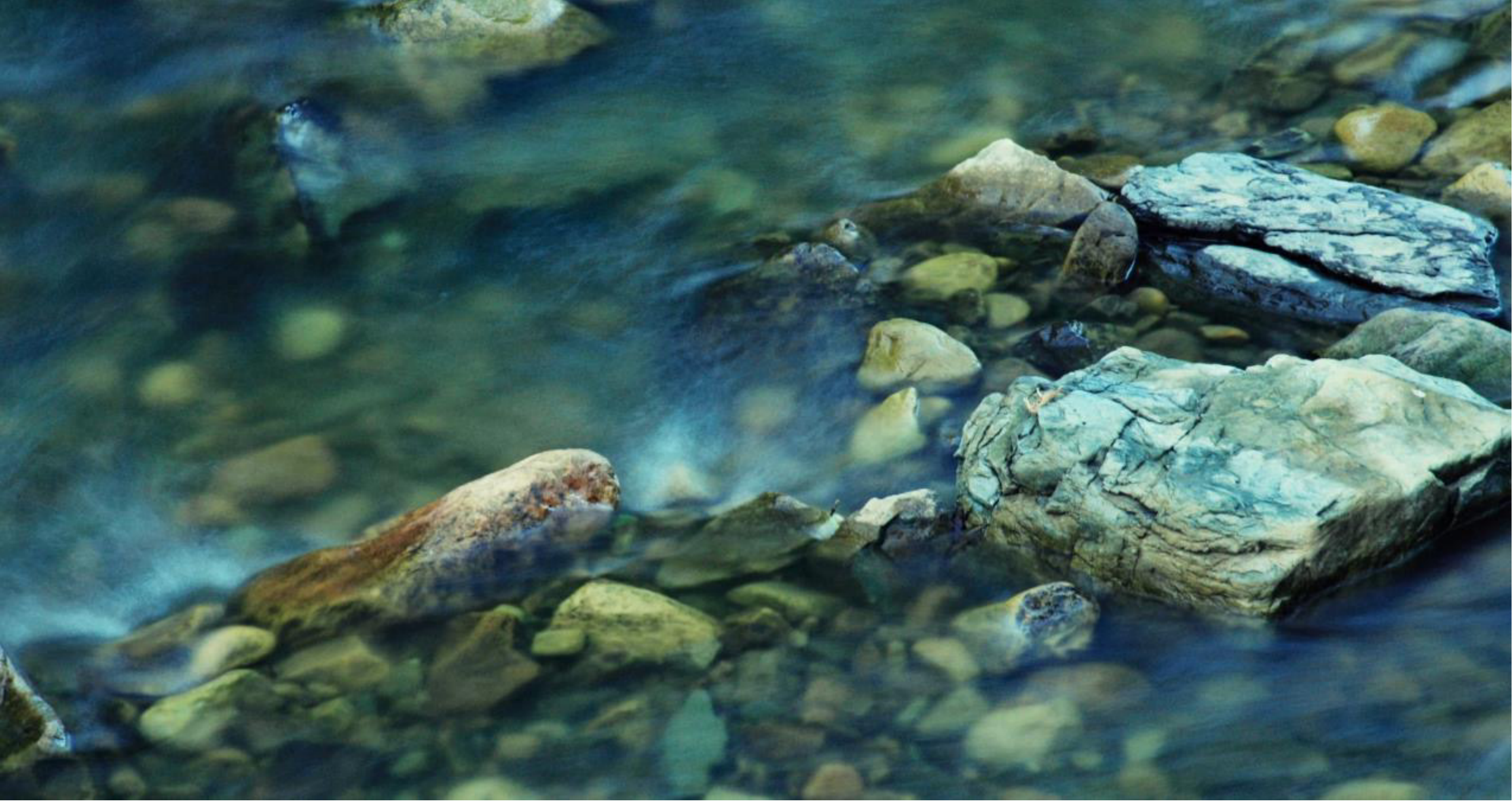

November 2022
Pioneer Aggregates South Parcel Project

Fisheries Technical Report

Prepared for CalPortland

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ABBREVIATIONS

ASTM	ASTM International
cfs	cubic feet per second
DMC	City of DuPont Municipal Code
Ecology	Washington State Department of Ecology
EDT	Ecosystem Diagnosis and Treatment
EIS	Environmental Impact Statement
I-5	Interstate 5
JBLM	Joint Base Lewis-McChord
mg/L	milligram per liter
MLLW	mean lower low water
MRP	Manufacturing and Research Park
OS	Open Space
Project	Pioneer Aggregates South Parcel Project
R-4	Residential-4
Report	Fisheries Technical Report
RM	river mile
RR	Residential Reserve
SEPA	State Environmental Policy Act
South Parcel Project	Pioneer Aggregates South Parcel Project
WDFW	Washington Department of Fish and Wildlife

1 Introduction

Glacier Northwest, Inc. dba CalPortland is seeking regulatory approvals for the Pioneer Aggregates South Parcel Project (South Parcel Project or Project), which proposes to extend sand and gravel mine operations to the southeast of existing activities at the Pioneer Aggregates Mine in DuPont, Washington. This Fisheries Technical Report (Report) has been prepared in support of the South Parcel Project. Figure 1 provides an overview map of the South Parcel Project.

This document evaluates the environmental conditions and potential impacts of the South Parcel Project (Proposed Action) and No Action Alternative on fisheries resources. These analyses are being conducted as a component of the State Environmental Policy Act (SEPA) evaluation for the South Parcel Project.

The following Report describes existing conditions of fisheries (affected environment) and potential impacts from the Proposed Action. In addition, proposed monitoring and mitigation measures for the Proposed Action are presented. The Sequalitchew Creek Restoration Plan, developed by CalPortland and the Environmental Caucus in accordance with the 2011 Settlement Agreement, includes a commitment from CalPortland for funding, monitoring data, and advocacy. The plan also requires coordination between the Environmental Caucus, South Puget Sound Salmon Enhancement Group (SPSSEG), and Joint Base Lewis-McChord (JBLM). In the absence of CalPortland, the advocate and sponsor for the Sequalitchew Creek Restoration Plan under the No Action Alternative would be SPSSEG.

1.1 Description of the Proposed Action

Consistent with 2012 Settlement Agreement discussed later, the South Parcel Project includes horizontal expansion of mining into approximately 188 acres previously undisturbed by mining, and vertical expansion of approximately 125 acres where re-mining will deepen a portion of the existing mine. The South Parcel Project would extend mining at the current rate for approximately 14 additional years.

The Proposed Action activities would be focused southeast of the existing Pioneer Aggregates Mine in DuPont, southwestern Pierce County, Sections 22, 23, and 26, Township 19 North, Range 1 East, of the Willamette Meridian (Figure 1). The Project is bordered to the north and west by the existing Pioneer Aggregates Mine; to the east by industrial and distribution facilities including Amazon, Dania, Pier 1 Imports, and FedEx; and to the south by Sequalitchew Creek and the Creekside Village residential development. The Project would occur on lands owned by Weyerhaeuser Company and leased to CalPortland.

The South Parcel Project includes mining within areas previously undisturbed by mining (termed the "Expansion Area") and mining deeper within a portion of the existing mine, referred to as the "Re-Mine Area." The Expansion Area is approximately 188 acres composed of three subareas (see Figure 2). The Kettle Area is a 10.8-acre previously undisturbed area. The 9.2-acre Buffer Strip is a strip of vegetation that was retained along the inside of the originally permitted mine bordering the South Parcel. The South Parcel is 168 acres located southeast of the original mine and inside the Mineral Resource Overlay in the City of DuPont's adopted Comprehensive Plan.

The Re-Mine Area consists of 125 acres in the southeastern portion of the existing mine where current conditions limit the depth of mining activities. Lowering of the groundwater elevation would allow vertical expansion of the mine.

The South Parcel Project was developed consistent with a 2012 Settlement Agreement between CalPortland, the City of DuPont, the Washington State Department of Ecology (Ecology), and a coalition of environmental groups collectively referred to as the Environmental Caucus. The Settlement Agreement describes a process for a Restoration Plan for the Sequalitchew Creek watershed to be permitted and implemented contemporaneously with mining of the South Parcel. The Restoration Plan is designed "to help restore and enhance the Sequalitchew Creek watershed, including flows along the entire length of the Creek." The Restoration Plan is not intended solely as mitigation for the South Parcel Project, but the benefits of implementing the Restoration Plan will mitigate for the impacts of the mine. The Restoration Plan is described in Section 4

1.2 Existing Mine

CalPortland's original sand and gravel mine was permitted in 1997 (355 acres). As provided under the Settlement Agreement, CalPortland applied for permits in 2013 for the North Parcel Mine Expansion to allow mining of approximately 142 acres within the North Parcel. Following the publication of a Final Environmental Impact Statement (EIS) in June 2013, the North Parcel mining expansion was permitted in 2014.

Mining activities at the existing site include mining, processing, transport of sand and gravel, and manufacturing of concrete. The processing area is located adjacent to the mine site on a 52-acre parcel owned by Glacier. Sand and gravel is removed from the mine by bull dozers and wheel loaders and transferred to the processing area by conveyor belts. At the processing facility, the material from the mine is crushed, washed, and separated into different size gradations. Aggregate products are stored in stockpiles in the processing area for distribution.

After completion of the production process, the majority of the finished aggregate products are transported from the plant area by conveyors and placed onto barges (approximately 80%) at Glacier's dock and barge-loading facility at Tatsolo Point. The remainder (approximately 20%) is sold as aggregate or used to make concrete on-site; in both cases it is transported by truck.

Water used to wash gravel during processing is recycled through a clarifying process to remove silt and clay. This fine material is then run through a belt press to remove excess water and transported by truck and placed in holding cells in the mine, where it is allowed to dry for up to 3 years.

After drying, fines may be used to raise the floor of the mine by placing the material in cells separated by rock curtains to facilitate drainage. The material is placed in approximately 6-inch lifts and compacted to a material dry density of 90% (ASTM International [ASTM]:D-1557) or greater. Once filled to the desired height with fines from the belt press in this manner, a gravel cap of not less than 10 feet is placed over the compacted fines to mitigate potential for settlement and facilitate drainage.

