ATTACHMENT G: GEOTECHNICAL ENGINEERING REPORT AND PERCOLATION EVALUATION

REPORT

Geotechnical Engineering Report

2580 Minkler Road in Sedro-Woolley, Skagit County, Washington

Submitted to:

Tenaska Storage Solutions
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Omaha, Nebraska 68145

Submitted by:

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Project No. 00223

6/28/2023

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APPENDICES

1.0 EXECUTIVE SUMMARY

This report presents the results of a geotechnical engineering study conducted by Terra-Geo, Inc. (Terrageo) for the Goldeneye Battery Energy Storage Site (BESS) located in Skagit County, State of Washington. The purpose of our investigation was to evaluate subsurface conditions at the site and to provide geotechnical, corrosion and pavement recommendations for site development. This geotechnical study was performed in accordance with Terrageo Proposal No. P00223, dated March 13, 2023, and your subsequent authorization of our proposal under our Master Service Agreement.

- Terrageo understands that the site elevation will be raised with the importing of approximately 5 feet of soil to develop the site and that retaining walls may be required at the perimeter. This increase in loading will have limited effects on pad settlement and the settlements should occur as the structural fill is compacted in place. Terrageo suggests that mechanically stabilized earth walls be considered in light of the sites liquefaction concerns.
- Terrageo understands that the BESS units will be approximately 120 feet in length by 12 feet wide, thus imparting approximately 200 psf to the surface soils. Terrageo also understands that these units may be able to accept some total and differential movements.
- Silts, gravels and sands, all with varying amounts of silt were encountered in the exploration locations. The soils were found to be variable in composition, depth and density. Generally, the site can be described as near surface quiet water deposits overlaying overbank deposits underlain by channel deposits. The soils typically increased in density with depth.
- Groundwater was encountered at all explorations at a depth of 5 to 9 feet below ground level. Artesian conditions are apparent at the site as the groundwater levels rose in the test pits and several borings. This should be considered when installing augercast piling as heaving sands should be anticipated at site.
- Static settlement of the existing fill and post-liquefaction displacements are expected to be at the borderline of those tolerable by typical structures founded on conventional spread footings. Therefore, we do not anticipate ground improvement using vibroflotation, aggregate piers or dynamic compaction for the site. Terrageo recommends we be contacted prior to designing foundation elements for the site. Additional ground improvement and foundation support options may be considered after discussion with the structural engineer and establishment of tolerable displacements.
- We recommend an allowable bearing pressure of 3,000 psf for shallow foundations (i.e., footings and mats) constructed within the approved structural fill anticipated to develop the site. We also recommend a subgrade modulus value of 200 pci for the structural fill. Recommendations for site and subgrade preparation, earthwork, fill placement and compaction, drainage, and temporary and permanent slope cuts are included.
- For deep foundations recommend augercast or pin pile deep foundations advanced into the dense non-liquefiable gravels encountered at depths of about 40-45 feet below existing grades.
- Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We therefore recommend that the Terrageo be retained to monitor this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein.

2.0 SITE AND PROJECT DESCRIPTION

As indicated on attached Figures 1 and 2, the subject site is located 2580 Minkler Road in Sedro-Woolley, (LAT 48°30'27.83"N, LONG 122°12'4.44"W) Skagit County, Washington. The cleared, approximately 11-acre site is lightly vegetated and historically farmed with wind break trees about its perimeter and is relatively flat. Hansen Creek runs north south to the west of the proposed site and appears to express the water table locally. As shown on Figure 2, the approximately 11 acre site is relatively flat, has a residential home, shop building, barns and lawns in its western portion, a farm field with grass vegetation through its central and eastern portions and treed areas in its northeast and southeast corners that contains underbrush and blackberries.

We understand the proposed project entails developing the site with approximately 5 feet of fill and the construction of retaining walls to support the perimeter of the built-up site. Construction of BESS units (housing the batteries, control systems, HVAC, and fire suppression); MV inverters / transformers; underground MV collection cabling; O&M/fire access roads (compacted gravel or AC paving); project substation including switchgear and HV transformer.

2.1 USDA SITE SOILS

A review of the USDA Natural Resources Conservation Service for Skagit County Washington, the Soil Survey maps the site as Field Silt Loam, Minkler Silt Loam and Sumas Silt Loam. The Soil Survey places the capacity of the most limiting layer for these soils Ksat at moderately high (0.57 to 1.98 inches/hour), although the field work showed high groundwater. Based on our review of the soils encountered in the test pits and borings excavated at the site, we interpret the site to primarily be underlain by silt, sands and gravels of various amounts. We observed no evidence of surficial erosion at the site or adjacent areas at the time of our site visits, particularly where vegetation is established.

2.2 REGIONAL GEOLOGY

The recent geologic history of the Puget Sound Lowland region has been dominated by several glacial episodes. The most recent, the Vashon Stade of the Fraser Glaciation (about 12,000 to 20,000 years ago), is responsible for most of the present day geologic and topographic conditions. As worldwide sea levels lowered and the Puget lobe of the Vashon Stade advanced southward from British Columbia into the Puget Sound Lowland, sediments composed of proglacial lacustrine silt and clay, advance outwash, lodgment till, and recessional outwash were deposited upon either bedrock or older Pre-Vashon sediments. The older Pre-Vashon deposits include predominantly glacial and nonglacial sediments deposited during repeated glacial and interglacial periods during the past 2 million years. As the Puget Lobe of the Vashon Stade glacier retreated northward, it deposited a discontinuous veneer of recessional outwash and local deposits of ablation till upon the glacial landscape. The sculpted landscape was characterized by elongated north-south oriented

uplands, and intervening valleys. Post glacial deposits include: alluvium deposited within active stream channels, modern lacustrine deposits, organic silt and local peat deposits within depressions, drainages, and outwash channels; volcanic lahar, and landslide deposits.

2.2.1 Local Geology

The (Dragovich, et. Al. 1999) geologic map (See Figure 3) reveals the site to be underlain by Older alluvium and lahar run-out deposits of the Skagit River valley (Holocene), an Iron-stained sand, silt and clay; minor volcaniclastic sands and gravels of probable Glacier Peak Origin, forms terraces generally 15-50 feet above modern flood plain.

The project area lies in the broad alluvial valley of the Skagit River. The Holocene alluvial sediments have been filling the valley since the retreat of Vashon Stade glaciers from the area. The alluvial sediments consist of interbedded channel, overbank and quiet-water deposits. Channel deposits consist primarily of sand and gravel that were deposited in a relatively high-energy environment, typically on the bed or point bar of a channel of the Skagit River. Overbank deposits consist of silt and silty fine sand that were deposited during floods of the Skagit River. Overbank deposits may also contain trace amounts of woody debris and other organic material. Quiet-water deposits primarily consist of silt, clay and fine sand that were deposited in low-energy environments, such as lakes, marshes, estuary type environments, oxbow lakes, or small side channels associated with the Skagit River. Quiet-water deposits tend to contain more organic material than the overbank deposits.

From boreholes and well logs reviewed a few miles downstream, these alluvial sediments can be more than 150 feet thick. According to the geologic map by Dethier and Whetten (1981), isolated bedrock outcrops are present within the valley, although it does not appear that any are located within the project area.

The most recent agent of change in the project area has been human activity. In the course of modern settlement in the Sedro-Woolley area, humans have greatly modified the area of the project through the construction of bridges, placement of fill, placement of rip-rap along the river banks, and the construction of buildings, structures, roads, and utilities.

3.0 FIELD EXPLORATIONS AND SUBSURFACE CONDITIONS

3.1 FIELD EXPLORATIONS

Terrageo mobilized to the site twice to complete subsurface explorations for this project. The first mobilization was on December 16, 2022, for the purpose of advancing test pits. On May 29, 2023 we mobilized the second time for the advancement of borings and taking of the field resistivity tests. The locations of these test pits, borings and resistivity alignment are presented on the attached Figure 2. The exploration locations were established through a handheld GPS unit.

Test Pits: A total of seven exploratory test pits (TP-1 through TP-7) were excavated at the site using a Takeuchi TB280 backhoe. Each pit was advanced to a maximum depth of approximately 10 feet bgs. Bag samples were collected at depth from the test pit excavations, along with bucket samples for additional laboratory testing. Terrageo personnel were onsite during the excavation process to locate the test pits, observe the excavation, obtain representative soils samples, and log the subsurface conditions. Upon completion, the test pits were backfilled with the excavated soils.

Auger Borings: A total of eight exploration borings were advanced to depths ranging from 30 to 70 feet below ground surface (bgs). The borings were advanced using a track-mounted, hollow-stem modified EC-95 drill rig operated by Boretec1 under subcontract to Terrageo. The deeper 70 foot borings employed mud rotary techniques below 30 feet. A Terrageo representative was on-site to observe the borings, obtain representative soil samples, and log the subsurface conditions. Upon completion of the borings, the boreholes were backfilled with bentonite chips per Washington State Department of Ecology regulations. Soil cuttings were spread on site.

During drilling, soil samples were generally obtained on 5-foot depth intervals using the Standard Penetration Test (SPT) procedure, ASTM D1587. This test and sampling method consists of driving a standard 2-inch outside diameter (OD) split-barrel sampler a distance of 18 inches into the soil with a 140-pound hammer, free-falling a distance of 30 inches. The number of blows required to drive the sampler through each of the three successive, 6-inch intervals is noted. The total number of blows struck during the final 12 inches of penetration is considered the Standard Penetration Resistance (N), or “blow count”. If 50 or more blows are struck within one 6-inch interval, the hammer operations are ceased, and the blow count is recorded as 50 blows for the actual number of inches of penetration. The resulting N values provide a measure of relative density of granular soils of the relative consistency of cohesive soils. Field judgment is required when assigning density descriptions to soils with a high percentage of gravel or cobbles since the driving resistance is often increased by the presence of such materials.

Three near surface samples were taken with thin-walled Shelby tubes pushed to collect “undisturbed” samples. These samples were capped and taped to prevent moisture loss and

transported to for the purpose of thermal resistivity and corrosion testing.

Heaving sand conditions were encountered at several borehole locations. Heaving sands occur when the hollow stem auger is below the water table and the head difference between the groundwater and the inside of the augers pushes clean sands up into the inside of the auger. When the driller lowers the sample rods into the auger to begin sampling, the heaving sands may already be flowing up into the auger, causing the blow counts for the SPT to be low. Alternatively, sands may continue to heave into the auger as the sample is being driven, causing the sampler and auger to be locked and advanced together, resulting in SPT blow counts to be high. During the advancement of borings for this project, we encountered both low and high blow counts. Noted areas of heave were considered when estimating a design SPT N value for the sandy soil layers.

The Boring Logs presented in attached Appendix A describes the various types of soils encountered in the boring, based primarily on visual interpretations made in the field and supported by our subsequent laboratory examination and testing. The log indicates the approximate depth of the contacts between different soil layers, although these contacts may be gradual, indistinct or undulating. Where a change in soil type occurred between sampling intervals, we inferred the depth of contact. Our log also graphically indicates the blow count, sample type, sample number, and approximate depth of each soil sample obtained from the boring. If any groundwater was encountered in the boreholes, the approximate groundwater depths are depicted on the boring log. Groundwater depth estimates are typically based on the moisture content of soil samples, the wetted height on the drilling rods, and the water level measured in the borehole after the auger has been extracted. Subsurface materials encountered were logged and classified in general accordance with the Manual Visual Classification Method (ASTM D 2488) by the geotechnical representative.

For both the test pits and the borings, Soil samples obtained from the explorations were placed in relatively air-tight plastic bags, or garbage bags and buckets. The stratigraphic contacts shown on the individual test pit and boring logs represent the approximate boundaries between soil types. The actual transitions may be more gradual and indistinct. The soil and groundwater conditions depicted are only for the specific dates and locations reported, and therefore, are not necessarily representative of other locations and times. Test pit and boring logs are presented in Appendix A. Soil and groundwater conditions encountered in the explorations are summarized below.

3.2 SUBSURFACE CONDITIONS

3.2.1 Soil Descriptions

Surface Topsoil: At the surface of each exploration, vegetation and 6 to 18 inches of topsoil, rootmat or duff was encountered. The topsoil was found to be organic silts with varying amounts of sands and some gravels.

Quiet-Water Deposits (Silts with Sand, Sandy Silts and Silty Sands) – Quiet-water deposits primarily consist of silt, clay, and fine sand that were deposited in low-energy environments, such as lakes, marshes, oxbow lakes, or small side channels associated with the Skagit River. Quiet-water deposits tend to contain more organic material than overbank deposits. Quiet-water deposits were encountered underlying the fill or as lenses within the other deposits. This deposit encountered varied in thickness of 10 to 18.5. Generally, the deposit consisted of very soft to soft, bluish gray to brown to red-brown, non-stratified to stratified, silt with sand with organic fragments up to 8 inches in thickness, and trace iron-oxide staining. Each of the test pits were terminated within this unit.

Overbank Deposits (Silty Sand with Gravel) – Overbank deposits are deposited during floods of the Skagit River. Overbank deposits are generally finer grained than the channel deposits and may also contain trace organic materials. Overbank deposits were encountered in the borings underlying quiet-water deposits. The overbank deposits generally overlay and were occasionally interbedded with the channel deposits. In general the overbank deposits consisted of loose to medium dense, light gray to blue gray, stratified, fine sandy silt with trace organic fragments and trace gravel to dense, light gray, non-stratified, silt with some fine sand, sand seams, and iron-oxide stained layers and pockets of loose, brown to light gray, stratified, sand with little silt and trace iron-oxide stained layers. All borings, except the 70 foot deep B-1 and B-4 were terminated within this unit.

Channel Deposits (Silty Gravels with Sand OR Silty Sand with Gravel) – Channel deposits were deposited in a relatively high-energy environment, typically on the bed or pointbar of a channel of the Skagit River. This unit generally underlies the overbank deposits and occasionally interbedded with quiet-water deposits. The channel deposits generally consisted of compact to very dense, brown gray, non-stratified to slightly stratified, fine to coarse sand with little to trace silt and trace gravel. Borings B-1 and B-4 were terminated in this unit.

Subangular scoria and mica grains were observed in some overbank and channel deposit samples. These minerals typically mechanically alter during transport. The shape and size of the minerals observed in the samples indicates that the material did not travel far and in fact might be a lahar deposit. However, we did not distinguish between a river channel deposit and a possible lahar deposit.

3.2.2 Shrink-Swell Potential

Granular soil types displaying very low to no plasticity were encountered within our explorations. Laboratory analysis indicated the soil types as non-plastic characteristics. The shrink-swell potential of near surface soil is very low and are not anticipated to require special design measures where structures are proposed.

3.2.3 Frost Penetration

The near-surface soils are slightly to moderately susceptible to frost heave. However, foundation and floor slab elements are expected to bear on compacted fill or granular fill. We anticipate that the depth of frost penetration in this region is approximately 18 inches. The recommended exterior and interior footing embedment depths provided herein should allow adequate frost protection. Frost susceptibility in pavement areas is also expected to be low if they are constructed and supported as recommended, excluding icing of permeable pavements.

3.2.4 Groundwater and Soil Moisture

We observed groundwater seepage in all borings and test pits between 5 and 10 feet. The test pits showed water stains and mottling within their depths and an artesian groundwater condition was encountered during the subsurface explorations. With the test pits, water was typically encountered at depths of 7 to 9 feet below grade and started to fill the excavation. Over the next hours, the sidewalls of the excavation would typically begin to collapse, as groundwater rose in the test pit, resulting in final water depths about 2 feet higher than what was encountered during excavation. Without the benefit of survey equipment, the Engineer noted the nearby Hansen Creek had a groundwater elevation similar to the final elevations in the test pits and borings. Similarly, groundwater was encountered within the borings at these levels, however, the test pits revealed a more accurate depiction of the groundwater conditions onsite and were performed in winter months when the groundwater would be higher. Groundwater conditions should be considered during utility excavation and foundation placement.

3.3 GEOLOGIC HAZARDS

The subject site is in Skagit County, Washington, where regulated geologically hazardous areas include erosion, landslide, earthquake, or other geological hazards. We evaluated the site conditions for the presence of geologically Critical Areas as defined in Skagit County's critical areas code, specifically SCC 14.24.400-430. Discussions are provided below.

3.3.1 Erosion hazard area.

SCC 14.24.410 (1) Erosion hazard area: The following are considered known or suspected erosion hazards:

(a) Areas with gradients greater than or equal to 30%.
(b) Areas located within the following map units:
No. 1 Andic Cryochrepts,
Nos. 3 and 4 Andic Xerocrepts,
No. 13 Birdsview,
Nos. 47 and 48 Dystric Xerochrepts,
Nos. 50 and 51 Dystic Xerorthents,
Nos. 63 and 65 Guemes,
No. 69 Hoogdal,
No. 90 Lithic Haploxerolls,
No. 91 Marblemount,
No. 99 Mundt and Nos.

150 and 151 Typic Croyorthods;
or mapped severe erosion hazard, as identified in the U.S. Department of Agriculture Natural Resources Conservation Service Soil Survey of Skagit County Area, WA (1989).

(c) Costal Beaches or Bluffs
(d) Areas designated in the Department of Ecology, Coastal Zone Atlas, Washington, Volume Two Skagit County (1978) as U (Unstable), UB (Unstable Bluff), URS (Unstable Recent Slide), or UOS (Unstable Old Slide).
(e) Areas susceptible to rapid stream incision and stream bank erosion.

SCC 14.24.410 (1) Erosion hazard recommendation: The subject site is not at risk for erosion hazards as none of the above criteria are applicable. The slopes are less than 30% and the USDA NRCS mapped the site soils are not on the above list of map units. The erosion potential of the onsite soils are "not rated" as of writing this report and no erosion of these materials were noted onsite during the several visits.

The site's soils will be susceptible to erosion when exposed during construction. In our opinion, proper implementation, and maintenance of Best Management Practices (BMPs) for erosion prevention and sedimentation control will adequately mitigate the erosion potential in the planned development area. Erosion protection measures as required by Skagit County will need to be in place prior to and during grading activity on the site.

3.3.2 Landslide hazard area

SCC 14.24.410 (2) Landslide hazard: The following are considered known or suspected landslide hazards:

(a) Areas designated in the Department of Ecology, Coastal Zone Atlas, Washington, Volume Two Skagit County (1978) as U (Unstable), UB (Unstable Bluff), URS (Unstable Recent Slide), or UOS (Unstable Old Slide).
(b) Slopes having gradients of 15% or greater:
(i) That intersect geologic contacts with permeable sediments overlying low-permeability sediment or bedrock and springs or groundwater seepage are present; or
(ii) That are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials.
(c) Slopes of 40% or steeper and with a vertical relief of 10 feet or more.
(d) Areas of previous failure such as earth slumps, earthflows, mudflows, lahars, debris flows, rock slides, landslides or other failures as observed in the field or as indicated on maps or in technical reports published by the U.S. Geological Survey, the Geology and Earth Resources Division of the Washington Department of Natural Resources, or other documents authorized by government agencies.
(e) Potentially unstable areas resulting from rapid stream incision, stream bank erosion, and undercutting by wave action.
(f) Coastal bluffs.
(g) Slopes with a gradient greater than 80% and subject to rock fall.
(h) Areas that are at risk from snow avalanches.
(i) Areas designated on the Skagit County Alluvial Fan Study Orthophoto Maps as alluvial fans or as identified by the Administrative Official during site inspection.
(j) Areas located in a narrow canyon potentially subject to inundation by debris flows or catastrophic flooding.
(k) Those areas delineated by the U.S. Department of Agriculture's Natural Resources Conservation Service Soil Survey of Skagit County as "severe" (Table 9) limitation for building development.

SCC 14.24.410 (2) Landslide hazard recommendation: None of the above criteria applies to the subject site. Accordingly, the site does not contain Landslide Hazard Areas as defined by Skagit

County Code.

3.3.3 Seismic hazard area

SCC 14.24.410 (3) Seismic hazard: These are areas subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement, soil liquefaction or surface faulting. The following are known or suspected seismic hazards:

(a) Areas located within a high liquefaction susceptibility as indicated on the Liquefaction Susceptibility Map of Skagit County issued by Washington Department of Natural Resources dated September 3, 2004, or as amended thereafter. A site assessment is not required for high liquefaction hazard areas for single-family residence proposals unless other criteria provided in this Section apply.

(b) Areas located within 1/4 mile of an active fault as indicated on investigative maps or described in studies by the United States Geologic Survey, Geology and Earth Resources Division of the Washington Department of Natural Resources, or other documents authorized by government agencies, or as identified during site inspection.

(c) Those known or suspected erosion and landslide hazards referenced in Subsections (1) and (2) of this Section.

(d) Tsunami and seiche hazard areas include coastal areas and lake shoreline areas susceptible to flooding, inundation, debris impact, and/or mass wasting as the result of coastal or inland wave action generated by seismic events or other geologic events. Suspect tsunami hazard areas are indicated on the Tsunami Hazard Map of the Anacortes-Whidbey Island Area, Washington: Modeled Tsunami Inundation from a Cascadia Subduction Zone Earthquake. A site assessment is not required for tsunami and seiche hazard areas but they are addressed through the frequently flooded section of this Chapter.

SCC 14.24.410 (3) Seismic hazard recommendation: The subject site is susceptible to liquefaction, but not the other seismic hazards outlined above. The Liquefaction Susceptibility Map of Skagit County rates the site as moderately to highly susceptible to liquefaction. Within Section 3.4 Seismic Design Parameters of this report, Terrageo has provided soil site class, seismic hazard potential and liquefaction calculation results for the site development personnel to consider.

Geologically hazardous areas shall be designated consistent with the definitions provided in WAC 365-190-030 and 365-190-120. Some geologic hazards can be reduced or mitigated by engineering, design, or modified construction practices so that risks to health and safety are acceptable. When technology cannot reduce risks to acceptable levels, building and other construction in, above and below geologically hazardous areas should be avoided. (Ord. O20160004 § 6 (Att. 6); Ord. O20080014).

3.3.4 Volcanic hazard area

SCC 14.24.410 (4) Volcanic hazard: Volcanic hazard areas are subject to pyroclastic flows, lava flows, debris avalanche, and inundation by debris flows, mudflows, lahars or related flooding resulting from volcanic activity. Suspect volcanic hazards include those areas indicated in the United States Geologic Survey Open-File Report 95-499 as the volcanic hazard zone for Glacier Peak, Washington; or in the United States Geologic Survey Open-File Report 95-498 as the volcanic hazard area of Mount Baker, Washington. A site assessment is not required for volcanic hazard areas unless other criteria provided in this section apply.

SCC 14.24.410 (4) Volcanic hazard recommendation: The only potential Volcanic activity

affecting the subject site would be from Glacier Peak, through Lahars which are hot or cold mixtures of water, from melted snow, ice, and rock fragments that flow down the slopes of a volcano and typically enter river valleys. A moving lahar looks like a roiling slurry of wet concrete, and as it rushes downstream, the size, speed, and amount of material carried can constantly change. Volcanic hazard risk is negligible for the subject site.

3.3.5 Mine hazard area

SCC 14.24.410 (5) Mine hazard area: Mine hazard areas as designated on the Department of Natural Resources Map: Coal Measures of Skagit County (1924) or within 200 feet of any other current or historic mine operations determined to be a suspect or known geologically hazardous area by the Administrative Official.

SCC 14.24.410 (5) Mine hazard area recommendation: Mine hazard areas risk is negligible for the subject site.

3.4 SEISMIC DESIGN PARAMETERS

We understand that seismic design will be completed using procedures outlined in the 2018 International Building Code (IBC). Per the 2018 IBC, structures shall be designed and constructed to resist the effects of earthquake motions in accordance with American Society of Civil Engineers (ASCE) 7-16.

As discussed below, the soils at the site are potentially liquefiable during the design seismic event. Due to the presence of potentially liquefiable soils, the site is classified as Site Class F, and a site-specific response analysis could be required.

However, an exception is provided in ASCE 7-16 Section 20.3.1. Site-specific response analysis is not required for liquefiable soils, provided the structure has a fundamental period of vibration equal or less than 0.5 seconds. Provided this exception is true, the site-specific response spectrum for Site Class E may be used as a basis for a simplified design and analysis.

Additionally, in accordance with ASCE 7-16 Section 11.4.8, a ground motion hazard analysis is required for sites classified as Site Class E and because the spectral response acceleration at 1-second periods (S_1) is greater than or equal to 0.2. However, an exception is allowed, provided specific requirements are satisfied, related to the fundamental period of the considered structure.

Table 1 below provides recommended seismic design parameters for Site Class E. These values are only valid if the exceptions provided in ASCE 7-16 Sections 11.4.8 and 20.3.1 described apply to the structures. If these expectations do not apply, Terrageo should be consulted further as a site-specific response analysis could be required.

TABLE 1: RECOMMENDED SEISMIC DESIGN PARAMETERS

2018 IBC (ASCE 7-16) Seismic Design Parameters	Recommended Value
Site Soil Class[1]	E[2]
Site Latitude	48.508117 N
Site Longitude	-122.200983 W
Mapped Spectral Response Acceleration at Short Period, S_S (g)	0.983
Mapped Spectral Response Acceleration at 1 Second Period, S_1 (g)	0.35
Site Amplification Factor at 0.2 second period, F_A	1.3
Site Amplification Factor at 1.0 second period, F_V	2.6
Design Spectral Acceleration at 0.2 second; S_{DS} (g)	0.852
Design Spectral Acceleration at 1.0 second; S_{D1} (g)	0.601
Site Modified Peak Ground Acceleration; PGA_M (g)	0.572

1) Note: In general accordance with Chapter 20 of ASCE 7-16. The Site Class is based on the average characteristics of the upper 100 feet of the subsurface profile with Boring B-1 controlling for the site.
2) Note: ASCE 7-16 require a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope of our services does not include the required 100 foot soil profile determination. Two boring were extended to a maximum depth of 70 feet, and this seismic site class definition considers that similar soil continues below the maximum depth of the subsurface exploration. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration.
3) Note: In accordance with ASCE 11.4.8, a ground motion hazard analysis is not required for the following cases:
   - Structures on Site Class E sites with S_S greater than or equal to 1.0, provided the site coefficient Fa is taken as equal to that of Site Class C.
   - Structures on Site Class D sites with S_1 greater than or equal to 0.2, provided that the value of the seismic response coefficient Cs is determined by Eq. 12.8-2 for values of $T \leq 1.5Ts$ and taken as equal to 1.5 times the value computed in accordance with either Eq. 12.8-3 for $T_L \geq T > 1.5T_S$ or Eq. 12.8-4 for $T > T_L$.
   - Structures on Site Class E sites with S_1 greater than or equal to 0.2, provided that T is less than or equal to T_S and the equivalent static force procedure is used for design.

The above exceptions do not apply to seismically isolated structures, structures with damping systems or structures designed using the response history procedures of Chapter 18. The above was taken from the ASCE 7 Hazard Tool Website[1] the output for this analysis is presented in Appendix D.

3.4.1 Site Liquefaction

Liquefaction is the phenomenon whereby soils undergo significant loss of strength and stiffness due to vibration or large cyclic ground motions produced by a seismic event. Seismic events within high seismicity areas impart cyclic loading of saturated soils leading to the buildup of excess pore-water pressure as a result of soil particles being rearranged with a tendency toward denser packing. Under undrained conditions, such as earthquake shaking, loads are transferred from the soil skeleton to

[1] https://asce7hazardtool.online/

the pore-water with consequent reduction in the soils' shear strength. Loose, granular soils located below the water table are generally susceptible to liquefaction.

Based on the site geology and subsurface groundwater conditions, the hazard of liquefaction of the site soils is moderate for this site during a Maximum Credible Event (2475 year) design level earthquake and is most likely to trigger in the Quiet Water and Overbank Deposits, below the groundwater table, between 12 and 30 feet below the ground surface.

Liquefaction and lateral spreading for the site were evaluated using WSLiq software developed by Prof. Steven L. Kramer at the University of Washington, the results of which are presented in Appendix D. The estimated liquefaction induced settlements of the ground surface are presented in Table 2 below based on our understanding of the regional geology and the silty nature of the alluvial deposits of the site. Lateral spreading displacements are not anticipated due to the relative flatness of the site and the anticipated and the distance to the Skagit River.

TABLE 2: LIQUEFACTION SUMMARY

Exploration Location	Exploration Depth (feet)	Liquefaction Layer(s) depth (feet)	Total Ground Settlement (inches)[1]
B-1	70	17.5 – 44.0	3.6
B-2	30	14.0 – 30.0	1.2[2]
B-3	30	22.5 – 30.0	5.25[2]
B-4	70	12.5 – 27.5	1.2
B-5	30	23.0 – 30.0	0.3[2]
B-6	30	12.5 – 20.0	2.6
B-7	30	20.0 – 26.5	1.5
B-8	30	17.0 – 30.0	3.0[2]

1) Liquefaction estimates were calculated based on the 2475-year return period, with a PGA of 0.418g and earthquake magnitude (Mw) of 6.46. Settlement was determined by a weighted average of WSLiq supported models.
2) Liquefaction extended to the boring termination depth.

We estimate approximately 0.3 to 5.25 inches of liquefaction induced settlement of the ground surface based on our understanding of the regional geology and the alluvial deposits of the site. Terrageo understands that the BESS units will be located on the eastern portion of the site (Explorations B-3 through B-8), which shows to have a lower liquefaction potential. The BESS units may be mat, shallow, or deep foundation systems. Terrageo understands that the site may require on the order of 5 feet of fill and the BESS systems will have plan dimensions of 12 feet by 120 feet, imparting a load on the order of 200 psf. The differential settlement at each boring location is

anticipated to be ½ the total ground settlement presented in Table 2. Terrageo recommends the designer contact us when finalizing the foundation site layout and designing the foundation systems onsite, to ensure the various facility elements perform as anticipated under seismic loading. Given the anticipated liquefaction settlements at the subject site are on the order of what is post ground improvement performance criteria for liquefaction induced settlement (4 inches), we do not anticipate that ground improvement techniques for liquefaction mitigation will be required to develop the site.

However, we recommend any utilities connected to the proposed structures be designed with flexible connections to reduce damage during a seismic event. If liquefaction occurs, buried conduit or pipelines and subsurface chambers and vaults will react in a manner that depends on their position with respect to the groundwater table. Structures above the groundwater table will likely settle an amount equal to the settlement of the surrounding ground surface. Structures below the groundwater table will be subjected to upward buoyancy forces that must be resisted by the overlying backfill soil. Insufficient resistance will allow the structure to “float” to the surface. For structures in areas that have been mitigated for liquefaction the seismic shaking could cause compressive or tensile stresses from the passage of seismic surface waves through the ground.

3.5 SOIL RESISTIVITY TESTING

Insitu soil resistivity at the subject site was measured using the “Wenner Four-Pin” Method in accordance with IEEE Standard 81, IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System using an AEMC 6471 Ground Resistance Tester. The testing was conducted in the perpendicular North-South and East-West directions as shown on the attached Figure 2.

The four probes are designated as an input current probe C1 as the first pin, two internal probes, P1 and P2 which is a measure of the voltage for each spacing and the second outside pin is C2, the return current probe. Due to site constraints, the probe spacing was varied from a short spacing of 1.25 feet up to 150 feet. The results of this field testing are presented in Appendix B.

4.0 LABORATORY TESTING

Selected soil samples collected during the field exploration programs were tested to refine field classifications and to evaluate the physical properties of the soil used to assess the geotechnical aspects of project design and construction. Samples collected during excavations or borings were submitted to our Portland, Oregon laboratory. Subcontract laboratories were used for Thermal Resistivity and corrosion testing. The laboratory testing program included the following tests:

- Soil classification, in general accordance with ASTM D 2487. Few exceptions were made in USCS group name and symbols, as presented in the Terrageo Soil Classification System, Appendix A;
- Natural moisture content tests in accordance with ASTM D 2216;
- Grain size distribution in accordance with ASTM D 422 to confirm field classification and evaluate permeability of coarse grained soils;
- Atterberg limits determination with ASTM D4318 for plasticity and liquefaction analysis;
- One-dimensional consolidation testing with ASTM D2435 to evaluate site settlement.
- Modified Proctor (ASTM D1557);
- Corrosivity tests (pH, oxidation reduction (redox) potential, chloride, and sulfate content) as required by AWWA C105 and Resistivity tests (ASTM G57);
- Thermal Resistivity dryout curves on three shelby tubes sealed with field moisture content. Full dryout curves are provided.

Complete individual laboratory test results are presented in a similar order as above in Appendix D.

4.1 CORROSION POTENTIAL

Terrageo submitted several samples for subcontract laboratory testing to evaluate pH, resistivity, redox potential, chloride and sulfate content. These test results will be used by the designers to evaluate the potential for buried ferrous metals and sulfate/chloride attack on concrete. The results of these test are presented in the following Table 3.

TABLE 3: CORROSION TESTING SUMMARY

Exploration Location	Depth (feet)	pH/25°C (Units)	Chloride (MG/KG)	Sulfate (MG/KG)	Redox (mv)	Resistivity (ohm-cm)
B1-S1	3.5 - 5.0	5.76	1	1.87	0	160000
B5-S1	3.5 - 5.0	5.96	ND[1]	0.68	220	29500
B6-S1	3.5 - 5.0	5.88	0.307	1.36	280	93000

1) ND: non-detect

Complete individual laboratory test results are presented in Appendix D. From these results, we are of the opinion that the onsite soils are mildly corrosive to non-corrosive to buried ferrous materials and of negligible sulfate or chloride attack on concrete. This should only be used as a general indicator and detailed evaluations should be done by corrosion and cathodic protection specialist.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Our site investigation indicates that the proposed construction appears to be geotechnically feasible, provided that the recommendations of this report are incorporated into the design and construction phases of the project. Terrageo recommends we be contacted to provide a final review of the proposed construction documents if desired.

5.1 EARTHWORK

We anticipate that site development and earthwork will include the removal of structures, asphalt pavement and any existing utilities in the western portion of the site, if development of this area is required. We also understand that several feet of fill will be placed across the site. Areas of proposed improvements will require excavating for shallow foundations, utilities and other improvements, establishing subgrades for foundations and roadways and placing and compacting fill and backfill materials. We expect that site grading and earthwork can be accomplished with conventional earthmoving equipment. The following sections provide specific recommendations for site development and earthwork.

5.1.1 Clearing and Stripping

We anticipate that clearing and stripping depths at the site will typically be on the order of about 12 to 18 inches to remove sod and associated root network at the surface. However, it is likely that greater stripping depths will be required in areas of heavier vegetation, lower lying areas or in areas containing trees.

During stripping operations excessive disturbance of surficial soils may occur, especially if left exposed to wet conditions. Disturbed soils may require additional remediation during construction and grading. Soft subgrade potential exists for the siltier soils we observed in the eastern portion of the site. The siltier soils are compressible and may pose challenges for construction of utilities, trenches, and other improvements.

5.1.2 Erosion and Sediment Control

Erosion and sedimentation rates and quantities can be influenced by construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. Implementing an Erosion and Sedimentation Control Plan will reduce impacts to the project where erosion- prone areas are present. The plan should be designed in accordance with applicable county and/or state standards. The plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure;
- Re-vegetating or mulching denuded areas;
- Directing runoff away from exposed soils;

- Reducing the length and steepness of slopes with exposed soils;
- Decreasing runoff velocities;
- Preparing drainage ways and outlets to handle concentrated or increased runoff;
- Confining sediment to the project site;
- Inspecting and maintaining control measures frequently.

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce erosion and reduce transport of sediment to adjacent areas and receiving waters. Permanent erosion protection should be provided by paving, structure construction or landscape planting.

Until permanent erosion protection is established, and the site is stabilized, site monitoring may be required by qualified personnel to evaluate the effectiveness of the erosion control measures and to repair and/or modify them as appropriate. Provisions for modifications to the erosion control system based on monitoring observations should be included in the erosion and sedimentation control plan. Where sloped areas are present, some sloughing and raveling of exposed or disturbed soil on slopes should be expected. We recommend that disturbed soil be restored promptly so that surface runoff does not become channeled.

5.1.3 Temporary Excavations

The stability of open-cut slopes is a function of soil type, groundwater seepage, slope inclination, slope height, duration the excavation stays open and nearby surface loads. The use of inadequately designed open cuts could impact the stability of adjacent work areas, could affect existing utilities and could endanger personnel.

The contractor performing the work has the primary responsibility for protection of workers and adjacent improvements. In our opinion, the contractor will be in the best position to observe subsurface conditions continuously throughout the construction process and to respond to variable soil and groundwater conditions. Therefore, the contractor should have the primary responsibility for deciding whether to use open-cut slopes for much of the excavations rather than some form of temporary excavation support, and for establishing the safe inclination of the cut slope. Because of the diversity of construction techniques and available shoring systems, the design of temporary cut slopes is most appropriately left to the contractor proposing to complete the installation. Temporary cut slopes and shoring must comply with the provisions of Chapter 296-155 Washington Administrative Code (WAC), Part N, “Excavation, Trenching and Shoring.” Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls will be required under Washington Industrial Safety and Health Act (WISHA). The contract documents should specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety and providing shoring, as required, to protect personnel and structures. For

open cut slopes at the site, we recommend that:

- No traffic, construction equipment, stockpiles or building supplies be allowed at the top of the cut slopes within a distance of at least 5 feet from the top of the cut;
- The cut slopes should be planned such that they do not encroach on a 1H:1V influence line projected down from the edges of nearby or planned foundation elements.
- Exposed soil along the slope be protected from surface erosion by using waterproof tarps or plastic sheeting;
- Construction activities be scheduled so that the length of time the temporary cut is left open is reduced to the extent practicable;
- Erosion control measures be implemented as appropriate such that runoff from the site is reduced to the extent practicable;
- Surface water be diverted away from the slope; and
- The general condition of the slopes be observed periodically by the geotechnical engineer to confirm adequate stability.

Water that enters the excavation must be collected and routed away from prepared subgrade areas. We expect that this may be accomplished by installing a system of drainage ditches and sumps along the toe of the cut slopes. Some sloughing and raveling of the cut slopes should be expected. Temporary covering, such as heavy plastic sheeting with appropriate ballast, should be used to protect these slopes during periods of wet weather. Surface water runoff from above cut slopes should be prevented from flowing over the slope face by using berms, drainage ditches, swales or other appropriate methods.

5.1.4 Groundwater Handling Considerations

Based on our understanding of the proposed site improvements, including the placement of approximately 5 feet of fill for site development we do not anticipate that the regional groundwater table will be encountered during excavations at the site.

Groundwater was observed in every exploration between a depth of 5 and 10 feet. In the event that a deep excavation requires penetration of the groundwater, the excavation should be adequately shored, as explorations showed the silts and sands may heave into the cut and the onsite soils are susceptible to caving. We anticipate that groundwater excavations may require pumping and possibly could result in heaving silty sands. Ultimately, we recommend that the contractor performing the work be made responsible for controlling and collecting groundwater encountered, however, we recommend that Terrageo be contacted if open excavations, excluding deep foundations, are required for this project.

5.1.5 Subgrade Preparation

Subgrades across the sites should be thoroughly compacted to a uniformly firm and unyielding condition on completion of stripping and before placing structural fill. We recommend that subgrades

be proof-rolling with a heavy piece of wheeled construction equipment are appropriate methods of evaluation prior to placing the fill on the site.

If soft or otherwise unsuitable subgrade areas are revealed during evaluation that cannot be compacted to a stable and uniformly firm condition, we recommend that: (1) the unsuitable soils be scarified (e.g., with a ripper or farmer's disc), aerated and recompacted, if practical; or (2) the unsuitable soils be removed and replaced with compacted structural fill, as needed.

5.1.6 Subgrade Protection and Wet Weather Considerations

The near-surface soils observed in our explorations contain fines and will likely be susceptible to disturbance during periods of wet weather. The wet weather season generally begins in October and continues through May in western Washington; however, periods of wet weather can occur during any month of the year. It may be possible to conduct earthwork at the site during wet weather months provided appropriate measures are implemented to protect exposed soil. If earthwork is scheduled during the wet weather months, we offer the following recommendations:

- Measures should be implemented to remove or eliminate the accumulation of surface water from work areas. The ground surface in and around the work area should be sloped so that surface water is directed away and graded so that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches.
- Earthwork activities should not take place during periods of heavy precipitation.
- Slopes with exposed soils should be covered with plastic sheeting.
- The contractor should take necessary measures to prevent on-site soils and other soils to be used as fill from becoming wet or unstable. These measures may include the use of plastic sheeting, sumps with pumps and grading. The site soils should not be left uncompacted and exposed to moisture. Sealing exposed soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent to which these soils become wet or unstable.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with working pad materials not susceptible to wet weather disturbance.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.
- Protective surfacing such as placing asphalt-treated base (ATB) or haul roads made of quarry spalls or a layer of free-draining material such as well-graded pit-run sand and gravel may be necessary to limit disturbance to completed areas. Minimum quarry spall thicknesses should be on the order of 12 to 18 inches. Typically, minimum gravel thicknesses on the order of 24 inches are necessary to provide adequate subgrade protection.

5.2 FILL MATERIALS

5.2.1 Structural Fill

The workability of material for use as structural fill will depend on the gradation and moisture content of the soil. We recommend that washed crushed rock or select granular fill, as described below, be used for structural fill during wet weather. If prolonged dry weather prevails during the earthwork

phase of construction, materials with a somewhat higher fines content may be acceptable. Weather and site conditions should be considered when determining the type of import fill materials purchased and brought to the site for use as structural fill.

Material used for structural fill should be free of debris, organic contaminants and rock fragments larger than 6 inches. For most applications, we recommend that structural fill consist of material similar to “Select Borrow” or “Gravel Borrow” as described in Section 9-03.14 of the Washington State Department of Transportation (WSDOT) Standard Specifications.

5.2.2 Select Granular Fill

Select granular fill should consist of well-graded sand and gravel or crushed rock with a maximum particle size of 6 inches and less than 5 percent fines by weight based on the minus ¾-inch fraction. Organic matter, debris or other deleterious material should not be present. In our opinion, material with gradation characteristics similar to WSDOT Specification 9-03.9 (Aggregates for Ballast and Crushed Surfacing), or 9-03.14 (Borrow) is suitable for use as select granular fill, provided that the fines content is less than 5 percent (based on the minus ¾-inch fraction) and the maximum particle size is 6 inches.

5.2.3 Pipe Bedding and Trench Backfill

Trench backfill for the bedding and pipe zone should consist of well-graded granular material similar to “gravel backfill for pipe zone bedding” described in Section 9-03.12(3) of the WSDOT Standard Specifications. The material must be free of roots, debris, organic matter and other deleterious material. Other materials may be appropriate depending on manufacturer specifications and/or local jurisdiction requirements.

Trench backfill must be free of debris, organic material and rock fragments larger than 6 inches. We recommend that trench backfill material consist of material similar to “Select Borrow” or “Gravel Borrow” as described in Section 9-03.14 of the WSDOT Standard Specifications. Where excavations occur in the wet, alternative materials such as select granular fill should be considered.

5.2.4 On-Site Soil

Based on our subsurface explorations and experience, it is our opinion that existing site soils would not qualify as structural fill and trench backfill. Based on our experience, the silty sands, silts and trace clays at the site are moisture sensitive and will be very difficult or impossible to properly compact when wet.

In addition, it is likely that existing soils will be above optimum moisture content (OMC) when excavated, unless earthwork activities take place in the middle of summer. Even then, the soil could still be above OMC when excavated. Soils placed and compacted above OMC are typically difficult to work with and may have trouble achieving adequate compaction. If earthwork occurs during a

typical wet season, or if the soils are persistently wet and cannot be dried back due to prevailing wet weather conditions or lack of drying space/time, we recommend limited disturbance of the insitu soils and the use of imported structural fill or select granular fill, as described above.

5.2.5 Fill Placement and Compaction

General

To obtain proper compaction, fill soil should be compacted near OMC and in uniform horizontal lifts. Lift thickness and compaction procedures will depend on the moisture content and gradation characteristics of the soil and the type of equipment used. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Generally, 8- to 12-inch loose lifts are appropriate for steel-drum vibratory roller compaction equipment. Compaction should be achieved by mechanical means. During fill and backfill placement, sufficient testing of in-place density should be conducted to check that adequate compaction is being achieved.

Area Fills and Pavement Bases

Fill placed to raise site grades and materials under pavements and structural areas should be placed on subgrades prepared as previously recommended. Fill material placed below structures and footings should be compacted to at least 95 percent of the theoretical maximum dry density (MDD) per ASTM International (ASTM) D 1557. Fill material placed shallower than 2 feet below pavement sections should be compacted to at least 95 percent of the MDD. Fill placed deeper than 2 feet below pavement sections should be compacted to at least 92 percent of the MDD. Fill material placed in landscaping areas should be compacted to a firm condition that will support construction equipment, as necessary, typically around 85 to 90 percent of the MDD.

Trench Backfill

For utility excavations, we recommend that the initial lift of fill over the pipe be thick enough to reduce the potential for damage during compaction, but generally should not be greater than about 18 inches above the pipe. In addition, rock fragments greater than about 1 inch in maximum dimension should be excluded from this lift.

Trench backfill material placed below structures and footings should be compacted to at least 95 percent of the MDD per ASTM International (ASTM) D 1557. In paved areas, trench backfill should be uniformly compacted in horizontal lifts to at least 95 percent of the MDD in the upper 2 feet below subgrade. Fill placed below a depth of 2 feet from subgrade in paved areas must be compacted to at least 92 percent of the MDD per ASTM International (ASTM) D 1557. In non-structural areas, trench backfill should be compacted to a firm condition that will support construction equipment as necessary.

5.2.6 Permanent Slopes

For structural fill areas prepared as recommended above and on subgrade prepared as recommended above, we recommend permanent slopes of 26.5 degrees (2H:1V), inclinations relative to a horizontal reference plane for a maximum height of 5 feet. We are available to provide more detailed recommendations for permanent slopes that exceed 5 feet in height.

5.3 Mechanically Stabilized Earth (MSE) Walls

We understand that retaining walls may be used for grade transitions at the perimeter of the structural fill pad area. The walls are estimated to range from 4 to 6 feet in maximum height. The specifics for the design of the wall are not currently available. We are providing design parameters for mechanically stabilized earth (MSE) retaining walls as these systems can economically resist seismic and dynamic forces and transfers the bearing pressure to a wide area.

We recommend that the design calculations conform to WSDOT Specification Section 6-13.3(2). MSE walls should be assumed to have minimum grid lengths of 4 feet if no taller than 6 feet. The wall subgrade soils will generally consist of native soils suitable for support of these types of walls, provided they are compacted in place and inspected by geotechnical personnel before founding the MSE walls. We recommend that the base of the wall be compacted to a firm and unyielding condition. Wall systems may include large or small MSE welded wire face walls. Welded wire basket walls may be filled with rock or topsoil and planted depending on the desired aesthetics.

We recommend using an allowable bearing pressure of 2,000 psf for static conditions. This value can be increased by ⅓ for seismic and wind loading. MSE wall designs are typically performed by the wall system provider, however we recommend that the retaining walls be designed with the geotechnical design parameters presented in the following Table 4.

Table 4: MSE Design Parameters

Soil Properties	Wall Backfill	Retained Soil	Foundation Soil
Unit Weight (pcf)	130	130	110
Friction angle (deg)	34	34	30
Cohesion (psf)	0	0	0
Load State	**Sliding**	**Pullout**	**Overturning**
Static Conditions	1.5	1.5	2.0
Seismic Conditions	1.1	1.1	1.5

As an alternative to free-draining granular wall backfill, a prefabricated drainage structure may be used. A prefabricated drainage structure is a plastic drainage core or mesh, which is covered with

filter fabric to prevent soil intrusion and is fastened to the wall prior to placing backfill.

We recommend that a vertical uniform traffic surcharge of 250 psf be included in the design if traffic access will occur above the walls. If it is anticipated that there will be heavy construction equipment near the top of the wall, additional loading should be applied to take this into consideration. Adequate drainage provisions should be included in the wall design. We do not recommend reuse of on-site soils backfill of MSE walls.

5.4 DEEP FOUNDATIONS - GENERAL

We understand that deep foundations may be required for any substation structures, although the axial and lateral loading and locations of these potential foundations were not provided to Terrageo for the development of this report. Once these locations and loadings are determined, Terrageo should be contacted to ensure that the recommendations contained herein are appropriate. Depending on the proposed foundation levels within the anticipated site fill and the tolerances of the structures, conventional footings or mat foundations may be appropriate as presented in ensuing sections of this report.

Deep foundations transfer the structural loads through the softer upper soils into deeper, more competent soils. Given the presence of heaving soils and the site susceptibility to liquefaction induced settlement, cast-in-place piles will be the preferred deep foundation option for the proposed development. For elements requiring smaller capacity piles, driven 6 and 8 inch steel pipe piles are considered appropriate.

5.4.1 Augercast Piles

Several pile types are suitable for this project, including augercast piles, drilled piers, or drill-and-grouted micropiles. From our experience, augercast piles are likely the most economical pile option. Augercast piles are constructed by advancing a hollow-stem auger into the ground to a design pile tip elevation. When the needed embedment is achieved, grout is injected through the hollow stem of the auger under pressure and the auger is slowly withdrawn. Reinforcing steel is then set into the uncured grout column.

