to side channels and deposited woody debris, ultimately leading to habitat diversity. These areas provided feeding and resting habitat for juvenile salmonids in the form of low-velocity marshland and tidal channel habitats (Bottom et al. 2005). However, between the 1930s and 1970s, dams were built upriver of the action area on the Columbia River and its tributaries, significantly altered the timing and velocity of hydrologic flow and reducing peak season discharges. The change in hydrograph resulted in a decline of available aquatic habitat for native fish, particularly those that rely heavily on low-velocity side channel habitat for holding, feeding, and rearing.

Also, navigation management was implemented which has resulted in channelization of the of the Columbia River. Major irrigation withdraw upriver has also influenced flows. Many extents of the river's banks have been diked to provide flood protection. Due to these changes, several other aspects of aquatic habitat components have been affected including the amount and distribution of woody debris, rates and amounts of sediment transport, temperature patterns, the complexity and species composition of the food web, the distribution and abundance of salmonid predators, and the complexity and extent of tidal marsh vegetation and salinity in the estuary.

The river historically had annual spring freshet flows that averaged 75–100 percent higher than current spring freshet flows. In addition, historical winter flows (October through March) were approximately 35–50 percent lower than current flows. Importantly, these greater historical peaks encouraged greater sediment transport (ISAB 2000).

Historically, terrestrial habitat in the surrounding area was characterized by closed-canopy upland forest/woodland with patches of prairie (Hulse et al. 2002). Forest types in the region included coniferous forest with Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*), various deciduous forest including riparian black cottonwood (*Populus trichocarpa*) forest, and a variety of wetland types (Omernik 1987). Upland adjacent to the action area on the main Mill parcel along with a portion of Lady Island has been developed for industrial purposes. Residential parcels line on the north bank of the Columbia River in the action area portion downriver of Camas Slough.

5.2 Field Investigation

Biologists from Wood Environment & Infrastructure Solutions, Inc. (Wood), performed an initial field investigation of the Project area on July 16 and 17, 2019, to characterize the environment and fish and wildlife habitat, as well as to document the presence and extent of wetlands. A subsequent field investigation was performed by Wood biologists on July 22, 2020, including shoreline areas of Lady Island and Camas Slough that were not previously reviewed. Detailed information on the field effort and results is provided in the revised *In-water Overwater Removals Project Shoreline Report* (Tetra Tech 2023).

5.3 Aquatic Habitat

As stated, aquatic resources in the Project area consist of the Columbia River, including Camas Slough and wetlands along the riverbanks. The Washougal River flows into the Camas Slough at the Slough's eastern extent. The Washougal River is outside of the action area. An overview of the location of the aquatic resources identified in the Project area is provided in **Figure 2A**; additional detail is provided in **Figures 2B through 2E**. Further baseline conditions are considered for the listed species as a whole in **Appendix C**, such as subpopulation, water quality, habitat quality, channel conditions, hydrology, and watershed conditions.

5.3.1 Columbia River and Camas Slough

The Columbia River is the fourth largest river in North America. It is approximately 1,249 miles in length, draining approximately 258,000 square miles into the Pacific Ocean along the border of Washington and Oregon (Kammerer 1990). The Columbia River basin drainage consists of numerous sub-basins formed by tributaries to the mainstem river; the major tributaries consist of the Kootenai, the Flathead/Pend Oreille, the Snake, and the Willamette (BPA 2001). The lower Columbia River, in which the Project area is located, is approximately 146 miles long extending from the Bonneville Dam to the Pacific Ocean and the mouth of the Columbia River.

Camas Slough is an approximately 2.4-mile-long side channel of the Columbia River and branches from the mainstem at the tip of Lady Island forming the northern extent of Lady Island and the southern shoreline of the city of Camas. The confluence with the Washougal River occurs at the upriver end of the Camas Slough. In the Project vicinity, State Route 14 crosses the Slough twice on bridges, near the head of the Slough from Parker's Landing onto Lady Island, then travels back to the north riverbank at the Slough's midpoint (see **Figures 2A-2E**).

In the action area, the Columbia River and Camas Slough are tidal, with a mean daily tidal range of approximately 1.19 feet, and a diurnal range of 1.85 feet (NOAA Fisheries 2019). Tidal influence extends approximately 20 river miles farther upstream from the action area to head of tide at the Bonneville Dam. In general, tidal influence decreases as the volume of water increases in this system. At low water levels, the diurnal tidal fluctuation is readily observed in the action area and is not readily observed at high river stages.

Although tidal, the water in the action area is fresh as the saline wedge does not extend to influence water salinity at this location. Columbia River and Camas Slough are listed on Ecology's 303d Water Quality list of impaired waters for temperature and low oxygen.

5.3.1.1 Columbia River Sediment Quality

A *Sediment Quality Evaluation Report* by the U.S. Army Corps of Engineers (USACE 2019) for a reach of approximately 85 miles on the Columbia River Federal Navigation Channel reported that sediment grab samples taken at approximately RM 119 and 124, locations immediately adjacent and 4 miles upriver respectively to this Project, consisted of 98.0 percent coarse-grained sediment (sands and gravels) with a very low total organic content at 0.16 percent.

A sediment sampling and analysis event was performed by GP at operating Outfall 001 in 2017-2018 to comply with National Pollutant Discharge Elimination System (NPDES) monitoring requirements (ESA 2018). Sampling was designed to evaluate sediments 100 feet upriver and up to 500 feet downriver of the outfall. Sediment samples to depths of 8 inches below the surface were successfully collected.

Sediment characterization included conventional parameters (ammonia, sulfide, total organic carbon, percent total solids, total volatile solids, grain size), metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc), semivolatile organic compounds, organotins, total polycyclic aromatic hydrocarbons (PAHs), organochloride pesticides, total petroleum hydrocarbons, polychlorinated biphenyls (PCBs), and dioxins/furans. No other constituents of concern (COCs) were identified as requiring analysis for this outfall.

Analysis of sediments for conventional parameters and chemical data showed that no parameter exceeded any of the Sediment Management Standards (SMS)—Freshwater Sediment Cleanup Objectives (WAC 173-204-563; Ecology 2013). Sediments consisted of sand (range: 87 to 100 percent) with up to 4 percent gravels (two samples). Total organic carbon was generally very low, with one exception with moderate organic carbon (1,300 milligrams per kilogram).

5.3.1.2 Camas Slough Sediment Quality

Sediment sampling in the Camas Slough was performed in 2009 to support dredging disposal determination, and more recent sampling was done for NPDES compliance. Sediment characterization included conventional parameters (ammonia, sulfide, total organic carbon, percent total solids, total volatile solids, grain size), metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc), semivolatile organic compounds, organotins, total PAHs, organochloride pesticides, total petroleum hydrocarbons, PCBs, and dioxins/furans. No other COCs were identified as requiring analysis for this outfall. Analysis of sediments for conventional parameters and chemical data showed that no parameter exceeded any of the SMS—Freshwater Sediment Cleanup Objectives (WAC 173-204-563).

5.3.2 Wetland Habitat

Wetland habitat within the action area occurs at the river margin along Lady Island and the Mill parcel riverbanks. Within the action area, seven wetland areas were delineated and classified in July 2019 and July 2020 and additional details on each of the wetlands are provided in the revised *In-water Overwater Removals Project Shoreline Report* (Tetra Tech 2023). **Figure 6** shows the locations of each of the wetlands.

None of the wetland areas were inundated during the low flow/low tide conditions present during the 2019 field investigation. Wetland areas were partially inundated during the July 2020 field investigation due to the later timing of snowmelt that year. These wetland areas are seasonally inundated for long durations from November to May in most years, with the timing, duration, and depths dependent on weather patterns. Wetlands were categorized as *tidal riverine emergent wetlands* using the Cowardin Classification, and as *Tidal Riverine* using the Hydrogeomorphic Classification system. By definition, riverine wetlands extend waterward to the point where deep water prevents persistent rooted vegetation, and the area transitions to unconsolidated aquatic bed, usually at about 6 feet of water depth.

Wetland plant communities were characterized mainly with emergent sedge species (principally *Carex aquatilis*) at the lower shoreline, transitioning up bank to the invasive shrub species, indigo bush (*Amorpha fruticosa*) and, in some areas, reed canarygrass (*Phalaris arundinacea*).

Indigo bush, which is a facultative wetland plant, was also common above the wetland boundaries throughout the riverbank, where the plant appears able to grow well from the limited spaces between riprap. These riprap areas supporting indigo bush were determined to not have wetland soils due to the preponderance of rock and were not considered to be wetland areas.

Long stretches of unvegetated gravel bar and naturally rock riverbank separate the wetlands from each other. While these rocky locations met the definition for wetland hydrologic conditions, they were determined to not have hydric soils and not support hydrophytic vegetation.

5.3.3 Water Quality

The Columbia River mainstem water temperatures at Washougal, Washington, range from approximately 6°C (43°F) in early spring to approximately 22°C (72°F) in late summer (USGS 2019). Temperatures in the action area are assumed to be comparable to or higher than those within Camas Slough. For at least some of the year, water temperatures exceed the Matrix of Pathways and Indicators standards of 48°F for spawning, 54°F for rearing, and 41°F for incubation (see **Appendix C**).

Additionally, the Columbia River (Friendly Reach) is on Ecology's 303(d) list for temperature and the mainstem Columbia River in water resource inventory area 28 is listed for temperature (Ecology 2020). The U.S. Environmental Protection Agency has approved total maximum daily loads for dioxin and total dissolved gas in the Columbia River (ODEQ 1991; Ecology and ODEQ 2002). Chemical contamination of river systems in the action area occurs mostly through stormwater runoff from upland areas, industrial and agricultural areas, and urban development.

5.4 Vegetation and Soils Adjacent to the Action Area

The analysis area consists primarily of riparian habitat associated with the Columbia River. Vegetation in the vicinity of the mill is generally sparse to absent around the structures to be removed. Wherever plant communities are present, they are generally composed of predominantly weedy and invasive species.

Large portions of the action area consist of an aquatic bed with waters deep enough to lack a vegetation community. Riparian vegetation adjacent to the action area is generally characterized as disturbed habitat. Riverbanks along main Mill area consist of fill, are generally steep, support a variety of docks, and are generally armored with boulder-sized riprap.

Where vegetation is present, the areas support nonnative plants with few native plant species including non-native Himalayan blackberry (*Rubus armeniacus*) with indigo bush (*Amorpha fruticosa*) starting near the OHWM and extending to native and weedy herbaceous vegetation at the lower shore in some locations. Along portions of the riverbank, the lower shore consists of rocks with minimal to no vegetation or fine sediment. Vegetation growing along riverbanks adjacent to in-water removals includes Oregon ash (*Fraxinus latifolia*), Douglas-fir, western redcedar (*Thuja plicata*), various willows (*Salix* spp.), big-leaf maple (*Acer macrophyllum*) and cottonwoods (*Populus* spp.), along with some native understory trees and shrubs such as snowberry (*Symphoricarpos albus*) and red-osier dogwood (*Cornus stolonifera*).

Soils and sediments in riverbeds are not mapped by NRCS, but soil on the riverbank within the main Mill area are mapped as Fill Land representing areas developed with non-native soil materials (NRCS 2019). Other riverbank portions adjacent to the action area were mapped as either Newburg silt loam or Sauvie silt loam series. The north bank and the Lady Island riverbank were mapped as Newburg silt loam series, while the western extent of Lady Island and the area in the vicinity of the Riverbank Pumphouse were mapped as Sauvie silt loam series (maps are provided in the revised *In-water Overwater Removals Project Shoreline Report* [Tetra Tech 2023]).

Newberg silt loam series soils are somewhat excessively drained and located on floodplains with slopes of 3 to 8 percent. They are formed in loamy and sandy alluvium derived from mixed sedimentary and basic volcanic rocks. The soils are subject to frequent to occasional flooding from December through March.

Deep, poorly drained Sauvie silt loam series soils are also mapped on floodplains. This hydric soil is saturated to the surface in most years from December to March and subject to overflow tidal flooding. Sauvie soils form in mixed alluvium with volcanic ash on flat to 3 percent slopes. When artificially drained and protected from flooding, both soils are used for agriculture. Mapping of Sauvie series soils on Lady Island by NRCS largely coincides with provisional identification of wetland areas by the City of Camas.

Ecology has assigned soils on the main Mill parcel as Site No. 15156 for potential presence of hazardous substances regulated under Washington State's Model Toxics Control Act. The presence of contaminants on the parcel has not been evaluated at this time and no other contaminated or potentially contaminated sites are listed in the Project action area.

5.5 Timing of Species Presence

As stated, all six listed fish species retained for further evaluation (bull trout; Chinook, chum, and coho salmon; steelhead; and Pacific eulachon) are migratory through the action area, as a result one or more ESA-listed species would be likely present in any month (**Table 11 and Table 12**).

Table 11. Adult Upstream Migration Through Action Area

Fish Run	Fish Run Timing[1/]											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fall Chinook Salmon								■	■	■		
Chum Salmon										■	■	
Coho Salmon	■							■	■	■	■	■
Winter Steelhead	■	■	■	■							■	■
Summer Steelhead					■	■	■	■	■	■		
Bull Trout				■	■	■	■	■	■			
Pacific Eulachon	■	■	■	■	■							■

Note
1/ ESA listed fish run timings obtained from NOAA Fisheries (2020) and the Lower Columbia Fish Recovery Board (LCFRB 2010).

In summary, for adult migration, bull trout migrate through the action area to upstream spawning areas in summer to fall, usually around April to September. Peak Chinook adult migration occurs from August to October, while peak adult chum migration occurs from mid-October to November, and peak adult coho migration occurs from August to January. Steelhead are migratory in the action area and include both summer and winter stocks, running generally November through May and May through October, respectively. Because both winter and summer steelhead stocks occur in the action area, upstream migration of adults occurs throughout the year. In addition to salmon, adult Pacific eulachon are migratory in the action area between December and May.

Table 12. Juvenile Downstream Migration Through Action Area

Fish Run	Fish Run Timing[1/]											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fall Chinook Salmon					■	■	■	■				
Chum Salmon			■	■	■							
Coho Salmon				■	■	■						
Winter Steelhead			■	■	■	■						
Summer Steelhead			■	■	■	■						
Bull Trout				■	■	■	■	■	■	■	■	
Pacific Eulachon	■	■	■	■	■	■						

Note
1. ESA listed fish run timings obtained from NOAA Fisheries (2020) and the Lower Columbia Fish Recovery Board (LCFRB 2010).

In addition to adult migration through the action area, one or more outmigrating juveniles may be present in all months except December, with most of the juveniles migrating downriver with and following the spring freshet. Bull trout juvenile outmigration is likely to occur between April to

November but could occur at any time as they spend about one to three years in their natal streams prior to emigration. Peak Chinook juvenile outmigration occurs from May to mid-August, peak juvenile chum outmigration occurs from March to May, and peak juvenile coho outmigration occurs from April to June. Steelhead include both summer and winter stocks, however, they spend about one to three years in freshwater prior to emigration. Therefore, steelhead juveniles could occur throughout the year, but peak juvenile outmigration is likely to occur between March to June. Pacific eulachon larval outmigration occurs between January to June.

Note that as stated earlier, there is no spawning habitat for any of the ESA-listed fish species in the action area.

6.0 ANALYSIS OF EFFECTS

This section identifies and analyzes the reasonably foreseeable direct, indirect, and cumulative effects of the proposed activity on listed species or designated critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, which will be added to the environmental baseline (50 CFR 402.02). Proposed activities would result in direct effects on the action area that may affect listed species. Indirect effects are those that are caused by the proposed action and occur later but still are reasonably certain to occur, or that may result from effects on a prey species or an important habitat element. Indirect effects are likely to result from the proposed Project and may affect listed species.

Cumulative effects are future state, tribal, local, and private activities that are reasonably certain to occur within the action area and are likely to affect the species. An interrelated action is one that is part of a larger action and depends on the larger action for its justification. An interdependent action is one that has no independent utility apart from the proposed action.

Potential Project-related effects are similar to all ESA-listed fish species and involve potential temporary impacts that result from in-water work and other demolition-related disturbances in the action area. Potential long-term beneficial effects result from the Project due to a reduction in riverbed obstructions, reduced artificial shading by structures, reduced artificial avian perches, reduced predator refugia, riverbank reshaping, and removal of potentially hazardous materials from the aquatic environment.

6.1 Direct Effects

Environmental stressors may occur as an intense, short-lived event of destruction, also known as a disturbance. This is caused by the act of demolition, dredging, reshaping of the shoreline, and barge traffic. The potential effects of these stressors can include injury and/or mortality, temporarily being startled, disruption, and temporary change of habitat used by the ESA-listed species. However, the effect of the action can also have permanent direct effects that lasting effects post demolition. These effects were determined by a variety of factors including assessing the species use of the habitat and their sensitivity to such factors such are noise, turbidity, and predation by predators. Potential direct effects on all listed species would occur due to the Project activities are summarized in **Table 13**.

Table 13. Potential Effects of the Action

Environmental Stressor	Potential Effect
Noise	Injury and/or mortality, startle, disruption of behavior, temporary change of habitat for all listed species.
Water Quality	Injury and/or mortality, startle, disruption of behavior, temporary change of habitat for all listed species.
Chemical Contamination	Temporary disruption of behavior and change of habitat for all listed species. Permanent reduction in creosote timbers from the aquatic environment.
Human Disturbance	Temporary disruption of behavior and change of habitat for all listed species.
Aquatic and Avian Predation	Permanent reduction in refugia for aquatic predators and perches for avian predators.
Alteration of Aquatic Environment	Temporary disruption of behavior and change of habitat for all listed species. Followed by permanent reduction of shading and rubber tires. Overall improvement of existing habitat.

6.1.1 Hydroacoustic Impacts

This section of the BA uses metric distances for noise, consistent with industry practices. NOAA Fisheries has used sound threshold levels for fish since 2005, and these criteria were revised in 2008 (FHWG 2008).

Table 5 provides the current thresholds for underwater noise levels by functional group for fish. These thresholds represent levels of noise that produce either a behavioral disturbance (e.g., disruption of migration or foraging) or injury (e.g., internal tissue damage, hearing loss, or death) to fish within the threshold radius (Hastings and Popper 2005).

Direct injury to, mortality of, or behavioral disturbance in fish species may result from sound levels produced by impact pile driving (hoe-ram operation), vibratory pile driving, and other in-water demolition techniques used for the removal of in-water structures in Camas Slough and the Columbia River. Impacts associated with impact pile driving (hoe-ram operation) may include physical injury (particularly to air-filled spaces such as swim bladders), auditory tissue damage, temporary or permanent hearing loss, behavioral effects, and immediate and delayed mortality. The amount of energy and the resulting sound pressure from this activity depends on the size and type of pile, energy of the hammer, depth of the water column, and substrate. Impacts on individual fish depend on sound pressure levels, fish species, fish size, fish condition, and depth of the water column (Popper et al. 2006).

During in-water demolition activities. fish would be subject to disturbance as a result of machinery, as described in Section 3.1.2. Depending on the size of the pile, vibratory hammers produce a disturbance effect at a maximum distance of up to 100 meters (328 feet) from the pile. Removal of piles via vibratory hammer would result in fish disturbance, but not in fish injury. No attenuation would be used for vibratory hammer pile removal.

Fish would be subject to noise impacts from vibratory removal activities frequently during the removal of piles. Vibratory hammer operation for removals of piles could occur up to approximately 8 to 10 hours per workday and could occur during any hour of the day. All of the fish species and life stages of salmon, steelhead, and Pacific eulachon (see **Table 11 and Table 12**) could be exposed to this effect when they are present in the action area. However, because fish kills attributed to the use of a vibratory hammer have not been documented, this activity is unlikely to injure fish, and is not expected to significantly interfere with behaviors such as migration, rearing, or foraging. Thus, vibratory pile removal is not likely to adversely affect any of these species.

In-water demolition activities also include the removal of the Berger crane foundation and the Dock Warehouse Piers. A hoe-ram operation would be limited to the area where concrete exists and cannot be successfully removed by other methods. A worst-case estimate shows that if the operation of the hoe-ram were to be utilized for all cement demolition, it would occur over approximately 30 workdays, be generally used above the waterline. No attenuation would be utilized, as the sound would be stopped primarily by nearby land.

Use of hoe-ram operations with no attenuation for the Berger crane foundation removal would result in maximum noise impacts estimated to include:

- Fish injury to all sizes of fish at peak (instantaneous) sound levels up to 10 meters (33 feet) from the activity,
- Cumulative injury to fish greater than or equal to 2 grams in size, up to 125 meters (410 feet) from concrete removal activity,
- Cumulative injury to fish less than 2 grams in size up to 230 meters (755 feet) from removal activity, and
- Disturbance to all fish regardless of size up to 2,512 meters (8,241 feet) from removal activity.

