CHAPTER 3
AFFECTED ENVIRONMENT, IMPACTS, MITIGATION MEASURES, AND SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

This chapter of the Draft Environmental Impact Statement (DEIS) describes the affected environment (i.e., existing conditions), impacts of the EIS Alternatives, mitigation measures, and any significant unavoidable adverse impacts on the environment that would be anticipated under the EIS Alternatives.

3.1 EARTH

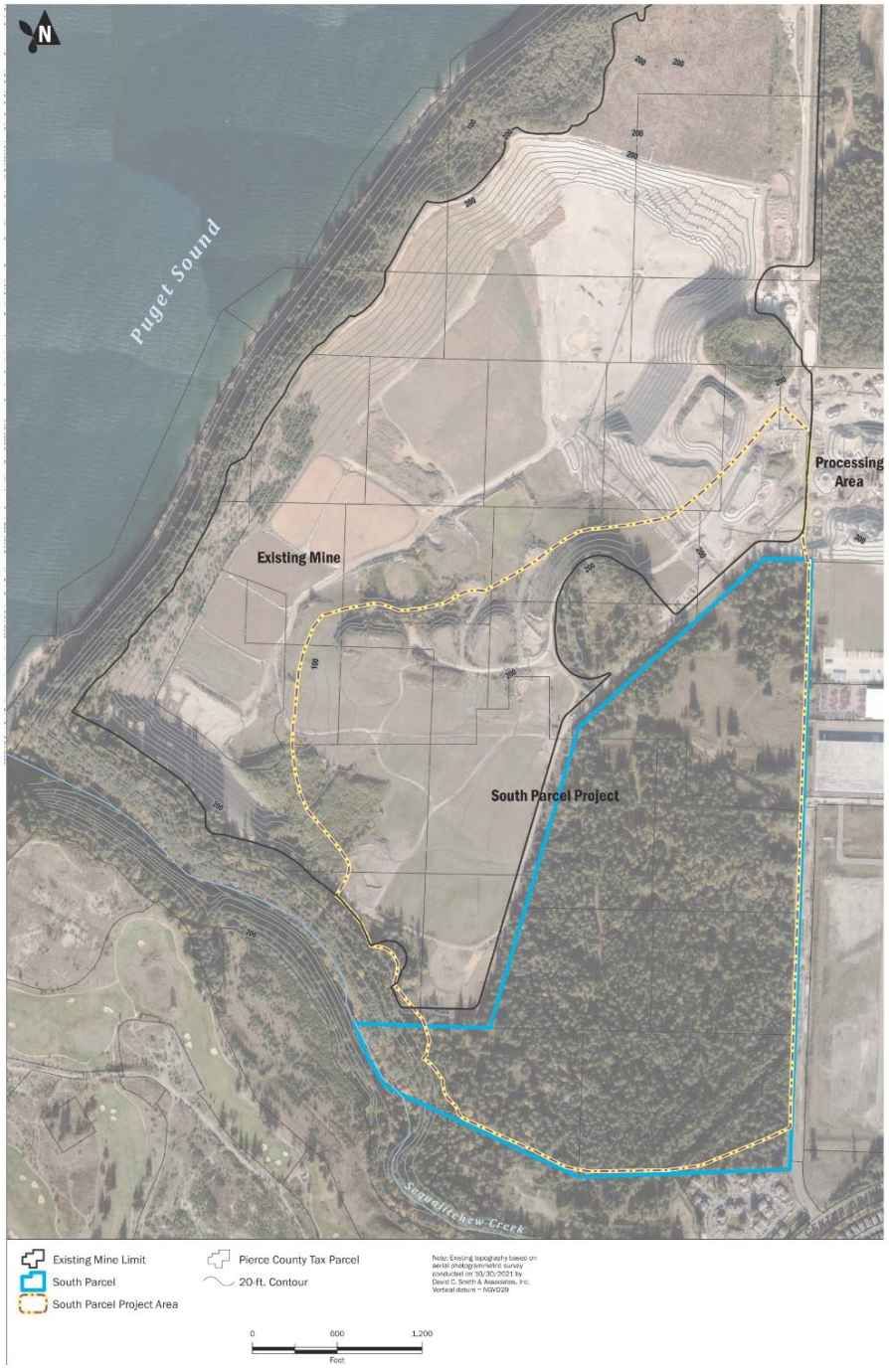
This section of the DEIS describes the existing topographic, soils, and geologic conditions on and in the vicinity of the site (including the approximately 188-acre Expansion Area and approximately 125-acre Re-mine Area onsite). Potential impacts associated with the EIS Alternatives are evaluated and mitigation measures identified. This section is based on the *Earth and Water Resources Report* (May 2023) prepared by Aspect Consulting and peer reviewed by Landau Associates (see **Appendix B**).

3.1.1 Affected Environment

Geologic and geotechnical analyses were performed to determine geologic conditions beneath the existing ground surface of the Pioneer Aggregates South Parcel Project site (including both the Expansion Area and Re-Mine Area portion of the site). These analyses were completed to evaluate the stability of proposed cut slopes and identify areas prone to geologic hazards, such as slope failure or seismically-induced soil liquefaction. The analyses rely on geologic investigations conducted over a period of more than 30 years, notably including over 109 borings completed in the late 1980s to facilitate planning of the initial Pioneer Aggregates mine (see **Appendix B** for detail).

Topography and Landform Geography

The site is comprised of the Expansion Area, which is undisturbed by mining, and the Re-Mine Area, which is a portion of the existing mine. Existing topography of both areas is shown on **Figure 3.1-1**. The Expansion Area portion of the site is generally flat and at an elevation of approximately 200 feet. The Re-Mine Area has a rolling slope toward the west down to the floor of the existing mine (western boundary of the site). The slopes to the west within the Re-Mine Area portion of the site vary between a grade of 10% to 70% locally.



Source: Aspect, 2022.

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Figure 3.1-1
Existing Topography

The Sequalitchew Creek ravine is located south and southwest of the site; this ravine forms most of the southern boundary of the existing mine. The ravine deepens as it approaches Puget Sound to a maximum depth of 175 feet below the plateau elevation. Slopes along the northern side of the Sequalitchew Creek ravine range from approximately 30% to 75%. A narrow-gauge railroad associated with the former E.I. DuPont de Nemours Company munitions facility was constructed on a bench cut into the northern slope of the ravine; it has since been converted to a public trail.

Regional Geology and Geologic History

The geology of the region, and South Parcel Project site, is dominated by past glaciation. The most recent ice-sheet glaciation of the Puget Lowland is termed the Vashon Stade of the Fraser Glaciation. Global and regional scientific observations indicate that there were many cooler climatic periods prior to the Vashon glaciation that produced ice-sheet glaciations, and deposits from a number of these pre-Vashon glacial and non-glacial periods in the Puget Lowland have been identified.