Augercast piles should be embedded below the liquefaction zones and into the gravels encountered between 35 and 40 feet below existing grades to account for potential downdrag forces. No reduction in pile capacity is required if the piles are installed on a center-to-center spacing of three pile diameters. Maintaining adequate head in the grout during augercast pile installation is imperative due to the artesian conditions encountered onsite. A qualified geotechnical engineer should observe the drilling operations, monitor grout placement and volumes, and evaluate the adequacy of individual drilled shaft installations.

Axial Capacity: The augercast piles should be installed below the liquifiable zones to ensure

liquefaction induced downdrag is captured in the foundation design. The axial bearing and uplift capacities of the auger cast piles are developed from side resistance in the bearing soils Terrageo has developed design recommendations for an 18-inch-diameter auger cast pile shafts assuming that the site will be developed with 5 feet of compact fill and a conservatively assumed 15-foot liquefiable zone starting at a depth of 10 feet below existing grades for the subject site.

TABLE 5: ALLOWABLE CAPACITY OF 18-INCH DIAMETER AUGERCAST PILING

Shaft Bearing Depth (feet)[1]	Allowable Static Conditions		Allowable Seismic Conditions
	Axial Compression	Axial Tension (Uplift)	Axial Compression
35-40	70 tons	45 tons	30 tons
40-45	85 tons	55 tons	60 tons

1) Shaft bearing depth is based on predevelopment grades.

The side resistance and end bearing capacities included in Table 5 apply to single typical pile for the site and are based on (2002) FHWA Continuous Flight Auger Piles (Augercast Piles) procedures. It should be noted that although FHWA design procedures were used in design of the piles, the design and capacities included in Table 5 include factors of safety appropriate for Allowable Stress Design procedures (factor of safety of 2 for skin and 3 for end bearing).

If piles are spaced at least three pile diameters on center, as recommended, no reduction of axial capacity for group action is needed. The structural characteristics of pile materials and structural connections may impose limitations on pile capacities and should be evaluated by the structural engineer. Full length steel reinforcing will be needed for shafts subjected to uplift loads.

Lateral Capacity: The design of the augercast piles will likely be governed by the lateral loads on the structures. The lateral capacity of the augercast piles will develop from the stiffness of the drilled shaft and the lateral resistance of the soil surrounding the drilled shaft.

We understand that the shafts will be designed using the L-PILE™ program. For evaluation of the lateral load behavior of the augercast piles, the parameters in Table 6 below can be used as input soil parameters for the L-PILE™ program. To account for liquefied soil conditions during the design seismic event, we recommend the p-multipliers Table 6 be applied the LPile generated p-y curves. The table below may conservatively be used for all the augercast piles.

TABLE 6: LATERAL PILE ANALYSIS INPUT PARAMETERS

GENERAL PROFILE FOR SITE				
Soil Parameter	**Layer 1[1]**	**Layer 2[2]**	**Layer 3[3]**	**Layer 2 (Glacial Till)**
Depth (ft)	0-5	5-17	17-35	35-75
USCS Soil Type	SP, GP	ML, SM	SM	GM
Soil Type (p-y curve model)	Sand (Reese)	Sand (Reese)	Sand (Reese)	Sand (Reese)
Effective Unit Weight (lb/ft^3)	135	110 (above GW table) 40 (below GW table)	50	70
Friction Angle (degrees)	40	30	33	38
p-y Modulus, k (lb/in^3)	125	25	50	200
P-Multipliers for Seismic Analysis	1.0	0.2	0.2	1.0

1) Compacted Fill imported to site.
2) Generally Quiet Water deposits - near surface silts, silty sands, silts with sand and sandy silt.
3) Generally Overbank Deposits – Sands and Silty sands with gravels – liquefiable in nature
4) Channel Deposits – Gravels and Sands with gravels, dense and hard.
5) Based on Brandenberg, et al, 2007.

Terrageo should be contacted if the piles are spaced closer than 5 diameters, center to center to account for group action of closely spaced piles.

Settlement: We estimate that the post-construction settlement of deep foundations, designed and installed as recommended, will be on the order of ½ inch or less. Maximum differential settlement should be less than about one-half the post-construction settlement. Most of this settlement will occur rapidly as loads are applied.

5.4.2 Driven Small Diameter Piles (Pin Piles)

Small diameter driven steel pipe piles, or pin piles, may also be considered, provided these piles will not be needed to carry tension loads. We are providing recommendations for six and eight-inch diameter piles. The structural engineer should evaluate the pile sizing and spacing based on the anticipated loads. The pipe should consist of schedule 40 galvanized pipe. The piles should meet the criteria for ASTM A-53 Grade “A” pipe. To achieve their allowable capacities, the piles should be driven to the refusal criteria specified in Table 7.

TABLE 7: PIN PILE DRIVING AND REFUSAL CRITERIA

Pile Diameter	Hammer Size (pounds)	Refusal Criteria	Allowable Pile Capacity
6-inch	3,000	Less than one inch of penetration for six seconds of continuous driving at 500 blows per minute, over three cycles.	15 tons
8-inch	3,000	Less than one inch of penetration for six seconds of continuous driving at 500 blows per minute, over three cycles.	25 tons

Pipe piles are typically provided in manageable lengths with straight cut ends. As each length is driven into the ground, additional lengths can be connected with compression fitted sleeve couplers. We discourage welding of pipe joints, particularly when galvanized pipe is used, as we have frequently observed welds break during driving.

Lateral Capacity: Due to the slenderness of pipe piles the lateral capacity of vertical pipe piles should be ignored in design calculations. Some resistance to lateral loads may be accomplished by battering the piles at a slope of 3H:12V (Horizontal:Vertical), or steeper. Lateral forces from wind or seismic loading may be resisted by the passive earth pressures acting against the pile caps. Passive resistance values may be determined using an equivalent fluid weight of 300 pounds per cubic foot (pcf). This value includes a safety factor of about 1.5 assuming that properly compacted granular fill will be placed adjacent to and surrounding the pile caps and grade beams and extend a horizontal distance equal to two times the height of the pile caps.

Estimated Pile Length: We anticipate the piles will achieve refusal in the underlying hard gravels. Similar to the augercast piles, the required pin pile length in order to develop the recommended pile capacity is expected to vary across the footprint of the structure, depending on the actual driving conditions encountered. For planning and cost estimating purposes we anticipate pile lengths will be in the range of 40 to 50 feet below grade. The actual pile length will depend on adequate penetration of the liquefiable zone and meeting the refusal criteria.

5.5 SHALLOW FOUNDATIONS

Provided the proposed structures at the site can withstand the anticipated liquefactions settlement, they may be satisfactorily supported on continuous wall and isolated column footings founded in the structural fill planned for the site. Exterior footings should be established at least 18 inches below the lowest adjacent grade. Interior footings can be founded a minimum of 12 inches below the top of the floor slab. Isolated column and continuous wall footings should have minimum widths of 24 and 18 inches, respectively.

Based on the groundwater conditions in our explorations and our understanding of the proposed footing elevations (bottom of footings established at or within a few feet of an approximately 5 foot increase in site grade) it is our opinion footing drains are not necessary to maintain bearing support

as provided in this report. However, because of the potential for near-surface seepage during wetter times of the year and from irrigation and potential landscaping, footing drains should be considered to maintain drier conditions around the structure and to reduce groundwater seepage that could migrate below the building slab. The sections below provide our recommendations for foundation bearing surface preparation and foundation design parameters.

5.5.1 Foundation Bearing Surface Preparation

Shallow footing excavations should be performed using a smooth-edged bucket to limit bearing disturbance. Foundations should bear on structural fill, the bearing surface should be compacted as necessary to a firm, unyielding condition. Loose or disturbed materials present at the base of footing excavations should be removed or compacted.

As structural fill is anticipated to be placed below footings to establish a bearing pad, we recommend the structural fill extend laterally beyond the foundation perimeter a distance equal to the depth of fill (measured from the base of the footing where necessary), or 3 feet, whichever is less.

Foundation bearing surfaces should not be exposed to standing water. If water is present in the excavation, it must be removed before placing formwork and reinforcing steel. Protection of exposed soil, such as placing a 6-inch thick layer of crushed rock or a 3- to 4-inch layer of lean-mix concrete, could be used to limit disturbance to bearing surfaces.

Prepared foundation bearing surfaces should be evaluated by a member of our firm prior to placement of formwork or reinforcing steel to verify that bearing surface has been prepared in accordance with our recommendations or to provide recommendations for remediating unsuitable bearing soils.

5.5.2 Allowable Soil Bearing Pressure

Shallow foundations bearing on subgrades prepared as recommended may be designed using an allowable soil bearing pressure of 3,000 pounds per square foot (psf). This bearing pressure applies to the total of dead and long-term live loads and may be increased by one-third when considering total loads, including earthquake or wind loads. These are net bearing pressures. The weight of the footing and overlying backfill can be ignored in calculating footing sizes. These bearing pressures are appropriate for shallow foundations constructed structural fill. We should be consulted if foundations will be constructed at elevations where they will not be bearing in at least 2 feet of structural fill.

5.5.3 Foundation Settlement

Disturbed soil must be removed from the base of footing excavations and the bearing surface should be prepared as recommended. Provided these measures are taken, we estimate the total static settlement of shallow foundations will be on the order of 1 inch or less for the bearing pressures presented above. Differential settlements could be on the order of ¼ to ½ inch between similarly

loaded foundations or over a distance of 50 feet of continuous footings. Settlements should occur rapidly, essentially as loads are applied. Settlements could be greater than estimated if disturbed or saturated soil conditions are present below footings. If reciprocating equipment requires site specific dynamic parameters or modal analysis, please contact our office.

5.5.4 Lateral Resistance

The ability of the soil to resist lateral loads is a function of the base friction, which develops on the base of foundations and slabs, and the passive resistance, which develops on the face of below-grade elements of the structure as these elements move into the soil. For cast-in-place foundations supported in accordance with the recommendations presented above, the allowable frictional resistance on the base of the foundation may be computed using a coefficient of friction of 0.35 applied to the vertical dead-load forces. If precast foundations are included as part of project plans, we can provide specific recommendations for base friction resistance for precast foundations. The allowable passive resistance on the face of the foundation or other embedded foundation elements may be computed using an equivalent fluid density of 250 pounds per cubic foot (pcf).

These values include a factor of safety of about 1.5. The passive earth pressure and friction components may be combined provided that the passive component does not exceed two-thirds of the total. The top foot of soil should be neglected when calculating passive lateral earth pressure unless the area adjacent to the foundation is covered with pavement or a slab-on-grade.

5.6 Slab-on-Grade Mat Foundations

Slab-on-grade mat foundations should bear on structural fill prepared as recommended in this report. We recommend the mat foundation subgrades be observed by a member of our firm during construction. Disturbed areas should be compacted, if possible, or removed and replaced with compacted structural fill. In all cases, the exposed soil should be compacted to a firm and unyielding condition.

We recommend the mat foundations be underlain by a minimum 6-inch-thick capillary break layer consisting of clean sand and gravel, crushed rock, or washed rock. The capillary break material should contain less than 3 percent fine material based on the percent passing the ¾-inch sieve size. Provided structural fill is prepared as recommended, we recommend slabs-on-grade be designed using an allowable bearing of 3000 psf and a modulus of subgrade reaction of 200 pounds per cubic inch (pci).

6.0 PAVEMENT DESIGN RECOMMENDATIONS

6.1 CONVENTIONAL ASPHALT CONCRETE PAVEMENTS

We provide recommended conventional Asphalt Concrete Pavements (ACP) sections below, which are based on our experience because estimated traffic loading is not available. We also provide alternate sections wherein ATB is substituted for the crushed surfacing base course layer. These pavement sections may not be adequate for heavy construction traffic loads such as those imposed by concrete transit mixers, dump trucks or cranes. The contractor should consider planned construction loading and determine whether the design sections are sufficient to support construction loading without damage. The recommended sections assume that final improvements surrounding the conventional ACP will be designed and constructed such that stormwater or excess irrigation water does not accumulate below the pavement section or pond on pavement surfaces.

Pavement subgrade should be prepared, placed and observed as previously described. Crushed surfacing base course and subbase should be moisture conditioned to near optimum moisture content and compacted to at least 95 percent of MDD (ASTM D 1557).

Crushed surfacing base course should conform to applicable sections of 4-04 and 9-03.9(3) of the WSDOT Standard Specifications. Hot mix asphalt should conform to applicable sections of 5-04, 9-02 and 9-03 of the WSDOT Standard Specifications.

Standard-Duty ACP – Automobile Driveways and Parking Areas

- 2 inches of hot mix asphalt, class ½ inch, PG 64-22.
- 4 inches of crushed surfacing base course.
- 6 inches of subbase consisting of select granular fill to provide a uniform grading surface and pavement support, to maintain drainage, and to provide separation from subgrade soils.
- Existing site soils or structural fill prepared in accordance with the “Subgrade Preparation” section.

Heavy-Duty ACP – Areas Subject to Heavy Truck Traffic

- 3 inches of hot mix asphalt, class ½ inch, PG 64-22.
- 6 inches of crushed surfacing base course.
- 6 inches of subbase consisting of select granular fill to provide a uniform grading surface and pavement support, to maintain drainage, and to provide separation from subgrade soils.
- Existing site soils or structural fill prepared in accordance with the “Subgrade Preparation” section.

6.2 PERVIOUS PAVEMENT

Our recommendations for pervious pavement design sections are based on information provided in the technical guidance manual for LID (Puget Sound LID manual), completed by the Puget Sound Partnership (December 2012) and our experience designing permeable pavements in the region. The pavement sections presented below are suitable for use in driveway and parking. The design

of pervious pavements for stormwater management should consider storage capacity of the pervious pavement system and infiltration rate of the subgrade soils. Our general recommendations are provided in the following sections; however, we recommend that final pervious pavement design should be in accordance with the complete recommendations provided in the Puget Sound LID manual.

Sections for pervious cement concrete pavement and porous asphalt pavement are presented below followed by specific recommendations for each section.

Pervious Cement Concrete Section

- 6 inches of pervious cement concrete.
- 6 inches (minimum) of permeable ballast, more permeable ballast may be required to provide adequate storage capacity for the section.
- Geotextile separation liner.
- Treatment layer (if necessary).
- Subgrade prepared as recommended below.

Porous Asphalt Concrete Section

- 4 inches of porous hot mix asphalt concrete.
- 6 inches (minimum) of permeable ballast, more permeable ballast may be required to provide adequate storage capacity for the section.
- Geotextile separation liner.
- Treatment layer (if necessary).
- Subgrade prepared as recommended below.

6.2.1 Pavement

Permeable pavements should be open graded and should have a minimum infiltration rate of at least 100 inches per hour when newly installed. Field infiltration tests should be considered on newly placed permeable pavements to verify the infiltration rate.

6.2.2 Permeable Ballast

We recommend a minimum 6-inch-thick permeable ballast layer that meets the specification for American Public Works Association (APWA) General Special Provision (GSP) 9-03.9(2) Option 1 (shown in Table 8 below). A thicker permeable ballast layer may be necessary to provide sufficient storage capacity for the design infiltration rate. In general, the permeable ballast can be considered to have a porosity of 30 percent.

TABLE 8: GRADATION SPECIFICATION FOR PERMEABLE BALLAST

Sieve Size	Percent Passing
2½ inch	99-100
2 inch	65-100
¾ inch	40-80
No. 4	0-5
No. 100	0-2
% Fracture	95

Permeable ballast layers between 6 and 12 inches thick should be placed as a single lift. The ballast should be lightly compacted to a firm unyielding condition. Overcompaction of the ballast can result in reduced permeability. The prepared ballast layer should be observed by the geotechnical engineer to ensure that the ballast has been adequately compacted prior to placement of the permeable pavement. If the permeable ballast layer is thicker than 12 inches, it should be placed and compacted in multiple lifts not exceeding 12 inches in thickness.

6.2.3 Treatment Layer

Stormwater must be treated prior to infiltration. Stormwater can be captured and pretreated prior to infiltration, treatment layers can be built into the infiltration systems, or the existing site soils must meet treatment criteria outlined in the SWMMWW (2019). In order to be suitable for stormwater treatment existing site soils must have a cation exchange capacity (CEC) greater than 5 milliequivalents/100 grams and an organic content of at least 1 percent. Completing CEC and organic content tests on the site soils was beyond our scope. Once the locations of the infiltration systems are determined, site soils should be tested to determine if they are suitable for stormwater treatment.

A geotextile separation fabric should be included between the bottom of the treatment layer and the prepared subgrade to prevent the treatment media from migrating into the subgrade soils. The separation geotextile should be non-woven and meet the requirement of WSDOT Standard Specification 9-33.1 for separation.

6.2.4 Subgrade Preparation

Subgrades below permeable pavement sections should be lightly compacted to a firm and unyielding condition before constructing the permeable pavement section; however, overcompaction of the subgrade should be avoided. Prepared subgrades should be protected from construction traffic, standing water or other disturbance. If portions of the subgrade become disturbed or are overcompacted, the subgrade should be scarified to a minimum depth of 8 inches

and recompacted. The subgrade should be recompacted to between 90 and 92 percent of the MDD.

6.2.5 Protection, Maintenance and Icing

It is imperative that soil is not tracked onto pervious pavement surfaced areas during construction. Periodic visual inspections should be performed throughout the pavement life to determine if pervious pavement surfaces are clogged with fine soil or vegetation. Surfaces should be swept with a high-efficiency or vacuum sweeper regularly (typically at least two to four times per year) and washed with a high-pressure hose at least once per year.

Because the relatively porous base and subbase layers allow some air movement below the pavement, pervious pavement surfaces may become icy more easily than conventional pavement surfaces. This problem is similar to differential icing of bridges and elevated road structures. Users should be made aware of the possibility of differential icing if pervious pavements are used.

7.0 REFERENCES

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8.0 UNCERTAINTIES AND LIMITATIONS

We have prepared this report for the owner and their consultants for use in design of this project only. This report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented in this report should not be construed as a warranty of the subsurface conditions. Experience has shown that soil and groundwater conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, Terrageo should be notified for review of the recommendations of this report, and revision of such if necessary.

Sufficient geotechnical monitoring, testing and consultation should be provided during construction to confirm that the conditions encountered are consistent with those indicated by explorations. Recommendations for design changes will be provided should conditions revealed during construction differ from those anticipated, and to verify that the geotechnical aspects of construction comply with the contract plans and specifications.

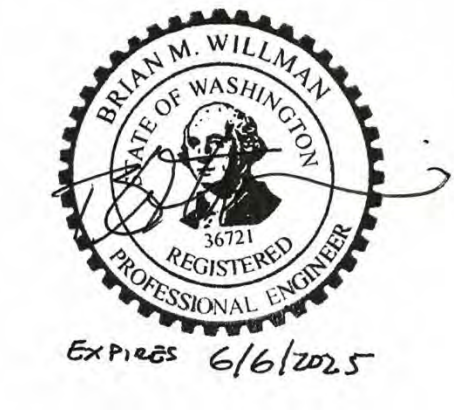
Within the limitations of scope, schedule and budget, Terrageo attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology at the time the report was prepared. No warranty, expressed or implied, is made. The scope of our work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or groundwater at this site.

Terra-Geo, Inc. appreciates the opportunity to provide this report and looks forward to working with you in the future. If you have any questions regarding this report, or need further assistance, please do not hesitate to call (503) 729-9195.

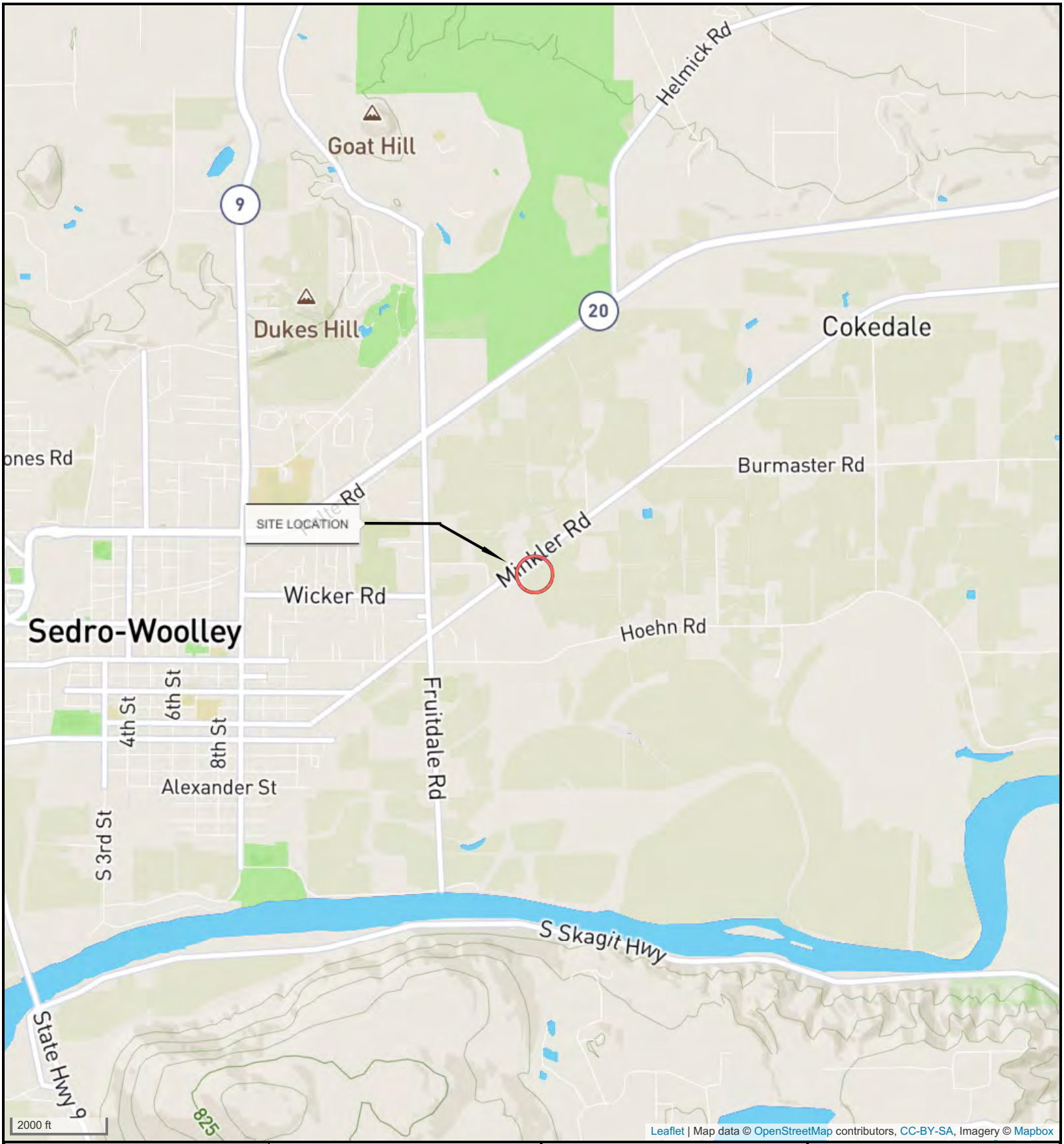
Sincerely,

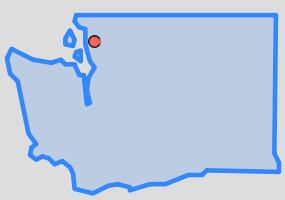
TERRA-GEO, INC

Brian M. Willman, PhD, PE, GE
Principal Engineer




TERRA-GEO





Latitude: 48.50817
Longitude: -122.20125

N
W E
S

TERRA-GEO

Tenaska, Inc.
Goldeneye

FIGURE 1
SITE LOCATION MAP

2580 Minkler Road
Sedro-Wolley, Washington

N

W E

S

Legend

- Test Pit
- Soil Boring
- Resistivity Center Pt.
- Resistivity Alignment
- Site Property Boundary

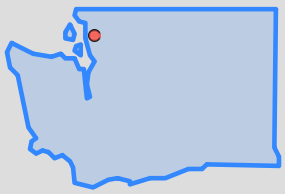
Latitude: 48.50786, Longitude: -122.20133

TERRA-GEO

FIGURE 2
SITE EXPLORATION MAP

Tenaska, Inc.
Goldeneye

2580 Minkler Road
Sedro-Wolley, Washington



Latitude: 48.50817
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TERRA-GEO

Tenaska, Inc.
Goldeneye

FIGURE 3
SITE GEOLOGY MAP

2580 Minkler Road Sedro-Wolley, Washington

Appendix A – Exploration Test Pit Logs, Boring Logs and Photos

TERRA-GEO

BORING AND WELL LOG LEGEND

SURFACE
- ASPHALT
- CONCRETE
- FILL
- TOPSOIL
- AIR
- ICE

USCS
- Well-graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- Silty GRAVEL (GM)
- Clayey GRAVEL (GC)
- Silty, Clayey GRAVEL (GC-GM)
- Well-graded GRAVEL with silt (GW-GM)
- Poorly graded GRAVEL with silt (GP-GM)
- Well-graded GRAVEL with clay (GW-GC)
- Poorly graded GRAVEL with clay (GP-GC)
- Well-graded SAND (SW)
- Poorly graded SAND (SP)
- Silty SAND (SM)
- Clayey SAND (SC)
- Silty, Clayey SAND (SC-SM)
- Well-graded SAND with silt (SW-SM)
- Poorly graded SAND with silt (SP-SM)
- Well-graded SAND with clay (SW-SC)
- Poorly graded SAND with clay (SP-SC)
- SILT (ML)
- Lean CLAY (CL)
- Silty CLAY (CL-ML)
- Organic SOIL (OL)
- Elastic SILT (MH)
- Fat CLAY (CH)
- Organic SOIL (OH)
- Organic SOIL (OL/OH)
- PEAT (PT)
- BEDROCK
- IGNEOUS Rock
- METAMORPHIC Rock
- SEDIMENTARY Rock
- WATER

Non-USCS
- Gravel
- Sand
- Silt
- Clayey Silt
- Silt & Clay
- Clay & Silt
- Silty Clay
- Clay
- Boulders
- Cobbles
- Peastone
- Glacial Till
- Iron Ore
- Wood
- Peat
- Saprolite
- Ash
- Waste

Volume Descriptors
- Trace = <5%
- Few = 5-10%
- Little = 15-25%
- Some = 30-45%
- Mostly = >=50%

Water Levels
- Water Level During Drilling
- Water Level at End of Drilling/in Completed Well

Well/Boring Completion
- Cap
- Riser
- Screen
- End Plug
- Annular Seal
- Sanitary Seal (Bentonite Slurry/Chips/Pellets/Powder, Other)
- Filter Pack (Sand, Gravel, Other)
- Backfill

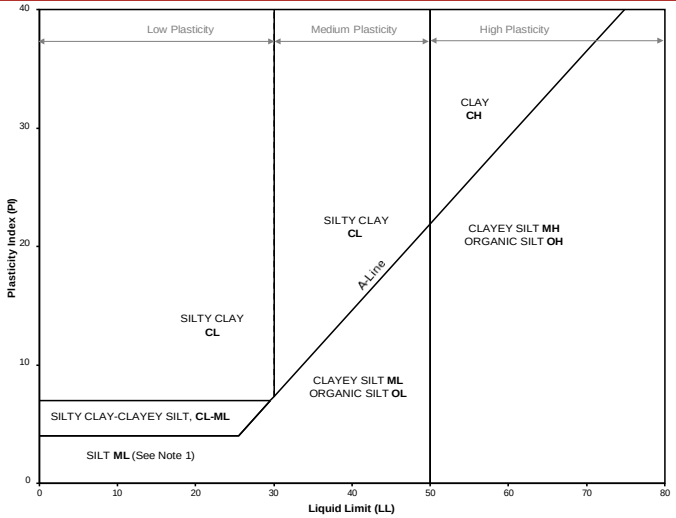
Sample Type
- GR — Grab
- EN — Encore
- SS — Split Spoon
- SH — Shelby Tube
- CO — Core Barrel
- DP — Direct Push
- ID — Lab Sample and ID

METHOD OF SOIL CLASSIFICATION

Terra-geo Inc. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content <30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with <12% * fines (by mass)	Poorly Graded	<4	≤1 or ≥3	<30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (>50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with <12% * fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
				Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content <30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3 mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3 mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3 mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% **(see Note 2, below)**	CL	SILTY CLAY
			Liquid Limit 30 to <50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CL	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous, or amorphous peat							75% to 100%		PEAT



Note 1 – Fine-grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are Non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics." For soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

* Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC, and, CL-ML. For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel). For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see plasticity chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, GM/SM, CL/ML. A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

METHOD OF SOIL CLASSIFICATION

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimeters	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	> 300	> 12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Mediu m Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	< 0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
≤ 5	trace
> 5 to 12	some
> 12 to 35	Primary soil name prefixed with “gravelly, sandy, SILTY, CLAYEY” as applicable
> 35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL, SAND and CLAY)

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

N = the number of blows required to drive a 2 inch (50 mm) split-spoon sampler one foot (300 mm) using a 140 lb (63.5 kg) hammer falling 30 inches (760 mm) after an initial 6 inch (150 mm) seating (ASTM D1586).

Cone Penetration Test (CPT):

An electronic cone penetrometer with a 60° conical tip and a typical projected end area of 10 or 15 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve friction (f_s) are recorded electronically in real time during penetration. The seismic CPT (SCPT) adds measurement of shear wave velocity (V_S) to the standard CPT.

Dynamic Cone Penetration Test (DCP), N_d:

The penetration rate by an 8 kg (17.6 lb) hammer dropped 575 mm (22.6 in.) to drive uncased a 20 mm (0.79 in.) diameter, 60° cone attached to 16 mm (5/8 in.) drive rods (ASTM D6951). Other test methods exist for DCPs with different configurations and different correlations.

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLE TYPES

AS	Auger sample
CS	Chunk sample
DO or DP	Drive open (SPT) or direct pushed tube sampler
DS	Denison type sample
FS	Foil sample
PS	Pitcher type sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

SOIL TESTS

M	water content
A	Atterberg limits (plastic and liquid limits)
G, H	grain size, hydrometer
UW	unit weight
Com	compaction
C	consolidation (oedometer) test
U	unconfined compression test
UU	unconsolidated undrained triaxial test
CD	consolidated isotropically drained triaxial test[1]
CU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D	direct shear test
V (FV)	field vane (LV-laboratory vane test)
SG	specific gravity
P	permeability
PD	pinhole dispersion
O	organic content test
PH	pH
CHEM	chemical analysis (refer to text)

1. Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[1]

Term	SPT ‘N’ (blows/foot)[2]
Very Loose	0 - 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. Definition of compactness descriptions based on SPT ‘N’ ranges from Terzaghi and Peck (1967) and correspond to typical average N_{60} values.
2. SPT ‘N’ in accordance with ASTM D1586, uncorrected for overburden pressure effects. ‘N’-values should be considered ONLY an approximate guide to consistency; for sensitive clays the ‘N’-value approximation for consistency terms does not apply.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	Undrained Shear Strength (tsf)	SPT ‘N’[1] (blows/foot)
Very Soft	<12	<0.12	0 to 2
Soft	12 to 25	0.12 to 0.25	2 to 4
Firm	25 to 50	0.25 to 0.5	4 to 8
Stiff	50 to 100	0.5 to 1	8 to 15
Very Stiff	100 to 200	1 to 2	15 to 30
Hard	>200	>2	>30

1. SPT ‘N’ in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-1 **Page:** 1 of 4

Drilling Start Date:	**05/30/2023 09:30**	Boring Depth (ft):	**70**
Drilling End Date:	**05/30/2023 11:20**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Shelby Tube, Split Spoon**
Drilling Method:	**Mud Rotary**	DTW During Drilling (ft):	**6**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50808, -122.20231**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
0								(0.00') Topsoil										0
								(0.75') SILT with gravel (ML); trace fine gravel, little fine-coarse sand, trace clay, nonplastic, medium stiff, moist, light brown										
				SH		2.00				15.4								
5																		5
				SS	1 2 1	0.33	3	(7.50') Silty SAND with gravel (SM); fine-coarse grained, some fine gravel, little silt, very loose, saturated, pale bluish-black, black and white grains of sand		35.3								
10																		10
				SS	1 1 1	1.50	2	(13.50') SILT (ML); few fine-medium sand, low plasticity, very soft, saturated, light bluish-gray (14.5') 4-inch layer of wood encountered		41								
15																		15
				SS	4 5 7	1.50	12	(17.50') Silty SAND with gravel (SM); fine-coarse grained, little fine-coarse gravel, little silt, medium dense, saturated, light bluish-gray, white and black granules		58.3								
20																		20

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-1 **Page:** 2 of 4

Drilling Start Date:	**05/30/2023 09:30**	Boring Depth (ft):	**70**
Drilling End Date:	**05/30/2023 11:20**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Shelby Tube, Split Spoon**
Drilling Method:	**Mud Rotary**	DTW During Drilling (ft):	**6**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50808, -122.20231**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
20								(17.50') Silty SAND with gravel (SM); fine-coarse grained, little fine-coarse gravel, little silt, medium dense, saturated, light bluish-gray, white and black granules											20
				SS	3 4 7	1.00	11			17.2									
25								(24') Silty SAND with gravel (SM); fine-coarse grained, little fine-coarse gravel, little silt, medium dense, moist, light bluish-gray, white and black granules											25
				SS	6 7 11	0.66	18	(28.50') Silty GRAVEL with sand (GM); fine-coarse grained, little fine-coarse sand, little silt, medium dense, slightly moist, pale bluish-gray, black and white grains		12.3									
30																			30
				SS	18 19 17	0.80	36	(33.5') As Above: grades to dense, 2-inch thick wood layer encountered		10.2									
35								(37') Difficulty drilling through gravel layers.											35
				SS	4 7 9	0.80	16			12.5		30	24	6	19.8				
40																			40

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-1 **Page:** 3 of 4

Drilling Start Date:	**05/30/2023 09:30**	Boring Depth (ft):	**70**
Drilling End Date:	**05/30/2023 11:20**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Shelby Tube, Split Spoon**
Drilling Method:	**Mud Rotary**	DTW During Drilling (ft):	**6**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50808, -122.20231**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
40								(38.50') Silty GRAVEL with sand (GM); fine-coarse grained, little fine-coarse sand, little silt, medium dense, slightly moist, pale bluish-gray, black and white sand grains										40
				SS	8 9 14	1.50	23											
								(44.00') Silty SAND with gravel (SM); fine-coarse grained, some fine-coarse gravel, little silt, medium dense, slightly moist, pale bluish-gray, black and white sand grains. (46.5') Difficulty advancing augers in Gravels										
45																		45
				SS	10 6 7	0.50	13			8.1								
								(49.00') Silty GRAVEL (GM); fine-coarse grained, few fine-coarse sand, little silt, medium dense, slightly moist, pale bluish-gray, greenish to black and white sand grains and fine gravels (51') Difficulty advancing augers in Gravels										
50																		50
				SS	16 20 17	1.20	37			11.2								
								(53.5') As Above: Grades to Dense										
55																		55
								(56') Difficulty advancing augers in Gravels										
				SS	12 18 20	1.10	38			14								
60																		60

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-1 **Page:** 4 of 4

Drilling Start Date:	**05/30/2023 09:30**	Boring Depth (ft):	**70**
Drilling End Date:	**05/30/2023 11:20**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Shelby Tube, Split Spoon**
Drilling Method:	**Mud Rotary**	DTW During Drilling (ft):	**6**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50808, -122.20231**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
60								(58.50') Silty SAND with gravel (SM); fine-coarse grained, some fine-coarse gravel, little silt, dense, slightly moist, pale bluish-gray, white and black sand grains										60
				SS	2 5 7	1.50	12	(63.5') As Above: grades to medium dense.		22.3		33	25	8	18.8			
65																		65
				SS	4 6 10	1.10	16			21.9								
70								(70.00') Boring terminated										70
75																		75
80																		80

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-2 **Page:** 1 of 2

Drilling Start Date:	**05/31/2023 11:06**	Boring Depth (ft):	**30**
Drilling End Date:	**05/31/2023 12:36**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**5**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50829, -122.20215**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
0								(0.00') Topsoil										0
								(1.50') SILT with sand (ML); trace fine gravel, little fine-medium sand, trace clay, low plasticity, medium stiff, wet, light brown										
5		▼		SS	3 3 3	0.85	6			39.4								5
10				SS	1 1 3	1.50	4	(8.5') becomes wet and has more of a blue-gray color (9.5') 2-inch wood layer encountered in sample		41.4								10
15				SS	3 6 7	1.00	13	(14.00') Silty SAND with gravel (SM); fine-coarse grained, little fine-coarse gravel, little silt, medium dense, moist, pale bluish-gray, black and white sand grains		24.1								15
20				SS	3 5 5	1.50	10			24.4								20

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-2 **Page:** 2 of 2

Drilling Start Date:	**05/31/2023 11:06**	Boring Depth (ft):	**30**
Drilling End Date:	**05/31/2023 12:36**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**5**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50829, -122.20215**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
20								(14.00') Silty SAND with gravel (SM); fine-coarse grained, little fine-coarse gravel, little silt, medium dense, moist, pale bluish-gray, black and white sand grains											20
25				SS	3 7 5	1.50	12			25								25
30				SS	4 9 5	1.50	14			11.5								30
								(30.00') Boring terminated										
35																		35
40																		40

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-3 **Page:** 1 of 2

Drilling Start Date:	**5/30/2023 08:35**	Boring Depth (ft):	**30**
Drilling End Date:	**05/30/2023 09:11**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**7.5**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**6.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50744, -122.20209**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
0								(0.00') Topsoil										0
								(1.50') SILT with sand (ML); little fine-medium sand, little clay, low plasticity, medium stiff, slightly moist, light brown, gray brown									
				SS	2 2 4	1.35	6			11.2								
5																		5
				SS	1 2 4	1.00	6	(9') As Above: moisture content increases		28.1								
10																		10
				SS	1 2 3	1.50	5	(13.50') Silty SAND (SM); fine-medium grained, some silt, few clay, loose, slightly moist, pale bluish-gray		11.8		43	28	15	47.9			
15																		15
				SS	4 6 8	1.50	14			22.9								
20																		20

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-3 **Page:** 2 of 2

Drilling Start Date:	**5/30/2023 08:35**	Boring Depth (ft):	**30**
Drilling End Date:	**05/30/2023 09:11**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**7.5**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**6.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50744, -122.20209**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
20								(18.50') Silty SAND with gravel (SM); fine-coarse grained, little fine-coarse gravel, little silt, medium dense, moist, pale bluish-gray, black and white sand grains										20
				SS	1 1 1	1.50	2	(23.5') As Above: becomes very loose		29.6								
25																		25
				SS	3 2 5	1.50	7	(28.5') As Above: becomes loose in density		15.7								
30								(30.00') Boring terminated										30
35																		35
40																		40

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-4 **Page:** 1 of 4

Drilling Start Date:	**05/30/2023 11:50**	Boring Depth (ft):	**70**
Drilling End Date:	**05/30/2023 13:45**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Split Spoon**
Drilling Method:	**Mud Rotary**	DTW During Drilling (ft):	**7**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50751, -122.19970**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	Blow Counts	Recovery (ft)	N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
0								(0.00') Topsoil										0
								(1.50') Silty SAND (SM); fine-coarse grained, few fine gravel, some silt, loose, moist, light reddish-brown										
5				SS	2 5 5	1.00	10			23.6									5
		▽						(7.50') SILT with sand (ML); few fine gravel, some fine-coarse sand, low plasticity, medium stiff, wet, light bluish-gray										
10				SS	1 2 3	1.50	5			51.2									10
								(12.50') Silty SAND with gravel (SM); fine-coarse grained, little fine gravel, some silt, loose, wet, pale bluish-gray, black and white sand grains										
15				SS	2 3 4	1.50	7			35.7									15
								(18.5') As Above: density increases to medium dense, moisture decreases to moist										
				SS	3 5 11	0.50	16			11.2									
20																		20

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-4 **Page:** 2 of 4

Drilling Start Date:	**05/30/2023 11:50**	Boring Depth (ft):	**70**
Drilling End Date:	**05/30/2023 13:45**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Split Spoon**
Drilling Method:	**Mud Rotary**	DTW During Drilling (ft):	**7**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50751, -122.19970**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
20								(18.5') As Above: density increases to medium dense, moisture decreases to moist										20
25				SS	12 21 27	0.90	48	(23.5') As Above: density increases to Dense		12.1								25
30				SS	10 13 17	1.30	30	(27.50') Silty GRAVEL (GM); fine-coarse grained, few fine-medium sand, little silt, dense, dry, very pale bluish-gray, white and black sand grains		6.8		41	30	11	24.4			30
35				SS	25 26 21	0.40	47			11.5								35
40				SS	18 25 20	0.50	45			6.8								40

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-4 **Page:** 3 of 4

Drilling Start Date:	**05/30/2023 11:50**	Boring Depth (ft):	**70**
Drilling End Date:	**05/30/2023 13:45**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Split Spoon**
Drilling Method:	**Mud Rotary**	DTW During Drilling (ft):	**7**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50751, -122.19970**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
40								(27.50') Silty GRAVEL (GM); fine-coarse grained, few fine-medium sand, little silt, dense, dry, very pale bluish-gray, white and black sand grains										40
				SS	18 15 21	0.50	36			5.4								
45								(46') difficulty drilling due to gravels										45
				SS	15 16 11	0.40	27			9.1								
50																		50
				SS	9 11 15	1.50	26	(53.50') Silty GRAVEL with sand (GM); fine-coarse grained, some fine-coarse sand, little silt, dense, dry, pale bluish-gray, white and black sand grains		7.8								
55																		55
				SS	8 12 14	1.50	26			8.8		37	28	9	16.6			
60																		60

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-4 **Page:** 4 of 4

Drilling Start Date:	**05/30/2023 11:50**	Boring Depth (ft):	**70**
Drilling End Date:	**05/30/2023 13:45**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Split Spoon**
Drilling Method:	**Mud Rotary**	DTW During Drilling (ft):	**7**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50751, -122.19970**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
60								(53.50') Silty GRAVEL with sand (GM); fine-coarse grained, some fine-coarse sand, little silt, dense, dry, pale bluish-gray, white and black sand grains											60
				SS	8 12 16	1.50	28	(63.5') As Above		10.1								
65																		65
				SS	7 13 16	1.50	29			13.4								
70								(70.00') Boring terminated										70
75																		75
80																		80

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-5 **Page:** 1 of 2

Drilling Start Date:	**05/30/2023 14:19**	Boring Depth (ft):	**30**
Drilling End Date:	**05/30/2023 14:58**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Shelby Tube, Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**6**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50808, -122.19974**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
0								(0.00') Topsoil										0
								(1.00') SILT with sand (ML); trace fine gravel, little fine-medium sand, few clay, low plasticity, soft, wet, light brown										
				SH		2.00				54.3									
5																		5
				SS	1 1 2	1.50	3			69									
10				SH								41	31	10	78.6			10
								(12.50') Silty SAND with gravel (SM); fine-coarse grained, little fine-coarse gravel, little silt, medium dense, wet, light brown										
				SS	3 5 6	1.25	11			40									
15																		15
				SS	7 6 7	0.50	13	(18.50') Silty SAND with gravel (SM); fine-coarse grained, little fine gravel, little silt, medium dense, wet, pale bluish-gray, white and black sand grains		23.8								
20																		20

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-5 **Page:** 2 of 2

Drilling Start Date:	**05/30/2023 14:19**	Boring Depth (ft):	**30**
Drilling End Date:	**05/30/2023 14:58**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Shelby Tube, Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**6**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50808, -122.19974**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
20								(18.50') Silty SAND with gravel (SM); fine-coarse grained, little fine gravel, little silt, medium dense, wet, pale bluish-gray, white and black sand grains										20
				SS	4 11 22	1.50	33	(23.5') As Above: grades to dense		18.2								
25																			25
				SS	2 4 14	1.50	18	(28.5') As Above: grades to medium dense		14								
30								(30.00') Boring terminated											30
35																			35
40																			40

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-6 **Page:** 1 of 2

Drilling Start Date:	**05/31/2023 9:22**	Boring Depth (ft):	**30**
Drilling End Date:	**05/31/2023 10:05**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Shelby Tube, Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**7**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50864, -122.19992**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
0								(0.00') Topsoil										0
								(1.00') SILT with sand (ML); little fine-medium sand, trace clay, low plasticity, medium stiff, slightly moist, light brown										
				SH		2.00				39.5								
5																		5
				SS	2 3 2	1.50	5			56.4								
10																		10
				SS	2 3 5	1.50	8	(12.50') Silty SAND with gravel (SM); fine-coarse grained, little fine-coarse gravel, little silt, loose, wet, light bluish-gray, black and white sand grains (14.5') 4-inch thick wood layer encountered		56.7								
15																		15
				SS	3 4 5	1.50	9			29.4								
20																		20

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-6 **Page:** 2 of 2

Drilling Start Date:	**05/31/2023 9:22**	Boring Depth (ft):	**30**
Drilling End Date:	**05/31/2023 10:05**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Shelby Tube, Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**7**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7.5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50864, -122.19992**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
20								(14.5') 4-inch thick wood layer encountered										20
				SS	4 7 10	1.30	17	(23.5') As Above: grades to medium dense		20.6								
25																		25
				SS	6 5 7	1.50	12	(27.00') Silty SAND (SM); fine-coarse grained, few fine-coarse gravel, little silt, medium dense, moist, pale bluish-gray, black and white sand grains		7.3								
30								(30.00') Boring terminated										30
35																		35
40																		40

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-7 **Page:** 1 of 2

Drilling Start Date:	**05/31/2023 8:25**	Boring Depth (ft):	**30**
Drilling End Date:	**05/31/2023 9:05**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Shelby Tube, Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**7.5**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50905, -122.19980**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	Blow Counts	Recovery (ft)	N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
0								(0.00') Topsoil										0
								(1.00') Sandy SILT (ML); trace fine gravel, some fine-coarse sand, few clay, medium plasticity, soft, moist, dark reddish-brown										
				SS	1 1 2	1.00	3			32.5									
5																		5
				SS	2 1 2	1.50	3			38.4									
10				SH		2.00		(9.5') 2-inch wood layer encountered				43	32	11	60.5			10
								(12.00') Silty SAND with gravel (SM); fine-coarse grained, little fine-coarse gravel, little silt, loose, wet, light bluish-gray, black and white sand grains										
				SS	2 3 5	1.33	8			29.9									
15																		15
				SS	4 6 9	1.25	15	(18.5') As Above: grades to medium dense		27		45	31	14	12.7			
20																		20

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-7 **Page:** 2 of 2

Drilling Start Date:	**05/31/2023 8:25**	Boring Depth (ft):	**30**
Drilling End Date:	**05/31/2023 9:05**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Shelby Tube, Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**7.5**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**7**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50905, -122.19980**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
20								(18.5') As Above: grades to medium dense										20
25				SS	3 5 7	1.50	12	(22.50') Silty SAND with gravel (SM); fine-coarse grained, little fine-coarse gravel, little silt, medium dense, slightly moist, pale bluish-gray, black and white sand grains		18.4					19.5			25
30				SS	4 11 11	1.50	22	(30.00') Boring terminated		14.4								30
35																		35
40																		40

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-8 **Page:** 1 of 2

Drilling Start Date:	**05/31/2023 10:10**	Boring Depth (ft):	**30**
Drilling End Date:	**05/31/2023 10:55**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**7**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50833, -122.20040**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
0								(0.00') Topsoil										0
								(1.00') Silty SAND with gravel (SM); fine-coarse grained, little fine-coarse gravel, little silt, loose, wet, light bluish-gray, black and white sand grains									
				SS	2 5 5	1.50	10			28.7								
5		▼																5
		▽																
				SS	3 4 4	1.30	8			29.4								
10																		10
								(12.00') SILT (ML); few fine-medium sand, low plasticity, medium stiff, moist, light bluish-gray									
				SS	1 1 3	1.50	4			40.1								
15																		15
								(17.50') Silty, Clayey SAND and gravel (SC-SM); fine-coarse grained, little fine-coarse gravel, little silt, trace clay, medium dense, moist, light bluish-gray, black and white sand grains									
				SS	3 6 8	1.25	14			29.5		26	20	6	21.7			
20																		20

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-8 **Page:** 2 of 2

Drilling Start Date:	**05/31/2023 10:10**	Boring Depth (ft):	**30**
Drilling End Date:	**05/31/2023 10:55**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**7**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50833, -122.20040**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
20								(17.50') Silty, Clayey SAND and gravel (SC-SM); fine-coarse grained, little fine-coarse gravel, little silt, trace clay, medium dense, moist, light bluish-gray, black and white sand grains										20
				SS	9 3 9	1.50	12	(23.50') Silty SAND (SM); fine-coarse grained, few fine gravel, little silt, medium dense, slightly moist, pale bluish-gray, black and white sand grains		8.8								
25																		25
				SS	2 4 7	1.50	11			11.4								
30								(30.00') Boring terminated										30
35																		35
40																		40

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**BORING LOG** **Boring No.** B-8 **Page:** 2 of 2