Fish would be subject to noise impacts from hoe-ram operation activities for approximately 8 to 10 hours per workday, spread over approximately 30 days of work (not necessarily consecutive). These impacts would be minimized by using the hoe-ram operation only where concrete removal is required, and where no other removal alternative for removal exists, and would be limited to occurring during the in-water work window as set by the agencies.

The use of the hoe-ram is likely to adversely affect individuals of all listed salmon, steelhead, and Pacific eulachon present in the areas exposed to noise above the injury threshold and disturbance guidance during these activities. See **Tables 11 and 12** for the species and life stages that occur throughout the year in the action area that could be exposed to this effect.

Due to the extremely limited numbers of bull trout present in the action area, the risk of exposure is discountable. Thus, both the vibratory hammer and hoe-ram operation are not likely to adversely affect bull trout.

Saw cutting would be utilized if concrete pilings accidentally break while being removed from the water. Additional sources of noise that could permeate underwater include dredging and the use of barges. However, these activities would be limited by an in-water work window when the migration of adults and juveniles is least likely to occur. Therefore, these activities are not likely to adversely affect any of these species.

6.1.2 Water Quality

The proposed activities include temporary disturbance of soils and sediments during removal of piles and demolition of structures, and restoration of shoreline at and above the OHWM. The movement of these materials could result in erosion from disturbed or loosened soils and increase the sediment load in runoff that may enter Camas Slough or the Columbia River or ditches within the action area. Removal of structures and pilings below OHWM may mobilize existing bottom sediments and lead to increased turbidity and sedimentation of the action area. Sedimentation and turbidity can increase scour potential, alter shoreline vegetative structure, and affect primary food production and fish feeding efficiency. High turbidity may also impair respiration in salmonids. The timing of construction would be designed to minimize in-water disturbance by limiting the in-water work period to low tide times and low-flow conditions during the agency-established fish window. With these measures in place, sedimentation and turbidity effects would be short-term and minimal throughout the in-water demolition phase.

The use of heavy equipment brings the unlikely but potential risk for hazardous materials such as fuel, oils, or hydraulic fluids to enter the surrounding environment. Such an introduction could degrade water quality or be toxic to fish. BMPs would be implemented, and spill prevention and management measures would be incorporated during construction to further reduce the risk to the environment in case of an inadvertent spill (see Section 2.7 for impact minimization and avoidance measures). Potential effects on water quality as a result of the introduction of contaminants such as fuel or oil are expected to be insignificant given the small quantity possible and short-term during the construction phase.

Potential impacts from dredging of contaminated sediments are more difficult to assess. Most of the information concerning the effects of contaminated sediments on marine organisms deals with the impacts of settled sediments. Few studies have dealt with resuspended contaminated sediments. Organisms exposed to resuspended contaminated sediments can develop physiological problems due to direct exposure to dissolved contaminants or bioaccumulation of metals and organic chemicals. However, much of the data suggest that significant adverse impacts do not occur at resuspended sediment concentrations and durations typically associated with dredging Projects. In general, previous studies indicate that potential effects from dredging are transient and not significant (Anchor 2003).

Short-term contaminant risks can be expected primarily from increases in water-column exposure. In most situations where sediment contamination is from historical chemical releases, contaminant partitioning behavior and disequilibrium between the water column and sediments results in contaminant concentrations in the water column that are far lower than those in the sediment interstitial water. Dredging and resuspension will introduce interstitial water into the water column, as well as facilitate desorption of contaminants from suspended sediment particles into the water column. The resulting increase in water column exposure can result in adverse effects to aquatic biota either through direct toxicity to the exposed organisms, or by increasing tissue residues of bioaccumulative contaminants within the food chain (Bridges et al. 2008).

6.1.2.1 General Effects of Turbidity on Fish

Turbidity is a naturally occurring phenomenon in the Columbia River, especially with increased flows during the spring due to snow melting, controlled releases by the various dams along the river, and storms that may occur any time of the year. Several factors contribute to turbidity levels in the water, including suspended sediments, dissolved particles, finely divided organic and inorganic matter, chemicals, plankton, and other microscopic organisms. While not all of these materials may be harmful to fish, it is known that high levels of turbidity can be fatal to salmonids. However, salmonids also can be affected by turbidity at relatively low levels (Lloyd 1987). Juvenile salmonids have been observed in naturally turbid estuaries and highly turbid glacial streams; this indicates that they can cope with elevated turbidity during certain life stages (Gregory and Northcote 1993, cited in Bash et al.

2001). In contrast, salmonids not normally exposed to elevated turbidity levels may be adversely affected at relatively low levels (Gregory 1992, cited in Bash et al. 2001).

Several factors play a role in determining the severity of effects, such as turbidity level, the extent of the turbidity plume, duration and frequency of exposure, the toxicity and angularity of the particles, life stage of the fish, and access of “turbidity refugia” (Bash et al. 2001). Turbidity above background levels may have the following effects on fish, depending on the amounts and length of exposure: direct mortality, gill tissue damage, physiological stress, and behavioral changes.

Direct Mortality: Direct mortality from extremely high levels of suspended sediment has been demonstrated. However, the concentrations at which mortality occurred were far higher than those typically occurring during dredging operations. Laboratory studies have consistently found that the 96-hour median lethal concentration for juvenile salmonids is above 6,000 milligrams per liter (mg/L) (Stober et al. 1981; Salo et al. 1980). Based on an evaluation of seven clamshell dredge operations, LaSalle (1988) determined that the upper limits in suspended sediment levels were 700 mg/L and 1,100 mg/L at the surface and bottom of the water column, respectively (within approximately 300 feet of the operation). Concentrations of this magnitude could occur at sites with fine silt or clay substrates, which are not typical of the Project site. Because direct mortality occurs at turbidity levels that far exceed those of typical dredging operations, direct mortality from suspended sediment is not expected to occur during Project construction.

Gill Tissue Damage: When the filaments of salmonid gills are clogged with sediment, fish attempt to expunge the sediment by opening and closing their gills excessively, in a physiological process known as “coughing.” In response to the irritation, the gills may secrete a protective layer of mucus. Although this may interfere with respiration, it is not a lethal effect (Berg 1982, as cited in Bash et al. 2001). Servizi and Martens (1992) noted a significant increase in coughing in sub-yearling coho when turbidity measured 30 Nephelometric turbidity units. Redding et al. (1987) also found that the appearance of gill tissue was similar for control fish and those exposed to high, medium, and low concentrations of suspended topsoil, ash, and clay. Based on the results of these studies, juvenile and subadult salmonids, if present, are not expected to experience gill tissue damage even if exposed to the upper limit of suspended sediment expected to be generated by dredging and debris removal. Further, adult salmonids, if present, would be expected to avoid areas with less than favorable conditions and would, therefore, tend to avoid potentially harmful conditions.

Physiological Stress: Exposure to approximately 500 mg/L of suspended sediment for two to eight consecutive days has been found to cause stress in salmonids (Redding et al. 1987; Servizi and Martens 1987). These studies found no significant difference in blood plasma glucose concentrations at concentrations of 150 to 200 mg/L of glacial till. These results suggest that the upper limit of suspended sediment near dredging activity (700 to 1,100 mg/L for very fine substrates) can cause stress in juveniles if exposure continues for an extended time. Continued exposure, however, is unlikely due to the tendency for salmonids to avoid areas with elevated suspended sediment concentrations (Salo et al. 1980). While sediment concentrations in the Project area may reach an upper limit (700 to 1,100 mg/L for very fine substrates) of suspended sediment during dredging and debris removal activities, it is expected that concentrations would occur for a shorter period than two to eight consecutive days. Concentrations of suspended sediment caused by pile removal and other demolition related activities would be too low to cause stress in salmonids.

Behavioral Changes: Behavioral responses to elevated levels of suspended sediment include feeding disruption and changes in migratory behavior (Servizi and Martens 1987). Several studies indicate that salmonid foraging behavior is impaired by high levels of suspended sediment (Bisson and Bilby 1982; Berg and Northcote 1985). Redding et al. (1987) found that yearling coho and steelhead exposed to high levels (2,000 to 3,000 mg/L) of suspended sediment did not rise to the surface to feed. However, yearling coho and steelhead exposed to lower levels (400 to 600 mg/L) actively fed at the surface. The results of these studies suggest that the thresholds at which feeding effectiveness is impaired exceeded the upper limit of expected suspended solids during dredging and pile removal. Therefore, significant changes in feeding are not expected.

Additionally, adult salmonids are not necessarily closely associated with the shoreline and would be less vulnerable to adverse impacts should they encounter turbid conditions. Whitman et al. (1982) used volcanic ash from the eruption of Mount Saint Helens to recreate highly turbid conditions faced by returning adult salmon. Their study found that adult Chinook was able to detect natal waters through olfaction even when subjected to seven days of total suspended sediment levels of 650 mg/L. Suspended sediment levels are not expected to reach that level and salmonids would tend to avoid areas with higher concentrations of sediment; therefore, no changes in migratory behavior are expected due to Project construction. In addition, all construction would be scheduled to occur within approved windows for construction which minimizes the number of fish potentially exposed to any increases in turbidity.

6.1.3 Chemical Contamination

Numerous potential sources of chemical contamination are associated with in-water work in the Columbia River and Camas slough from the demolition activities:

- Equipment located in or over the water (such as barges or equipment operating on barges, temporary work platforms, and existing structures) are potential sources of contamination.
- Demolition of structures would occur both in and over the water and may release contamination such as concrete debris, concrete dust created by saw cutting, and possibly lead paint.
- Approximately 3,000 piles, of which approximately 2,000 are timber piles, are proposed for removal. It is assumed that these piles have been chemically treated, based on their age and intended purpose. Contaminants from the piles could be mobilized during demolition and/or removal of the piles.

The majority of demolition would occur in the Camas Slough along the riverbank and along the river bottom. Demolition would occur on the riverbank. Breaking up the Berger crane foundation or the Dock Warehouse piers with a hoe-ram operation, excavator, or saw cutter could potentially introduce concrete dust and debris into the water; however, because of the containment proposed, debris booms and turbidity curtains would be used to retain suspended sediments and potential debris reducing the extent and duration of effects from materials that may enter the water.

The primary effect of removing piles is the temporary suspension of sediment, which may result in increased levels of turbidity and/or potential release of any contaminants contained in disturbed sediment. Throughout the Project area sediments have been determined to be comprised of coarse-grained materials, with up to 80 percent sand in many locations. This coarse material does not remain in suspension due to its size and settles out quickly, limiting both the extent and duration of turbidity when disturbed. In addition, low levels of organic matter content in most locations limit the surface areas available for chemical adsorption, which reduces the likelihood of long-term chemical retention in sediments.

Sediment in Camas Slough and Columbia River in the Project area has been tested repeatedly prior to annual dredging events by GP and others and has been generally demonstrated to not contain any chemicals of concern at levels above state regulatory levels.

Suspended sediment may hamper adult salmon respiratory function, potentially stalling migrating salmon in the mouths of rivers or streams while waiting for water to clear. Increased turbidity also may hinder juvenile foraging ability or affect the distribution of prey species. Conducting demolition during low water would reduce potential sediment impacts by allowing work to occur in the dry.

Hydrocarbons can leach from treated piles into the surrounding aquatic environment, soils, and benthic organisms during the life of the pile, potentially causing adverse effects on fish and benthic invertebrates. Sediments in direct contact with treated piles have increased likelihood of creosote concentration, so any removed treated wood piles would be placed directly in a containment area (barge deck) without any attempt to clean debris attached to the pile. Impacts from broken piles would likely be minimal, as floating debris would be collected inside the float containment boom and collected for disposal.

It is assumed that approximately 2,000 timber pilings to be removed have been chemically treated using a wood preservative such as creosote. The primary chemical of concern in creosote is polycyclic aromatic hydrocarbons, which can leach into the substrate surrounding each pile. Removal of these piles has the potential to temporarily adversely affect fish species present through increased suspended sediment resulting in exposure. However, fish are at lower risk than mollusks and benthic organisms, since fish have some ability to metabolize and excrete polycyclic aromatic hydrocarbons. Removing treated piles would improve the surrounding aquatic environment over the long term through the removal of contaminated sediment. No containment is proposed for the removal of the timber pilings; however, the high flow in the Columbia River would be highly likely to dilute any contamination encountered, and the extent of the contamination is expected to be minimal.

In general, construction equipment operating on land poses a low risk of releasing chemical contaminants (such as petroleum fuel, other fluids, and from erosion of the shoreline) that could enter surface water bodies by way of stormwater inlets, ditches, or other forms of conveyance. Implementation of an SPCC and erosion control plan would minimize the risk of contaminants entering the water from land and would ensure that the risk of contaminant release is discountable. Overall, this aspect of the Project is unlikely to adversely affect any listed fish.

6.1.4 Human Disturbance

In-water disturbance during construction may disturb salmonids such that they avoid the Project area because of human disturbance. Work is proposed to occur during the approved in-water work window during low-flow conditions. However, salmonids have the potential to occur year-round in the action area and may be migrating through the area during the construction time frame. Therefore, there is potential to encounter and possibly injure individual salmonids during the removal of pilings, demolition of structures, and removal of debris. These could result in temporary direct impacts on salmonids during construction activities.

6.1.5 Aquatic Predation

Several studies have shown that overwater structures in fresh water increase the vulnerability of salmonids to predators by creating favorable predator habitat. Northern pike minnow associate with back-eddies or the edges of shear flow areas created by pilings in free-flowing areas while other predators associate with the dock structure itself (Petersen and Ward 1999). Large- and smallmouth bass have been documented utilizing overwater structures for foraging and spawning (Kaher et al. 2000). Juvenile Chinook salmon are the salmonids most likely to be found near overwater structures in the littoral zone. Nearshore habitats in the main-stem Columbia River are critically important for subyearling fall Chinook salmon (Dauble et al. 1989; Rondorf et al. 1990). Since juvenile Chinook salmon use the littoral zone as rearing habitat, they are most vulnerable to predators. After subyearlings become larger than 60 to 70 millimeters, they tend to move into deeper water which greatly reduces their vulnerability to predators in littoral zones and around docks (Chapman 2007).

Overwater structures may increase predation on juvenile salmonid salmon in several ways which include providing cover and preferred refugia for ambush predators such as bass, create shaded areas that increase a predator's capture efficiency of pray, and interrupt migration routes. The additional time spent navigating around these structures increase exposure to predators in these areas. In addition, changes in substrate, aquatic vegetation, and ambient light caused by overwater structures may indirectly increase predation through ecological interactions.

Northern pikeminnow and smallmouth bass are the primary predators that use the nearshore littoral zone. Northern pikeminnow feed primarily on juvenile salmonids (Petersen et al. 1993) and are the primary predator of juvenile salmonids in Columbia River reservoirs (Beamesderfer and Rieman 1988; Poe and Rieman 1988; Poe et al. 1991; Zimmerman 1999).

As the salmon migrate downstream, they increase in size and move farther offshore. Studies conducted upriver in McNary Reservoir and the Hanford Reach of the Columbia River found that subyearling Chinook salmon favored water less than 2 meters deep with low lateral bed slopes and water velocities less than 0.4 m/s (Vendetti et al. 1997; Tiffan et al. 2002). These shallow shoreline habitats with low velocities and slopes likely provide refuge from predatory fish that may be too large to enter very shallow water. Differences in habitat associations of subyearling Chinook salmon and their primary predators help to reduce predation on Chinook, although structures may also attract predators. Subyearling Chinook salmon prefer sandy or small gravel/cobble substrate and avoid complex habitats such as bedrock cliffs and riprap (Key et al.1996; Garland and Tiffan 2002).

Northern pikeminnows, the primary predator of juvenile salmonids, tend to occupy free-flowing areas with low-velocity (1-foot per second or less) microhabitats and back-eddies (Beamesderfer and Rieman 1988; Petersen et al. 1993). Pilings supporting overwater structures tend to create backwater, low-velocity habitat which is preferred by these predators. Due to the reduction is overwater structures and pilings within the water this is considered a long-term direct benefit to salmonids.

6.1.6 Avian Predation

Predatory birds are sometimes attracted to in-water structures such as pilings. They will congregate on these man-made structures and use them as an artificial perch point. Since birds congregate where prey is abundant, these perches could provide them with the opportunity to prey on juvenile salmon migrating through the action area. Upstream of Bonneville Dam, predation by birds (particularly terns and cormorants) can be substantial, but predation in the lower Columbia River is generally very low (Evans et al. 2012). Since the Columbia River is both wide and deep in the Project area, young fish will not tend to be concentrated, reducing the attractiveness of the site to predatory birds.

The effects of overwater structures on the relationship between salmonids and avian predators are widely recognized but have not been subject to extensive study (Carrasquero 2001). Some birds may use the Project facilities as perches, but it is unlikely that the presence of birds will result in the predation of substantial numbers of salmonids as they move downriver. While the research is limited in regard to actual predation by birds, this Project intends to remove a significant number of pilings that currently provide perch points, and therefore benefit young fish migrating through the Camas Slough and Columbia River channel. Thus, this is considered a long-term direct benefit to salmonids.

6.1.7 Alteration of Aquatic Environments

Aquatic habitats within the action area have been previously disturbed by historic and current uses. Wood mill operations throughout the area required the installation of dolphins, pilings, and pipelines to support structures and infrastructure as well as historic log driving for mill operations. Much of these activities were outside of wetland areas but within the aquatic habitats of Camas Slough and Columbia River. Treated wood pilings have been identified as sources of contamination through the release over time of metals, polycyclic aromatic hydrocarbons, and metal oxides, depending on the treatment method (WDFW 2006; Werme et al. 2010; Hutton and Samis 2000). The physical structure of pilings and dolphins also may affect microhabitats by increasing shading and local scour, including impacts on shoreline stability (WDFW 2006; Werme et al. 2010).

Removal of dolphins and pilings would result in temporary disturbance and water quality impacts such as increased sediment, as described above, but would also result in permanent habitat improvement. The action of removing treated wood pilings and dolphins may result in a temporary release of contaminants through disturbance of contaminated sediment and exposure of previously buried treated wood, which can act as fresh creosote upon exposure to oxygen in the water (Seattle Public Utilities 2015). Potential effects on aquatic habitats as a result of disturbance of contaminated sediments are expected to be insignificant based on the age of most of the pilings and would not be discernible on the individual level. Removal of treated pilings and dolphins removes these sources of contamination. Over the long term, the concentration of contaminants in the sediment would decrease, water quality would improve, and the pathway of exposure for fish through contamination of prey and forage would be reduced. Removal of dolphins and pilings is expected to benefit aquatic habitats in the long term.

6.2 Indirect Effects

Indirect effects result from the proposed action but occur at a later time or place, but which are still reasonably certain to occur. Specific elements of the Project that may cause indirect effects on fish include the following:

- Temporary increase in turbidity and/or pollutants due to sediment disturbance, inadvertent introduction of debris and/or contaminants into the action area (e.g., petroleum products from equipment).
- Temporary disturbance to prey/food sources down or upriver from in-water work activities.
- Temporary disturbance to migration of adults and outmigration of juveniles using Camas Slough as a thoroughfare to reach the Washougal River.

6.2.1 Water Quality

Removal of pilings and structures may result in increased turbidity from disturbance of sediment and could result in increased sediment load from runoff that may enter the Columbia River or Camas Slough within the action area. Increased turbidity may result in prey/food sources avoiding the Project area, which would indirectly affect salmonids by relocating their food source or screening food sources.

Sedimentation and turbidity can alter the riparian vegetative structure and primary food production, and also could alter the prey/food source population for salmonids. For this Project, sedimentation and turbidity impacts would be short-term, occurring primarily during the construction phase. Following construction, the aquatic habitat would likely re-equilibrate within hours to conditions suitable for primary food production. Therefore, these potential impacts on water quality are considered temporary indirect effects on salmonids.

6.2.2 Altered Predator-Prey Relationships

The potential loss of some salmonid prey due to siltation and substrate disturbance may occur during structure and pile removal. However, there would likely be minimal to no effects on predator-prey relationships for rearing anadromous fish after demolition is complete. Short-term impacts due to increased siltation would likely diminish over time and not cause any long-term changes to foraging behavior or prey availability.

6.2.3 Washougal River Migration

The published federal in-water work window for the Columbia River is from November 15 to February 28, in any given year. However, the nearby Washougal River has a much shorter in-water work window of August 1 to August 31 (WDFW 2018). While the action area does not extend to the mouth of the Washougal River, multiple salmon species are known to use the Camas Slough as a migrating channel to reach the Washougal River as adults and to out-migrate back into the Columbia River towards the ocean as juveniles. Therefore, it is likely that species that are migrating as adults to the nearby Washougal River are likely to pass through the action area around the in-water work window set for the Washougal River and would likely be within the river for spawning well after August and would less likely being residing in Camas Slough.