During the southward advance of the Vashon ice sheet, ice blocked the normal northward drainage of water from the Puget Sound Lowland, creating a lake into which silt, clay, and fine sand were deposited. As the Vashon ice sheet advanced farther southward, meltwater streams and rivers filled the remaining low areas with a blanket of sand and gravel that extended throughout the lowland. These subglacial troughs are visible today as the major waterways of Puget Sound, Hood Canal, Lake Washington, and Lake Sammamish, and many of the broad river valley bottoms in the Puget Lowland. A discontinuous layer of basal till (also described as lodgment till) was deposited where the glacial ice sheet contacted previously deposited sediment.

The Vashon ice sheet was short lived in the lowland and the advance of glacial ice appears to have stagnated abruptly. Sediment that was entrained on or within the ice was deposited on the landscape when the ice melted. These deposits are called ablation till and are found largely intact where they were deposited on the uplands. Ablation till deposited in low areas was reworked by meltwater streams that flowed from the melting glaciers to form recessional outwash. In places, the deposits were influenced by shifting ice margins creating highly variable ice contact deposits, which contain both water-worked sands and gravels, and interbeds and lenses of silt and clay and till-like deposits.

These recessional sand and gravel deposits and interbedded ice contact deposits are collectively identified as Vashon Recessional Outwash (Qvr). The recessional outwash generally consists of clean (containing very little silt and clay) sand and gravel, or sand and gravel with variable amounts of silt and interbeds and lenses of silty sands and gravels.

As the glaciers melted and receded, a lobe of ice blocked the northward drainage of the Puyallup valley, creating Glacial Lake Puyallup. A prominent late recessional gravelly outwash member called the Steilacoom Gravel is interpreted to have formed when a series

of ice dam bursts (jokulhlaups) released the glacially impounded water in Glacial Lake Puyallup. Floodwaters spilled and transported coarse-grained sediments into a broad outwash plain in the Sequalitchew Creek area. These coarse-grained deposits created thick deltas where the outburst channels flowed into a lower elevation lake (Glacial Lake Russell) that had formed behind the remaining Vashon glacial ice.

Glacial Lake Russell (which is now partially occupied by modern Puget Sound) was deep and had steep sided walls in the site area, similar to those of the modern coastal bluffs. The contact between the sediments exposed in the former walls of Glacial Lake Russell and the overlying late glacial delta and flood deposits derived from Glacial Lake Puyallup is similarly steep and exhibits a marked change in soil types. The contact is called the "Olympia Beds Truncation". The location of the Olympia Beds Truncation is a key geologic and hydrologic feature at the site; see Figure 6 of **Appendix B**).

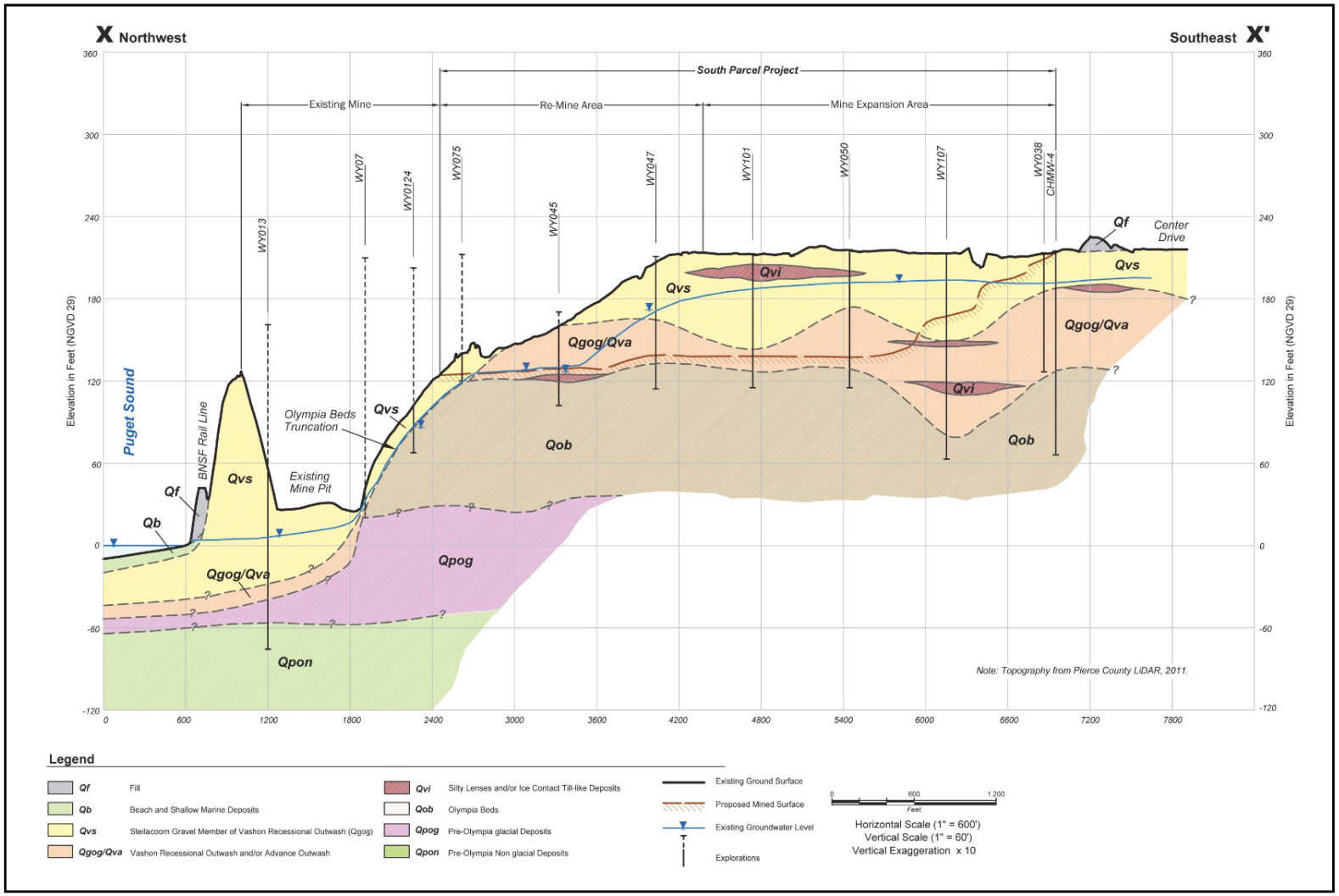
Site Geology

The geologic units of glacial and non-glacial origin were deposited at the site vicinity before, during, and after the Vashon glaciation. Understanding of site geologic conditions was further informed through borings and monitoring well explorations installed at the site (see Figures 5 and 6 of **Appendix B**). **Figure 3.1-2** shows the extent of the geologic units. These units are described below (see **Appendix B** for details.)

The surface geology of the site area consists primarily of Vashon-age recessional sand and gravel (Qgog) locally known as Steilacoom Gravel (Qvs). The recessional glacial unit is underlain by older Vashon-age glacial deposits, pre-Vashon non-glacial deposits, and pre-Vashon glacial deposits – all comprised primarily of sand and gravel.