1.3 Description of No Action Alternative

This document also evaluates the No Action Alternative. A No Action Alternative is required by SEPA. "No action" is interpreted to mean that the City would take no action on the mining proposal, but it does not necessarily mean that nothing would happen on the subject site.

Under the No Action Alternative, the South Parcel would not be mined but the property could be developed for manufacturing and research and residential uses under existing land use and zoning designations.

Portions of the South Parcel are zoned for Manufacturing and Research Park (MRP; 136.2 acres), Residential-4 (R-4; 16.1 acres), Residential Reserve (RR; 22.3 acres), and Open Space (OS; 3.8 acres). The MRP zoned areas are subject to restrictive covenants related to the Former DuPont Works Cleanup Site. These covenants restrict use of the property to industrial uses and, barring further remediation activities, would prevent re-zoning of the MRP areas.

The extent of development could vary considerably depending on zoning, density, and Project-specific and regulatory elements such as setbacks, open space, and critical areas. Areas zoned MRP would be available for development of up to 112 acres of light manufacturing and research. Buildings may be up to 65 to 70 feet tall, and there are no maximum lot coverage requirements other than those necessary to meet required setbacks (25 feet on the front property line, 15 feet on the sides and rear) and landscaping requirements (20% of lot area). Provision of 0.3 to 1 parking space per employee working at maximum shift is required.

Under the No Action Alternative, development would occur consistent with the City of DuPont Municipal Code (DMC) critical areas chapter (DMC 25.105), which could allow for development near the top of the Sequalitchew Creek ravine with a setback to be determined by a geotechnical engineer or engineering geologist.

The areas of the South Parcel zoned R-4 can be developed at a density of up to 4.5 single-family residences per gross acre,[1] resulting in a total of approximately 76 residences. An additional 4 single-

1 "Gross acre" means land designated for residential purposes in the Comprehensive Plan, inclusive of related streets and neighborhood parks (DMC 25.10.040).

family residences could be developed in the smaller portion zoned for RR density (one dwelling unit per 5 gross acres).

There would be no changes in the use of the areas of the South Parcel zoned for OS. These areas currently include the naturally vegetated slope of the Sequalitchew Creek ravine and the Sequalitchew Creek pedestrian trail.

A summary of the parcels, zoning, and development potential of the South Parcel is presented in Table 1.

Table 1
Parcels, Zoning, and Development Potential of the South Parcel

Parcel No.	Zoning	Parcel Area in Acres	Potential Development
0119262015	MRP	21.0	16.8 acres MRP
	OS	3.8	None
	Total	**24.7**	**16.8 acres MRP**
0119262016	MRP	34.1	27.3 acres MRP
0119233016	MRP	20.0	16.0 acres MRP
0119233017	MRP	20.3	16.3 acres MRP
0119233014	MRP	20.3	16.3 acres MRP
0119233015	MRP	20.5	16.4 acres MRP
0119233011	R-4	16.1	72 residences
	R-R	22.3	4 residences
	Total	**38.4**	**76 residences**

Note:
Potential development for MRP areas includes buildings, parking lots, and access roads, but not vegetated areas.

Under the No Action Alternative scenarios, there would be no change in use of the areas within the existing mine. However, once the Re-Mine Area is reclaimed, it would likely be redeveloped according to its underlying zoning, similar to the South Parcel.

The Kettle Wetland is within the existing mine and would remain intact, the buffers would remain vegetated, and mining operations would continue in other portions of the existing mine. The Kettle Wetland, its buffer, and other mine-related buffers could potentially be removed once the existing mine is reclaimed and redeveloped for future uses.

2 Affected Environment

The affected environment for the fisheries analysis is focused on the lower 1.4 miles of Sequalitchew Creek, and the estuary and brackish marsh near the mouth of the creek. Other affected environments addressed in this analysis include the Puget Sound nearshore north of the Nisqually flats to Tatsolo Point and potential fish habitat in the Edmond Marsh complex. These areas are all outside the footprint of the South Parcel Project but are subject to potential indirect effects from Project-related changes to the Vashon Aquifer and the Restoration Plan.

The fisheries resources that exist within the proposed mine expansion area have been previously described in the *Pioneer Aggregates Mining Facility and Reclamation Plan Final EIS* (City of DuPont 1993). Additional sources of fisheries information consulted for this analysis include the following:

- *Summary of Cumulative Effects of DuPont Mining and Restoration Projects on Aquatic Habitat, Surface Water and Groundwater* (Aspect 2016)
- *Pioneer Aggregates Mining Expansion and North Sequalitchew Project Surface Water and Geomorphology Technical Report* (Herrera Environmental Consultants 2005a)
- *Fish Habitat Benefit Evaluation for Sequalitchew Creek: Pioneer Aggregates North Sequalitchew Creek Project* (Anchor Environmental 2004a)
- *Supplemental Report: North Sequalitchew Creek Project* (Anchor Environmental 2004b)
- *Salmonid Habitat Limiting Factor Analysis: Chambers-Clover Creek Watershed WRIA 12* (Runge et al. 2003)
- *A Twentieth Century History of Sequalitchew Creek* (Andrews and Swint 1994)

2.1 Sequalitchew Creek

A description of the Sequalitchew Creek watershed and the physical and biological habitat characteristics of Sequalitchew Creek is presented in the following sections. Additional description of the historical, existing, and predicted conditions of water quality and quantity records in this document can be found in the *Earth and Water Resources Report, DuPont Mine South Parcel Project* (Aspect 2022).

2.1.1 Sequalitchew Creek Watershed

Sequalitchew Creek (Water Resource Inventory Area 12-0019) drains a watershed covering approximately 38.4 square miles that discharges into Puget Sound (Runge et al. 2003). Figure 1 illustrates the characteristics of the Sequalitchew Creek drainage basin. Above the headwaters of Sequalitchew Creek is a cryptorheic[2] basin with headwaters located at river mile (RM) 9.6 in Kinsey Marsh on the east side of Interstate 5 (I-5). Kinsey Marsh flows drain to Murray Creek which flows 3.8 miles to American Lake on the west side of I-5. American Lake (1,162 surface acres) has no

[2] A crytorheic basin is a watershed that terminates where flow goes entirely subsurface.

defined outflow channel; however, there is a weir that maintains the maximum elevation of the lake water. On rare occasions, runoff from American Lake flows into Sequalitchew Lake (81 surface acres) but the frequency of surface flow is too low to form a defined channel between the two waterbodies (CH2M Hill 2003). A regional groundwater table maintains the water level in American Lake and Sequalitchew Lake (Andrews and Swint 1994).

2.1.2 Physical Habitat Characteristics of Upper Sequalitchew Creek

Sequalitchew Creek is largely an artificial channel from its source at the Lake Sequalitchew weir to the west end of West Edmond Marsh. This channel is excavated within the existing wetland complex, and has extremely low velocity where it flows in a culvert under DuPont Steilacoom Road. Except under extreme high flow conditions, all flow that passes through that culvert either infiltrates or evaporates within the Edmond Marsh Complex. The Edmond Marsh Complex is described in detail in the *Plants and Animals Technical Report, DuPont Mine South Parcel Project* (Anchor QEA 2022). Descriptions of direct, indirect, and cumulative impacts to the Edmond Marsh related to the alternatives can also be found in that document.

2.1.3 Physical Habitat Characteristics of Lower Sequalitchew Creek

Sequalitchew Creek above RM 1.0 and below Edmond Marsh is typically dry. Only rarely is there a surface water connection between Edmond Marsh and Lower Sequalitchew Creek. There are no gage data for this reach, but analysis of the mid ravine and lower ravine gages suggests that they are infrequent (maybe a handful over 19 years) and short lived (approximately 1 to 5 days). Most appear related to storm events, but some are from humans removing or altering the beaver dam at the west end of Edmond Marsh. The source of water in the lower mile of the creek is groundwater discharged from the Vashon Aquifer as springs in the Sequalitchew Creek ravine, below elevations of approximately 195 feet down to the top elevation of the Olympia Bed deposits at elevations between approximately 100 and 120 feet, spanning a creek reach of approximately 0.7 mile. Based on stream gaging data, this groundwater discharge to the creek varies between approximately 0.5 cubic feet per second (cfs) in the summer to 2.5 cfs in the winter. Progressing downstream past the Olympia Bed Truncation, Sequalitchew Creek becomes a losing stream as the water table drops through the outwash to near sea level (Aspect 2022).

The slope of the thalweg[3] ranges from about 2% to 3% in the ravine and the width of the stream varies from about 12 to 20 feet. Pebble counts of the streambed material were conducted at 24 stations. At 15 stations, the median gravel size (D_{50}) was between 0.5 and 1.5 inches. At the remaining 6 sites, the gravel was finer.

[3] The thalweg is the line connecting the lowest points of successive cross-sections along the course of a stream.

Sequalitchew Creek in the lower ravine has average annual flow of 2.8 cfs. The flows rises to between 3 and 4 cfs during the spawning periods for the salmonid species using the creek (Figure 4). During summer, flows drop and sometimes the creek dries up completely, leaving only small pools wetted (Runge et al. 2003). As a result, fish are unable to use the creek throughout the year, and aquatic invertebrate prey production is reduced (Bell 1991).

Comparison of recent flow monitoring results with earlier gaging efforts in 1977 to 1978 (Thut et al. 1978) and 1984 to 1987 (Firth 1991) indicates that the streamflow is about 38% to 55% lower now than it was in those periods. Average monthly flow rates near the mouth of Sequalitchew Creek are shown in Table 2.

Table 2
Average Flows in Sequalitchew Creek Watershed

Month	Average Flow in cfs				
	Diversion Weir	Mid-Sequalitchew Creek Ravine	Lower Sequalitchew Creek Ravine		
	2003 to 2021	2004 to 2021	1977 to 1978	1984 to 1987	1999 to 2021
January	15.6	2.5	9.7	5.9	4.0
February	19.6	2.6	12.8	8.5	4.2
March	21.5	2.2	12.2	8.7	3.8
April	19.8	2.0	0.7	9.4	3.2
May	12.7	1.6	1.6	7.8	2.7
June	7.4	1.2	1.5	3.7	1.9
July	3.2	0.9	0.2	1.3	1.3
August	2.8	0.8	0.1	1.0	1.1
September	2.4	0.8	0.1	1.0	1.1
October	3.7	0.8	0.1	1.4	1.4
November	7.1	1.3	2.4	3.7	2.6
December	10.9	1.9	10.5	5.1	3.5
Mean annual flow	10.5	1.6	4.3	4.8	2.7

Note:
All results are in cfs.