In-water work could have a temporary indirect effect on salmonids accessing the Washougal River as it could delay late-returning adults or early-outmigrating juveniles. However, this would a temporary impact while in-water work is occurring, and the Project is working with the agencies to determine the most suitable in-water work window to minimize impacts on salmon migration.

6.2.4 Human Disturbance

As discussed, short-term effects of excavation, demolition, dredging and fill placement include temporary reduction in water quality parameters such as increased turbidity, which may result in temporary disturbance to aquatic species including causing prey/food sources for salmonids to avoid the area during construction activities.

Placement of fill within Camas Slough below the OHWM to restore riverbed contours may result in long-term indirect effects to salmonids by facilitating altered hydraulic flows that could result in new current patterns to emerge, alter sediment deposition, and resultant riverbank vegetation development and habitat for fauna and prey/food sources, resulting in a net increase in available potential habitat for vegetation and prey/food sources.

6.3 Critical Habitat Effects

Critical habitat has been designated within the action area for the listed species retained for further evaluation. Because construction noise is anticipated to permeate into aquatic environments (see Section 3.1.2), noise impacts on listed fish species and critical habitat were evaluated.

The proposed construction activities have the potential to temporarily increase sedimentation and turbidity through in-water work, sediment and soil disturbance, and removal or alteration of the shoreline in the Project area. The proposed demolition activities would remove or alter the shoreline and portions of the aquatic bed to accommodate the removal of pilings and structures, including debris removal. In-water work also may result in temporary prey/food sources avoiding the Project area. These effects are considered temporary and are anticipated to be insignificant given the size of the Project area and action area within the riverine habitat, and provided that construction planning, minimization measures, and BMPs are implemented to further minimize effects. With these measures in place, no long-term negative effects on PCEs for bull trout; Chinook, chum, and coho salmon; steelhead; or Pacific eulachon critical habitat are anticipated to occur as a result of the proposed construction.

6.4 Summary of Effects on Habitat Pathways and Indicators

A checklist is provided in **Table 14** to address each habitat parameter for potential effects of the proposed construction activities on the action area reach and downstream habitat of the listed species retained for further evaluation. The proposed construction activities have the potential to temporarily affect select habitat parameters, such as temporary increases in sedimentation and turbidity, the potential for minimal, temporary adverse effects in the case of inadvertent spills (e.g., fuel or oil from construction equipment), and temporary disturbance to food sources. Temporary effects are anticipated to be minimized through the use of construction planning and timing, as well as implementation of BMPs. No long-term degradation of habitat parameters is anticipated to occur as a result of the proposed construction. However, as a result of this Project several parameters could be restored with the removal of in-water structures and overwater structures that currently reside along the Camas Slough riverbank.

Table 14. Summary of Potential Project Effects for all ESA Listed Species' Habitat

Habitat Parameter	Effects of the Action		
	Restore	Maintain	Degrade
Subpopulation Characteristics			
Subpopulation size		x	
Growth and survival		x	
Life history diversity and isolation		x	
Persistence and genetic integrity		x	
Water Quality			
Temperature		x	
Sediment		x	
Chemical Contamination	x		
Habitat Access			
Physical Barriers	x		
Habitat Elements			
Substrate		x	
Large Woody Debris Quantity		x	
Pool Frequency and Quality		x	
Large Pools		x	
Off-channel Habitat		x	
Refugia	x [1/]		
Channel Condition & Dynamics			
Width/Depth Ratio		x	
Stream Bank Condition	x		
Floodplain Connectivity		x	
Flow/Hydrology			
Change in Peak/Base Flows		x	
Increase in Drainage Network		x	

Habitat Parameter	Effects of the Action		
	Restore	Maintain	Degrade
Watershed Conditions			
Road Density & Location		x	
Disturbance History		x	
Riparian Reserves		x	
Disturbance Regime		x	
Integration of Species and Habitat		x	

Note:
1/ The refugia for salmonids would be restored due to the reduction in predator refugia.

6.5 Cumulative Effects

No future state, local, or private activities that are reasonably certain to occur within the action area were identified that would require a cumulative effects analysis. Following removal of the obsolete infrastructure, GP intends to continue to operate the mill located on the site.

6.6 Effects from Interrelated and Interdependent Activities

No interdependent or interrelated activities are anticipated as a result of the proposed Project. No changes to mill operations would result from removal of the structures.

7.0 CONCLUSIONS AND EFFECT DETERMINATIONS

The environmental baseline in the action area may be affected by the following:

- Temporary disruption in normal fish activity from in-water work created by elevated noise levels in the Camas Slough and the Columbia River, potentially causing a disturbance, injury, or mortality to listed fish.
- Temporary increase in turbidity and/or pollutants due to sediment disturbance, inadvertent introduction of debris and/or contaminants into the action area drainage (e.g., petroleum products from equipment).
- Temporary disturbance of migration of adults and outmigration of juveniles using Camas Slough as a thoroughfare to reach the Washougal River.
- Temporary disturbance of prey/food sources from human disturbance during in-water work activities.
- Long-term reduction of aquatic predator refugia through removal of artificial structures.
- Long-term reduction of avian predation on juvenile fish through removal of artificial perches.
- Permanent improvement of habitat through removal of artificial structures (e.g., treated wood and metal dolphins, pilings).
- Permanent reduction of numbers of potential in-water sources of creosote through removal of treated wood.
- Permanent reduction of shading by man-made structures

Based on the proposed Project actions and its anticipated effects (see Section 6.0), and considering the minimization and avoidance measures outlined in Section 2.7, effect determinations for listed species occurring in the action area are summarized in **Table 15** and discussed in further detail in Sections 7.1 through 7.6.

Table 15. Effect Determinations for Listed Species in the Action Area

Species	Listing Status	Effect Determination
Bull trout (*Salvelinus confluentus*) Critical habitat; in action area	Threatened	May affect but is not likely to adversely affect.
Chinook salmon (*Oncorhynchus tshawytscha*) Lower Columbia River ESU Critical habitat; in action area	Threatened	May affect but is not likely to adversely affect.
Chum Salmon (*Oncorhynchus keta*) Columbia River ESU Critical habitat; in action area	Threatened	May affect but is not likely to adversely affect.
Coho Salmon (*Oncorhynchus kisutch*) Lower Columbia River ESU Critical habitat; in action area	Threatened	May affect but is not likely to adversely affect.
Steelhead (*Oncorhynchus mykiss*) Lower Columbia River DPS Critical habitat; in action area	Threatened	May affect but is not likely to adversely affect.

Species	Listing Status	Effect Determination
Pacific Eulachon (*Thaleichthys pacificus*) Southern DPS Critical habitat; in action area	Threatened	May affect but is not likely to adversely affect.

Abbreviations:
DPS = Distinct Population Segment
ESU = Evolutionarily Significant Unit

7.1 Bull Trout

7.1.1 Bull Trout Species

The effect determination for bull trout as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Bull trout are documented as occurring and are migratory in the mainstem Lower Columbia River basin, including the action area.
- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet of the Camas Slough. Hoe-ram operations to remove concrete and vibratory pile removal would occur to remove dolphins and piles within Camas Slough and Columbia River.
- Migratory/forage habitat for bull trout is available within the action area.

A "not likely to adversely affect" determination is warranted based on the following rationale:

- In-water work would be restricted to a time period when juveniles are less likely to occur in the Project area.
- Migration of adult bull trout would not be impaired.
- Suitable spawning habitat is not located within the action area.
- The amount of foraging habitat affected would be insignificant in comparison to the available foraging habitat in the Project vicinity. In addition, these habitats are protected by local critical areas regulations.
- The effects of sedimentation and turbidity would be minimized by adhering to an erosion control plan and implementing erosion control BMPs. Implementation of BMPs for erosion and sediment control would render effects on bull trout insignificant.
- Refueling of equipment would occur farther than 150 feet from any surface water feature. All equipment operators would be trained in spill response and an SPCC plan would be prepared for this Project.
- Removal of pilings and restoration of the shoreline would reduce erosion and chemical contamination, which would benefit fish habitat.

7.1.2 Bull Trout Critical Habitat

The effect determination for bull trout critical habitat as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Critical habitat for bull trout has been designated within the action area.
- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet of Camas Slough.

A "not likely to adversely affect" determination is warranted based on the following rationale:

- No critical habitat PCEs would be affected by the proposed Project.
- The amount of habitat affected would be insignificant in comparison to the available habitat and designated critical in the Project vicinity. In addition, these habitats are protected by local critical areas regulations.
- Suitable spawning habitat is not located within the action area.
- Removal of pilings and restoration of the shoreline would reduce erosion and chemical contamination, which would benefit fish habitat and prey/food source habitat.

7.2 Chinook Salmon

7.2.1 Chinook Salmon Species

The effect determination for Chinook salmon, LCR ESU, as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Chinook salmon are documented as occurring in the mainstem Lower Columbia River, including the action area.
- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet of the Camas Slough. Hoe-ram operations to remove concrete and vibratory pile removal would occur to remove dolphins and piles within Camas Slough and Columbia River.
- Migratory/forage habitat for Chinook salmon is available within the action area.

A "not likely to adversely affect" determination is warranted based on the following rationale:

- In-water work would be restricted to a time period when juveniles are less likely to occur in the Project area.
- Migration of adult Chinook salmon would not be impaired.

- Suitable spawning habitat is not located within the action area.
- The amount of foraging habitat affected would be insignificant in comparison to the available foraging habitat in the Project vicinity. In addition, these habitats are protected by local critical areas regulations.
- The effects of sedimentation and turbidity would be minimized by adhering to an erosion control plan and implementing erosion control BMPs. Implementation of BMPs for erosion and sediment control would render effects on Chinook salmon insignificant.
- Refueling of equipment would occur farther than 150 feet from any surface water feature. All equipment operators would be trained in spill response and an SPCC plan would be prepared for this Project.
- Removal of pilings and restoration of the shoreline would reduce erosion and chemical contamination, which would benefit fish habitat.

7.2.2 Chinook Salmon Critical Habitat

The effect determination for Chinook salmon critical habitat as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Critical habitat for Chinook salmon has been designated within the action area.
- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet of Camas Slough.

A "not likely to adversely affect" determination is warranted based on the following rationale:

- No critical habitat PCEs would be affected by the proposed Project.
- The amount of habitat affected would be insignificant in comparison to the available habitat and designated critical in the Project vicinity. In addition, these habitats are protected by local critical areas regulations.
- Suitable spawning habitat is not located within the action area.
- Removal of pilings and restoration of the shoreline would reduce erosion and chemical contamination, which would benefit fish habitat and prey/food source habitat.

7.3 Chum Salmon

7.3.1 Chum Salmon Species

The effect determination for chum salmon, Columbia River ESU, as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Chum salmon are documented as occurring in the mainstem Lower Columbia River, including the action area.
- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet Camas Slough. Hoe-ram operations to remove concrete and vibratory pile removal would occur to remove dolphins and piles within Camas Slough and Columbia River.
- Migratory/forage habitat for chum salmon is available within the action area.

A "not likely to adversely affect" determination is warranted based on the following rationale:

- In-water work would be restricted to a time period when juveniles are less likely to occur in the Project area.
- Migration of adult chum salmon would not be impaired.
- Suitable spawning habitat is not located within the action area.
- The amount of foraging habitat affected would be insignificant in comparison to the available foraging habitat in the Project vicinity. In addition, these habitats are protected by local critical areas regulations.
- The effects of sedimentation and turbidity would be minimized by adhering to an erosion control plan and implementing erosion control BMPs. Implementation of BMPs for erosion and sediment control would render effects on chum salmon insignificant.
- Refueling of equipment would occur farther than 150 feet from any surface water feature. All equipment operators would be trained in spill response and an SPCC plan would be prepared for this Project.
- Removal of pilings and restoration of the shoreline would reduce erosion and chemical contamination, which would benefit fish habitat.

7.3.2 Chum Salmon Critical Habitat

The effect determination for chum salmon critical habitat as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Critical habitat for chum salmon has been designated within the action area.
- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet of Camas Slough.

A "not likely to adversely affect" determination is warranted based on the following rationale:

- No critical habitat PCEs would be affected by the proposed Project.
- The amount of habitat affected would be insignificant in comparison to the available habitat and designated critical in the Project vicinity. In addition, these habitats are protected by local critical areas regulations.
- Suitable spawning habitat is not located within the action area.
- Removal of pilings and restoration of the shoreline would reduce erosion and chemical contamination, which would benefit fish habitat and prey/food source habitat.

7.4 Coho Salmon

7.4.1 Coho Salmon Species

The effect determination for coho salmon, LCR ESU, as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Coho salmon are documented as occurring in the mainstem Lower Columbia River, including the action area.
- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet of the Camas Slough. Hoe-ram operations to remove concrete and vibratory pile removal would occur to remove dolphins and piles within Camas Slough and Columbia River.
- Migratory/forage habitat for coho salmon is available within the action area.

A "not likely to adversely affect" determination is warranted based on the following rationale:

- In-water work would be restricted to a time period when juveniles are less likely to occur in the Project area.
- Migration of adult coho salmon would not be impaired.
- Suitable spawning habitat is not located within the action area.
- The amount of foraging habitat affected would be insignificant in comparison to the available foraging habitat in the Project vicinity. In addition, these habitats are protected by local critical areas regulations.
- The effects of sedimentation and turbidity would be minimized by adhering to an erosion control plan and implementing erosion control BMPs. Implementation of BMPs for erosion and sediment control would render effects on coho salmon insignificant.
- Refueling of equipment would occur farther than 150 feet from any surface water feature. All equipment operators would be trained in spill response and an SPCC plan would be prepared for this Project.

- Removal of pilings and restoration of the shoreline would reduce erosion and chemical contamination, which would benefit fish habitat.

7.4.2 Coho Salmon Critical Habitat

The effect determination for coho salmon critical habitat as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Critical habitat for coho salmon has been designated within the action area.
- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet of the Camas Slough.

A "not likely to adversely affect" determination is warranted based on the following rationale:

- No critical habitat PCEs would be affected by the proposed Project.
- The amount of habitat affected would be insignificant in comparison to the available habitat and designated critical in the Project vicinity. In addition, these habitats are protected by local critical areas regulations.
- Suitable spawning habitat is not located within the action area.
- Removal of pilings and restoration of the shoreline would reduce erosion and chemical contamination, which would benefit fish habitat and prey/food source habitat.

7.5 Steelhead

7.5.1 Steelhead Species

The effect determination for steelhead, LCR DPS, as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Steelhead are migratory in the Columbia River, including the action area. Adult and juvenile steelhead may occur in the action area year-round.
- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet of the Camas Slough. Hoe-ram operations to remove concrete and vibratory pile removal would occur to remove dolphins and piles within Camas Slough and Columbia River.
- Migratory/forage habitat for steelhead is available within the action area.

A "not likely to adversely affect" determination is warranted based on the following rationale:

- In-water work would be restricted to a time period when juveniles are less likely to occur in the Project area.
- Migration of adult steelhead would not be impaired.
- Suitable spawning habitat is not located within the action area.
- The amount of foraging habitat affected would be insignificant in comparison to the available foraging habitat in the Project vicinity. In addition, these habitats are protected by local critical areas regulations.
- The effects of sedimentation and turbidity would be minimized by adhering to an erosion control plan and implementing erosion control BMPs. Implementation of BMPs for erosion and sediment control would render effects on steelhead insignificant.
- Refueling of equipment would occur farther than 150 feet from any surface water feature. All equipment operators would be trained in spill response and an SPCC plan would be prepared for this Project.
- Removal of pilings and restoration of the shoreline would reduce erosion and chemical contamination, which would benefit fish habitat.

7.5.2 Steelhead Critical Habitat

The effect determination for steelhead critical habitat as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Critical habitat for steelhead has been designated within the action area.
- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet of the Camas Slough.

A "not likely to adversely affect" determination is warranted based on the following rationale:

- No critical habitat PCEs would be affected by the proposed Project.
- The amount of habitat affected would be insignificant in comparison to the available habitat and designated critical in the Project vicinity. In addition, these habitats are protected by local critical areas regulations.
- Suitable spawning habitat is not located within the action area.
- Removal of pilings and restoration of the shoreline would reduce erosion and chemical contamination, which would benefit fish habitat and prey/food source habitat.

7.6 Pacific Eulachon

7.6.1 Pacific Eulachon Species

The effect determination for Pacific eulachon, southern DPS, as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Pacific eulachon are migratory in the Columbia River, including the action area. Adult and juvenile steelhead may occur in the action area year-round.
- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet of the Camas Slough. Hoe-ram operations to remove concrete and vibratory pile removal would occur to remove dolphins and piles within Camas Slough and Columbia River.
- Migratory habitat for Pacific eulachon is available within the action area.

A "not likely to adversely affect" determination is warranted based on the following rationale:

- In-water work would be restricted to a time period when juveniles are less likely to occur in the Project area.
- Migration of adult Pacific eulachon would not be impaired.
- Suitable spawning habitat is not located within the action area.
- No foraging habitat is located within the action area.
- The effects of sedimentation and turbidity would be minimized by adhering to an erosion control plan and implementing erosion control BMPs. Implementation of BMPs for erosion and sediment control would render effects on Pacific eulachon insignificant.
- Refueling of equipment would occur farther than 150 feet from any surface water feature. All equipment operators would be trained in spill response and an SPCC plan would be prepared for this Project.
- The proposed armoring of a portion of the dike would provide additional scour and erosion protection, reducing the amount of sedimentation and turbidity from dike banks benefiting fish habitat.

7.6.2 Pacific Eulachon Critical Habitat

The effect determination for Pacific eulachon critical habitat as a result of the proposed Project is "**may affect but is not likely to adversely affect**."

A "may affect" determination is warranted based on the following rationale:

- Critical habitat for Pacific eulachon has been designated within the action area.

- The Project would require in-water work (removal of pilings/dolphins, and debris) that may result in temporary increases in sedimentation and turbidity during construction.
- Clearing and grading (removal of structures and restoring the shoreline) would occur within 100 feet of the Camas Slough.

A “not likely to adversely affect” determination is warranted based on the following rationale:

- No critical habitat PCEs would be affected by the proposed Project.
- The amount of habitat affected would be insignificant in comparison to the available habitat and designated critical in the Project vicinity. In addition, these habitats are protected by local critical areas regulations.
- Suitable spawning habitat is not located within the action area.
- Removal of pilings and restoration of the shoreline would reduce erosion and chemical contamination which would benefit fish habitat and prey/food source habitat.

8.0 REFERENCES

59 Federal Register 35860. 1994. Endangered and Threatened Wildlife and Plants; The Plant, Water Howellia (*Howellia Aquatilis*), Determined to Be a Threatened Species. No. 134. 34860-35864. July 14. https://ecos.fws.gov/docs/federal_register/fr2623.pdf. Accessed December 7, 2020.

63 Federal Register 11774. 1998. Endangered and Threatened Species; Proposed Threatened Status and Designated Critical Habitat for Hood Canal Summer-Run Chum Salmon and Columbia River Chum Salmon. No. 46. 11774-11795. March 10. https://www.govinfo.gov/content/pkg/FR-1998-03-10/pdf/98-5472.pdf. Accessed May 15, 2020.

63 Federal Register 13347. 1998. Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington, Oregon, and California. No. 53. 13347-13371. March 19. https://www.govinfo.gov/content/pkg/FR-1998-03-19/pdf/98-6972.pdf. Accessed May 15, 2020.

64 Federal Register 14308. 1999. Endangered and Threatened Species; Threatened Status for Three Chinook Salmon Evolutionarily Significant Units (ESUs) in Washington and Oregon, and Endangered Status for One Chinook Salmon ESU in Washington. No. 56. 14308-14328. https://www.govinfo.gov/content/pkg/FR-1999-03-24/pdf/99-6815.pdf. Accessed May 15, 2020.

64 Federal Register 14508. 1999. Endangered and Threatened Species: Threatened Status for Two ESUs of Chum Salmon in Washington and Oregon. No. 57. 14508-14517. March 25. https://www.govinfo.gov/content/pkg/FR-1999-03-25/pdf/99-6814.pdf. Accessed May 15, 2020.

65 Federal Register 3875. 2000. Endangered and Threatened Wildlife and Plants; Endangered Status for “Erigeron decumbens” var. “decumbens” (Willamette Daisy) and Fender's Blue Butterfly (“Icaricia icarioides fenderi”) and Threatened Status for “Lupinus sulphureus” ssp. “kincaidii” (Kincaid's Lupine). No. 16. 3875-3890. January 25. https://www.govinfo.gov/content/pkg/FR-2000-01-25/pdf/00-1561.pdf. Accessed May 31, 2020.