The uppermost pre-Vashon non-glacial sequence at the site is identified as the Olympia beds. These non-glacial deposits are generally marked by an increase in silt, organics, and wood fragments. Older unnamed glacial and non-glacial deposits lie below the Olympia beds. These are identified as pre-Olympia non-glacial deposits (Qpon) and pre-Olympia glacial deposits (Qpog).

Steilacoom Gravel, which is comprised of the late-glacial delta and flood deposits, is a member of the Vashon Recessional Outwash unit and is identified as Qgog on the geologic map (see **Figure 3.1-2**). Steilacoom Gravel is located at the site and is considered an aggregate resource; this is the same geologic unit currently being mined in the existing mine area.



Source: Aspect, 2022.

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Figure 3.1-2

Geologic Cross-Section

After the end of the Vashon glaciation, non-glacial conditions resumed in the site area. Post-glacial geologic units deposited at the site included beach and shallow marine deposits, colluvium on slopes, and alluvium in drainage bottoms. Topsoil developed on soils in stable and forested uplands areas.

The site's geology was and continues to be influenced by tectonic/seismic events. The site lies within the Puget Sound Lowland, between the Cascade and Olympic Mountain Ranges. The Cascade and Olympic Mountains and the Puget Sound Lowland resulted from tectonic forces. These forces cause moderate-size earthquakes that are frequently felt throughout the region as well as infrequent large earthquakes.

Subsurface Conditions

Subsurface conditions at the site are inferred from review of the existing soil boring and well logs, published geologic data and maps, and geological reconnaissance. Based on the available information, the inferred geologic units at the site are described in sequence below.

Topsoil

Topsoil, including up to several inches of forest duff (organic debris), is present at the site. The duff layer is primarily present within upland forested areas. Portions of the site (primarily the Expansion Area) are vegetated with conifer and deciduous trees. The Re-Mine Area portion of the site has been previously cleared and is now vegetated with shrubs and grasses. Undisturbed, native topsoil is generally not present in the Re-Mine Area; however, topsoil has been placed over portions of the Re-Mine Area as a component of mine reclamation.

Steilacoom Gravel Subunit of Vashon Recessional Outwash

The majority of near-surface Vashon recessional outwash in the area is composed of the Steilacoom Gravel subunit (Qvs) of the Vashon Recessional Outwash (Qgog) deposit. This deposit consists of sandy gravel and gravelly sand with minor amounts of silt, ranging between 2 and 6%.

The Steilacoom Gravel has not been glacially overridden and is anticipated to be medium dense at the surface, grading to dense at depth. Like most outwash deposits, Steilacoom Gravel possesses a minor degree of cohesion which gives it a good intermediate-term standup time that is exhibited by the near vertical temporary cuts up to 70 feet high in the active area of the existing mine.

Olympia Beds

The Olympia Bed (Qob) deposits are located below the Steilacoom Gravel. The Qob unit is generally composed of interbedded lacustrine (lake sediments) and fluvial (river and stream sediments) deposits. Lacustrine deposits consist of silt and clay. The fluvial deposits consist primarily of sand but may contain oxidized gravelly lenses and layers. Interbed thickness of this unit ranges from inches up to about 10 feet. Some organic silt and peat layers that were deposited in wetlands and bogs are also generally present in this unit. The Qob unit has been overridden by the Vashon ice sheet and is generally very dense to hard in its natural state. Where exposed to seepage or weathering, its surface degrades and loosens.

The Qob deposits generally are considerably finer grained than the Vashon deposits above and can perch groundwater. Seepage has been noted at the top of the Qob unit where exposed in the road cut and natural ravine slopes along Sequalitchew Creek. If a lacustrine bed perches groundwater and is intersected by the surface of the slope, it could result in seepage onto the slope.

The contact between the top of the Olympia Beds and the overlying outwash deposits is generally encountered in the Olympia Beds at 80 to 140 feet below the ground surface.[1] (See **Appendix B** for detail).

Hydrogeology

Surficial site soils are generally highly transmissive to water. Stormwater tends to infiltrate into the natural soil surface rather than collect as runoff. The Steilacoom Gravel is generally highly transmissive to groundwater flow and storm water will infiltrate until it encounters the regional groundwater table, or until it encounters a silty interbed that locally perches groundwater. Additional information on surface water and groundwater is provided in Section 3.3, **Surface Water and Groundwater**, of this DEIS.

Geologically Hazardous Areas

Geologically hazardous areas (GHAs) are areas "susceptible to erosion, sliding, or other potentially hazardous geological events" as described in Section 25.105.030 of the DuPont Municipal Code (DMC). GHAs are defined in DMC 25.105.030, including the following:

- Landslide Hazard Areas

[1] *Olympia Beds are found between 87 to 139 feet below the ground surface in the borings closest to Edmond Marsh. Several of the borings closest to the marsh did not encounter the Olympia Beds at their completion depths of 65 to 103 feet. These borings are located in the southeast corner of the South Parcel and in the southern portion of the parcel now occupied by the Amazon Fulfillment Center. In 2002, a boring was completed in the western end of Edmond Marsh and encountered the Olympia Beds at a depth of 84 feet. Boring logs for these explorations are provided in* ***Appendix B.***

- Steep Slopes
- Erosion Hazard Areas
- Seismic Hazard Areas

The presence of GHAs in the Expansion Area and Re-Mine portions of the site are shown in **Figure 3.1-3** and described below. GHAs associated with the existing mine and Sequalitchew Creek areas immediately off the site are also identified and described.

Expansion Area Portion of Site

The Expansion Area portion of the site does not include any areas that meet the definition of GHAs. Topography is generally characterized by level ground or gentle slopes, typically inclined at gradients less than 15% that do not fall under the GHA criteria.
Areas interpreted as old rail grade cut and fill slopes steeper than 40% that locally exceed more the 10 feet of vertical relief were observed in the southeast portion of the Expansion Area. These do not qualify as GHAs because they do not intersect a geologic contact with relatively impermeable sediment or bedrock; do not have spring or groundwater seepage (DMC 25.105.030.345); and include stable constructed slopes that have historically performed well.

