GEOTECHNICAL ENGINEERING REPORT

Pioneer Aggregates South Parcel Project

Prepared for: CalPortland

Project No. 040001-018 • March 8, 2021 FINAL

earth + water

Aspect
CONSULTING

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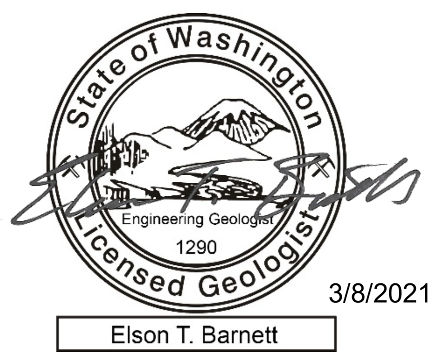

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1 Introduction

Aspect Consulting, LLC (Aspect) prepared this report to present the results of our geological and geotechnical engineering study for the Pioneer Aggregates South Parcel Project (South Parcel Project) proposed by Glacier Northwest, Inc. dba CalPortland. Our recommendations are based on the current grading, mining, and drainage plans proposed for the South Parcel Project in the "Pioneer Aggregates South Parcel Project Engineering Plan Set" (Aspect, 2021a).

The South Parcel Project area is located within the existing mine and on the previously unmined lands just southeast of the existing mine in the City of DuPont in southwestern Pierce County, Sections 22, 23, 26, and 27, Township 19 North, Range 1 East of the Willamette Meridian (see Figure 1). The South Parcel Project area is bordered to the northwest by the existing mine; to the east by Joint Base Lewis-McChord (JBLM), an Intel facility, Westblock Pacific, and other industrial/distribution facilities; and to the south by Sequalitchew Creek. The mine expansion includes several parcels, collectively known as the South Parcel, that are owned by Weyerhaeuser and leased to CalPortland. Figure 2 shows the site layout.

1.1 Purpose and Scope

The purpose of this study was to provide geotechnical analysis of the proposed final grading of the South Parcel Project, and to provide geotechnical design recommendations to be utilized in development. This study does not address temporary slopes related to active mining at the site.

Our study included a review of available literature and studies related to the South Parcel Project area and a site reconnaissance to view natural slope and cut slope behavior. Geologic data were utilized to assess the type, thickness, distribution and physical properties of the subsurface sediments, and groundwater conditions. Engineering studies were completed to determine the stability of proposed permanent cut slopes under static and seismic conditions, suitable cut slope angles, and drainage considerations. This report summarizes our current work related to the proposed grading and provides development recommendations based on our present understanding of the South Parcel Project.

2 Project Description

The South Parcel Project includes horizontal expansion of mining into approximately 188 acres previously undisturbed by mining (termed the Expansion Area), and vertical expansion of approximately 125 acres where re-mining will deepen a portion of the existing mine (termed the Re-Mine Area). The South Parcel Project would extend mining at the current rate for approximately 14 additional years.

The South Parcel Project is located within a Mineral Resource Overlay applied by the City of DuPont's Comprehensive Plan. The purpose of the overlay is to conserve mineral resources of long-term commercial significance, as required by the Growth Management Act.

Mining would involve six primary activities: logging; clearing and topsoil removal; groundwater management; mining; processing and transport; and reclamation. These activities would overlap, with multiple occurring at any one time.

The existing topography and proposed final grades are shown on Figure 2. At the completion of mining, cut slopes within the South Parcel Project will lie at a maximum angle of about 3H:1V (horizontal to vertical). Along the toe of the mining cut slope along the eastern edge of the Expansion Area, regional groundwater will be slightly above the base of the excavation. Provisions for safe handling of seepage will be accomplished as described in the following section. Restoration of the final slopes will include addition of a topsoil and mulch layer to support final erosion control and revegetation.

The southeast corner of the Expansion Area will be graded into a series of gently sloping benches separated by 3H:1V cut slopes. The benches and all but the lowest cut slope will be designed to lie above the regional groundwater table.

A temporary noise berm would be constructed along a portion of the southern boundary of the Expansion Area. The fill berm will be constructed at a maximum 2H:1V slope angle using standard construction and geotechnical engineering practices for fill slopes, as specified in Section 4 of this report. The berm would remain on site throughout mining, then be regraded to support future site uses. The temporary noise berm would be roughly 1,500 feet long by 20 feet high and setback from the property boundary by at least 20 feet. The berm would be constructed of overburden, reclamation materials, and other materials available on site.

2.1 Groundwater Management

An existing aquifer is present in the sands and gravels to be mined in the South Parcel Project. Wells will be installed and pumped in advance of mining to intercept groundwater and dry out the gravels for mining. A mining trough will be utilized to minimize the amount of time required for active dewatering by pumping wells. Once mining of each section of each trough is completed, the adjacent wells can be turned off, allowing groundwater to passively seep from the stable mine slope and flow by gravity to an infiltration facility on the floor of the existing mine. After mining the trough along the perimeter, gravel will be extracted from the interior area.

The groundwater management plan is presented in more detail in the "South Parcel Monitoring Plan" (Aspect, 2017).

2.2 Mining

Mining activities would begin near the existing processing plant then proceed to the south along the east side of the Expansion Area once groundwater monitoring parameters are within established criteria, as described in the Mining Plan included in the Pioneer Aggregates South Parcel Project Engineering Plan Set" (Aspect, 2021a). No mining is proposed within 100 feet of the top of slope of the Sequalitchew Creek ravine.

2.3 Reclamation

Reclamation includes grading of mined slopes, replacement of topsoil, revegetation, and monitoring to ensure vegetation is established and other reclamation goals are met. The reclamation plan calls for some mined areas to be covered with fine soil material, mixed with excess sand, gravel, and overburden, and then capped with topsoil that is stored on site. Plantings would include mixtures of trees, shrubs, and grasses. Finished grades are designed to anticipate long-term future use of the land, based on City of DuPont zoning designations, and reclamation requirements.

3 Geologic Setting and Site Conditions

3.1 Regional Geologic Setting

Geologic nomenclature in this report is primarily based on Borden and Troost (2001) and Walsh et. al. (2003), which provide the most recent comprehensive regional understanding of Pleistocene stratigraphy in the south-central Puget Sound Lowland. We also reference other nomenclature where previous studies use a different name for the same or similar geologic units.

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 geologists have identified deposits from a number of these pre-Vashon glacial and non-glacial periods in the Puget Lowland (Borden and Troost, 2001).

During the southward advance of the Vashon ice sheet, ice blocked the normal northward drainage of water from the Puget Sound Lowland, creating a pro-glacial 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 and 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 (commonly described as lodgment till in older studies) was deposited where the glacial ice sheet contacted previously deposited sediment.

The Vashon ice sheet was short lived in the lowland and the 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) on the geologic map and profiles. 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 (jökulhlaups) released the glacially impounded water in Glacial Lake Puyallup (Troost, 2007; and Troost and Sofield, 2011). 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 area of the South Parcel, 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” in this document and other recent documents on the area (and was called the “Kitsap cutoff” in some older reports). The location of the Olympia Beds Truncation (Figure 2 in the “Preliminary Stormwater Management Report” [Aspect, 2021b]) is a key geologic and hydrologic feature at the Expansion Area.

3.2 Site Geologic Setting

Geologic units of glacial and non-glacial origin were deposited at the project vicinity before, during, and after the Vashon glaciation. The surface geology of the South Parcel Project area consists primarily of Vashon-age recessional sand and gravel locally known as Steilacoom Gravel. This 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 and are observed in borings. They are termed the Olympia beds since being age-dated by Troost (Borden and Troost, 2001). Strata now known as Olympia beds were previously included within the informally named Kitsap formation (Walters and Kimmel, 1968).

Older unnamed glacial and non-glacial deposits lie below the Olympia beds. These are identified as pre-Olympia non-glacial deposits (Qpon), second pre-Olympia glacial deposits (Qpog2), and second pre-Olympia non-glacial deposits (Qpon2).

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 Qvr on the geologic map. The proposed mining of the South Parcel Project will occur within the Steilacoom Gravel and is the same geologic unit currently being mined in the existing mine area.

After the end of the Vashon glaciation, non-glacial conditions resumed in the area of the Site. 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.

3.3 Site Reconnaissance and Subsurface Explorations

A site reconnaissance was conducted on November 1, 2019. The reconnaissance focused on examining the areas upslope of Sequalitchew Creek for indications of springs, seepage, and instability. Slopes within the existing pit were also evaluated for seeps and springs, and the general nature of the soils exposed in natural and man-made cuts. Natural and mined slope angles were measured and the behavior of historical mine slopes on the active and reclaimed mine slopes in the vicinity were examined. We also looked for evidence of concentrated surface water on the uplands of the Expansion Area and made general observations of surficial soil types. Areas of suspected former borrow pits on the slopes along the shoreline were examined to confirm that existing topography is the result of past mining activities and not natural slope instability.

Field observations were noted on a topographic map, and locations of specific features were recorded with a field GPS for plotting on topographic base maps. Results of the reconnaissance (including observations of hydrology, geology, and slope stability) are incorporated in subsequent sections of this report.

Figure 3 shows the existing subsurface information at the Site from previous reports and investigation efforts, which were used to inform this study. No subsurface explorations were conducted specifically for this study. Logs of previous borings and wells are provided in Appendix A.

3.4 Site Subsurface Conditions

Subsurface conditions were inferred from review of the existing soil boring and well logs (Appendix A), published geologic data and maps, and our geological reconnaissance. Based on the available information, the inferred geologic units at the Site are described below.

3.4.1 Topsoil

Topsoil, including up to several inches of forest duff (organic debris), is present in the Expansion Area. The duff layer is primarily present within upland forested areas. The Expansion Area is vegetated with conifer and deciduous trees that will be cleared. The Re-Mine Area has been previously cleared and is vegetated with shrubs and grasses. Topsoil is generally not present in the Re-Mine Area.

3.4.2 Colluvium

Colluvium consists of the surficial soil materials that have been transported down a slope by gravity. Colluvium is present in the upper 1 to 2 feet of the forest soils on the steep slope along the shoreline, outside of the South Parcel Project. Colluvium generally consisted of a sand and gravel mixture derived from the underlying intact soil unit, with minor amounts of organic material. Colluvium is typically loose and may contain variable amounts of silt in some places.