70 Federal Register 37160. 2005. Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs. No. 123. 37159-37204. June 28. https://www.govinfo.gov/content/pkg/FR-2005-06-28/pdf/05-12351.pdf. Accessed May 15. 2020.

70 Federal Register 52630. 2005. Endangered and Threatened Species; Designation of Critical Habitat for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead in Washington, Oregon, and Idaho. No. 170. 52629-52858. September 2. https://www.govinfo.gov/content/pkg/FR-2005-09-02/pdf/05-16391.pdf. Accessed May 15, 2020.

71 Federal Register 833. 2006. Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead. No. 3. 833-862. January 5. https://www.govinfo.gov/content/pkg/FR-2006-01-05/pdf/06-47.pdf. Accessed May 15, 2020.

75 Federal Register 13012. 2010. Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of Eulachon. No. 52. 13012-13024. March 18. https://www.govinfo.gov/content/pkg/FR-2010-03-18/pdf/2010-5996.pdf. Accessed May 31, 2020.

75 Federal Register 63897. 2010. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States. No. 200. 63897 – 64070. October 18. https://www.govinfo.gov/content/pkg/FR-2010-10-18/pdf/2010-25028.pdf. Accessed May 15, 2020.

76 Federal Register 50448. 2011. Endangered and Threatened Species; 5-Year Reviews for 17 Evolutionarily Significant Units and Distinct Population Segments of Pacific Salmon and Steelhead. No. 157. 50448-50449. August 15. https://www.govinfo.gov/content/pkg/FR-2011-08-15/pdf/2011-20453.pdf. Accessed May 15, 2020.

76 Federal Register 65324. 2011. Endangered and Threatened Species; Designation of Critical Habitat for the Southern Distinct Population Segment of Eulachon. No. 203. 65323-65352. October 20. https://www.govinfo.gov/content/pkg/FR-2011-10-20/pdf/2011-26950.pdf. Accessed May 31, 2020.

81 Federal Register 9251. 2016. Endangered and Threatened Species; Designation of Critical Habitat for Lower Columbia River Coho Salmon and Puget Sound Steelhead. No. 36. 9251-9325. February 24. https://www.govinfo.gov/content/pkg/FR-2016-02-24/pdf/2016-03409.pdf. Accessed May 15, 2020.

Anchor (Anchor Environmental). 2003. Literature Review of Effects of Resuspended Sediments Due to Dredging Operations. Prepared for Los Angeles Contaminated Sediment Task Force, Los Angeles, CA. June. Available at: https://www.coastal.ca.gov/sediment/Lit-ResuspendedSediments.pdf

Azerrad, J. M. 2016. Periodic Status Review for the Columbian White-tailed Deer in Washington. Washington Department of Fish and Wildlife, Olympia, Washington, 28+iii pp.

Bash, Jeff, Cara Berman, and Susan Bolton. 2001. Effects of Turbidity and Suspended Solids on Salmonids. Prepared for the Washington State Transportation Commission. November.

Beamesderfer, Raymond C., and Bruce E. Rieman. 1988. Size selectivity and bias in estimates of population statistics of smallmouth bass, walleye, and northern squawfish in a Columbia River reservoir. *North American Journal of Fisheries Management* 8:505-510.

Berg, L. 1982. The effect of exposure to short-term pulses of suspended sediment on the behavior of juvenile salmonids. In: *Proceedings of the Carnation Creek Workshop: a 10-year Review,* G.F. Hartman (ed.), 177-196. Malaspina College, Nanaimo, Canada.

Berg, L. and T.G. Northcote. 1985. Changes in territorial, gill flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. *Canadian Journal of Fisheries and Aquatic Sciences* 42:1410-1417.

Bisson, Peter A., and Robert E. Bilby 1982. Avoidance of suspended sediment by juvenile coho salmon. *North American Journal of Fisheries Management* 2:371-374.

Blahm, T.H., and R.J. McConnell. 1971. Mortality of adult eulachon (*Thaleichthys pacificus*) subjected to sudden increases in water temperature. *Northwest Science* 45(3): 178-182.

Bottom, Daniel L., Charles A. Simenstad, Antonio M. Baptista, David A. Jay, Jennifer Burke, Kim K. Jones, Edmundo Casillas, and Michael H. Schiewe. 2005. Salmon at River's End: The Role of the Estuary in Decline and Recovery of Columbia River Salmon. NOAA Technical Memorandum NMFS-NWFSC-68. August.

BPA (Bonneville Power Administration). 2001. The Columbia River System: The Inside Story. September 1. https://www.bpa.gov/p/Generation/Hydro/hydro/columbia_river_inside_story.pdf. Accessed May 20, 2020.

Bridges, Todd S., Stephen Ells, Donald Hayes, David Mount, Steven C. Nadeau, Michael R. Palermo, Clay Patmont, and Paul Schoreder. 2008. The Four Rs of Environmental Dredging: Resuspension, Release, Residual, and Risk. January 2005. U.S. Army Engineer Research and Development Center, Vicksburg, MS. ERDC/EL TR-08-4.

Buchanan, Joseph B. 2016. Periodic status review for the Northern Spotted Owl. Washington Department of Fish and Wildlife Program. February.

Carrasquero, Jose. 2001. Over-water structures: Freshwater issues. White Paper. Prepared for Washington Department of Fish and Wildlife, Washington Department of Ecology and Washington Department of Transportation by Herrera Environmental Consultants. June 14.

Chapman, D. W. 2007. Effects of docks in Wells Dam Pool on subyearling summer/fall Chinook salmon. Douglas County Public Utility District.

Dauble, Dennis D., Thomas L. Page, and R. William Hanf, Jr. 1989. Spatial Distribution of Juvenile salmonids in the Hanford reach, Columbia River. *U.S. National Marine Fisheries Service Bulletin* 87:775–790.

DNR (Washington Department of Natural Resources). 2017. Derelict Creosote Piling Removal Best Management Practices for Pile Removal & Disposal. https://www.dnr.wa.gov/publications/aqr_rest_pileremoval_bmp_2017.pdf. Accessed July 21, 2020.

Dolat S.W. 1997. Acoustic measurements during the Baldwin Bridge demolition. Sonalysts, Inc. Waterford, Connecticut.

Ecology (Washington State Department of Ecology). 2013. Sediment Management Standards, WAC Chapter 173-204. https://fortress.wa.gov/ecy/publications/publications/1309055.pdf.

Ecology. 2019. 2019 Stormwater Management Manual for Western Washington (SWMMWW). https://fortress.wa.gov/ecy/ezshare/wq/Permits/Flare/2019SWMMWW/2019SWMMWW.htm. Accessed December 10, 2020.

Ecology. 2020. Washington State's Water Quality Assessment 303(d)/305(b) List. https://apps.ecology.wa.gov/ApprovedWQA/ApprovedPages/ApprovedSearch.aspx. Accessed June 30, 2020.

Ecology and ODEQ (Oregon Department of Environmental Quality). 2002. Total Maximum Daily Load (TMDL) for Lower Columbia River Total Dissolved Gas. September.

EPA (U.S. Environmental Protection Agency). 2016. Best Management Practices for Piling Removal and Placement in Washington State. Region 10, US Environmental Protection Agency. February 18.

ESA. 2018. Sediment Data Report: NPDES Waste Discharge Permit NO. WA0000256. Prepared by Environmental Associates for Georgia-Pacific Consumer Products (Camas) LLC. Camas, Washington. February.

Evans, Allen F., Nathan J. Hostetter, Daniel D. Roby, Ken Collis, Donald E. Lyons, Benjamin P. Sandford, Richard D. Ledgerwood, and Scott Sebring. 2012. Systemwide evaluation of avian predation on juvenile salmonids from the Columbia River based on recoveries of passive integrated transponder tags. *Transactions of the American Fisheries Society* 141: 975-989.

Everitt, R., C. Fiscus, and R. DeLong. 1980. Northern Puget Sound Marine Mammals. U.S. Environmental Protection Agency, Washington, D.C. EPA-600/7-80-139 (NTIS PB81127516).

FHWG (Fisheries Hydroacoustic Working Group). 2008. Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving. Memorandum to Applicable Agency Staff. https://wsdot.wa.gov/sites/default/files/2018/01/17/ENV-FW-BA_InterimCriteriaAgree.pdf.

Foundation for Water and Energy Education (FWEE). 2020. What makes the Columbia River Unique and how we benefit. https://fwee.org/environment/what-makes-the-columbia-river-basin-unique-and-how-we-benefit/. Accessed December 3, 2020.

Garland, Rodney D., and Kenneth F. Tiffan. 2002. Comparison of sub-yearling fall Chinook salmon's use of riprap revetments and unaltered habitats in Lake Wallula of the Columbia River. *North American Journal of Fisheries Management* 22:1283–1289.

Gregory, R.S. 1992. The influence of ontogeny, perceived risk of predation, and visual ability on the foraging behavior of juvenile Chinook salmon. *Theory and Application of Fish Feeding Ecology* 18: 271–284.

Gregory, R.S., and T.G. Northcote. 1993. Surface, planktonic, and benthic foraging by juvenile Chinook salmon (Oncorhynchus tshawytscha) in turbid laboratory conditions. *Canadian Journal of Fisheries and Aquatic Sciences* 50: 233–240.

Hastings, M.C., and A.N. Popper. 2005. Effects of sound on fish. August 23. https://www.nrc.gov/docs/ML1434/ML14345A573.pdf.

Hulse, D., S. Gregory, and J. Baker, eds. 2002. *Willamette River Basin Planning Atlas: Trajectories of Environmental and Ecological Change.* The Pacific Northwest Ecosystem Research Consortium. Corvallis, OR: Oregon State University Press.

Hutton, K.E., and S.C. Samis. 2000. Guidelines to Protect Fish and Fish Habitat from Treated Wood Used in Aquatic Environments in the Pacific Region. Habitat and Enhancement Branch, Fisheries and Oceans Canada. Canadian Technical Report of Fisheries and Aquatic Sciences 2314. Vancouver, British Columbia, Canada. https://www.arlis.org/docs/vol1/A/45002912.pdf. Accessed on August 5, 2020.

ISAB (Independent Scientific Advisory Board). 2000. The Columbia River Estuary and the Columbia River Basin Fish and Wildlife Program. ISAB 2000-5. November 28.

Kaher, Tom, Martin Grassley, and David Beaucamp. 2000. A summary of the effects of bulkheads, piers, and other artificial structures and shoreline development on ESA-listed salmonids in lakes. Prepared for the City of Bellevue, WA.

Kammerer, J.C. 1990. Largest Rivers in the United States. Water Fact Sheet. U.S, Geological Survey Open-File Report 87-242. May. http://pubs.usgs.gov/of/1987/ofr87-242/pdf/ofr87242.pdf.

Key, L.O., R.D. Garland, and K. Kappenman. 1996. Nearshore habitat use by subyearling Chinook salmon and non-native piscivores in the Columbia River. In: *Identification of the Spawning, Rearing, and Migratory Requirements of Fall Chinook in the Columbia River Basin,* D.W. Rondorf and K.F. Tiffan, editors, 64–79. 1994 Annual Report to Bonneville Power Administration, contract DE-AI79-91BP21708, Portland, Oregon.

Knudsen F.R., C.B. Schreck, S.M. Knapp, P.S. Enger, and O. Sand. 1997. Infrasound produces flight and avoidance responses in Pacific juvenile salmonids. *Journal of Fish Biology* 51:824–829. April.

LaSalle, M.W. 1988. Physical and chemical alterations associated with dredging: An overview. Pages 1-12 in: C.A. Simenstad (ed.). Effects of dredging on anadromous pacific coast fishes. Workshop Proceedings, Seattle, Sept. 8–9, 1988.

LCFRB (Lower Columbia Fish Recovery Board). 2010. Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan. https://www.lcfrb.gen.wa.us/librarysalmonrecovery.

Lloyd, Denby S. 1987. Turbidity as a water quality standard for salmonid habitats in Alaska. *North American Journal of Fisheries Management* 7: 34–45. January.

NOAA Fisheries (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2000. Biological Opinion, Reinitiation of consultation on the operation of the Federal Columbia River Power System, including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin. December 21.

NOAA Fisheries. 2016. 5-Year Review: Summary & Evaluation of Lower Columbia River Chinook Salmon, Columbia River Chum Salmon, Lower Columbia River Coho Salmon, and Lower Columbia River Steelhead. https://repository.library.noaa.gov/view/noaa/17021. Accessed May 10, 2020.

NOAA Fisheries. 2019. Datums for Station ID: 9440047, Washougal, Columbia River, Washington. https://tidesandcurrents.noaa.gov/datums.html?datum=MSL&units=0&epoch=0&id=9440047&name=WASHOUGAL%2C+COLUMBIA+RIVER&state=WA. Accessed June 1, 2020.

NOAA Fisheries. 2020. ESA Threatened and Endangered Species Directory. https://www.fisheries.noaa.gov/species-directory/threatened-endangered. Accessed April 10, 2020.

NRCS (Natural Resource Conservation Service). 2010. Introduction to Nelson's Checker-mallow, a Federally-listed Threatened Species, and a Key and Photo Guide to the Checker-mallow Species that Occur within its Range. September. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_042947.pdf. Accessed May 15, 2020.

NRCS. 2019. Soil Survey: Clark County, Washington. Version 16, September 10. https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed July 11, 2020.

NRCS. 2020. Oregon SNOTEL Current Snow Water Equivalent (SWE) % of Normal. https://www.wcc.nrcs.usda.gov/ftpref/data/water/wcs/gis/maps/or_swepctnormal_update.pdf. Accessed December 17, 2020.

Nickelson, T.E., J.W. Nicholas, A.M. McGie, R.B. Lindsay, D.L. Bottom, R.J. Kaiser, and S.E. Jacobs. 1992. Status of anadromous salmonids in Oregon coastal basins. Oregon Department of Fish and Wildlife, Research and Development Section, Corvallis, and Ocean Salmon Management, Newport, Oregon.

ODEQ (Oregon Department of Environmental Quality). 1991. Total Maximum Daily Load for 2,3,7,8-TCDD in the Columbia River Basin. Decision Document. February 1991.

ODEQ. 1995. 1992-1994 Water quality standards review. Department of Environmental Quality, Standards and Assessment Section. Final issues papers. Portland, OR.

Omernik, James M. 1987. Ecoregions of the Coterminous United States: Map Supplement. *Annals of the Association of American Geographers* 77(1):118-125.

Pearson, Scott F. and Bob Altman. 2005. Range-wide Streaked Horned Lark (*Eeremophila alpestris strigata*) Assessment and Preliminary Conservation Strategy. Washington Department of Fish and Wildlife, Wildlife Program. September.

Petersen, James H., and Donald L. Ward. 1999. Development and corroboration of a bioenergetics model for northern pikeminnow feeding on juvenile salmonids in the Columbia River. *Transactions of the American Fisheries Society* 128: 784–801.

Petersen, J. H., Sauter, S.T. Frost, C.N., Gray, S.R., and Poe, T.P. 1993. Indexing juvenile salmonid consumption by northern squawfish in the Columbia River below Bonneville Dam and in John Day Reservoir, 1992. In: *Systemwide Significance of Predation on Juvenile Salmonids in Columbia and Snake River Reservoirs: Annual Report 1992 to Bonneville Power Administration, Portland, Oregon,* J. H. Petersen and T. P. Poe, editors.

Poe, Thomas P., and Bruce E. Rieman. 1988. Predation by resident fish on juvenile salmonids in John Day Reservoir, 1983-1986. Oregon Department of Fish and Wildlife, Fish Research Project DE-AI79-82BP35097, Final Report, Portland, Oregon.

Poe, Thomas P., Hal C. Hansel, Steven Vigg, Douglas E. Plamer, and Linda A. Prendergast. 1991. Feeding of predaceous fishes on out-migrating juvenile salmonids in John Day Reservoir, Columbia River. *Transactions of the American Fisheries Society* 120(4):405–420.

Popper, Arthur N., Thomas J. Carlson, Anthony D. Hawkins, Brandon L. Southall, and Roger L. Gentry. 2006. Interim Criteria for Injury of Fish Exposed to Pile Driving Operations: A White Paper. https://www.nrc.gov/docs/ML0932/ML093210627.pdf. Accessed May 20, 2020.

Redding, J. Michael, Carl B. Schreck., and Fred H. Everest. 1987. Physiological effects on coho salmon and steelhead of exposure to suspended solids. *Transactions of the American Fisheries Society* 116:737-744.

Reiser, D.W. and Bjornn, T.C. 1979. Habitat requirements of anadromous salmonids. Gen Tech Rep PNW96. USDA Forest Service. Pacific Northwest Forest and Range Experiment Station. Portland, OR.

Richardson, John W., Charles R. Greene, Jr., Charles I. Malme, and Denis H. Thomson. 1995. *Marine Mammals and Noise.* Academic Press. San Diego, California.

Rieman, Bruce E., and John D. McIntyre. 1993. Demographic and Habitat Requirements for Conservation of Bull Trout. General Technical Report INT-302. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. September.

Rondorf, Dennis W., Gerard A. Gray, and Robert B. Fairley. 1990. Feeding ecology of subyearling Chinook salmon in riverine and reservoir habitats of the Columbia River. *Transactions of the American Fisheries Society* 119:16-24.

Salo, E.O., N.J. Bax, T.E. Prinslow, C.J. Whitmus, B.P. Snyder, and C.A. Simenstad. 1980. The Effects of Construction of Naval Facilities on the Outmigration of Juvenile Salmonids from Hood Canal, Washington. FRI-UW-8006. April. https://digital.lib.washington.edu/researchworks/handle/1773/4563.

Sandercock, F.K. 1991. Life History of Coho Salmon. In Pacific Salmon Life Histories, edited by C. Groot and L. Margolis. UBC Press.

Seattle Public Utilities. 2015. Seattle Biological Evaluation. May 2015 revision. http://www.seattle.gov/utilities/construction-resources/design-standards/seattle-biological-evaluation/sbe-document. Accessed on August 5, 2020.

Servizi, James A. and Dennis W. Martens. 1987. Some Effects of Suspended Fraser River Sediments on Sockeye salmon (Oncorhynchus nerka). Pages 254-264. In: H.D. Smith, L. Margolis, and C.C. Wood (eds.). Sockeye salmon (Oncorhynchus nerka) Population Biology and Future Management. Canadian Special Publication of Fisheries and Aquatic Sciences 96

Servizi, James A. and Dennis W. Martens. 1992. Sublethal responses of coho salmon (Oncorhynchus kisutch) to suspended sediments. *Canadian Journal of Fisheries and Aquatic Sciences* 49(7):1389-1395.

Smith, W. E., and Saalfeld, R. W. 1955. Studies on Columbia River smelt *Thaleichthys pacificus* (Richardson). Washington Department of Fisheries, Fisheries Research Paper 1(3): 3–26.

Spence B.C., Lomnicky G.A., Hughes R.M., and Novitzki, R.P. 1996. An ecosystem approach to salmonid conservation. ManTech Environ Res Serv Corp, Corvallis, OR. TR-4501-96-6057.

Stober, Q.J., Ross, B.D., Melby, C.L,. Dinnel, P.A., Jagielo, T.H., and Salo, E.O. 1981. Effects of Suspended Volcanic Sediment on Coho and Chinook salmon in the Toutle and Cowlitz Rivers. Technical Completion Report. FRI–UW–8 124. November. https://digital.lib.washington.edu/researchworks/handle/1773/3985.

Tetra Tech. 2023. Shoreline Report including Critical Areas Review, Ordinary High Water Determination, and Impact Assessment, Camas Mill, Camas, WA. Prepared for Georgia-Pacific Consumer Operations, LLC. Tetra Tech: Bothell, Washington.

Tiffan, Kenneth F., Rodney D. Garland, and Dennis W. Rondorf. 2002. Quantifying flow-dependent changes in subyearling fall Chinook salmon rearing habitat using two-dimensional spatially-explicit modeling. *North American Journal of Fisheries Management* 22:713–726.

USACE (U.S. Army Corps of Engineers). 2010. Approved Work Windows For Fish Protection For Waters Within National Park Boundaries, Columbia River, Snake River, and Lakes By Watercourse. September 3. https://www.nws.usace.army.mil/Portals/27/docs/regulatory/ESA%20forms%20and%20templates/work_windows%20Waters_in_NPs_CR_SR_Lakes.pdf. Accessed August 1, 2020.