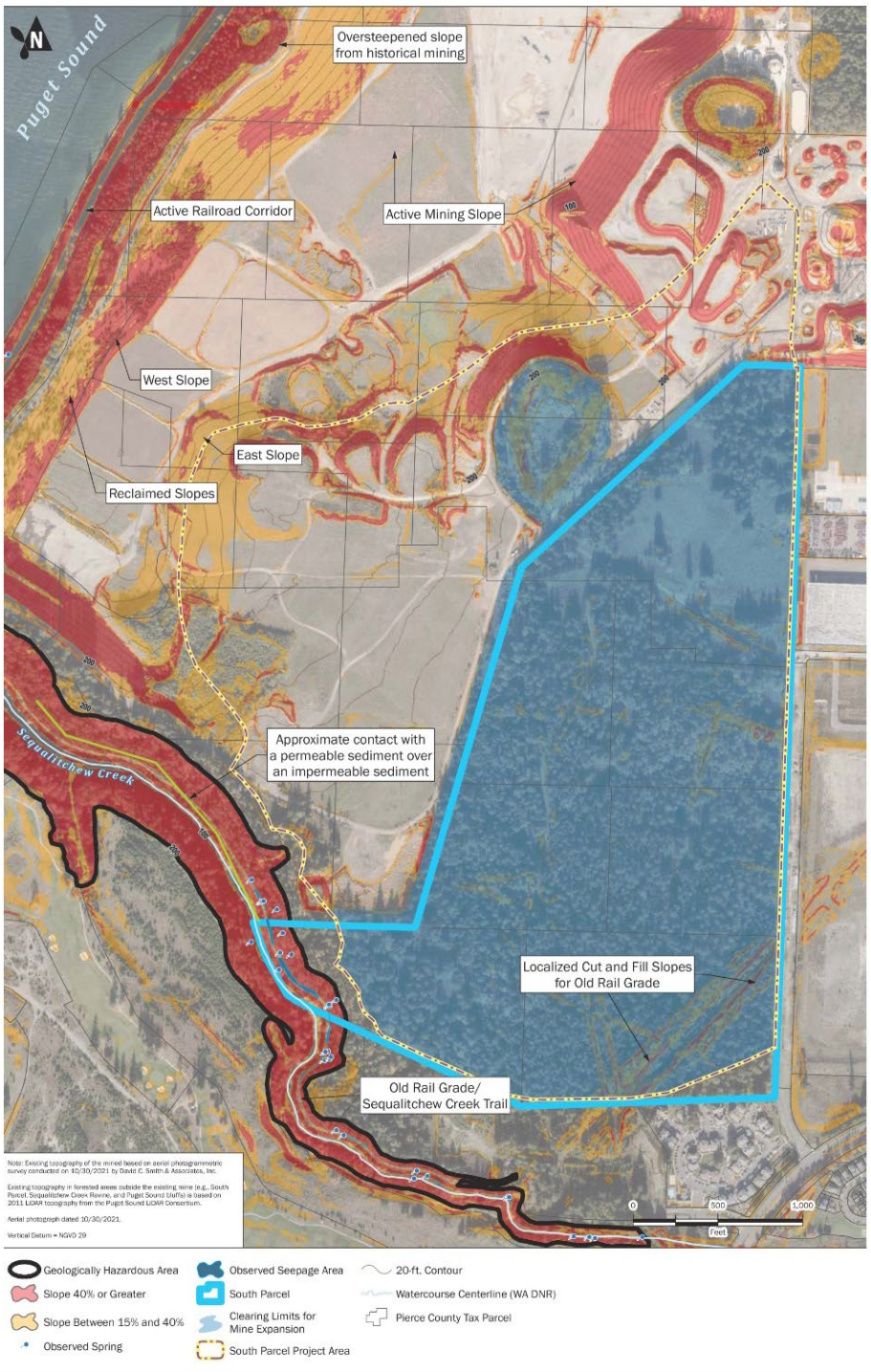
There are no channels, channel forming processes, or areas subject to coastal erosion within the Expansion Area, and there are no erosion hazard areas as defined by the City.

The Expansion Area does not include soils on slopes greater than 40% that are expected to be seasonally or perpetually saturated that pose a specific risk of settlement, movement, or liquefaction for seismic hazard areas as defined by the City.

Re-Mine Area Portion of Site

Existing conditions in the Re-Mine Area portion of the site do not meet the definition of GHAs, although there are areas with slopes steeper than 15% (see **Figure 3.1-3**). The topography of the Re-Mine Area generally consists of a gentle slope to the northwest descending toward the floor of the existing mine. Steeper slopes are present to the northwest of the Kettle wetland, where the slope is greater than 40%, and along the westernmost portion of the Re-Mine Area, where it typically varies between 15 to 40% Some of the steeper slopes shown on **Figure 3.1-3** within the Re-Mine Area represent temporary stockpiles or fill placement.

The areas of steeper slopes within the Re-Mine Area do not qualify as GHAs as they are either temporary slopes within an active mine or were designed and approved by a qualified professional experienced with the site and are thus exempted from being a GHA. There are no channels, channel-forming processes, or areas subject to coastal erosion within the Re-Mine Area, so there are no erosion hazard areas as defined by the City.



Source: Aspect, 2022.

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Figure 3.1-3

Geological Hazardous Areas—Existing Conditions

The Re-Mine Area does not contain seismic hazard areas because the soils on slopes greater than 40% are not expected to be seasonally or perpetually saturated and do not pose a specific risk of settlement, movement, or liquefaction.

Existing Mine Area (Off-Site)

The existing mine includes constructed slopes on the south and west sides that have been graded to their final configuration and reclaimed with topsoil and planting. The west slope is about 175 feet high and is smoothly graded at about 30% up to 50%, as shown on **Figure 3.1-3**. The subsurface soil under the topsoil of the west slope is sand and gravel with a trace of fines. The slope has been planted with grasses and conifer trees.

The west slope has a slope gradient of greater than 40% with a vertical relief greater than 10 feet, but it does not meet GHA criteria because it was designed and approved by a qualified professional experienced with the site, and thus is exempted from being a GHA.

No indication of past or imminent slope failure, land sliding, or erosion was observed (see **Appendix B** for detail). There are no topographic features that would suggest slumping or calving (when chunks of slopes are released), and there are no areas of exposed soil. The vegetation shows no evidence of disturbance from slope instability or erosion.

There are no channels, channel forming processes, or areas subject to coastal erosion within the existing mine, so there are no erosion hazard areas as defined by the City.

The existing mine does not contain seismic hazard areas because the soils on slopes greater than 40% are not expected to be seasonally or perpetually saturated and do not pose a specific risk of settlement, movement, or liquefaction.

Sequalitchew Creek Ravine (Off-Site)

Most of the Sequalitchew Creek ravine lies offsite, along the southern boundary of the existing mine and the site (see **Figure 3.1-3**). A small portion of the Sequalitchew Creek ravine is located within the Expansion Area portion of the site, but outside the proposed mining area. The ravine runs westward for approximately 1.5 miles down to the creek confluence with Puget Sound. The slopes on the northern side of the ravine range from approximately 30% to 75%.

The north slope of the Sequalitchew Creek ravine includes a bench cut for a former railroad grade that ran down the full length of the ravine. The railroad grade has been redeveloped into the Sequalitchew Creek Trail, surfaced with asphalt on the upper portion and crushed rock lower down.

Perennial groundwater seeps from the ravine's north slope at several locations, as shown on **Figure 3.1-3**. On the eastern two-thirds of the ravine, the subsurface soil in the upper

part of the slope (from the top of the ravine at approximate elevation 200 feet down to about elevation 110 feet) is permeable sand and gravel with minor silt; below approximately elevation 110 feet, the soil is silty and relatively impermeable. In the western third of the ravine, the subsurface soil is permeable sand and gravel for the entire height of the ravine valley wall.