3.4.3 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 of the Vashon Recessional Outwash (Qvr) deposit. Soils from the Steilacoom Gravel account for most, if not all, of the soils that will be excavated during mining operations. This soil consists of sandy gravel and gravelly sand with minor amounts of silt, ranging between 2 and 6 percent. Where exposed in the adjacent working mine slopes and on road cuts in the active areas of the existing mine, this unit often has a relatively open matrix between gravel clasts. In other areas, the interstices are filled with sand.

This unit 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 apparently resulting from silt and clay binding and slight iron oxide cementation at the grain contacts. This cohesion 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.

3.4.4 Olympia Beds

The Olympia Bed (Qob) deposits were observed 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 to 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.

3.4.5 Groundwater

Surficial Site soils are generally highly transmissive to water. Stormwater will tend to infiltrate into natural surfaces rather than collect as runoff. The Steilacoom Gravel is generally highly transmissive to groundwater flow and stormwater will infiltrate until it encounters the regional groundwater table, or until it encounters a silty interbed that locally perches groundwater.

More detail regarding the groundwater conditions can be found in the "Groundwater Model Updated DuPont Mine South Parcel Expansion Area" (Aspect, 2017).

3.5 Existing Slope Conditions

To evaluate the stability of the slopes in their existing condition, we measured the naturally occurring slope angles, noted the angle of cut slopes that have historically performed well, and looked for indications of past slope instability. Two areas were evaluated, both of which are outside of the South Parcel Project: the west-facing steep slopes that descend toward a BNSF railroad embankment and Puget Sound, and the south-facing slopes of the Sequalitchew Creek ravine.

3.5.1 Steep Slopes West of the South Parcel Project

Steep slopes occur along the west-facing slopes of the bluff above Puget Sound, then level off at the BNSF railroad embankment. Slope angles of approximately 60 to 70 percent appear to be the natural configurations for these soils. Slopes greater that 70 percent exhibit raveling and small, surficial failures. Slopes as steep as 80 percent were observed only in constructed cut-and-fill areas along the shoreline and are likely near the upper limit of stability for this area and in these soils.

Small, shallow surface failures were observed in several locations on the steep slopes upslope of the BNSF railroad embankment. The majority of the observed slide features are stormwater-induced raveling features, shallow colluvial sloughing, and shallow rotational failures typically less than 4 feet deep and involving less than 100 cubic yards of material. No indications of deep rotational landslides were observed on the natural slopes.

Slopes in the existing mine to the north of the South Parcel Project were observed to determine the range of slope angles that will stand under temporary conditions, such as during mining and before reclamation. Temporary mine slopes in the clean sand and gravel were noted to stand vertically but more typically stood at 75 degrees. Loose sand and gravel that had raveled from the cuts stood at 35 degrees. No reports of mine slope or natural ravine slope failures were noted in the area after the 2001 Nisqually earthquake.

3.5.2 Steep Slopes South of the South Parcel Project

The steep slopes of the Sequalitchew Creek ravine are south of the existing mine and South Parcel Project. These slopes run westward for about 1.5 miles down to the creek confluence with Puget Sound. A small portion of the Sequalitchew Creek ravine is located within the South Parcel property boundary, but outside the South Parcel Project. The ravine is about 10 feet deep near the east edge of the South Parcel to approximately 100 feet deep in the west edge of the South Parcel. The ravine deepens to approximately 175 feet at its mouth. The south-facing slopes in the ravine range from approximately 30 to 75 percent.

Perennial groundwater seeps are present along the ravine’s north slope in at least two locations, as shown in Figure 2 of the “Critical Areas Report” (Anchor and Aspect, 2021). 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.

During the site visit of the north Sequalitchew Creek ravine slope on November 1, 2019, no indications of recent or imminent slope movement or erosion were observed on native ravine slopes. The south-facing slopes are densely forested with mature conifers and deciduous trees that were 1 to 3 feet in diameter at breast height. The trees were generally straight in vertical growth position, suggesting that there has been no slope movement during the several decades of their lifetime. No reports of steep ravine-slope failures were noted in the area after the 2001 Nisqually earthquake.

The steep slopes south of the South Parcel Project are not expected to be negatively impacted by the mining activities.

3.6 Seismic Considerations

The proposed South Parcel Project will comply with the design requirements of the International Building Code (IBC) (ICC, 2015).

3.6.1 Seismic Hazards

The Puget Sound area is known to be seismically active, with the primary seismic hazard coming from three sources: subduction zone, intraslab, and shallow crustal earthquakes.

Subduction zone earthquakes occur when the interface between the North American tectonic plate and the subducting Juan de Fuca plate ruptures. These events are likely to have magnitudes of up to 9, but the distance to the rupture zone would reduce the intensity of shaking at the Site, although shaking could last several minutes.

Intraslab earthquakes occur due to tensional rupture within the subducting Juan de Fuca plate at depths of 45 to 60 kilometers (30 to 35 miles). This is the source of the region's largest recent earthquakes and has the potential to produce magnitude 7.5 events. Although these earthquakes occur every few decades, the depth to the epicenter protects the Puget Sound population from more significant shaking and damage.

Shallow crustal earthquakes occur on shallow faults within the Puget Sound region due to tectonic stresses. Several minor earthquakes occur in the region each year, most of which are not even felt. However, some of the shallow faults are capable of producing significant, damaging earthquakes. These include the Seattle fault zone, located approximately 30 miles north of the South Parcel Project area, and the Tacoma fault zone located approximately 15 miles north of the South Parcel Project area. Both of these faults are known to be active, meaning they have ruptured and produced significant earthquakes within the Holocene Epoch (the last 10,000 years) and are interpreted to be capable of rupturing again.

Other regional faults which are not yet well understood but are believed to have been active in the Quaternary Period (the last 2 million years) include the Olympia fault, located about 10 miles southwest of the South Parcel Project area, and the Hood Canal fault zone, located approximately 30 miles northwest of the South Parcel Project area.

The combined risks of all of these potential seismic sources are incorporated into the ground surface accelerations values that are used in slope stability analyses.

3.6.2 Seismic Design Parameters

The IBC seismic design is based on the "Maximum Considered Earthquake (MCE)" with a 2 percent probability of exceedance (PE) in 50 years (2,475-year return period) (ICC, 2015). Based on the subsurface conditions documented in explorations near the South Parcel Project area we recommend that the Site be considered a Site Class D. The MCE seismic design parameters taken from the U.S. Geological Survey and adjusted for Site Class D are presented in the table below (ASCE, 2018).

Table 1. Seismic Design Parameters

Design Parameter	Recommended Value
Site Class	D
Peak Ground Acceleration (PGA)	0.527g(1)
Short Period Spectral Acceleration (S_s)	1.373g
1-Second Period Spectral Acceleration (S_1)	0.487g
Site Coefficient (F_a)	1.000
Site Coefficient (F_v)	1.813
Peak Ground Acceleration Adjusted for Site Class (A_s)	0.580g
Design Short Period Spectral Acceleration (S_{DS})	0.915g
Design 1-Second Period Spectral Acceleration (S_{D1})	0.883g

Notes:

1. G = Gravitational force
2. Based on the latitude and longitude of the Site: 47.111528°N, 122.649022°W World Geodetic System 1984 (WGS84)
3. The risk category used was III

3.6.3 *PGA Reduction for Wave Scattering*

The peak average acceleration of a sliding mass, such as an embankment slope, is a fraction of the site-adjusted PGA (Table 1) due to seismic wave scattering, represented as a wave scattering reduction factor. The wave scattering reduction factor, α, is dependent on the height of the subject slope and the 1-Second Period Spectral Acceleration, S_1 value (Table 1).

We determined the wave scattering reduction factor using the methodology presented by the Federal Highway Administration (FHWA) for the South Parcel Project area (FHWA, 2011). The wave scattering reduction factors and subsequent reduced PGA values for use in slopes stability analyses are presented below in Table 2 for cross sections A-A' through D-D' (Figures 3 and 4).

Table 2. Wave Scattering Reduced PGA

Cross Section	α, wave scattering reduction factor	Reduced PGA Due to Wave Scattering
A-A'	0.857	0.497g
B-B'	0.833	0.483g
C-C'	1.000	0.580g
D-D'	0.749	0.434g

3.6.4 Liquefaction Hazard

Liquefaction occurs when loose, saturated, and relatively cohesionless soil deposits temporarily lose strength from seismic shaking. The primary factors controlling the onset of liquefaction include intensity and duration of strong ground motion, characteristics of subsurface soil, in situ stress conditions, and the depth to groundwater.

Based on the density of the soils and thorough review of groundwater conditions and fluctuations, the South Parcel Project area is not susceptible to liquefaction during a seismic event.

4 Engineering Evaluations

4.1 Slope Stability Analyses

The static and seismic stability of proposed cut slopes of the South Parcel Project was analyzed using the two-dimensional, limit-equilibrium slope stability software program Slide by RocScience and stratigraphy and proposed 3H:1V grading shown on cross section A-A' through D-D'. The locations where stability analyses were performed are shown on Figures 3 and 4 and were selected as being representative of critical permanent slope configurations. The slope stability results are presented in Appendix B.

The stability analysis software program performs slope stability computations based on the modeled slope conditions, and calculates a factor of safety against slope failure, FOS, defined as:

$$FOS = s/\tau$$

where "s" is the available shear strength of the soil and "τ" is the shear stress generated from gravitational forces acting on the slope mass. A "just-stable" equilibrium condition would result in a FOS of 1.0, while an unstable condition would result in a FOS less than 1.0, implying failure is imminent or is already occurring.

For static and seismic conditions, FOS of 1.5 and 1.1, respectively, are the recommended minimums for permanent slopes that could affect adjacent structures and property.

4.1.1 Soil Properties and Strength Parameters

Soil properties and strength parameters used in the static slope stability analysis were selected based on our review of logs of explorations at the Site, observations of natural and constructed cut slope performance at the Site, and our engineering judgement. We conservatively assumed the slopes will not be vegetated for some time after grading. Once vegetation is established, root reinforcement is generally expected to increase slope stability.