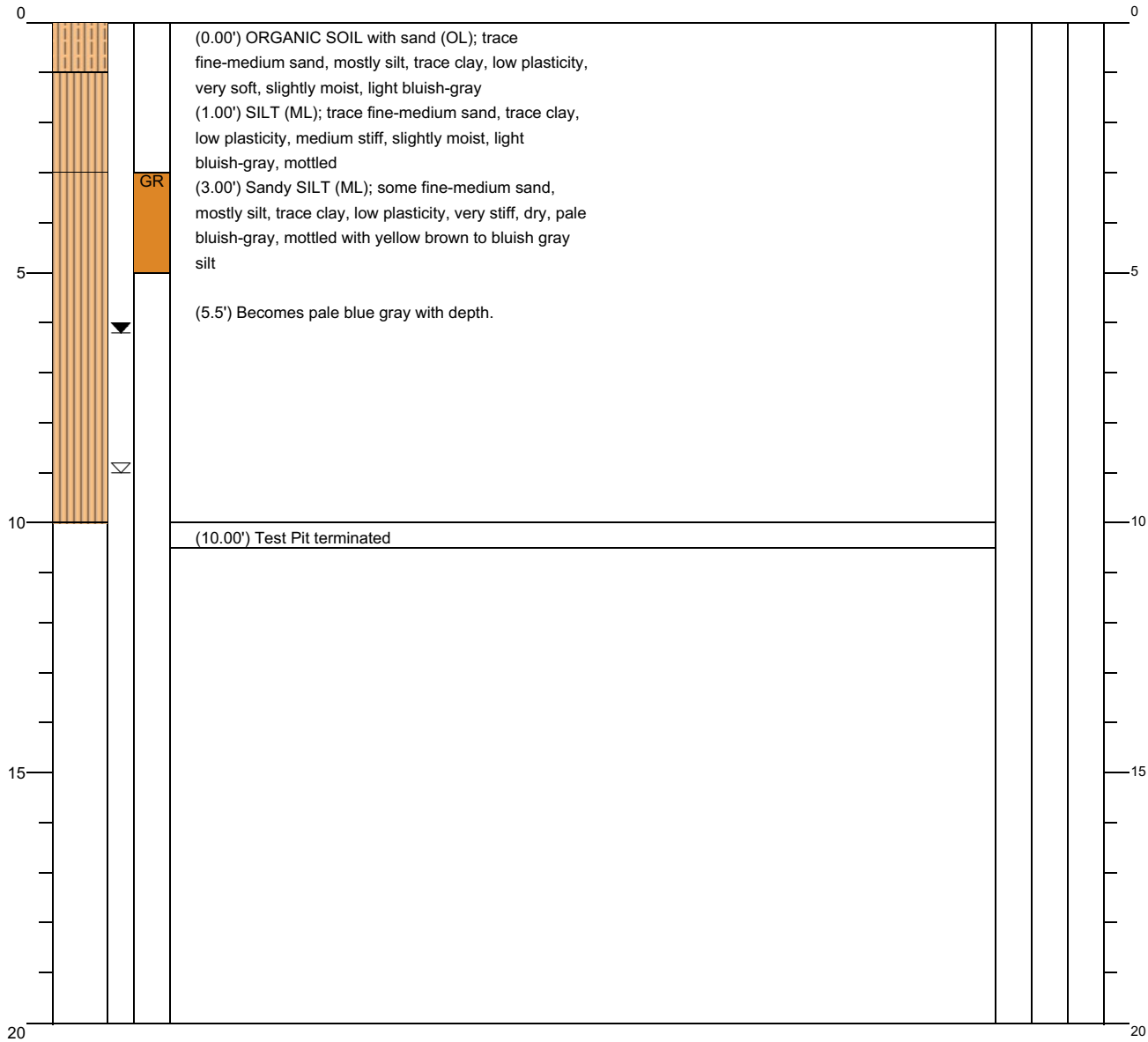
Drilling Start Date:	**05/31/2023 10:10**	Boring Depth (ft):	**30**
Drilling End Date:	**05/31/2023 10:55**	Boring Diameter (in):	**4.00**
Drilling Company:	**Boretec-1**	Sampling Method(s):	**Split Spoon**
Drilling Method:	**Hollow Stem Auger**	DTW During Drilling (ft):	**7**
Drilling Equipment:	**EC95**	DTW After Drilling (ft):	**5**
Driller:	**Logan Hand**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50833, -122.20040**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	BORING COMPLETION	COLLECT: Sample Type	COLLECT: Blow Counts	COLLECT: Recovery (ft)	COLLECT: N Value RQD%	SOIL/ROCK VISUAL DESCRIPTION	PID (ppm)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index (PI)	#200 Sieve (%)	Pocket Penetrometer (tsf)	Unconfined Compressive Strength (tsf)	DEPTH (ft)
20								(17.50') Silty, Clayey SAND and gravel (SC-SM); fine-coarse grained, little fine-coarse gravel, little silt, trace clay, medium dense, moist, light bluish-gray, black and white sand grains										20
				SS	9 3 9	1.50	12	(23.50') Silty SAND (SM); fine-coarse grained, few fine gravel, little silt, medium dense, slightly moist, pale bluish-gray, black and white sand grains		8.8								
25																		25
				SS	2 4 7	1.50	11			11.4								
30								(30.00') Boring terminated										30
35																		35
40																		40

NOTES:

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T1 **Page:** 1 of 1

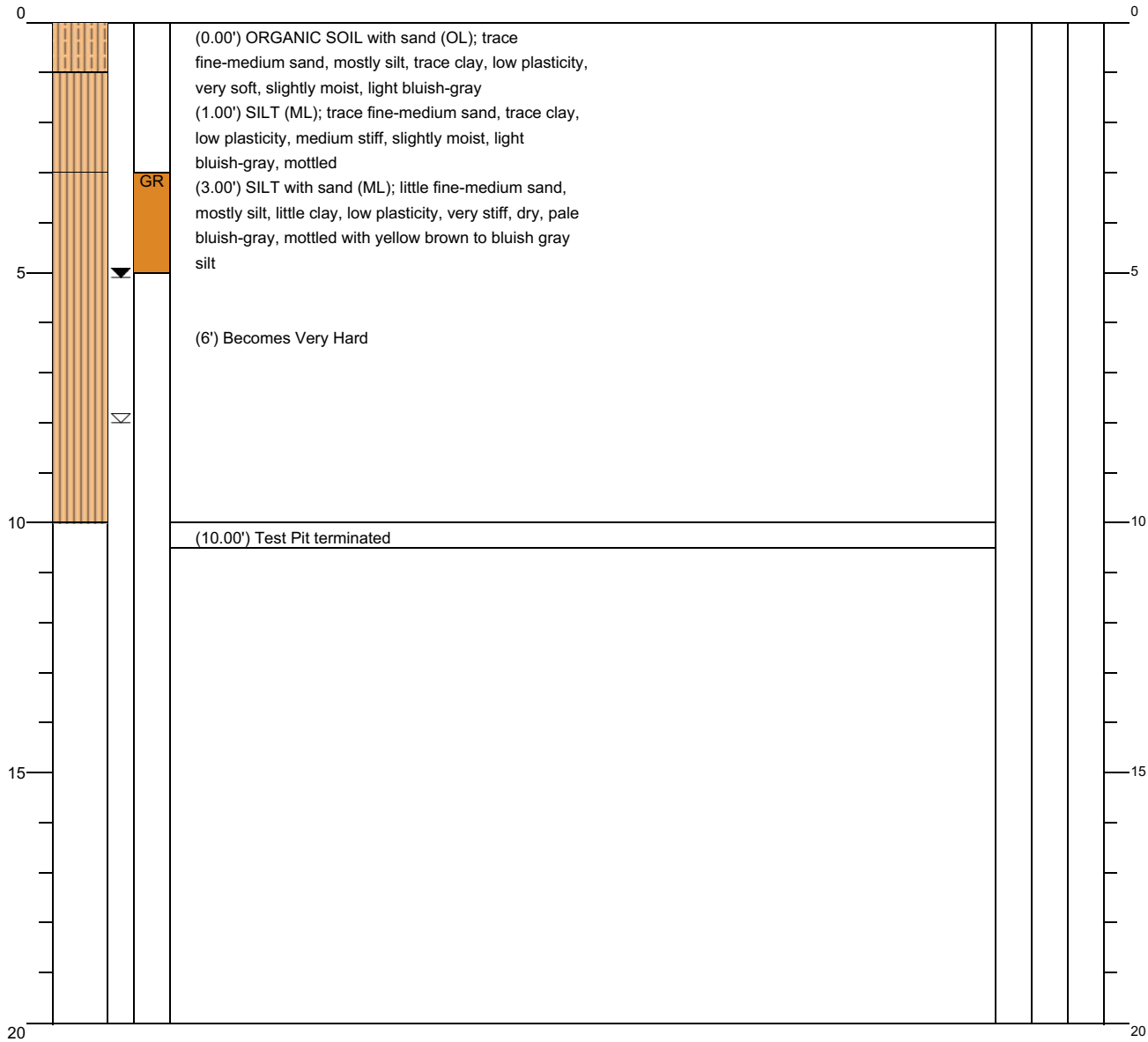
Excavation Date:	**12/16/22 08:00**	Excavation Depth (ft):	**10**
Excavated By:	**Cedar Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**9**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**6.2**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50806, -122.20194**



NOTES: Utility location performed before excavation

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T2 **Page:** 1 of 1

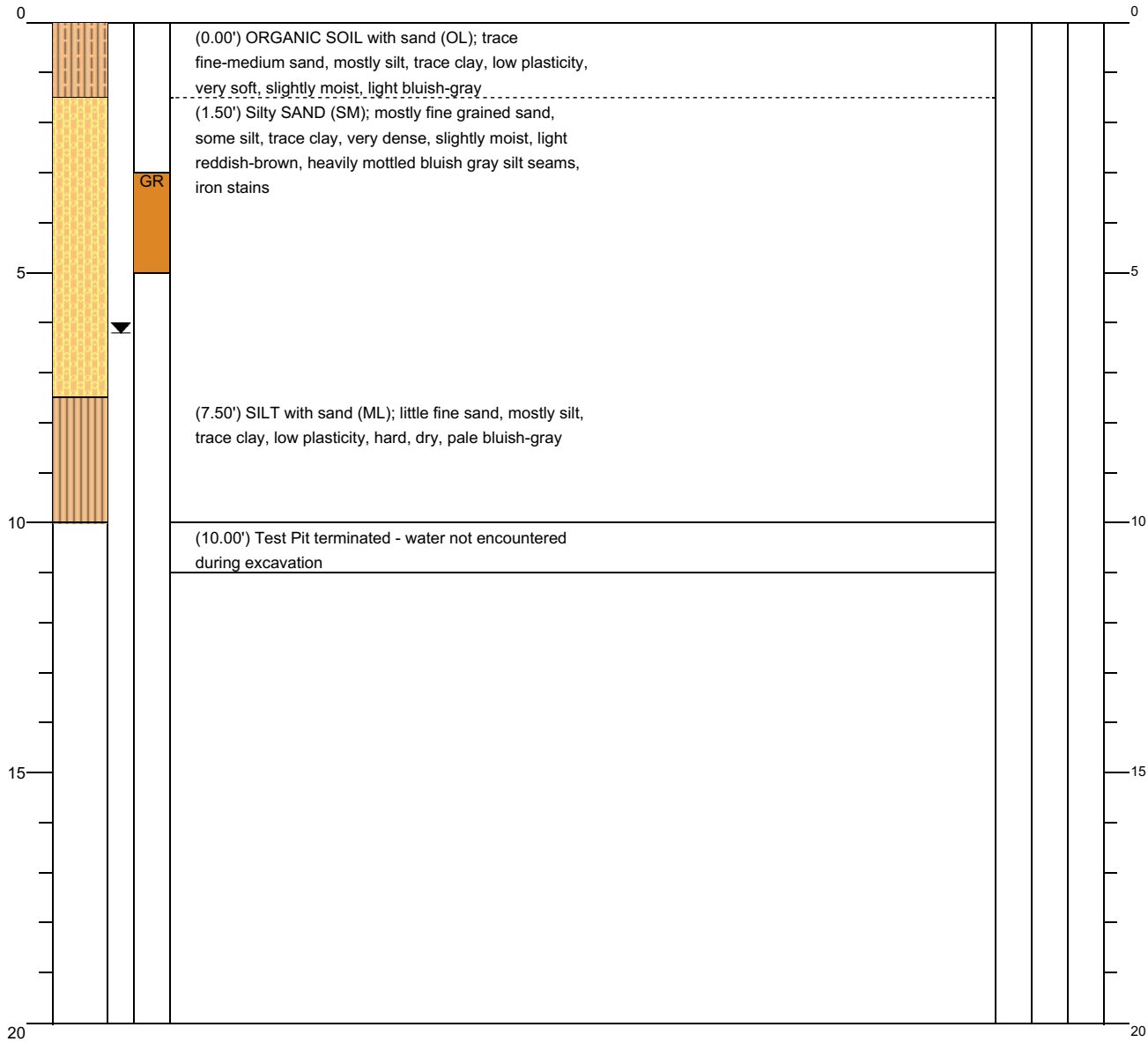
Excavation Date:		Excavation Depth (ft):	**10**
Excavated By:	**Cedar Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**8**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**5.1**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50833, -122.20139**



NOTES: Utility location performed before excavation

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T3 **Page:** 1 of 1

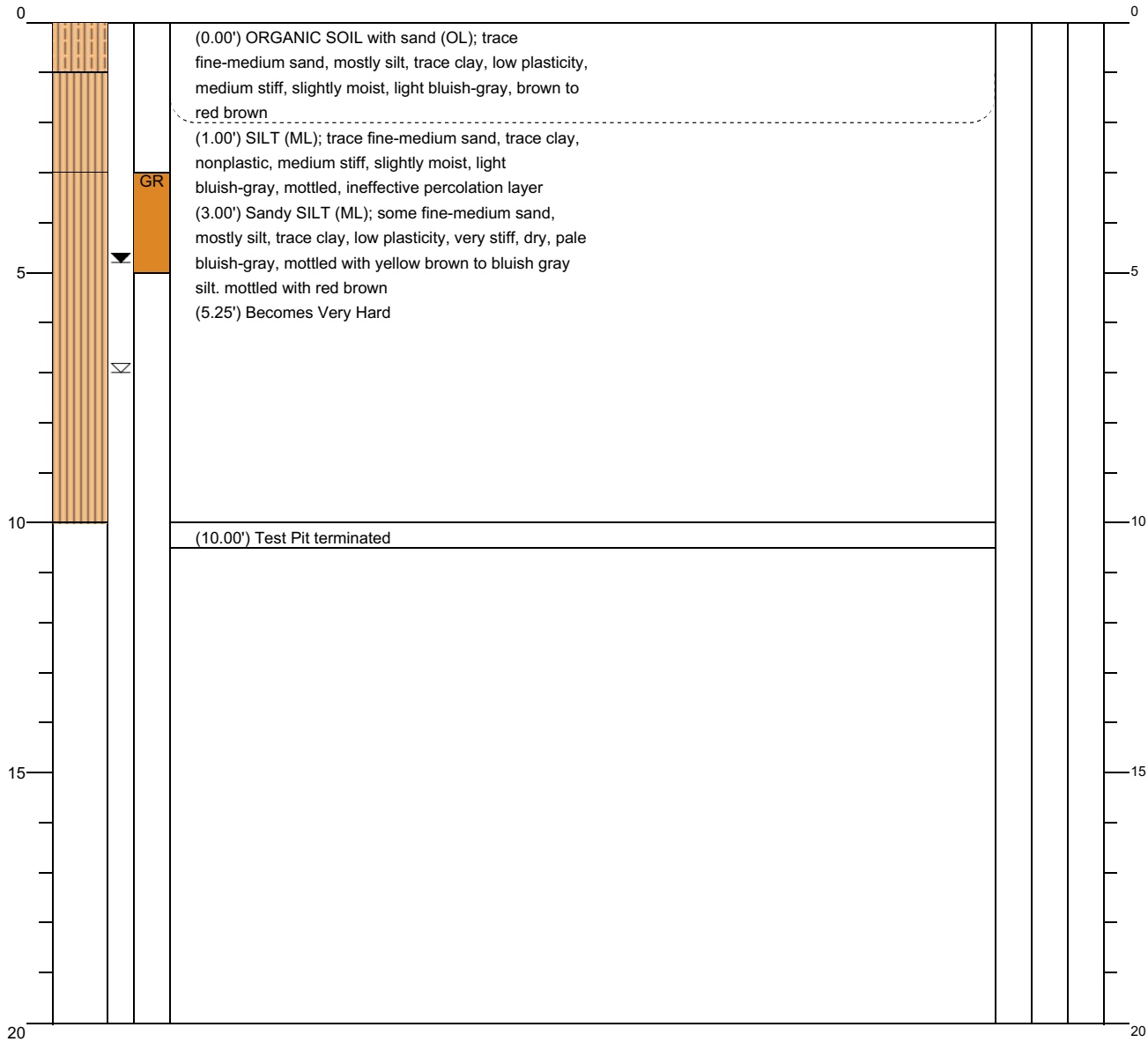
Excavation Date:	**12/16/2022**	Excavation Depth (ft):	**10**
Excavated By:	**Cedar Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**N/A**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**6.2**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50806, -122.20139**



NOTES: Utility location performed before excavation

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T4 **Page:** 1 of 1

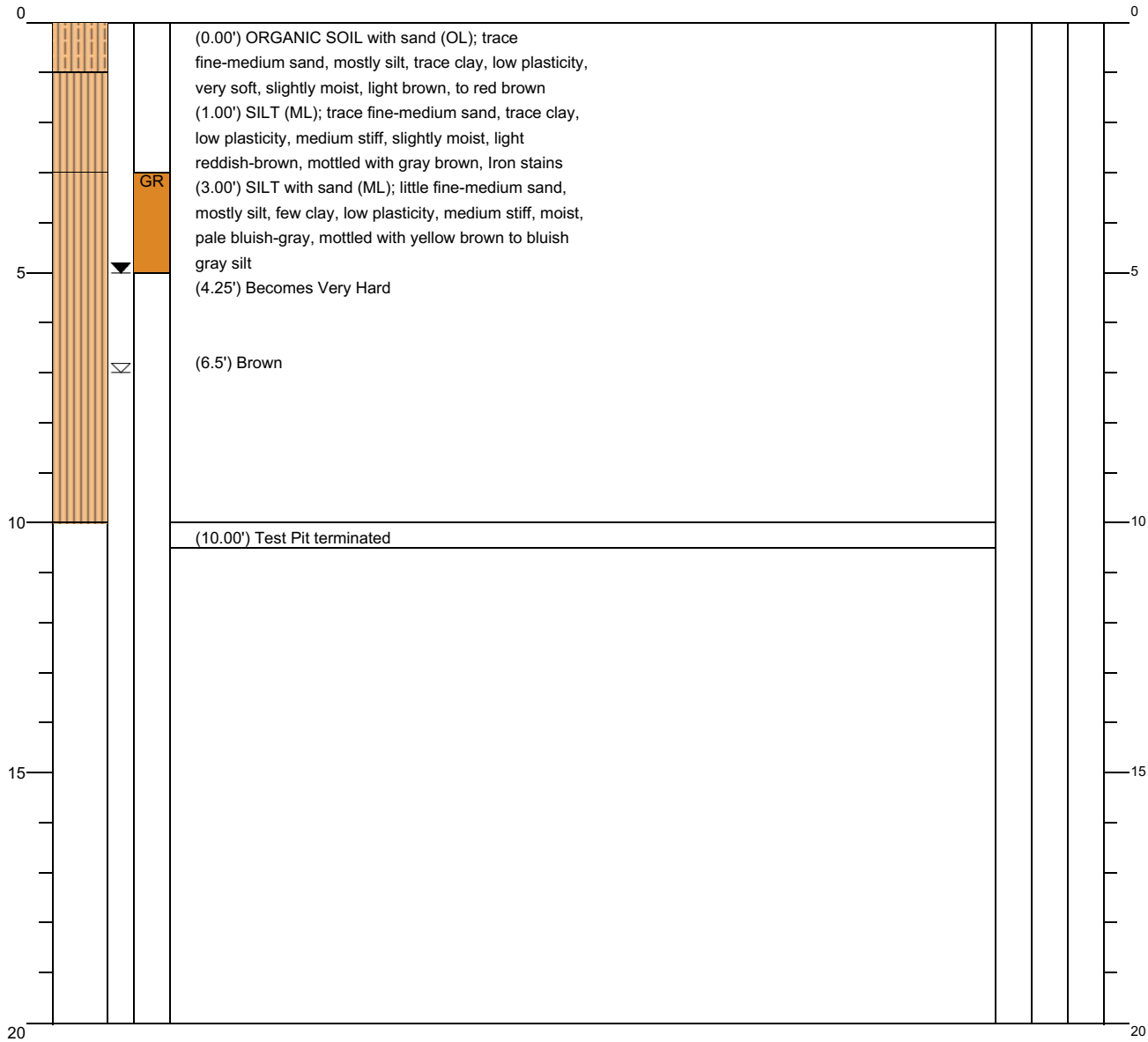
Excavation Date:	**12/16/2022**	Excavation Depth (ft):	**10**
Excavated By:	**Cedar Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**7**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**4.8**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50861, -122.20056**



NOTES: Utility location performed before excavation

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T5 **Page:** 1 of 1

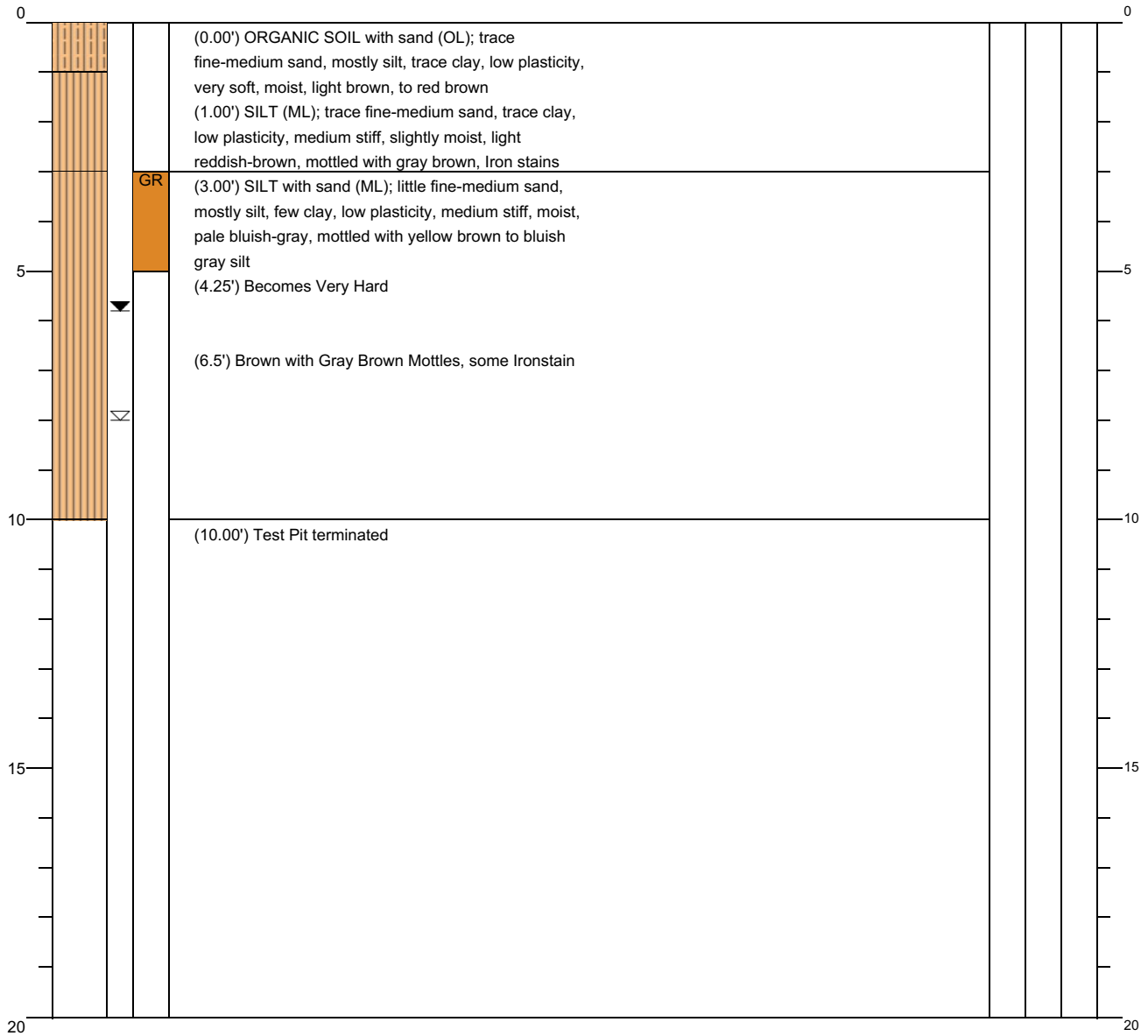
Excavation Date:	**12/16/2022**	Excavation Depth (ft):	**10**
Excavated By:	**Cedar Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**7**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**5**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50806, -122.20028**



NOTES: Utility location performed before excavation

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T6 **Page:** 1 of 1

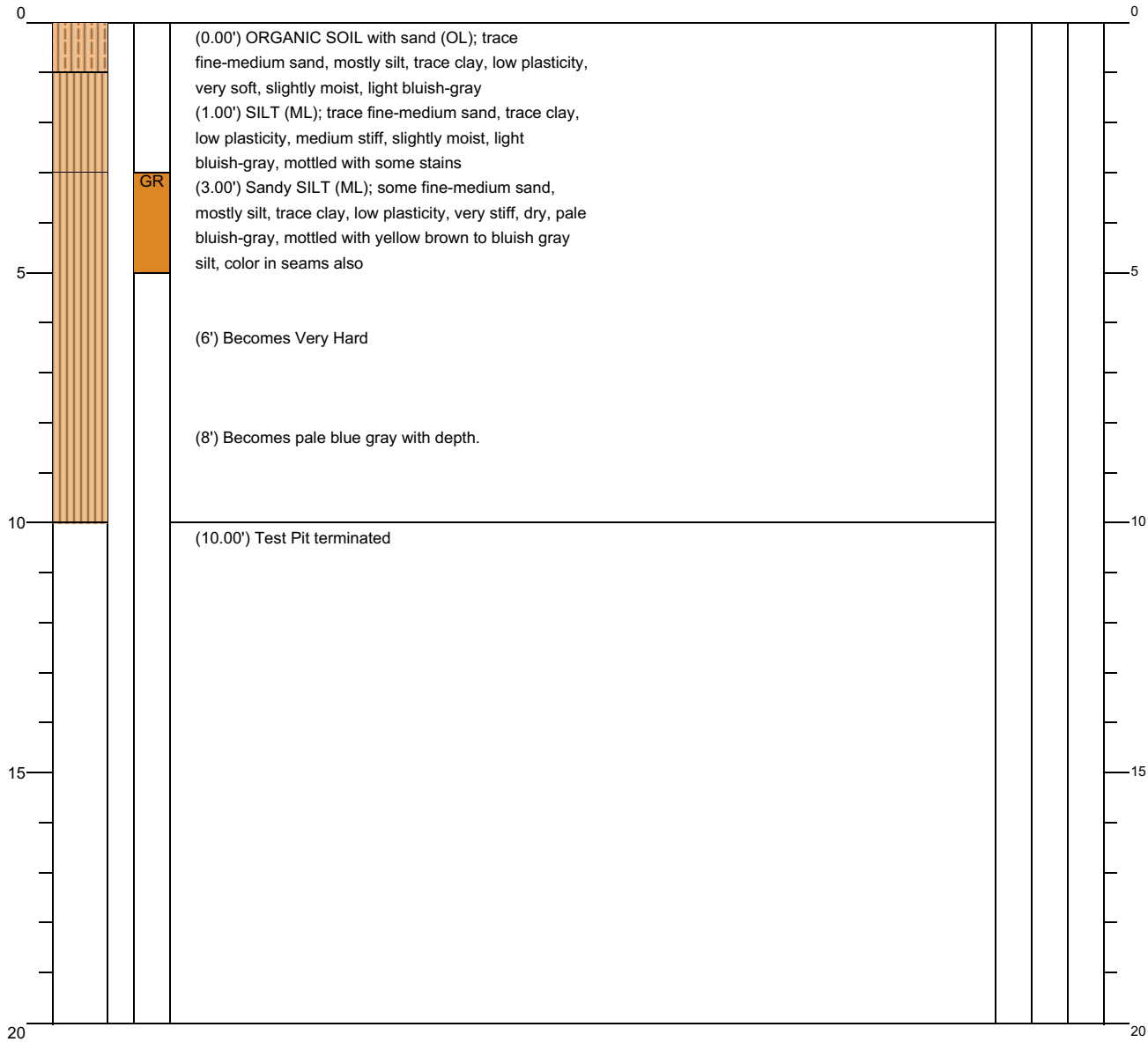
Excavation Date:		Excavation Depth (ft):	**0**
Excavated By:	**Cedar Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**8**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**5.8**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50889, -122.19972**



NOTES: Utility location performed before excavation

TERRA-GEO	**Client:** Tenaska, Inc. **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T7 **Page:** 1 of 1

Excavation Date:		Excavation Depth (ft):	**0**
Excavated By:	**Cedar Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**N/A**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**N/A**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50750, -122.19944**



NOTES: Utility location performed before excavation

PHOTO 1 TP-1 During Excavation	
PHOTO 2 TP-1 Before Backfill	

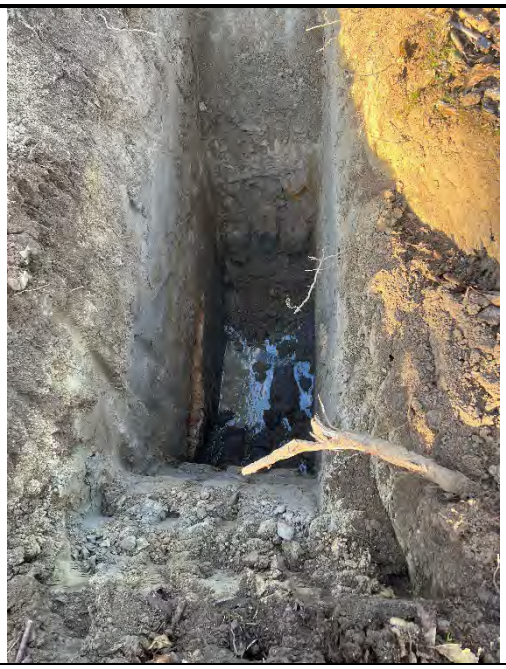
PHOTO 3 TP-2 During Excavation	
PHOTO 4 TP-2 Before Backfill	

PHOTO 5 TP-3 During Excavation	
PHOTO 6 TP-3 Before Backfill	

PHOTO 7 TP-4 During Excavation		
PHOTO 8 TP-4 Before Backfill		

PHOTO 9 TP-5 During Excavation		
PHOTO 10 TP-5 Before Backfill		

PHOTO 11 TP-6 During Excavation		
PHOTO 12 TP-6 Before Backfill		

PHOTO 13 TP-7 During Excavation		

Appendix B – Field Resistivity Results

TERRA-GEO

FIELD RESISTIVITY REPORT

Start Testing: 11:15 am **Conclude Testing: 12:45 pm**

DATE: 5/29/2023	**JOB NO: 00223**
PROJECT: Goldeneye BESS	
LOCATION: 2580 Minkler Road in Sedro-Wolley, Skagit County, Washington	
WEATHER: 64 degrees, mostly sunny	**SURFACE CONDITIONS: Vegetated Grasses, slightly moist at surface**
RESISTIVITY OPERATORS: Brian Willman, Soleil Willman-Day using AEMC 6471 Ground Resistance Tester	

Test Point	Probe Spacing (feet)	Resistance Reading (Ohms)		**Calculated Resistivity (Ohm-Meters)**	
		East-West Direction	North-South Direction	**East-West Direction**	**North-South Direction**
1	1.25	526	436	**1259**	**1044**
2	2.5	338	627	**1618**	**3002**
3	5.0	111.4	212	**1067**	**2030**
4	7.5	232	130	**3332**	**1867**
5	10	91	206	**1743**	**3945**
6	15	90.9	69.3	**2611**	**1991**
7	20	82.9	63	**3175**	**2413**
8	30	73.5	94.3	**4223**	**5418**
9	40	67.8	56.1	**5194**	**4298**
10	50	94.4	60.1	**9039**	**5755**
11	60	73.1	52.6	**8400**	**6044**
12	80	80.2	63.4	**12287**	**9713**
13	100	84.1	56.1	**16106**	**10744**
14	150	211	99.2	**60613**	**28497**

Appendix C – Laboratory Testing Results

COMBINED LABORATORY TESTING

			Atterberg Limits			% Fines
Exploration	Depth (ft)	USCS Description	LL	PL	PI	Passing #200
TP-1	3.0-5.0	Sandy Silt (ML)				66.7
TP-2	3.0-5.0	Silt with Sand (ML)				73.5
TP-3	3.0-5.0	Silty Sand (SM)				27.8
TP-4	3.0-5.0	Sandy Silt (ML)	45	35	10	63.8
TP-5	3.0-5.0	Silt with Sand (ML)	41	30	11	83.4
TP-6	3.0-5.0	Silt with Sand (ML)				82.8
TP-7	3.0-5.0	Sandy Silt (ML)				57.2
B1-S8	38.5-40.0	(GM) Silty Gravel with Sand	30	24	6	19.8
B1-S13	63.5-65.0	(SM) Silty Sand with Gravel	33	25	8	18.8
B3-S3	13.5-15.0	(SM) Silty Sand	43	28	15	47.9
B4-S6	28.5-30.0	(GM) Silty Gravel	41	30	11	24.4
B4-S12	58.5-60.0	(GM) Silty Gravel with Sand	37	28	9	16.6
B5-S2B	10.0-12.0	Silt with Sand (ML)	41	31	10	78.6
B7-S2B	10.0-12.0	Sandy Silt (ML)	43	32	11	60.5
B7-S4	18.5-20.0	Silty Sand with Gravel (SM)	46	31	15	12.7
B7-S5	23.5-25.0	(SM) Silty Sand	NP	NP	NP	19.5
B8-S4	18.5-20.0	(SC-SM) Silty, Clayey Sand with Gravel	26	20	6	21.7

MOISTURE CONTENT CALCULATION SHEET
ASTM D-2216

PROJECT TITLE: Goldeneye Geotechnical Report
PROJECT NO. 00223
DATE: 6/2/2021
TECH: SMW
REVIEW: BMW

BORING No.	SAMPLE No.	DEPTH (ft)	WET WT (g)	DRY WT (g)	TARE WT (g)	TARE No.	MOISTURE CONTENT	DESCRIPTION
B-1	S-1	3-5	66.57	59.55	13.93	J5	15.4%	
B-1	S-2	8.5-10	52.23	42.27	14.05	I3	35.3%	
B-1	S-3	13.5-15	52.79	41.50	13.95	D3	41.0%	
B-1	S-4	18.5-20	57.08	41.31	14.26	A6	58.3%	
B-1	S-5	23.5-25	56.33	50.17	14.30	J3	17.2%	
B-1	S-6	28.5-30	73.65	67.12	14.01	F1	12.3%	
B-1	S-7	33.5-35	68.91	63.83	13.79	G9	10.2%	
B-1	S-8	38.5-40	53.09	48.78	14.26	D1	12.5%	
B-1	S-9	43.5-45	50.10	45.34	14.23	B1	15.3%	
B-1	S-10	48.5-50	78.79	73.94	14.23	C5	8.1%	
B-1	S-11	53.5-55	59.81	55.19	14.02	K3	11.2%	
B-1	S-12	58.5-60	90.32	80.96	14.08	C1	14.0%	
B-1	S-13	63.5-65	57.16	49.39	14.54	A7	22.3%	
B-1	S-14	68.5-70	48.18	42.06	14.16	K2	21.9%	
B-2	S-1	3.5-5.0	54.63	43.19	14.16	C7	39.4%	
B-2	S-2	8.5-10	55.81	43.62	14.14	F5	41.4%	
B-2	S-3	13.5-15	48.60	41.86	13.93	B2	24.1%	
B-2	S-4	18.5-20	58.24	49.57	14.04	B9	24.4%	
B-2	S-5	23.5-25	74.98	62.83	14.26	E8	25.0%	
B-2	S-6	28.5-30	76.25	69.86	14.16	I7	11.5%	
B-3	S-1	3.5-5.0	52.19	48.36	14.10	H8	11.2%	
B-3	S-2	8.5-10	80.68	66.07	14.16	C3	28.1%	
B-3	S-3	13.5-15	47.87	44.29	14.00	H5	11.8%	

TERRA-GEO

MOISTURE CONTENT CALCULATION SHEET
ASTM D-2216

PROJECT TITLE: Goldeneye Geotechnical Report
PROJECT NO. 00223
DATE: 6/2/2021
TECH: SMW
REVIEW: BMW

BORING No.	SAMPLE No.	DEPTH (ft)	WET WT (g)	DRY WT (g)	TARE WT (g)	TARE No.	MOISTURE CONTENT	DESCRIPTION
B-3	S-4	18.5-20	44.34	38.73	14.27	G1	22.9%	
B-3	S-5	23.5-25	71.71	58.54	14.09	J4	29.6%	
B-3	S-6	28.5-30	62.86	56.23	14.13	E2	15.7%	
B-4	S-1	3.5-5	52.28	45.02	14.20	I2	23.6%	
B-4	S-2	8.5-10	54.71	41.02	14.28	H6	51.2%	
B-4	S-3	13.5-15	65.93	52.42	14.55	A8	35.7%	
B-4	S-4	18.5-20	76.82	70.53	14.30	H4	11.2%	
B-4	S-5	23.5-25	94.27	85.63	14.46	E5	12.1%	
B-4	S-6	28.5-30	68.56	65.09	14.16	B4	6.8%	
B-4	S-7	33.5-35	60.71	55.92	14.16	J9	11.5%	
B-4	S-8	38.5-40	95.03	89.91	14.09	J8	6.8%	
B-4	S-9	43.5-45	48.20	46.43	13.92	F6	5.4%	
B-4	S-10	48.5-50	47.78	44.96	14.12	H2	9.1%	
B-4	S-11	53.5-55	70.15	66.10	14.35	H3	7.8%	
B-4	S-12	58.5-60	41.31	39.11	14.03	G2	8.8%	
B-4	S-13	63.5-65	81.67	75.47	14.17	K1	10.1%	
B-4	S-14	68.5-70	52.63	48.05	13.81	E3	13.4%	
B-5	S-1	3-5	53.49	39.60	14.01	G2	54.3%	
B-5	S-2	8.5-10	69.81	47.01	13.98	F8	69.0%	
B-5	S-3	13.5-15	98.16	74.14	14.05	G3	40.0%	
B-5	S-4	18.5-20	66.14	56.15	14.13	I4	23.8%	
B-5	S-5	23.5-25	72.31	63.33	14.12	F9	18.2%	
B-5	S-6	28.5-30	69.27	62.51	14.25	J2	14.0%	

TERRA-GEO

MOISTURE CONTENT CALCULATION SHEET
ASTM D-2216

PROJECT TITLE: Goldeneye Geotechnical Report
PROJECT NO. 00223
DATE: 6/2/2021
TECH: SMW
REVIEW: BMW

BORING No.	SAMPLE No.	DEPTH (ft)	WET WT (g)	DRY WT (g)	TARE WT (g)	TARE No.	MOISTURE CONTENT	DESCRIPTION
B-6	S-1	3-5	65.50	50.98	14.21	J8	39.5%	
B-6	S-2	8.5-10	37.41	28.98	14.04	B8	56.4%	
B-6	S-3	13.5-15	63.42	45.51	13.93	J5	56.7%	
B-6	S-4	18.5-20	53.29	44.42	14.27	F3	29.4%	
B-6	S-5	23.5-25	66.82	57.78	13.96	D2	20.6%	
B-6	S-6	28.5-30	50.92	48.44	14.54	B6	7.3%	
B-7	S-1	3.5-5	51.68	42.58	14.57	D7	32.5%	
B-7	S-2	8.5-10	44.54	36.13	14.25	E1	38.4%	
B-7	S-3	13.5-15	74.58	60.67	14.17	J1	29.9%	
B-7	S-4	18.5-20	74.63	61.74	14.00	I1	27.0%	
B-7	S-5	23.5-25	49.14	43.71	14.15	F2	18.4%	
B-7	S-6	28.5-30	50.65	46.06	14.10	G5	14.4%	
B-8	S-10	3.5-5	54.28	45.30	14.03	H7	28.7%	
B-8	S-11	8.5-10	45.95	38.74	14.24	E7	29.4%	
B-8	S-12	13.5-15	38.25	31.64	15.16	H9	40.1%	
B-8	S-13	18.5-20	38.79	33.18	14.19	C2	29.5%	
B-8	S-14	23.5-25	77.57	72.44	13.96	F7	8.8%	
B-8	S-14	28.5-30	57.77	53.32	14.17	D5	11.4%	

TERRA-GEO

Sieve & Hydrometer Analysis Data Sheet

ASTM D422-63(2007)

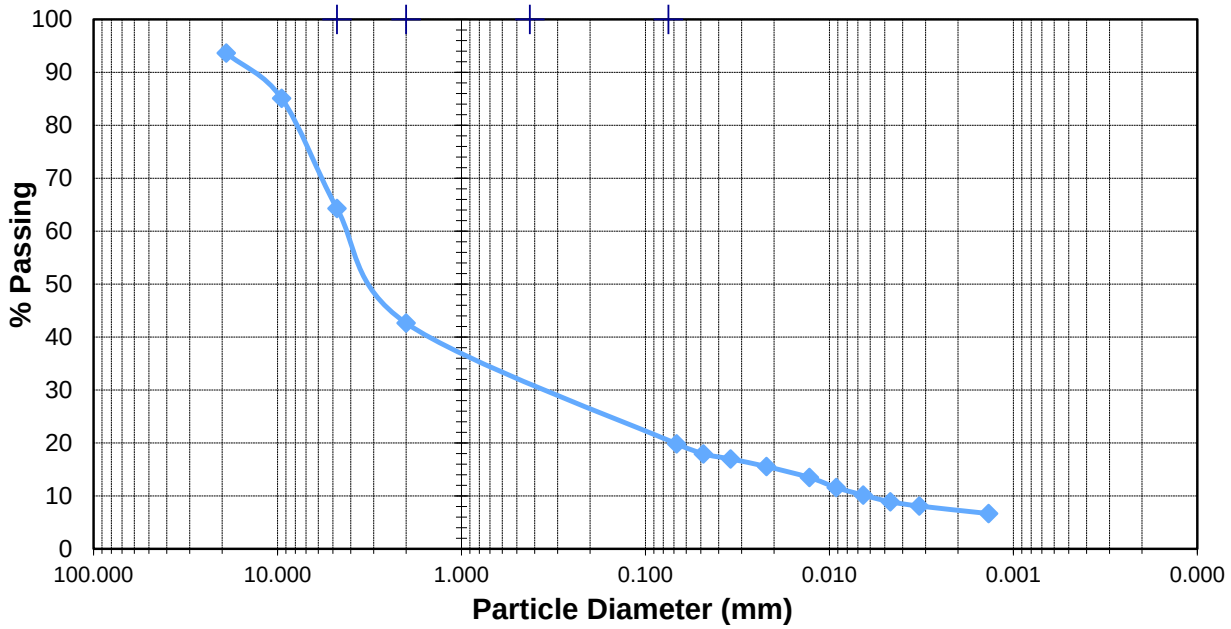
Project Name:	Goldeneye	**Tested By:**	SMW	**Date:**	6/2/2023
Location:	B-1, S-8	**Checked By:**	BMW	**Date:**	6/2/2023
Sample Type:	Split Spoon	**Test Number:**	00223-01		
Sample Depth:	38.5-40.0 feet	**Gnd Elev.:**			

USCS Soil Classification: (GM) Silty Gravel with Sand

Weight of Container (g): 16.7 **Weight of Container & Soil (g):** 1016.6

Weight of Dry Sample (g): 999.9

	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.4	843.9	63.5	6.4	93.6
3/8 in	9.500	739.9	825.4	85.5	8.6	85.1
#4	4.750	756.6	964.7	208.1	20.8	64.3
#10	2.000	686.3	902.6	216.3	21.6	42.7
Hydrometer	0.0677					19.8
Hydrometer	0.0484					17.9
Hydrometer	0.0345					17.0
Hydrometer	0.0220					15.5
Hydrometer	0.0129					13.5
Hydrometer	0.0092					11.6
Hydrometer	0.0066					10.2
Hydrometer	0.0047					8.9
Hydrometer	0.0032					8.1
Hydrometer	0.0014					6.7
			TOTAL:	**1000.0**	**100.0**	



Grain Size Distribution Curve Results:

% Gravel:	57.3	**D_{10}:**	0.0066	**C_u:**	62.1
% Sand:	22.8	**D_{30}:**	0.33	**C_c:**	40.2
% Fines:	19.8	**D_{60}:**	0.41		

TERRA-GEO

Hydrometer Method B-1, S-8

Specific Gs					Meniscus Corr				Sample weight (g)	#200 (%)
2.7					0.0015				100.10	
Date	Start Time	Elapsed Time (min)	temp. ©	Actual Hydro Rdng (Ra)	Hyd. Corr. For Meniscus	L from Calc	K from Table	D (mm)	Finer (%)	Adjusted Finer (%)
6/5/2023	9:08:00 AM	0.50	21.1	1.0110	1.0125	12.99	0.01328	0.0677	19.8	
6/5/2023		1.00	21.1	1.0098	1.0113	13.31	0.01328	0.0484	17.9	0.00
6/5/2023		2.00	21.1	1.0092	1.0107	13.46	0.01328	0.0345	17.0	0.00
6/5/2023		5.00	21.1	1.0083	1.0098	13.70	0.01328	0.0220	15.5	0.00
6/5/2023		15.00	21.1	1.0070	1.0085	14.05	0.01328	0.0129	13.5	0.00
6/5/2023		30.00	21.1	1.0058	1.0073	14.36	0.01328	0.0092	11.6	0.00
6/5/2023		60.00	21.1	1.0049	1.0064	14.60	0.01328	0.0066	10.2	0.00
6/5/2023		120.00	21.1	1.0041	1.0056	14.81	0.01328	0.0047	8.9	0.00
6/5/2023		250.00	21.1	1.0036	1.0051	14.95	0.01328	0.0032	8.1	0.00
6/6/2023	9:08:00 AM	1440.00	21.1	1.0027	1.0042	15.18	0.01328	0.0014	6.7	0.00

Sieve & Hydrometer Analysis Data Sheet

ASTM D422-63(2007)

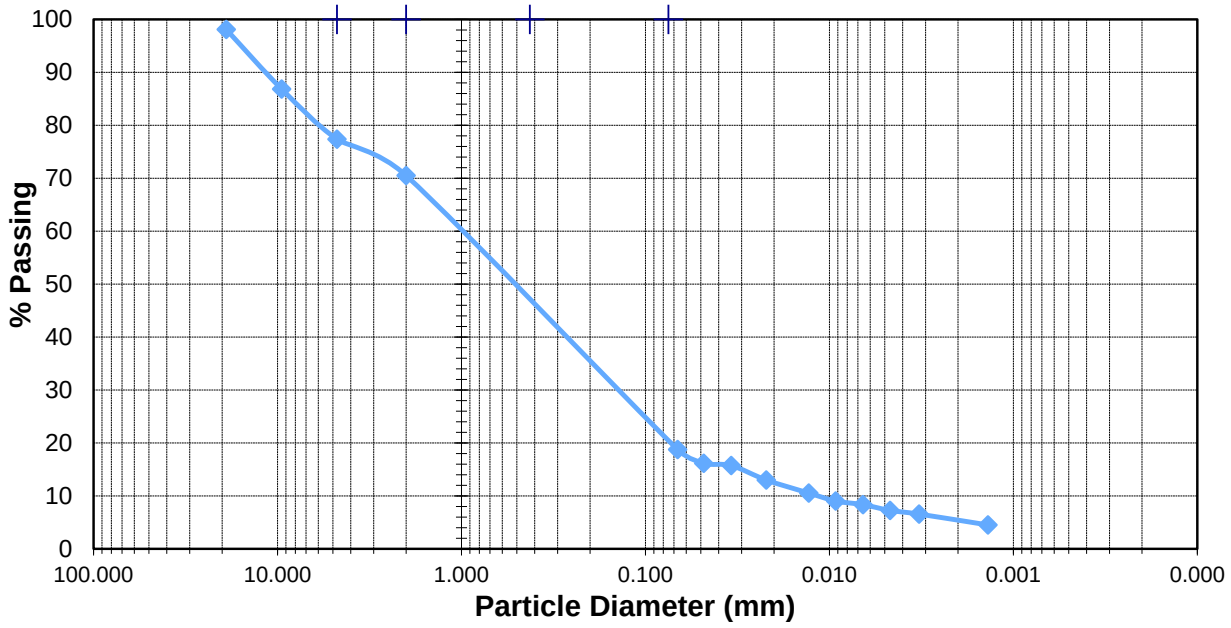
Project Name:	Goldeneye	**Tested By:**	SMW	**Date:**	6/2/2023
Location:	B-1, S-13	**Checked By:**	BMW	**Date:**	6/2/2023
Sample Type:	Split Spoon	**Test Number:**	00223-02		
Sample Depth:	63.5-65.0 feet	**Gnd Elev.:**			