The channel of Sequalitchew Creek is a relatively confined channel formed by historically higher flows (see Section 3.3, **Groundwater**, and Section 3.4, **Surface Water**, for details). The creek currently experiences limited flow and thus has limited channel-forming processes. No indication of an active channel migration zone is evident (see **Appendix E** for details).

The existing Sequalitchew Creek ravine includes areas with soils on slopes greater than 40% that are expected to be seasonally or perpetually saturated that pose a specific risk of settlement, movement, or liquefaction associated with seismic hazards, as defined by the City.

Based on the slope steepness, the presence of the seeps, and the contact between permeable and impermeable soils, the north slope of the Sequalitchew Creek ravine qualifies as a landslide hazard area, steep slope, and seismic hazard under DMC GHA criteria. The slope is identified by the DNR as susceptible to shallow landslides.

DMC 25.105.050 (3) defines erosion hazards as including channel migration zones (areas along a river or stream where the channel can be reasonably predicted to migrate over time). The Sequalitchew Creek migration zone is considered an erosion hazard.

3.1.2 Impacts of the Alternatives

This section identifies and analyzes impacts to topography, soils, and geologic hazard areas on and in the vicinity of the Pioneer Aggregates South Parcel Project site under the EIS Alternatives.

ALTERNATIVE 1 – PROPOSED ACTION

Topography

Site (Expansion Area and Re-Mine Area Onsite)

Natural deposits of sand and gravel would be removed from a 313-acre area, altering the topography and leaving an irregular-shaped bowl feature where the mine operated. Additional slopes would be created in an area where slopes did not previously exist, thus providing more opportunity for shallow slope instability and erosion. However, proper

reclamation and erosion control measures as planned for in the Proposed Action would limit any potential slope instability and erosion impacts (as illustrated in **Figure 3.1-4)**.

Following mining, the slopes on the eastern edge of the Expansion Area would be about 80 to 120 ft. tall and would be inclined at 3H:1V (33%). Benches would be excavated in the southeast corner of the Expansion Area. The bottom surface of the Expansion Area would generally follow the contours of the top of the Olympia Beds. A thin layer of gravel, several feet thick, is anticipated to be left on top of the Olympia Beds to provide a stable working surface.

Within the Re-Mine Area portion of the site, topography would also substantially change as the current rolling slopes would be mined down to the Olympia Beds. As with the Expansion Area, a working surface of gravel would be left atop the Olympia Beds. Slopes within the Re-Mine Area would be inclined at 3H:1V (33%), where groundwater is expected to emanate from the toe of the slope and 2H:1V (50%), where the slopes are anticipated to be dry.

The proposed finished slopes would be less steep than other areas that have been mined and reclaimed to the west. The slopes steeper than 40% (up to 50%) and the slopes along the Sequalitchew Creek Trail exceeding 60% all appear to be performing well (see **Appendix B**). The soils are fairly homogenous across the active mine area and Re-Mine Area and are generally expected to perform similarly to in the past (**see Appendix B** for details).

Existing Mine (Off-Site)

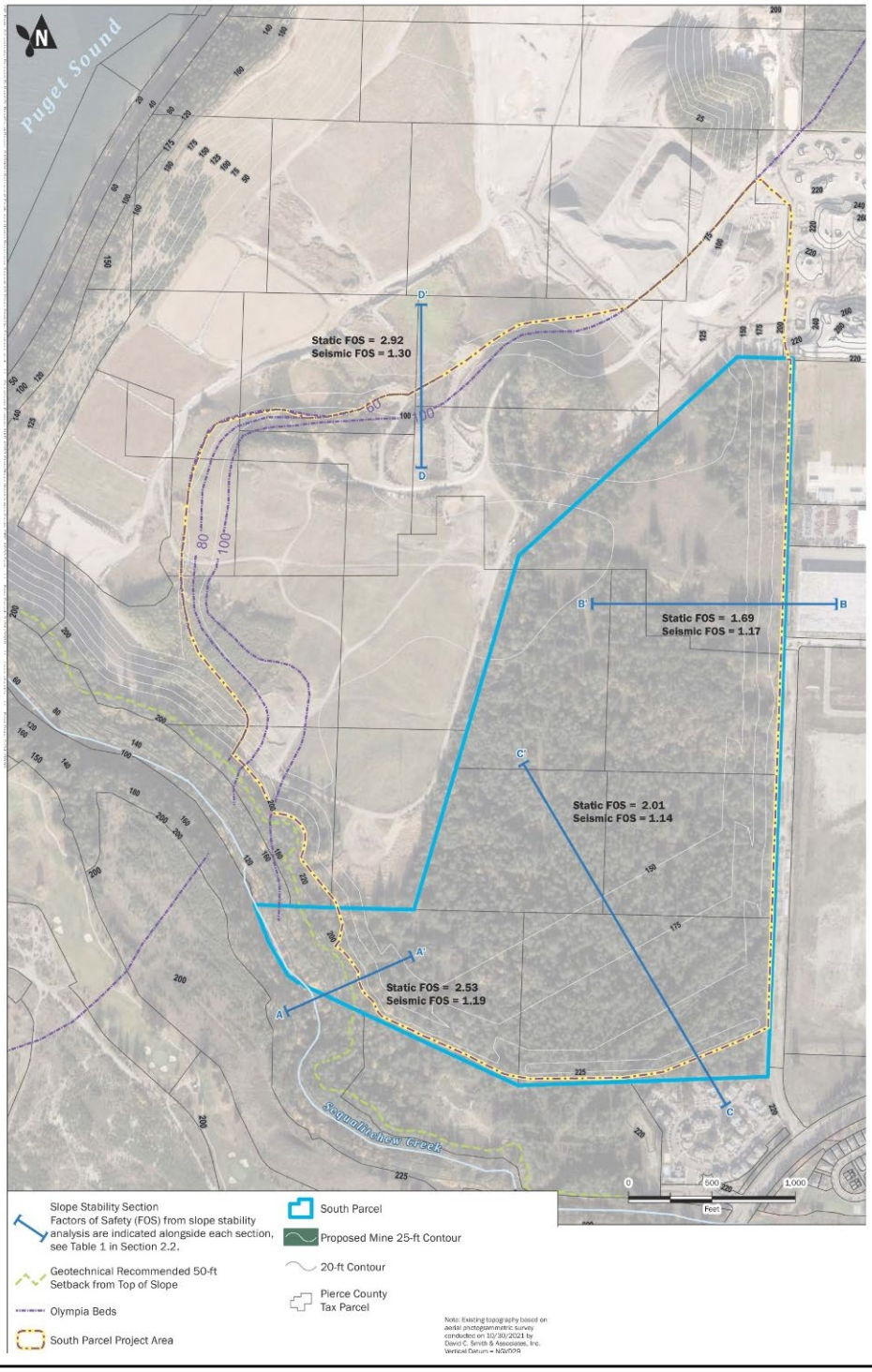
There would be no change to the topography of the slopes of the Existing Mine as a result of the Proposed Action. However, these slopes may be modified under the current permits as mining activity continues and have already been evaluated for potential impacts in SEPA analysis associated with the current permits. Changes to the existing slopes under the current permits are not evaluated in this DEIS.