Soil properties and strength parameters used in seismic slope stability analysis were further modified using a back-calculation methodology based on Site slope performance after the 2001 Nisqually earthquake. The back-calculation method uses the observation that the Site slope soils were strong enough to withstand the level of shaking recorded from the 2001 Nisqually earthquake without resulting in widespread slope stability failures. In our opinion, the values selected for analysis as shown in Table 3 below are conservative.

Table 3. Summary of Soil Properties Used in Slope Stability Analyses

Soil Unit	Total Unit Weight (pcf)	Strength Parameters	
		Friction Angle (degrees)	Cohesion (psf)
Steilacoom Gravel (Qs)	115	35	100
Olympia Beds (Qob)	130	35	400

Notes:
pcf = pounds per cubic foot
psf = pounds per square foot.

4.1.2 Groundwater Levels

Groundwater levels considered in the slope stability analysis were based on the conditions described in the "Groundwater Model Updated DuPont Mine South Parcel Expansion Area" (Aspect, 2017). Groundwater levels assumed in our slope stability analyses are illustrated in Appendix B.

4.1.3 Seismic Input Parameters

A lateral gravitational constant equal to one-half of the PGA reduced for wave scattering (Table 2) was input to the seismic condition slope stability analysis. Slopes or portions of slopes exhibiting FOS of 1.1 or greater under these conditions could expect to undergo minor lateral deformations as a result of a strong earthquake.

4.1.4 Slope Stability Analysis Results

Slope stability results considering the conditions and assumptions presented above are presented in Table 4 below. The results are presented graphically in Appendix B.

Table 4. Summary of Factor of Safety Values for Slope Stability Analysis Results

Profile	Static (1)	Seismic (2)
A-A’	2.53	1.19
B-B’	1.69	1.17
C-C’	2.01	1.14
D-D’	2.92	1.30

Notes:
1. Limit equilibrium minimum factor of safety found using Spencer’s method in SLIDE
2. Pseudostatic seismic analysis with a reduced PGA due to wave scattering from Table 2

Section A-A’

Figures B-1 and B-2 present the slope stability analysis results for the static and seismic conditions along Section A-A’ extending to Sequalitchew Creek to the southwest of the South Parcel Project. Our analysis results indicate static and seismic condition slope stability for the proposed graded slope satisfies the recommend stability criteria.

We qualitatively evaluated the impact of the proposed grading on the existing southwest-facing slope above Sequalitchew Creek. No grading or modification is planned for this slope. Based on our analysis, the proposed grading of the northeast-facing slope along Section A-A’ will not impact the stability of the existing southwest-facing slope, nor vice versa.

Section B-B’

Figures B-3 and B-4 present the slope stability analysis results for the static and seismic conditions along Section B-B’ extending through the east side of the South Parcel Project toward existing warehouse buildings off site to the east. Our analysis results indicate static and seismic condition slope stability for the proposed graded slope satisfies the recommend stability criteria.

Section C-C’

Figures B-5 and B-6 present the slope stability analysis results for the static and seismic conditions along Section C-C’ extending through the south east side of the South Parcel Project. Our analysis results indicate static and seismic condition slope stability for the proposed graded slope satisfies the recommend stability criteria.

Section D-D’

Figures B-7 and B-8 present the slope stability analysis results for the static and seismic conditions along Section D-D’ extending through the northwest side of the South Parcel Project. Our analysis results indicate static and seismic condition slope stability for the proposed graded slope satisfies the recommend stability criteria.

4.2 Erosion Hazards and Mitigation

Due to their generally coarse-grained nature and good infiltration characteristics, the soils in the South Parcel Project 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 stormwater management techniques in place, even these conditions are unlikely to result in significant erosion of the coarse soils. The main area of the South Parcel Project potentially susceptible to erosion is the placement of loose topsoil for re-vegetation on the final cut slopes.

The proposed mine will be excavated as a closed depression and all surface runoff will drain internally. Therefore, erosion does not have the potential to cause harm to 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 activities included in the “Pioneer Aggregates South Parcel Project Engineering Plan Set” (Aspect, 2021a) includes erosion control Best Management Practices (BMPs) that will reduce potential for off-site transport of sediment.

To reduce the risk for erosion impacts to the Sequalitchew Creek ravine slopes south of the South Parcel Project area, and in general accordance with DMC 25.105.070(2) (City of DuPont, 2021), we recommend to maintain at least a 50-foot buffer from the top of steep slopes. Consistent with the 2012 Settlement Agreement, the project includes a 100-foot buffer along the top of the slope along the Sequalitchew Creek ravine. The 100-foot buffer provides ample protection for erosion of steep slopes.

4.3 Site Preparation

4.3.1 Stripping and Grubbing

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 saleable materials extracted from the mine.

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

4.3.2 Permanent Slopes

Large, permanent slopes along the periphery of the South Parcel Project are planned for a slope of 3H:1V, as described in Slope Stability Analysis Results (Section 4.1.4) above. In addition, the temporary berm along the southern boundary is planned to have 2H:1V side slopes. Slightly steeper slopes will generally not create a gross slope stability problem but will require maintenance and adjustment as the soils ravel. This raveling will need to be minimized by slope replanting.

In cut slope areas where the fine-grained sediments of the Olympia Beds (Qob) are at or near the base of the excavation, a zone of seepage emergence is expected on the face of the slope. To maintain a stable face, a surface treatment must be constructed on the seepage face. The system must freely allow the discharge of seepage while maintaining pressure on the natural soils to confine them in place.

We recommend use of a two-layered aggregate system. The first layer shall be an 8-inch thick layer of fine gravel/coarse sand designed to prevent movement of the native soils. The filter layer properties shall be determined in the field based on the properties of the exposed native soil and the following equations:

$$D50_{filter} \leq 25 * D50_{native}$$
$$D15_{filter} \leq 5 * D85_{native}$$

The second layer shall be 16 inches of clean, coarse aggregate (medium gravel to cobbles) to provide weight and armor against surface flows. The total depth of materials would be 24 inches at a minimum and provide a minimum of 100 pounds per square foot of area. Planting media can be placed on top of the gravel to aid in creating some of the wet planting area desired for wetland mitigation. On mid-slope areas, a similar system shall be used where localized seepage spots are encountered. After fully covering the actual seepage zones, the gravel and planting media shall extend a minimum of 5 feet beyond the confined area. Extension of this slope treatment farther down the slope may be appropriate where the quantity of seepage could create erosion problems on the slope.

4.4 Site Suitability for Infiltration

Infiltration ponds are proposed for long-term management of stormwater. The infiltration ponds are located in the existing mine, west of the Olympia Bed truncation (i.e., Kitsap cutoff) at an approximate elevation of 25 feet (see Figure 2 in the "Preliminary Stormwater Management Report" [Aspect, 2021b]).

The infiltration properties of soils in the pond areas were estimated using the methodology provided in Volume III, Chapter 3.3.6, Section 3 of the *Stormwater Management Manual for Western Washington* (Ecology, 2019). This methodology relates infiltration rates to the grain-size characteristics of the soil. Grain-size information was obtained from CalPortland's gridded borings at the location and depth closest to the proposed pond locations (Lonestar Northwest, 1989). Data from the two borings closest to each infiltration pond, in the 168- to 188-foot depth range (which corresponds to the soils below the bottom of the infiltration ponds) were used to estimate infiltration rates. Conservative correction factors of CFv = 0.33, CFt = 0.40, and CFm = 0.9 were applied.

The long-term infiltration rates corresponding with these grain-size results are 8.2, 8.1, and 8.2 inches per hour for Ponds C, D, and E, respectively.

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Limitations

Work for this project was performed for CalPortland (Client), and this report was prepared consistent with recognized standards of professionals in the same locality and involving similar conditions, at the time the work was performed. No other warranty, expressed or implied, is made by Aspect Consulting, LLC (Aspect).

Recommendations presented herein are based on our interpretation of site conditions, geotechnical engineering calculations, and judgment in accordance with our mutually agreed-upon scope of work. Our recommendations are unique and specific to the project, site, and Client. Application of this report for any purpose other than the project should be done only after consultation with Aspect.

Variations may exist between the soil and groundwater conditions reported and those actually underlying the site. The nature and extent of such soil variations may change over time and may not be evident before construction begins. If any soil conditions are encountered at the site that are different from those described in this report, Aspect should be notified immediately to review the applicability of our recommendations.

Risks are inherent with any site involving slopes and no recommendations, geologic analysis, or engineering design can assure slope stability. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the Client.

It is the Client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, and agents, are made aware of this report in its entirety. If project developments result in changes from the preliminary project information, Aspect should be contacted to determine if our recommendations contained in this report should be revised and/or expanded upon.

The scope of work does not include services related to construction safety precautions. Site safety is typically the responsibility of the contractor, and our recommendations are not intended to direct the contractor’s site safety methods, techniques, sequences, or procedures. The scope of our work also does not include the assessment of environmental characteristics, particularly those involving potentially hazardous substances in soil or groundwater.

All reports prepared by Aspect for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect. Aspect’s original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Please refer to Appendix C titled “Report Limitations and Guidelines for Use” for additional information governing the use of this report.

We appreciate the opportunity to perform these services. If you have any questions please call Owen Reese, Principal Water Resource Engineer, 206.838.5844.