USCS Soil Classification: (SM) Silty Sand with Gravel

Weight of Container (g): 17.6 **Weight of Container & Soil (g):** 989.5

Weight of Dry Sample (g): 971.9

	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.4	798.8	18.4	1.9	98.1
3/8 in	9.500	739.9	849.3	109.4	11.3	86.9
#4	4.750	756.6	848.7	92.1	9.5	77.4
#10	2.000	686.3	753.0	66.7	6.9	70.5
Hydrometer	0.0669					18.8
Hydrometer	0.0482					16.2
Hydrometer	0.0342					15.7
Hydrometer	0.0220					13.0
Hydrometer	0.0129					10.5
Hydrometer	0.0092					9.0
Hydrometer	0.0066					8.4
Hydrometer	0.0047					7.3
Hydrometer	0.0033					6.6
Hydrometer	0.0014					4.5
			TOTAL:	**973.9**	**100.2**	



Grain Size Distribution Curve Results:

% Gravel:	29.5	**D_{10}:**	0.0129	**C_u:**	77.5
% Sand:	51.8	**D_{30}:**	0.13	**C_c:**	1.3
% Fines:	18.8	**D_{60}:**	1		

TERRA-GEO

Hydrometer Method B-1, S-13

Specific Gs					Meniscus Corr				Sample weight (g)	#200 (%)
2.7					0.0015				116.00	
Date	Start Time	Elapsed Time (min)	temp. ©	Actual Hydro Rdng (Ra)	Hyd. Corr. For Meniscus	L from Calc	K from Table	D (mm)	Finer (%)	Adjusted Finer (%)
6/5/2023	9:43:00 AM	0.50	21.1	1.0122	1.0137	12.67	0.01328	0.0669	18.8	
6/5/2023		1.00	21.1	1.0103	1.0118	13.17	0.01328	0.0482	16.2	0.00
6/5/2023		2.00	21.1	1.0100	1.0115	13.25	0.01328	0.0342	15.7	0.00
6/5/2023		5.00	21.1	1.0080	1.0095	13.78	0.01328	0.0220	13.0	0.00
6/5/2023		15.00	21.1	1.0062	1.0077	14.26	0.01328	0.0129	10.5	0.00
6/5/2023		30.00	21.1	1.0051	1.0066	14.55	0.01328	0.0092	9.0	0.00
6/5/2023		60.00	21.1	1.0046	1.0061	14.68	0.01328	0.0066	8.4	0.00
6/5/2023		120.00	21.1	1.0038	1.0053	14.89	0.01328	0.0047	7.3	0.00
6/5/2023		250.00	21.1	1.0033	1.0048	15.03	0.01328	0.0033	6.6	0.00
6/6/2023	9:43:00 AM	1440.00	21.1	1.0018	1.0033	15.42	0.01328	0.0014	4.5	0.00

Sieve & Hydrometer Analysis Data Sheet

ASTM D422-63(2007)

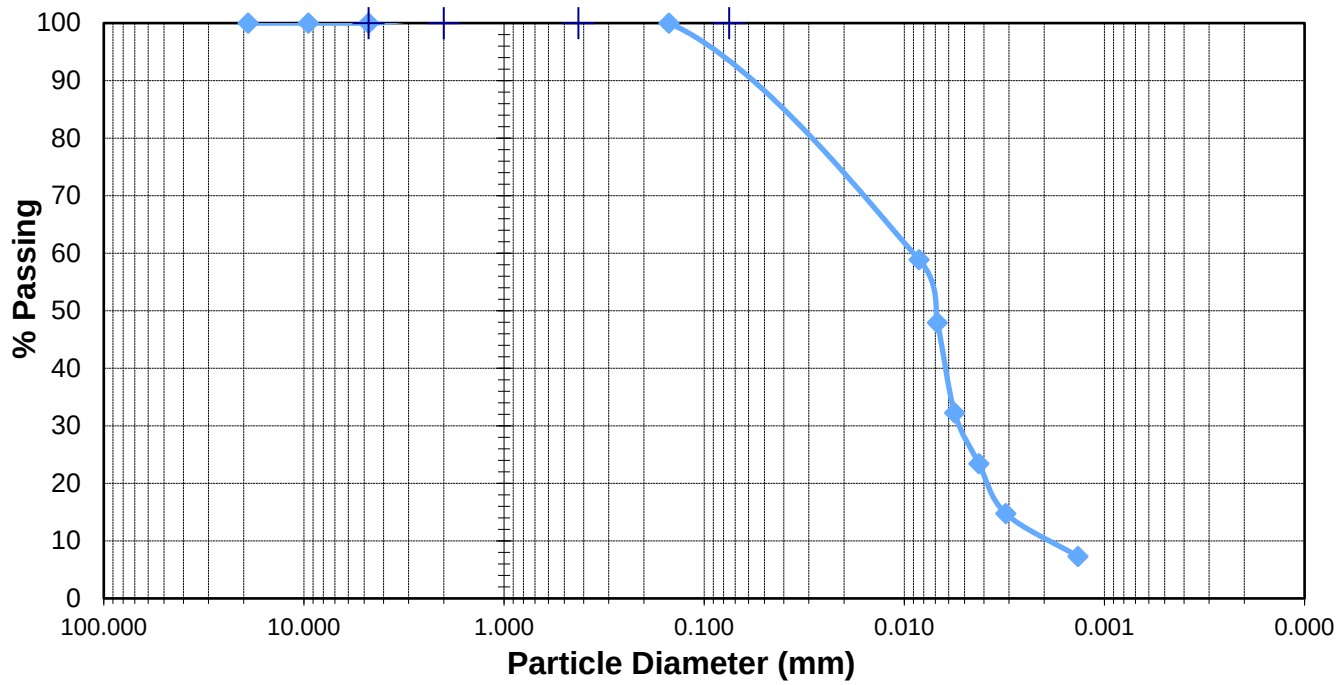
Project Name:	Goldeneye	**Tested By:**	SMW	**Date:**	6/2/2023
Location:	B-3, S-3	**Checked By:**	BMW	**Date:**	6/2/2023
Sample Type:	Split Spoon	**Test Number:**	00223-03		
Sample Depth:	13.5-15.0 feet	**Gnd Elev.:**			

USCS Soil Classification: (ML) Silt

Weight of Container (g): 17.6 **Weight of Container & Soil (g):** 636.0

Weight of Dry Sample (g): 618.4

	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000			0.0	0.0	100.0
3/8 in	9.500			0.0	0.0	100.0
#4	4.750			0.0	0.0	100.0
#100	0.150			0.0	0.0	100.0
Hydrometer	0.0084					58.9
Hydrometer	0.0068					47.9
Hydrometer	0.0056					32.3
Hydrometer	0.0042					23.4
Hydrometer	0.0031					14.8
Hydrometer	0.0014					7.3
			TOTAL:	**0.0**	**0.0**	



Grain Size Distribution Curve Results:

% Gravel:	0.0	**D_{10}:**	0.002	**C_u:**	4.5
% Sand:	10.0	**D_{30}:**	0.0053	**C_c:**	1.6
% Fines:	90.0	**D_{60}:**	0.009		

TERRA-GEO

Hydrometer Method B-3, S-3

Specific Gs					Meniscus Corr				Sample weight (g)	#200 (%)
2.7					0.0015				104.40	
Date	Start Time	Elapsed Time (min)	temp. ©	Actual Hydro Rdng (Ra)	Hyd. Corr. For Meniscus	L from Calc	K from Table	D (mm)	Finer (%)	Adjusted Finer (%)
6/5/2023		15.00	21.1	1.0372	1.0387	6.06	0.01328	0.0084	58.9	0.00
6/5/2023		30.00	21.1	1.0300	1.0315	7.96	0.01328	0.0068	47.9	0.00
6/5/2023		60.00	21.1	1.0197	1.0212	10.69	0.01328	0.0056	32.3	0.00
6/5/2023		120.00	21.1	1.0139	1.0154	12.22	0.01328	0.0042	23.4	0.00
6/5/2023		250.00	21.1	1.0082	1.0097	13.73	0.01328	0.0031	14.8	0.00
6/6/2023	9:20:00 AM	1440.00	21.1	1.0033	1.0048	15.03	0.01328	0.0014	7.3	0.00

Sieve & Hydrometer Analysis Data Sheet

ASTM D422-63(2007)

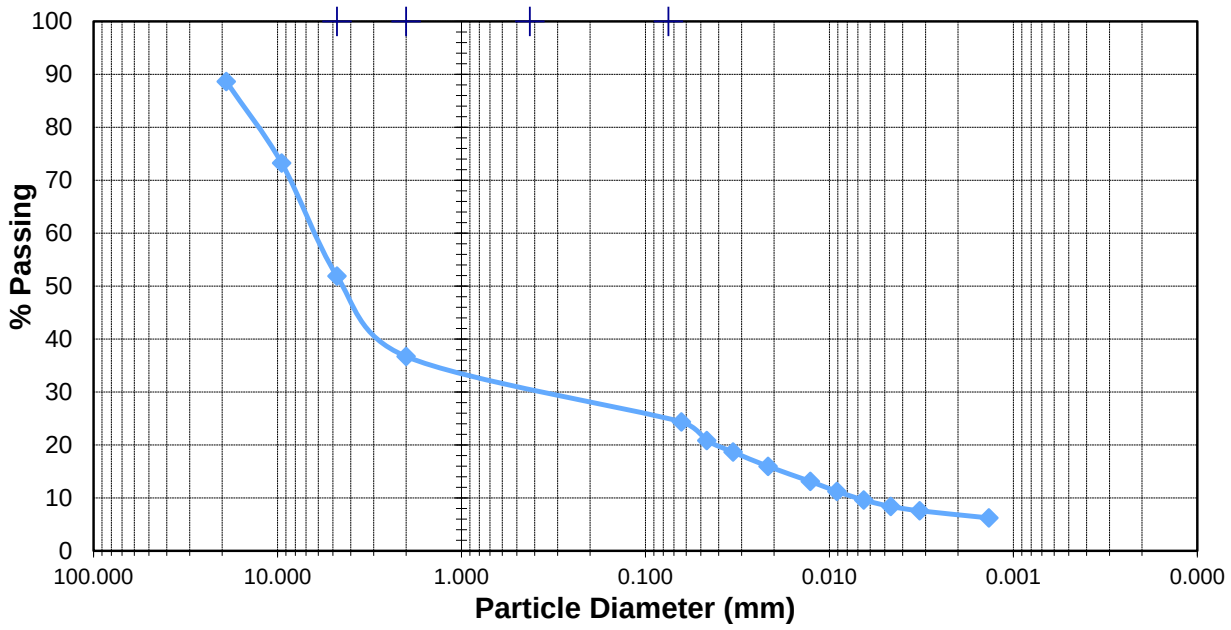
Project Name:	Goldeneye	**Tested By:**	SMW	**Date:**	6/2/2023
Location:	B-4, S-6	**Checked By:**	BMW	**Date:**	6/2/2023
Sample Type:	Split Spoon	**Test Number:**	00223-04		
Sample Depth:	28.5-30.0 feet	**Gnd Elev.:**			

USCS Soil Classification: (GM) Silty Gravel

Weight of Container (g): 16.8 **Weight of Container & Soil (g):** 706.4

Weight of Dry Sample (g): 689.6

	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.7	859.0	78.3	11.4	88.6
3/8 in	9.500	740.1	846.3	106.2	15.4	73.2
#4	4.750	759.7	906.9	147.2	21.3	51.9
#10	2.000	687.4	792.1	104.7	15.2	36.7
Hydrometer	0.0638					24.4
Hydrometer	0.0464					20.8
Hydrometer	0.0334					18.7
Hydrometer	0.0216					16.0
Hydrometer	0.0127					13.1
Hydrometer	0.0091					11.2
Hydrometer	0.0065					9.6
Hydrometer	0.0046					8.4
Hydrometer	0.0032					7.6
Hydrometer	0.0014					6.2
			TOTAL:	**686.6**	**99.6**	



Grain Size Distribution Curve Results:

% Gravel:	63.3	**D_{10}:**	0.007	**C_u:**	885.7
% Sand:	12.4	**D_{30}:**	0.37	**C_c:**	3.2
% Fines:	24.4	**D_{60}:**	6.2		

TERRA-GEO

Hydrometer Method B-4, S-6

Specific Gs					Meniscus Corr				Sample weight (g)	#200 (%)
2.7					0.0015				117.40	
Date	Start Time	Elapsed Time (min)	temp. ©	Actual Hydro Rdng (Ra)	Hyd. Corr. For Meniscus	L from Calc	K from Table	D (mm)	Finer (%)	Adjusted Finer (%)
6/5/2023	9:43:00 AM	0.50	21.1	1.0165	1.0180	11.53	0.01328	0.0638	24.4	
6/5/2023		1.00	21.1	1.0139	1.0154	12.22	0.01328	0.0464	20.8	0.00
6/5/2023		2.00	21.1	1.0123	1.0138	12.64	0.01328	0.0334	18.7	0.00
6/5/2023		5.00	21.1	1.0103	1.0118	13.17	0.01328	0.0216	16.0	0.00
6/5/2023		15.00	21.1	1.0082	1.0097	13.73	0.01328	0.0127	13.1	0.00
6/5/2023		30.00	21.1	1.0068	1.0083	14.10	0.01328	0.0091	11.2	0.00
6/5/2023		60.00	21.1	1.0056	1.0071	14.42	0.01328	0.0065	9.6	0.00
6/5/2023		120.00	21.1	1.0047	1.0062	14.65	0.01328	0.0046	8.4	0.00
6/5/2023		250.00	21.1	1.0041	1.0056	14.81	0.01328	0.0032	7.6	0.00
6/6/2023	9:43:00 AM	1440.00	21.1	1.0031	1.0046	15.08	0.01328	0.0014	6.2	0.00

Sieve & Hydrometer Analysis Data Sheet

ASTM D422-63(2007)

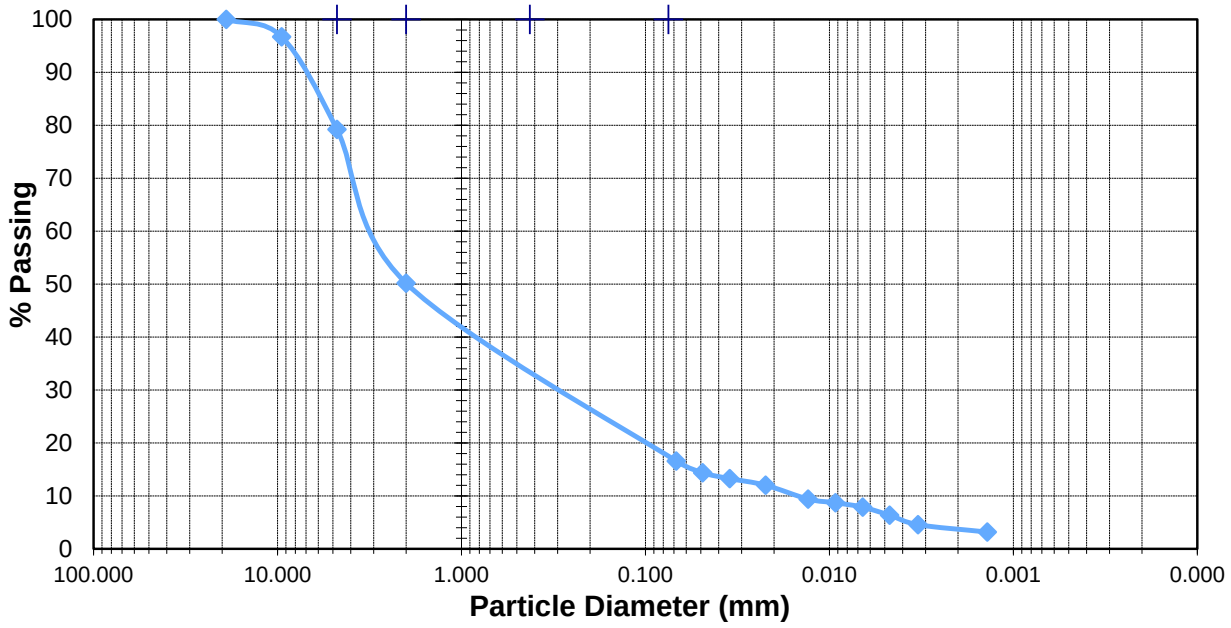
Project Name:	Goldeneye	**Tested By:**	SMW	**Date:**	6/2/2023
Location:	B-4, S-12	**Checked By:**	BMW	**Date:**	6/2/2023
Sample Type:	Split Spoon	**Test Number:**	00223-05		
Sample Depth:	58.5-60.0 feet	**Gnd Elev.:**			

USCS Soil Classification: (GM) Silty Gravel with Sand

Weight of Container (g): 17.6 **Weight of Container & Soil (g):** 858.5

Weight of Dry Sample (g): 840.9

	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.6	780.6	0.0	0.0	100.0
3/8 in	9.500	740.6	768.3	27.7	3.3	96.7
#4	4.750	760.2	907.2	147.0	17.5	79.2
#10	2.000	687.7	931.9	244.2	29.0	50.2
Hydrometer	0.0680					16.6
Hydrometer	0.0489					14.4
Hydrometer	0.0348					13.3
Hydrometer	0.0222					12.0
Hydrometer	0.0131					9.4
Hydrometer	0.0093					8.7
Hydrometer	0.0066					7.9
Hydrometer	0.0047					6.4
Hydrometer	0.0033					4.6
Hydrometer	0.0014					3.2
			TOTAL:	**839.3**	**99.8**	



Grain Size Distribution Curve Results:

% Gravel:	49.8	**D_{10}:**	0.09	**C_u:**	3.4
% Sand:	33.6	**D_{30}:**	0.17	**C_c:**	1.0
% Fines:	16.6	**D_{60}:**	0.31		

TERRA-GEO

Hydrometer Method B-4, S-12

Specific Gs					Meniscus Corr				Sample weight (g)	#200 (%)
2.7					0.0015				114.90	
Date	Start Time	Elapsed Time (min)	temp. ©	Actual Hydro Rdng (Ra)	Hyd. Corr. For Meniscus	L from Calc	K from Table	D (mm)	Finer (%)	Adjusted Finer (%)
6/6/2023	9:13:00 AM	0.50	21.1	1.0105	1.0120	13.12	0.01328	0.0680	16.6	
6/6/2023		1.00	21.1	1.0089	1.0104	13.54	0.01328	0.0489	14.4	0.00
6/6/2023		2.00	21.1	1.0081	1.0096	13.76	0.01328	0.0348	13.3	0.00
6/6/2023		5.00	21.1	1.0072	1.0087	13.99	0.01328	0.0222	12.0	0.00
6/6/2023		15.00	21.1	1.0053	1.0068	14.50	0.01328	0.0131	9.4	0.00
6/6/2023		30.00	21.1	1.0048	1.0063	14.63	0.01328	0.0093	8.7	0.00
6/6/2023		60.00	21.1	1.0042	1.0057	14.79	0.01328	0.0066	7.9	0.00
6/6/2023		120.00	21.1	1.0031	1.0046	15.08	0.01328	0.0047	6.4	0.00
6/6/2023		250.00	21.1	1.0018	1.0033	15.42	0.01328	0.0033	4.6	0.00
6/7/2023	9:13:00 AM	1440.00	21.1	1.0008	1.0023	15.69	0.01328	0.0014	3.2	0.00

Sieve & Hydrometer Analysis Data Sheet

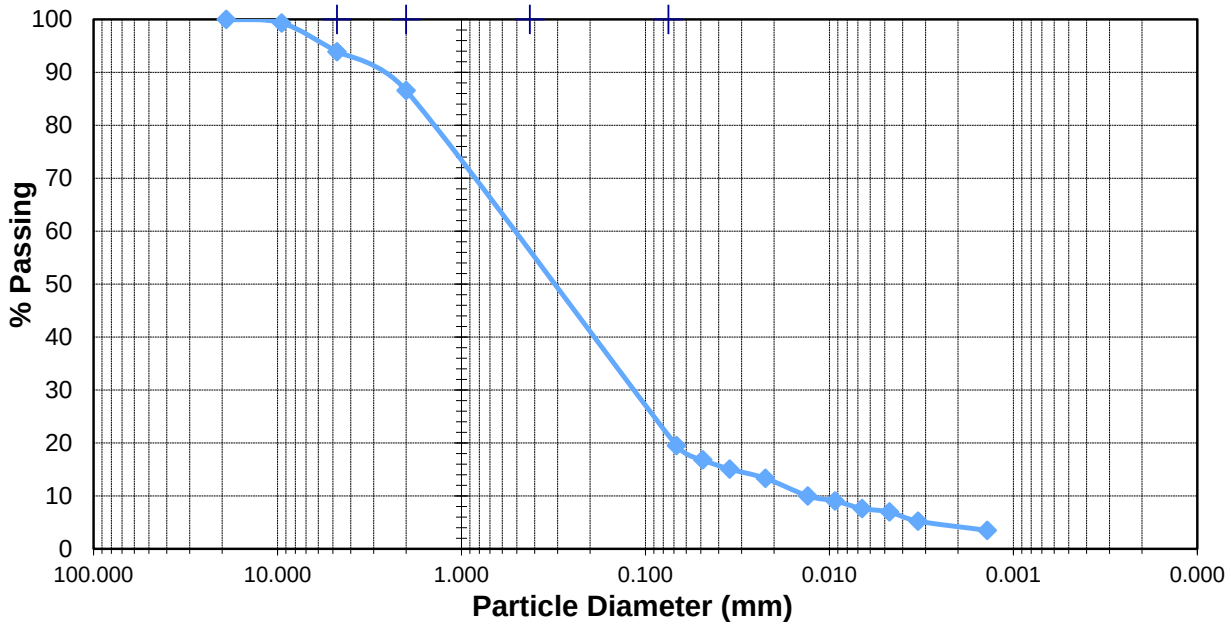
ASTM D422-63(2007)

Project Name:	Goldeneye	**Tested By:**	SMW	**Date:**	6/2/2023
Location:	B-7, S-5	**Checked By:**	BMW	**Date:**	6/2/2023
Sample Type:	Split Spoon	**Test Number:**	00223-06		
Sample Depth:	23.5-25.0 feet	**Gnd Elev.:**			

USCS Soil Classification: (SM) Silty Sand

Weight of Container (g):	17.6	**Weight of Container & Soil (g):**	636.0
Weight of Dry Sample (g):	618.4		

	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.6	780.6	0.0	0.0	100.0
3/8 in	9.500	740.6	744.8	4.2	0.7	99.3
#4	4.750	763.8	797.3	33.5	5.4	93.9
#10	2.000	689.3	734.6	45.3	7.3	86.6
Hydrometer	0.0678					19.5
Hydrometer	0.0488					16.8
Hydrometer	0.0349					15.1
Hydrometer	0.0223					13.3
Hydrometer	0.0131					10.0
Hydrometer	0.0093					9.0
Hydrometer	0.0066					7.6
Hydrometer	0.0047					7.0
Hydrometer	0.0033					5.2
Hydrometer	0.0014					3.5
			TOTAL:	**619.8**	**100.2**	



Grain Size Distribution Curve Results:

% Gravel:	13.4	**D_{10}:**	0.09	**C_u:**	3.4
% Sand:	67.1	**D_{30}:**	0.17	**C_c:**	1.0
% Fines:	19.5	**D_{60}:**	0.31		

TERRA-GEO

Hydrometer Method B-7, S-5

Specific Gs					Meniscus Corr				Sample weight (g)	#200 (%)
2.7					0.0015				100.10	
Date	Start Time	Elapsed Time (min)	temp. ©	Actual Hydro Rdng (Ra)	Hyd. Corr. For Meniscus	L from Calc	K from Table	D (mm)	Finer (%)	Adjusted Finer (%)
6/6/2023	9:34:00 AM	0.50	21.1	1.0108	1.0123	13.04	0.01328	0.0678	19.5	
6/6/2023		1.00	21.1	1.0091	1.0106	13.49	0.01328	0.0488	16.8	0.00
6/6/2023		2.00	21.1	1.0080	1.0095	13.78	0.01328	0.0349	15.1	0.00
6/6/2023		5.00	21.1	1.0069	1.0084	14.07	0.01328	0.0223	13.3	0.00
6/6/2023		15.00	21.1	1.0048	1.0063	14.63	0.01328	0.0131	10.0	0.00
6/6/2023		30.00	21.1	1.0042	1.0057	14.79	0.01328	0.0093	9.0	0.00
6/6/2023		60.00	21.1	1.0033	1.0048	15.03	0.01328	0.0066	7.6	0.00
6/6/2023		120.00	21.1	1.0029	1.0044	15.13	0.01328	0.0047	7.0	0.00
6/6/2023		250.00	21.1	1.0018	1.0033	15.42	0.01328	0.0033	5.2	0.00
6/7/2023	9:34:00 AM	1440.00	21.1	1.0007	1.0022	15.71	0.01328	0.0014	3.5	0.00

Sieve Analysis Data Sheet

ASTM D422-63(2007)

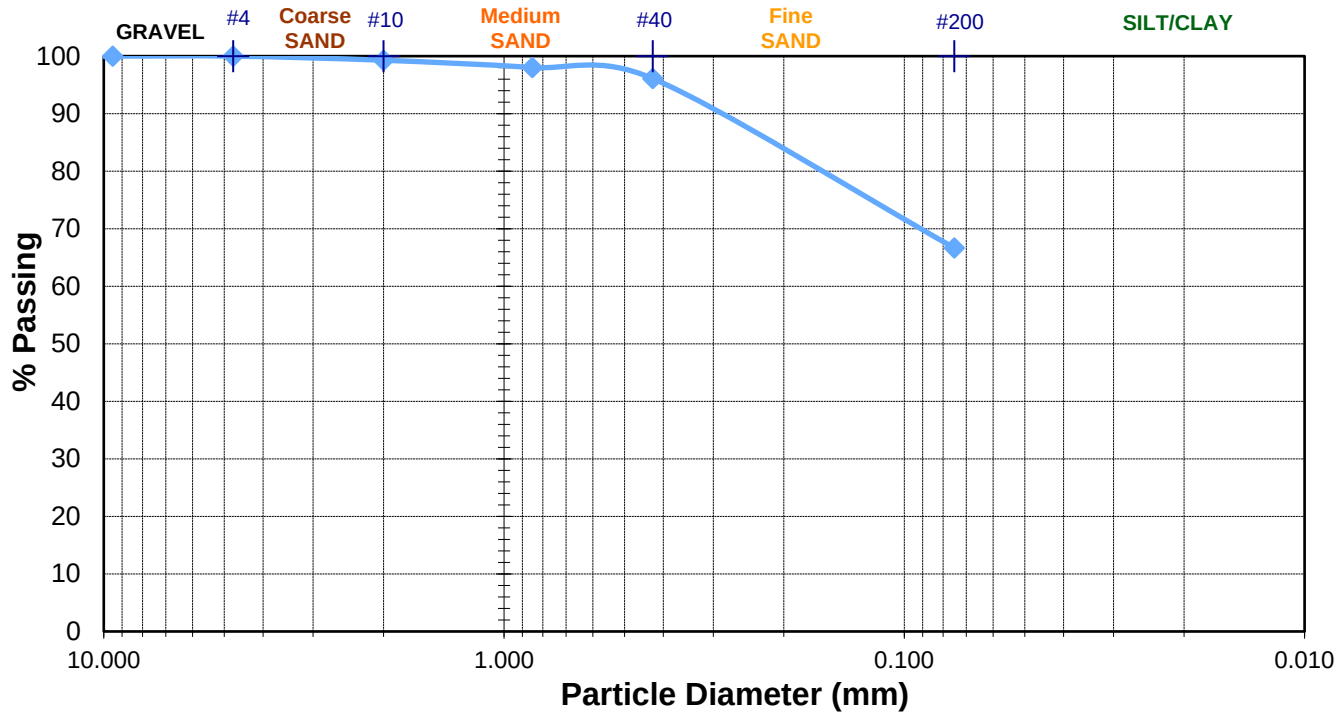
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/28/2022
Location:	Test Pit - 1	**Checked By:**	BMW	**Date:**	12/28/2022
Sample Type:	Grab	**Test Number:**	02422-01		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Sandy Silt (ML)

Weight of Container (g): 17.9 **Weight of Container & Soil (g):** 747.1

Weight of Dry Sample (g): 729.2

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.4	780.4	0.0	0.0	100.0
3/8 in	9.500	740.0	740.0	0.0	0.0	100.0
#4	4.750	756.4	756.4	0.0	0.0	100.0
#10	2.000	686.0	691.2	5.2	0.7	99.3
#20	0.850	617.7	626.9	9.2	1.3	98.0
#40	0.425	560.3	574.3	14.0	1.9	96.1
#200	0.075	515.6	730.3	214.7	29.4	66.7
Pan		485.2	972.6	487.4	66.8	-0.2
			TOTAL:	**730.405**	**100.2**	



Grain Size Distribution Curve Results:

% Gravel:	0.0	**D_{10}:**	0.001	**C_u:**	530.0
% Sand:	33.3	**D_{30}:**	0.01	**C_c:**	0.2
% Fines:	66.7	**D_{60}:**	0.53		

TERRA-GEO

Sieve Analysis Data Sheet

ASTM D422-63(2007)

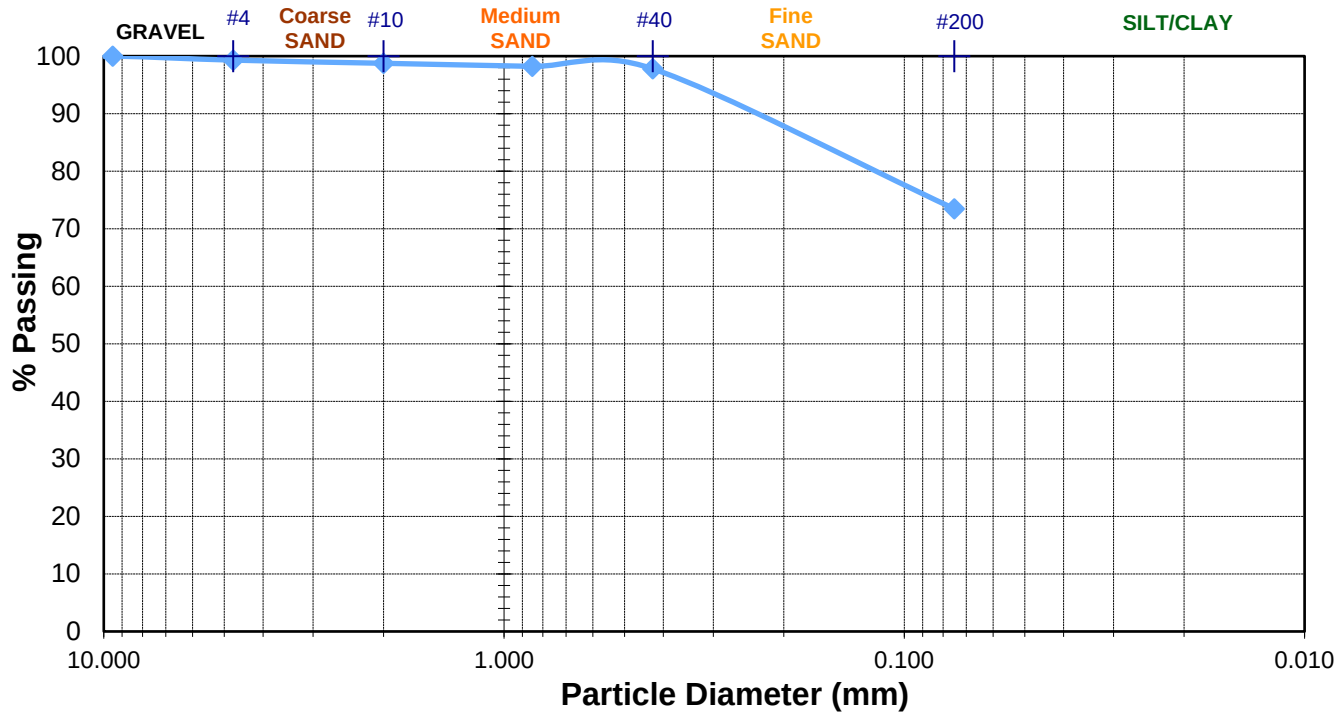
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/28/2022
Location:	Test Pit - 2	**Checked By:**	BMW	**Date:**	12/28/2022
Sample Type:	Grab	**Test Number:**	02422-02		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Silt with Sand (ML)

Weight of Container (g): 16.3 **Weight of Container & Soil (g):** 507.8

Weight of Dry Sample (g): 491.5

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.4	780.4	0.0	0.0	100.0
3/8 in	9.500	740.0	740.0	0.0	0.0	100.0
#4	4.750	756.0	759.4	3.4	0.7	99.3
#10	2.000	686.3	689.0	2.7	0.5	98.8
#20	0.850	617.0	619.6	2.6	0.5	98.2
#40	0.425	560.0	562.1	2.1	0.4	97.8
#200	0.075	515.4	635.0	119.6	24.3	73.5
Pan		484.6	845.7	361.1	73.5	0.0
			TOTAL:	**491.5**	**100.0**	



Grain Size Distribution Curve Results:

% Gravel:	0.7	**D_{10}:**	0.0005	**C_u:**	54.0
% Sand:	25.8	**D_{30}:**	0.0015	**C_c:**	0.2
% Fines:	73.5	**D_{60}:**	0.027		

TERRA-GEO

Sieve Analysis Data Sheet

ASTM D422-63(2007)

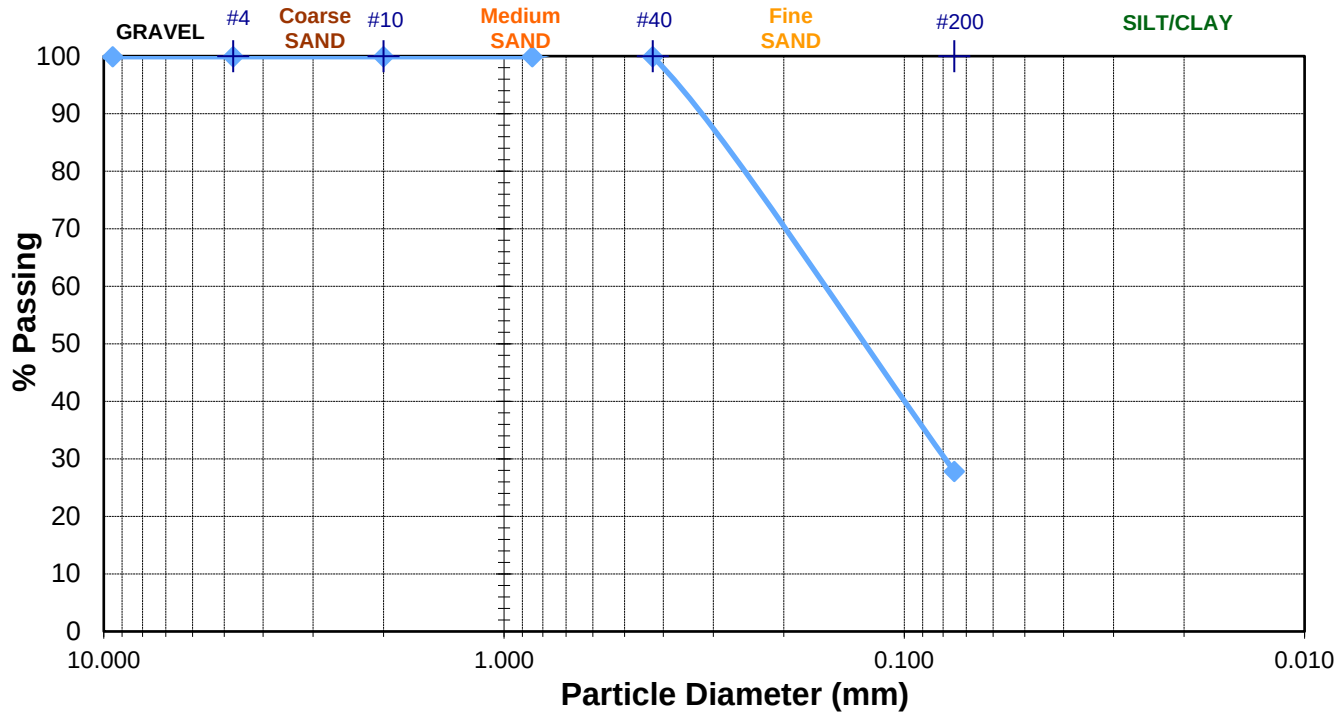
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/28/2022
Location:	Test Pit - 3	**Checked By:**	BMW	**Date:**	12/28/2022
Sample Type:	Grab	**Test Number:**	02422-03		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Silty Sand (SM)

Weight of Container (g): 14.1 **Weight of Container & Soil (g):** 406.0

Weight of Dry Sample (g): 391.9

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.3	780.5	0.2	0.1	99.9
3/8 in	9.500	739.7	739.9	0.2	0.1	99.9
#4	4.750	756.0	756.0	0.0	0.0	99.9
#10	2.000	685.9	685.9	0.0	0.0	99.9
#20	0.850	617.1	617.1	0.0	0.0	99.9
#40	0.425	560.1	560.1	0.0	0.0	99.9
#200	0.075	515.5	798.0	282.5	72.1	27.8
Pan		485.1	594.4	109.3	27.9	-0.1
			TOTAL:	**392.2**	**100.1**	



Grain Size Distribution Curve Results:

% Gravel:	0.1	**D_{10}:**	0.048	**C_u:**	3.8
% Sand:	72.1	**D_{30}:**	0.08	**C_c:**	0.7
% Fines:	27.8	**D_{60}:**	0.18		

TERRA-GEO

Sieve Analysis Data Sheet

ASTM D422-63(2007)

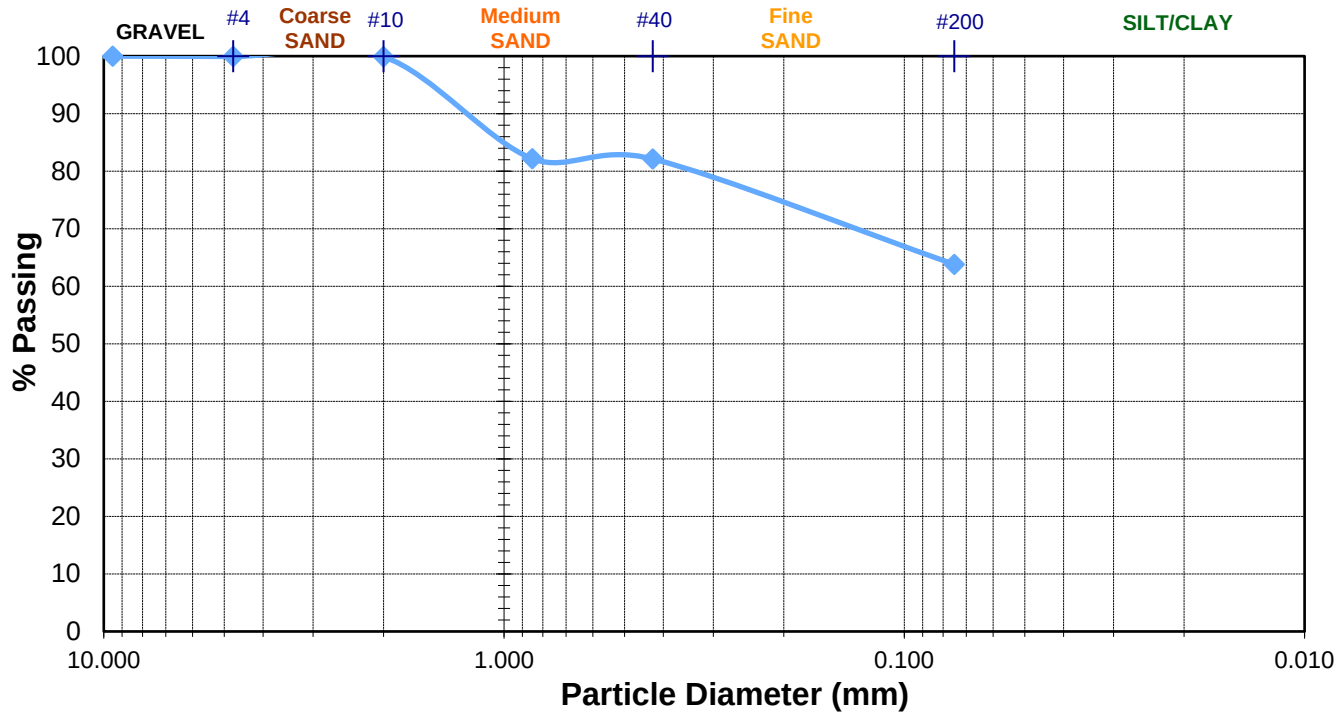
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/29/2022
Location:	Test Pit - 4	**Checked By:**	BMW	**Date:**	12/29/2022
Sample Type:	Grab	**Test Number:**	02422-04		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Sandy Silt (ML)

Weight of Container (g): 16.4 **Weight of Container & Soil (g):** 581.7

Weight of Dry Sample (g): 565.3

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.5	780.5	0.0	0.0	100.0
3/8 in	9.500	739.9	739.9	0.0	0.0	100.0
#4	4.750	756.0	756.3	0.3	0.1	99.9
#10	2.000	686.1	686.3	0.2	0.0	99.9
#20	0.850	617.0	717.2	100.2	17.7	82.2
#40	0.425	560.0	560.3	0.3	0.1	82.1
#200	0.075	515.4	619.0	103.6	18.3	63.8
Pan		484.6	848.5	363.9	64.4	-0.6
			TOTAL:	**568.5**	**100.6**	



Grain Size Distribution Curve Results:

% Gravel:	0.1	**D_{10}:**	0.0015	**C_u:**	53.3
% Sand:	36.1	**D_{30}:**	0.0044	**C_c:**	0.2
% Fines:	63.8	**D_{60}:**	0.08		

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Sieve Analysis Data Sheet

ASTM D422-63(2007)

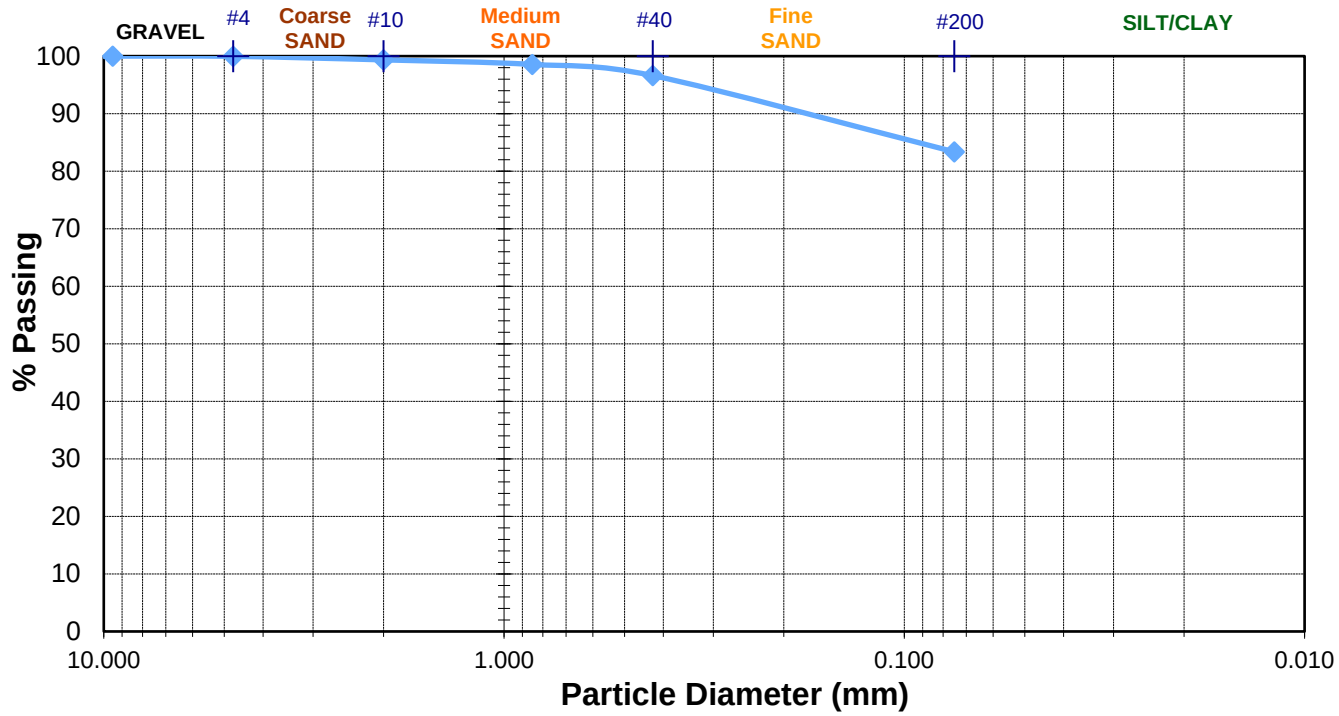
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/29/2022
Location:	Test Pit - 5	**Checked By:**	BMW	**Date:**	12/29/2022
Sample Type:	Grab	**Test Number:**	02422-05		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Silt with Sand (ML)

Weight of Container (g): 14.1 **Weight of Container & Soil (g):** 354.4

Weight of Dry Sample (g): 340.3

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.5	780.5	0.0	0.0	100.0
3/8 in	9.500	780.5	780.5	0.0	0.0	100.0
#4	4.750	739.9	740.0	0.1	0.0	100.0
#10	2.000	755.8	757.9	2.1	0.6	99.4
#20	0.850	617.4	620.1	2.7	0.8	98.6
#40	0.425	560.2	566.8	6.6	1.9	96.6
#200	0.075	516.3	561.4	45.1	13.3	83.4
Pan		485.0	765.1	280.1	82.3	1.1
			TOTAL:	**336.7**	**98.9**	



Grain Size Distribution Curve Results:

% Gravel:	0.0	**D_{10}:**	0.001	**C_u:**	8.0
% Sand:	16.6	**D_{30}:**	0.004	**C_c:**	2.0
% Fines:	83.4	**D_{60}:**	0.008		

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Sieve Analysis Data Sheet

ASTM D422-63(2007)

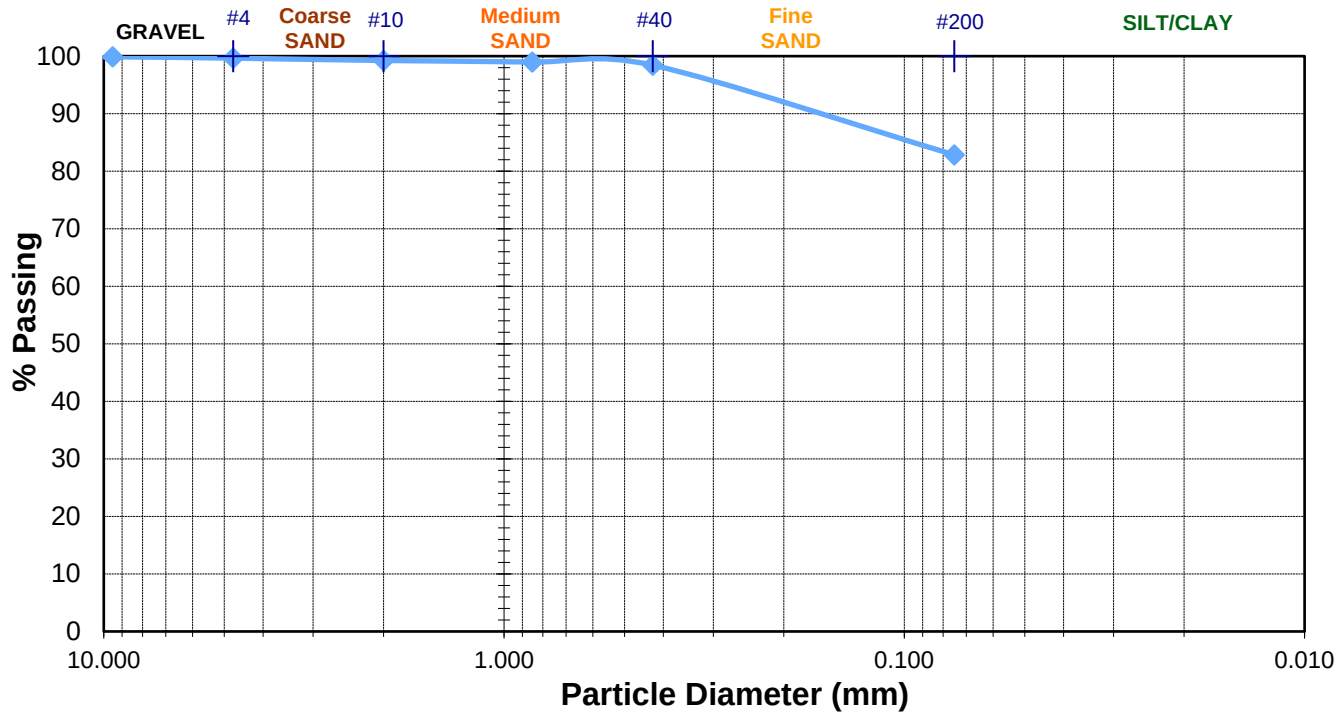
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/29/2022
Location:	Test Pit - 6	**Checked By:**	BMW	**Date:**	12/29/2022
Sample Type:	Grab	**Test Number:**	02422-06		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Silt with Sand (ML)