A constructed wetland mitigation area has been proposed near the toe of the west slope at the base of area where mining has already been completed. The constructed wetland slopes would be at gradients less than 15%.

Other minor changes within the existing mine include the construction of storm water conveyance, treatment, and infiltration facilities, and groundwater conveyance and infiltration facilities.

Sequalitchew Creek Ravine (Off-Site)

Topography in the Sequalitchew Creek ravine would not be altered as a result of the Proposed Action (see **Figure 3.1-4**).



Source: Aspect, 2022.

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Figure 3.1-4
Proposed Topography

The dewatering and grading associated with the Proposed Action would reduce groundwater flow toward the steep slopes of Sequalitchew Creek ravine along the east portion of the Expansion Area onsite. The Proposed Action would also route groundwater that would potentially flow toward the creek instead toward the mined areas. Ultimately, this is anticipated to reduce the potential for landslides and slope failures within the Sequalitchew Creek ravine. The seeps and springs identified on **Figure 3.1-3** are expected to be reduced or dewatered in their entirety, which may reduce the level of landslide hazard susceptibility within the ravine (see Section 3.3, **Surface Water** and Section 3.4, **Groundwater**, for details on groundwater and surface water flow).

Slope Stability

A geotechnical analysis (Aspect 2021) evaluated the stability of the proposed cut slopes of the South Parcel Project during mining operations is. The analysis showed acceptable factor of safety values (that exceed 1.5 static and 1.1 for seismic conditions) for slope stability for the mined condition within the site area and the adjacent Sequalitchew Creek ravine (see **Appendix B** for detail).

Under a post-mining reclamation plan approved by the DNR, the mine slopes would be progressively reclaimed over the life of the Proposed Action. Mine slopes would be graded to 3H:1V or flatter where groundwater seepage is expected (i.e., on the eastern and southern slopes of the Expansion Area portion of the site) once the slope is no longer being mined. Slopes where groundwater is not anticipated to be present, such as along the southern boundary of the Re-Mine Area portion of the site, would be graded to 2H:1V.

Backfill is not required to achieve the reclaimed configuration; however, backfill may be used to enhance reclamation, as has been done elsewhere within the Existing Mine, to improve vegetation performance. The backfill would consist of retained finer material from the Expansion Area and imported clean fill. The proposed slope angles are flatter than the natural angle of repose of the remaining original soils and would provide the long-term erosion control and landscape base for planting. After establishment of vegetation, any long-term slope stability impact to earth-related features is expected to be low. The already high stability of newly created slopes would generally increase with the establishment of vegetation.

Erosion Potential

Due to their generally coarse-grained nature and good infiltration characteristics, the soils in the site area possess a low erosion risk and are generally not moisture sensitive. The erosion potential is increased by the removal of vegetation and construction of mine slopes; however, with proper storm water management techniques in place, these conditions are not anticipated to result in significant erosion of the coarse soils. The primary element of

the Proposed Action potentially susceptible to erosion is the placement of loose topsoil for revegetation on the final cut slopes. Revegetation would minimize the potential for erosion.

Under the Proposed Action, mining activities would create a closed depression and all surface water runoff would drain internally. Therefore, erosion is not anticipated to impact on- or off-site surface water bodies or aquatic resources. However, management of erosion remains important for establishment of vegetation during reclamation, visual appearance of the slopes, and the long-term performance of the infiltration ponds. The Proposed Action includes erosion control Best Management Practices (BMPs), consistent with Ecology's Sand and Gravel General Permit and City of DuPont's requirements as defined in DMC 25.105.030.25, that would reduce the potential for off-site transport of sediment.

To reduce the risk for erosion impacts to the Sequalitchew Creek ravine slopes south of the site, the Proposed Action includes a 100-foot buffer along the top of the slope along the Sequalitchew Creek ravine (**see Figure 3.1-3**). This buffer exceeds that required by DMC 25.105.070(2)[2], which requires a 50-foot buffer between proposed development activity and hillslopes of 40% (22 degrees or approximately 2.5H:1V) and is also greater than the buffer recommended in a previous geotechnical report, and therefore provides greater protection to the off-site ravine. The 100-foot buffer is intended to provide protection for erosion of steep slopes along with other recommended mitigation measures and Best Management Practices (BMPs) identified under 3.1.3 Mitigation Measures.

The City of DuPont requires preparation of an erosion control plan per DMC 22.01.180 for all sites disturbing more than one acre. The erosion control plan for the Pioneer Aggregates South Parcel Project identifies the specific BMPs to be used during and after mining for erosion and sediment control.

Topsoil Removal and Replacement

Topsoil contains fines and organic material that is not suitable for construction aggregate and has physical characteristics that are not compatible with efficient use of the equipment used to transport and process aggregate materials extracted from the mine. Topsoil is also generally the most fertile part of soil, containing soil structure, organic matter, and micro-organisms beneficial to plants and an essential component for successful reclamation of the mine.

Washington's laws governing Surface Mine Reclamation (RCW 78.44) require the conservation of topsoil as a component of reclaiming surface mines for future uses. The

[2] *Note that the Geotechnical Engineering Report (Aspect Consulting, 2021a) on file with the City of DuPont recommended maintaining at least a 50-foot buffer from the top of steep slopes.*

Proposed Action includes the steps typically used to conserve topsoil on aggregate mines. Topsoil would be stripped and stockpiled as the mining operation advances into the property and topsoil would be replaced as the mined areas are reclaimed following extraction.

Heavy Metals

Past industrial activities have resulted in elevated metals concentrations in portions of the Expansion Area. The Former DuPont Works Site is a clean-up site associated with the historical explosives and commercial munitions facility that operated from 1909 through 1976. The primary contaminants are arsenic and lead in surface soils. Cleanup activities were completed in 1993 to address the highest concentrations of lead, generally found along the foundations of the former buildings. Weyerhaeuser entered a Consent Decree with the Washington State Department of Ecology (Ecology) that required implementation of a restrictive covenant limiting land use on the Former DuPont Works Site to industrial uses, which is the origin of the Manufacturing and Research Park zoning for much of the site.