USACE. 2019. Sediment Quality Evaluation Report: Vancouver to the Dalles Federal Navigation Channel, Columbia River Miles 108+15 to 136+30, Oregon, and Washington. Prepared by the Sediment Quality Team (CENWP-ODN-W).

USFWS (U.S. Fish and Wildlife Service). 1996. Water Howellia (*Howellia aquatilis*) Recovery Plan. Helena, Montana. September. https://ecos.fws.gov/docs/recovery_plan/960924.pdf. Accessed January 10, 2021.

USFWS. 2010. Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington. Region 1, U.S. Fish and Wildlife Service. May 20.

USFWS. 2015. Recovery plan for the coterminous United States population of bull trout (*Salvelinus confluentus*). Portland, Oregon.

USFWS. 2020a. Information for Planning and Consultation (IPaC) online tool. https://ecos.fws.gov/ipac/. Accessed April 6, 2020.

USFWS. 2020b. Washington's Federally Protected Species. https://www.fws.gov/wafwo/promo.cfm?id=177175754. Accessed April 8, 2020.

USFWS.2020c. Northern Spotted Owl. Oregon Fish and Wildlife Office. https://www.fws.gov/oregonfwo/articles.cfm?id=149489595. Accessed May 15, 2020.

USFWS. 2020d. Streaked Horned Lark. Oregon Fish and Wildlife Office. https://www.fws.gov/oregonfwo/articles.cfm?id=149489450. Accessed September 5, 2019.

USFWS. 2020e. Golden Paintbrush. Washington Fish and Wildlife Office. https://www.fws.gov/wafwo/articles.cfm?id=149489587. Accessed May 15, 2020.

USFWS. 2020f. Water howellia. Oregon Fish and Wildlife Office. https://www.fws.gov/oregonfwo/articles.cfm?id=149489516. Accessed May 15, 2020.

USFWS. 2022. Information for Planning and Consultation (IPaC) online tool. https://ecos.fws.gov/ipac/. Accessed December 13, 2022.

USGS (U.S. Geological Survey). 2019. Oregon Water Science Center USGS Data Grapher. https://or.water.usgs.gov/cgi-bin/grapher/graph_setup.pl.

Vendetti, D.A., M.A. Tennier, and D.W. Rondorf. 1997. Nearshore movements of juvenile fall Chinook salmon in the Columbia River. In: *Identification of the spawning, rearing, and migratory requirements of fall Chinook salmon in the Columbia River basin,* D. W. Rondorf and K. F. Tiffan editors, 69–84. Annual Report to the Bonneville Power Administration, Contract DEAI7991BP21708, Portland, Oregon.

WDFW (Washington Department of Fish and Wildlife). 2006. Overwater Structures and Non-Structural Piling White Paper. Prepared by Jones and Stokes Associates, in association with Anchor Environmental, LLC and R2 Resource Consultants. https://wdfw.wa.gov/sites/default/files/publications/00995/wdfw00995.pdf. Accessed on August 5, 2020.

WDFW. 2018. Times When Spawning or Incubating Salmonids are Least Likely to be within Washington State Freshwaters. June 1. https://wdfw.wa.gov/sites/default/files/2019-02/freshwater_incubation_avoidance_times.pdf. Accessed May 15, 2020.

WDFW. 2020a. Priority Habitats and Species (PHS) Interactive mapper. https://geodataservices.wdfw.wa.gov/hp/phs/. Accessed April 8, 2020.

WDFW. 2020b. SalmonScape online mapper. http://apps.wdfw.wa.gov/salmonscape/map.html. Accessed April 8, 2020.

WDFW. 2020c. Streaked horned lark. https://wdfw.wa.gov/species-habitats/species/eremophila-alpestris-strigata. Accessed May 15, 2020.

WDFW, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Ellensburg, WA, USA. 54 pp.

WDFW and ODFW (Oregon Department of Fish and Wildlife). 2001. Washington and Oregon Eulachon Management Plan. Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife, Olympia, Washington.

WSDOT (Washington State Department of Transportation). 2019. Biological Assessment Preparation for Transportation Projects: Advanced Training Manual. August.

WSF (Washington State Ferries). 2019. Biological Assessment Reference: Washington State Ferries Capital, Repair, and Maintenance Projects. Seattle, Washington.

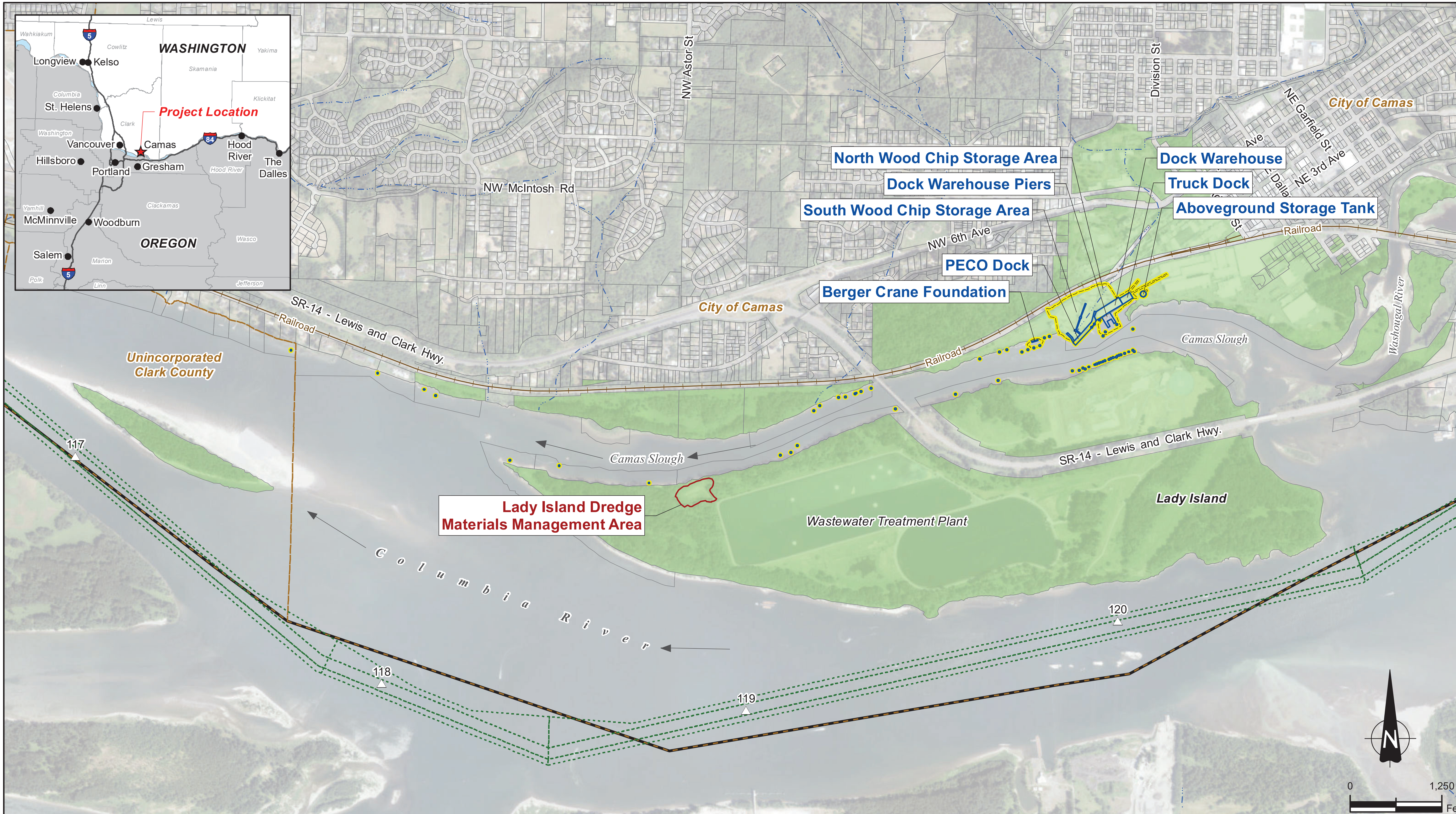
Werme, Christine, Jennifer Hunt, Erin Beller, Kristen Cayce, Marcus Klatt, Aroon Melwani, Eric Polson, and Robin Grossinger. 2010. Removal of Creosote-Treated Pilings and Structures from San Francisco Bay. Prepared for California State Coastal Conservancy. December 10. https://www.sfei.org/sites/default/files/biblio_files/ReportNo605_Creosote_Dec2010_finalJan13.pdf. Accessed August 5, 2020.

Whitman, Randall P., Thomas P. Quinn, and Ernest L. Brannon. 1982. Influence of Suspended Volcanic Ash on Homing Behavior of Adult Chinook Salmon. *Transactions of the American Fisheries Society* 111: 63-69. doi:10.1577/1548-8659(1982)111<63:IOSVAO>2.0.CO;2.

Wiles, Gary J., and Kevin S. Kalasz. 2017. Status report for the Yellow-billed Cuckoo in Washington. Washington Department of Fish and Wildlife, Olympia, Washington.

Zimmerman, Mark P. 1999. Food habits of smallmouth bass, walleyes, and northern pikeminnow in the lower Columbia River basin during outmigration of juvenile anadromous salmonids. *Transactions of the American Fisheries Society* 128:1036–1054.

FIGURES



Legend	
Project Limits	Tax Lot
Columbia River Mile Marker	Tax Lot Owned by Georgia-Pacific
Stream/River	City Boundary
Structure To Be Removed	County Boundary
Dolphin To Be Removed	Federal Navigation Channel
Lady Island Dredge Materials Management Area	

GEORGIA-PACIFIC
CONSUMER OPERATIONS LLC

Tetra Tech

TETRA TECH

IN-WATER & OVERWATER
STRUCTURES REMOVAL PROJECT
CAMAS MILL, CAMAS, WASHINGTON

PROJECT LOCATION

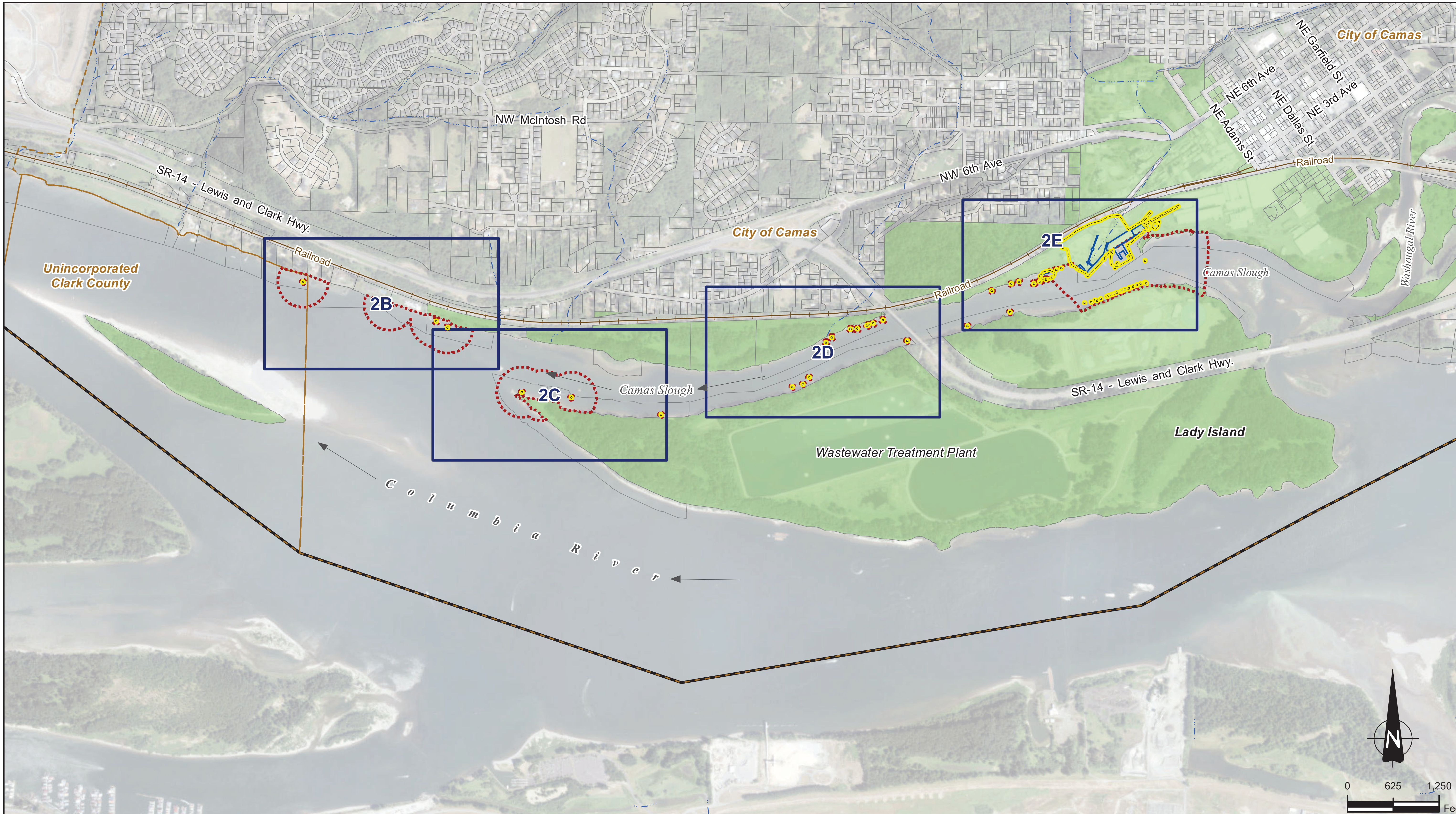
DATE NOVEMBER 2022

SCALE 1 " = 1,250 '

PROJECT NO.

FIGURE 1

R:\PROJECTS\CAMAS_0117-0064\FIGURES_UPDATE\MAPS\Figure 1 - Project Location.mxd - sierra.marrs - 11/2/2022 - 1:29:21 PM



Project Limits	Tax Lot
Structure To Be Removed	Tax Lot Owned by Georgia-Pacific
Dolphin To Be Removed	City Boundary
Action Area	County Boundary
Stream/River	

GEORGIA-PACIFIC
CONSUMER OPERATIONS LLC

Tetra Tech

TETRA TECH

IN-WATER & OVERWATER STRUCTURES REMOVAL PROJECT
CAMAS MILL, CAMAS, WASHINGTON

STRUCTURES TO BE REMOVED AND STUDY AREA MAP OVERVIEW

DATE JANUARY 2023

SCALE 1 " = 1,250 '

PROJECT NO.

FIGURE 2A

R:\PROJECTS\CAMAS_0117-0064\FIGURES_UPDATE\MAPS\Figure 2A - Study Area Map - Overview.mxd - sierra.marrs - 1/12/2023 - 2:22:47 PM

- Project Limits
- Structure To Be Removed
- Dolphin To Be Removed
- Tax Lot
- Tax Lot Owned by Georgia-Pacific
- City Boundary

Action Area:

- Vibratory Pile Removal Underwater Action Area
- Dredging Water Quality Action Area

GEORGIA-PACIFIC
CONSUMER OPERATIONS LLC

Tetra Tech

TETRA TECH

IN-WATER & OVERWATER
STRUCTURES REMOVAL PROJECT
CAMAS MILL, CAMAS, WASHINGTON

STRUCTURES TO BE REMOVED
AND STUDY AREA MAP

DATE	JANUARY 2023
SCALE	1 " = 200 '
PROJECT NO.	
FIGURE	2B

Project Limits
Structure To Be Removed
Dolphin To Be Removed
Tax Lot
Tax Lot Owned by Georgia-Pacific

Action Area:
Vibratory Pile Removal Underwater Action Area
Dredging Water Quality Action Area

GEORGIA-PACIFIC
CONSUMER OPERATIONS LLC

Tetra Tech

TETRA TECH

IN-WATER & OVERWATER
STRUCTURES REMOVAL PROJECT
CAMAS MILL, CAMAS, WASHINGTON

STRUCTURES TO BE REMOVED
AND STUDY AREA MAP

DATE	JANUARY 2023
SCALE	1 " = 200 '
PROJECT NO.	
FIGURE	2C

R:\PROJECTS\CAMAS_0117-0064\FIGURES_UPDATE\MAPS\Figure 2B-2E - Study Area Map - Mapbook.mxd - sierra.marrs - 1/12/2023 - 2:22:36 PM

Project Limits	Action Area:
Structure To Be Removed	Dredging Water Quality Action Area
Dolphin To Be Removed	
Tax Lot	
Tax Lot Owned by Georgia-Pacific	

GEORGIA-PACIFIC
CONSUMER OPERATIONS LLC

Tetra Tech

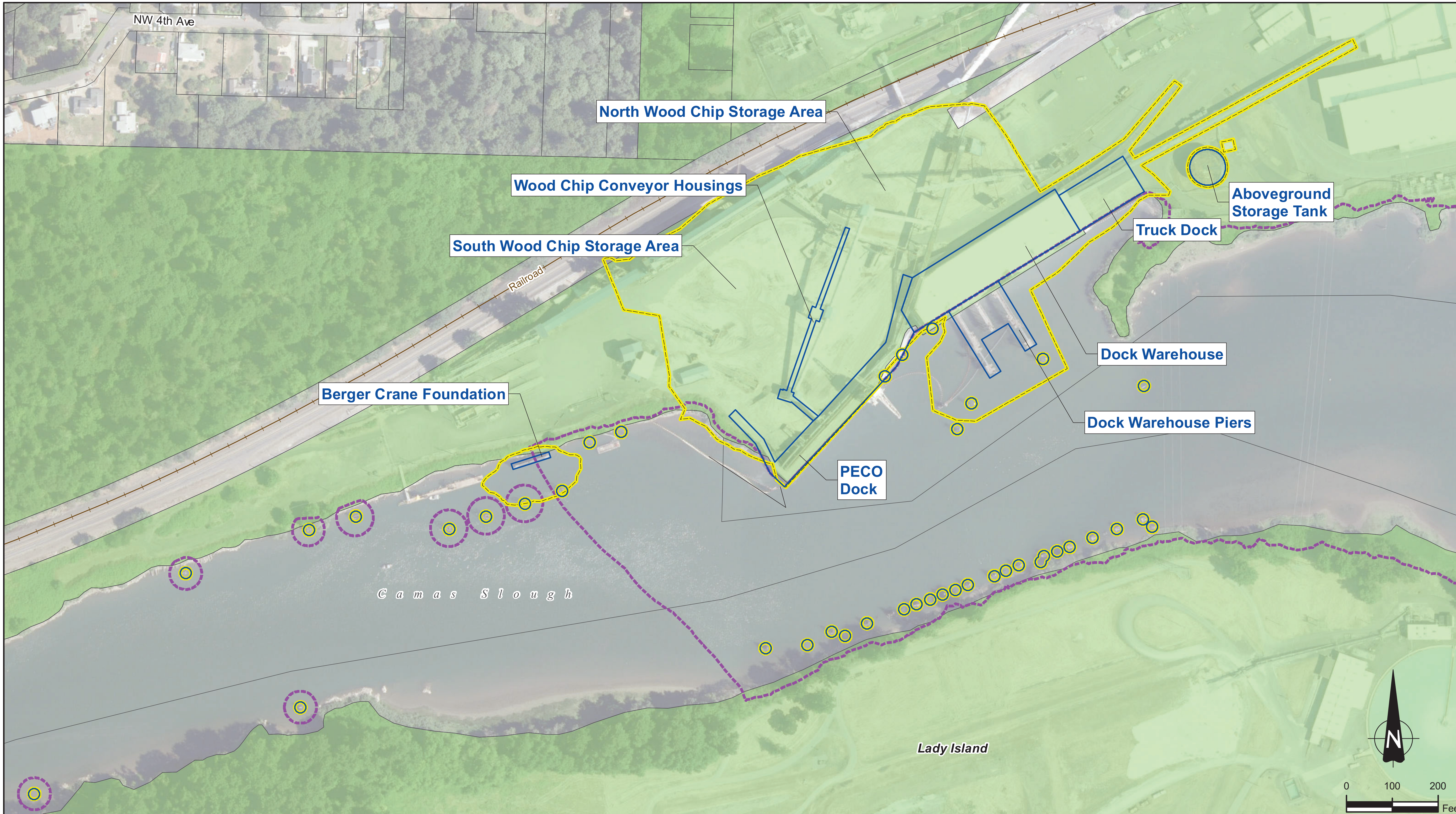
TETRA TECH

IN-WATER & OVERWATER STRUCTURES REMOVAL PROJECT
CAMAS MILL, CAMAS, WASHINGTON

STRUCTURES TO BE REMOVED AND STUDY AREA MAP

DATE: JANUARY 2023
SCALE: 1 " = 200 '
PROJECT NO.
FIGURE: 2D

R:\PROJECTS\CAMAS_0117-0064\FIGURES_UPDATE\MAPS\Figure 2B-2E - Study Area Map - Mapbook.mxd - sierra.marrs - 1/12/2023 - 2:22:40 PM