Weight of Container (g): 17.1 **Weight of Container & Soil (g):** 359.8

Weight of Dry Sample (g): 342.7

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.5	780.5	0.0	0.0	100.0
3/8 in	9.500	739.9	740.3	0.4	0.1	99.9
#4	4.750	756.1	756.9	0.8	0.2	99.6
#10	2.000	685.9	687.3	1.4	0.4	99.2
#20	0.850	617.1	618.0	0.9	0.3	99.0
#40	0.425	560.1	562.0	1.9	0.6	98.4
#200	0.075	515.3	568.7	53.4	15.6	82.8
Pan		485.2	771.8	286.6	83.6	-0.8
			TOTAL:	**345.4**	**100.8**	



Grain Size Distribution Curve Results:

% Gravel:	0.4	**D_{10}:**	0.001	**C_u:**	8.0
% Sand:	16.8	**D_{30}:**	0.004	**C_c:**	2.0
% Fines:	82.8	**D_{60}:**	0.008		

TERRA-GEO

Sieve Analysis Data Sheet

ASTM D422-63(2007)

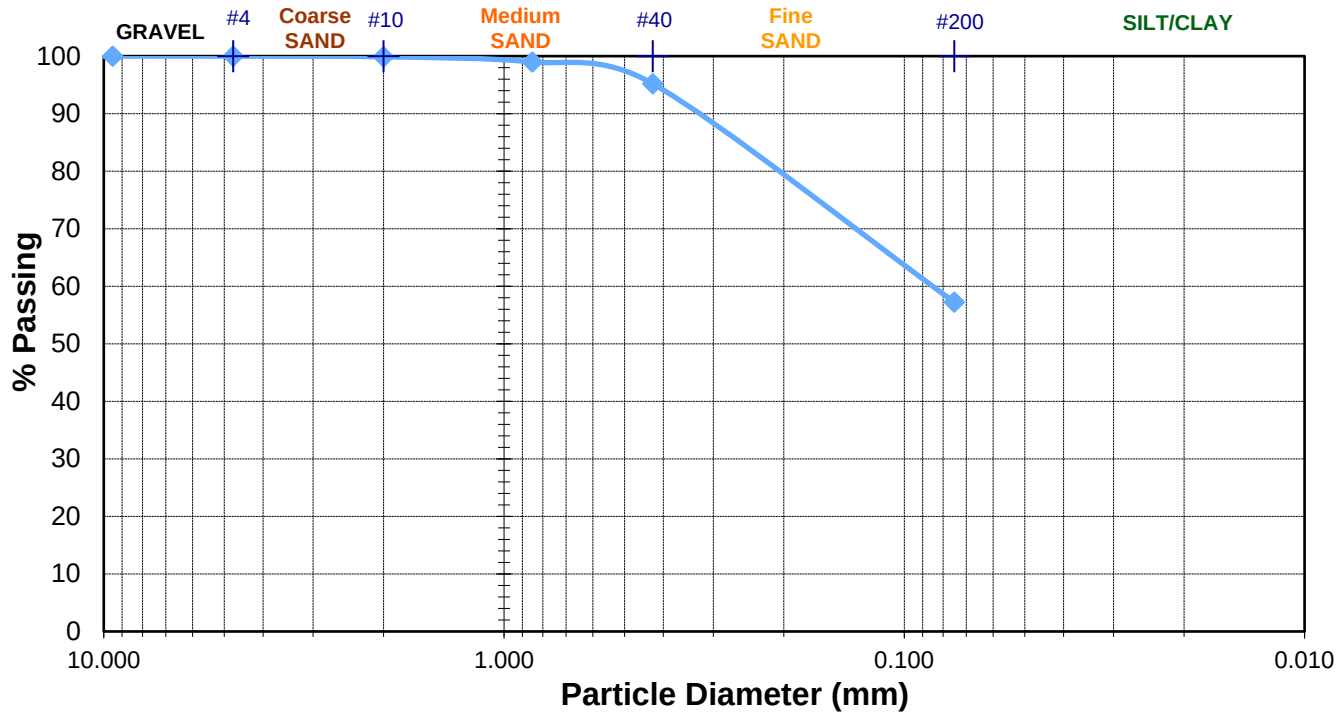
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/29/2022
Location:	Test Pit - 7	**Checked By:**	BMW	**Date:**	12/29/2022
Sample Type:	Grab	**Test Number:**	02422-07		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Sandy Silt (ML)

Weight of Container (g): 15.7 **Weight of Container & Soil (g):** 459.9

Weight of Dry Sample (g): 444.2

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.5	780.5	0.0	0.0	100.0
3/8 in	9.500	739.9	739.9	0.0	0.0	100.0
#4	4.750	756.1	756.1	0.0	0.0	100.0
#10	2.000	686.5	687.0	0.5	0.1	99.9
#20	0.850	617.6	621.6	4.0	0.9	99.0
#40	0.425	560.3	577.1	16.8	3.8	95.2
#200	0.075	515.5	684.1	168.6	38.0	57.2
Pan		485.2	739.8	254.6	57.3	-0.1
			TOTAL:	**444.5**	**100.1**	



Grain Size Distribution Curve Results:

% Gravel:	0.0	**D_{10}:**	0.008	**C_u:**	106.3
% Sand:	42.8	**D_{30}:**	0.018	**C_c:**	0.0
% Fines:	57.2	**D_{60}:**	0.85		

TERRA-GEO

Sieve Analysis Data Sheet

ASTM D422-63(2007)

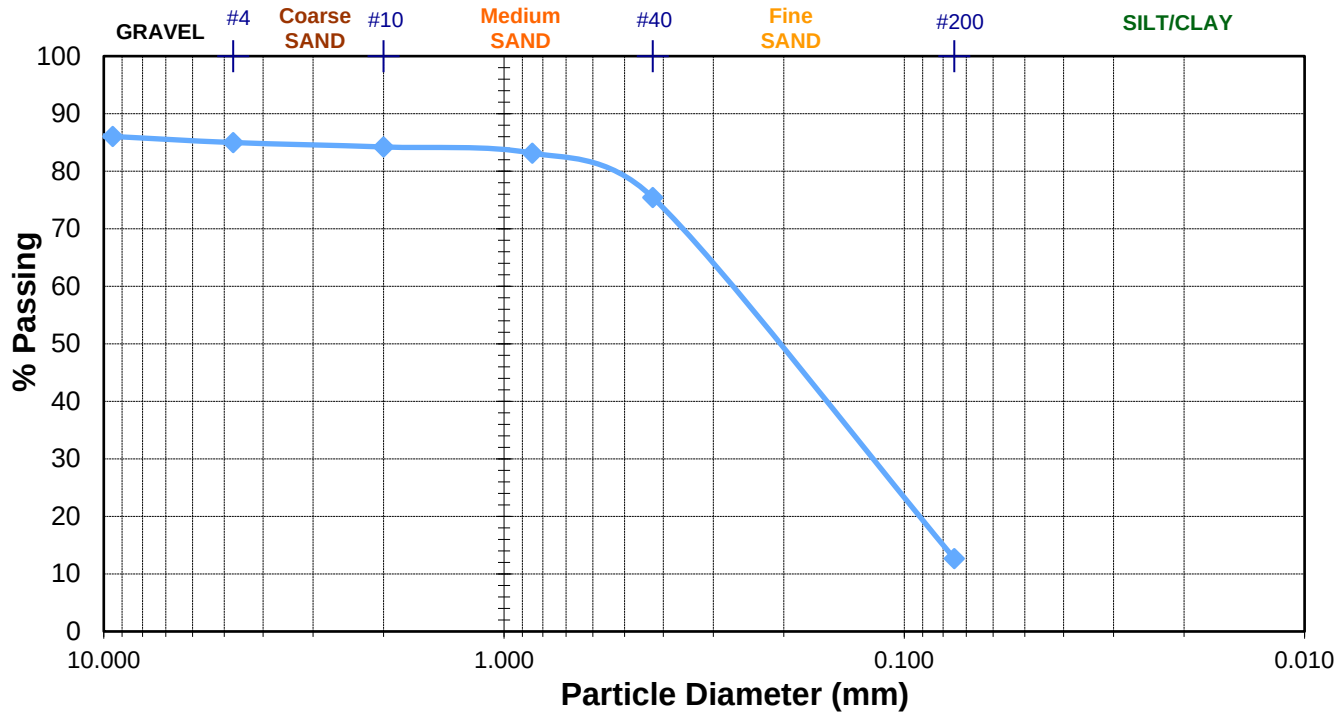
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/17/2023
Location:	B-7, S-4	**Checked By:**	BMW	**Date:**	6/17/2023
Sample Type:	Split Spoon	**Test Number:**	00223-14		
Sample Depth:	18.5-20.0 feet	**Gnd Elev.:**			

USCS Soil Classification: Silty Sand with Gravel (SM)

Weight of Container (g): 17.6 **Weight of Container & Soil (g):** 487.8

Weight of Dry Sample (g): 470.2

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.5	841.0	60.5	12.9	87.1
3/8 in	9.500	739.9	745.0	5.1	1.1	86.0
#4	4.750	757.3	762.3	5.0	1.1	85.0
#10	2.000	687.0	690.6	3.6	0.8	84.2
#20	0.850	618.3	623.4	5.1	1.1	83.1
#40	0.425	561.8	598.0	36.2	7.7	75.4
#200	0.075	515.5	810.6	295.1	62.8	12.7
Pan		485.2	542.4	57.2	12.2	0.5
			TOTAL:	**467.8**	**99.5**	



Grain Size Distribution Curve Results:

% Gravel:	15.0	**D_{10}:**	na	**C_u:**	#VALUE!
% Sand:	72.3	**D_{30}:**	na	**C_c:**	#VALUE!
% Fines:	12.7	**D_{60}:**	na		

TERRA-GEO

Sieve Analysis Data Sheet

ASTM D422-63(2007)

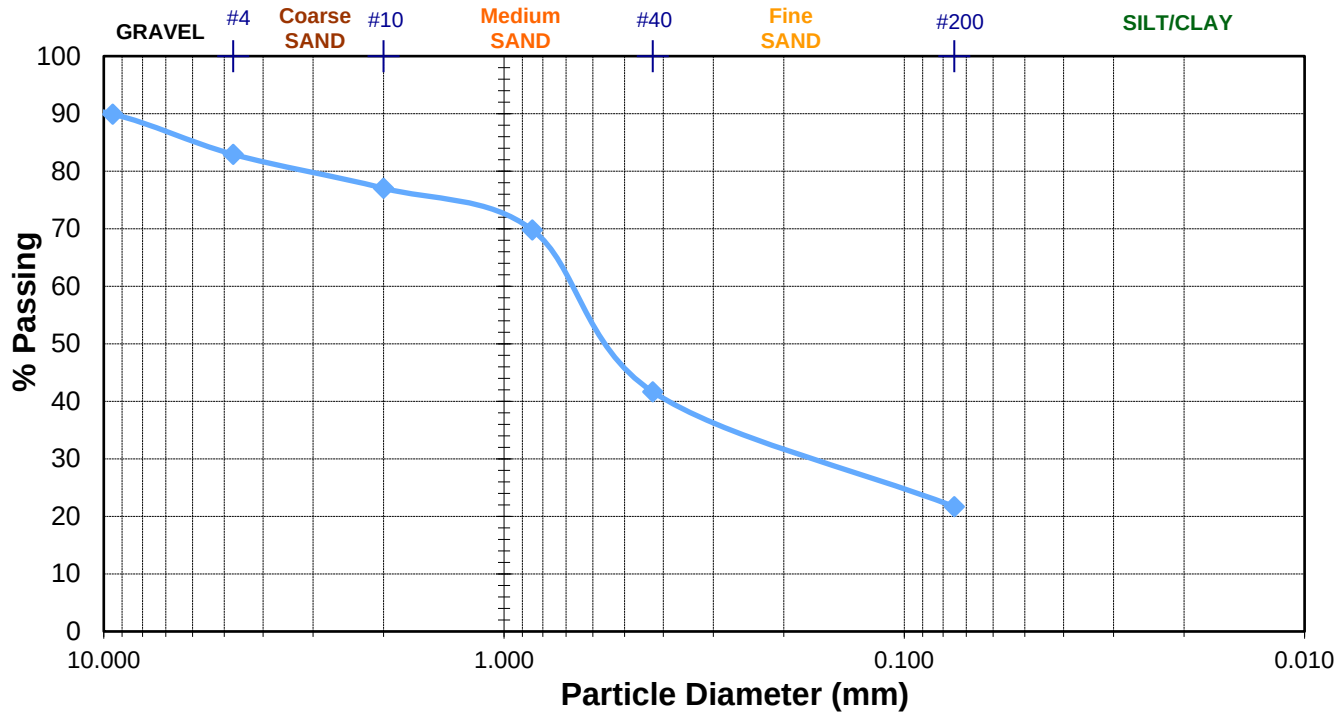
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/17/2023
Location:	B-8, S-4	**Checked By:**	BMW	**Date:**	6/17/2023
Sample Type:	Split Spoon	**Test Number:**	00223-15		
Sample Depth:	18.5-20.0 feet	**Gnd Elev.:**			

USCS Soil Classification: (SC-SM) Silty, Clayey Sand with Gravel

Weight of Container (g): 17.3 **Weight of Container & Soil (g):** 327.9

Weight of Dry Sample (g): 310.6

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.5	802.6	22.1	7.1	92.9
3/8 in	9.500	739.9	749.1	9.2	3.0	89.9
#4	4.750	756.1	777.8	21.7	7.0	82.9
#10	2.000	686.5	704.8	18.3	5.9	77.0
#20	0.850	617.6	640.1	22.5	7.2	69.8
#40	0.425	560.3	647.7	87.4	28.1	41.7
#200	0.075	515.5	577.5	62.0	20.0	21.7
Pan		485.2	553.3	68.1	21.9	-0.2
			TOTAL:	**311.3**	**100.2**	



Grain Size Distribution Curve Results:

% Gravel:	17.1	**D_{10}:**	na	**C_u:**	#VALUE!
% Sand:	61.2	**D_{30}:**	na	**C_c:**	#VALUE!
% Fines:	21.7	**D_{60}:**	na		

TERRA-GEO

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/14/23
Location:	Sedro - Woolley Washington	**Checked By:**	BMW	**Date:**	6/15/23
Sample Type:	GRAB - Test Pit 4	**Test Number:**	02422-08		
Sample Depth:	3-5 Feet	**Gnd Elevation:**			

USCS Soil Classification: Sandy Silt

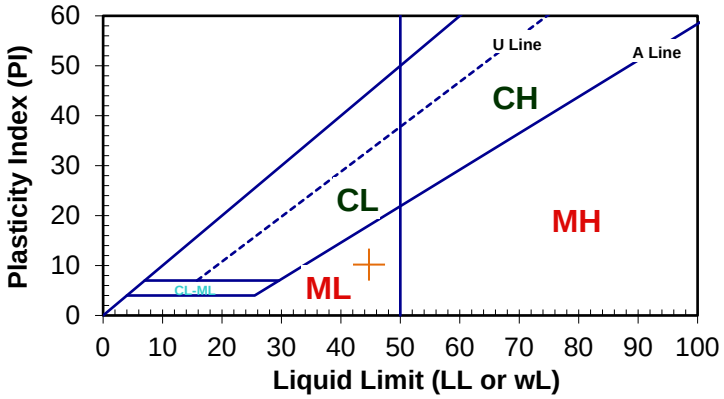
TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					17	24	28	
Can Number	---	---	L11	L3			L15	L6	L12	
Mass of Empty Can	M_C	(g)	21.10	21.10			21.10	21.20	21.60	
Mass Can & Soil (Wet)	M_{CMS}	(g)	24.30	24.90			36.30	33.90	36.40	
Mass Can & Soil (Dry)	M_{CDS}	(g)	23.50	23.90			31.50	30.00	31.90	
Mass of Soil	M_S	(g)	2.40	2.80			10.40	8.80	10.30	
Mass of Water	M_W	(g)	0.80	1.00			4.80	3.90	4.50	
Water Content	w	(%)	33.3	35.7			46.2	44.3	43.7	

Liquid Limit (LL or w_L) (%):	**45**
Plastic Limit (PL or w_P) (%):	**35**
Plasticity Index (PI) (%):	**10**
USCS Classification:	**ML**

PI at "A" Line = 0.73(LL-20)

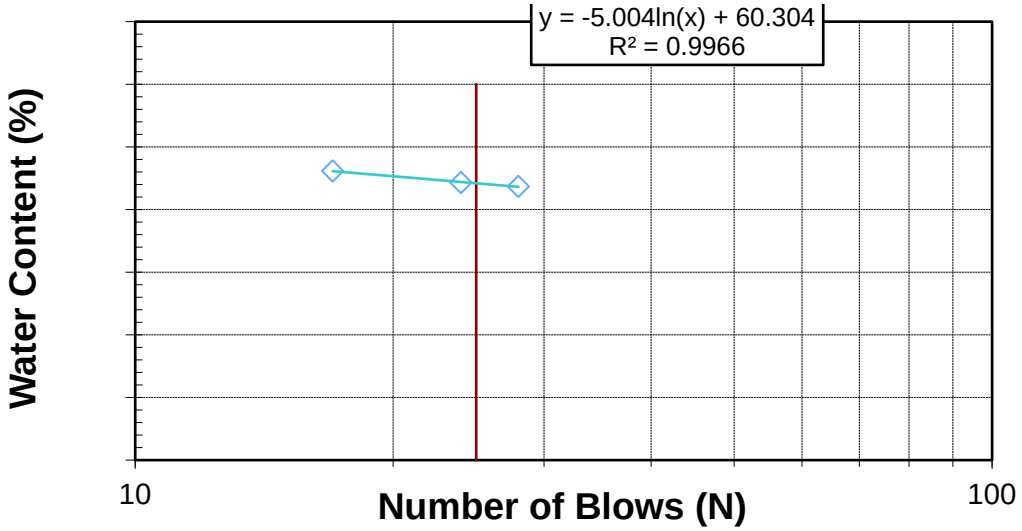
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



PROCEDURE USED

	Wet Preperation Multipoint
X	Dry Preperation Multipoint
	Procedure A Multipoint
	Procedure B One-Point



TERRA-GEO

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/14/23
Location:	Sedro - Woolley Washington	**Checked By:**	BMW	**Date:**	6/15/23
Sample Type:	GRAB - Test Pit 5	**Test Number:**	02422-08		
Sample Depth:	3-5 Feet	**Gnd Elevation:**			

USCS Soil Classification: Silt with Sand

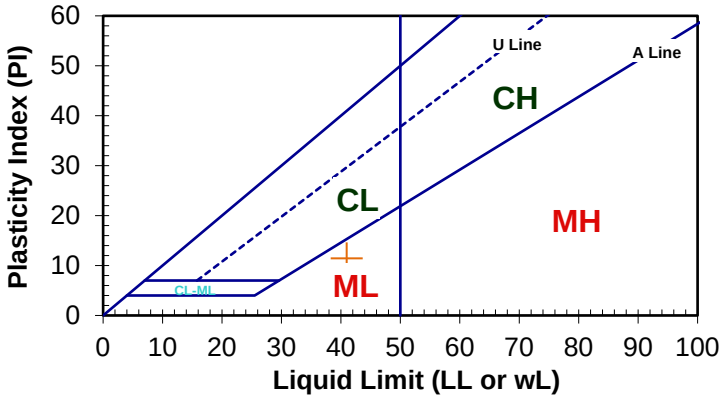
TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					17	26	33	
Can Number	---	---	L1	L4			L2	L8	L11	
Mass of Empty Can	M_C	(g)	25.20	24.90			25.20	25.10	25.40	
Mass Can & Soil (Wet)	M_{CMS}	(g)	32.20	31.50			43.20	38.20	38.90	
Mass Can & Soil (Dry)	M_{CDS}	(g)	30.60	30.00			37.80	34.40	35.10	
Mass of Soil	M_S	(g)	5.40	5.10			12.60	9.30	9.70	
Mass of Water	M_W	(g)	1.60	1.50			5.40	3.80	3.80	
Water Content	w	(%)	29.6	29.4			42.9	40.9	39.2	

Liquid Limit (LL or w_L) (%):	41
Plastic Limit (PL or w_P) (%):	30
Plasticity Index (PI) (%):	11
USCS Classification:	ML

PI at "A" Line = 0.73(LL-20)

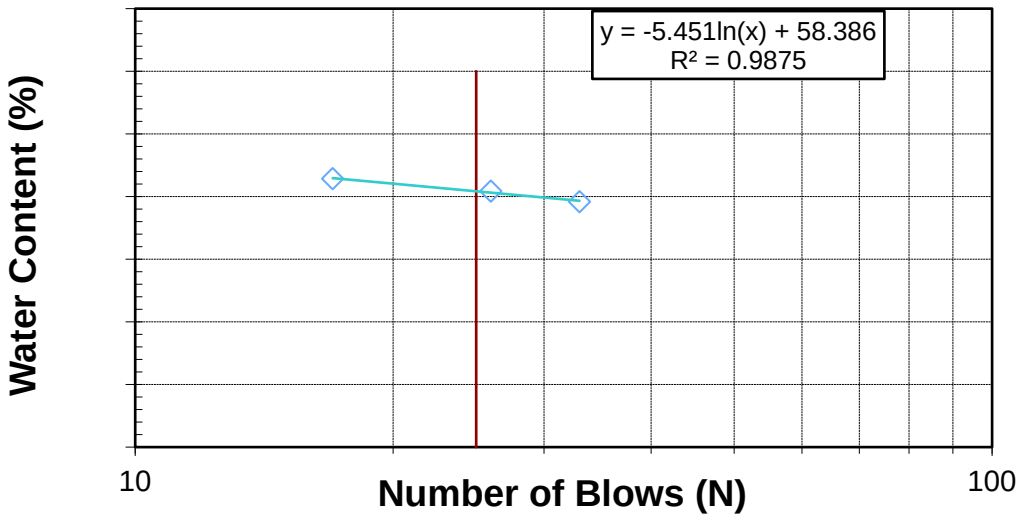
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



PROCEDURE USED

- [ ] Wet Preperation Multipoint
- [X] Dry Preperation Multipoint
- [ ] Procedure A Multipoint
- [ ] Procedure B One-Point



TERRA-GEO

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/14/23
Location:	Sedro - Woolley Washington	**Checked By:**	BMW	**Date:**	6/15/23
Sample Type:	B-1, S-8	**Test Number:**	00223-7		
Sample Depth:	38.5-40 feet	**Gnd Elevation:**			

USCS Soil Classification: (GM) Silty Gravel with Sand

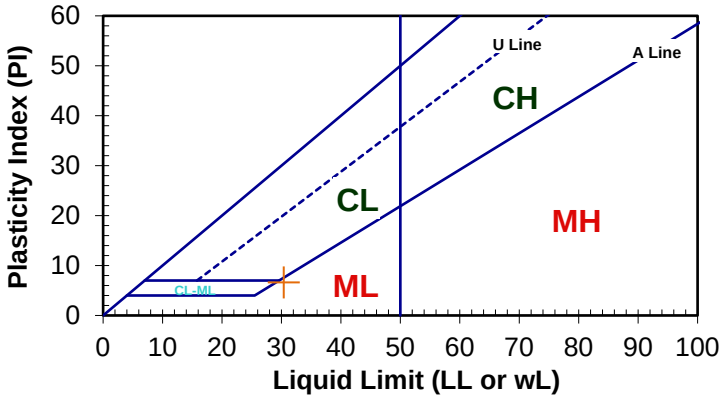
TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					19	30	40	
Can Number	---	---	H4	M1			I3	J4	D3	
Mass of Empty Can	M_C	(g)	14.22	14.18			14.17	14.14	13.92	
Mass Can & Soil (Wet)	M_{CMS}	(g)	24.70	25.10			40.89	36.99	34.17	
Mass Can & Soil (Dry)	M_{CDS}	(g)	22.78	22.91			34.36	31.98	29.41	
Mass of Soil	M_S	(g)	8.56	8.73			20.19	17.84	15.49	
Mass of Water	M_W	(g)	1.92	2.19			6.53	5.01	4.76	
Water Content	*w*	(%)	22.4	25.1			32.3	28.1	30.7	

Liquid Limit (LL or w_L) (%):	**30**
Plastic Limit (PL or w_P) (%):	**24**
Plasticity Index (PI) (%):	**7**
USCS Classification:	**ML**

PI at "A" Line = 0.73(LL-20)

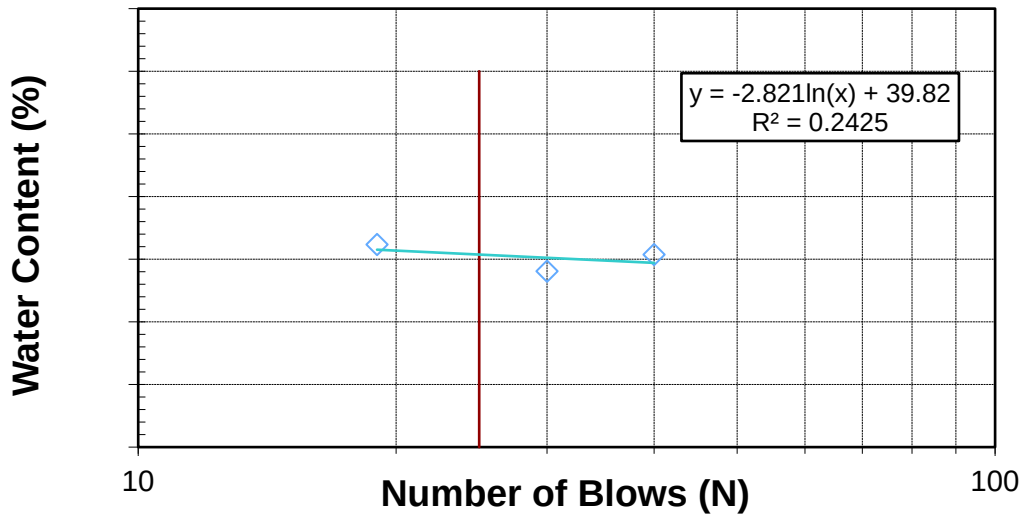
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



PROCEDURE USED

- [ ] Wet Preperation Multipoint
- [X] Dry Preperation Multipoint
- [ ] Procedure A Multipoint
- [ ] Procedure B One-Point



TERRA-GEO

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/12/23
Location:	Sedro - Woolley Washington	**Checked By:**	BMW	**Date:**	6/13/23
Sample Type:	B-1, S-13	**Test Number:**	00223-8		
Sample Depth:	63.5-65.0 feet	**Gnd Elevation:**			

USCS Soil Classification: (SM) Silty Sand with Gravel

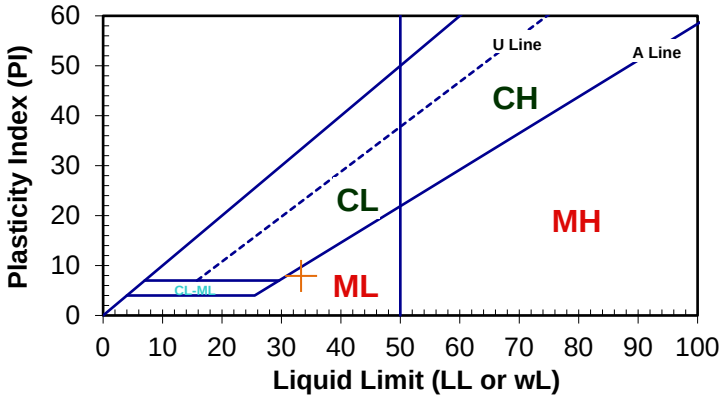
TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					20	23		
Can Number	---	---	F2	A6			J4	K2		
Mass of Empty Can	M_C	(g)	14.10	14.28			14.05	14.14		
Mass Can & Soil (Wet)	M_{CMS}	(g)	22.98	24.11			36.60	46.60		
Mass Can & Soil (Dry)	M_{CDS}	(g)	21.14	22.17			30.68	38.92		
Mass of Soil	M_S	(g)	7.04	7.89			16.63	24.78		
Mass of Water	M_W	(g)	1.84	1.94			5.92	7.68		
Water Content	w	(%)	26.1	24.6			35.6	31.0		

Liquid Limit (LL or w_L) (%):	**33**
Plastic Limit (PL or w_P) (%):	**25**
Plasticity Index (PI) (%):	**8**
USCS Classification:	**ML**

PI at "A" Line = 0.73(LL-20)

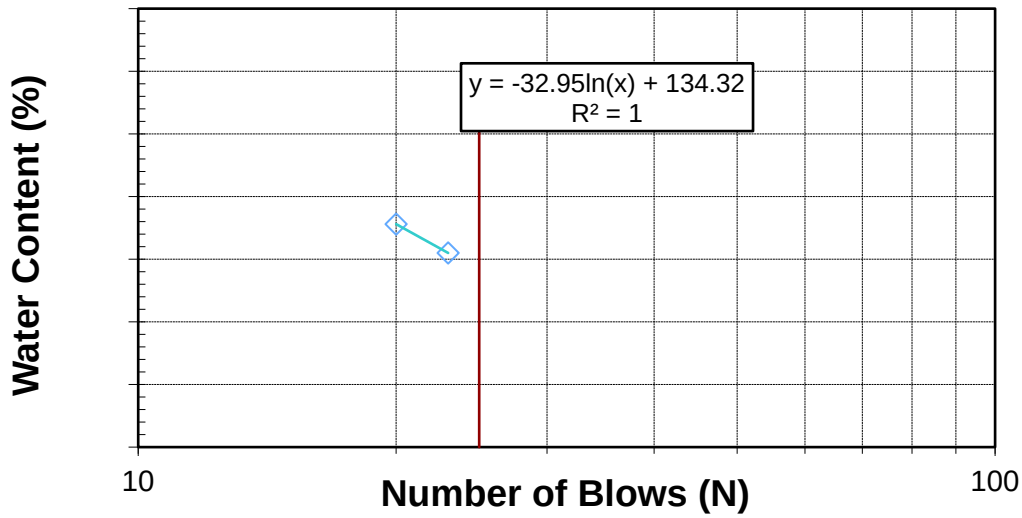
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



PROCEDURE USED

- [ ] Wet Preperation Multipoint
- [X] Dry Preperation Multipoint
- [ ] Procedure A Multipoint
- [ ] Procedure B One-Point



TERRA-GEO

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/12/23
Location:	Sedro - Woolley Washington	**Checked By:**	BMW	**Date:**	6/13/23
Sample Type:	B-3, S-3	**Test Number:**	00223-9		
Sample Depth:	13.5-15.0 feet	**Gnd Elevation:**			

USCS Soil Classification: (SM) Silty Sand

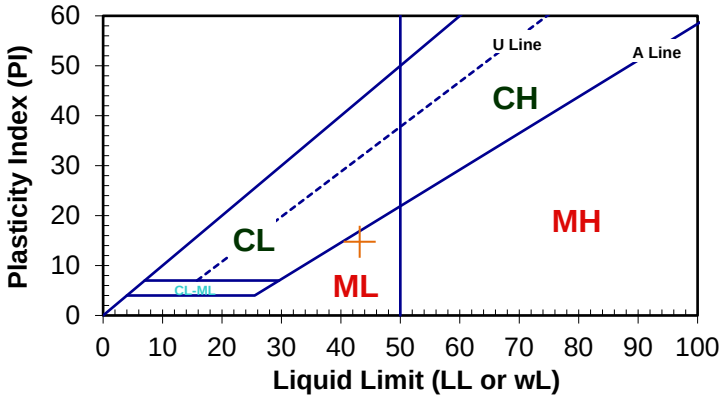
TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					21	25	29	
Can Number	---	---	F2	A6			E9	D1	B5	
Mass of Empty Can	M_C	(g)	14.14	14.28			14.24	14.06	14.03	
Mass Can & Soil (Wet)	M_{CMS}	(g)	18.41	24.93			34.80	36.60	32.01	
Mass Can & Soil (Dry)	M_{CDS}	(g)	17.46	22.59			28.90	29.75	26.38	
Mass of Soil	M_S	(g)	3.32	8.31			14.66	15.69	12.35	
Mass of Water	M_W	(g)	0.95	2.34			5.90	6.85	5.63	
Water Content	w	(%)	28.6	28.2			40.2	43.6	45.6	

Liquid Limit (LL or w_L) (%):	43
Plastic Limit (PL or w_P) (%):	28
Plasticity Index (PI) (%):	15
USCS Classification:	ML

PI at "A" Line = 0.73(LL-20)

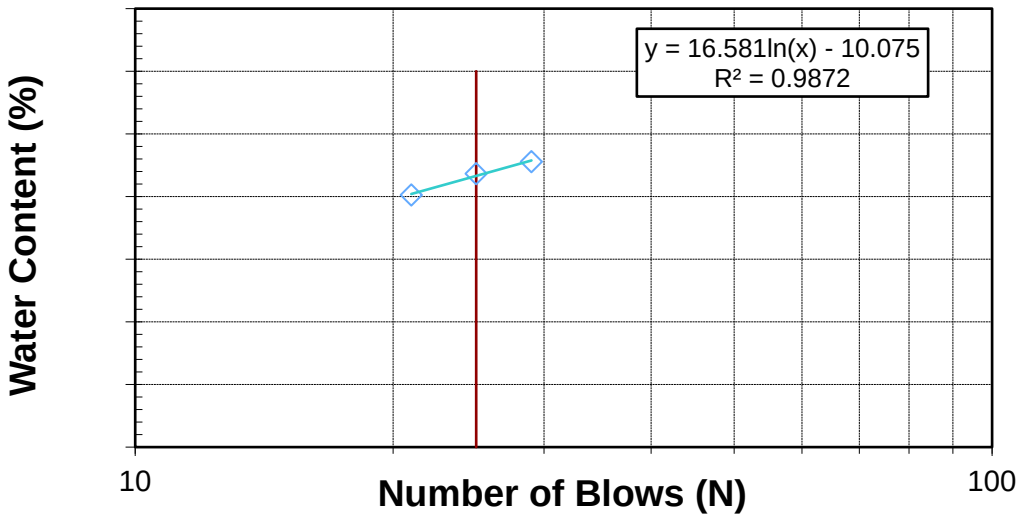
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



PROCEDURE USED

- [ ] Wet Preperation Multipoint
- [X] Dry Preperation Multipoint
- [ ] Procedure A Multipoint
- [ ] Procedure B One-Point



TERRA-GEO

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/17/23
Location:	Sedro - Woolley Washington	**Checked By:**	BMW	**Date:**	6/18/23
Sample Type:	B-4, S-6	**Test Number:**	00223-10		
Sample Depth:	28.5-30.0 feet	**Gnd Elevation:**			

USCS Soil Classification: (GM) Silty Gravel

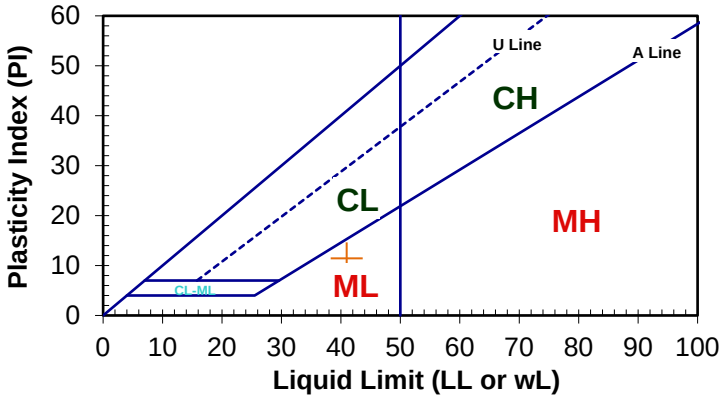
TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					17	26	33	
Can Number	---	---	X12	X14			X1	X7	X3	
Mass of Empty Can	M_C	(g)	25.20	24.90			25.20	25.10	25.40	
Mass Can & Soil (Wet)	M_{CMS}	(g)	32.20	31.50			43.20	38.20	38.90	
Mass Can & Soil (Dry)	M_{CDS}	(g)	30.60	30.00			37.80	34.40	35.10	
Mass of Soil	M_S	(g)	5.40	5.10			12.60	9.30	9.70	
Mass of Water	M_W	(g)	1.60	1.50			5.40	3.80	3.80	
Water Content	w	(%)	29.6	29.4			42.9	40.9	39.2	

Liquid Limit (LL or w_L) (%):	**41**
Plastic Limit (PL or w_P) (%):	**30**
Plasticity Index (PI) (%):	**11**
USCS Classification:	**ML**

PI at "A" Line = 0.73(LL-20)

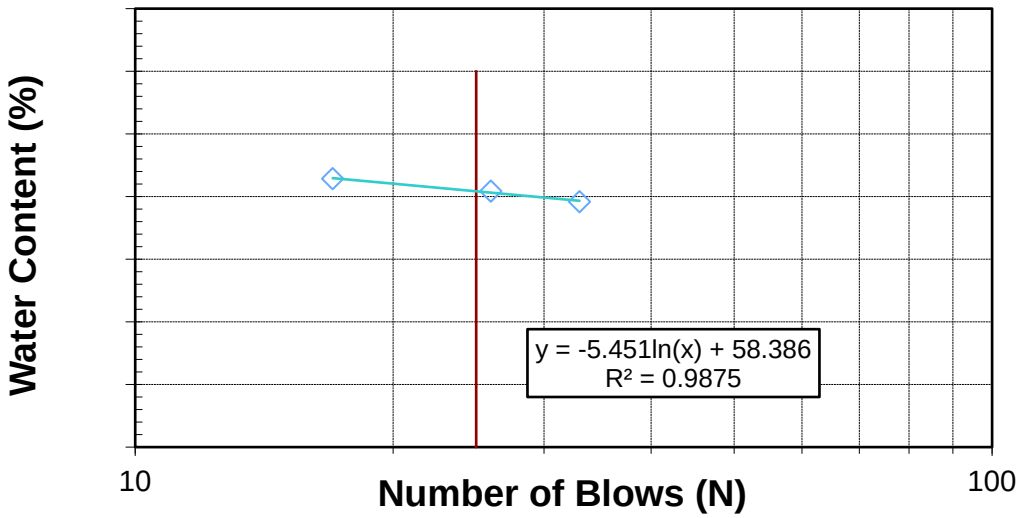
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



PROCEDURE USED

	Wet Preperation Multipoint
X	Dry Preperation Multipoint
	Procedure A Multipoint
	Procedure B One-Point



TERRA-GEO

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/17/23
Location:	Sedro - Woolley Washington	**Checked By:**	BMW	**Date:**	6/18/23
Sample Type:	B-4, S-12	**Test Number:**	00223-11		
Sample Depth:	58.5-60.0 feet	**Gnd Elevation:**			

USCS Soil Classification: (GM) Silty Gravel with Sand

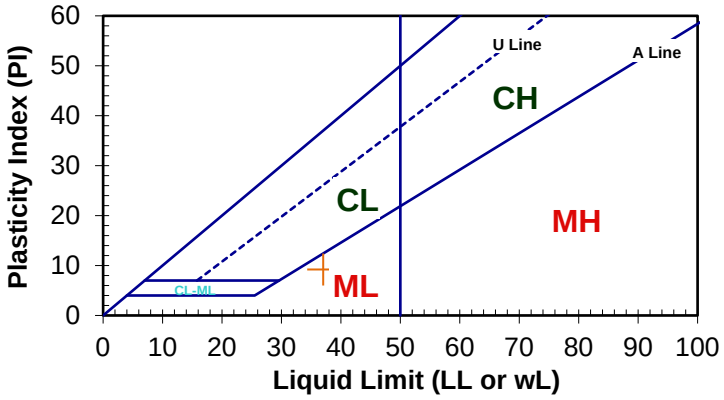
TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					31	26	20	
Can Number	---	---	A5	F3			G4	C2	E4	
Mass of Empty Can	M_C	(g)	14.14	14.19			14.17	15.61	15.98	
Mass Can & Soil (Wet)	M_{CMS}	(g)	22.94	22.36			39.06	34.40	37.75	
Mass Can & Soil (Dry)	M_{CDS}	(g)	21.04	20.57			32.44	29.34	31.76	
Mass of Soil	M_S	(g)	6.90	6.38			18.27	13.73	15.78	
Mass of Water	M_W	(g)	1.90	1.79			6.62	5.06	5.99	
Water Content	w	(%)	27.5	28.1			36.2	36.9	38.0	

Liquid Limit (LL or w_L) (%):	**37**
Plastic Limit (PL or w_P) (%):	**28**
Plasticity Index (PI) (%):	**9**
USCS Classification:	**ML**

PI at "A" Line = 0.73(LL-20)

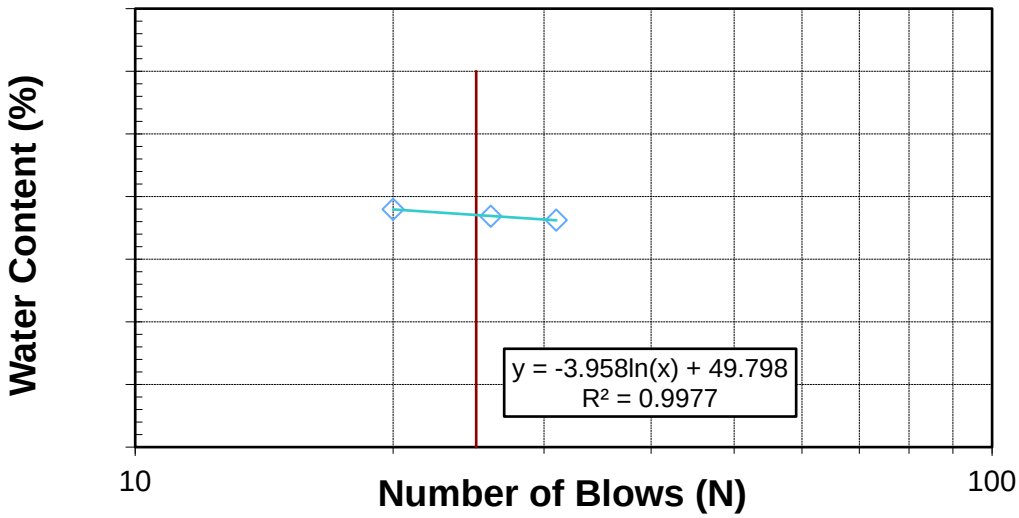
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



PROCEDURE USED

- [ ] Wet Preperation Multipoint
- [X] Dry Preperation Multipoint
- [ ] Procedure A Multipoint
- [ ] Procedure B One-Point



TERRA-GEO

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/17/23
Location:	Sedro - Woolley Washington	**Checked By:**	BMW	**Date:**	6/18/23
Sample Type:	B-5, S-2B	**Test Number:**	00223-17		
Sample Depth:	10.0-12.0 feet	**Gnd Elevation:**			

USCS Soil Classification: SILT (ML)

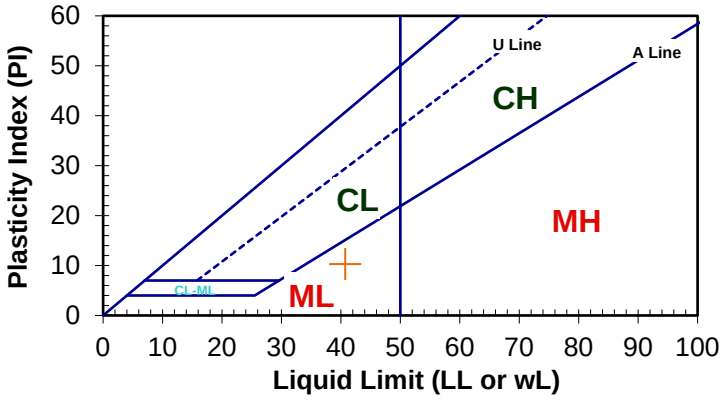
TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					16	21	29	
Can Number	---	---	Z11	Z4			Z1	Z5	Z3	
Mass of Empty Can	M_C	(g)	25.20	25.00			29.00	20.80	25.00	
Mass Can & Soil (Wet)	M_{CMS}	(g)	33.15	33.35			58.70	39.59	45.89	
Mass Can & Soil (Dry)	M_{CDS}	(g)	31.30	31.40			49.80	34.20	40.00	
Mass of Soil	M_S	(g)	6.10	6.40			20.80	13.40	15.00	
Mass of Water	M_W	(g)	1.85	1.95			8.90	5.39	5.89	
Water Content	w	(%)	30.3	30.5			42.8	40.2	39.2	

Liquid Limit (LL or w_L) (%):	**41**
Plastic Limit (PL or w_P) (%):	**30**
Plasticity Index (PI) (%):	**10**
USCS Classification:	**ML**

PI at "A" Line = 0.73(LL-20)

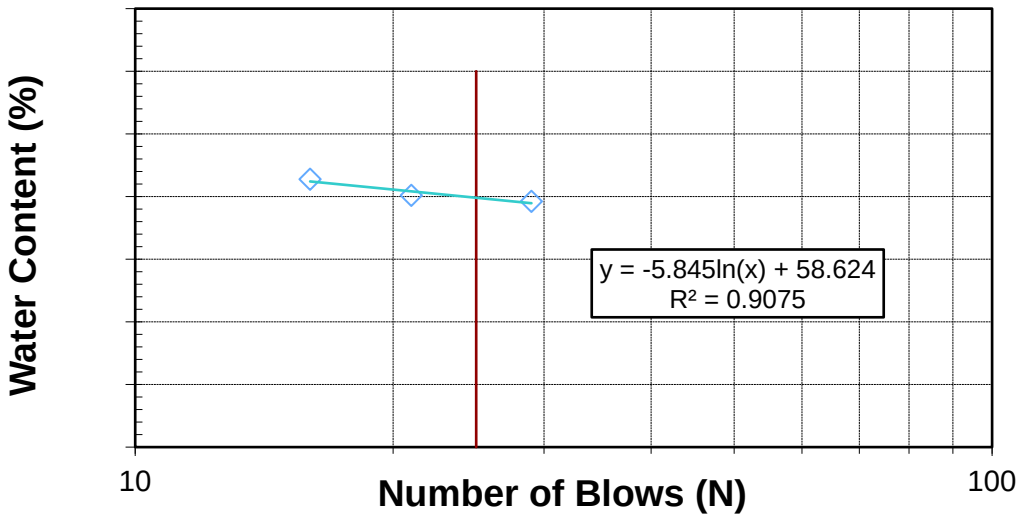
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



PROCEDURE USED

	Wet Preperation Multipoint
X	Dry Preperation Multipoint
	Procedure A Multipoint
	Procedure B One-Point



TERRA-GEO

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/17/23
Location:	Sedro - Woolley Washington	**Checked By:**	BMW	**Date:**	6/18/23
Sample Type:	B-7, S-2B	**Test Number:**	00223-16		
Sample Depth:	10.0 -12.0 feet	**Gnd Elevation:**			

USCS Soil Classification: Sandy Silt (ML)

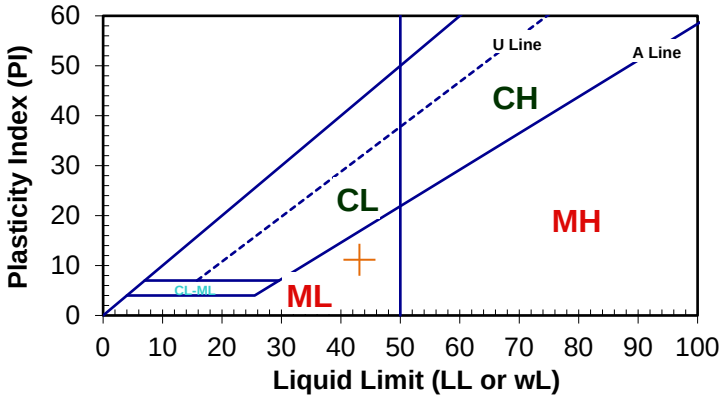
TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					19	27	41	
Can Number	---	---	SD1	SD4			SD10	SD11	SD17	
Mass of Empty Can	M_C	(g)	21.00	20.70			21.00	21.70	21.30	
Mass Can & Soil (Wet)	M_{CMS}	(g)	23.50	23.20			40.80	47.20	45.40	
Mass Can & Soil (Dry)	M_{CDS}	(g)	23.00	22.50			34.80	39.50	38.20	
Mass of Soil	M_S	(g)	2.00	1.80			13.80	17.80	16.90	
Mass of Water	M_W	(g)	0.50	0.70			6.00	7.70	7.20	
Water Content	w	(%)	25.0	38.9			43.5	43.3	42.6	

Liquid Limit (LL or w_L) (%):	43
Plastic Limit (PL or w_P) (%):	32
Plasticity Index (PI) (%):	11
USCS Classification:	ML

PI at "A" Line = 0.73(LL-20)