In addition, the Expansion Area is located within the Tacoma Smelter Plume (TSP) in an area where Ecology predicts concentrations of arsenic in surface soils may range between 40 and 100 parts per million (ppm). Ecology has established cleanup levels for properties within the TSP. The cleanup levels are conservative and support residential use. Ecology's cleanup level for arsenic in soil is 20 ppm and the cleanup level for lead in soil is 250 ppm. For comparison, the United States Environmental Protection Agency (EPA) has established an action level of 230 ppm for arsenic and 500 ppm for lead to guide cleanup decisions in areas near the former smelter. Ecology has pre-approved certain approaches to achieve the established cleanup levels at properties within the TSP. Mixing of impacted surface soils with deeper clean soils is one of the approved approaches under the Final Interim Action Plan

The proposed mining and reclamation activities are intended to serve as a permanent and final remedy for any lead- and arsenic-impacted soils within the Expansion Area. Under the Proposed Action, topsoil within the Expansion Area would be removed to facilitate extraction and would be conserved and maintained on site to be incorporated into the reclaimed mine landscape and support re-vegetation and reclamation of mined areas consistent with the potential subsequent residential land use identified in the City of DuPont Comprehensive Land Use Plan. Stripping, stockpiling, and replacement of topsoil would be completed using methods and procedures that are generally the same as those used in the existing mine area, including employment of BMPs to control erosion and fugitive dust. Samples would be collected from stockpiled topsoil for each mine segment and analyzed in accordance with a Cleanup Action Plan developed for the Pioneer Aggregates South Parcel Project. If the sample results indicate the topsoil does not contain arsenic in concentrations exceeding 20 ppm (the conservative cleanup level established by Ecology for the TSP) or lead in concentrations exceeding 250 ppm, then the topsoil would

be used in reclamation. If the sample results indicate the topsoil contains arsenic in concentrations equal to or greater than 20 ppm, then clean soil would be mixed with the topsoil to reduce the arsenic concentration. Stockpiled topsoil would not be used for reclamation until sample results confirm the concentrations of arsenic and lead meet cleanup criteria.

Geologically Hazardous Areas

The impacts of the Proposed Action relative to landslide and steep slope hazards, and seismic hazards and liquefaction hazards are discussed below (also see **Figure 3.1-5)**. The identified Geologically Hazardous Areas are shown in **Figure 3.1-5** encircled with a bold black line. **Figure 3.1-5** also includes shading to indicate slope angles; shaded areas are not necessarily Geologically Hazardous Areas.

Landslide and Steep Slope Hazardous Areas

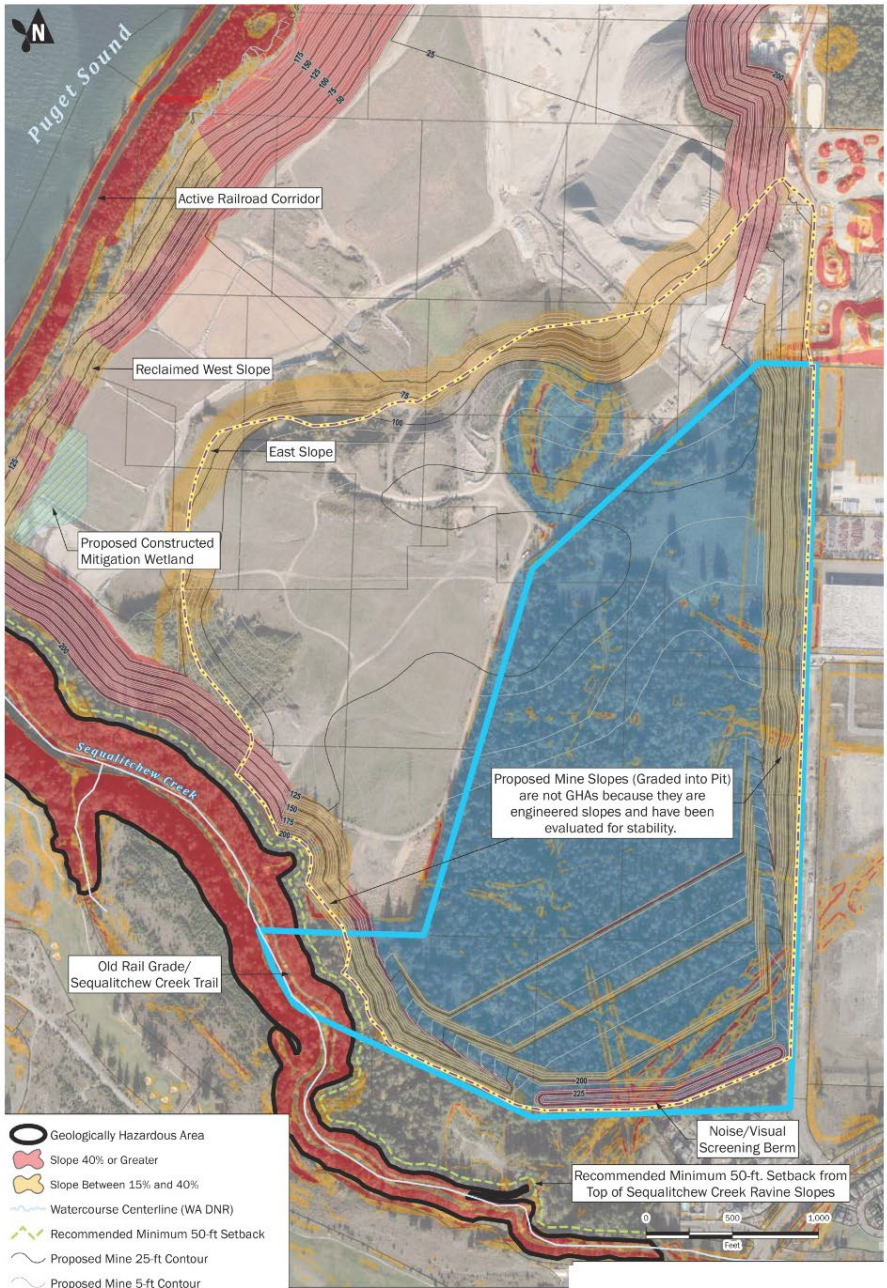
Landslide and steep slope hazards are not present within the site area but are present nearby in the Sequalitchew Creek ravine. The proposed mined slopes would be contoured to drain away from the ravine as shown on **Figure 3.1-5**. The slope stability analysis (see **Appendix B**) determined acceptable factor-of-safety values (greater than 1.5) for each of the profiles in the Expansion Area and Re-Mine Area portions of the site, as shown on **Figure 3.1-4**. Thus, the mined slopes would not be considered landslide or steep slope hazards.

Mining under the Proposed Action would locally reduce seeps and springs that have been observed in the Sequalitchew Creek ravine, as shown on **Figure 3.1-3**, resulting in an improvement in slope stability (see Section 3.5, **Plants and Animals**, for discussion on wetland habitat conditions). The Sequalitchew Creek ravine slope would also have an acceptable Factor of Safety greater than 1.5, as shown on **Figure 3.1-4**.

The hazard mitigations listed in Section 3.1.3, Mitigation Measures are intended to protect landslide and steep slope hazards located outside of, but nearby, the site area.

Erosion Hazardous Areas

The channel migration zone within the Sequalitchew Creek ravine, which is defined as an erosion hazard area, is not anticipated to be impacted by the Proposed Action. The flows from ravine springs would be reduced by the proposed dewatering process which would reduce the potential for channel migration and its associated potential for erosion. Therefore, no significant adverse impacts are anticipated to erosion hazards from the Proposed Action at the site or in adjacent areas.



Source: Aspect, 2022.