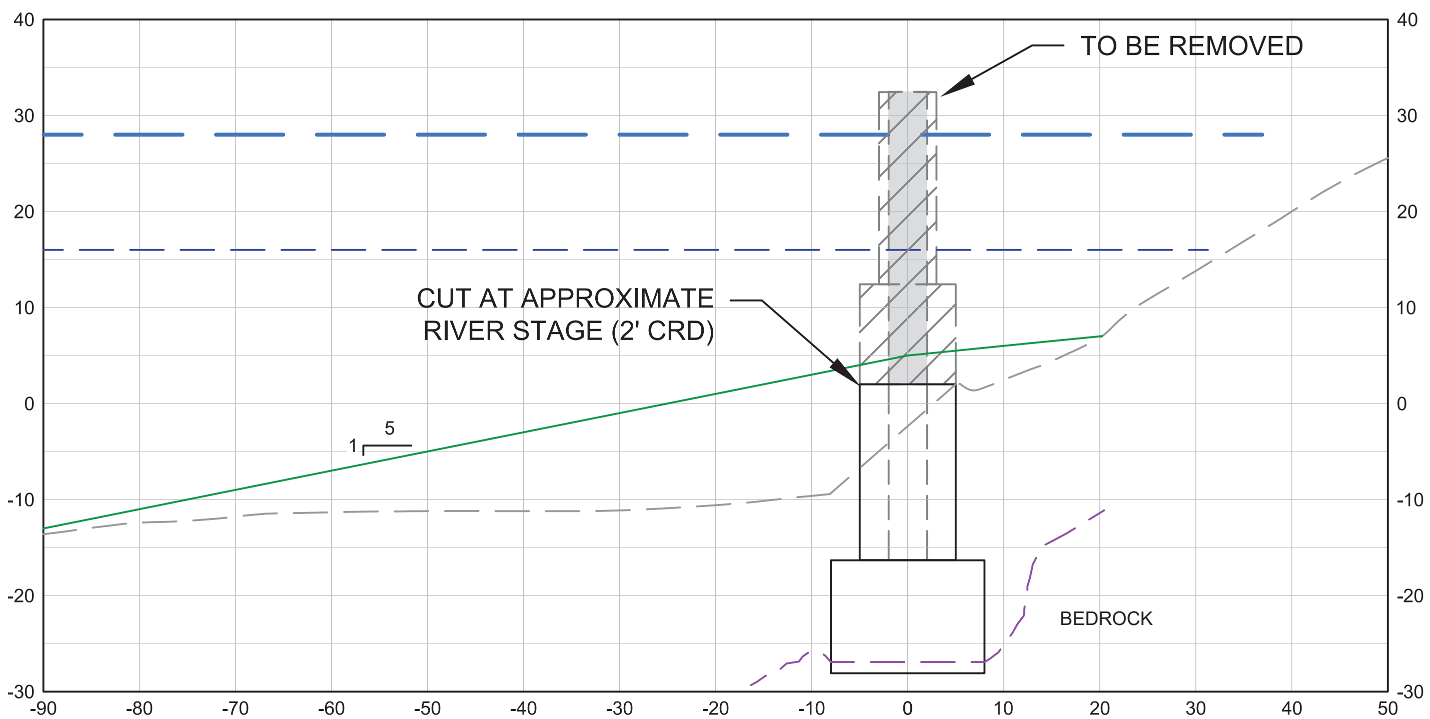


Project Limits
Structure To Be Removed
Dolphin To Be Removed
Tax Lot
Tax Lot Owned by Georgia-Pacific

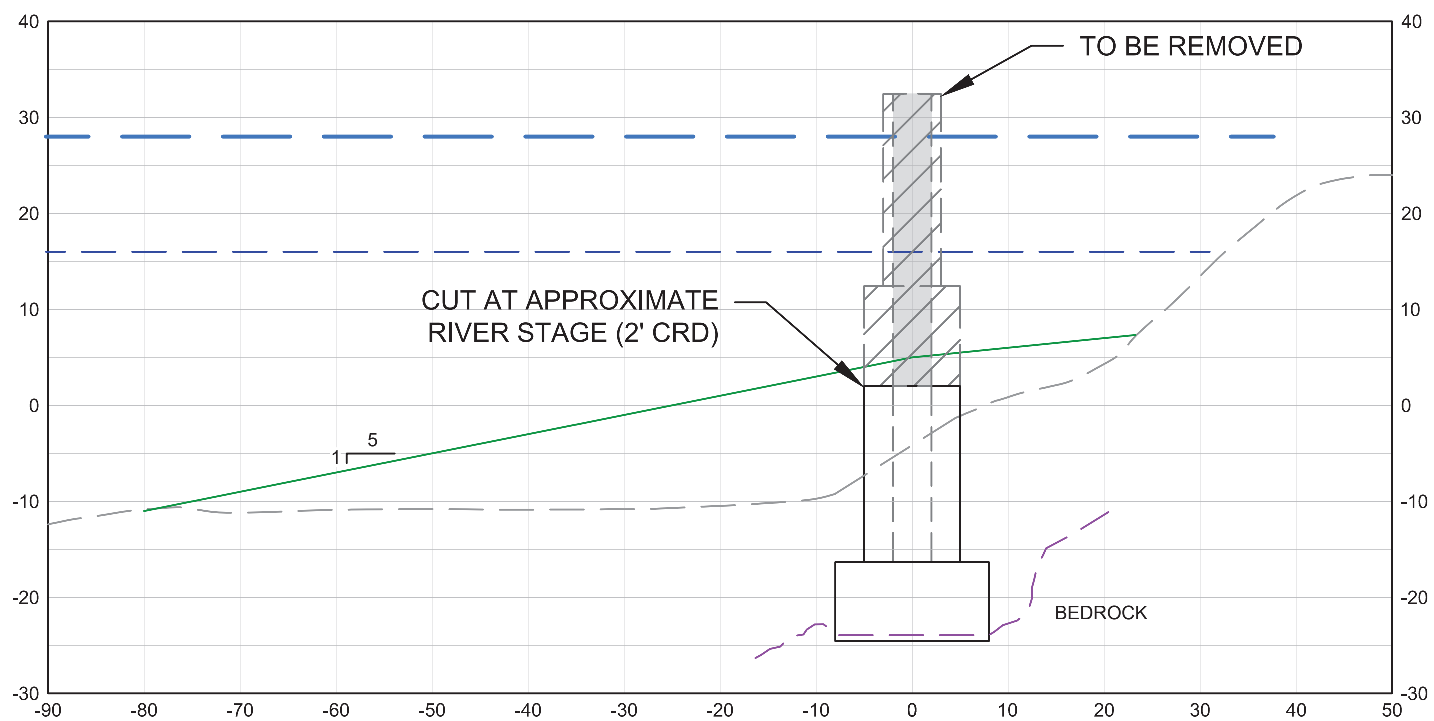
Action Area:
Dredging Water Quality Action Area

GEORGIA-PACIFIC CONSUMER OPERATIONS LLC	TETRA TECH	IN-WATER & OVERWATER STRUCTURES REMOVAL PROJECT CAMAS MILL, CAMAS, WASHINGTON	DATE	JANUARY 2023
			SCALE	1 " = 200 '
Tetra Tech		STRUCTURES TO BE REMOVED AND STUDY AREA MAP	PROJECT NO.	
			FIGURE	2E

R:\PROJECTS\CAMAS_0117-0064\FIGURES_UPDATE\MAPS\Figure 2B-2E - Study Area Map - Mapbook.mxd - sierra.marrs - 1/12/2023 - 2:22:43 PM



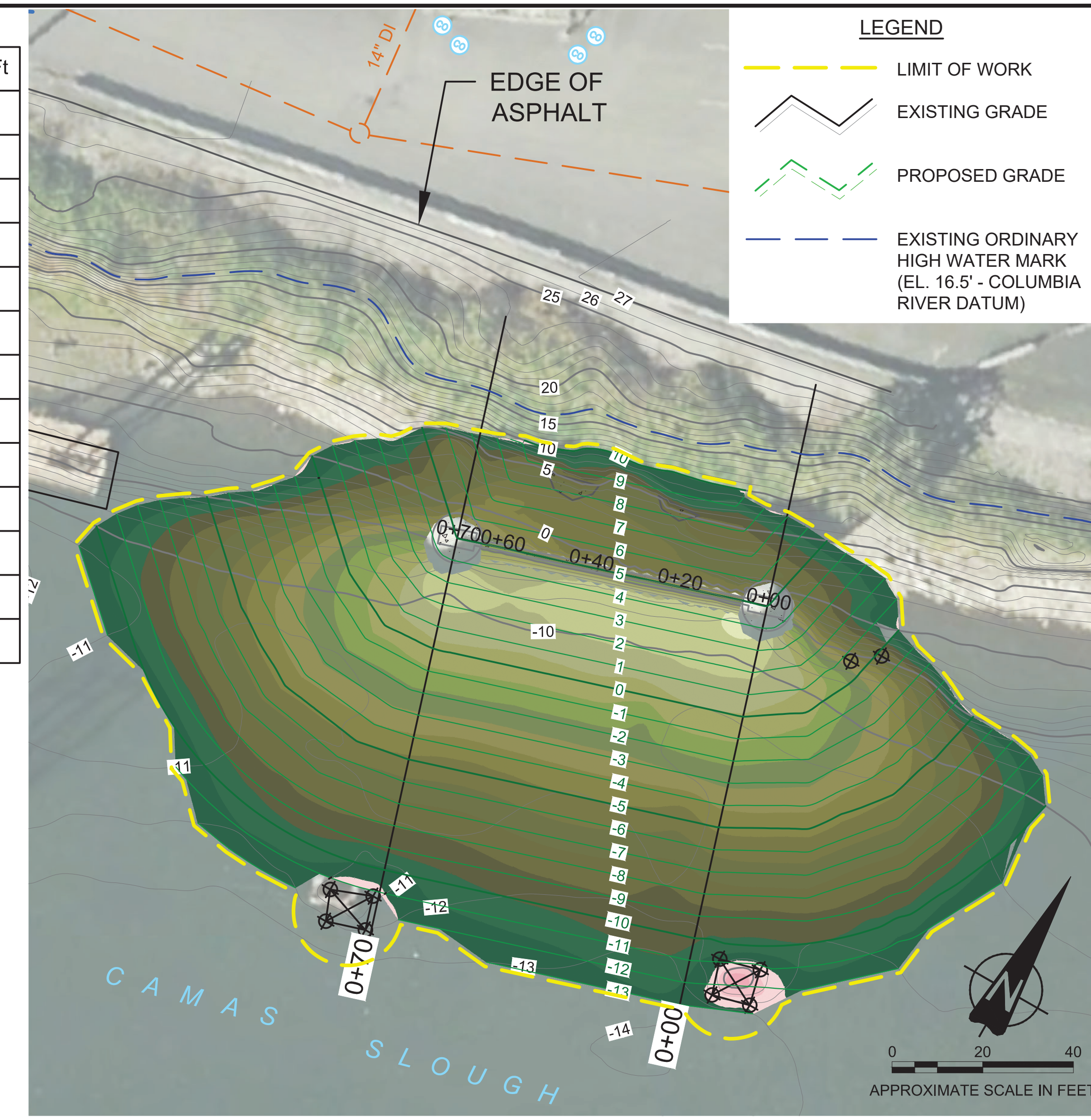
CROSS SECTION 0+00

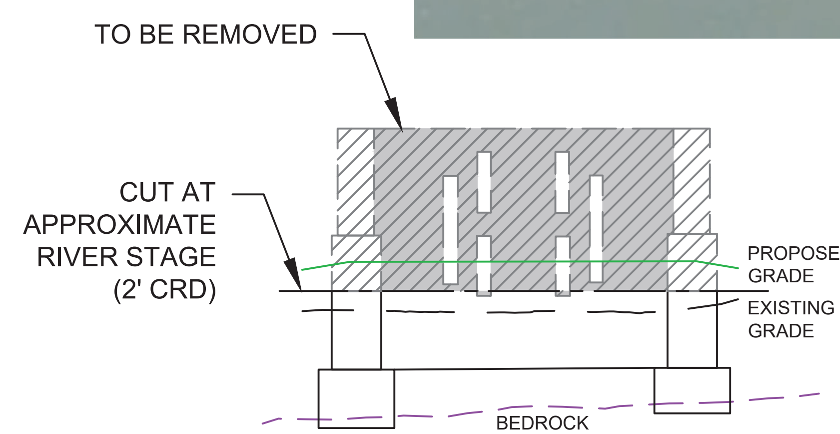


CROSS SECTION 0+70

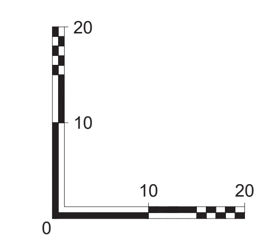
Depth Thickness Table in Ft		
MIN	MAX	Color
0	+1	
+1	+2	
+2	+3	
+3	+4	
+4	+5	
+5	+6	
+6	+7	
+7	+8	
+8	+9	
+9	+10	
+10	+11	
+11	+12	

3,500 c□FILL





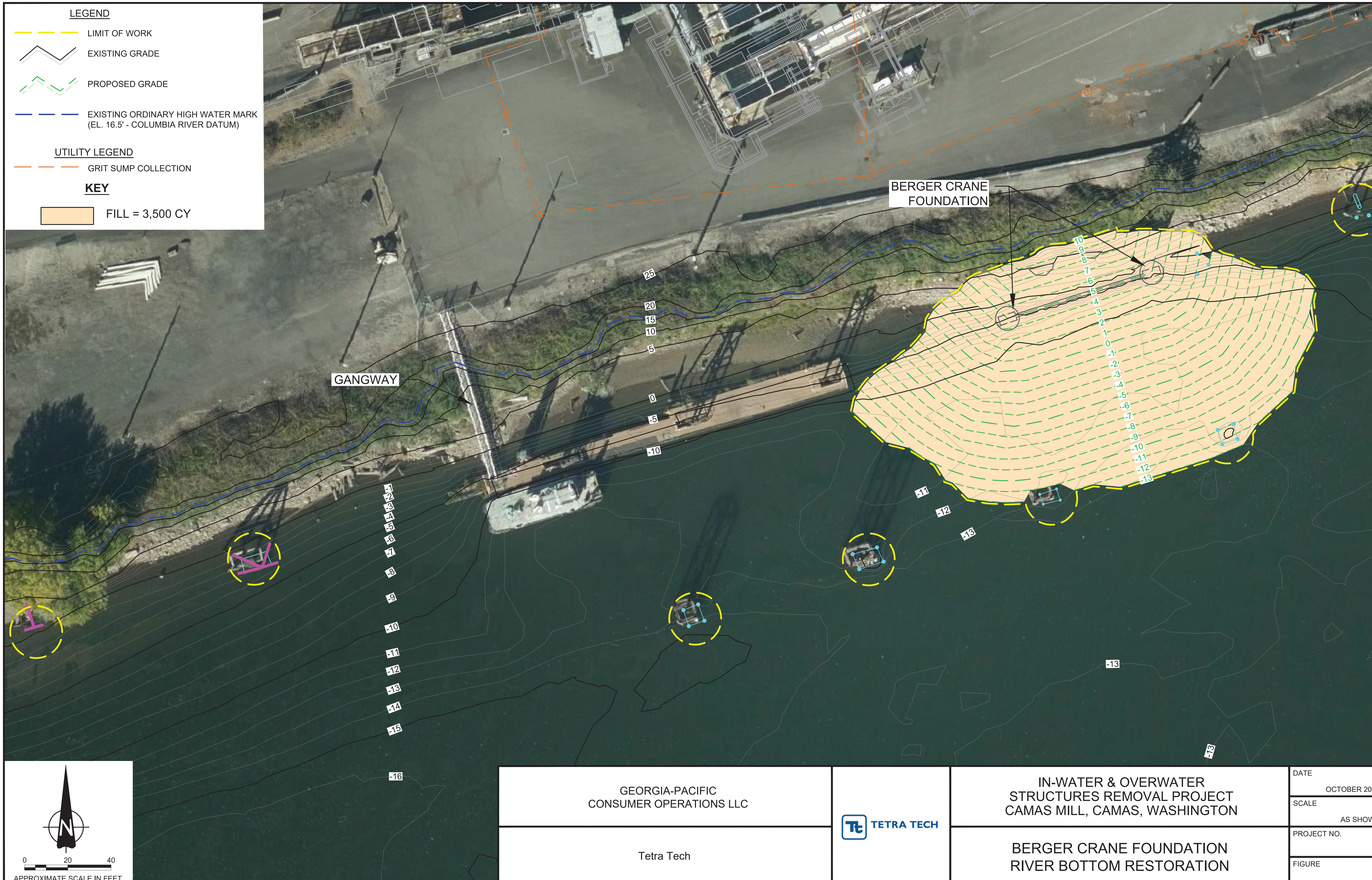
BERGER CRANE FOUNDATION PHOTO

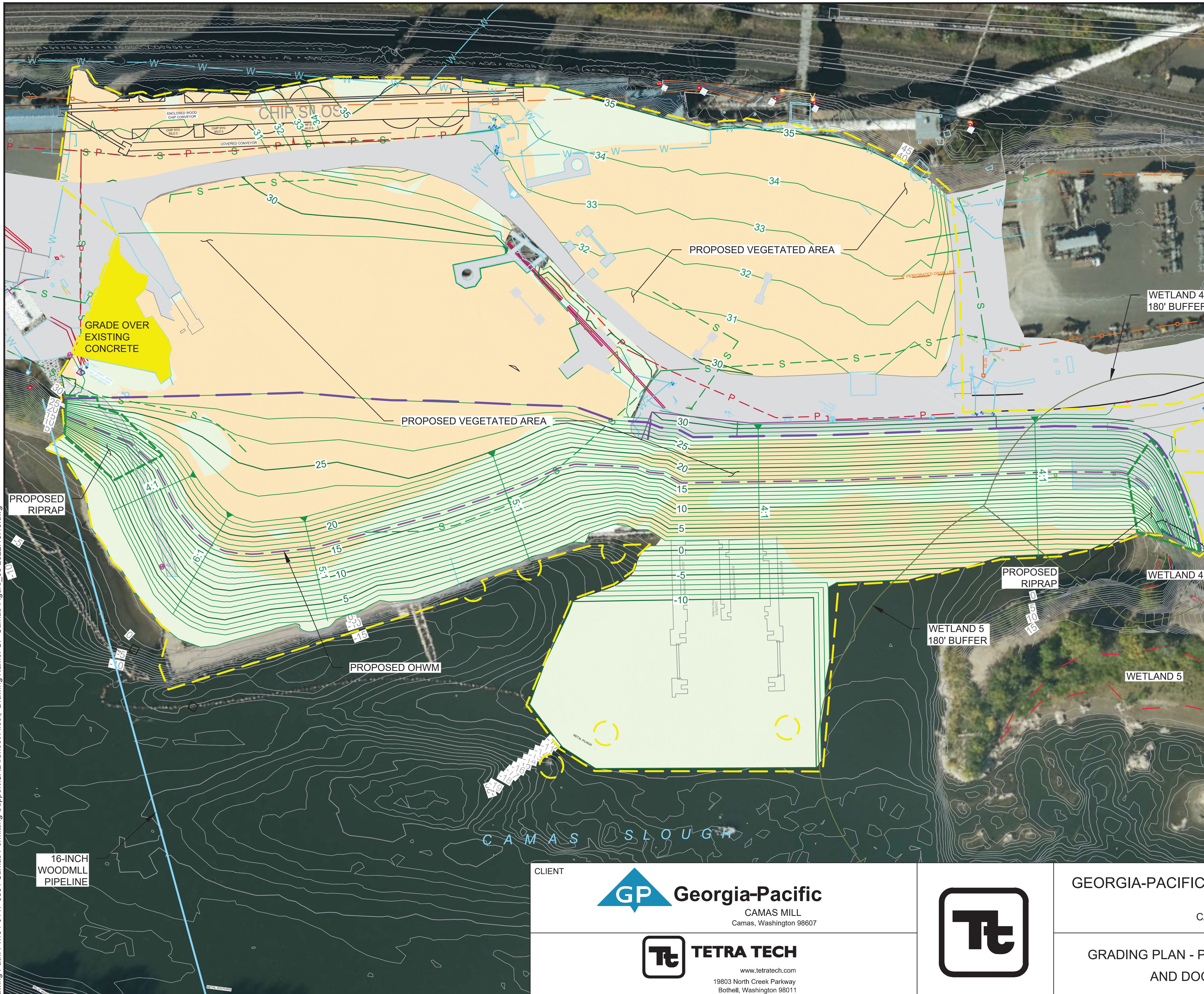


CROSS SECTION LEGEND

- ORDINARY HIGH WATER MARK (EL. 16.5' - COLUMBIA RIVER DATUM
- 100-YEAR FLOOD PLAIN (EL. 28' - COLUMBIA RIVER DATUM)
- EXISTING GRADE
- PROPOSED FINAL GRADE