FIGURES

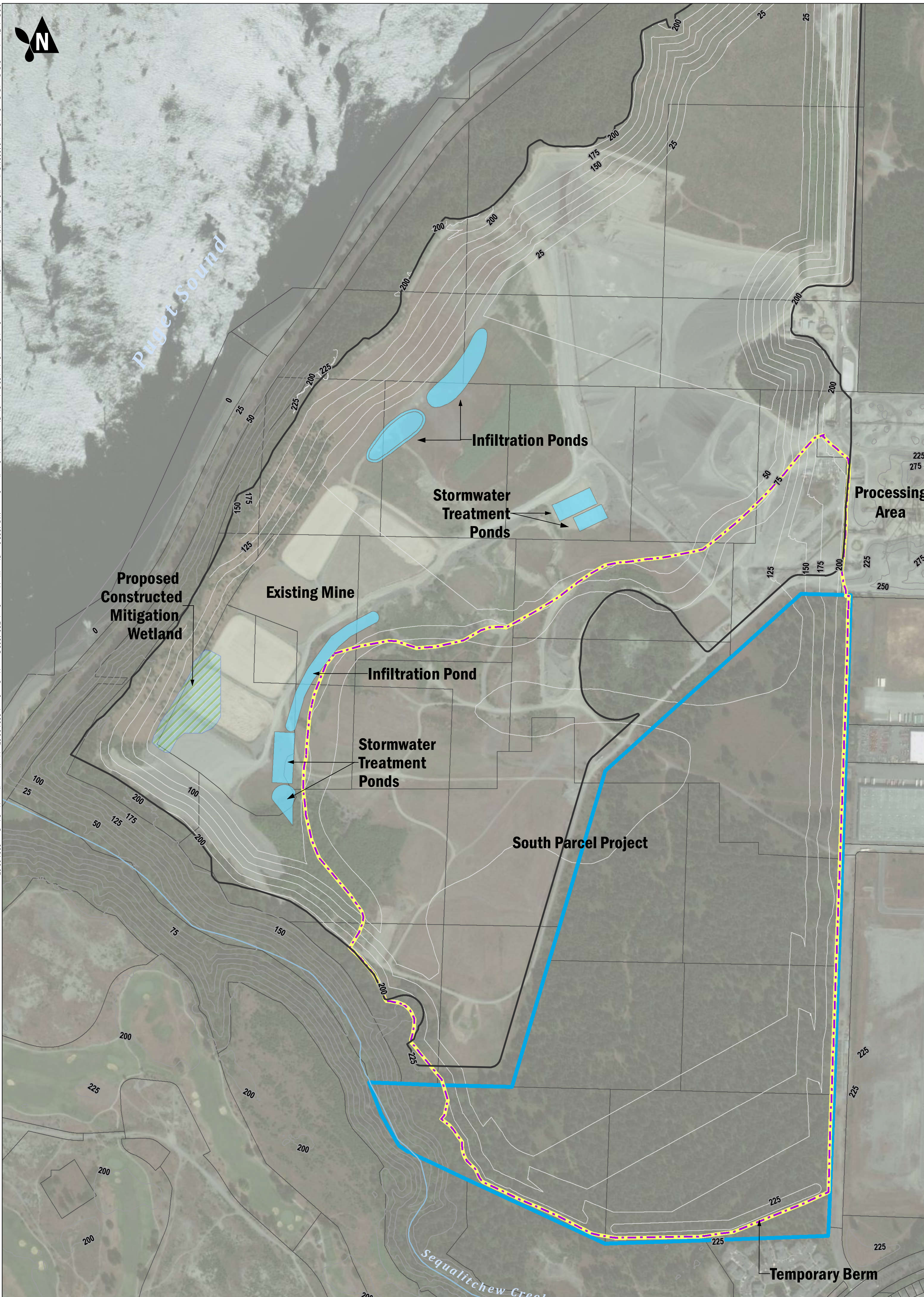
Vicinity Map

Pioneer Aggregates South Parcel Project
CalPortland
DuPont, Washington

Aspect CONSULTING	FEB-2021	BY: ETB / WEG	FIGURE NO.
	PROJECT NO. 040001-018	REVISED BY: SBM	1

Basemap Layer Credits | | Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

GIS Path: T:\projects_8\DuPont\DuPontSouthParcel_040001\Delivered\SouthParcelMineExpansion\Pioneer Aggregates South Parcel Project\01 Vicinity Map.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 2021-02-18 || User: trullen || Print Date: 2021-02-18



- Existing Mine Limit
- Ponds
- South Parcel
- Proposed Constructed Mitigation Wetland
- South Parcel Project Area
- Pierce County Tax Parcel
- 25-ft. Contour (Pierce County LiDAR, 2011)
- Proposed Mine 25-ft Contour

0 600 1,200

Feet

Project Site Plan

Pioneer Aggregates South Parcel Project
CalPortland
DuPont, Washington

Aspect CONSULTING	MAR-2021	BY: ETB / WEG	FIGURE NO. 2
	PROJECT NO. 040001-18	REVISED BY: - - -	

Basemap Layer Credits || Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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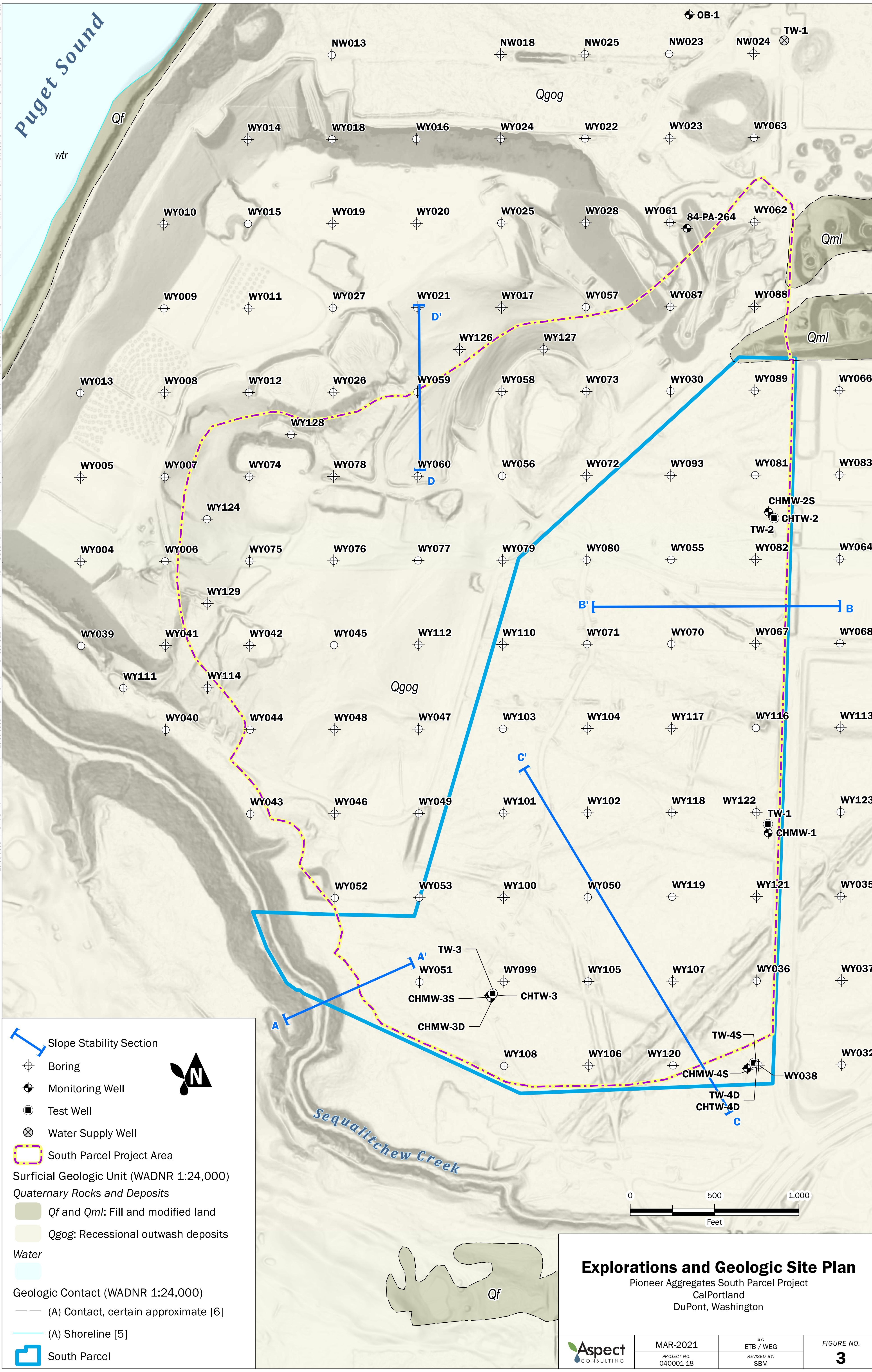


Explorations and Geologic Site Plan

Pioneer Aggregates South Parcel Project
CalPortland
DuPont, Washington

Aspect CONSULTING	MAR-2021	BY: ETB / WEG	FIGURE NO. 3
	PROJECT NO. 040001-18	REVISED BY: SBM	

Slope Stability Sections
Proposed Conditions

Pioneer Aggregates South Parcel Project
CalPortland
DuPont, Washington

Aspect CONSULTING	MAR-2021	BY: CRS / WEG	FIGURE NO.
	PROJECT NO. 040001-18	REVISED BY: - - -	4

Basemap Layer Credits || Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

GIS Path: T:\projects_8\DuPont\DuPontSouthParcel_040001\Delivered\SouthParcelMineExpansion\Pioneer Aggregates South Parcel Project\04 Slope Stability Sections.mxd || Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet || Date Saved: 2021-03-07 || User: trullen || Print Date: 2021-03-07

APPENDIX A

Boring and Well Logs

LONE STAR NORTHWEST

DUPONT PROJECT

1-24-89 - Coordinated

Boring: L.S.W.Y. 051

Boring Location: N 655500 E 464500

Ground Elevation: 216

Elevation Water Table: 215 - 50 = 165'? (saturated zone)
Coordinate at S.L. 2-20-89

Date Drill: Dec. 14, 1988
Began drilling 11:

Sampled by:

Depth	Strata	Sample Interval	Description/Drilling Notes
			Sandy gravel, gravel co to mostly fn (2" max), silt coated,
5			subround to round, few broken, 60 to 70%, sand co to md, loose;
			Top 1' organic, dark brown, below 1' slightly organic, md brown
		8	Below 8' coarser intervals with some +2½" gravel
10			content higher (65 to 75%) organics reduced
15			
		18	
20			Gravel co to mostly fn (avg ±5/8"), silt coated, 60 to 70%
			sand mostly md; occasional oversize or small cobble
25			Sand content increasing, becoming silty
		28	28' moisture increasing
30			Gravel coarsing, 65 to 75%, sand coarser
35			
	Recessional	38	
40			Gravel co to fn, heavy silt coating, 60 to 70%
			few oversize, sand co to md, loose, wet to
45			slightly soupy in intervals -
			Interval gravel fn, 70 to 80%
		48	48' Gravelly sand, sand co to fn, 60 to 70%, gravel mostly fn
50			50 - Saturated, soupy sand, silty
		54	
55	- - -		54 Sandy gravel, gravel co to fn, sticky silt coated
			70 to 80%, sand md, loose, saturated, brown - heavy volcanics
		58	
60	VR Reworked Kitsap?		59 - Gravelly sand, sand md to fn, 50 to 60%, gravel co to fn,
			slightly silty, soupy, saturated, brown
65			63 Sandy gravel, gravel co to fn, 70 to 80%, sand mostly md

LONE STAR NORTHWEST
DUPONT PROJECT

Boring: L.S.WY 051

Boring Location: N 655500 E 464500

Ground Elevation: 216

Elevation Water Table:

Date Drill: Dec. 14, 1988

Finished drilling 1:10 P.M.