This change in flows in Lower Sequalitchew Creek was the result of actions upstream in Edmond Marsh. The Washington Department of Fish and Wildlife (WDFW) created a channel through Edmond Marsh around 1976. The purpose of the channel was to facilitate the use of Lake Sequalitchew in a fish augmentation program. The channel was maintained to prevent beaver dams and vegetation from raising water levels in the marsh. With higher water levels in Edmond Marsh, more water flows out the Diversion Canal and less flows toward Lower

Sequalitchew Creek. Maintenance of the channel was necessary to attract juvenile fish to migrate to Puget Sound via Edmond Marsh and the Sequalitchew Creek Ravine rather than the Diversion Canal. The route of migration through the marsh and ravine would have a much larger rate of survival as it would provide opportunities for growth and acclimation in the estuary. It is assumed that any fish migrating via the Diversion Canal would be killed or stunned by the drop to Tatsolo Point.

2.1.4 Biological Habitat Characteristics of Sequalitchew Creek

The Sequalitchew Creek drainage basin contains both anadromous and resident fish that occur at different times of the year and use different portions of the creek. Anadromous fish reported to use Sequalitchew Creek within the Project area include coho salmon (*Oncorhynchus kisutch*), chum salmon (*O. keta*), and cutthroat trout (*O. clarkii*) (Runge et al. 2003; WDFW 2022). The U.S. Fish and Wildlife Service also identifies bull trout (*Salvelinus confluentus*), a threatened species, as occurring in the Project vicinity (USFWS 2003, 2022). Native bull trout populations are known to be present in the Nisqually River, whose mouth is located approximately 1 mile south of Sequalitchew Creek (Runge et al. 2003; Salmonscape 2022). Although suitable habitat for bull trout does not exist within Lower Sequalitchew Creek, it is likely that this species is present in the nearshore habitat and could enter Lower Sequalitchew Creek estuary to forage during salmon smolt out-migration.

Resident fish reported or expected to occur in Sequalitchew Creek within the Project area include cutthroat trout (*O. clarki*), rainbow trout (*O. mykiss*), sculpins (*Cottus* sp.), and western brook lamprey (*Lampetra richardsonii*) (City of DuPont 1992; Wydoski and Whitney 1979). Other resident fish reported to occur in the Sequalitchew Creek drainage basin, but outside the Project area, include kokanee salmon (*O. nerka*) and spiny ray fish in American Lake and Sequalitchew Lake (Pierce County 1996). Chum salmon have been reported to spawn in the lower 650 feet of Sequalitchew Creek in the past (City of DuPont 1993).

2.1.4.1 Historical Augmentation of the Fishery

WDFW augmented the fishery of Sequalitchew Creek intermittently from 1980 to 2001. Coho salmon smolts were released into Sequalitchew Creek from 1980 to 1994 and again in 2001. The annual number of coho salmon smolts released ranged from 2,280 to 987,480 with an average annual release of 238,477. These smolts were released in the spring (March 25 to May 31) between 1980 and 1994, and during the winter (December 11) in 2001. Fall Chinook salmon (O. *tshawytscha*) smolts were also released into Sequalitchew Creek in 1990 and 1991. These smolts were released in the spring (April 2 to 16) in numbers that ranged from 19,800 to 42,800 with an average annual release of 27,533. Coho salmon, chum salmon, and cutthroat trout are currently reported to utilize Sequalitchew Creek according to the most recent information from WDFW (Salmonscape 2022) and the *WRIA 12 Salmonid Habitat Limiting Factors Report* (Runge et al. 2003).

Coho salmon spawning survey records for Sequalitchew Creek indicate sporadic observations have been made by WDFW in 1962, and between 1982 and 1985. These surveys conducted in the winter (November 6 to December 27) extended from the mouth to RM 1.6. These data indicate that the annual number of adult coho salmon observed ranged from 0 to 145 with an annual average of 22. These surveys occurred during the period when smolts were released in the watershed, and flows were maintained by cutting a channel through Edmond Marsh.

The time of year when anadromous fish are reported to occur in Sequalitchew Creek within the Project area is as follows: Coho salmon smolts out-migrate from March to May, while returning adults spawn from late November to early January. Chum salmon spawn between December and February, and the fry out-migrate immediately after emerging from the gravels, which is usually between March and June (WDF 1975). Resident and sea-run cutthroat trout reside in Sequalitchew Creek throughout the entire year. Adults typically spawn in the spring and summer (February to August) and the fry emerge in late summer. Adult bull trout can potentially be present in the lowest portions of Sequalitchew Creek at any time of the year but are most likely to enter the stream to forage on out-migrating salmon smolts between March and June. Bull trout are not expected to use Sequalitchew Creek for spawning purposes due to the limited known distribution in the vicinity and the lack of spawning conditions that bull trout require (Runge et al. 2003).

2.1.4.2 Fish Habitat Under Existing Flows

Anchor Environmental (2004a, 2004b) completed an analysis of salmonid spawning and passage in Sequalitchew Creek based on water depth and flow. The analysis was conducted for coho salmon, chum salmon, and cutthroat trout. The Toe-Width Method and the Stage Discharge Analysis methods were combined to characterize the existing stream habitat. The Toe-Width Method provides a calculation for optimal flow conditions in cfs for the stream and uses data on the physical characteristics of the stream channel to estimate the streamflow that provides the maximum habitat for salmonid spawning and rearing. The Stage Discharge Analysis provides an analysis of minimum flow conditions for a given life stage. Both approaches utilize WDFW-developed and approved formulas.

The Toe-Width Method results indicate that optimal flows for both spawning and rearing in Sequalitchew Creek would be higher than current flows (Anchor Environmental 2004a). A discharge of 2.5 cfs was used in the analysis. This flow is representative of flows in a drier-than-average year during coho and chum salmon spawning. Based on a period of record from 2000 to 2001, the measured average flow during November, December, and January was 3.4 cfs (standard deviation of 2.0 cfs). At a discharge of 2.5 cfs, the lower reaches of Sequalitchew Creek provide unsuitably low depths for adult chum salmon passage and spawning, and unsuitably low depths for adult coho salmon passage and spawning. At a discharge of 2.5 cfs, depths are generally adequate to support resident cutthroat trout rearing and spawning. The monthly mean of flows for the driest month in each year (2000 to 2021) averaged approximately 1 cfs, and there were many months when the average flow was 0.3 cfs or less. Cutthroat trout habitat would be severely limited during these periods.

A later study was conducted by ICF International (ICF 2013) using the Ecosystem Diagnosis and Treatment (EDT), a fish life-cycle habitat model that characterizes the aquatic environment temporally (monthly) and spatially (stream reaches). The model was run for both chum and coho salmon. This study found that, "habitat potential for the current condition suggests that Sequalitchew Creek could support a small quantity of natural chum salmon. However, the number of fish and productivity suggests the stream cannot support an independent population and is likely not self-sustaining" (ICF 2013). For coho salmon, the study found that the under current conditions, "adult capacity and abundance is essentially zero" (ICF 2013).

2.2 Marine Shoreline Description

Fish habitat along the marine shoreline at the mouth of Sequalitchew Creek and the barge-loading facility has been previously described (City of DuPont 1993, 1995). A description of these physical and biological habitat characteristics, along with additional information collected for this study, are presented in the following sections.

2.2.1 Physical Habitat Characteristics of the Marine Shoreline

2.2.1.1 Mouth of Sequalitchew Creek

The Puget Sound shoreline at the mouth of Sequalitchew Creek is characterized by an armored slope above a gravel beach with minimal estuarine habitat. Farther offshore, a shallow soft sediment bench extends from the Nisqually River delta to just north of the mouth of Sequalitchew Creek. The BNSF railroad tracks paralleling the shoreline in this area are perched on a steep riprap berm. On the Case Inlet side of the railroad there are gravel deposits on either side of the mouth of Sequalitchew Creek that extend above the high tide line. These create more complete nearshore habitats, with beach grasses, drift logs, and low angle beaches extending into the subtidal zone. The railroad berm bisects the mouth of Sequalitchew Creek and influences tidal currents, wave action, and sediment deposition along the marine shoreline. There is a brackish marsh associated with Sequalitchew Creek on the upstream side of the railroad berm. Wind waves and tidal flows in the marsh are limited by a culvert under the railroad berm. The culvert draining Sequalitchew Creek through this railroad berm influences tidal exchanges, deltaic sediment deposition, and fish passage. There is limited rearing habitat in the brackish marsh on the upstream side of the railroad berm because this berm does not allow the channel to meander and otherwise naturally braid into multiple tidal channels. The loss of these natural processes limits the quantity and quality of fish habitat in this estuary.

2.2.1.2 Marine Shoreline West of the Existing Mine

The shoreline on the Puget Sound side of the railroad berm also has limited fish habitat because the steep slope influences wave action, sediment deposition, and estuarine vegetation. Waves formed by the predominant wind direction (from the southwest) break on the riprap-lined slope during high tides and do not allow for the deposition of fine-grained substrate in most areas. Substrate along the shoreline that is influenced by high-energy waves and wave reflection scouring is dominated by cobbles and gravel. In addition, the steep riprap embankment does not allow estuarine vegetation to grow above the high tide line. This limits the organic export of nutrients and benthic invertebrates that juvenile salmonids need during their acclimation to estuarine conditions. Within about a quarter mile on either side of the mouth of Sequalitchew Creek there is an accretionary sand bar at the shoreline. This sandbar reduces wave energy and scour. The sandier substrate off shore of the bar supports patches of eelgrass (*Zostera marina*; Ecology 2022). The bottom substrate farther offshore that is not influenced by wave scouring consists of fine-grained sediment overlying cobbles.