GEORGIA-PACIFIC CONSUMER OPERATIONS LLC	TETRA TECH	IN-WATER & OVERWATER STRUCTURES REMOVAL PROJECT CAMAS MILL, CAMAS, WASHINGTON	DATE	OCTOBER 2022
			SCALE	AS SHOWN
Tetra Tech		GRADING PLAN BERGER CRANE FOUNDATION	PROJECT NO.	
			FIGURE	3


LEGEND
LIMIT OF WORK
EXISTING GRADE
PROPOSED GRADE
EXISTING ORDINARY HIGH WATER MARK
(EL. 16.5' - COLUMBIA RIVER DATUM)
UTILITY LEGEND
GRIT SUMP COLLECTION
KEY
FILL = 3,500 CY
BERGER CRANE
FOUNDATION
GANGWAY
0 20 40
APPROXIMATE SCALE IN FEET
GEORGIA-PACIFIC
CONSUMER OPERATIONS LLC
Tetra Tech
TETRA TECH
IN-WATER & OVERWATER
STRUCTURES REMOVAL PROJECT
CAMAS MILL, CAMAS, WASHINGTON
BERGER CRANE FOUNDATION
RIVER BOTTOM RESTORATION
DATE
OCTOBER 2022
SCALE
AS SHOWN
PROJECT NO.
FIGURE
4



LEGEND

- LIMIT OF WORK
- EXISTING GRADE CONTOURS (SITEWIDE LAND SURVEYING 7/07/20)
- PROPOSED FINAL GRADE CONTOURS
- PROPOSED ORDINARY HIGH WATER MARK (OHWM) (EL. 16.5' - COLUMBIA RIVER DATUM)
- PROPOSED 100-YEAR FLOOD PLAIN (EL. 28' - COLUMBIA RIVER DATUM)
- EXISTING WETLAND

UTILITY LEGEND

- FIRE MAIN
- WATER
- PROCESS SEWER
- GRIT SUMP COLLECTION
- OVERHEAD POWER LINE
- UNDERGROUND POWER LINE
- NATURAL GAS

EARTHWORK QUANTITIES

NORTH WOOD CHIP AREA:
130,730 SF (3.00 ACRE)

CUT =	5,678 CY
FILL =	32,943 CY

SOUTH WOOD CHIP AREA, PECO DOCK, WAREHOUSE, AND PIERS:
340,088 SF (7.81 ACRE)

CUT =	32,676 CY
FILL =	20,788 CY

DRAFT

0 50 100
APPROXIMATE SCALE IN FEET

CLIENT

Georgia-Pacific
CAMAS MILL
Camas, Washington 98607

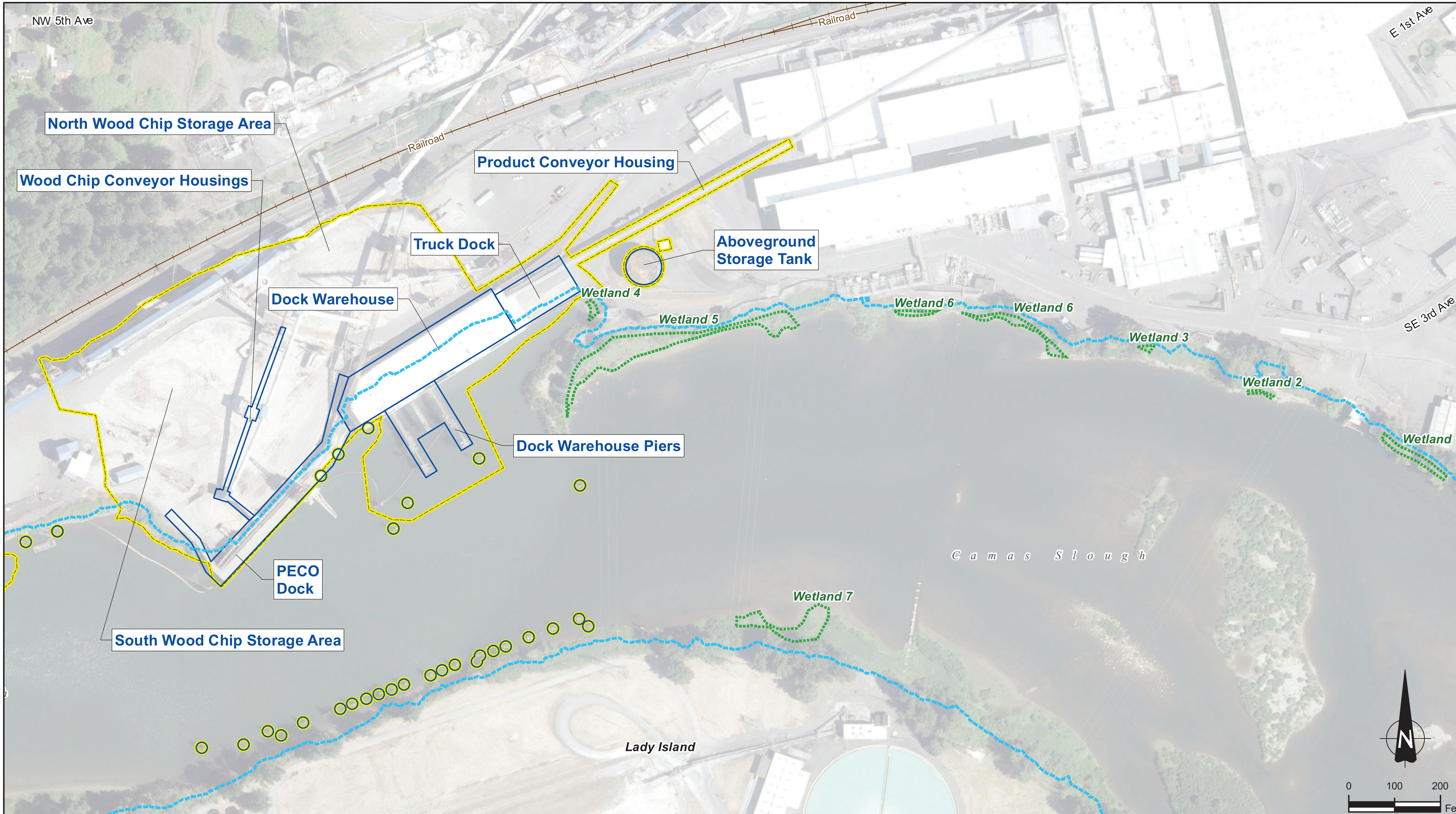
TETRA TECH
www.tetratech.com
19803 North Creek Parkway
Bothell, Washington 98011
Phone: 425-482-7600 Fax: 425-482-7652

GEORGIA-PACIFIC CONSUMER OPERATIONS LLC
CAMAS MILL
CAMAS, WASHINGTON

GRADING PLAN - PECO DOCK, DOCK WAREHOUSE, AND DOCK WAREHOUSE PIERS

DATE	10/19/22
SCALE	AS SHOWN
PROJECT No.	194-0117
FIGURE	5

Plot Date: 10/19/22 - 5:03pm, Plotted by: joel.cameron
Drawing Path: P:\194-0117-0064 Camas Permitting Support\CAD\ Sheet Files\, Drawing Name: GP-Camas-Figure_05-2022.10.19.dwg



Project Limits
Structure To Be Removed
Dolphin To Be Removed
OHWM (elevation: 16.05 ft., CRD)
Wetland Boundary (surveyed 08/20/2019 & 07/22/2020)

Notes:
ft = foot/feet
CRD = Columbia River datum
OHWM = Ordinary High Water Mark

GEORGIA-PACIFIC
CONSUMER OPERATIONS LLC

Tetra Tech

TETRA TECH

IN-WATER & OVERWATER
STRUCTURES REMOVAL PROJECT
CAMAS MILL, CAMAS, WASHINGTON

WETLAND MAP

DATE	JANUARY 2023
SCALE	1 " = 200 '
PROJECT NO.	
FIGURE	6

DRAWN BY: SD CHECKED BY: KD

R:\PROJECTS\CAMAS_0117-0064\FIGURES_UPDATE\MAPS\Figure 6 - Wetland Map.mxd - sierra.marrs - 1/12/2023 - 2:54:54 PM

APPENDIX A: ESSENTIAL FISH HABITAT EVALUATION

The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries) has determined that an Essential Fish Habitat (EFH) consultation is necessary for the proposed Project to satisfy the requirements in the Magnuson-Stevens Fishery Conservation and Management Act and the 1996 Sustainable Fisheries Act.

An EFH assessment is an analysis of the effects of a proposed action on essential fish habitat. Mandatory contents include a description of the proposed action; an analysis of the effects of that action on EFH; the federal agency's views on those effects; and proposed mitigation, if applicable. Additional information that should be discussed (if appropriate) includes the results of on-site inspections; the views of recognized experts on affected habitat or fish species; a review of pertinent literature; and an alternatives analysis (50 Code of Federal Regulations 600.920[g]).

EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. To interpret the definition of EFH, "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate. "Substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities. "Necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. "Spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

The EFH is described by Fishery Management Councils in amendments to Fishery Management Plans and is approved by the Secretary of Commerce, acting through NOAA Fisheries (50 Code of Federal Regulations 600.10). Salmonid EFH is discussed in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan (PFMC 2019a).

Essential Fish Habitat within the Action Area

For the in-water and over-water demolition of structures at the Camas Mill, Pacific salmon and groundfish EFH management units were identified within portions of the action area in Camas Slough and the Columbia River (NOAA Fisheries 2020). The majority of the action area is identified as Pacific salmon EFH. The marine influence and possible saltwater intrusion within the action area require that marine species of fish and their associated life-history stages with designated EFH need to be addressed.

The EFH designation for the Pacific salmon fishery includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except above the impassable barriers as identified by the Pacific Fishery Management Council. The Pacific salmon management unit includes Chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), and pink salmon (*O. gorbuscha*). Only Chinook and coho species have been documented in the Columbia River (WDFW 2020). The Project action area does not provide spawning habitat for these species, due to its location within the tidally influenced lower reach of the Columbia River, which lacks suitable spawning substrate. However, the Project action area does contain adequate habitat for adult migration, juvenile out-migration, and rearing where suitable habitat is present. Coho and Chinook are known to stage in Columbia River as subadults.

The EFH designation for groundfish is defined as those waters and substrates necessary to ensure the production is needed to support a long-term sustainable fishery (PFMC 2019a). The marine extent of groundfish EFH includes those waters from the near-shore and tidal submerged environment within Washington, Oregon, and California state territorial waters out to the exclusive economic zone offshore between the Canada and Mexico borders. The west coast groundfish management unit in the Washington coast nearshore environment includes 83 species that generally live on or near the bottom of the ocean and include species groups such as skates and sharks, rockfish, flatfish, lingcod, English sole and other groundfish (PFMC 2019b). Because of their association with the ocean bottom and coastal areas, they are not likely to occur in the Project area but may be associated with areas downstream from the action area in the more tidally influenced lower Columbia River estuary.

Analysis of Potential Effects

Potential impacts of the proposed Project on Endangered Species Act listed fish species and habitats are discussed in Section 7.0 of this Biological Assessment and are expected to be similar for all federally managed fish species that occur within the action area. The proposed construction activities have the potential to temporarily affect select habitat parameters, such as temporary increases in sedimentation and turbidity, for minimal, temporary adverse effects in the case of inadvertent spills (e.g., fuel or oil from construction equipment), temporary disturbance to food sources, and limited removal of riverine habitat (refugia). Temporary effects are anticipated to be minimal through the use of construction planning and timing, and implementation of best management practices to further minimize effects. No long-term degradation of habitat parameters for Pacific salmon or groundfish is anticipated to occur as a result of the proposed construction.

Essential Fish Habitat Conservation Measures

Several measures would be implemented to minimize potential adverse effects to fish habitat in general. These measures are listed below:

- Contractors would be required to prepare and implement a spill prevention, control, and countermeasures plan consistent with Washington State Department of Ecology regulations.
- Contractor personal would be trained in hazardous material handling and would be equipped with appropriate spill response materials including oil-absorbent pads.
- Extreme care would be taken to ensure that no petroleum products, hydraulic fluid, sediment, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into surface water.
- Material used for construction would be stockpiled in upland areas, in a designated stockpile area.
- Equipment would be inspected daily for drips or leads in order to prevent spills or releases to surface water.
- In order to reduce the potential impacts on listed species, work would be conducted during low flow conditions to the extent possible.

Conclusion and Effect Determination

The proposed construction activities have the potential to temporarily affect select riverine habitat parameters. Temporary effects are anticipated to be minimal through the use of construction planning and timing, and implementation of best management practices to further minimize effects. Removal of wood-treated pilings, improvement of the shoreline, and removal of debris would provide long-term beneficial effects to water quality through reduced sedimentation and turbidity. No long-term degradation of habitat parameters is anticipated to occur as a result of the proposed construction. Therefore, the Project ***will not adversely affect*** EFH for Pacific salmonids or groundfish.

References

NOAA Fisheries (National Oceanic and Atmospheric Administration Fisheries). 2020. Habitat Conservation – Essential Fish Habitat (EFH) mapper. https://www.habitat.noaa.gov/application/efhmapper/index.html. Accessed April 8, 2020.

PFMC (Pacific Fishery Management Council). 2019a. Coastal Pelagic Species Fishery Management Plan as Amended through Amendment 17. June. https://www.pcouncil.org/documents/2019/06/cps-fmp-as-amended-through-amendment-17.pdf/. Accessed June 9, 2020.

PFMC. 2019b. Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery. December. https://www.pcouncil.org/documents/2016/08/pacific-coast-groundfish-fishery-management-plan.pdf/. Accessed June 9, 2020.

WDFW (Washington Department of Fish and Wildlife). 2020. Priority Habitats and Species (PHS) Interactive mapper. https://geodataservices.wdfw.wa.gov/hp/phs/. Accessed April 8, 2020.

APPENDIX B: SPECIES DESCRIPTIONS AND LIFE HISTORIES

LISTED SPECIES RETAINED FOR FURTHER EVALUATION

Bull Trout

Bull trout were historically distributed in major river drainages in the Pacific Northwest from California to the headwaters in Canada. Despite a fairly wide range of bull trout in the Northwest, current distribution in the Columbia River basin represents approximately only 45 percent of their historical distribution in this basin (63 Federal Register [FR] 31647).

Bull trout exhibit resident and migratory life history strategies, depending on population and local habitat accessibility and structure. Resident bull trout spend their life cycle in the stream or tributary in which they spawn and rear. Migratory bull trout spawn in streams where rearing takes place for up to four years before migrating to lakes (adfluvial), rivers (fluvial), or in some cases, the ocean (anadromous). Resident and migratory populations may occur together (63 FR 31647).

Unlike other salmonids, bull trout have a narrower tolerance for habitat quality parameters and require particularly cold, clean water. Bull trout reach breeding age between four and seven years of age and may live up to 12 years. Unlike other salmonids, bull trout have a narrower tolerance for habitat quality parameters and require particularly cold, clean water. Because of this, their spawning generally takes place between August and November. Migratory bull trout may begin spawning in April. Fry emerge in early April to May.

Chinook Salmon (Lower Columbia River Evolutionarily Significant Unit)

Chinook are the largest of the Pacific salmon species and are found in the larger river systems and some smaller coastal river drainages from California to Alaska. Chinook alevins emerge in the spring and exhibit either “ocean-type” or “stream-type” life-history strategies. Migration distance, stream flows, and temperatures, and productivity of streams and estuaries appear to be the strongest environmental factors affecting species emigration timing (Myers et al. 1998).

Chinook in the lower Columbia River generally follows an ocean-type life history cycle. This means they migrate to the ocean as fry, sub-yearling, or yearling juveniles. Ocean-type juveniles generally rear in estuaries and enter saltwater during their first year, usually in the late summer and fall. There are two Lower Columbia River (LCR) Chinook Evolutionarily Significant Unit (ESU) runs that typically fall in this category: fall-run (tules) and late fall-run (brights). Although a third run does exist (the spring-run), Chinook from this run were historically only found in the upper portions of the basin with snowmelt-driven flow regimes.

Adults enter freshwater between August and December, after spending between two to six years in the ocean before returning to their natal streams. Peak spawning occurs from late September to November. Depending on water temperatures, egg incubation lasts through the fall and winter months and emergence occurs in April. Downstream migration begins one to four months after emergence and occurs from March to October. Rearing juveniles are likely to be present in the lower Columbia River year-round. This is because fry will generally search for suitable rearing habitat within side sloughs, side channels, spring-fed seep areas, and areas along the outer edges of the stream. These quiet-water side margins and off-channel slough areas are vital for early juvenile habitat.

Chum Salmon (Columbia River Evolutionarily Significant Unit)

Chum have the largest natural geographic and spawning distribution of any Pacific salmonid, primarily because their range extends farther along the shore of the Arctic Ocean than other salmonids. Chum are also the second largest of Pacific salmon and known for their large canine-like fangs and the striking body color of spawning males. Chum spend more of their life history in marine waters than other Pacific salmonids. They typically spawn in coastal areas, and juveniles out-migrate to the ocean almost immediately after emergence (Good et al. 2005).

Columbia River chum ESU adults return to the river in mid-October to December. They primarily spawn in the lower reaches of the Columbia River and their migration is mostly related to water temperatures. Chum fry out-migrate from March through May, shortly after emergence. Chum juveniles feed in the estuaries before entering the ocean.

Coho Salmon (Lower Columbia River Evolutionarily Significant Unit)

Similar to Chinook in their distribution, coho occur in major river basins around the Pacific Rim from California to Alaska. Coho do not have the major life-history variations seen in some of the other listed salmonid species occurring in the lower Columbia River. The LCR coho ESU includes two distinct runs: early returning (Type S) and late returning (Type N). Type S coho generally migrate south of the Columbia River once they reach the ocean, returning to freshwater in mid-August and to spawning tributaries in early September. Spawning peaks from mid-October to early November. Type N coho have a northern distribution in the ocean, return to the Columbia River from late September through December, and enter the tributaries from October through January.

LCR coho ESU adults typically return to spawn as type N, returning from late September through November. After emergence as fry, they move to shallow, low-velocity rearing areas, which usually include pool habitat, quiet backwaters, side channels, and small creeks (LCRFB 2010). Juveniles migrate seaward from April to June after spending at least a year in the river. They spend approximately 18 months in the ocean before returning to freshwater by the age of 3 to spawn.

Steelhead (Lower Columbia River Distinct Population Segment)

Steelhead exhibit highly complex life-history strategies—more so than other species of Pacific salmonid. Steelhead exhibit both anadromous and freshwater resident life histories and may produce offspring that take on a life-history strategy opposite to that of their parents. The anadromous form may spend up to seven years in freshwater before entering the smolt life stage, and they may spend up to three years in salt water prior to first spawning (Good et al. 2005). Steelhead can spawn more than once (iteroparous), whereas almost all other salmonids spawn only once before dying (semelparous).

The non-anadromous forms are typically referred to as rainbow trout. Although the anadromous and resident forms are considered to be the same species, the exact relationship between the two forms is not well understood, and little data is available on the interactions between the two forms. In coastal populations, it is unusual for the two forms to co-occur, in part because they are usually separated by a natural or man-made migration barrier.

The LCR steelhead distinct population segment (DPS) includes both summer- and winter-run steelhead. Summer-run steelhead are considered stream-natural types, enter the freshwater in a sexually immature condition between May and October, and require several months to mature and spawn. Winter-run steelhead are ocean-maturing, and enter freshwater between November and April, and spawn shortly thereafter (NOAA Fisheries 2005). Fry emergence occurs from March into July, with peak emergence generally occurring in April and May.

Summer-run rearing takes place primarily in the faster parts of pools, while winter-run rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. The dominant age class of out-migrating steelhead smolts in the lower Columbia River is typically age two and generally occurs from March to June, with peak outmigration usually in April or May (NOAA Fisheries 2005).

Pacific Eulachon (Southern Distinct Population Segment)

Pacific eulachon are members of the osmerid family (smelts) and are endemic to the northeastern Pacific Ocean. The Columbia River and its tributaries support the largest known Pacific eulachon run in the world (Gustafson et al. 2010). Pacific eulachon are very important to the Pacific coastal food web, due to their availability during spawning runs and their high lipid content. They are consumed by a large variety of shorebirds, marine mammals, and fish.