Sampled by:

216
72
134

Depth	Strata	Sample Interval	Description/Drilling Notes
			Below 65' reworked Kitsap
144 el. 70	- Kitsap - 144	72	70 - Few gray silt silt balls, gravel co to fn. 65 to 25%.
			72' - Silt, gray with co to fn gravel interbeds -
			Kitsap v. moist to wet, med. dense.
72			
216 78 138		78	

LONE STAR NORTHWEST
DUPONT PROJECT

Boring: L.S.W.Y 067

Ground Elevation: 206

Date Drill: Jan 9-10, 1989

Started drilling 3:55 P.M

Boring Location: N 657500 E 466500

Elevation Water Table: [illegible] 188'
Caved in at 9.5' 2-21-89

Sampled by:

Stopped @ 28' 1/9/89
lost ± 45 min, getting drill unstuck when moving out

Depth	Strata	Sample Interval	Description/Drilling Notes
			Sandy gravel, gravel co to mostly fn (<3/4"), subround to
5			round, slightly silt coated, 60 to 70%; sand md to fn,
			loose, moist; Top 1' organic, dark brown, below 1' md dk brown
		8	One cobble at 7'
10			Below 8' gravel co to fn, silt coated 60 to 70%, oversize fairly common, 5 to
			10%, sand md, loose, grayish brown
15			
			At 16' moisture increasing
		18	18' water return - groundwater, gr effluent light brown
20			Gravel co to fn, 65 to 75%, 5 to 10% oversize,
			sand co to md, loose, saturated, gray brown 18 to 20
25			below 20 brown
			"Fill" Zone
		28	
30	√s		28 Sandy gravel, gravel co to mostly fn, interbeds
			coarse more common, 60 to 70%; sand md, some
35			sand interbed (slightly soupy) few oversize, md dense
			saturated brownish-gray; some gravel stained & oxidized
		38	
40			Same as above with stained and oxidized gravel more
			~~fairly~~ common, intervals sand co to md
45			
			Sand content increasing, gravel finer below 46'
		48	
50			Gravel co to fn ~~60 to 70%~~ 50 to 60%, no oversize, sand mostly
		52	md to fn.
55	√R		Below 52 gravel finer, slightly more oxidized and stained,
			brown with yellowish cast, gray-brown effluent
		58	
60			Gravel co to fn (30:70); becoming finer below 62'
			60 to 70%; sand co to fn, coarsing with depth
65		65	

Slight Sand Fm

LONE STAR NORTHWEST
DUPONT PROJECT

Boring: L.S.W.Y 067 | Boring Location: N 657500 E 466500

Ground Elevation: 207 | Elevation Water Table:

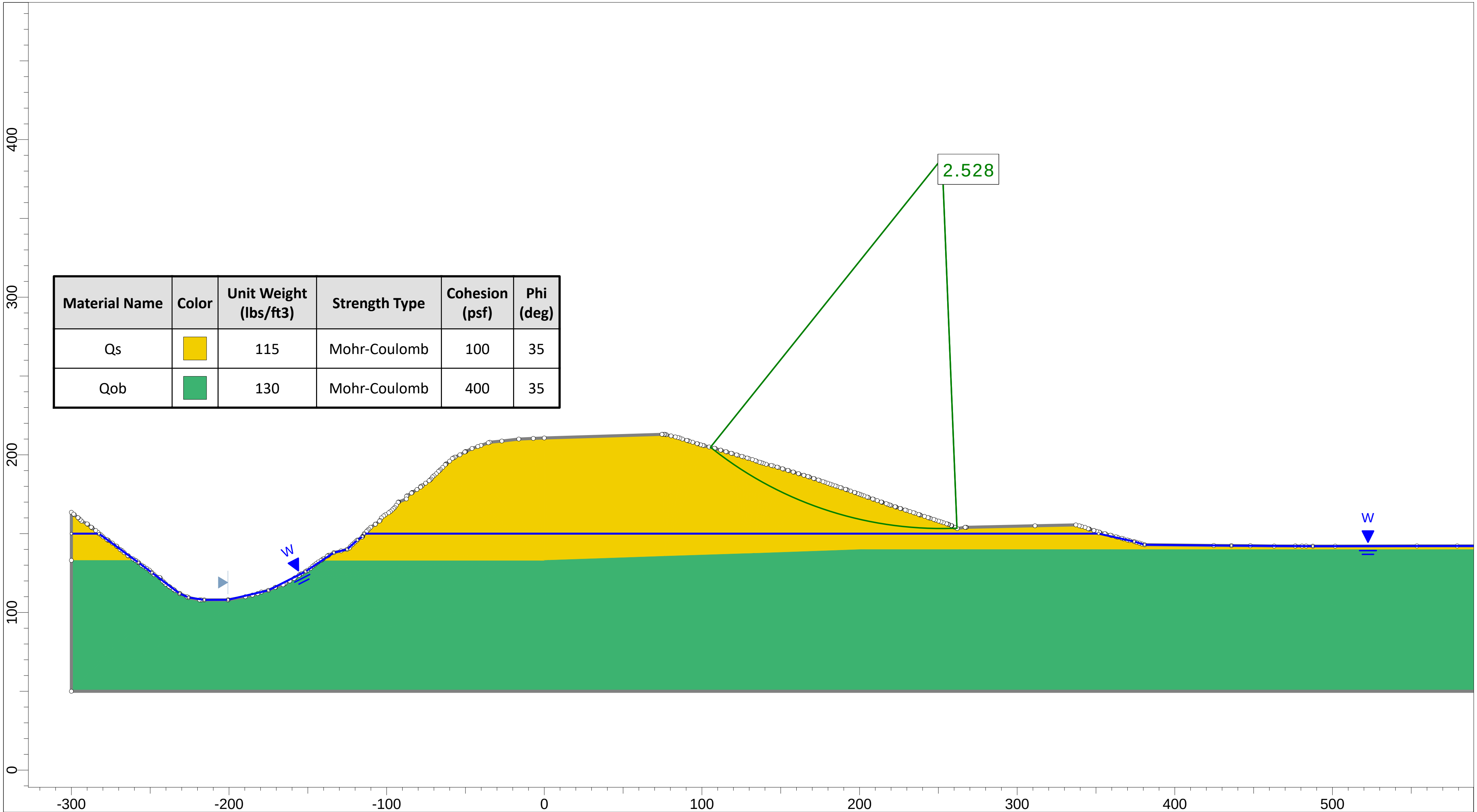
Date Drill: Jan 9-10, 1989 | Sampled by:

Drilling complete 8:20 AM

Depth	Strata	Sample Interval	Description/Drilling Notes
	VR		Sand content increasing 50 to 60%, md, gravel co
70	VT		to mostly fn, gray brown with yellowish cast, effluent
207 / 71 / 136	Kitsap 136	71	light chocolate brown with yellowish cast - Below 68 gravel stained and oxidized - Transition zone
			71 Silt, gray
75			73 Sand, fn, bluish gray silty
		78	75 Sandy silt, dark gray, sand very fn.
80			78 Bottom Hole

APPENDIX B

Slope Stability Results



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Qs		115	Mohr-Coulomb	100	35
Qob		130	Mohr-Coulomb	400	35