2.2.1.3 Barge Loading Facility

The Puget Sound shoreline at the Pioneer Aggregates barge loading facility near Tatsolo Point has previously been described in the Pioneer *Aggregates Barge Loading Facility and DuPont Shoreline Master Program Amendment—Supplemental EIS* (City of DuPont 1995). This shoreline is located where the BNSF railroad tracks also parallel the shoreline. The railroad tracks are perched on a steep berm composed of riprap that occupies the intertidal zone to nearly mean lower low water (MLLW) meaning there is little intertidal beach present. This railroad berm influences tidal currents, wave action, and sediment deposition along the marine shoreline. Although there is a gravel beach adjacent to the railroad berm approximately 200 feet north of the dock, the area has minimal nearshore habitat value.

The shoreline on the Puget Sound side of the railroad berm has limited fish habitat because the steep slope influences wave action, sediment deposition, and estuarine vegetation. Waves formed by the predominant wind direction (from the southwest) break on the riprap-lined slope and do not allow for the deposition or effective transport of fine-grained substrate. Substrate along the shoreline is influenced by high-energy waves and wave reflection, which scour away finer material leaving only cobbles and coarse gravel above -4 feet MLLW. In addition, the steep riprap embankment does not allow estuarine vegetation to grow above the high tide line. This limits the organic export of nutrients and benthic invertebrates that juvenile salmonids need during their acclimation to estuarine conditions. The bottom substrate farther offshore that is not influenced by wave scouring consists of coarse, sandy sediment overlying cobbles. Fine sand and silt gradually replace the coarser sediment until about -25 to -35 feet MLLW. Below this depth the sediment is predominantly silt and fine sandy mud (City of DuPont 1995).

2.2.2 Biological Habitat Characteristics of the Marine Shoreline

The reach of Case Inlet west of the existing mine and the nearshore from the mouth of Sequalitchew Creek are habitat for numerous species of fish and marine invertebrates. WDFW Priority Habitats and Species mapping documents the presence of key habitats for cutthroat trout, coho salmon, and chum salmon migration and rearing; and Pacific sand lance (*Ammodytes hexapterus*) and surf smelt (*Hypomesus pretiosus*) breeding. The reach is used by Dungeness crab (*Cancer magister*) and various genera of pandalid shrimp. Kelp and algae beds are present in the shallow subtidal, and there have been limited observations of eelgrass in the vicinity.

2.2.2.1 Mouth of Sequalitchew Creek

Although fish habitat along the marine shoreline at the mouth of Sequalitchew Creek is influenced by the railroad berm, this area is still used by a variety of species (City of DuPont 1993). These include plants and invertebrates in the intertidal and subtidal zones, as well as the marine and diadromous fish species described below.

Prior studies indicate that 75 plant species were found growing on the bottom substrate in the intertidal area (0 to 9 feet above MLLW). Of these intertidal plants, more than half were red algae (Rhodophytes) and green algae (Chlorophytes). The majority of the subtidal plants were found between 0 and -16 feet below MLLW. Small patches of eelgrass in sparse densities were observed near the mouth of Sequalitchew Creek (City of DuPont 1993).

Prior studies also identified 270 species of invertebrates in the intertidal area, with the majority of these species occurring near 0 feet MLLW (City of DuPont 1993). Several species of limpets, barnacles, and periwinkles were the dominant molluscan groups. The most productive area was the lower intertidal area near the mouth of Sequalitchew Creek. Subtidal invertebrates found in this area include snails (gastropods), worms (polychaetes), sea stars, and amphipod crustaceans.

Marine fish observed along the shoreline in this area include 31 species of bottomfish, 26 species of bottom-dwelling (demersel) fish, and 11 water-column (pelagic) species (City of DuPont 1993). The predominant bottomfish include English sole (*Parophrys vetulus*), rock sole (*Lepidosetta bilineata*), and starry flounder (*Platichthys stellatus*). The dominant demersel fish include buffalo sculpin (*Enophrys bison*), Pacific tomcod (*Microgadus proximus*), staghorn sculpin (*Leptocottus armatus*), rockfish species (*Sebastes* spp.), cabezon (*Scorpaenichthys marmoratus*), painted greenling (*Oxylebius pictus*), and pipefish (*Syngnathus griseolineatus*). The pelagic fish are represented by shiner perch (*Cymatogaster aggregate*), surfperches (Embiotocidae), and tubesnout (*Aulorhynchus flavidus*).

Salmonid species observed along the marine shoreline include coho, chum, Chinook, and pink salmon (City of DuPont 1993). Adult coho salmon were found along the shoreline at the Sequalitchew Creek mouth in September and October, but most of these fish were returning to spawn in the Chambers Creek, McAllister Creek, and Nisqually River watersheds. Returning chum salmon are found along the shoreline at the Sequalitchew Creek mouth in December and January, but most of these fish spawn in the Nisqually River. Chinook and pink salmon observed along the marine shoreline are mainly migrating to the Nisqually River system.

Juvenile salmonids are found along the shoreline at the Sequalitchew Creek mouth during the spring out-migration, but many of these fish originate in the Nisqually River. Juvenile coho salmon are typically found between May and June. The peak migration of juvenile chum salmon occurred between mid-February and late July. Juvenile Chinook salmon were observed migrating from late May to July.

As noted previously, a native population of bull trout is known to inhabit the Nisqually River system (Runge et al. 2003; Salmonscape 2022). Fish from this population may utilize the nearshore environment near the mouth of Sequalitchew Creek and may also enter the lowest portion of the creek to forage on juvenile salmonids.

2.2.2.2 Barge Loading Facility

Habitat along the marine shoreline at the barge loading dock has previously been described in the *Pioneer Aggregates Barge Loading Facility and DuPont Shoreline Master Program Amendment—Supplemental EIS* (City of DuPont 1995). Like the area described at the mouth of Sequalitchew Creek, both areas are influenced by the railroad berm. However, the barge loading dock area has less diversity than the mouth of Sequalitchew Creek. The following provides a summary of the plants and invertebrates in the intertidal and subtidal zones; marine fish; and salmonids found in this area.

An intertidal flora and fauna survey conducted approximately 200 yards south of the barge loading dock in 1978 found little macroalgae above +6 feet MLLW. Only rockweed (*Fucus gardneri*) was present at +6 feet MLLW. At lower elevations, several species of red and green algae were common, and at 0 feet MLLW, several species of kelp dominated. Periodic bathymetric surveys have not detected significant material spills.

Subtidal plants are distributed at various depths and include macroalgae and kelp at around -8 feet MLLW. A narrow band of bull kelp (*Nereocystis leutkeana*) extends along the shoreline in both directions from the barge loading dock. Algae species are restricted to the area above -20 to -30 feet MLLW, and the most prevalent algae species was sea lettuce (*Ulva lactuca*). Ribbon kelp (*Laminaria saccharina*) was the second most common algae in this area. A variety of filamentous and foliose red algae species are present; the most common is *Sarcodiotheca gaucichaudii*. The cumulative percent cover of these algae ranged from 100% in the shallow subtidal zone to less than 5% at -20 to -30 feet MLLW. No eelgrass beds were observed in the vicinity of the dock.

Subtidal animals living within (infauna) and on top (epifauna) of the sea bed are present at various depths. The most common infauna group is polychaete worms, while the epifauna is dominated by shrimp and crab species. Larger animals included cockles (*Clinocardium nuttallii*), sea cucumbers (*Parastichopus californicus*), several species of sea stars, Dungeness crab (*Cancer magister*), rock crab (*Cancer productus*), and geoducks (*Panope abrupta*).

Marine fish observed along the shoreline in this area include shiner perch, Pacific herring (*Clupea harengus pallasi*), sand dab (*Citharichthys sordidus*), English sole, and starry flounder. Four salmon species (coho, chum, chinook, and pink) are expected to occur in this area. However, this area is less productive for juvenile salmon rearing and adult migration than the mouth of Sequalitchew Creek due to its greater distance from the Nisqually River. As noted previously, a native population of bull trout is known to inhabit the Nisqually River system (Runge et al. 2003). Fish from this population may utilize the nearshore environment in the vicinity of Sequalitchew Creek, including the barge loading facility.

3 Impacts of the Proposed Action and No Action Alternative

3.1 Impacts of the Proposed Action

This section is divided into two parts: direct impacts, which are directly related to the actions in the South Parcel Project Area; and indirect impacts, which are associated with aquifer drawdown outside the South Parcel Project Area (see Figure 2).

3.1.1 Direct Impacts of the Proposed Action

The Proposed Action would directly affect fish habitat by extending the operation of the marine barge loading dock within the marine shoreline. This would prolong shading beneath the facility, which can inhibit macroalgae growth and epibenthic productivity. These would have a small effect on the overall availability of nutrients for fish. The proposed mine expansion would extend by about 14 years the period when the barge loading dock continues to be used to transport aggregate to market. Fisheries impacts (e.g., shading, spill risk) associated with use of this barge loading dock have previously been described in the *Pioneer Aggregates Barge Loading Facility and DuPont Shoreline Master Program Amendment—Supplemental EIS* (City of DuPont 1995) and a previous *Fisheries Technical Report* (Herrera 2005).

Potential fisheries impacts to the marine shoreline include direct and indirect effects from the spillage of sand and gravel from the conveyor, overturning of barges during loading, accidental spills of pollutants, shading, and lighting, and are summarized as follows:

- Sand and gravel spilled in sufficient quantities could smother the benthic community where the spill occurs.
- Accidental spills of petroleum products (diesel) and other pollutants (hydraulic oil) could potentially occur during barge loading and maintenance activities.
- Extending the life of the conveyor and barge loading dock by about 14 years would extend any impacts to areas directly beneath the dock by shading the shallow water, as well as impacts associated with dock lighting. These impacts would occur until the dock is eventually removed.

3.1.2 Indirect Impacts of the Proposed Action

The Proposed Action would not directly affect Sequalitchew Creek, but the drawdown of the Vashon Aquifer would indirectly reduce flow in Lower Sequalitchew Creek. Lower Sequalitchew Creek is entirely spring fed (as described in Section 2.1.3). Groundwater discharge to Sequalitchew Creek during active dewatering is predicted to be 79% less than baseline conditions, on average, resulting in a decrease in average flow in Sequalitchew Creek from 1.6 cfs to 0.34 cfs at the mid-ravine gage. The greatest decrease would occur during the wet season.

Without restoration, these indirect impacts would reduce flows during the spawning life stage of chum salmon and the spawning and rearing life stages of coho salmon and cutthroat trout. Impacts during the spawning season would be severe: seriously limiting the amount of habitat for resident cutthroat trout and eliminating spawning habitat for anadromous species. This would reduce the spatial extent of habitat available and reduce the portion of the year when fish habitat is accessible.