The Pacific eulachon Southern DPS is significant to the species because it constitutes over half of the geographic range of the entire species' distribution and includes at least two of the major production areas (the Columbia and Fraser Rivers) for the entire species. Unfortunately, this species has declined in the past 20 years, especially since the mid-1990s.

Pacific eulachon typically spend three to five years in saltwater before returning to freshwater to spawn from late winter through early summer. River entry and spawning begin as early as December and January in the Columbia River basin and last through May, with peak entry and spawning during February and March. Pacific eulachon require freshwater for spawning and are unlikely to spawn in the brackish waters of the lower Columbia River estuary. Within days of hatching, the larvae are rapidly carried downstream and dispersed by estuarine and ocean currents. As they grow, they migrate out to deeper depths. Although adults can repeatedly spawn, most die shortly after spawning.

OTHER CONSIDERED SPECIES

Coastal Cutthroat Trout

Cutthroat trout (*Oncorhynchus clarki clarki*) are widely distributed in the lower Columbia River tributary systems and all life history forms are reported in all lower Columbia River drainages. They were originally proposed to be listed as threatened in 1999 in the southwestern Washington/Columbia River DPS (which includes the Columbia River and its tributaries), but the U.S. Fish and Wildlife Service withdrew the listing proposal in 2002 and reconfirmed in 2010 (75 FR 8621).

Similar to bull trout, there are several life-history forms of cutthroat trout, including resident, fluvial, and anadromous (LCFRB 2010). The boundaries are not rigid and individual fish are known to move from one life-history form to another within their lifespan. The non-migratory life-history form includes fish generally found in small streams and headwaters and are smaller at maturity. The freshwater migratory life-history form are fish that migrate entirely within freshwater. This includes populations that migrate from large tributaries to small tributaries to spawn, pupations that inhabit lakes and migrate upstream to spawn in the lake's tributaries, and populations that live in lakes and migrate downstream to spawn in the lake outlet (USFWS 2020) Lastly, the saltwater migratory life-history form migrates from freshwater natal areas to feed in marine environments.

Cutthroat trout typically spawn from December through June, with peak spawning in February. Fry emerge between March and June, with peak emergence in mid-April. Due to their use of a large variety of habitat types, they spend more time in the freshwater environment than do most other anadromous Pacific salmonids (USFWS 2020). Coastal cutthroat trout would likely be encountered during the in-water construction work window while they are migrating or rearing, but currently, they are only listed as a species of concern. While they do not hold the same protections as other salmonids on this Project, the same precautions would apply to this species to ensure the species is not negatively affected.

Therefore, the Project is ***likely to affect, but will not adversely affect populations, individuals, or suitable habitat*** for coastal cutthroat trout, as they could use the Project action area for migrating, feeding, or rearing. Effects are likely to be very minimal even if they are displaced by the Project, because similar suitable habitat is abundant outside of the action area.

Green Sturgeon

Green sturgeon (*Acipenser medirostris*) are an anadromous sturgeon found in nearshore marine waters from Mexico to Canada. Green sturgeon are long-lived, slow-growing fish and the most marine-oriented of the sturgeon species. Northern and Southern DPS green sturgeon occupies coastal estuaries and coastal marine waters, and therefore those observed in coastal bays, estuaries, and coastal marine waters outside of natal rivers may belong to either DPS. The southern DPS at present only contains a single spawning population, the Sacramento River (73 FR 52083). The northern DPS, consisting of Klamath River and Rogue River spawning populations, was listed as a species of concern (LCRFB 2010). However, sturgeon from both DPSs occur in the Columbia River estuary during summer months and typically occur offshore from late fall through early spring.

While the southern DPS sturgeon are anadromous, they are only known to utilize the lower Columbia River estuary from the mouth of the river up to river kilometer 74 or 46 miles seasonally (74 FR 52299). This is far outside of the range of the action area, which is roughly 76 miles upstream of the designated habitat for the species. There is no evidence of spawning in the Lower Columbia River by green sturgeon.

While it is possible that green sturgeon could exist within the action area of the Camas Slough or Columbia River, it is unlikely they will be encountered during the in-water work window, as they would be occurring offshore during that time period, rather than using the estuary or mainstem river. Therefore, the Project is ***not likely to affect populations, individuals, or suitable habitat*** for green sturgeon, as the action area is well outside of the current range of this species; thus, this species would not be exposed to Project impacts.

Pacific Lamprey

Pacific lamprey (*Entosphenus tridentatus*) are a native anadromous inhabitant of most Pacific Northwest rivers, including the Columbia River. Young lampreys are algae filter feeders and burrow in sandy stream margins and side channels for about six years before migrating downstream to the ocean (LCRFB 2010). Adults, on the other hand, are parasitic and feed by attaching themselves to a variety of prey in marine environments. While, this species is not listed as either a species of concern, threatened, or endangered, they are culturally and ecologically important to the lower Columbia River, as they are an important food source for native peoples and many estuary inhabitants.

After spending one to three years in the ocean, they cease feeding and migrate to freshwater in the spring (Columbia River Inter-Tribal Fish Commission 2020). Pacific lamprey are susceptible to many of the same threats as salmonids, which include reduced access to spawning habitat, degradation of spawning and rearing areas, and losses of juveniles to entrainment and non-indigenous predators. It is likely that Pacific lamprey would be encountered during the in-water construction work window while they are migrating, rearing, or feeding; however, they are not currently listed. While they do not hold the same protections as other fish within the lower Columbia River, the same precautions would apply to this species to ensure the species is not negatively affected.

Therefore, the Project is ***likely to affect, but will not adversely affect populations, individuals, or suitable habitat*** for Pacific lamprey, as they could use the Project action area for migrating, feeding, or rearing. Effects are likely to be very minimal even if they are displaced by the Project because similar suitable habitat is abundant outside of the action area.

REFERENCES

63 Federal Register 31647. 1998. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Klamath River and Columbia River Distinct Population Segments of Bull Trout. No. 111. 31647-31674. July 10. https://www.govinfo.gov/content/pkg/FR-1998-06-10/pdf/98-15319.pdf. Accessed July 24, 2020.

73 Federal Register 52083. 2008. Endangered and Threatened Wildlife and Plants: Proposed Rulemaking To Designate Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon. No. 174. 52083-52110. September 8. https://www.govinfo.gov/content/pkg/FR-2008-09-08/pdf/E8-20632.pdf. Accessed July 24, 2020.

74 Federal Register 52299. 2009. Endangered and Threatened Wildlife and Plants: Final Rulemaking To Designate Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon. No. 195. 52299-52351. October 9. https://www.govinfo.gov/content/pkg/FR-2009-10-09/pdf/E9-24067.pdf. Accessed July 24, 2020.

Columbia River Inter-Tribal Fish Commission. 2020. Pacific Lamprey, A Cultural Resource. https://www.critfc.org/fish-and-watersheds/columbia-river-fish-species/lamprey/. Accessed July 24, 2020.

Good, Thomas P., Robin S. Waples, and Pete Adams (editors). 2005. Updated status of Federally Listed ESUs of West Coast Salmon and Steelhead. NOAA Technical Memorandum NMFS-NWFSC-66. June.

Gustafson, R.G., M.J. Ford, D. Teel, and J.S. Drake. 2010. Status review of eulachon (*Thaleichthys pacificus*) in Washington, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-105. March.

LCFRB (Lower Columbia Fish Recovery Board). 2010. Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan.

Myers, James M., Robert G. Kope, Gregory J. Bryant, David Teel, Lisa J. Lierheimer, Thomas C. Wainwright, W. Stewart Grant, F. William Waknitz, Kathleen Neely, Steven T. Lindley, and Robin S. Waples. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum, NMFS-NWFSC-35. February.

NOAA Fisheries (NOAA Fisheries Protected Resources Division). 2005. Final Assessment of NOAA Fisheries' Critical Habitat Analytical Review Teams for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead. NOAA Fisheries Protected Resources Division, Portland, Oregon. https://repository.library.noaa.gov/view/noaa/18667. Accessed July 24, 2020.

USFWS (U.S. Fish and Wildlife Service). 2020. Coastal Cutthroat Trout. Washington Fish and Wildlife Office. https://www.fws.gov/wafwo/articles.cfm?id=149489586. Accessed July 24, 2020.

APPENDIX C: SUMMARY OF HABITAT PATHWAYS AND INDICATORS

A habitat assessment was conducted using the U.S. Fish and Wildlife Service matrix of pathways and indicators to rate habitat parameters for bull trout to establish baseline conditions for the Project reach of Columbia River. Most of the habitat parameters in the matrix of pathways were assessed at the action area scale. Where necessary, information for watershed-scale habitat parameters were used for the Lower Columbia River.

Table C-1 summarizes the baseline habitat conditions for bull trout. Baseline habitat parameters and conditions are briefly discussed in the following sections for bull trout specifically which range from subpopulation characteristics to watershed conditions within the action area.

There are five other species protected by the National Oceanic and Atmopheric Association (NOAA) Fisheres Service within the action area; therefore, baseline habitat conditions such as water quality parameters for Chinook, chum, coho, steelhead, and Pacific eulachon would also be similar throughout the action area.

Table C-1. Summary of Baseline Conditions for Bull Trout Habitat

Habitat Parameter	Environmental Baseline[1/]			Effects of the Action		
	Properly Functioning	At-Risk	Not Properly Functioning	Restore	Maintain	Degrade
Bull Trout Subpopulation Characteristics						
Subpopulation size			x		x	
Growth and survival			x		x	
Life history diversity and isolation			x		x	
Persistence and genetic integrity			x		x	
Water Quality						
Temperature			x		x	
Sediment			x		x	
Chemical Contamination			x	x		
Habitat Access						
Physical Barriers		x		x		
Habitat Elements						
Substrate		x			x	
Large Woody Debris Quantity			x		x	
Pool Frequency and Quality		x			x	
Large Pools		x			x	
Off-channel Habitat		x			x	
Refugia		x		x [2/]		
Channel Condition & Dynamics						
Width/Depth Ratio		x			x	
Steam Bank Condition		x		x		
Floodplain Connectivity			x		x	

Habitat Parameter	Environmental Baseline[1/]			Effects of the Action		
	Properly Functioning	At-Risk	Not Properly Functioning	Restore	Maintain	Degrade
Flow/Hydrology						
Change in Peak/Base Flows			x		x	
Increase in Drainage Network		x			x	
Watershed Conditions						
Road Density & Location			x		x	
Disturbance History			x		x	
Riparian Reserves		x			x	
Disturbance Regime			x		x	
Integration of Species and Habitat		x			x	

Notes:
1/ The categories of function ("properly functioning," "at risk," and "not properly functioning") are defined for each indicator in the "USFWS Matrix of Diagnostics - Pathways and Indicators" as provided in the WSDOT Biological Assessment Preparation for Transportation Projects: Advanced Training Manual (WSDOT 2019).
2/ The refugia for salmonids would be restored due to the reduction in predator refugia.

Subpopulation Characteristics within Subpopulation Watersheds

The Priority Habitats and Species database (WDFW 2020) indicates bull trout are present throughout the Columbia River watershed. Current bull trout abundance in the mainstem of the Columbia River has not been thoroughly documented. However, records indicate that bull trout detections are infrequent and limited to very few individuals (USFWS 2002). The low abundance of bull trout in the Columbia River indicates that the migratory form of bull trout is essentially absent. Numerous migration barriers (dams) occur between the various subpopulations which have fragmented bull trout habitat and prevented access to historical foraging and overwintering sites. Subpopulations are not likely to recover within 5 to 10 years.

Due to the low abundance of bull trout in the Columbia River, the Project is not expected to affect large numbers of bull trout. Core populations occur in Columbia River tributaries far from the action area. The Project is expected to *maintain* subpopulation characteristics.

Water Quality

The Columbia River mainstem water temperatures at Washougal, Washington, range from approximately 6 degrees Centigrade (°C) to 43 degrees Fahrenheit (°F) in early spring to approximately 22°C (72°F) in late summer (USGS 2019). Temperatures in the action area are assumed to be comparable or higher within Camas Slough. For at least some of the year, water temperatures exceed the matrix standards of 48°F for spawning, 54°F for rearing, and 41°F for incubation.

Additionally, the Columbia River (Friendly Reach) is on the Washington State Department of Ecology 303(d) list for temperature, and the mainstem Columbia River in Water Resource Inventory Area 28 is listed for temperature (Ecology 2020). The U.S. Environmental Protection Agency has approved total maximum daily loads for dioxin and total dissolved gas in the Columbia River (ODEQ 1991, Ecology and ODEQ 2002). Substrates in the action area consist mainly of sand with a very low proportion of fine sediment.

The proposed Project would not further degrade riparian vegetation, affect cool water sources, or reduce flow. During construction, the Project would implement a temporary erosion and sediment control plan and a pollution control plan to minimize the risk of introducing chemical contaminants into the Columbia River and Camas Slough.

There would be no permanent impacts to chemical contamination or substrates in these water bodies. The risk of contamination from equipment is restricted to the duration of the Project. Stormwater runoff would undergo a high level of treatment before being discharged into the Columbia River or Camas Slough. Therefore, the Project would *maintain* water quality.

Habitat Access

There are no physical barriers to fish passage within the action area, nor are there barriers between the action area and the Pacific Ocean. The proposed Project would not involve the creation of permanent physical barriers and would reduce the number of physical barriers such as docks and pilings. However, pile removal operations and debris booms would create a temporary barrier to migration in the Columbia River. In-water work also would create temporary, partial barriers to the migration of juvenile fish in shallow in-water habitat. The Project would *temporarily degrade* this indicator but ultimately would maintain this indicator and could potentially *restore* habitat access.

Habitat Elements

In the Columbia River and Camas Slough, the substrate consists mainly of sand, with relatively small percentages of fine sediments and organic material (NOAA Fisheries 2002). Bedrock is known to occur near or at the surface in some locations in Camas Slough, and within 25 feet of the surface throughout Camas Slough which has led to gravel and cobble in the substrate to be present within Camas Slough. However, there is little to no gravel or cobble present in the substrate within the Columbia River. There is also a lack of woody riparian vegetation along the river, due to historic conversion to agriculture, urban and industrial development, in addition to extensive dredging which has limited the recruitment of large woody debris to the river channels.

The Columbia River contains essentially no pool habitat within the action area. Camas Slough, on the other hand, is considered sufficient in providing consistent holding water for adult salmon. However, glide habitat is the dominant stream habitat type in this area. Few to no pools are formed or maintained by large wood, and the potential for future recruitment of large wood in these systems is very low. Pool quality is similarly degraded. Adequate cover is limited due to the lack of large wood, overhanging banks, alcoves, and other types of cover. The sandy substrate of the Columbia River moves continuously with the river currents, which is likely to cause a reduction in the volume of any pools that may form. Cool water is generally absent, as evidenced by 303(d) list temperature exceedances.

Within the action area, the Columbia River and Camas Slough contain few to no backwaters, ponds, oxbows, and other low-energy off-channel habitats. Historic off-channel areas have been filled, rechanneled, diverted, and otherwise developed for urban use over the past 150 years. Although the

Project may involve some riparian or in-stream restoration, improvements would not increase large wood to 80 pieces per mile. Therefore, the Project would *maintain* habitat elements.

Channel Conditions and Dynamics

Within the action area, the Columbia River measures on average 2,400 feet wide and has a variable channel depth up to 75 feet deep. Camas Slough measures approximately 800 feet wide with a variable water channel depth.

The Columbia River is a broad channel constrained by surrounding urbanized development. Streambanks along the Columbia River and Camas Slough within the action area are generally stable. The Project would temporarily affect the riverbank of the Columbia River and Camas Slough during demolition and would improve riverbank conditions by the removal of structures.

There is a severe reduction in connectivity between the river and its historic floodplain due to riverbank armoring and fills. Overbank flows occur only very occasionally. As a result, wetland extent is thought to be reduced. As a result of development and the presence of invasive species, the succession of riparian vegetation has been significantly altered.

The Project would not affect river depth, bank stability, erosion, or floodplain connectivity and is expected to *maintain* the channel conditions and dynamics.

Flow/Hydrology

The development on the Columbia River, including hydropower system, navigation, irrigation, and flood control, has significantly influenced peak seasonal discharges and the velocity and timing of flows in the river. The Columbia River estuary historically received annual spring freshet flows that were 75 to 100 percent higher on average than current freshet flows. Historical winter flows (October through March) also were approximately 35 to 50 percent lower than current flows (Independent Scientific Advisory Board 2000). Camas Slough receives all the Washougal River discharge, where flows regularly exceed 1,000 cubic feet per second from November to April, and typically fall below 100 cubic feet per second in late summer (LCFRB 2010).

The action area is urbanized, and the surrounding is industrial due to the nearby mill operations. Additionally, the drainage of natural streams in the area has been changed, routed underground through pipes.

The Project is expected to *maintain* the flow and hydrology and could potentially improve the drainage of natural stormwater from the surrounding area, with the removal of several structures.

Watershed Conditions

Roads crossing the river have been constructed above the channel beds. The road network within the action area is low density, as most of the work to be performed is either in water or along the shoreline of Camas Mill. However, given the current industrial, commercial, and urban development of the surrounding area, overall vegetation conditions, impervious surfaces, and high road densities have affected runoff regimes.

The Columbia River watershed consists of well over 15 percent "equivalent clear-cut area." Additionally, riparian forests along the lower mainstem of the Washougal River and the Camas Slough have been cleared for industrial uses, residential uses, and road corridors and only a few places contain native deciduous species. The disturbance is especially pronounced in riparian areas, and there is no potential for the development of old-growth due to intense urbanization.

Numerous dams throughout the Columbia Basin regulate flows within the action area. Although the hydrograph is stable, it is highly altered from its natural state. The Columbia River channel is highly simplified, with little hydraulic complexity in the pools or side channels.

Overall, the Project is expected to *maintain* the current watershed conditions.

Integration of Species and Habitat Conditions

The integration of species and habitat conditions in the action area is currently very poor. Very few detections of bull trout have been recorded in the lower Columbia River at, near, or downstream of Bonneville Dam. Habitat conditions in the action area are not expected to improve within five to ten years. The tributary subpopulations of bull trout are separated by many miles of mainstem Columbia River and several large passage barriers. The subpopulations are effectively isolated from one another.

In-water work to remove pilings and docks would create a temporary passage barrier within the action area. However, given that few bull trout use the action area and given that large dams already isolate the subpopulations from one another, the Project is not expected to a cause significant barrier to migration between subpopulation areas. The Project also would have no effect on survival and recruitment where core subpopulations occur in the Lewis, Hood, and Klickitat Rivers. Likewise, the Project would not affect habitat conditions in these areas. Therefore, the Project would *maintain* this indicator.

References

Ecology (Washington State Department of Ecology). 2020. Washington State's Water Quality Assessment 303(d)/305(b) List. https://apps.ecology.wa.gov/ApprovedWQA/ApprovedPages/ApprovedSearch.aspx. Accessed June 30, 2020.

Ecology and ODEQ (Oregon Department of Environmental Quality (ODEQ). 2002. Total Maximum Daily Load (TMDL) for Lower Columbia River Total Dissolved Gas. September.

Independent Scientific Advisory Board. 2000. The Columbia River Estuary and the Columbia River Basin Fish and Wildlife Program. ISAB 2000-5. November 28.

LCFRB (Lower Columbia Fish Recovery Board). 2010. Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan.

ODEQ (Oregon Department of Environmental Quality). 1991. Total Maximum Daily Load for 2,3,7,8-TCDD in the Columbia River Basin. Decision Document. February 1991.

NMFS (National Marine Fisheries Service). 2002. Endangered Species Act Section 7 Consultation and Magnuson-Stevens Act Essential Fish Habitat Consultation: Biological Opinion for the Columbia River Federal Navigation Channel Improvements Project.

USFWS (U.S. Fish and Wildlife Service). 2002. Chapter 20, Lower Columbia Recovery Unit, Washington. In: U.S. Fish and Wildlife Service. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.

USGS (U.S. Geological Survey). 2019. Oregon Water Science Center USGS Data Grapher. https://or.water.usgs.gov/cgi-bin/grapher/graph_setup.pl.

WDFW (Washington Department of Fish and Wildlife). 2020. Priority Habitats and Species (PHS) Interactive mapper. https://geodataservices.wdfw.wa.gov/hp/phs/. Accessed April 8, 2020.

WSDOT (Washington State Department of Transportation). 2019. Biological Assessment Preparation for Transportation Projects: Advanced Training Manual. August.