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

A-A'
Static Conditions

Slope Stability Analysis

Pioneer Aggregates South Parcel Project
DuPont, Washington

SLIDEINTERPRET 8.032

SCALE: 1:1000

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Aspect CONSULTING

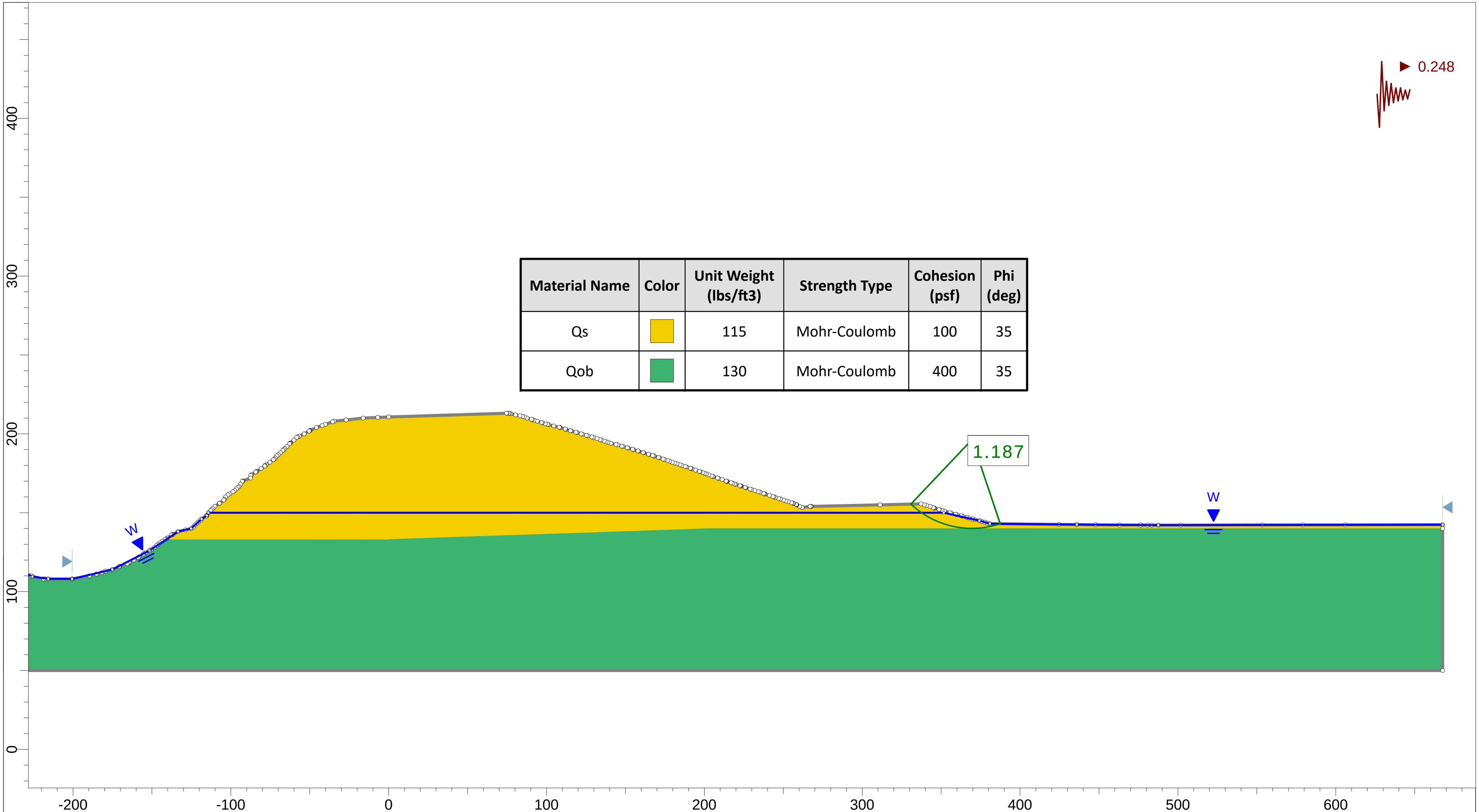
3/8/2021

PROJECT NO. 040001

BY: CRS

REVIEWED BY: REVIEWED BY: NCS

APPENDIX: **B-1**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Qs	Yellow	115	Mohr-Coulomb	100	35
Qob	Green	130	Mohr-Coulomb	400	35

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

A-A'
Seismic Conditions

Slope Stability Analysis

Pioneer Aggregates South Parcel Project
DuPont, Washington

SLIDEINTERPRET 8.032

SCALE: 1:1000

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Aspect CONSULTING

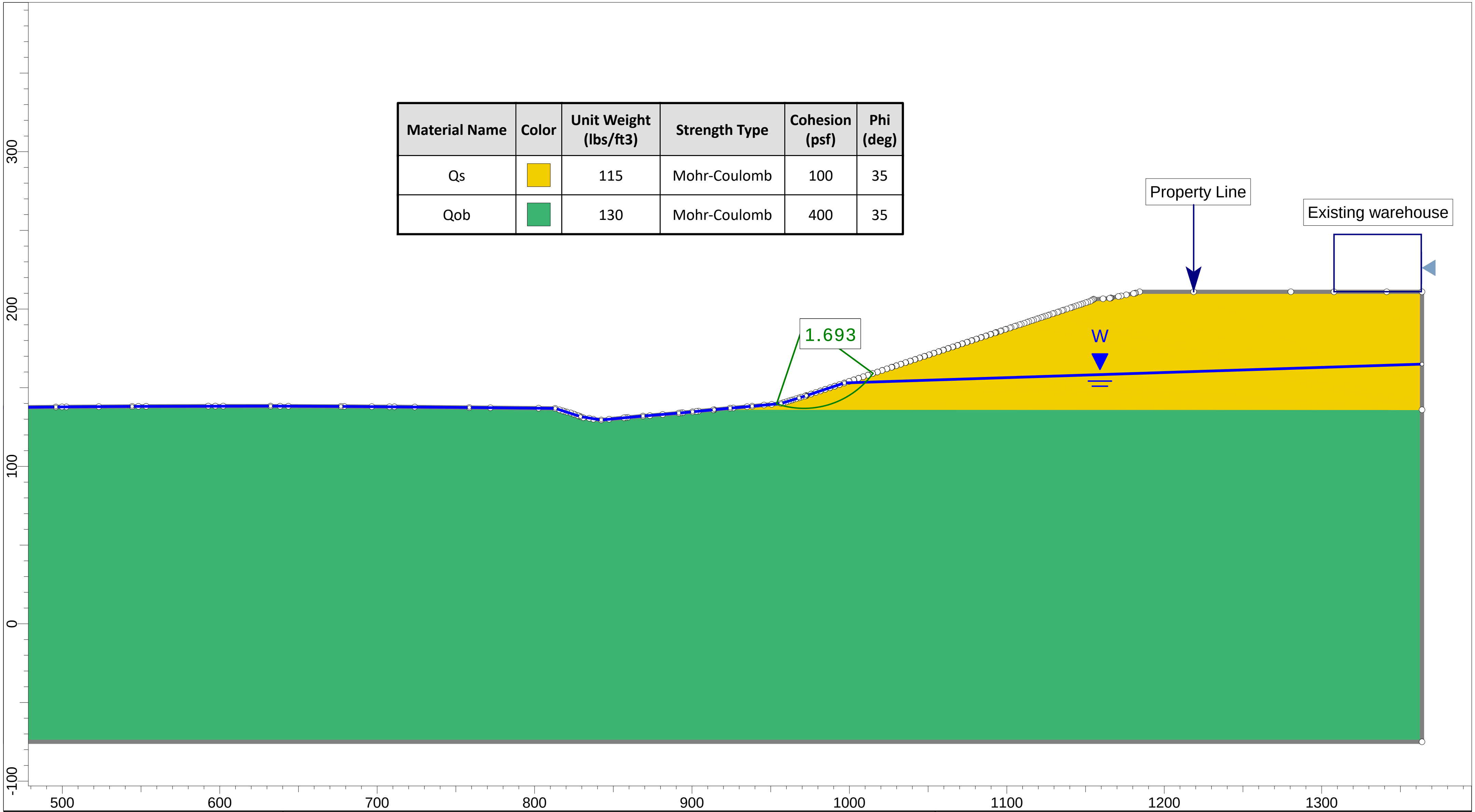
3/8/2021

PROJECT NO. 040001

BY: CRS

REVIEWED BY: REVIEWED BY: NCS

APPENDIX: **B-2**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Qs	(yellow)	115	Mohr-Coulomb	100	35
Qob	(green)	130	Mohr-Coulomb	400	35

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

B-B'
Static Conditions

Slope Stability Analysis

Pioneer Aggregates South Parcel Project
DuPont, Washington

SLIDEINTERPRET 8.032

SCALE: 1:1000
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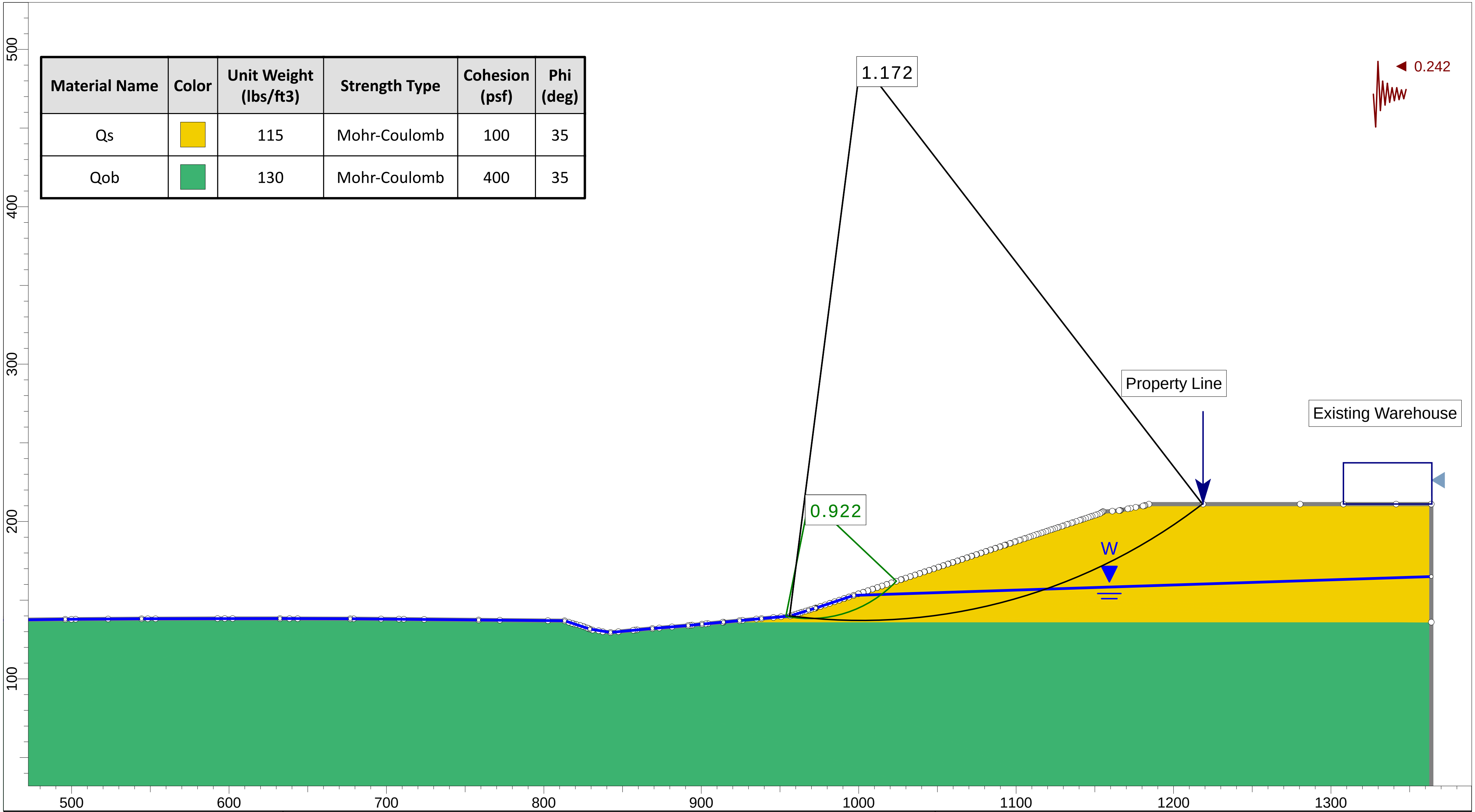
3/8/2021
PROJECT NO. 040001