3.2 Impacts of the No Action Alternative

Under the No Action Alternative, the condition of the Sequalitchew Creek fish populations and fish habitat would remain similar to existing conditions. Suitable and accessible habitat for all species of fish currently and historically present would continue to be a fraction of what they were a few decades ago. Surface flows from Edmond Marsh into Lower Sequalitchew Creek would continue to occur during extreme precipitation events and would not contribute meaningfully to habitat. The creek would continue be unused or used very little by chum and coho salmon and cutthroat trout.

4 Cumulative Effects of Proposed Action and Restoration Plan

The South Parcel Project, described in Section 1.2, includes implementation of the Restoration Plan, reflected in the 2012 Settlement Agreement and developed by CalPortland and the Environmental Caucus. The Restoration Plan, which is a related action, seeks to restore and enhance streamflow and ecological functions from Sequalitchew Lake through Edmond Marsh into Sequalitchew Creek ravine. The Restoration Plan is intended to sequentially restore diverted flows back to the creek, improve the sustainability of flows through the system, and restore aquatic habitat by removing flow-related fish passage barriers and increasing the habitat available to aquatic species.

This section identifies what is currently known about the cumulative effects of the Proposed Action and the Restoration Plan. The Restoration Plan is being designed and permitted independently, and the specific impacts of the plan will be evaluated in those documents. Since the effects of the restoration will be evaluated in a subsequent SEPA document, these conclusions should be framed as general and preliminary. A cumulative effects analysis is an evaluation of the combined effects on biological resources for the Proposed Action, including the effects of reasonable and foreseeable development projects in the vicinity of the study area. One such set of reasonable and foreseeable effects would be from the cumulative impacts of continued growth in the region. These will occur regardless of whether or not the Project occurs. The other set of reasonable and foreseeable effects on Sequalitchew Creek, the marine nearshore, and wetlands is the impacts of the restoration plan. This analysis of impacts is based on the current understanding of the Restoration Plan actions being carried out by JBLM, SPSSEG, or others. These actions may change as they are being further designed and permitted. Therefore, much of this analysis is based on the restoration targets of the plan, such as increased flows in Sequalitchew Creek.

4.1 Benefits

The cumulative effects of the mining and full implementation of the restoration plan for the Sequalitchew Creek watershed would reverse many of the adverse impacts to the watershed and creek that have occurred over decades. The benefits would be noticeable over a large portion of the stream and wetland habitats in the basin and would largely restore lost and reduced ecosystem functions including the movement of water, sediment, nutrients, biota, and dissolved gasses through the watershed from the headwater springs on Sequalitchew Lake to Puget Sound. The reconnection of Sequalitchew Creek to its historical primary source of flow, Sequalitchew Lake, would address the root cause of the primary historical impacts to the system.

These projects cumulatively have the potential to restore an annual average of 10.8 cfs to a 1,200-foot reach of Sequalitchew Creek that currently experiences little to no consistent flow. Seasonally, the flows in this reach following restoration are predicted to be between 2.2 cfs in August up to just over 22 cfs in March. Flows of this magnitude would re-establish a functioning stream in the now frequently dry channel, providing new aquatic and riparian habitat and a connection between the Sequalitchew Creek ravine and the marshes. This would provide a corridor for both aquatic and terrestrial species and would provide new opportunities for species expansion and recovery.

In the Sequalitchew Creek ravine, the restoration and mining projects would result in a seven-fold increase in flow on an annual average basis, from the current 1.6 cfs up to 11.2 cfs. Peak flows could reach up to 60 cfs, sufficient to restore the natural channel-forming processes necessary to improve habitat conditions in the ravine. Currently, the flows in the ravine are inadequate to move sediment effectively, create pools, or scour finer-grained materials from the substrate to create conditions suitable for spawning. Peak flows could be adaptively managed by adjusting the weir at the Diversion Canal and limiting flow through Edmond Marsh to prevent flooding or detrimental effects to the wetlands or the stream channel.

The restoration project would also restore fish passage from Sequalitchew Creek to East and West Edmond Marshes. Two fish barrier culverts will be replaced by fish-passable structures, which in combination with increased flows will allow migratory access above the ravine springs and into Edmond Marsh. Restoration would affect the conditions sufficiently to allow establishment of emergent vegetation in the western extent of the complex where inundation will persist through more of the growing season, providing excellent rearing habitat for juvenile coho salmon and cutthroat trout. These effects would increase the size, diversity, and complexity of available fish habitat types.

The greatly increased flow through Edmond Marsh would also improve water quality conditions by increasing dissolved oxygen concentrations and diluting and flushing an area of elevated iron concentrations in the center of the marsh.

4.2 Impacts

The greatest potential impacts to fish associated with restoring the natural flow regime to the Sequalitchew Creek watershed would be increased summer stream temperatures, and increased frequency of periods of high flow in winter and spring. These impacts will be mitigated through adaptive management by the restoration implementation team. These same impacts would occur with or without the change in groundwater elevation resulting from mining. Summer low flows below the Sequalitchew Creek Ravine Springs would be reduced during prolonged dry summers. At all other times, the benefits of increased flow would not be affected by lower groundwater.

The implementation of the Restoration Plan would result in water levels in Sequalitchew Creek Marsh and Edmond Marsh that are more consistent with conditions when the diversion canal only flowed during severe precipitation events. That change would also result in a loss of current wetland area and, likely, a return to the shape and extents of the marsh in the 1970s. See the accompanying *Plants and Animals Technical Report* (Anchor QEA 2022) for more discussion of wetland impacts.

The flow from Sequalitchew Lake is also warmer in summer than the current flow in the ravine. The Project effects would represent a return to a more natural, surface-flow-dominated condition, but one with warmer stream temperatures. Sequalitchew Creek would experience temperatures up to 21°C in June, July, and August and cool temperatures down to 5°C in winter. The seasonal pattern of average monthly temperatures in Sequalitchew Creek with mining and restoration are shown in Figure 3. The predicted stream temperatures would be considerably warmer than the current spring discharge in the creek for most of the year. The surface water quality criterion for temperature applicable to Sequalitchew Creek is 16°C for the 7-day average of daily maximums. The analysis based on grab samples suggests this threshold may be exceeded from May through September.

Finally, there are predicted to be infrequent periods when the mining and restoration projects would result in streamflows that are lower than currently occur. This condition would occur during extended dry periods, when outflow from Sequalitchew Lake is naturally low or non-existent. Streamflows would be lower than existing conditions about 10.5% of the time, typically in August and September of particularly dry years. Existing flows during these periods currently average 0.8 cfs and do not provide aquatic habitat for anadromous fish; mining and restoration would further reduce these flows during these periods (to 0.4 cfs). This means that fish in the system below Edmonds Marsh will have less habitat as the population moves downstream to the remaining channel area.

4.3 Cumulative Effects for Fish Habitat in the Watershed

The combined effects of the mining and restoration projects on stream habitat would include a re-establishment of flow from Sequalitchew Lake to flow through the marshes and into Sequalitchew Creek ravine. The projects would also result in re-establishing ecosystem processes, specifically, the movement of water, sediment, nutrients, biota, and dissolved gasses through the watershed from the headwater springs on Sequalitchew Lake to Puget Sound. The increase in hydrology and stream energy would increase aquatic ecosystem productivity and create and maintain habitat diversity.

Re-establishment of peak flows and the associated sediment movement is key to restarting the arrested habitat-forming processes downstream of Edmond Marsh and is a key objective of the Restoration Plan. Currently, even where flows persist perennially, they are inadequate to move sediment effectively, create pools, or scour finer-grained materials from the substrate to create conditions suitable for spawning. The input of sediment and organic matter will stimulate biological productivity and develop greater resources at the lower trophic levels. Restoration would also result in pool and riffle habitat formation over time.

This habitat and development of lower trophic productivity are key to developing conditions sufficient to restore target species such as chum salmon and cutthroat trout in the system. Chum salmon will also benefit from the restoration of a more varied hydrograph. Puget Sound stocks typically spawn in freshwater systems in November and December as flows rise in response to winter rains. This effect has been limited in the system due to the current lack of surface water connectivity.

Previous studies by Anchor Environmental (2004a) and ICF (2013) showed that additional flow would result in increased capacity of the stream to support spawning and rearing of coho and chum salmon. These studies pre-date the completion of the Restoration Plan, but both approaches used predicted flow restoration scenarios similar to flows resulting from the cumulative effects of mining and restoration. The Anchor Environmental (2004a) study analyzed the effects of higher flows in the lower ravine within the lower 3,600 feet of the stream (not the upper ravine). The report concluded that additional flow in the lower reaches of Sequalitchew Creek would "provide significantly enhanced habitat conditions to support coho and chum salmon and cutthroat trout. Existing conditions in Lower Sequalitchew Creek indicate the habitat potential is significantly suppressed, and opportunities for salmon to access and use stream habitat is also very limited. Habitat features exist (e.g., appropriate spawning gravel, LWD and SWD, limited physical barriers) that will provide conditions important for coho and chum salmon and cutthroat trout spawning and rearing with more water present in the stream channel." The ICF (2013) study found that restoring chum access to lower gradient reaches of Sequalitchew Creek near the midpoint of the ravine "is predicted to improve overall productivity and nearly double abundance from the current condition."

4.3.1 Water Quality

The mining and restoration projects would introduce surface water from the upper watershed to the creek. Water passing through Edmond Marsh has low levels of turbidity and pollutants (Aspect Consulting 2022). The projects will affect stream temperature in the Sequalitchew Creek ravine by restoring the flow of surface water in the system which has a different temperature. The effects would vary seasonally as the volume of water from Sequalitchew Lake and its associated temperature vary. In summer, the outflow from Sequalitchew Lake is warmer than Sequalitchew Creek; in winter, it is colder.

Sequalitchew Creek would experience warm temperatures in June, July, and August, with temperatures reaching up to 21°C (70°F) and cool temperatures in winter, down to 5°C to 6°C (41°F to 43°F) as shown in Figure 5. The predicted stream temperatures would be considerably warmer than the current spring discharge in the creek for most of the year. The surface water quality criterion for temperature applicable to Sequalitchew Creek is 16°C for the 7-day average of daily maximums. The analysis based on grab samples suggests that this threshold may be exceeded from May to September.