EA Engineering, Science, and Technology, Inc., PBC

Figure 3.1-5

Geological Hazardous Areas—Proposed Action

Seismic Hazard Areas

No adverse impacts are anticipated to seismic hazards from mining under the Proposed Action at the site or in adjacent areas. The slope stability analysis for seismic condition shows acceptable factor of safety values (greater than 1.1) in the Expansion Area portion of the site, Re-Mine Area portion of the site, and Sequalitchew Creek ravine.

Topography at the Expansion Area portion of the site would be permanently altered as a result of mining activities. These changes are illustrated by comparing **Figures 3.1-3** and **3.1-5**. The proposed conditions would include finished slopes inclined at 3H:1V (33%) toward the interior of the existing mine (**Figure 3.1-5**). A 20-foot-high soil berm would be constructed with side slopes at 2H:1V (50%) along the south side of the Expansion Area portion of the site.

The proposed finished slopes would be less steep than other areas that have been mined and reclaimed to the west. As within the reclaimed mine areas, the slopes steeper than 40% (up to 50%) and the slopes along the Sequalitchew Creek Trail exceeding 60% are all performing well.

There would be no seismic hazard areas created, as slopes in the Expansion Area portion of the site would be below 40%.

CUMULATIVE IMPACTS

The annual amount of earth moving mining activity with the Proposed Action in combination with mining at the Existing Mine would not exceed existing levels, and cumulative earth impacts associated with mining are not anticipated. In addition, earth-related impacts associated with mining would be temporary in nature and would occur some distance from potential future development that could occur in the vicinity. Therefore, no significant cumulative earth-related impacts from the combination of mining and future development are anticipated.

ALTERNATIVE 2 – NO ACTION

The No Action Alternative includes two scenarios: Scenario A - Continuation of Existing Conditions; and Scenario B - Site Development Under Existing Zoning.

Scenario A

Under Scenario A - Continuation of Existing Conditions, mining activities associated with the Re-Mine Area portion of the site and the Existing Mine would continue as currently permitted. The mining operation would retain a vegetated buffer at its perimeter, and active mining conditions that currently exist would continue. The Existing Mine has an estimated remaining life of 6 to 10 years with mining currently limited to 10 feet above

groundwater. The Expansion Area is assumed to remain undeveloped and would continue in its vegetated condition.

Scenario B

Under Scenario B - Site Development Under Existing Zoning, the proposal would not occur. The site would be developed for urban uses consistent with the City's Future Land Use Map. The majority of the area affected is currently designated by the City of DuPont as Manufacturing/Research, with a portion designated Residential. Mining and reclamation would continue within the currently permitted footprint of the existing mine. The kettle wetland and its buffer would remain undisturbed.

Development of the Expansion Area portion of the site would likely occur over time on one or more individual parcels at a time. As each parcel is developed, it would likely be mostly logged and cleared, then graded and developed consistent with applicable zoning regulations. Logging and clearing along with the development would likely leave a 50-foot buffer along the top of the Sequalitchew Creek ravine, as required under the DuPont Municipal Code, rather than the 100-foot buffer required for the mine under the Settlement Agreement. Topography would be expected to remain relatively flat, with the minor topographic depressions filled to level building sites. Under the existing zoning, a portion of each parcel would need to remain vegetated, either as the existing forest or as landscaped areas.

Clearing would increase the potential for surface erosion during construction; however, standard erosion and sediment control BMPs would reduce adverse impacts. Future development would be required to comply with City of DuPont Sensitive Areas Code, and state and local erosion and sediment control requirements.

Development would also increase the volume of stormwater generated as permeable soils with established vegetation (forest) are replaced with impervious areas (including building roofs and pavement) and landscaped areas. Stormwater would likely be managed through infiltration, which would result in an increased volume of groundwater flow, although the change would likely be minor relative to the groundwater flow in the aquifer.

Individual development of the parcels would not be likely to address the metals-contaminated soils as comprehensively as the Proposed Action. It is more likely that capping would be used as a remedy given the lower cost compared with mixing, as well as consistency with the likely developed condition (e.g., paved parking lots and building footprints). The use of capping, combined with differences in parcel remediation extent and approach as individual parcels are developed separately, would likely prevent lifting of the restrictive covenants from the former DuPont Works site and rezoning of the Manufacturing and Research Park area.

3.1.3 Mitigation Measures

The following mitigation measures have been included in the Proposed Action to reduce impacts on slope stability and erosion (see Section 3.3, **Groundwater**, and Section 3.4, **Surface Water**, for additional discussion and mitigation measures related to surface water and groundwater):

Proposed Mitigation Measures

- A reclamation plan would be prepared and implemented in accordance with the Surface Mining Act (RCW 78.44). The reclamation plan would be submitted to DNR for review and approval prior to mining. Prior review by the City is also required as part of that process.

- Mining would occur in segments; no mass clearing of the Expansion Area portion of the site would occur.

- An erosion and sediment control plan would be prepared and implemented in accordance with the requirements of the City of DuPont Municipal Code (DMC 22.01.180) and the NPDES Sand and Gravel General Permit. Erosion control features would include storm water drainage into the interior of the mine and onsite storm water disposal.

- A vegetated buffer would be maintained between the proposed mine area and the top of steep slopes in accordance with the City of DuPont's Sensitive Areas Code [DMC 25.105.070(2)].

- A 100-foot setback would be maintained from the top of slopes greater than 40% within the Sequalitchew Creek ravine, consistent with the conditions for the existing mine and the 1994 and 2012 Settlement Agreements.

- Earthwork for excavation and reclamation would be in accordance with the federal and state statutes of the Mine Safety and Health Act and the Surface Mining Act.

- Topsoil would be stockpiled and used for reclamation of mined areas. Consistent with the approved Reclamation Plan, Cleanup Action Plan developed for the South Parcel Project and published Ecology guidance, samples would be collected from stockpiled topsoil to confirm arsenic concentrations meet Ecology standards.

- After application of the topsoil, slopes would be re-vegetated by planting with trees and grass. When reclamation is complete, heavy equipment would generally not operate on the reclaimed slopes except for construction or maintenance of pedestrian paths, access roads, utilities, or other permitted facilities.

- The Expansion Area would be cleared in segments corresponding to the mining plan.
- Internal drainage would be maintained during mining.
- Mine slopes would be track-walked to tamp soils and create surface roughness to encourage infiltration of storm water on the slope.
- Mine slopes would be reclaimed with soil amendments and vegetation according to a DNR-approved Reclamation Plan.
- The existing wheel wash, or equivalent equipment, would continue to be used and maintained for vehicles exiting the mine.
- Settling ponds would be constructed upstream of the infiltration ponds.
- Mine slopes would be periodically inspected and repaired or revegetated to reduce erosion or improve surface stability.

3.1.4 Significant Unavoidable Adverse Impacts

The Proposed Action would result in the unavoidable alteration of topography and creation of new slopes. With implementation of proposed mitigation measures, however, no significant unavoidable adverse earth-related impacts are anticipated from the Proposed Action.