BY: CRS
REVIEWED BY: REVIEWED BY: NCS

APPENDIX: **B-3**

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Qs		115	Mohr-Coulomb	100	35
Qob		130	Mohr-Coulomb	400	35



Legend
Search Grid
Search Limits
Modeled Groundwater Level
Boring Location and Depth

B-B'
Seismic Conditions

Slope Stability Analysis

Pioneer Aggregates South Parcel Project
DuPont, Washington

SLIDEINTERPRET 8.032

SCALE: 1:1000
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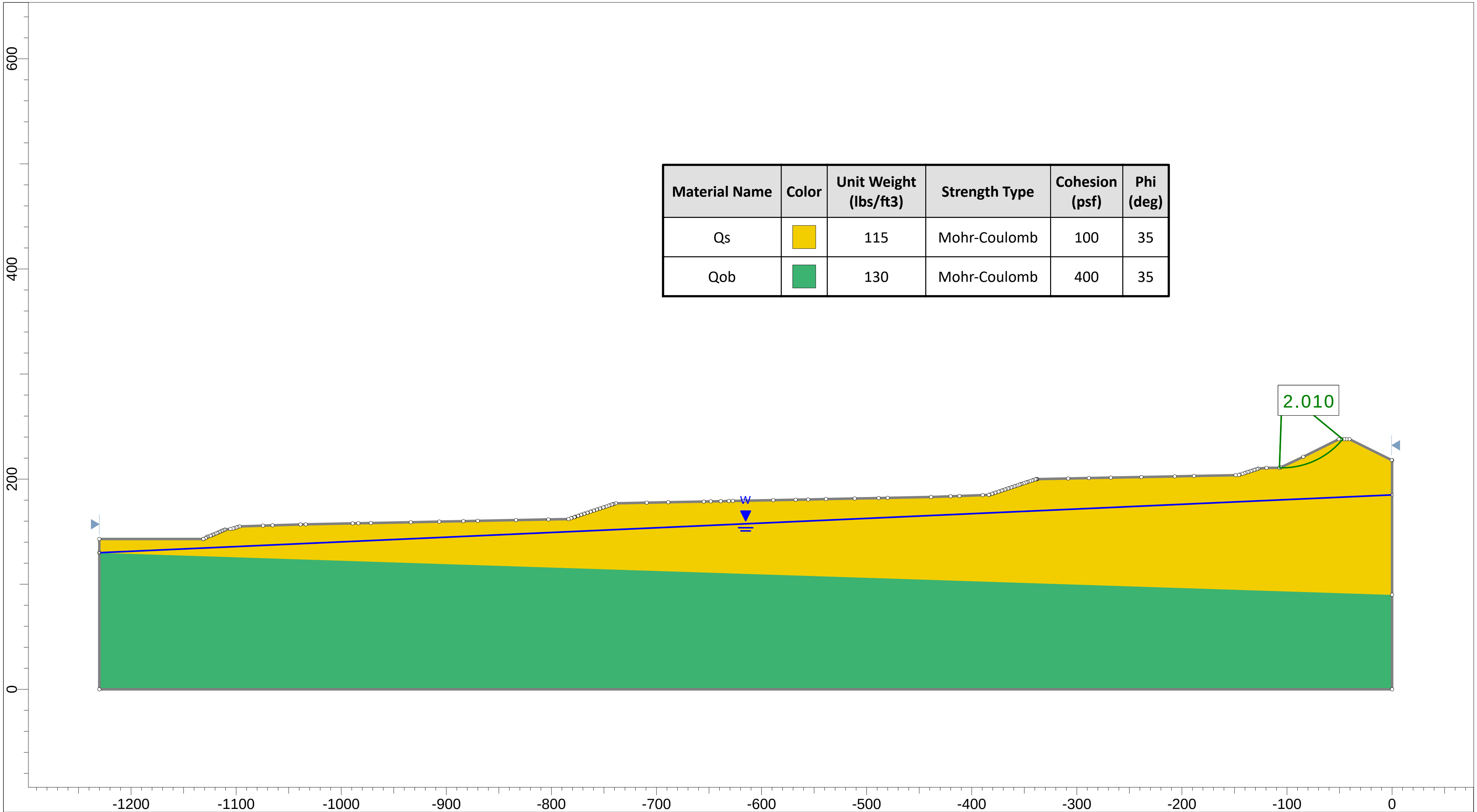
3/8/2021
PROJECT NO. 040001

BY: CRS
REVIEWED BY:
REVIEWED BY: NCS

APPENDIX:
B-4

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Qs	(yellow)	115	Mohr-Coulomb	100	35
Qob	(green)	130	Mohr-Coulomb	400	35



Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

C-C'
Static Conditions

Slope Stability Analysis

Pioneer Aggregates South Parcel Project
DuPont, Washington

SLIDEINTERPRET 8.032

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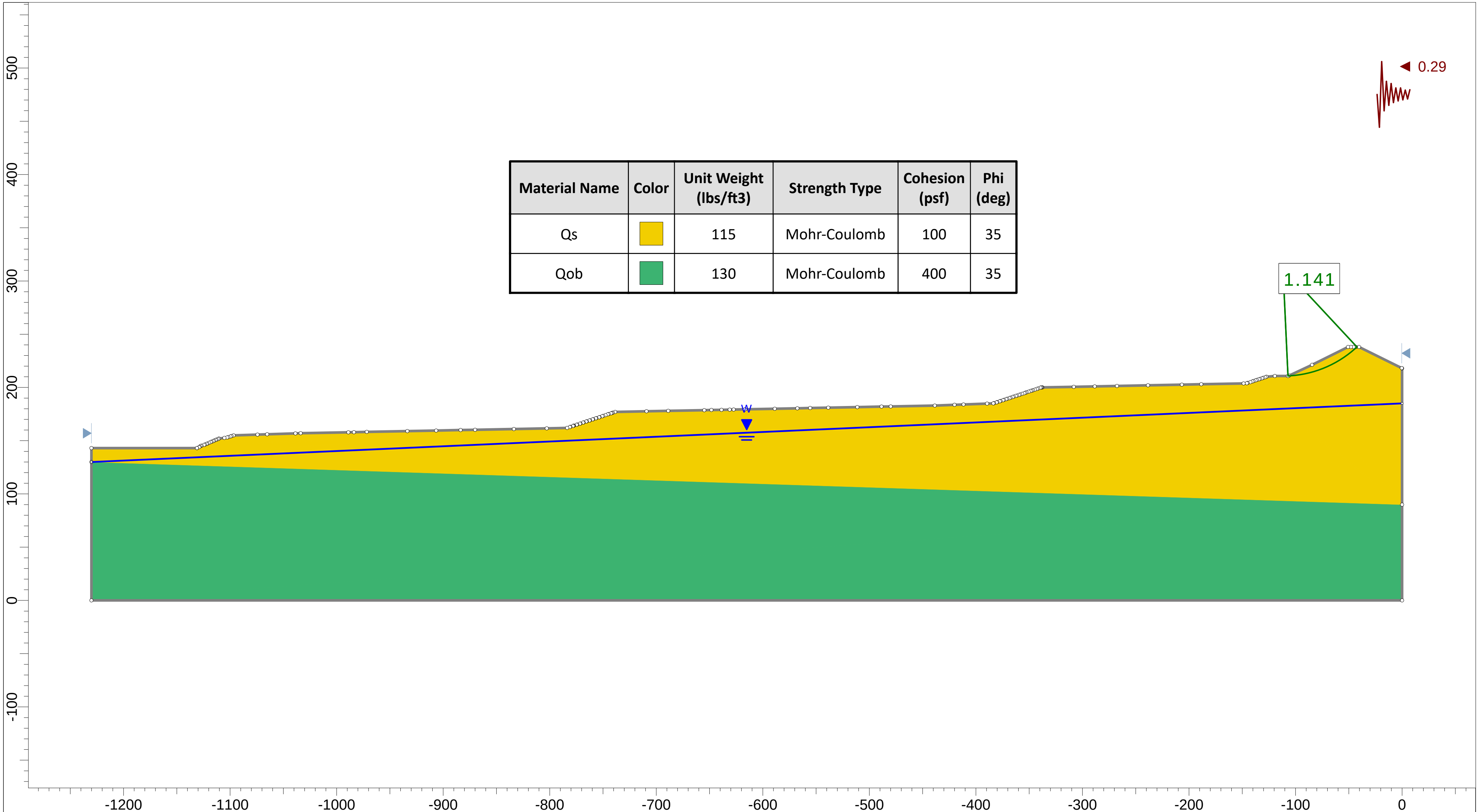
3/8/2021

PROJECT NO. 040001

BY: CRS

REVIEWED BY: REVIEWED BY: NCS

APPENDIX: **B-5**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Qs		115	Mohr-Coulomb	100	35
Qob		130	Mohr-Coulomb	400	35