This temperature increase may have the potential to alter habitat for juvenile fish present. Increased stream temperatures have been shown to decrease time to emergence in several salmonid species, including coho salmon (Quinn 2005). Cutthroat trout, which spawn and rear later in the season, have been shown to hatch earlier as temperatures increase (Quinn 2005). Although sublethal, this temperature increase may impact growth and survival, with juveniles potentially competing for resources earlier in the year (Anlauf-Dunn et al. 2022; Leach 2012; Quinn 2005).

Historically, the stream temperatures in Sequalitchew Creek were likely closer to those observed today in the lake outflow. The steady, cool temperatures currently observed in the ravine reflect the proportionally greater input of groundwater resulting from diversion of the lake outflow from the system.

The dissolved oxygen levels in Lake Sequalitchew and Lower Sequalitchew Creek are high (>9 milligrams per liter [mg/L]). Water quality in the marshes is more typical of stagnant waterbodies exposed to the life cycle of aquatic plants. Dissolved oxygen concentrations are lower (typically <4 mg/L) and are predicted to be raised with the addition of water flowing more rapidly through the system.

4.3.2 Water Quantity

The cumulative effect of the mining and restoration projects on streamflow was evaluated and streamflows were predicted at two locations (Aspect 2022). These locations are the dry reach near Center Drive, and in Sequalitchew Creek at the mid-ravine gage.

4.3.2.1 Flows in the Dry Reach

Under existing conditions, the dry reach currently experiences no consistent flow passing through the entire reach. The bottom of the dry reach is above the current groundwater levels, so ground infiltration in the dry reach would not be affected by lowering of groundwater with mining.

The mining and restoration projects are predicted to result in an average flow of 10.8 cfs in the dry reach. The flow would vary seasonally from a monthly average of 2.2 cfs in August to 22.3 cfs in March as shown in Figure 4. Peak flows could be as high as 60 cfs if all water is routed through the wetlands during peak flow events. To avoid flooding during peak flows, the highest flows could be directed to the Diversion Canal or detained in the marshes. The results presented here do not account for the diversion of peak flows or detention in the marshes.

Modeling indicates there would be periods when there would be no outflow from West Edmond Marsh, and thus no flow in the dry reach. These occur on 401 days of the 19-year period of record (or 7.7% of the time) and typically occur in July and August. These periods last for multiple weeks and occurred in 5 of the 19 years simulated (2004, 2005, 2015, 2017, and 2018). The occurrence of these dry periods could be reduced or eliminated if beaver management structures are built to store water and release it slowly and consistently during periods when there is no flow from Sequalitchew

Lake. Should flow be disrupted, it would temporarily disrupt the habitat and migratory functions of the stream reach between the Sequalitchew ravine springs and Edmond Marsh.

4.3.2.2 Flows in Sequalitchew Creek at Mid-Ravine Gage

After passing through the dry reach, streamflows would enter the Sequalitchew Creek ravine. The vast majority of flow would originate from Sequalitchew Lake, but there would be contribution from springs within the ravine, although the contribution from these springs would be lower than it is under existing conditions.

Spring flow in the upper reaches of the Sequalitchew Creek ravine would be affected by the lowered groundwater levels associated with mining. The groundwater model results for active dewatering, and the long-term condition that would persist after active dewatering has ceased, predict a reduction in spring flow of 79%, varying from 73% in January to 86% in summer.

On average, flow in Sequalitchew Creek at the mid-ravine gage would generally be similar to but slightly higher than the flows in the dry reach (i.e., 0.4 cfs greater), reflecting the input of spring flow. The annual average flow at the mid ravine gage would be 11.2 cfs. Monthly average flows would range from 2.2 cfs in August to 22.9 cfs in March as shown in Figure 5. Peak flows would be generally the same magnitude (approximately 60 cfs) as in the dry reach.

There would be periods when the cumulative effects of the mining and restoration projects would result in a reduction in flows at the mid-ravine gage when compared with the existing condition. Of the 19 years evaluated, flows would be lower with the projects during 45 periods, lasting a total of 547 days, or about 10.5% of the time. Included in this tally are 24 days when there would be no flow at the mid-ravine gage. Under existing conditions, there were 7 days with no measurable flow at the gage. As noted previously, these effects could be mitigated in part or in whole by careful implementation of the beaver management actions called for in the Restoration Plan.

The median duration of a period when flows would be lower with mining and restoration (hereafter referred to as a "lower flow event") was 3 days, but there were 9 lower flow events lasting more than 2 weeks. The longer events occurred in 6 of the 19 years simulated (2004, 2005, 2015, 2016, 2017, and 2018). The longest single lower flow event was 99 days, ending in October 2017. However, lower flow events dominated the summer and fall of 2005, when there were five lower flow events between July 20 and December 23 lasting a total of 136 days. Lower flow events occurred most commonly in July, August, and September, but occasionally occurred all months except March. The average streamflow during lower flow events was 0.8 cfs under existing conditions and would be 0.4 cfs with mining and restoration. The decrease in streamflow during lower flow events ranged from 0.1 cfs up to 1.3 cfs. Again, these effects could be mitigated in part or in whole by careful implementation of the beaver management actions called for in the Restoration Plan.

4.3.3 Edmond Marsh

An aspirational goal of the restoration plan is to reintroduce a sustainable population of coho salmon. If successful, the aquatic area of West Edmond Marsh will provide excellent rearing habitat for juveniles. Juvenile coho salmon typically stay in freshwater wetlands and small streams for 2 years or more after spawning.

4.3.4 Nearshore Habitat

The additional flow in Sequalitchew Creek will transport more nutrients and fine sediment to the nearshore. The mouth of the creek is near the south end of a drift cell with net transport to the north. The additional sediment would benefit the nearshore by replacing some of the sediment that would naturally come from the exposed bluffs above the railroad. Currently this sediment cannot cross the tracks, and the lower shoreline is heavily armored, preventing erosive forces from recruiting sediment below the railroad. Additional nutrients and sediment will also increase biotic productivity on the Puget Sound shoreline at the mouth of the creek, increasing prey resources for fish. Conditions in the brackish marsh are expected to remain stable. Although salinity at the surface may drop, the saltwater wedge that enters the marsh at high tide will still cover the entire vegetated surface of the marsh.

5 Monitoring and Mitigation Measures

Specific mitigation measures associated with dewatering and other aspects of the mining project are discussed in the Groundwater Section of the Earth and Water Resources Report (Aspect 2022).

Existing mitigation measures at the barge loading facility at Tatsolo Point will continue. The facility is designed in accordance with adopted federal, state, and local regulations and guidelines to reduce the likelihood of spills of lubricants, fuels, and chemicals employed in the processing and manufacturing processes proposed for the site. The overwater portion of the conveyor shall be enclosed to prevent spillage of gravel. The dock is not used for the delivery of supplies, or chemical or other materials by water; a spill plan has been prepared for all elements and operations of the facility (marine and upland). Appropriate oil spill containment equipment is available at the dock site.

Mining operations will continue to manage fugitive dust, and forested buffers around Sequalitchew Creek will remain to protect water quality. Site water and stormwater is recycled and/or infiltrated in the mine, eliminating turbid runoff. During construction of the mitigation wetland and other excavation of soils, construction best management practices will be used to prevent erosion of soils.

The restoration and mining projects both include monitoring and adaptive management programs aimed at ensuring the projects achieve their objectives. A main purpose of ongoing monitoring and adaptive management is to look for detrimental cumulative effects and, if identified, adaptively respond to minimize them.

The adaptive management process is built around the following five steps:

1. Assess
2. Design
3. Implement and monitor
4. Evaluate
5. Adjust

The process is iterative and would continue throughout the projects. Adaptive management plans are in development for each project and will be incorporated into the Restoration Plan and Monitoring Plan.

Monitoring will include continued collection of groundwater and surface water observations at the existing monitoring network, as well as the installation of new monitoring locations and focused monitoring efforts associated with the implementation of the projects. Monitoring data would be shared between the project implementers to allow both adaptive management processes to proceed with the best available information.

6 Significant Unavoidable Adverse Impacts

6.1 Proposed Action

The cumulative impacts of the Project and restoration would generally improve all aspects of the freshwater fish habitat in the Sequalitchew Creek watershed. However, the cumulative impacts of the Project and restoration would permanently and unavoidably reduce the flow of the Sequalitchew Creek springs. This could reduce flows in the creek during drought years when surface water flow from Edmond Marsh is extremely low. Increased water temperature in the summer will create sub-lethal conditions that would reduce fish movement and growth until temperatures are reduced again in the fall. The overall effect of beaver management in storing winter water for summer release is not yet fully quantified, but the dry reach could still go dry and flows below the Sequalitchew Creek springs could be reduced during those periods.

6.2 No Action Alternative

Under the No Action Alternative, the dry reach would remain dry and Edmond Marsh would remain inaccessible to fish downstream. Lower Sequalitchew Creek would continue to have only a fraction of its historical flow and would remain unlikely to support spawning of chum and coho salmon. Rearing habitat for coho salmon and cutthroat trout would remain limited to just a few specific areas within the system.