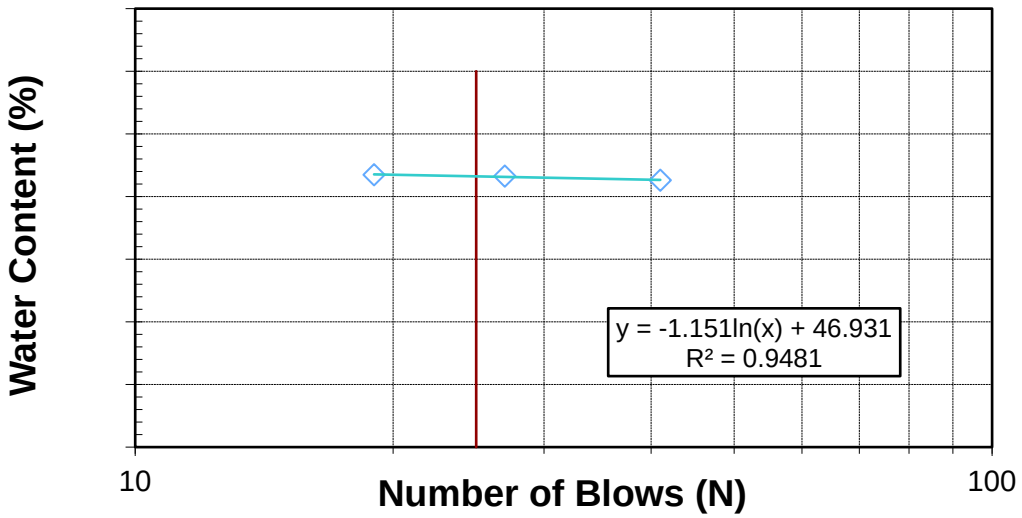
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



PROCEDURE USED

	Wet Preperation Multipoint
X	Dry Preperation Multipoint
	Procedure A Multipoint
	Procedure B One-Point



TERRA-GEO

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/17/23
Location:	Sedro - Woolley Washington	**Checked By:**	BMW	**Date:**	6/18/23
Sample Type:	B-7, S-4	**Test Number:**	00223-12		
Sample Depth:	18.5-20.0 feet	**Gnd Elevation:**			

USCS Soil Classification: Silty Sand (SM)

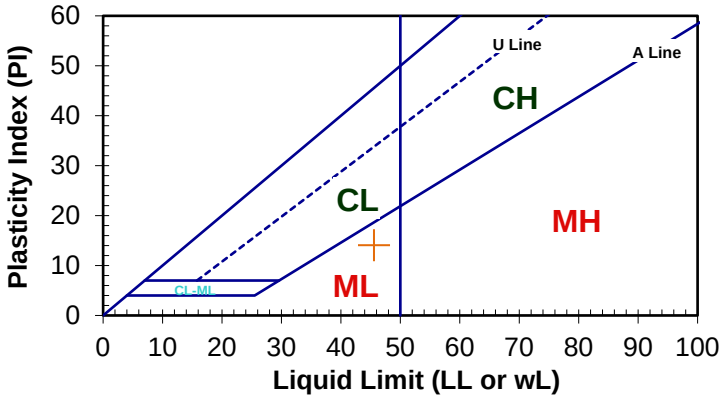
TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					20	28	48	
Can Number	---	---	M13	M6			M1	M4	M9	
Mass of Empty Can	M_C	(g)	24.90	24.90			25.10	24.70	31.00	
Mass Can & Soil (Wet)	M_{CMS}	(g)	28.40	27.70			46.30	48.40	50.90	
Mass Can & Soil (Dry)	M_{CDS}	(g)	27.60	27.00			39.50	40.90	44.90	
Mass of Soil	M_S	(g)	2.70	2.10			14.40	16.20	13.90	
Mass of Water	M_W	(g)	0.80	0.70			6.80	7.50	6.00	
Water Content	*w*	(%)	29.6	33.3			47.2	46.3	43.2	

Liquid Limit (LL or w_L) (%):	**46**
Plastic Limit (PL or w_P) (%):	**31**
Plasticity Index (PI) (%):	**14**
USCS Classification:	**ML**

PI at "A" Line = 0.73(LL-20)

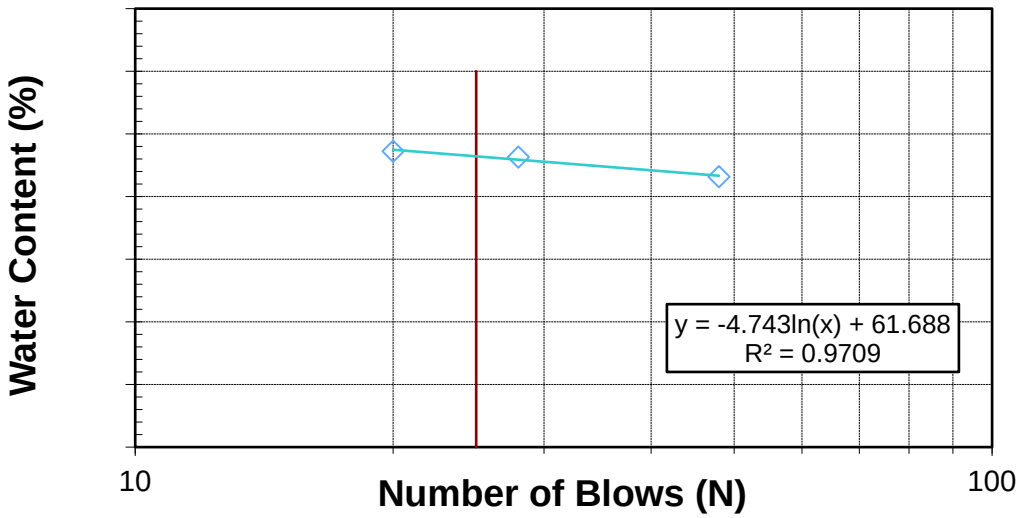
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



PROCEDURE USED

- [ ] Wet Preperation Multipoint
- [X] Dry Preperation Multipoint
- [ ] Procedure A Multipoint
- [ ] Procedure B One-Point



TERRA-GEO

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	6/17/23
Location:	Sedro - Woolley Washington	**Checked By:**	BMW	**Date:**	6/18/23
Sample Type:	B-8, S-4	**Test Number:**	00223-13		
Sample Depth:	18.5-20.0 feet	**Gnd Elevation:**			

USCS Soil Classification: (SC-SM) Silty, Clayey Sand with Gravel

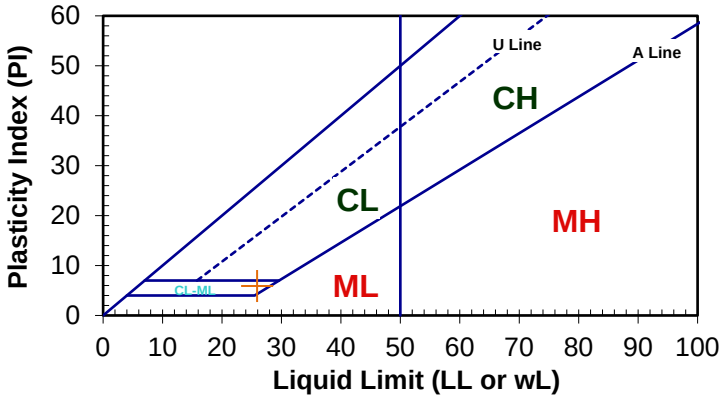
TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					16	21	29	
Can Number	---	---	Z11	Z4			Z1	Z5	Z3	
Mass of Empty Can	M_C	(g)	25.20	25.00			29.00	20.80	25.00	
Mass Can & Soil (Wet)	M_{CMS}	(g)	32.50	32.70			55.40	37.70	43.70	
Mass Can & Soil (Dry)	M_{CDS}	(g)	31.30	31.40			49.80	34.20	40.00	
Mass of Soil	M_S	(g)	6.10	6.40			20.80	13.40	15.00	
Mass of Water	M_W	(g)	1.20	1.30			5.60	3.50	3.70	
Water Content	w	(%)	19.7	20.3			26.9	26.1	24.7	

Liquid Limit (LL or w_L) (%):	**26**
Plastic Limit (PL or w_P) (%):	**20**
Plasticity Index (PI) (%):	**6**
USCS Classification:	**CL-ML**

PI at "A" Line = 0.73(LL-20)

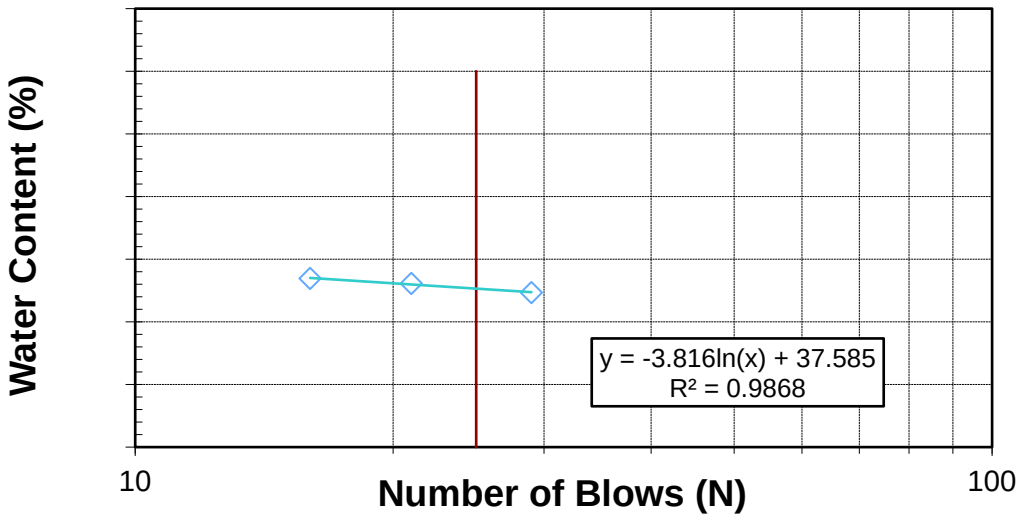
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



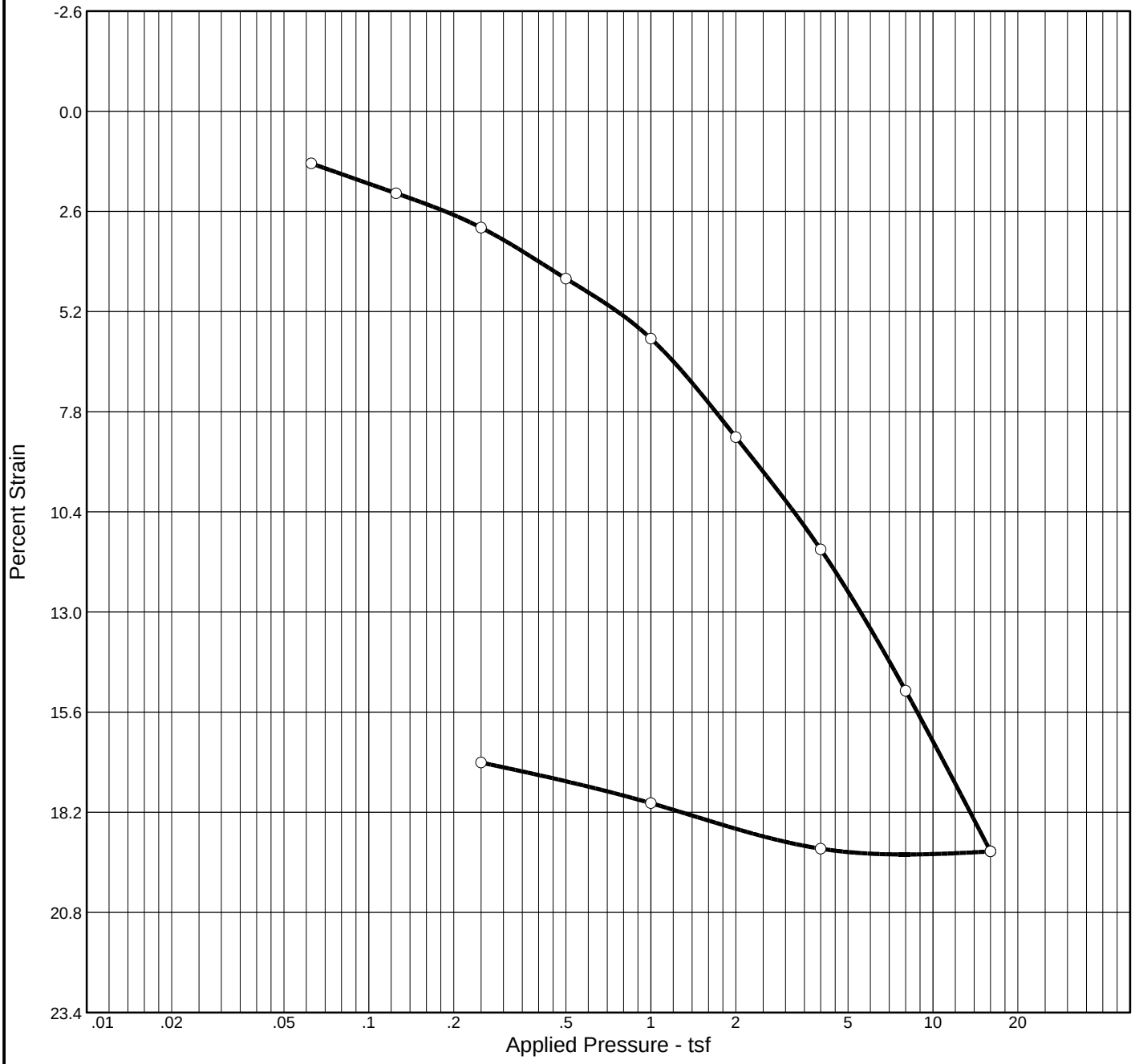
PROCEDURE USED

	Wet Preperation Multipoint
X	Dry Preperation Multipoint
	Procedure A Multipoint
	Procedure B One-Point



TERRA-GEO

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
97.6 %	49.9 %	70.2	45	10	2.65		2.14	0.33	0.03			1.356

MATERIAL DESCRIPTION	USCS	AASHTO
Silt	ML	-----

Project No. 00223

Project: Goldeneye BESS
Sedro - Woolley, Washington

Source: B-5 **Elev./Depth:** 10.0-12.0 ft.

Remarks:

Sample not uniform in density and
top platen tilted slightly testing

TERRA-GEO

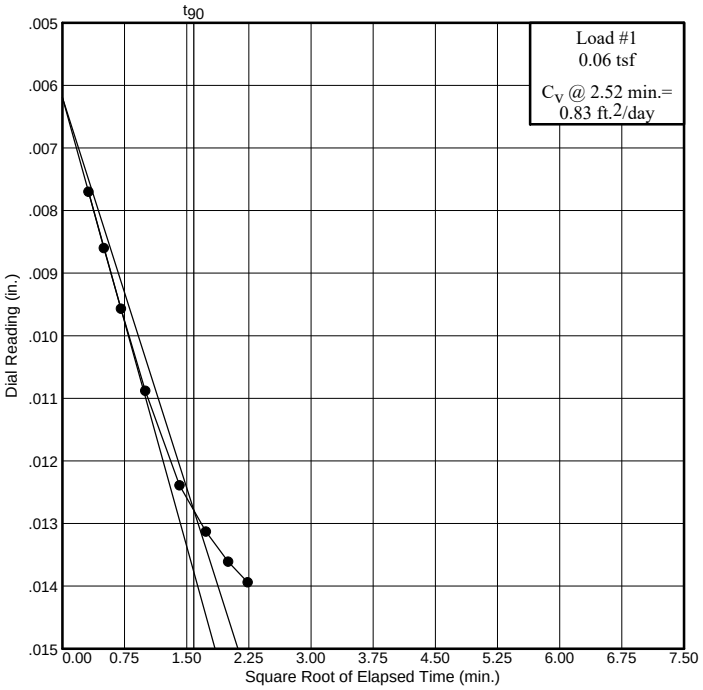
Dial Reading vs. Time

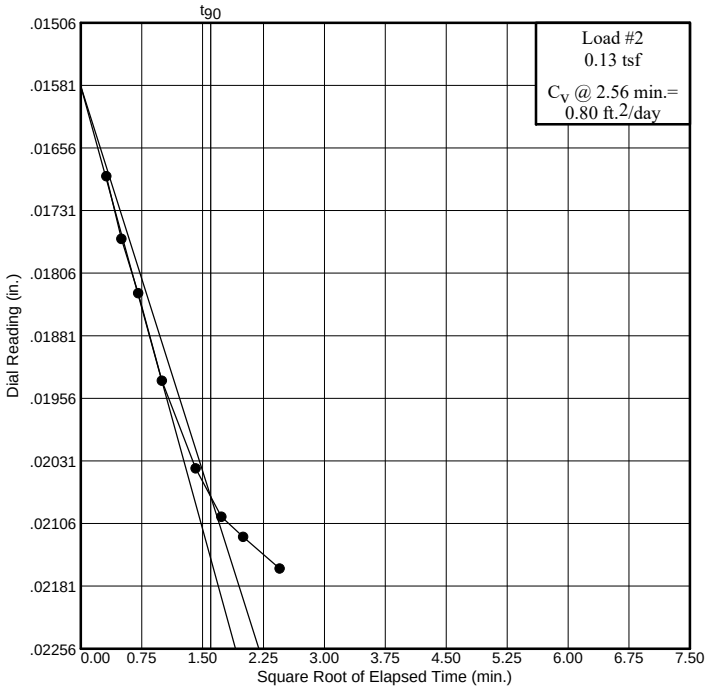
Project No: 00223

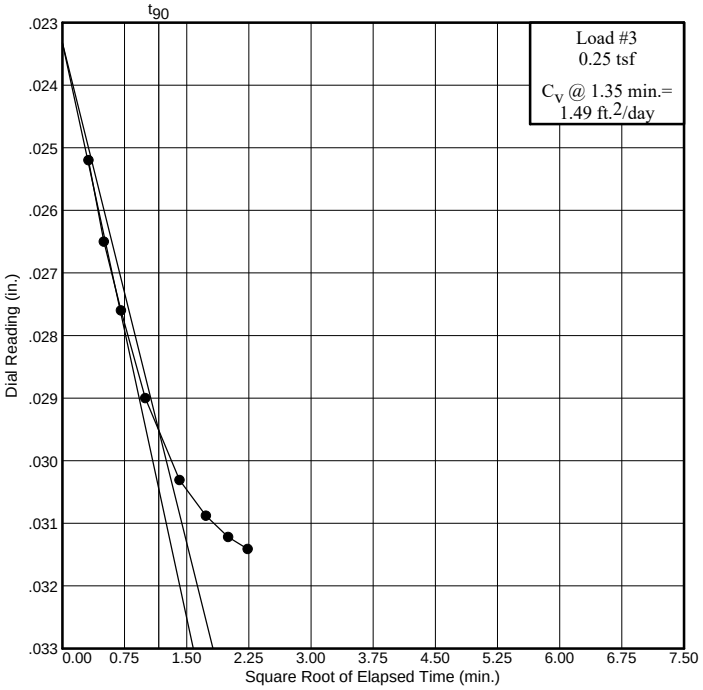
Goldeneye BESS

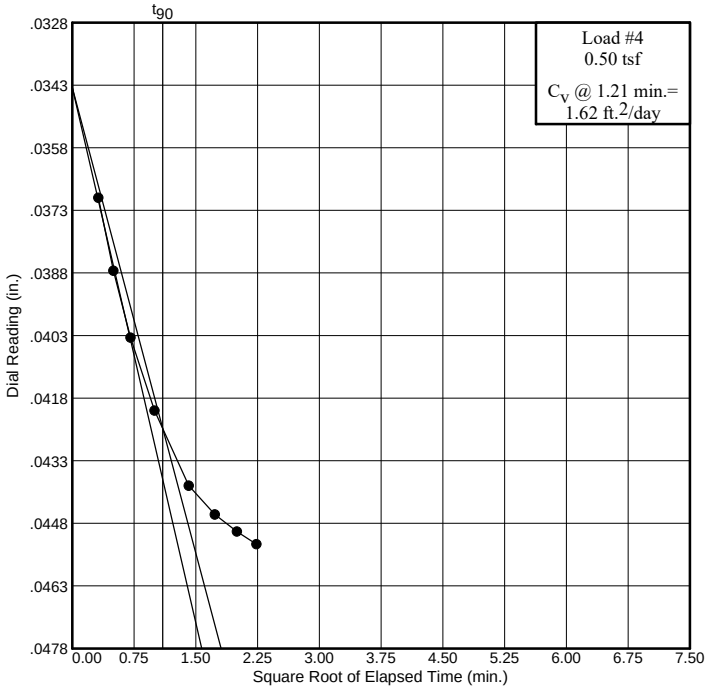
Boring B-5

Depth: 10-12 feet









Terra-Geo, Inc

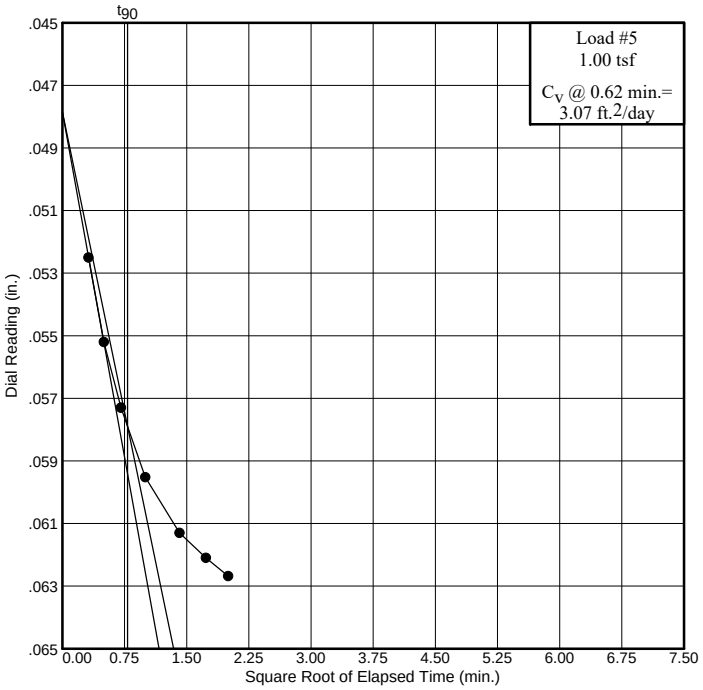
Dial Reading vs. Time

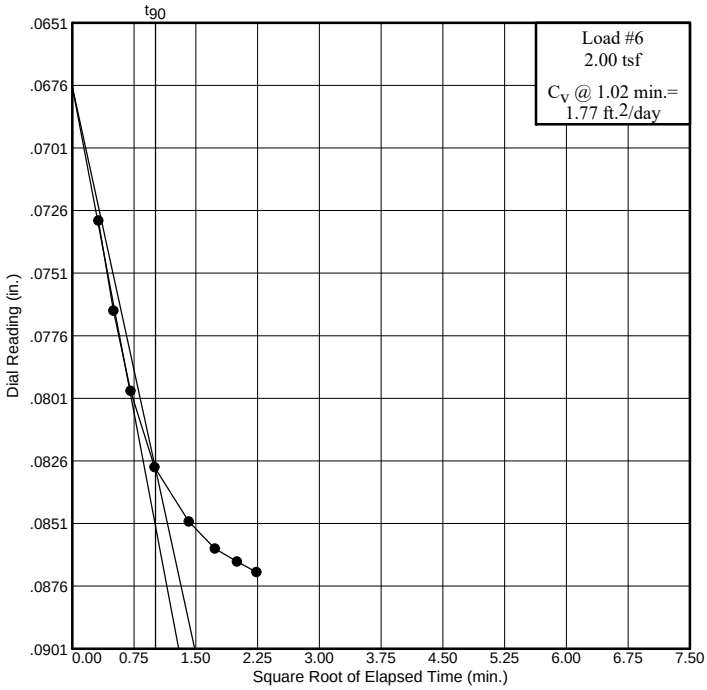
Project No: 00223

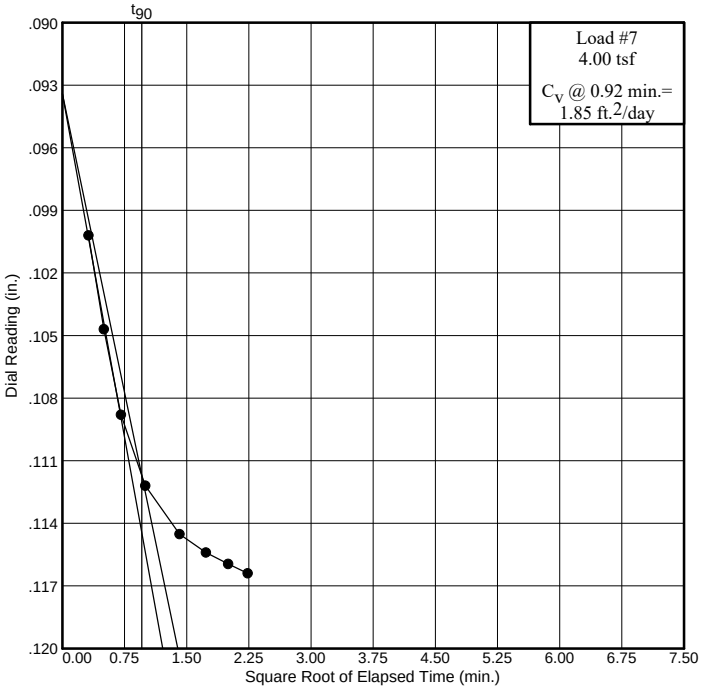
Goldeneye BESS

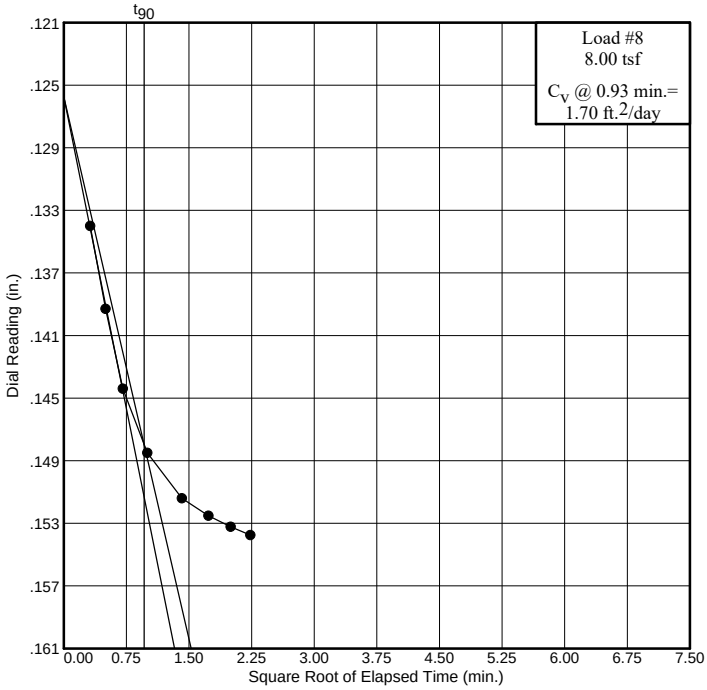
Boring B-5

Depth: 10-12 feet









Terra-Geo, Inc

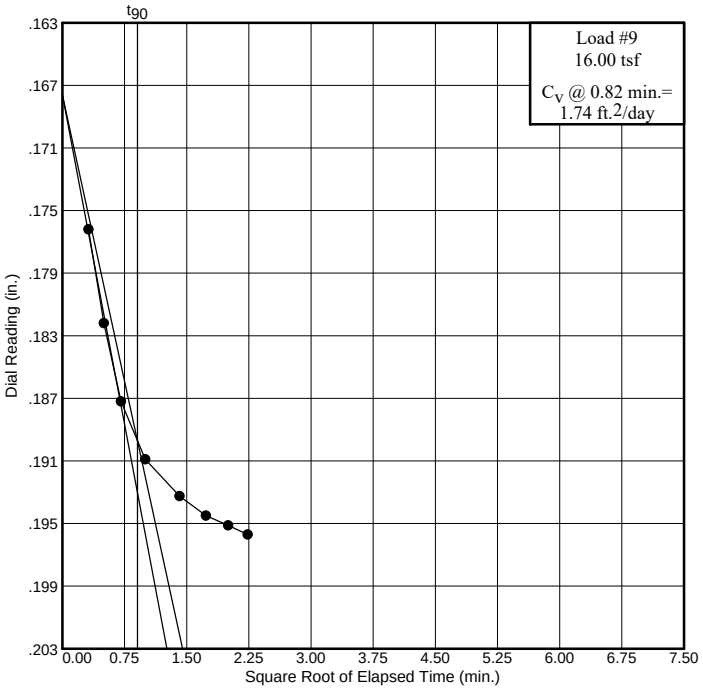
Dial Reading vs. Time

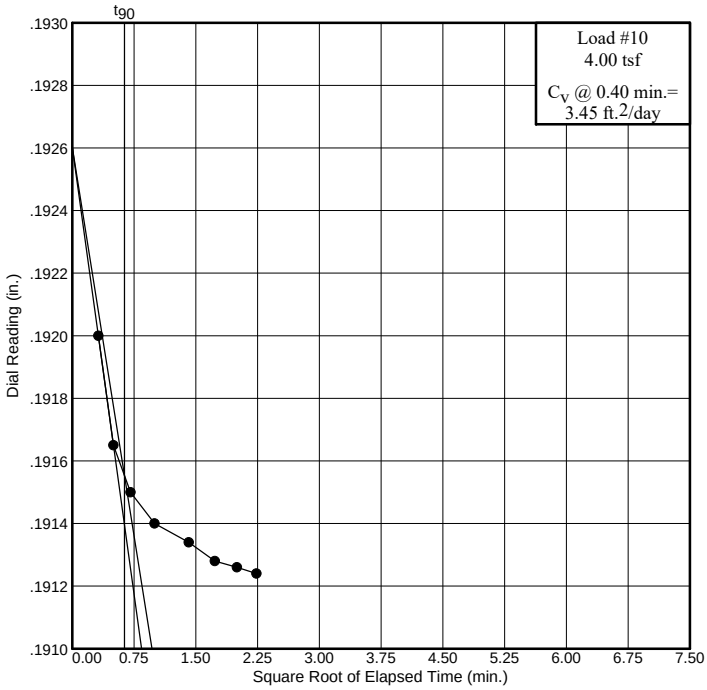
Project No: 00223

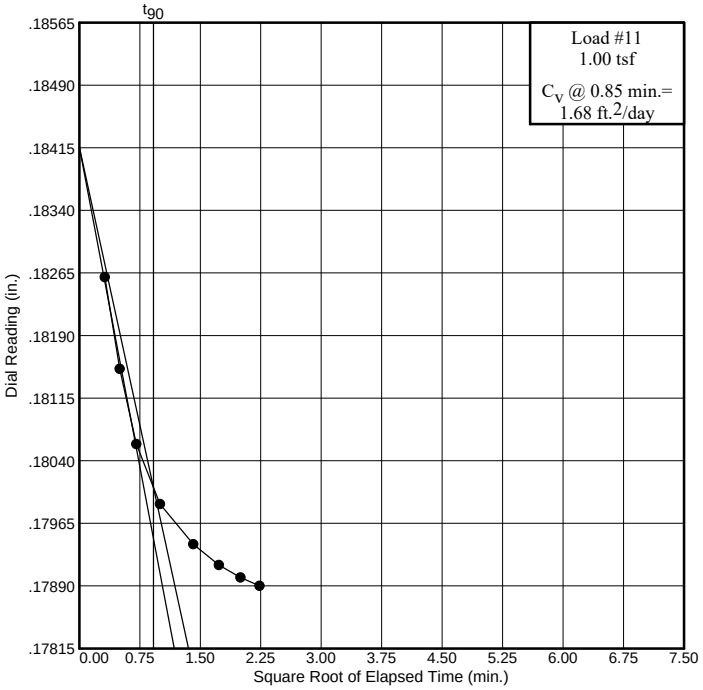
Goldeneye BESS

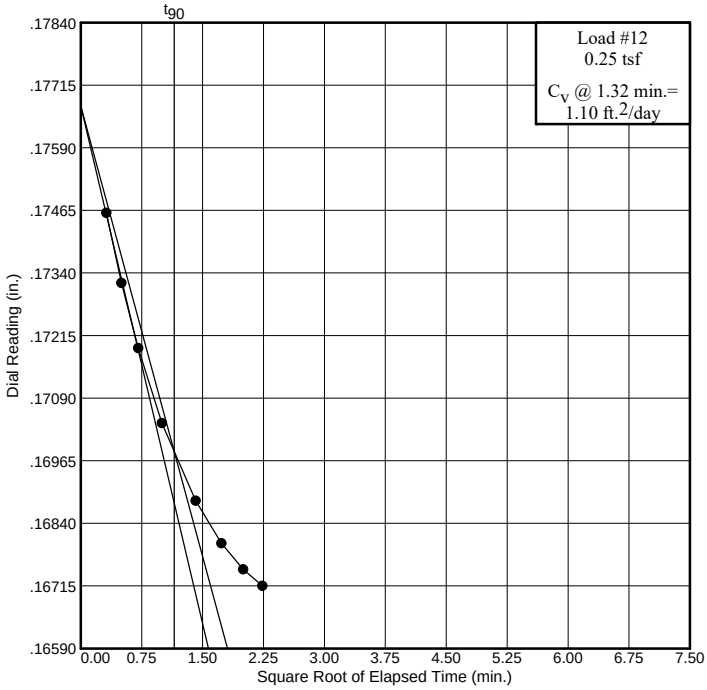
Boring B-5

Depth: 10-12 feet









Terra-Geo, Inc

Soil Compaction (Proctor) Testing Data Sheet

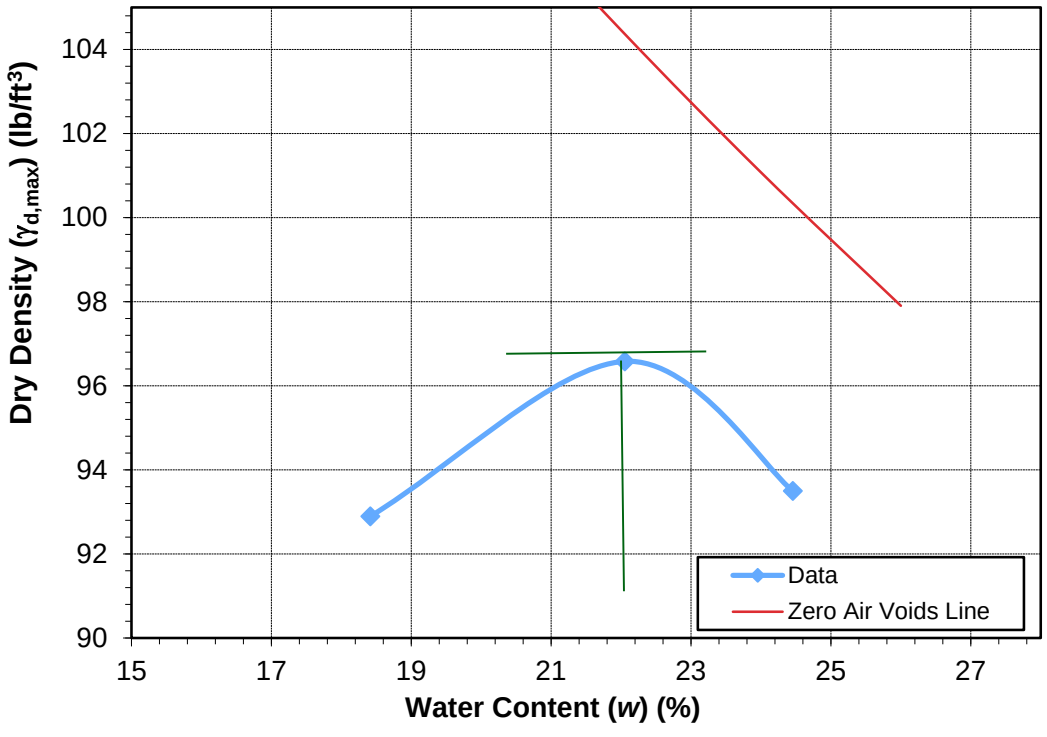
ASTM D698 & D1557

Project Name:	Goldeneye	**Tested By:**	SMW	**Date:**	5/22/2023
Location:	TP-2	**Checked By:**	BMW	**Date:**	5/23/2023
Sample Source:	5-7 feet	**Test No.:**	00223-07		
Sample Type:	Grab				

USCS Soil Classification: Sandy Silt (ML) **G_s:** 2.65

Test Standard:	ASTM D1557	**Mold Dia (in):**	4
Test Method:	Method B	**Mold Vol. (ft^3):**	0.033

	Air Dry	90 ml	180 ml	270 ml
TRIAL NUMBER	**1**	**2**	**3**	**4**
Mass of Soil & Mold (M_t) (lb):	17.82	18.08	18.03	
Mass of Mold (M_{mold}) (lb):	14.19	14.19	14.19	
Mass of Soil (M_s) (lb):	3.63	3.89	3.84	
Wet Density (γ_{wet}) (lb/ft^3):	110.0	117.9	116.4	
Can Number	TR26	TR23	TR15	
Mass of Empty Can (g):	16.20	16.30	15.80	
Mass Can & Soil (Wet) (g):	567.30	560.90	478.40	
Mass Can & Soil (Dry) (g):	481.60	462.50	387.50	
Mass of Soil (g):	465.40	446.20	371.70	
Mass of Water (g):	85.70	98.40	90.90	
Water Content *w* (%):	**18.4**	**22.1**	**24.5**	
Dry Density (γ_{dry}) (lb/ft^3):	**92.9**	**96.6**	**93.5**	



UNCORRECTED

$\gamma_{d,max}$ (lb/ft^3): 96.6

OMC (%): 22.1

Specialty Analytical

9011 SE Jannsen Rd
Clackamas, OR 97015
TEL: (503) 607-1331
Website: www.specialtyanalytical.com

June 16, 2023

Brian Willman
Terrageo
18740 SW Boones Ferry Road
Tualatin, OR 97062
TEL: (503) 729-9195
FAX:

RE: Goldeneye/ 00223 Order No.: 2306021

Dear Brian Willman:

There were no problems with the analysis and all data for associated QC met EPA or laboratory specifications, except where noted in the Case Narrative, or as qualified with flags. Results apply only to the samples analyzed. Without approval of the laboratory, the reproduction of this report is only permitted in its entirety.

If you have any questions regarding these tests, please feel free to call.

Sincerely,

Marty French
Lab Director

Specialty Analytical

WO#: **2306021**
Date Reported: **6/16/2023**

CLIENT: Terrageo
Project: Goldeneye/ 00223

Lab ID: 2306021-001 **Matrix:** SOIL
Client Sample ID B-1 S-1 **Collection Date:** 5/30/2023 9:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
CHLORIDE ION IN SOIL				**D512**	**SW9056PR**	Analyst: **NK**
Chloride	1.00	0.249		mg/Kg	1	6/13/2023 8:21:00 PM
SULFATE IN SOIL				**ASTM-C1580-09**	**SW9056PR**	Analyst: **NK**
Sulfate, Water Soluble	1.87	0.249		mg/Kg	1	6/13/2023 8:21:00 PM
ORP POTENTIAL OF SOIL				**G200**		Analyst: **AT**
Oxidation-Reduction Potential	130	0		mv	1	6/9/2023 11:52:22 AM
SOIL RESISTIVITY-WENNER				**G57**		Analyst: **NK**
Soil Resistivity	160000	1.00		ohm-cm	1	6/9/2023 1:40:00 PM
PH OF SOIL				**D4972**		Analyst: **AT**
pH	5.76	0		pH Units	1	6/6/2023 11:28:41 AM

Lab ID: 2306021-002 **Matrix:** SOIL
Client Sample ID B-5 S-1 **Collection Date:** 5/30/2023 2:19:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
CHLORIDE ION IN SOIL				**D512**	**SW9056PR**	Analyst: **NK**
Chloride	ND	0.497	Q	mg/Kg	2	6/13/2023 8:43:00 PM
SULFATE IN SOIL				**ASTM-C1580-09**	**SW9056PR**	Analyst: **NK**
Sulfate, Water Soluble	0.680	0.497	Q	mg/Kg	2	6/13/2023 8:43:00 PM
ORP POTENTIAL OF SOIL				**G200**		Analyst: **AT**
Oxidation-Reduction Potential	220	0		mv	1	6/6/2023 2:14:42 PM
SOIL RESISTIVITY-WENNER				**G57**		Analyst: **NK**
Soil Resistivity	29500	1.00		ohm-cm	1	6/9/2023 1:40:00 PM
PH OF SOIL				**D4972**		Analyst: **AT**
pH	5.96	0		pH Units	1	6/6/2023 11:34:41 AM

Specialty Analytical

WO#: **2306021**
Date Reported: **6/16/2023**

CLIENT: Terrageo
Project: Goldeneye/ 00223

Lab ID: 2306021-003 **Matrix:** SOIL
Client Sample ID B-6 S-1 **Collection Date:** 5/31/2023 9:22:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
CHLORIDE ION IN SOIL				**D512**	**SW9056PR**	Analyst: **NK**
Chloride	0.307	0.250		mg/Kg	1	6/13/2023 9:29:00 PM
SULFATE IN SOIL				**ASTM-C1580-09**	**SW9056PR**	Analyst: **NK**
Sulfate, Water Soluble	1.36	0.250		mg/Kg	1	6/13/2023 9:29:00 PM
ORP POTENTIAL OF SOIL				**G200**		Analyst: **AT**
Oxidation-Reduction Potential	280	0		mv	1	6/6/2023 2:19:42 PM
SOIL RESISTIVITY-WENNER				**G57**		Analyst: **NK**
Soil Resistivity	93000	1.00		ohm-cm	1	6/9/2023 1:40:00 PM
PH OF SOIL				**D4972**		Analyst: **AT**
pH	5.88	0		pH Units	1	6/6/2023 11:37:41 AM

QC SUMMARY REPORT

Specialty Analytical

WO#: **2306021**

6/16/2023

Client: Terrageo

Project: Goldeneye/ 00223 **TestCode:** **CL_ASTM_S**

Sample ID: **CCV 20 PPM**	SampType: **CCV**	TestCode: **CL_ASTM_S**	Units: **mg/Kg**	Prep Date:	RunNo: **49700**
Client ID: **CCV**	Batch ID: **21519**	TestNo: **D512**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639841**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	19.2	0.250	20.00	0	96.2	90	110				

Sample ID: **CCV 20 PPM**	SampType: **CCV**	TestCode: **CL_ASTM_S**	Units: **mg/Kg**	Prep Date:	RunNo: **49700**
Client ID: **CCV**	Batch ID: **21519**	TestNo: **D512**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639845**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	20.6	0.250	20.00	0	103	90	110				

Sample ID: **2306021-002ADUP**	SampType: **DUP**	TestCode: **CL_ASTM_S**	Units: **mg/Kg**	Prep Date:	RunNo: **49700**
Client ID: **B-5 S-1**	Batch ID: **21519**	TestNo: **D512**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639849**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	ND	1.49						0	0	20	Q

Sample ID: **CCV 20 PPM**	SampType: **CCV**	TestCode: **CL_ASTM_S**	Units: **mg/Kg**	Prep Date:	RunNo: **49700**
Client ID: **CCV**	Batch ID: **21519**	TestNo: **D512**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639853**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	20.7	0.250	20.00	0	104	90	110				

Qualifiers: H Holding times for preparation or analysis exceeded

QC SUMMARY REPORT

Specialty Analytical

WO#: **2306021**

6/16/2023

Client: Terrageo

Project: Goldeneye/ 00223 **TestCode:** **CL_ASTM_S**

Sample ID: **CCV 20 PPM**	SampType: **CCV**	TestCode: **CL_ASTM_S**	Units: **mg/Kg**	Prep Date:	RunNo: **49700**
Client ID: **CCV**	Batch ID: **21519**	TestNo: **D512**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639853**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sample ID: **MBLK**	SampType: **MBLK**	TestCode: **CL_ASTM_S**	Units: **mg/Kg**	Prep Date:	RunNo: **49700**
Client ID: **PBS**	Batch ID: **21519**	TestNo: **D512**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639856**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	ND	0.250									

Sample ID: **LCS**	SampType: **LCS**	TestCode: **CL_ASTM_S**	Units: **mg/Kg**	Prep Date:	RunNo: **49700**
Client ID: **LCSS**	Batch ID: **21519**	TestNo: **D512**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639857**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	10.4	0.250	10.00	0	104	80	120				

Qualifiers: H Holding times for preparation or analysis exceeded

QC SUMMARY REPORT

Specialty Analytical

WO#: **2306021**

6/16/2023

Client: Terrageo

Project: Goldeneye/ 00223 **TestCode:** **PH_ASTM**

Sample ID: **2306021-001ADUP** SampType: **DUP** TestCode: **PH_ASTM** Units: **pH Units** Prep Date: RunNo: **49609**

Client ID: **B-1 S-1** Batch ID: **R49609** TestNo: **D4972** Analysis Date: **6/6/2023** SeqNo: **638574**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
pH	5.85	0						5.760	1.55	20	

Qualifiers: H Holding times for preparation or analysis exceeded

QC SUMMARY REPORT

Specialty Analytical

WO#: **2306021**

6/16/2023

Client: Terrageo

Project: Goldeneye/ 00223 **TestCode:** **REDOX_ASTM**

Sample ID: **2306021-003ADUP** SampType: **DUP** TestCode: **REDOX_AST** Units: **mv** Prep Date: RunNo: **49614**

Client ID: **B-6 S-1** Batch ID: **R49614** TestNo: **G200** Analysis Date: **6/6/2023** SeqNo: **638638**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Oxidation-Reduction Potential	290	0		0	0	0	0	283.0	3.81	20	

Sample ID: **2306021-001ADUP** SampType: **DUP** TestCode: **REDOX_AST** Units: **mv** Prep Date: RunNo: **49649**

Client ID: **B-1 S-1** Batch ID: **R49649** TestNo: **G200** Analysis Date: **6/9/2023** SeqNo: **639080**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Oxidation-Reduction Potential	140	0		0	0	0	0	129.0	11.7	20	

Qualifiers: H Holding times for preparation or analysis exceeded

QC SUMMARY REPORT

Specialty Analytical

WO#: **2306021**

6/16/2023

Client: Terrageo

Project: Goldeneye/ 00223 **TestCode:** **SO4_ASTM_S**

Sample ID: **CCV 20 PPM**	SampType: **CCV**	TestCode: **SO4_ASTM_**	Units: **mg/Kg**	Prep Date:	RunNo: **49701**
Client ID: **CCV**	Batch ID: **21519**	TestNo: **ASTM-C1580-**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639863**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate, Water Soluble	18.0	0.250	20.00	0	90.1	90	110				

Sample ID: **CCV 20 PPM**	SampType: **CCV**	TestCode: **SO4_ASTM_**	Units: **mg/Kg**	Prep Date:	RunNo: **49701**
Client ID: **CCV**	Batch ID: **21519**	TestNo: **ASTM-C1580-**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639867**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate, Water Soluble	20.8	0.250	20.00	0	104	90	110				

Sample ID: **CCB**	SampType: **CCB**	TestCode: **SO4_ASTM_**	Units: **mg/Kg**	Prep Date:	RunNo: **49701**
Client ID: **CCB**	Batch ID: **21519**	TestNo: **ASTM-C1580-**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639868**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate, Water Soluble	ND	0.250									

Sample ID: **2306021-002ADUP**	SampType: **DUP**	TestCode: **SO4_ASTM_**	Units: **mg/Kg**	Prep Date:	RunNo: **49701**
Client ID: **B-5 S-1**	Batch ID: **21519**	TestNo: **ASTM-C1580-**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639872**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate, Water Soluble	ND	1.49						0	0	20	Q

Qualifiers: H Holding times for preparation or analysis exceeded

QC SUMMARY REPORT

Specialty Analytical

WO#: **2306021**

6/16/2023

Client: Terrageo

Project: Goldeneye/ 00223 **TestCode:** **SO4_ASTM_S**

Sample ID: **2306021-002ADUP**	SampType: **DUP**	TestCode: **SO4_ASTM_**	Units: **mg/Kg**	Prep Date:	RunNo: **49701**
Client ID: **B-5 S-1**	Batch ID: **21519**	TestNo: **ASTM-C1580-**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639872**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sample ID: **CCB**	SampType: **CCB**	TestCode: **SO4_ASTM_**	Units: **mg/Kg**	Prep Date:	RunNo: **49701**
Client ID: **CCB**	Batch ID: **21519**	TestNo: **ASTM-C1580-**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639874**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate, Water Soluble	ND	0.250									

Sample ID: **CCV 20 PPM**	SampType: **CCV**	TestCode: **SO4_ASTM_**	Units: **mg/Kg**	Prep Date:	RunNo: **49701**
Client ID: **CCV**	Batch ID: **21519**	TestNo: **ASTM-C1580-**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639877**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate, Water Soluble	20.9	0.250	20.00	0	105	90	110				

Sample ID: **CCB/MB**	SampType: **CCB**	TestCode: **SO4_ASTM_**	Units: **mg/Kg**	Prep Date:	RunNo: **49701**
Client ID: **CCB**	Batch ID: **21519**	TestNo: **ASTM-C1580-**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639878**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate, Water Soluble	ND	0.250									

Qualifiers: H Holding times for preparation or analysis exceeded

QC SUMMARY REPORT

Specialty Analytical

WO#: **2306021**

6/16/2023

Client: Terrageo

Project: Goldeneye/ 00223 **TestCode:** **SO4_ASTM_S**

Sample ID: **MBLK**	SampType: **MBLK**	TestCode: **SO4_ASTM_**	Units: **mg/Kg**	Prep Date:	RunNo: **49701**
Client ID: **PBS**	Batch ID: **21519**	TestNo: **ASTM-C1580-**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639883**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate, Water Soluble	ND	0.250									

Sample ID: **LCS**	SampType: **LCS**	TestCode: **SO4_ASTM_**	Units: **mg/Kg**	Prep Date:	RunNo: **49701**
Client ID: **LCSS**	Batch ID: **21519**	TestNo: **ASTM-C1580-**	**SW9056PR**	Analysis Date: **6/13/2023**	SeqNo: **639884**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate, Water Soluble	10.0	0.250	10.00	0	100	90	110				

Qualifiers: H Holding times for preparation or analysis exceeded

Specialty Analytical
9011 SE Jannsen Rd
Clackamas, Oregon 97015
TEL: 503-607-1331 FAX: 503-607-1336
Website: www.specialtyanalytical.com

Sample Receipt Checklist

Client Name TERRA_GEO Work Order Number 2306021

RcptNo: 1 Date and Time Receive 6/5/2023 1:15:13 PM Received by: Mandy Wehe

Completed by Reviewed by:

Completed Date: 6/5/2023 Reviewed Date:

Carrier name: Client

Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	Not Present ☐
Are matrices correctly identified on Chain of custody?	Yes ☑	No ☐	
Is it clear what analyses were requested?	Yes ☑	No ☐	
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Samples in proper container/bottle?	Yes ☑	No ☐	
Were correct preservatives used and noted?	Yes ☑	No ☐	NA ☐
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
Were container lables complete (ID, Pres, Date)?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Was an attempt made to cool the samples?	Yes ☐	No ☐	NA ☑
All samples received at a temp. of > 0° C to 6.0° C?	Yes ☐	No ☐	NA ☑
Response when temperature is outside of range:			
Preservative added to bottles:			
Sample Temp. taken and recorded upon receipt?	Yes ☑	No ☐	To 10.9 ºC
Water - Were bubbles absent in VOC vials?	Yes ☐	No ☐	No Vials ☑
Water - Was there Chlorine Present?	Yes ☐	No ☐	NA ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	NA ☑
Are Samples considered acceptable?	Yes ☑	No ☐	
Custody Seals present?	Yes ☐	No ☑	
Traffic Report or Packing Lists present?	Yes ☐	No ☑	
Airbill or Sticker?	Air Bill ☐	Sticker ☐	Not Present ☑
Airbill No:			
Sample Tags Present?	Yes ☐	No ☑	
Sample Tags Listed on COC?	Yes ☐	No ☑	
Tag Numbers:			
Sample Condition?	Intact ☑	Broken ☐	Leaking ☐

Case Number: SDG: SAS:

Cooler Information

Equipment Information

Adjusted? _____ Checked by _____

Any No and/or NA (not applicable) response must be detailed in the comments section be

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Sample Receipt Checklist

Client Name TERRA_GEO Work Order Number 2306021

Client Contacted? ☐ Yes ☑ No ☐ NA Person Contacted: Comments:

Contact Mode: ☐ Phone: ☐ Fax: ☐ Email: ☐ In Person:

Client Instructions:

Date Contacted: Contacted By:

Regarding:

CorrectiveAction:

Sample Details

SampID	ClientSampID	ContainerID	Type	Org pH	Temp.	RcptNo	Cooler No	Comments
2306021-001A	B-1 S-1	Container-01 of 01	Bottle					
2306021-002A	B-5 S-1	Container-01 of 01	Bottle					
2306021-003A	B-6 S-1	Container-01 of 01	Bottle					

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9011 SE Jannsen Rd
Clackamas, OR 97015
Phone: 503-607-1331
Fax: 503-607-1336

Chain of Custody Record

Date: | Page: 1 of: 1 | Laboratory Project No (internal): 2306021

Project Name: Goldeneye | Temperature on Receipt: 10.9 °C

Client: Terra-Geo, Inc. | Project No: 00223 PO No: | Cooling: ice | Shipped Via: client

Address: 18740 SW Boones Ferry Road | Collected by: B. Willman | Custody Seal: Y (N) Intact / Broken Cooler / Bottle

City, State, Zip: Tualatin, Oregon 97062 | State Collected: OR ☐ WA ☑ OTHER | MDL ☐ TIER IV ☐ EDD ☐

Telephone: 503-729-9195 | Report To (PM): B. Willman | Sample Disposal: ☐ Return to client ☑ Disposal by lab (after 60 days)

AP Email: brian.willman@terra-geo.com | PM Email: brian.willman@terra-geo.com

Sample Name	Sample Date	Sample Time	Sample Matrix*	# of Containers	Requested Tests: pH	Redox	Chloride	Sulfate	Resistivity							Comments
1 B-1 S-1	5/30/23	0930	S	1	✔	✔	✔	✔	✔							
2 B-5 S-1	5/30/23	1419	S	1	✔	✔	✔	✔	✔							
3 B-6 S-1	5/31/23	0922	S	1	✔	✔	✔	✔	✔							
4																
5																
6																
7																
8																
9																
10																

*Matrix: A = Air, AQ = Aqueous, L=Liquid, O = Oil, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water, M = Miscellaneous

Turn-around Time: Standard (5-7 Business): ✔ 3 Day: ☐ 2 Day: ☐ Next Day: ☐ Same Day: ☐

Expedited turn-around requests should be coordinated in advance

Relinquished	Date/Time	Received	Date/Time
x [signature]	6/5/2023 12:55	x [signature]	6/5/23 12:55
x		x	
x		x	

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Clackamas, Oregon 97015
TEL: 503-607-1331 FAX: 503-607-1336
Website: www.specialtyanalytical.com

Definition Only

WO#: **2306021**
Date: **6/16/2023**

Definitions:

KEY TO FLAGS

A: This sample contains a Gasoline Range Organic not identified as a specific hydrocarbon product. The result was qualified against gasoline calibration standards.