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

C-C'
Seismic Conditions

Slope Stability Analysis

Pioneer Aggregates South Parcel Project
DuPont, Washington

SLIDEINTERPRET 8.032

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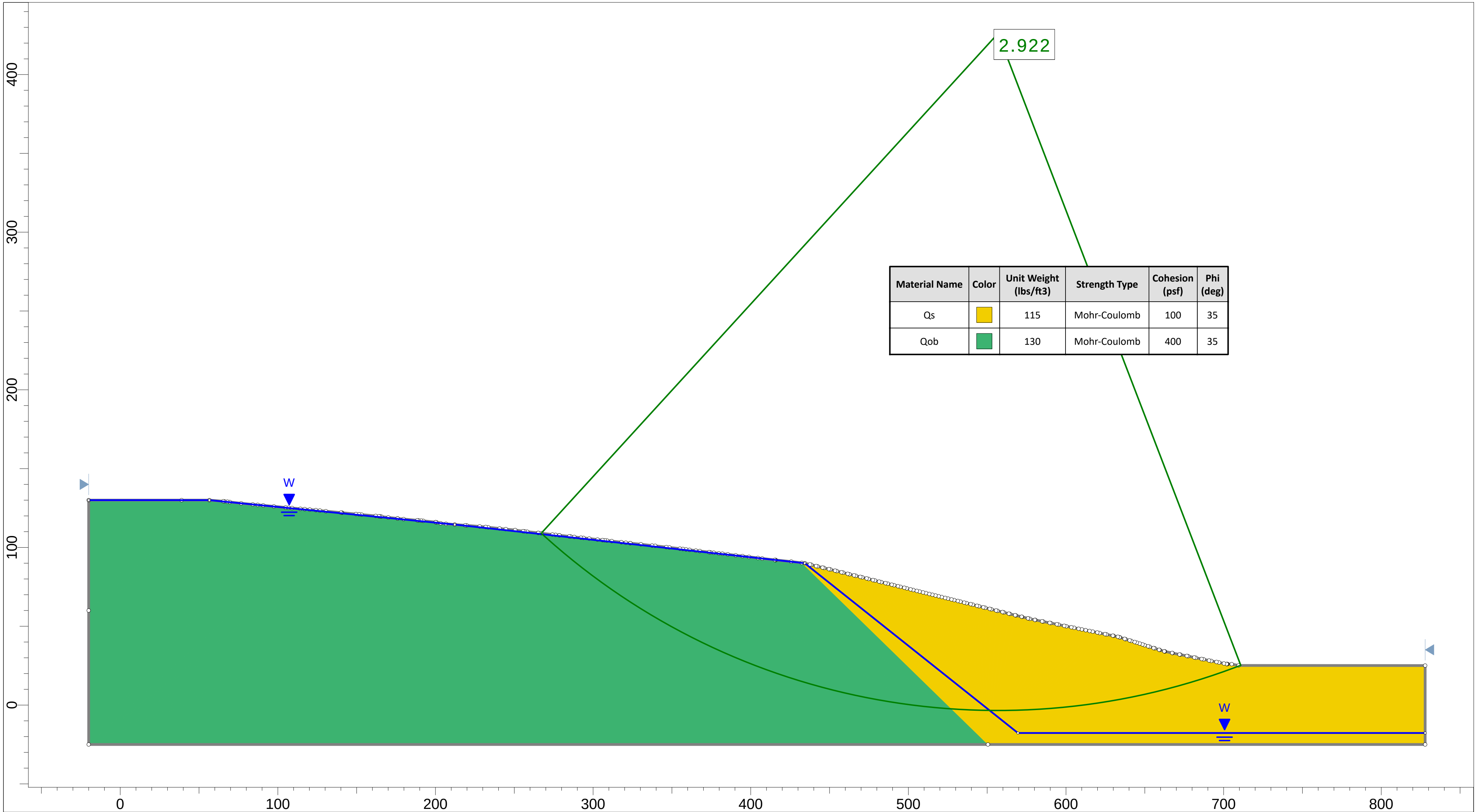
3/8/2021

PROJECT NO.
040001

BY:
CRS

REVIEWED BY:
REVIEWED BY: NCS

APPENDIX:
B-6



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Qs	yellow	115	Mohr-Coulomb	100	35
Qob	green	130	Mohr-Coulomb	400	35

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

D-D'
Static Conditions

Slope Stability Analysis

Pioneer Aggregates South Parcel Project
DuPont, Washington

SLIDEINTERPRET 8.032

SCALE: 1:1000
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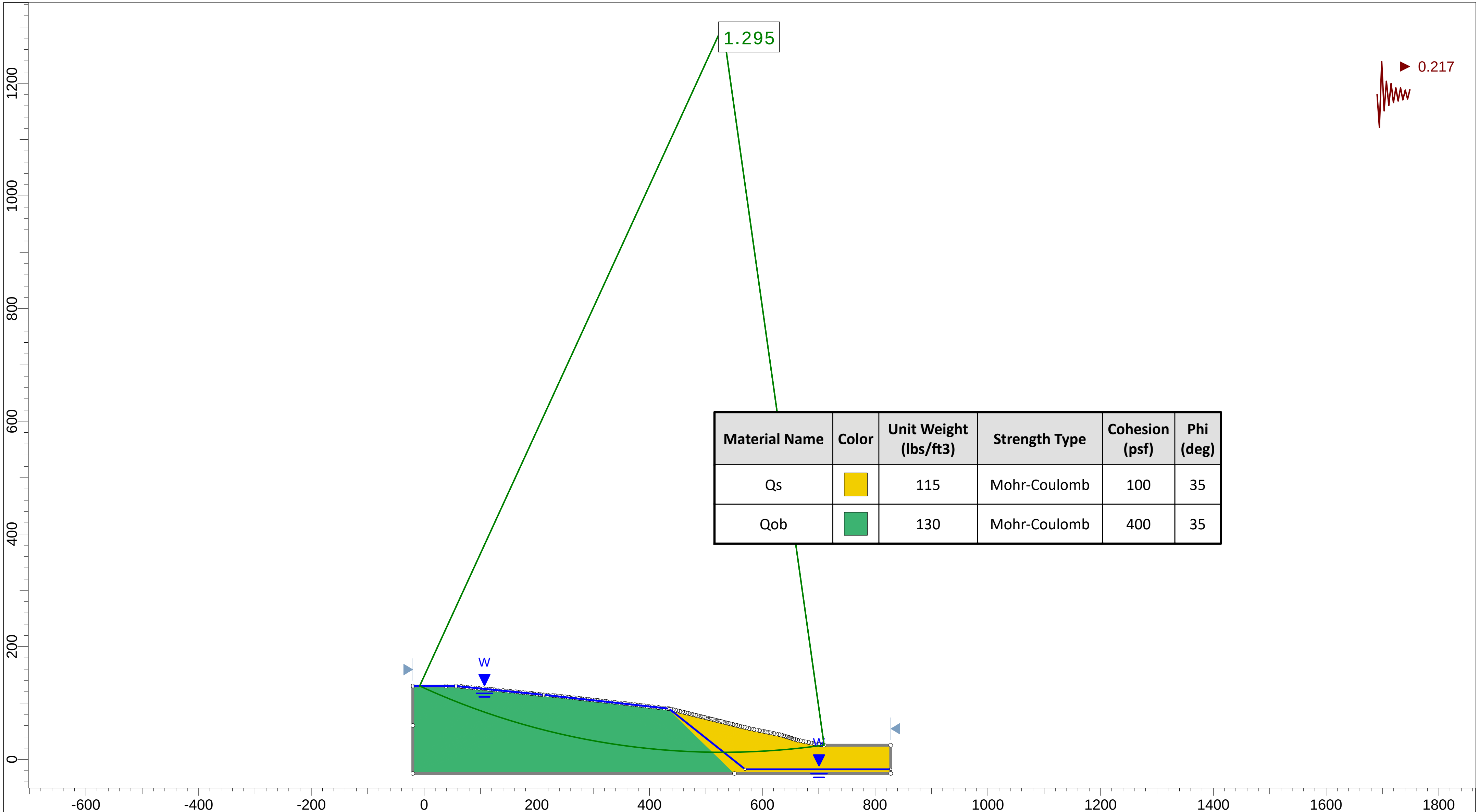
Aspect CONSULTING

3/8/2021
PROJECT NO. 040001

BY: CRS
REVIEWED BY: REVIEWED BY: NCS

APPENDIX: **B-7**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Qs		115	Mohr-Coulomb	100	35
Qob		130	Mohr-Coulomb	400	35

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

D-D'
Seismic Conditions

Slope Stability Analysis

Pioneer Aggregates South Parcel Project
DuPont, Washington

SLIDEINTERPRET 8.032

SCALE: 1:2800
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Aspect CONSULTING

3/8/2021
PROJECT NO. 040001

BY: CRS
REVIEWED BY: REVIEWED BY: NCS

APPENDIX: **B-8**

APPENDIX C

Report Limitations and Guidelines for Use

REPORT LIMITATIONS AND GUIDELINES FOR USE

Geoscience is Not Exact

The geoscience practices (geotechnical engineering, geology, and environmental science) are far less exact than other engineering and natural science disciplines. It is important to recognize this limitation in evaluating the content of the report. If you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or property, you should contact Aspect Consulting, LLC (Aspect).

This Report and Project-Specific Factors

Aspect's services are designed to meet the specific needs of our clients. Aspect has performed the services in general accordance with our agreement (the Agreement) with the Client (defined under the Limitations section of this project's work product). This report has been prepared for the exclusive use of the Client. This report should not be applied for any purpose or project except the purpose described in the Agreement.

Aspect considered many unique, project-specific factors when establishing the Scope of Work for this project and report. You should not rely on this report if it was:

- Not prepared for you;
- Not prepared for the specific purpose identified in the Agreement;
- Not prepared for the specific subject property assessed; or
- Completed before important changes occurred concerning the subject property, project, or governmental regulatory actions.

If changes are made to the project or subject property after the date of this report, Aspect should be retained to assess the impact of the changes with respect to the conclusions contained in the report.

Reliance Conditions for Third Parties

This report was prepared for the exclusive use of the Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against liability claims by third parties with whom there would otherwise be no contractual limitations. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with our Agreement with the Client and recognized geoscience practices in the same locality and involving similar conditions at the time this report was prepared

Property Conditions Change Over Time

This report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by events such as a change in property use or occupancy, or by natural events, such as floods, earthquakes, slope instability, or groundwater fluctuations. If any of the described events may have occurred following the issuance of the report, you should contact Aspect so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical, Geologic, and Environmental Reports Are Not Interchangeable

The equipment, techniques, and personnel used to perform a geotechnical or geologic study differ significantly from those used to perform an environmental study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually address any environmental findings, conclusions, or recommendations (e.g., about the likelihood of encountering underground storage tanks or regulated contaminants). Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding the subject property.

We appreciate the opportunity to perform these services. If you have any questions please contact the Aspect Project Manager for this project.