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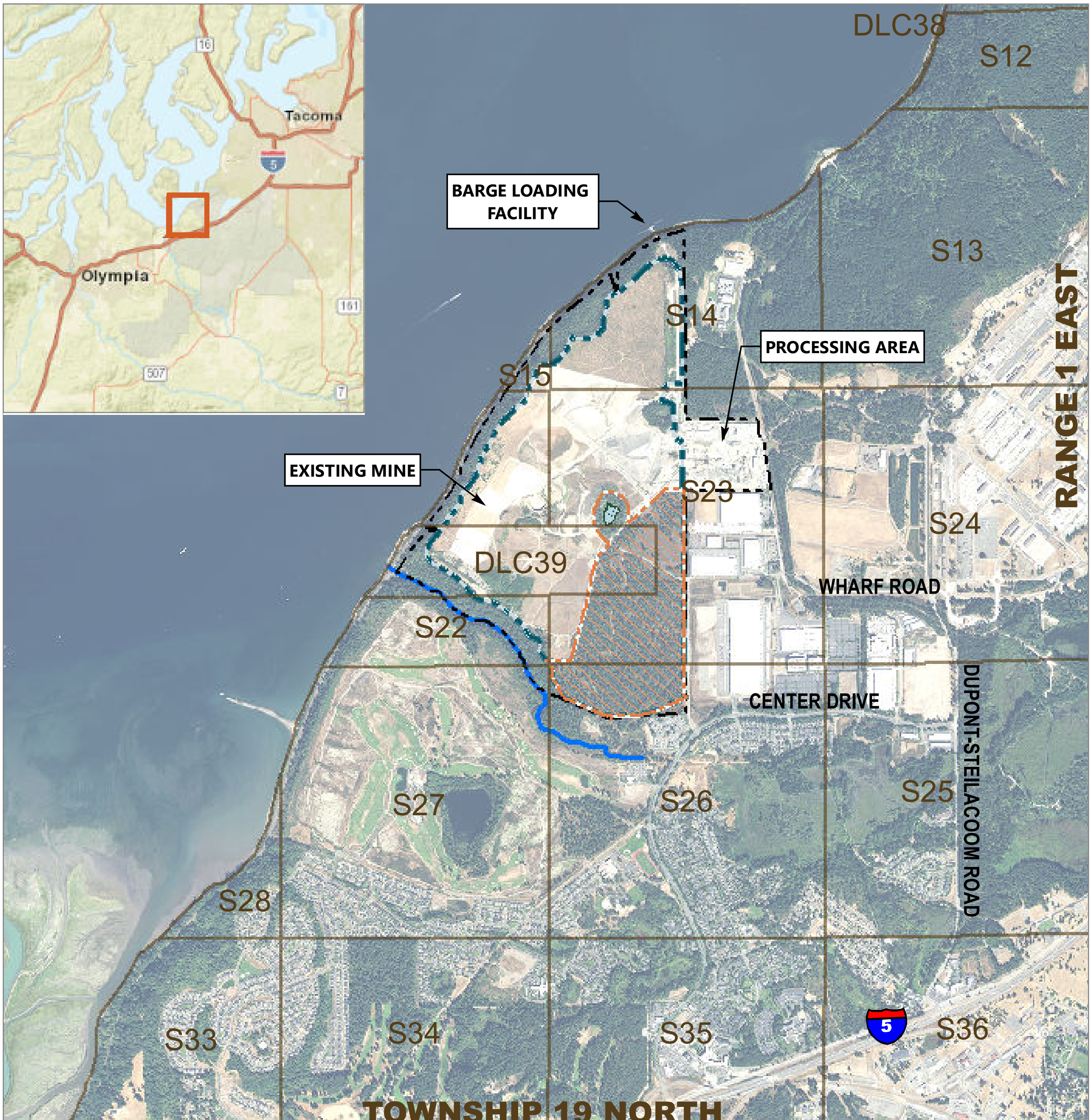
Figures



LEGEND:

- South Parcel Expansion Area (188 ac)
- South Parcel Mineral Resource Area Expansion
- Mining Limits (existing and proposed, 620 ac)
- Pioneer Aggregates Property (791 ac)
- Kettle Wetland
- Sequalitchew Creek
- Township | Range | Section

NOTES:
Imagery: 2017 USDA NAIP

0 3,000
Feet

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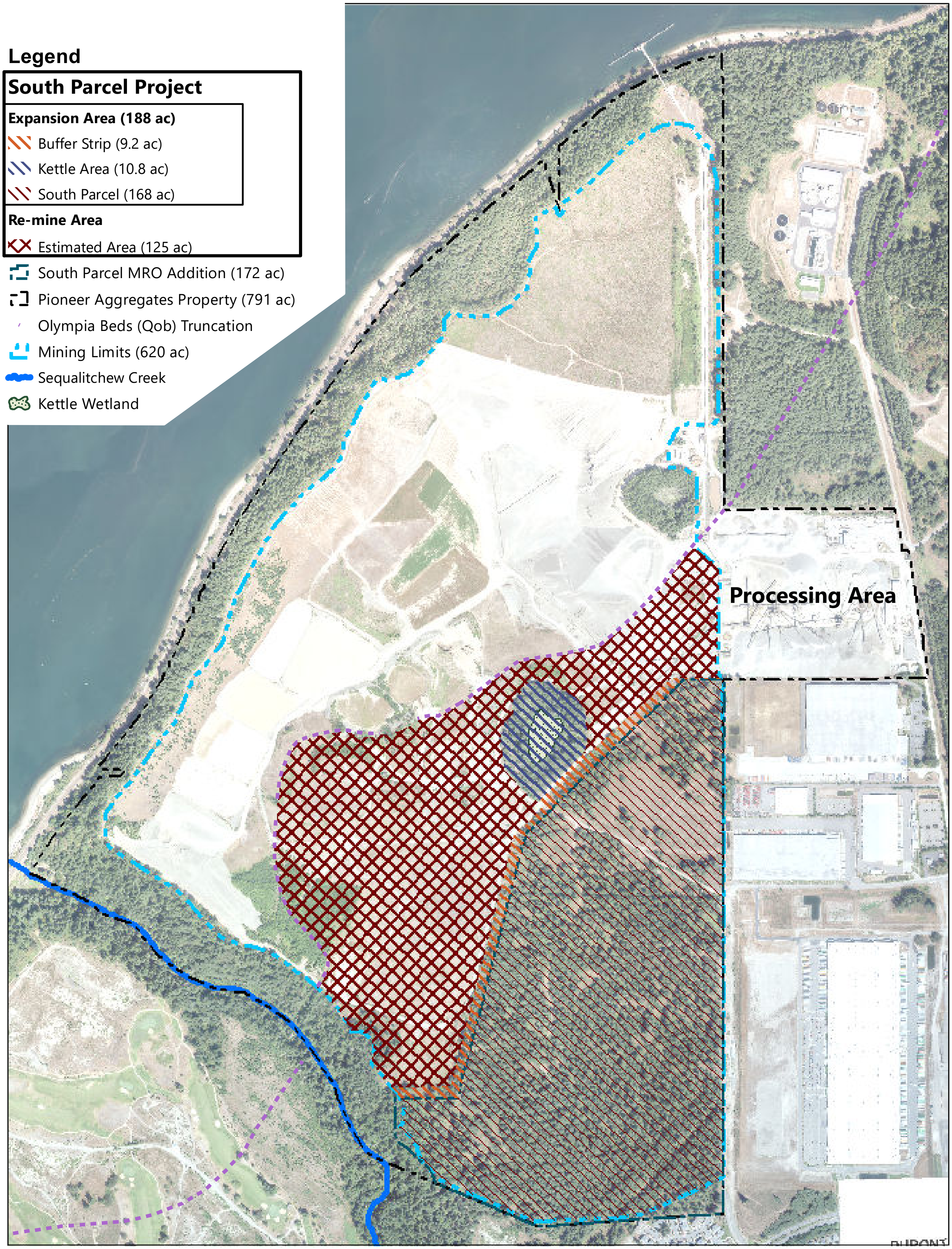
ANCHOR QEA

Figure 1
Vicinity Map
Fisheries Technical Report
Pioneer Aggregates South Parcel Project



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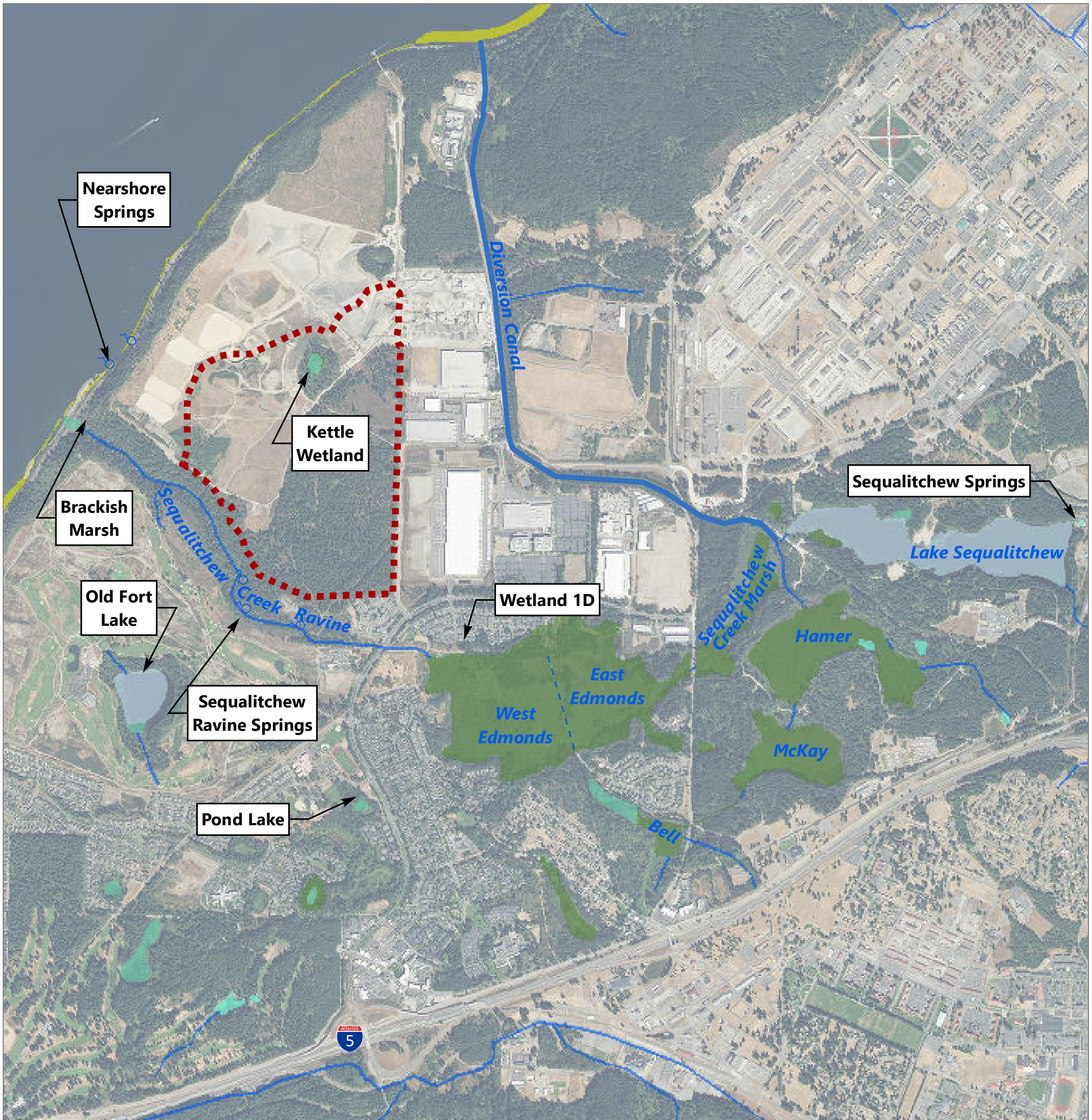
ANCHOR QEA