A1: This sample contains a Diesel Range Organic not identified as a specific hydrocarbon product. The result was qualified against diesel calibration standards.

A2: This sample contains a Lube Oil Range Organic not identified as a specific hydrocarbon product. The result was qualified against lube oil calibration standards.

A3: The results was determined to be Non-Detect based on hydrocarbon pattern recognition. The product was carry-over from another hydrocarbon type.

A4: The product appears to be aged or degraded.

B: The blank exhibited a positive result greater than the reporting limit for this compound.

CN: See Case Narrative.

E: Result exceeds the calibration range for this compound. The result should be considered an estimate.

F: The positive result for this hydrocarbon is due to single component contamination. The product does not match any hydrocarbon in the fuels library.

FS: Follow-up testing is suggested.

G: Result may be biased high due to biogenic interferences. Clean up is recommended.

H: Sample was analyzed outside recommended holding time.

HT: At client's request, samples was analyzed outside of recommended holding time.

HP: Sample was analyzed outside recommended holding time due to VOA having pH >2.

J: The results for this analyte is between the MDL and the PQL and should be considered an

Definitions:

estimated concentration.

K: Diesel result is biased high due to amount of Oil contained in the sample.

L: Diesel result is biased high due to amount of Gasoline contained in the sample.

M: Oil result is biased high due to amount of Diesel contained in the sample.

N: Gasoline result is biased high due to amount of Diesel contained in the sample.

MC: Sample concentration is greater than 4x the spiked value, the spiked value is considered insignificant.

MI: Result is outside control limits due to matrix interference.

NH: Sample matrix is non-homogeneous

MSA: Value determined by Method of Standard Addition.

O: Laboratory Control Standard (LCS) exceeded laboratory control limits but meets CCV criteria. Data meets EPA requirements.

Q: Detection levels elevated due to sample matrix.

R: RPD control limits were exceeded

RF: Duplicate failed due to result being at or near the method-reporting limit.

RP: Matrix spike values exceed established QC limits; post digestion spike is in control.

S: Recovery is outside control limits.

SC: CCV or LCS exceeded high recovery control limits, but associated samples are non-detect. Data meets EPA requirements.

SL: LCS exceeded recovery control limits, but associated MS/MSD passing. Data meets EPA requirements.

Definitions:

SV: CCV exceded low recovery control limits. ND as reported evaluated using EPA method 8260D section 11.4.3.2

TA: Sample treated with ascorbic acid for the removal of thiocyanates.

BASALT RIDGE TESTING LABORATORY LLC

June 12, 2023
Terra-Geo, Inc.
18740 Boones Ferry Rd.
Tualatin, OR 97062
ATTN: Brian Willman

IEEE 442 Thermal Analysis Testing Results
Project: Goldeneye 00223
June 2023 testing

Thermal dryout curves were generated on three soil samples received in shelby tube sections from Terra-Geo June 6, 2023. Thermal resistivity (rho) measurements were conducted at as-received, wet, and oven dry water contents in accordance with IEEE 442. Thermal grease was used to prevent the effects of thermal contact resistance between the sensors and the samples for the dry measurements. All measurements were performed at room temperature. The thermal dryout curves were interpolated between the oven dry and moistened water content points using the combination method described in the METER Group Application Note titled "Producing Thermal Dryout Curves for Buried Cable Applications." Measured and interpolated data are shown in the following tables and graphs.

Sample Information
Project: Goldeneye 00223
- B-1 S-1
- B-5 S-1
- B-6 S-1

Sample condition	Oven Dry	Native	Wet
Water content (g/g)	0.00	0.37	0.57
Water content (% mass)	0%	37%	57%
VWC (m3/m3)	0.00	0.39	0.60
VWC (%)	0%	39%	60%
Dry bulk density (g/cm3)	1.05	1.05	1.05
Dry unit wt. (pcf)	65.4	65.4	65.4
Measured IEEE conductivity (W/m K)	0.180	0.793	1.000
Measured IEEE Rho	554.4	126.1	100.0
Standard deviation IEEE Rho (C cm/W)	33.4	6.6	3.8

Table 1. Measured physical and thermal characteristics for the B-1 S-1 (3.5-5.0) feet depth sample

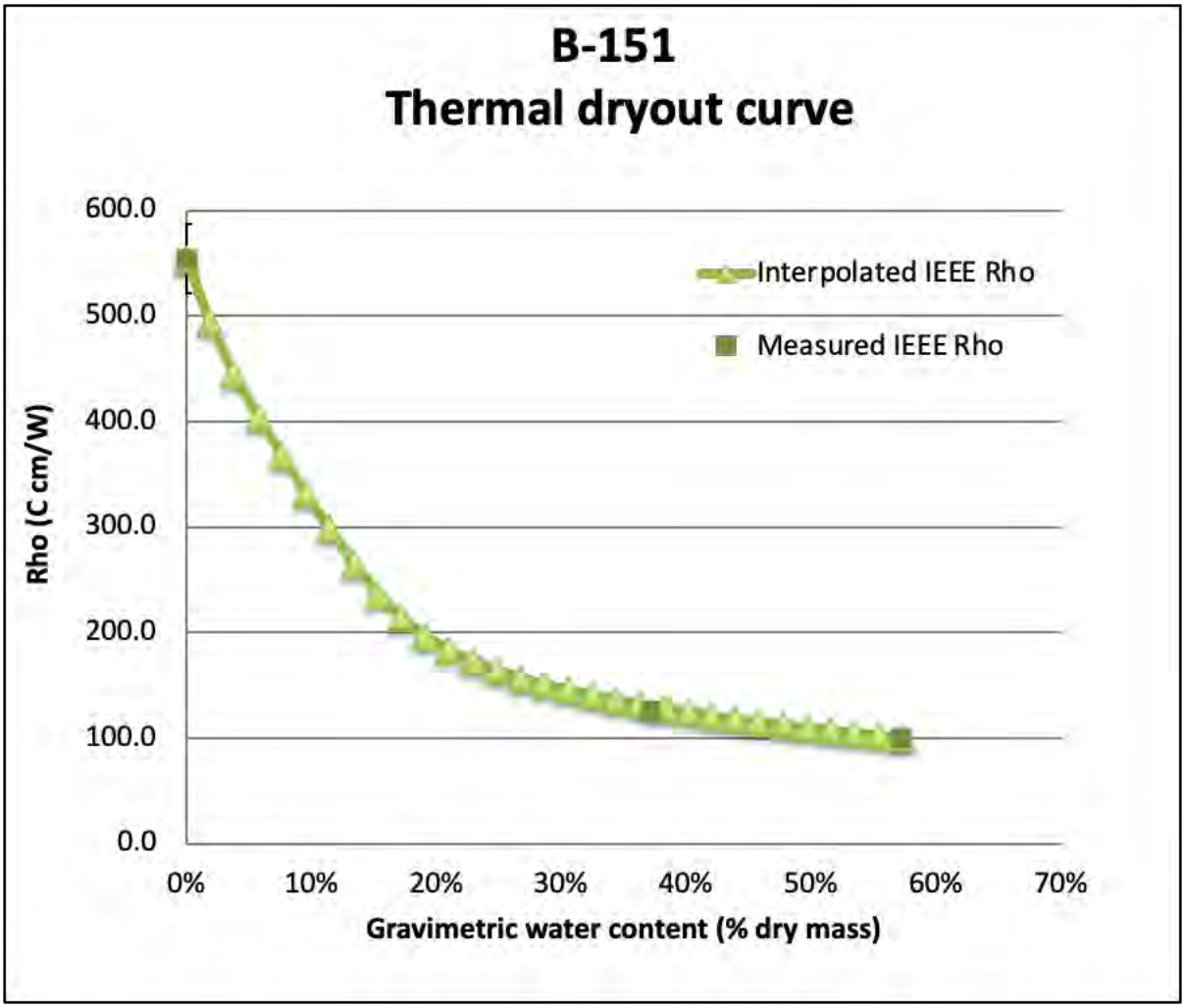


Figure 1. Thermal dryout curve for the B-1 S-1 sample with measured and interpolated thermal resistivity data. Error bars indicate ± one standard deviation in the three measurements made at each water content level.

Sample condition	Oven Dry	Native	Wet
Water content (g/g)	0.00	0.41	0.43
Water content (% mass)	0%	41%	43%
VWC (m3/m3)	0.00	0.53	0.55
VWC (%)	0%	53%	55%
Dry bulk density (g/cm3)	1.27	1.27	1.27
Dry unit wt. (pcf)	79.6	79.6	79.6
Measured IEEE conductivity (W/m K)	0.266	1.221	1.231
Measured IEEE Rho	375.9	81.9	81.2
Standard deviation IEEE Rho (C cm/W)	17.3	1.4	2.0

Table 2. Measured physical and thermal characteristics for the B-5 S-1 (3.5-5.0) feet depth sample

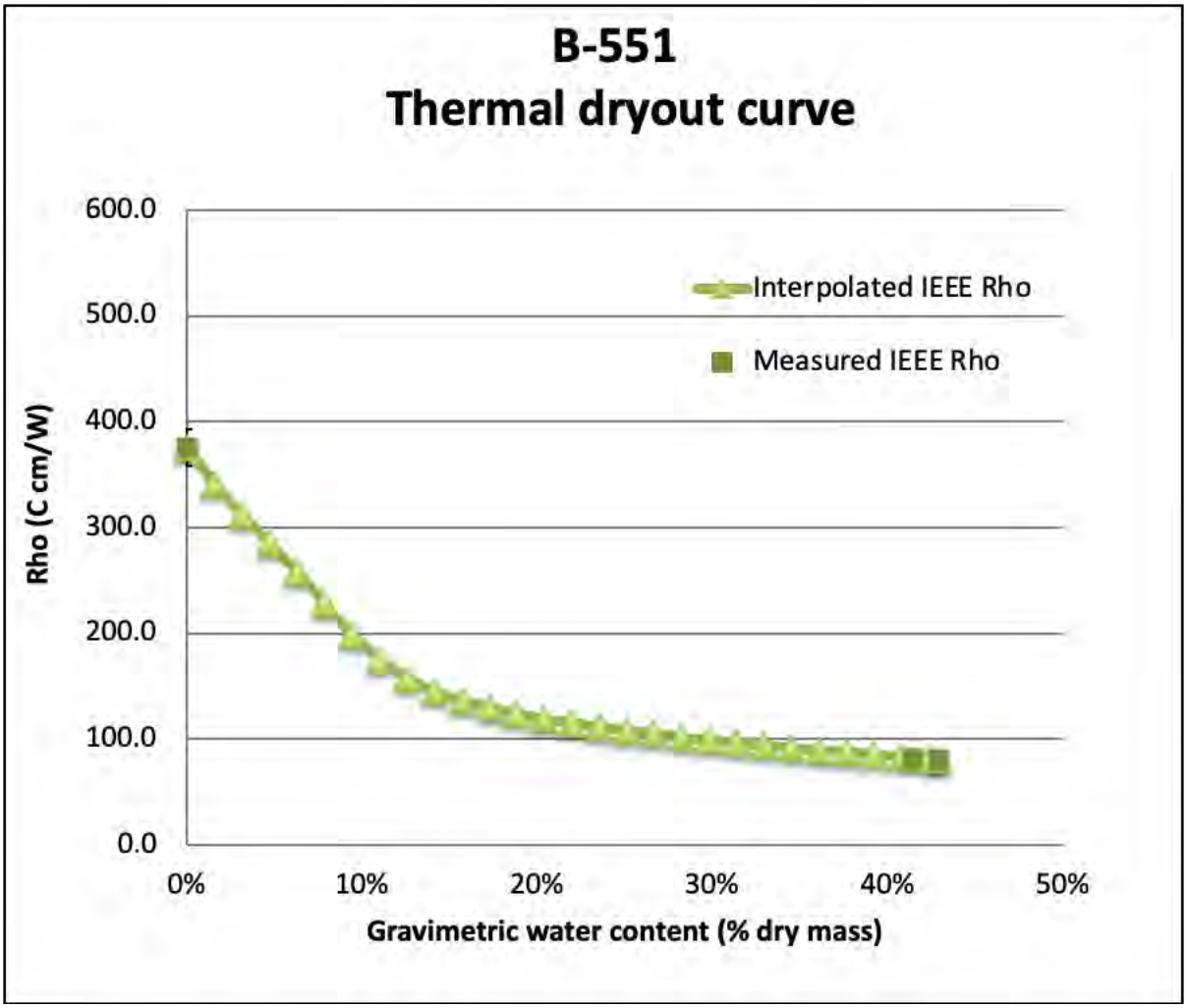


Figure 2. Thermal dryout curve for the B-5 S-1 sample with measured and interpolated thermal resistivity data. Error bars indicate ± one standard deviation in the three measurements made at each water content level.

Sample condition	Oven Dry	Native	Wet
Water content (g/g)	0.00	0.49	0.50
Water content (% mass)	0%	49%	50%
VWC (m3/m3)	0.00	0.56	0.57
VWC (%)	0%	56%	57%
Dry bulk density (g/cm3)	1.15	1.15	1.15
Dry unit wt. (pcf)	72.0	72.0	72.0
Measured IEEE conductivity (W/m K)	0.170	1.014	1.040
Measured IEEE Rho	588.0	98.6	96.2
Standard deviation IEEE Rho (C cm/W)	23.1	1.2	2.5

Table 3. Measured physical and thermal characteristics for the B-6 S-1 (3.5-5.0) feet depth sample

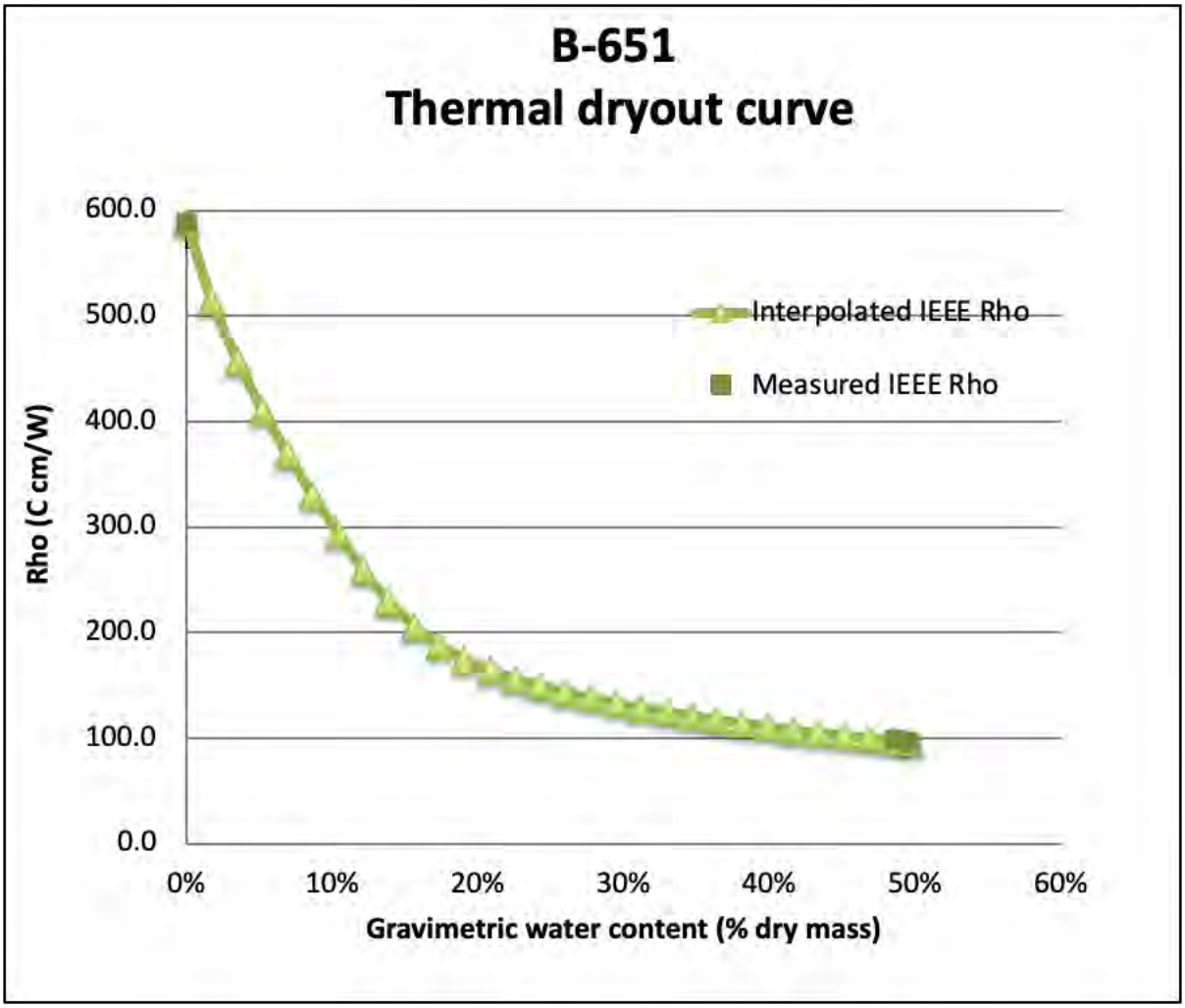


Figure 3. Thermal dryout curve for the B-6 S-1 sample with measured and interpolated thermal resistivity data. Error bars indicate ± one standard deviation in the three measurements made at each water content level.

BASALT RIDGE TESTING LABORATORY LLC

Please don't hesitate to contact me with questions or comments.

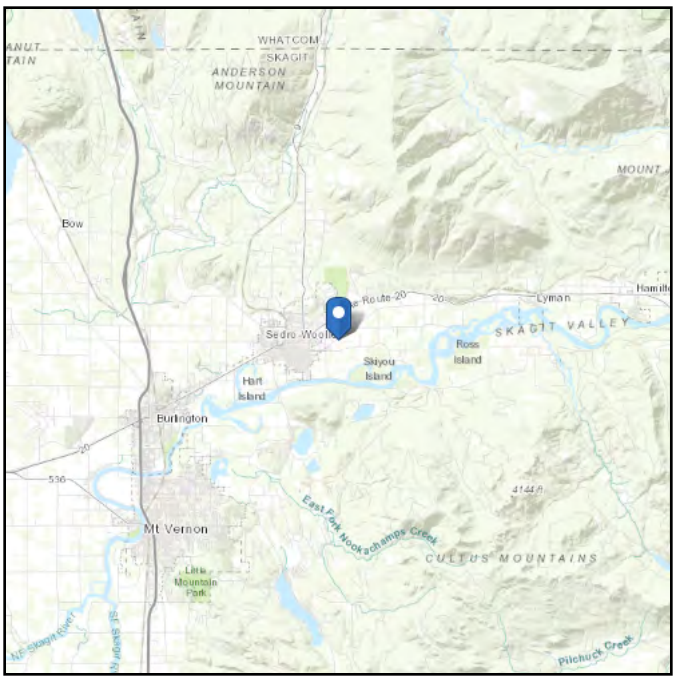
Douglas R. Cobos, Ph.D.
President, Basalt Ridge Testing Laboratory
(509) 338-5894
dcobos@basaltridgetesting.com

Appendix D – Seismicity and Liquefaction Calculations

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-16	**Latitude:**	48.508117
Risk Category:	I	**Longitude:**	-122.200983
Soil Class:	E - Soft Clay Soil	**Elevation:**	58.74120219467903 ft (NAVD 88)



Seismic

Site Soil Class: E - Soft Clay Soil

Results:

S_S :	0.983	S_{D1} :	N/A
S_1 :	0.35	T_L :	16
F_a :	1.3	PGA :	0.421
F_v :	N/A	PGA_M :	0.572
S_{MS} :	1.277	F_{PGA} :	1.358
S_{M1} :	N/A	I_e :	1
S_{DS} :	0.852	C_v :	1.291

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Sun Jun 18 2023

Date Source: USGS Seismic Design Maps

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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Liquefaction Hazard Evaluation Report
by WSLiq Program beta (May, 2009)

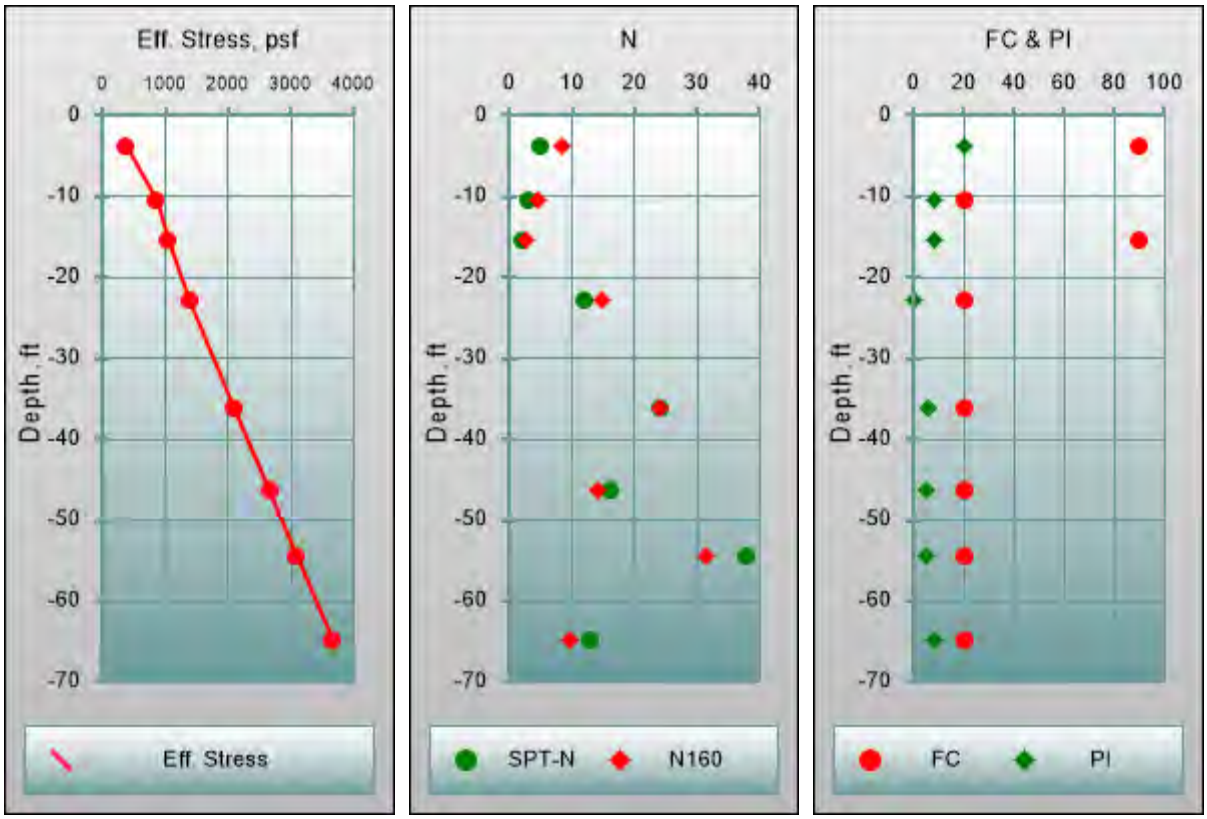
Site Name: Sedro Woolley BESS (Boring-1)
Site Location (N,W) = 48.508 , 122.202
Job No: 00223
Analyst: Willman
Date: 6/19/2023 3:24:31 AM

=== Soil Profile ===
Unit: ft
The number of soil layers: 8
GWT at top of layer: 2
GWT depth: 7.50
SPT Energy Ratio (%): 60.00
Amplification Factors: a= -0.1500 b= -0.1300
Elevation: 55.00
Ground Surface: Level

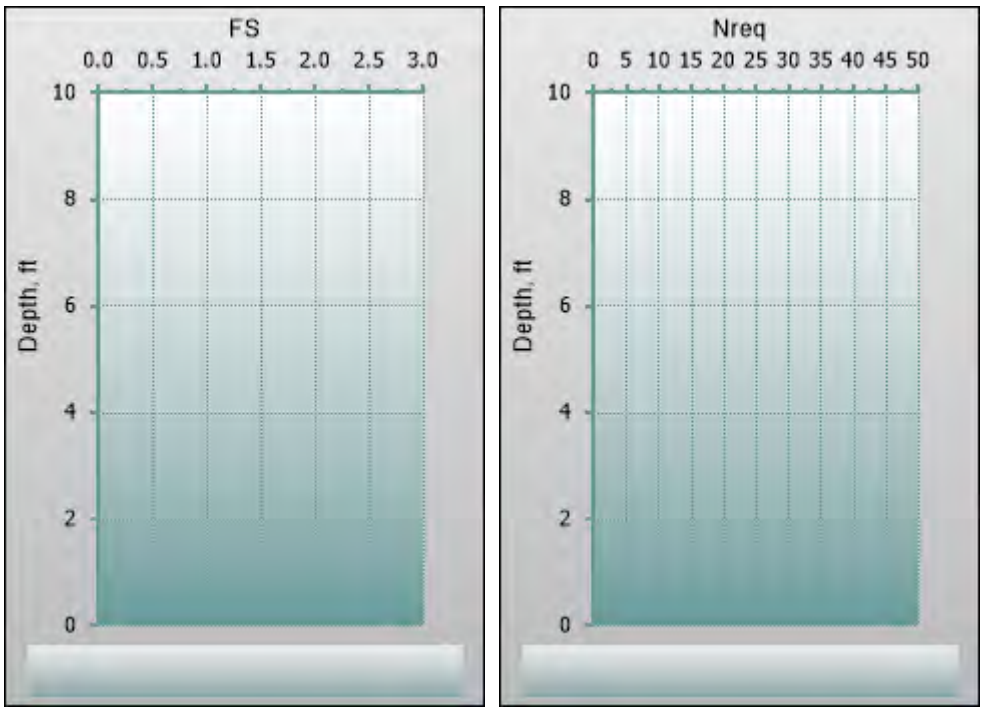
Layer	Descpt.	Thickness (ft)	Unit Weight (lb/ft3)	Nm	N160	Vs ft/sec
1	SILT_WITH_GRAVEL	7.5	100.00	5	8.5	526.3
2	SILTY_SAND_WITH_GRAVEL	6	100.00	3	4.7	453.8
3	SILT	4	100.00	2	2.8	403.5
4	SILTY_SAND_WITH_GRAVEL	11	110.00	12	14.8	678.4
5	SILTY_GRAVEL_WITH_SAND	15.5	120.00	24	24.1	829.4
6	SILTY_SAND_WITH_GRAVEL	5	110.00	16	14.3	737.4
7	SILTY_GRAVEL	11	120.00	38	31.4	947.7
8	SILTY_SAND_WITH_GRAVEL	10	115.00	13	9.9	694.3

Layer	FC (%)	PI	wc/LL	D50 (mm)	Ini. Eff. Stress (psf)	Ini. Total Stress (psf)
1	90	Unsat	Unsat	0.000	375.0	375.00
2	20	8	1	0.000	862.8	1050.00
3	90	8	1	0.000	1050.8	1550.00
4	20	0	1	0.000	1387.8	2355.00
5	20	6	1	0.000	2096.0	3890.00
6	20	5	1	0.000	2661.4	5095.00
7	20	5	1	0.000	3097.2	6030.00
8	20	8	1	0.000	3677.0	7265.00

Soil Profile Plots




```
=== Susceptibility Evaluation ===
-----------------------------------------------------------
Threshold: 0.5
Weighting factors: B-I= 0.50  B-S= 0.50
-----------------------------------------------------------
Layer     PI  wc/LL   B-I   B-S  Suscep. Index  Potential
    1  20.00   0.50  0.00  0.00          0.00         NO
    2   8.00   1.00  0.14  0.73          0.44         NO
    3   8.00   1.00  0.14  0.73          0.44         NO
    4   0.00   1.00  1.00  0.76          0.88        YES
    5   6.00   1.00  0.40  0.75          0.58        YES
    6   5.00   1.00  0.62  0.75          0.69        YES
    7   5.00   1.00  0.62  0.75          0.69        YES
    8   8.00   1.00  0.14  0.73          0.44         NO


=== Initiation ===
-----------------------------------------------------
```




```
=== Effects ===
-----------------------------------------------------


** Settlement **
----------------
>>>Multiple Scenario Results
Groud Surface Settlement MULTIPLE Scenario
Return Period (yrs) = 2475
Model Selected :
   Use all deterministic models.
-----------------------------------------


Tokimatsu & Seed
=================
Total ground surface settlement = 0.18 ft
-----------------------------------------------
  #    Depth thickness    ev    Weight    dh
          ft        ft     %              ft
-----------------------------------------------
  2    10.50       6.0   0.001    0.00    0.00
  3    15.50       4.0   0.001    0.00    0.00
  4    23.00      11.0   1.147    0.99    0.13
  5    36.25      15.5   0.098    0.24    0.00
  6    46.50       5.0   1.043    0.99    0.05
  7    54.50      11.0   0.001    0.00    0.00
  8    65.00      10.0   0.001    0.00    0.00
-----------------------------------------------

Ishihara & Yoshimine
=================
Total ground surface settlement = 0.35 ft
-----------------------------------------------
```

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	10.50	6.0	0.001	0.00	0.00
3	15.50	4.0	0.001	0.00	0.00
4	23.00	11.0	2.242	0.96	0.24
5	36.25	15.5	0.175	0.32	0.01
6	46.50	5.0	2.199	0.93	0.10
7	54.50	11.0	0.001	0.00	0.00
8	65.00	10.0	0.001	0.00	0.00

Shamoto et al.

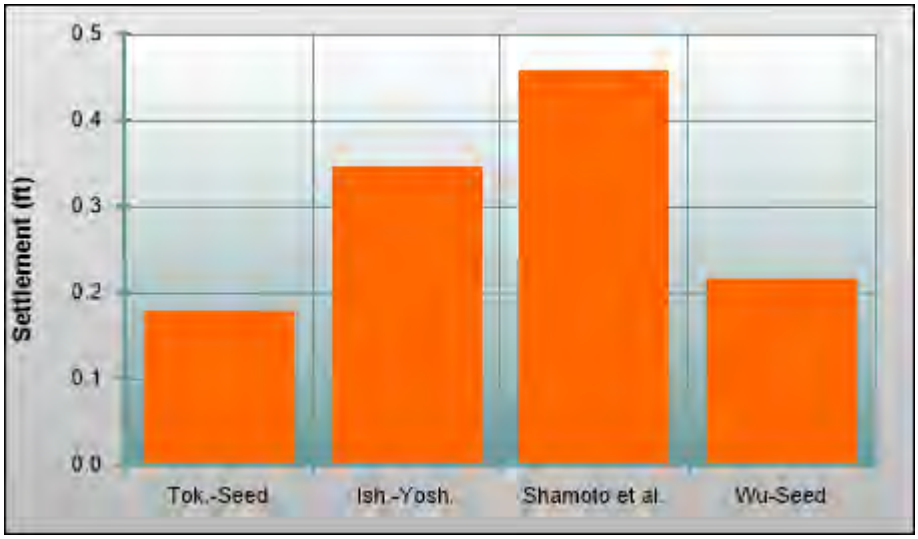
Total ground surface settlement = 0.46 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	10.50	6.0	0.000	0.00	0.00
3	15.50	4.0	0.000	0.00	0.00
4	23.00	11.0	3.372	0.86	0.32
5	36.25	15.5	1.037	0.05	0.01
6	46.50	5.0	3.188	0.83	0.13
7	54.50	11.0	0.514	0.00	0.00
8	65.00	10.0	0.000	0.00	0.00

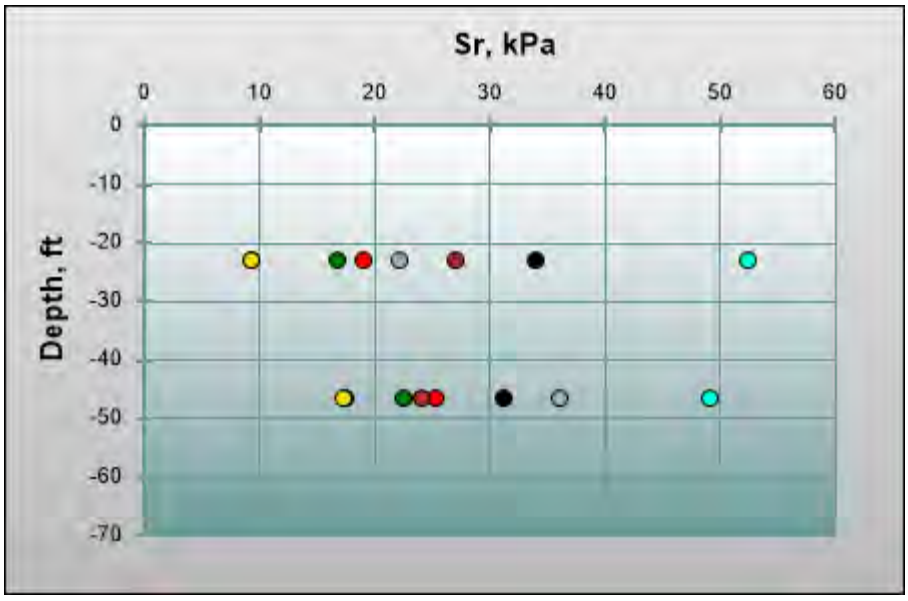
Wu & Seed

Total ground surface settlement = 0.22 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	10.50	6.0	0.000	0.00	0.00
3	15.50	4.0	0.000	0.00	0.00
4	23.00	11.0	1.603	0.86	0.15
5	36.25	15.5	0.474	0.08	0.01
6	46.50	5.0	1.506	0.81	0.06
7	54.50	11.0	0.015	0.00	0.00
8	65.00	10.0	0.000	0.00	0.00



```
=== Effects ===
--------------------------------------------------


** Residual Strength **
-----------------------
====== Soil Layers Selected ==================
Select All Soil Layers (under GWT and susceptible).

====== Models Selected ========================
Use All Residual Strength Models.


-----------------------------------------------------------

###### Unweighted Residual Strength ####################

Idriss Model:
   Layer 4:  Sr =   712 psf =  34.1 kPa = 0.336 atm
   Layer 6:  Sr =   652 psf =  31.2 kPa = 0.308 atm
-----------------------------------------------------
Kramer & Wang Median Model:
   Layer 4:  Sr =   398 psf =  19.0 kPa = 0.188 atm
   Layer 6:  Sr =   530 psf =  25.4 kPa = 0.250 atm
-----------------------------------------------------
Kramer & Wang Deterministic Model:
   Layer 4:  Sr =   352 psf =  16.8 kPa = 0.166 atm
   Layer 6:  Sr =   471 psf =  22.6 kPa = 0.223 atm
-----------------------------------------------------
Olson & Stark Model:
   Layer 4:  Sr =   196 psf =   9.4 kPa = 0.093 atm
   Layer 6:  Sr =   365 psf =  17.5 kPa = 0.172 atm
-----------------------------------------------------
Seed & Harder Upper Bound Model:
   Layer 4:  Sr =  1096 psf =  52.5 kPa = 0.518 atm
   Layer 6:  Sr =  1025 psf =  49.1 kPa = 0.484 atm
-----------------------------------------------------
Seed & Harder Lower Bound Model:
   Layer 4:  Sr =   565 psf =  27.1 kPa = 0.267 atm
   Layer 6:  Sr =   502 psf =  24.0 kPa = 0.237 atm
-----------------------------------------------------
Idriss & Boulanger Model:
   Layer 4:  Sr =   462 psf =  22.1 kPa = 0.219 atm
   Layer 6:  Sr =   755 psf =  36.2 kPa = 0.357 atm
-----------------------------------------------------
Idriss & Boulanger VR Model:
   Layer 4:  Sr =   195 psf =   9.3 kPa = 0.092 atm
   Layer 6:  Sr =   361 psf =  17.3 kPa = 0.171 atm
-----------------------------------------------------
```


Sr, kPa
0
10
20
30
40
50
60
Depth, ft
0
-10
-20
-30
-40
-50
-60
-70

Liquefaction Hazard Evaluation Report
by WSLiq Program beta (May, 2009)

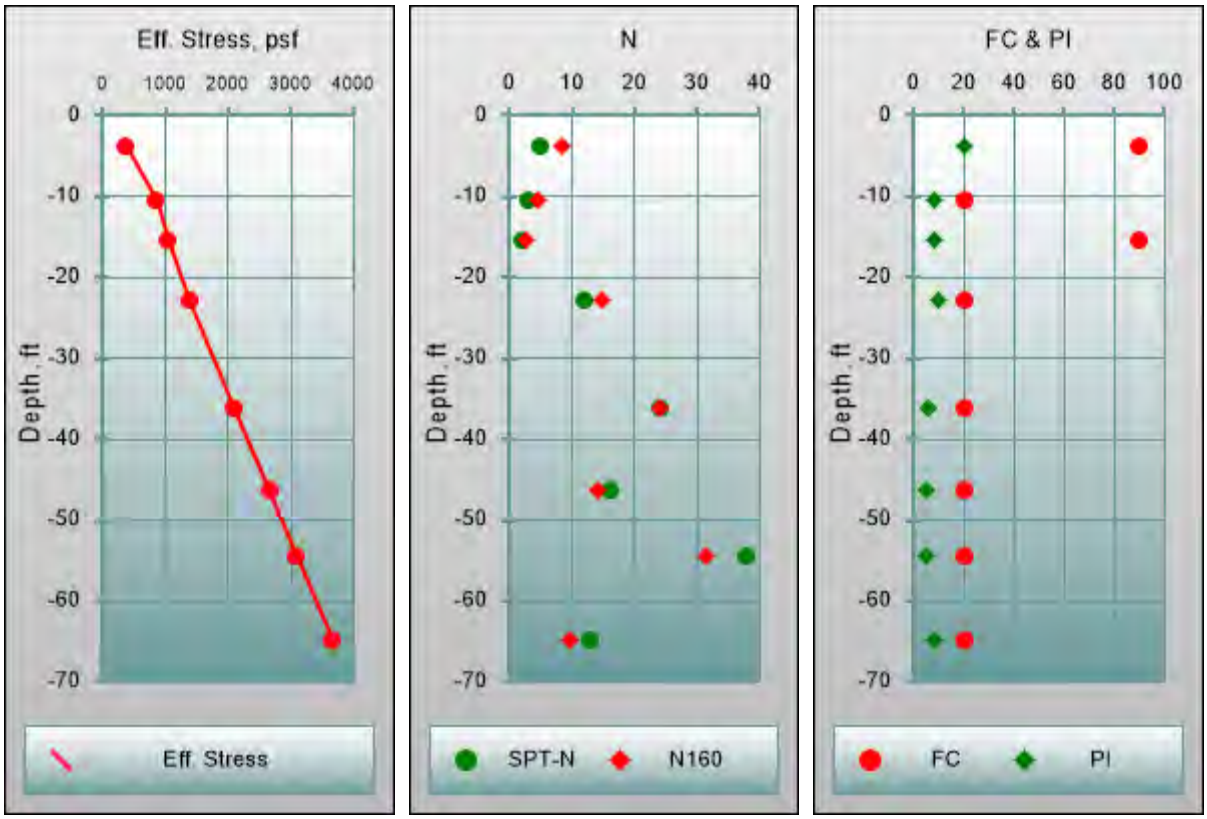
Site Name: Sedro Woolley BESS (Boring-2)
Site Location (N,W) = 48.508 , 122.202
Job No: 00223
Analyst: Willman
Date: 6/18/2023 6:39:51 AM

=== Soil Profile ===
Unit: ft
The number of soil layers: 3
GWT at top of layer: 2
GWT depth: 5.00
SPT Energy Ratio (%): 60.00
Amplification Factors: a= -0.1500 b= -0.1300
Elevation: 55.00
Ground Surface: Level

Layer	Descpt.	Thickness (ft)	Unit Weight (lb/ft3)	Nm	N160	Vs ft/sec
1	SILT_WITH_SAND	5	100.00	6	10.2	554.9
2	SILT_WITH_SAND	9	100.00	4	6.8	493.3
3	SILTY_SAND_WITH_GRAVEL	16	110.00	16	21.1	737.4

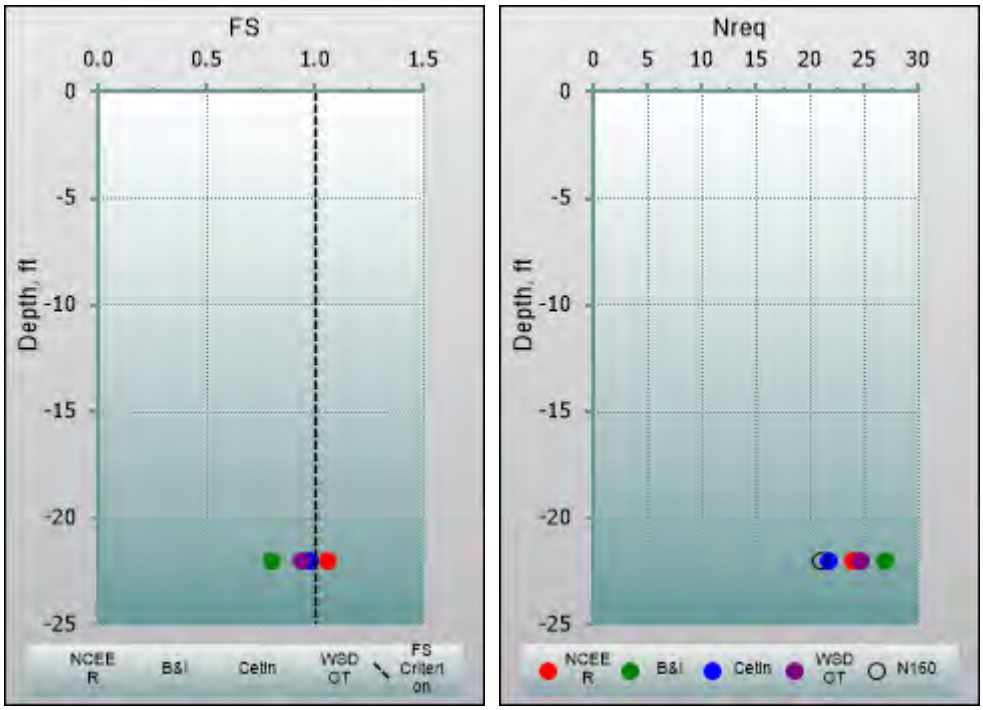
Layer	FC (%)	PI	wc/LL	D50 (mm)	Ini. Eff. Stress (psf)	Ini. Total Stress (psf)
1	80	Unsat	Unsat	0.000	250.0	250.00
2	80	8	0.9	0.000	669.2	950.00
3	20	5	0.9	0.000	1219.2	2280.00

Soil Profile Plots




```
=== Susceptibility Evaluation ===
------------------------------------------------------------
Threshold: 0.5
Weighting factors: B-I= 0.50  B-S= 0.50
------------------------------------------------------------
Layer     PI  wc/LL   B-I   B-S  Suscep. Index  Potential
    1  20.00   0.50  0.00  0.00          0.00         NO
    2   8.00   0.90  0.14  0.61          0.38         NO
    3   5.00   0.90  0.62  0.63          0.62        YES


=== Initiation ===
------------------------------------------------------

Initiation - Multiple Scenario
----------------------------------------
Retrun Period (yrs) = 2475
Models Selected :
Use All Deterministic Models.
--WSDOT Recommended--
   Use NCEER, Boulanger & Idriss, and
   Cetin's model with weighting factors
   of 0.4, 0.4, and 0.2 respectively.
----------------------------------------


===== Mean Mw and FS ==============
---NCEER Model------------
--- PGA = 0.418  Mw = 6.46---------

Layer  (N1)60    CSR     CRR     FS     Nreq
```

```
-----  ------  ------  ------  ------  ------
    3   21.08   0.303   0.322    1.06    24.0


===== Mean Mw and FS ==============
---Boulanger and Idriss Model------------
--- PGA = 0.418  Mw = 6.46---------

Layer  (N1)60    CSR     CRR     FS     Nreq
-----  ------  ------  ------  ------  ------
    3   20.36   0.358   0.287    0.80    26.9


===== Mean Mw and FS ==============
---Cetin et al. Model------------
--- PGA = 0.418  Mw = 6.46---------

Layer  (N1)60    CSR     CRR     FS     Nreq
-----  ------  ------  ------  ------  ------
    3   21.08   0.444   0.435    0.98    21.8

---WSDOT Recommended------------
--- PGA = 0.418  Mw = 6.46---------

Layer  (N1)60    CSR     CRR     FS     Nreq
-----  ------  ------  ------  ------  ------
    3   21.08   0.353   0.330    0.94    24.7

  Table of FS
---------------------------------------
  #     Depth   NCEER     B&I     Cetin     WSDOT
           ft                  PL=0.60   PL=0.60
  3    -22.00    1.06    0.80      0.98      0.94
```



=== Effects ===

** Settlement **

>>>Multiple Scenario Results
Groud Surface Settlement MULTIPLE Scenario
Return Period (yrs) = 2475
Model Selected :
   Use all deterministic models.