Figure 2
Project Components
Fisheries Technical Report
Pioneer Aggregates South Parcel Project



LEGEND:

South Parcel Project

Aquatic Resources

Stream/ Canal

Freshwater Pond

Spring

Lake

Estuarine and Marine Wetland

Freshwater Emergent Wetland

Freshwater Forested/Shrub Wetland

NOTES:
This map was created by modifying the USFWS National Wetland Inventory to correct inaccuracies and add additional detail

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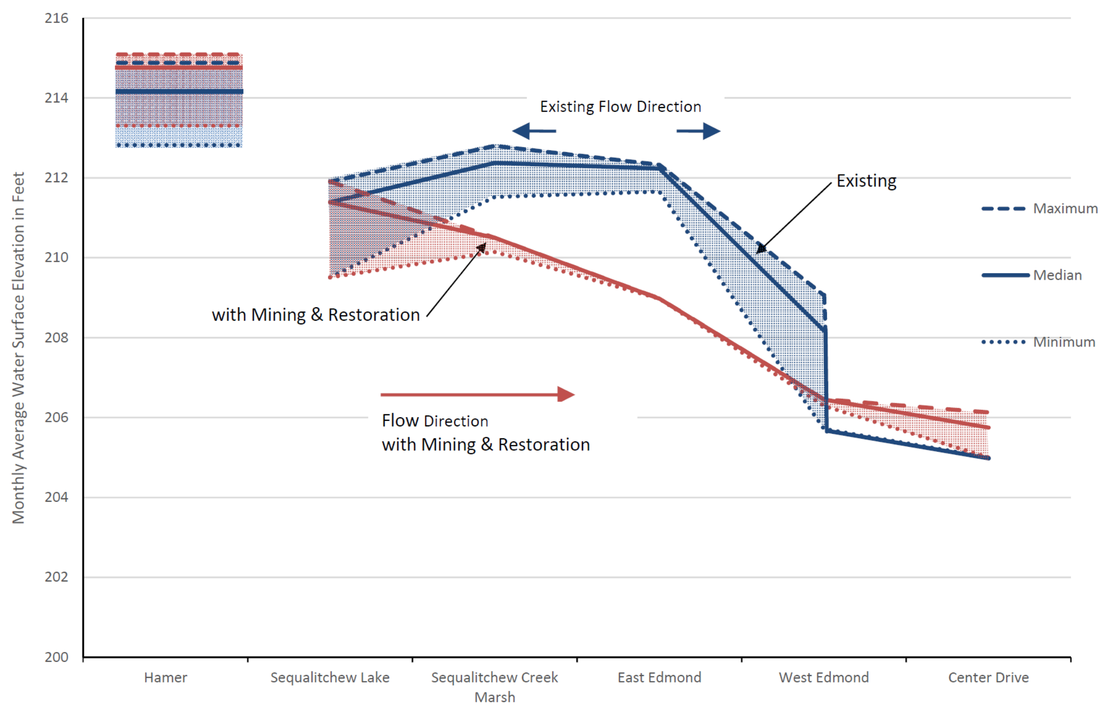
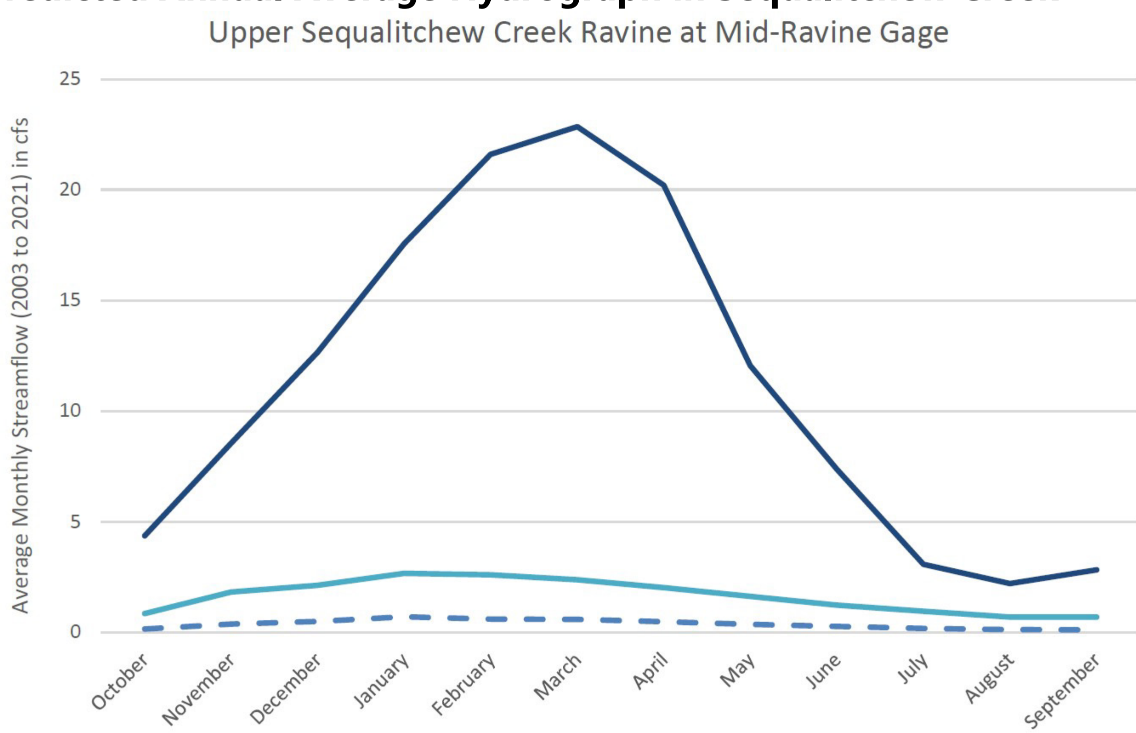
Figure 3
Aquatic Resources
Fisheries Technical Report
Pioneer Aggregates South Parcel Project

Predicted Surface Elevations in the Sequalitchew Creek Watershed

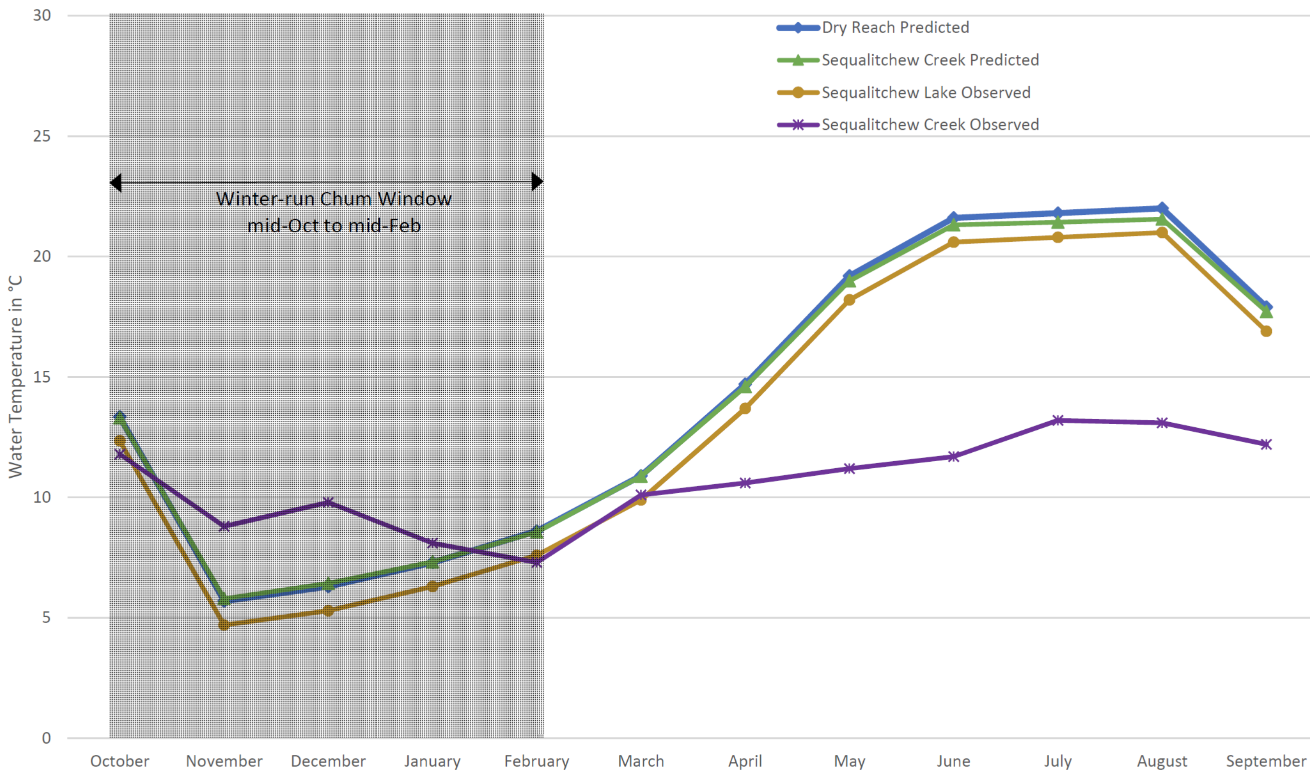


Predicted Annual Average Hydrograph in Sequalitchew Creek



Adapted from Aspect 2021

Predicted Effects on Stream Temperature in Sequalitchew Creek Before and After Mining and Restoration



Adapted from Aspect 2016