Tokimatsu & Seed
==========
Total ground surface settlement = 0.07 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.50	9.0	0.001	0.00	0.00
3	22.00	16.0	0.554	0.79	0.07

Ishihara & Yoshimine
==========
Total ground surface settlement = 0.11 ft

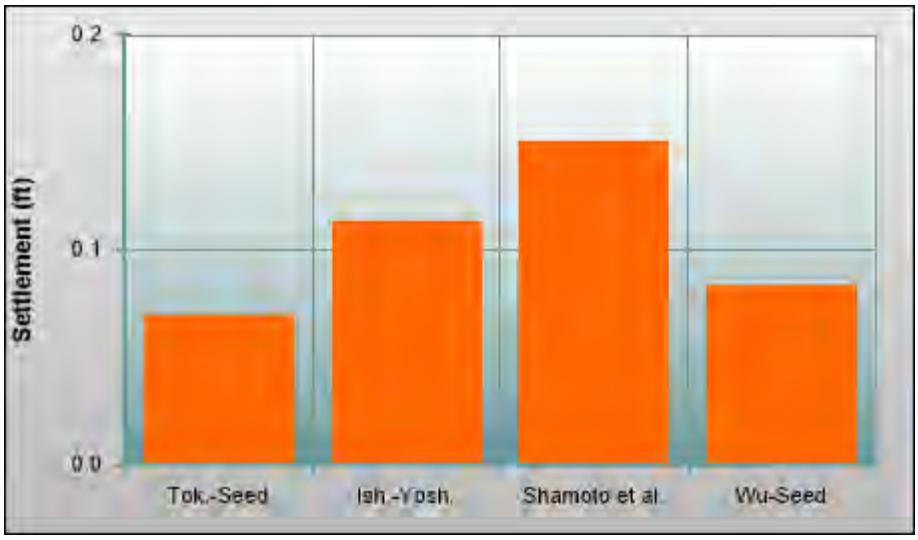
#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.50	9.0	0.001	0.00	0.00
3	22.00	16.0	0.930	0.77	0.11

Shamoto et al.
==========
Total ground surface settlement = 0.15 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.50	9.0	0.000	0.00	0.00
3	22.00	16.0	1.760	0.54	0.15

Wu & Seed
==========
Total ground surface settlement = 0.08 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.50	9.0	0.000	0.00	0.00
3	22.00	16.0	0.931	0.56	0.08


Settlement (ft)
0.2
0.1
0.0
Tok.-Seed
Ish.-Yosh.
Shamoto et al.
Wu-Seed

Liquefaction Hazard Evaluation Report
by WSLiq Program beta (May, 2009)

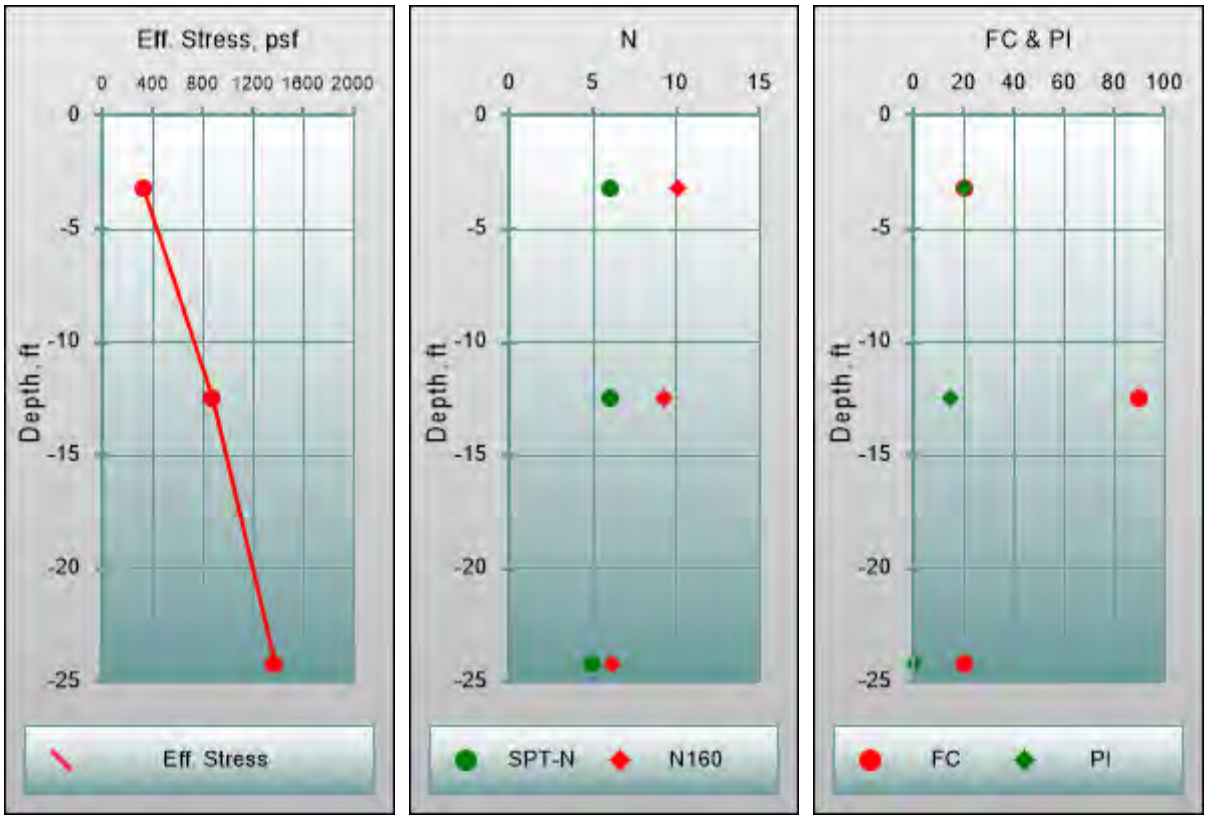
Site Name: Sedro Woolley BESS (Boring-3)
Site Location (N,W) = 48.508 , 122.202
Job No: 00223
Analyst: Willman
Date: 6/19/2023 3:53:05 AM

=== Soil Profile ===
Unit: ft
The number of soil layers: 4
GWT at top of layer: 2
GWT depth: 6.50
SPT Energy Ratio (%): 60.00
Amplification Factors: a= -0.1500 b= -0.1300
Elevation: 55.00
Ground Surface: Level

Layer	Descpt.	Thickness (ft)	Unit Weight (lb/ft3)	Nm	N160	Vs ft/sec
1	SILT_WITH_SAND	6.5	100.00	6	10.2	554.9
2	SILT_WITH_SAND	12	100.00	6	9.3	554.9
3	SILTY_SAND	4	110.00	14	18.6	709.4
4	SILTY_SAND_WITH_GRAVEL	7.5	115.00	5	6.0	526.3

Layer	FC (%)	PI	wc/LL	D50 (mm)	Ini. Eff. Stress (psf)	Ini. Total Stress (psf)
1	20	Unsat	Unsat	0.000	325.0	325.00
2	90	15	.9	0.000	875.6	1250.00
3	20	0	1	0.000	1196.4	2070.00
4	20	5	1	1488.9	1488.9	2721.25

Soil Profile Plots




```
=== Susceptibility Evaluation ===
---------------------------------------------------------
Threshold: 0.5
Weighting factors: B-I= 0.50  B-S= 0.50
---------------------------------------------------------
Layer     PI  wc/LL   B-I   B-S  Suscep. Index  Potential
    1  20.00   0.50  0.00  0.00          0.00         NO
    2  15.00   0.90  0.01  0.31          0.16         NO
    3   0.00   1.00  1.00  0.76          0.88        YES
    4   5.00   1.00  0.62  0.75          0.69        YES


=== Initiation ===
-----------------------------------------------------

Initiation - Multiple Scenario
----------------------------------------
Retrun Period (yrs) = 2475
Models Selected :
Use All Deterministic Models.
--WSDOT Recommended--
   Use NCEER, Boulanger & Idriss, and
   Cetin's model with weighting factors
   of 0.4, 0.4, and 0.2 respectively.
----------------------------------------


===== Mean Mw and FS ==============
---NCEER Model------------
--- PGA = 0.418  Mw = 6.46---------
```

Layer	(N1)60	CSR	CRR	FS	Nreq
3	18.62	0.283	0.268	0.95	23.1
4	5.96	0.287	0.114	0.40	23.3

===== Mean Mw and FS ==============
---Boulanger and Idriss Model------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
3	18.17	0.334	0.244	0.73	26.1
4	6.16	0.340	0.123	0.36	26.3

===== Mean Mw and FS ==============
---Cetin et al. Model------------
--- PGA = 0.418 Mw = 6.46---------

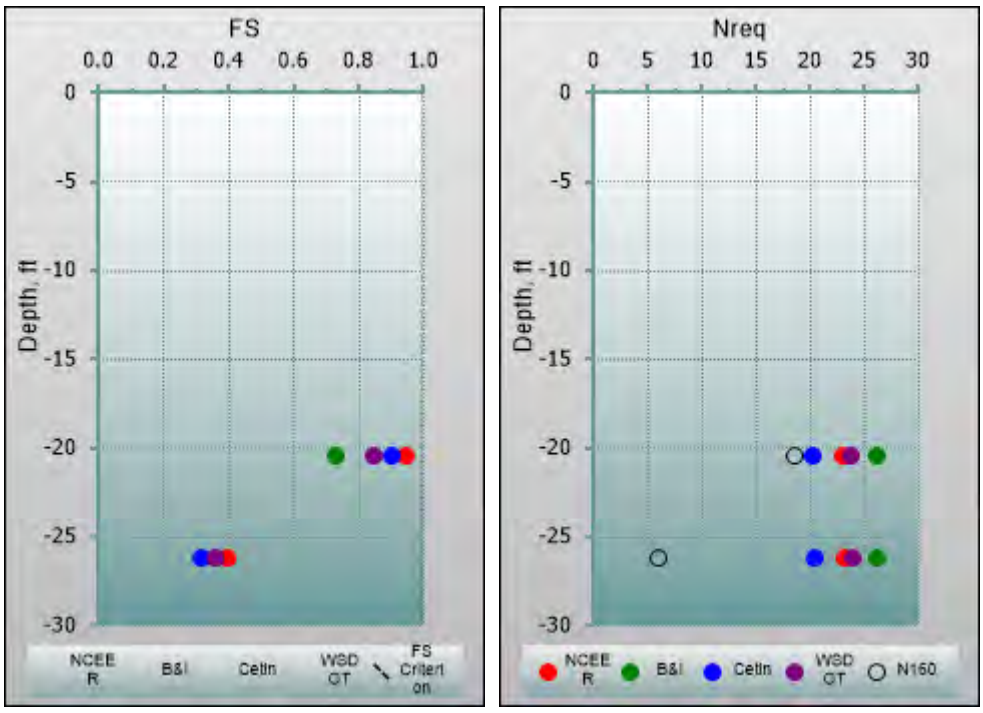
Layer	(N1)60	CSR	CRR	FS	Nreq
3	18.62	0.396	0.358	0.91	20.3
4	5.96	0.378	0.121	0.32	20.5

---WSDOT Recommended------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
3	18.62	0.326	0.276	0.85	23.7
4	5.96	0.326	0.119	0.36	23.9

Table of FS

#	Depth ft	NCEER	B&I	Cetin PL=0.60	WSDOT PL=0.60
3	-20.50	0.95	0.73	0.91	0.85
4	-26.25	0.40	0.36	0.32	0.36




```
=== Effects ===
-------------------------------------------------


** Settlement **
----------------
>>>Multiple Scenario Results
Groud Surface Settlement MULTIPLE Scenario
Return Period (yrs) = 2475
Model Selected :
   Use all deterministic models.
-----------------------------------------


Tokimatsu & Seed
=================
Total ground surface settlement = 0.22 ft
-----------------------------------------------
  #    Depth thickness    ev    Weight    dh
          ft        ft     %              ft
-----------------------------------------------
  2    12.50      12.0   0.001    0.00    0.00
  3    20.50       4.0   0.748    0.87    0.03
  4    26.25       7.5   2.555    1.00    0.19
-----------------------------------------------

Ishihara & Yoshimine
=================
Total ground surface settlement = 0.41 ft
-----------------------------------------------
  #    Depth thickness    ev    Weight    dh
          ft        ft     %              ft
-----------------------------------------------
  2    12.50      12.0   0.001    0.00    0.00
```

#	Depth ft	thickness ft	ev %	Weight	dh ft
3	20.50	4.0	1.376	0.84	0.05
4	26.25	7.5	4.823	1.00	0.36

Shamoto et al.

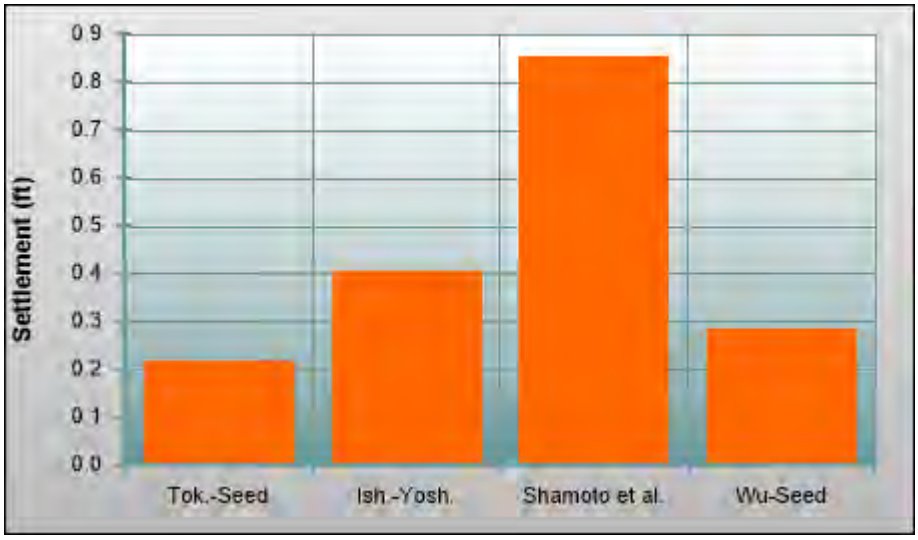
Total ground surface settlement = 0.85 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	12.50	12.0	0.000	0.00	0.00
3	20.50	4.0	2.209	0.65	0.06
4	26.25	7.5	10.627	1.00	0.80

Wu & Seed

Total ground surface settlement = 0.29 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	12.50	12.0	0.000	0.00	0.00
3	20.50	4.0	1.140	0.66	0.03
4	26.25	7.5	3.430	1.00	0.26



Liquefaction Hazard Evaluation Report
by WSLiq Program beta (May, 2009)

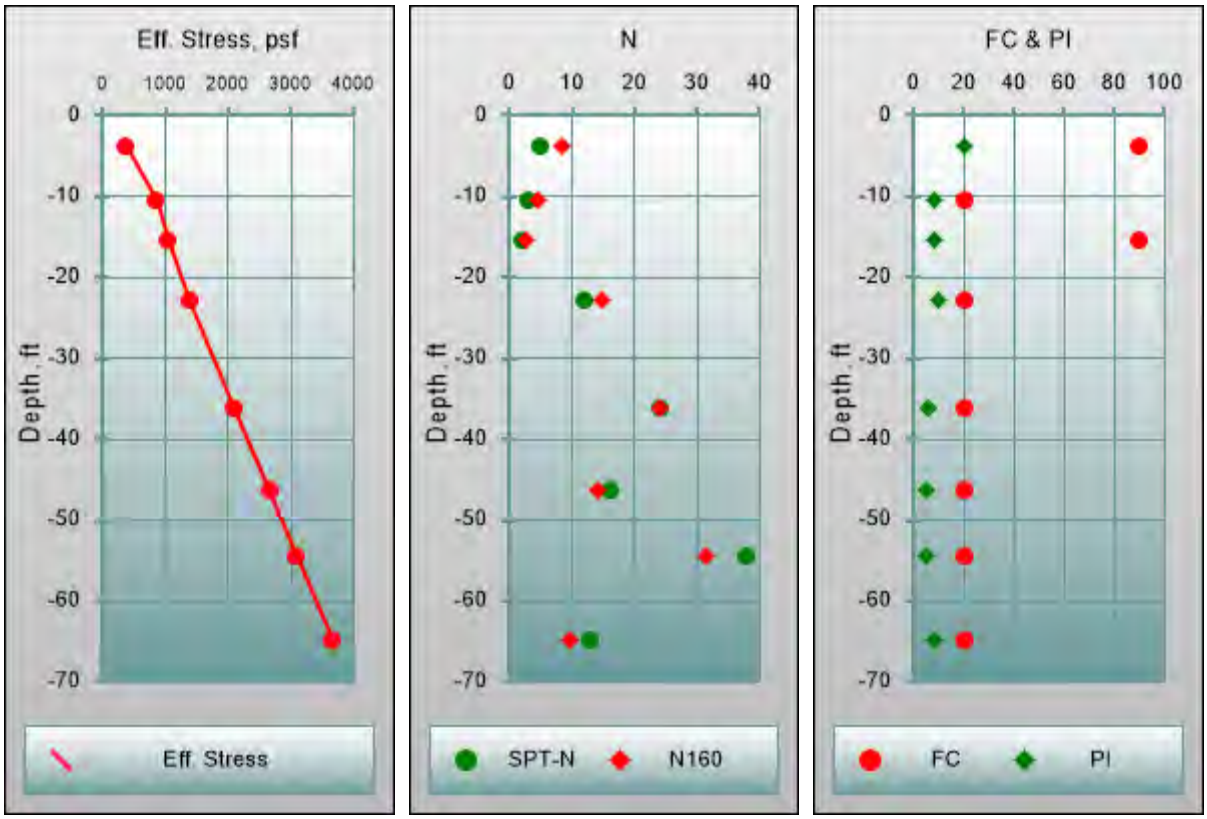
Site Name: Sedro Woolley BESS (Boring-4)
Site Location (N,W) = 48.508 , 122.202
Job No: 00223
Analyst: Willman
Date: 6/18/2023 6:50:05 AM

=== Soil Profile ===
Unit: ft
The number of soil layers: 6
GWT at top of layer: 2
GWT depth: 7.50
SPT Energy Ratio (%): 60.00
Amplification Factors: a= -0.1500 b= -0.1300
Elevation: 55.00
Ground Surface: Level

Layer	Descpt.	Thickness (ft)	Unit Weight (lb/ft3)	Nm	N160	Vs ft/sec
1	SILTY_SAND	7.5	110.00	10	17.0	643.4
2	SILT_WITH_SAND	5	100.00	5	7.6	526.3
3	SILTY_SAND_WITH_GRAVEL	7.5	110.00	12	16.0	678.4
4	SILTY_SAND_WITH_GRAVEL	7.5	110.00	48	56.1	1014.1
5	SILTY_GRAVEL	12.5	120.00	40	40.3	961.9
6	SILTY_GRAVEL	30	120.00	29	23.2	876.2

Layer	FC (%)	PI	wc/LL	D50 (mm)	Ini. Eff. Stress (psf)	Ini. Total Stress (psf)
1	20	Unsat	Unsat	0.000	412.5	412.50
2	80	11	1	0.000	919.0	1075.00
3	20	5	1	0.000	1191.5	1737.50
4	20	5	1	1548.5	1548.5	2562.50
5	25	11	1	2087.0	2087.0	3725.00
6	15	9	1	3311.0	3311.0	6275.00

Soil Profile Plots




```
=== Susceptibility Evaluation ===
-----------------------------------------------------------
Threshold: 0.5
Weighting factors: B-I= 0.50  B-S= 0.50
-----------------------------------------------------------
Layer     PI  wc/LL   B-I   B-S  Suscep. Index  Potential
    1  20.00   0.50  0.00  0.00          0.00         NO
    2  11.00   1.00  0.03  0.63          0.33         NO
    3   5.00   1.00  0.62  0.75          0.69        YES
    4   5.00   1.00  0.62  0.75          0.69        YES
    5  11.00   1.00  0.03  0.63          0.33         NO
    6   9.00   1.00  0.09  0.71          0.40         NO


=== Initiation ===
-----------------------------------------------------

Initiation - Multiple Scenario
----------------------------------------
Retrun Period (yrs) = 2475
Models Selected :
Use All Deterministic Models.
--WSDOT Recommended--
   Use NCEER, Boulanger & Idriss, and
   Cetin's model with weighting factors
   of 0.4, 0.4, and 0.2 respectively.
----------------------------------------


===== Mean Mw and FS ==============
---NCEER Model------------
```

--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
3	15.99	0.245	0.227	0.93	21.0
4	56.11	0.265	3.000	11.32	22.1

===== Mean Mw and FS ==============
---Boulanger and Idriss Model------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
3	15.80	0.289	0.209	0.73	24.4
4	46.00	0.313	3.000	9.59	25.3

===== Mean Mw and FS ==============
---Cetin et al. Model------------
--- PGA = 0.418 Mw = 6.46---------

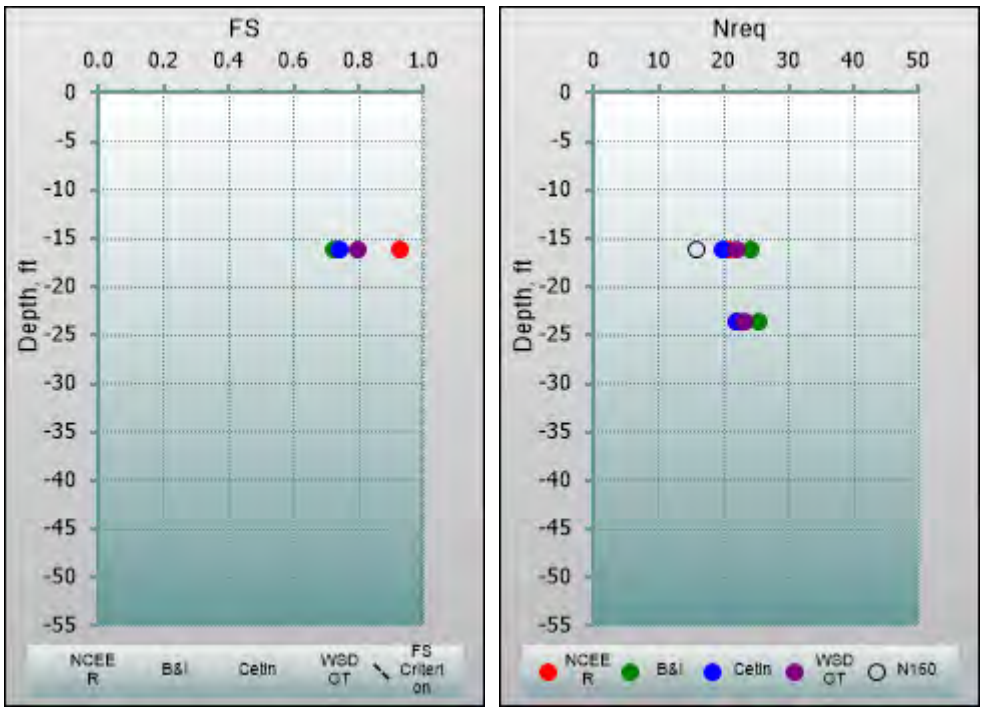
Layer	(N1)60	CSR	CRR	FS	Nreq
3	15.99	0.389	0.290	0.75	20.0
4	56.11	0.431	3.000	6.96	22.2

---WSDOT Recommended------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
3	15.99	0.291	0.232	0.80	22.1
4	56.11	0.317	3.000	9.46	23.4

Table of FS

#	Depth ft	NCEER	B&I	Cetin PL=0.60	WSDOT PL=0.60
3	-16.25	0.93	0.73	0.75	0.80
4	-23.75	11.32	9.59	6.96	9.46




```
=== Effects ===
-------------------------------------------------


** Settlement **
----------------
>>>Multiple Scenario Results
Groud Surface Settlement MULTIPLE Scenario
Return Period (yrs) = 2475
Model Selected :
   Use all deterministic models.
-----------------------------------------


Tokimatsu & Seed
=================
Total ground surface settlement = 0.06 ft
-----------------------------------------------
  #    Depth thickness    ev    Weight    dh
          ft        ft     %              ft
-----------------------------------------------
  2    10.00       5.0   0.001    0.00    0.00
  3    16.25       7.5   0.857    0.98    0.06
  4    23.75       7.5   0.001    0.00    0.00
  5    33.75      12.5   0.001    0.00    0.00
  6    55.00      30.0   0.001    0.00    0.00
-----------------------------------------------

Ishihara & Yoshimine
=================
Total ground surface settlement = 0.11 ft
-----------------------------------------------
  #    Depth thickness    ev    Weight    dh
          ft        ft     %              ft
```

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	10.00	5.0	0.001	0.00	0.00
3	16.25	7.5	1.643	0.91	0.11
4	23.75	7.5	0.001	0.00	0.00
5	33.75	12.5	0.001	0.00	0.00
6	55.00	30.0	0.001	0.00	0.00

Shamoto et al.

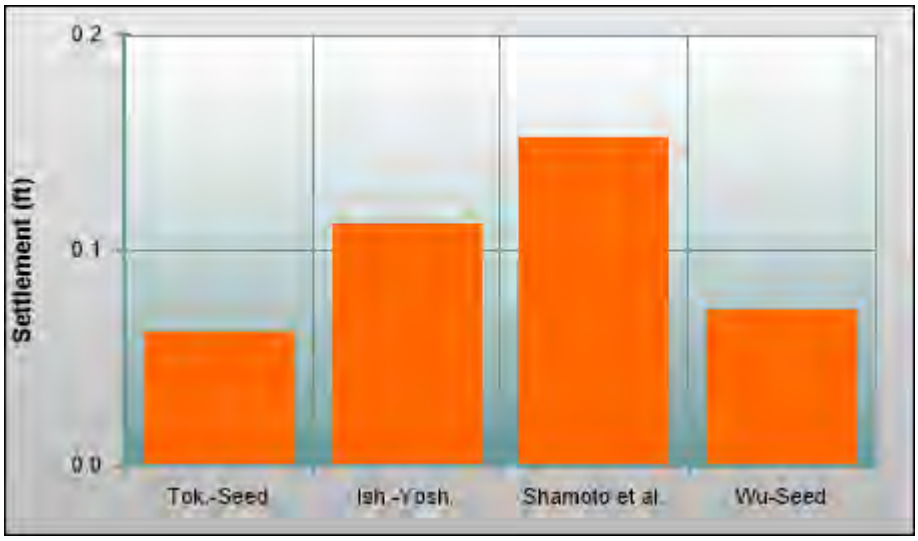
Total ground surface settlement = 0.15 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	10.00	5.0	0.000	0.00	0.00
3	16.25	7.5	2.645	0.77	0.15
4	23.75	7.5	0.000	0.00	0.00
5	33.75	12.5	0.000	0.00	0.00
6	55.00	30.0	0.000	0.00	0.00

Wu & Seed

Total ground surface settlement = 0.07 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	10.00	5.0	0.000	0.00	0.00
3	16.25	7.5	1.298	0.75	0.07
4	23.75	7.5	0.000	0.00	0.00
5	33.75	12.5	0.000	0.00	0.00
6	55.00	30.0	0.000	0.00	0.00



=== Effects ===

** Residual Strength **

====== Soil Layers Selected ==================
Select All Soil Layers (under GWT and susceptible).

====== Models Selected ========================
Use All Residual Strength Models.

Unweighted Residual Strength

Idriss Model:
   Layer 3: Sr =   859 psf = 41.1 kPa = 0.406 atm

Kramer & Wang Median Model:
   Layer 3: Sr =   418 psf = 20.0 kPa = 0.197 atm

Kramer & Wang Deterministic Model:
   Layer 3: Sr =   367 psf = 17.6 kPa = 0.173 atm

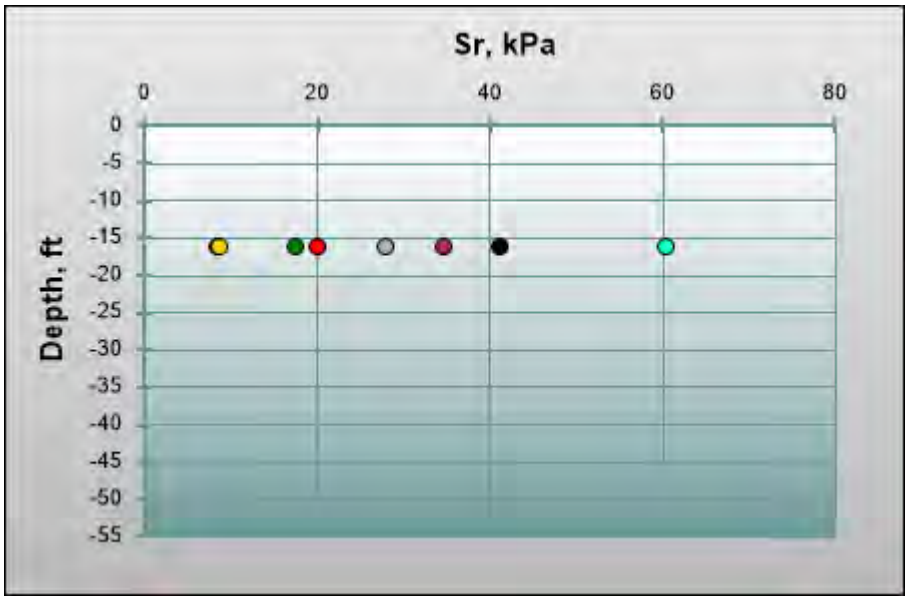
Olson & Stark Model:
   Layer 3: Sr =   179 psf =   8.6 kPa = 0.084 atm

Seed & Harder Upper Bound Model:
   Layer 3: Sr = 1263 psf = 60.5 kPa = 0.597 atm

Seed & Harder Lower Bound Model:
   Layer 3: Sr =   723 psf = 34.6 kPa = 0.341 atm

Idriss & Boulanger Model:
   Layer 3: Sr =   583 psf = 27.9 kPa = 0.276 atm

Idriss & Boulanger VR Model:
   Layer 3: Sr =   180 psf =   8.6 kPa = 0.085 atm



Liquefaction Hazard Evaluation Report
by WSLiq Program beta (May, 2009)

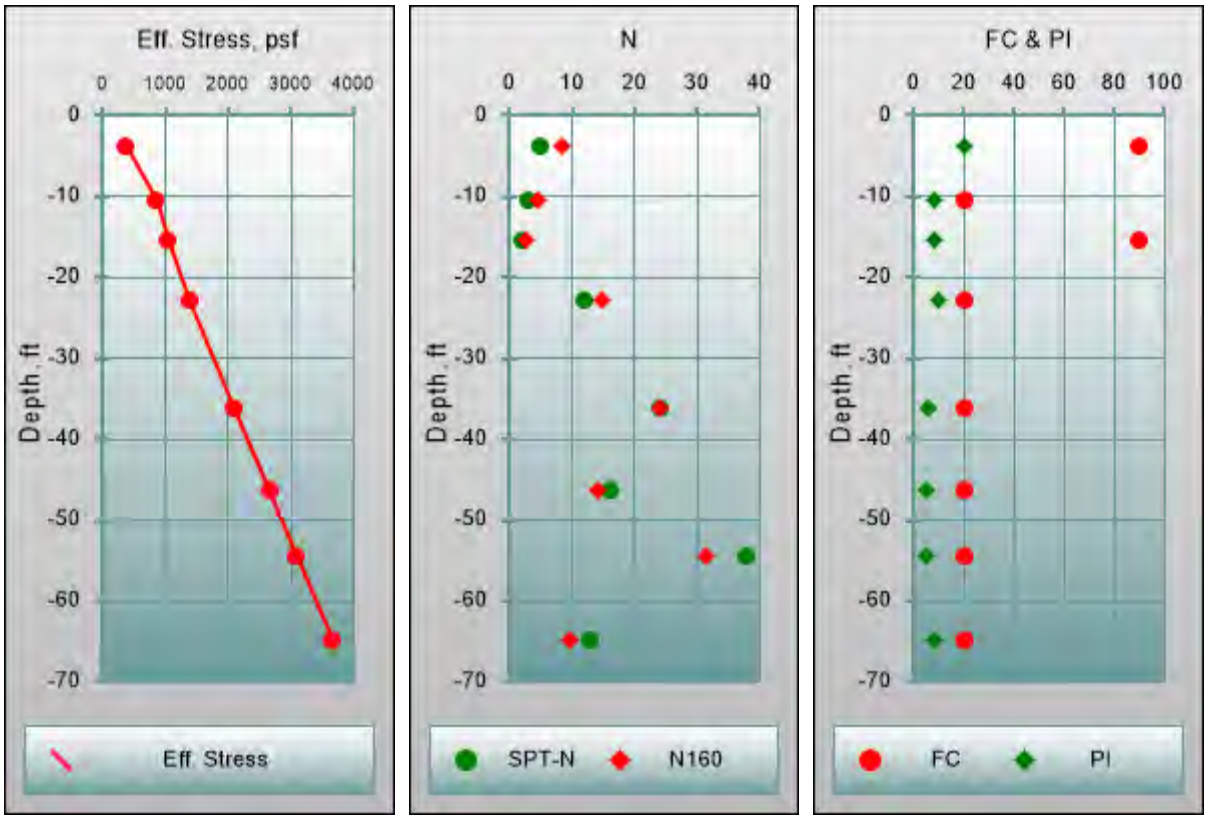
Site Name: Sedro Woolley BESS (Boring-5)
Site Location (N,W) = 48.508 , 122.202
Job No: 00223
Analyst: Willman
Date: 6/18/2023 6:54:15 AM

=== Soil Profile ===
Unit: ft
The number of soil layers: 5
GWT at top of layer: 2
GWT depth: 6.00
SPT Energy Ratio (%): 60.00
Amplification Factors: a= -0.1500 b= -0.1300
Elevation: 55.00
Ground Surface: Level

Layer	Descpt.	Thickness (ft)	Unit Weight (lb/ft3)	Nm	N160	Vs ft/sec
1	SILT_WITH_SAND	6	100.00	5	8.5	526.3
2	SILT_WITH_SAND	6.5	100.00	5	8.5	526.3
3	SILTY_SAND_WITH_GRAVEL	10.5	110.00	12	16.7	678.4
4	SILTY_SAND_WITH_GRAVEL	4	115.00	18	21.7	763.0
5	SILTY_GRAVEL	2.5	110.00	40	45.8	961.9

Layer	FC (%)	PI	wc/LL	D50 (mm)	Ini. Eff. Stress (psf)	Ini. Total Stress (psf)
1	80	Unsat	Unsat	0.000	300.0	300.00
2	80	10	1	0.000	722.2	925.00
3	15	8	1	0.000	1094.3	1827.50
4	15	6	1	1548.5	1449.4	2635.00
5	20	6	1	2087.0	1614.1	3002.50

Soil Profile Plots




```
=== Susceptibility Evaluation ===
-----------------------------------------------------------
Threshold: 0.5
Weighting factors: B-I= 0.50  B-S= 0.50
-----------------------------------------------------------
Layer     PI  wc/LL   B-I   B-S  Suscep. Index  Potential
    1  20.00   0.50  0.00  0.00          0.00         NO
    2  10.00   1.00  0.05  0.67          0.36         NO
    3   8.00   1.00  0.14  0.73          0.44         NO
    4   6.00   1.00  0.40  0.75          0.58        YES
    5   6.00   1.00  0.40  0.75          0.58        YES


=== Initiation ===
-----------------------------------------------------

Initiation - Multiple Scenario
----------------------------------------
Retrun Period (yrs) = 2475
Models Selected :
Use All Deterministic Models.
--WSDOT Recommended--
   Use NCEER, Boulanger & Idriss, and
   Cetin's model with weighting factors
   of 0.4, 0.4, and 0.2 respectively.
----------------------------------------


===== Mean Mw and FS ==============
---NCEER Model------------
--- PGA = 0.418  Mw = 6.46---------
```

Layer	(N1)60	CSR	CRR	FS	Nreq
4	21.75	0.288	0.298	1.03	23.3
5	45.80	0.287	3.000	10.44	23.3

===== Mean Mw and FS ==============
---Boulanger and Idriss Model------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
4	21.19	0.341	0.278	0.82	26.3
5	43.15	0.341	3.000	8.80	26.3

===== Mean Mw and FS ==============
---Cetin et al. Model------------
--- PGA = 0.418 Mw = 6.46---------

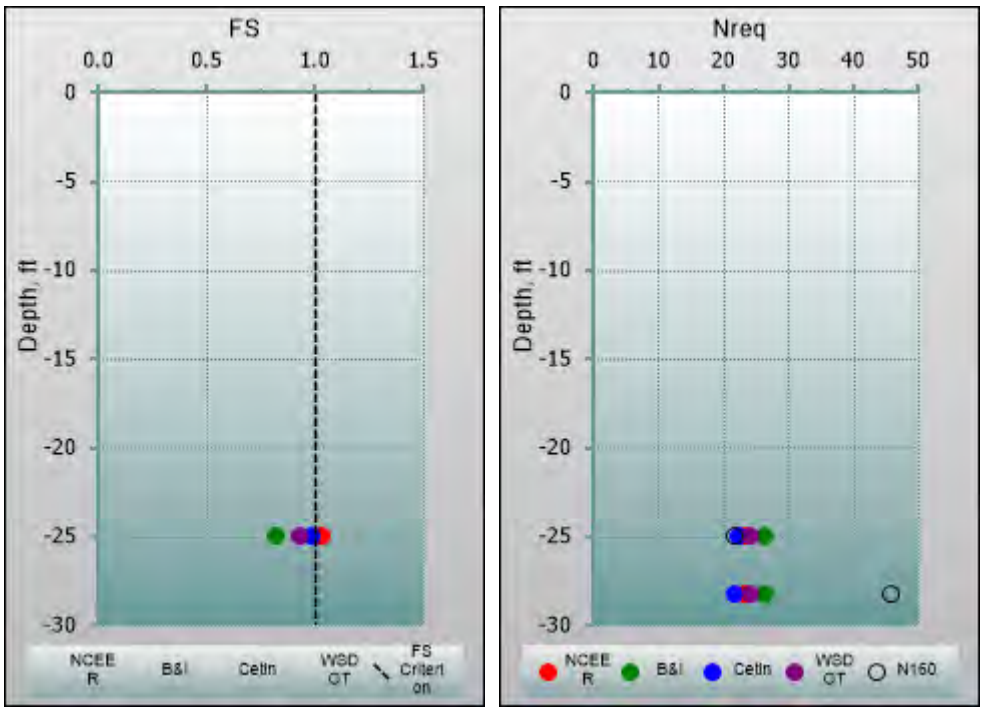
Layer	(N1)60	CSR	CRR	FS	Nreq
4	21.75	0.423	0.416	0.98	22.4
5	45.80	0.413	2.675	6.47	21.8

---WSDOT Recommended------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
4	21.75	0.336	0.314	0.93	24.3
5	45.80	0.334	2.935	8.79	24.2

Table of FS

#	Depth ft	NCEER	B&I	Cetin PL=0.60	WSDOT PL=0.60
4	-25.00	1.03	0.82	0.98	0.93
5	-28.25	10.44	8.80	6.47	8.79




```
=== Effects ===
-------------------------------------------------


** Settlement **
----------------
>>>Multiple Scenario Results
Groud Surface Settlement MULTIPLE Scenario
Return Period (yrs) = 2475
Model Selected :
   Use all deterministic models.
-----------------------------------------


Tokimatsu & Seed
=================
Total ground surface settlement = 0.02 ft
-----------------------------------------------
  #    Depth thickness    ev    Weight    dh
          ft        ft     %              ft
-----------------------------------------------
  2     9.25       6.5   0.001    0.00    0.00
  3    17.75      10.5   0.001    0.00    0.00
  4    25.00       4.0   0.601    0.78    0.02
  5    28.25       2.5   0.001    0.00    0.00
-----------------------------------------------

Ishihara & Yoshimine
=================
Total ground surface settlement = 0.03 ft
-----------------------------------------------
  #    Depth thickness    ev    Weight    dh
          ft        ft     %              ft
-----------------------------------------------
```

2	9.25	6.5	0.001	0.00	0.00
3	17.75	10.5	0.001	0.00	0.00
4	25.00	4.0	0.976	0.75	0.03
5	28.25	2.5	0.001	0.00	0.00

Shamoto et al.

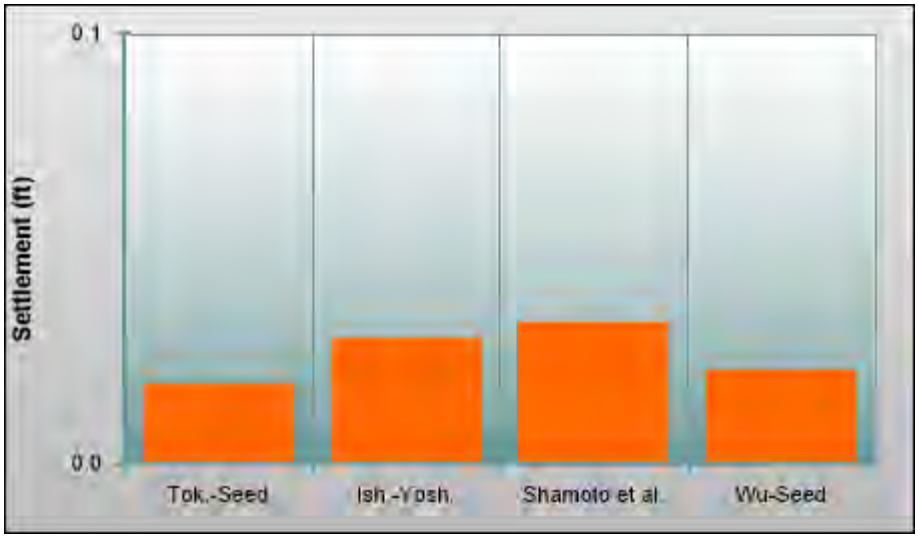
Total ground surface settlement = 0.03 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.25	6.5	0.000	0.00	0.00
3	17.75	10.5	0.000	0.00	0.00
4	25.00	4.0	1.545	0.54	0.03
5	28.25	2.5	0.000	0.00	0.00

Wu & Seed

Total ground surface settlement = 0.02 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.25	6.5	0.000	0.00	0.00
3	17.75	10.5	0.000	0.00	0.00
4	25.00	4.0	0.987	0.56	0.02
5	28.25	2.5	0.000	0.00	0.00



Liquefaction Hazard Evaluation Report
by WSLiq Program beta (May, 2009)

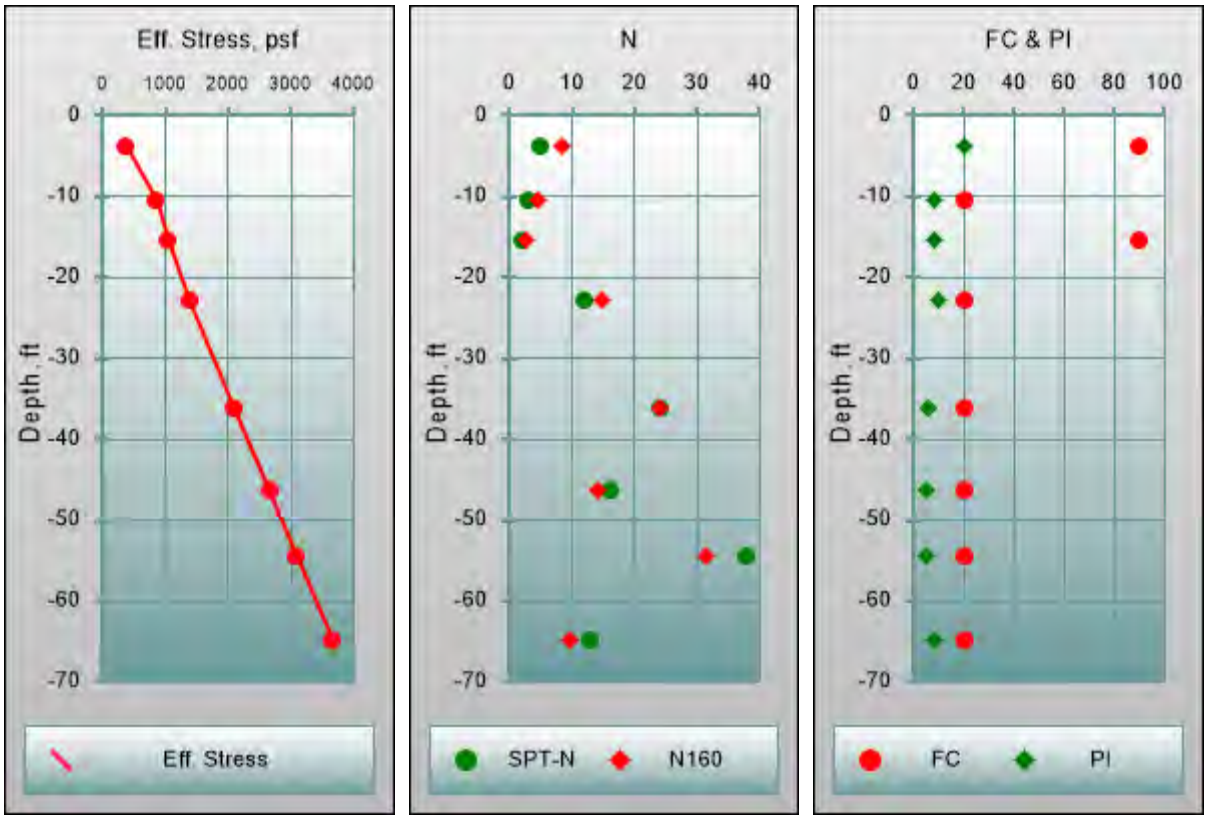
Site Name: Sedro Woolley BESS (Boring-6)
Site Location (N,W) = 48.508 , 122.202
Job No: 00223
Analyst: Willman
Date: 6/18/2023 6:57:17 AM

=== Soil Profile ===
Unit: ft
The number of soil layers: 4
GWT at top of layer: 2
GWT depth: 7.00
SPT Energy Ratio (%): 60.00
Amplification Factors: a= -0.1500 b= -0.1300
Elevation: 55.00
Ground Surface: Level

Layer	Descpt.	Thickness (ft)	Unit Weight (lb/ft3)	Nm	N160	Vs ft/sec
1	SILT_WITH_SAND	7	100.00	5	8.5	526.3
2	SILT_WITH_SAND	5.5	100.00	5	8.1	526.3
3	SILTY_SAND_WITH_GRAVEL	7.5	110.00	8	11.2	603.1
4	SILTY_SAND_WITH_GRAVEL	10	110.00	14	16.6	709.4

Layer	FC (%)	PI	wc/LL	D50 (mm)	Ini. Eff. Stress (psf)	Ini. Total Stress (psf)
1	80	Unsat	Unsat	0.000	350.0	350.00
2	80	10	0.9	0.000	803.4	975.00
3	15	5	0.9	0.000	1085.3	1662.50
4	20	8	0.9	1548.5	1501.8	2625.00

Soil Profile Plots




```
=== Susceptibility Evaluation ===
-----------------------------------------------------------
Threshold: 0.5
Weighting factors: B-I= 0.50  B-S= 0.50
-----------------------------------------------------------
Layer     PI  wc/LL   B-I   B-S  Suscep. Index  Potential
    1  20.00   0.50  0.00  0.00          0.00         NO
    2  10.00   0.90  0.05  0.56          0.31         NO
    3   5.00   0.90  0.62  0.63          0.62        YES
    4   8.00   0.90  0.14  0.61          0.38         NO


=== Initiation ===
-----------------------------------------------------

Initiation - Multiple Scenario
----------------------------------------
Retrun Period (yrs) = 2475
Models Selected :
Use All Deterministic Models.
--WSDOT Recommended--
   Use NCEER, Boulanger & Idriss, and
   Cetin's model with weighting factors
   of 0.4, 0.4, and 0.2 respectively.
----------------------------------------


===== Mean Mw and FS ==============
---NCEER Model------------
--- PGA = 0.418  Mw = 6.46---------
```

Layer	(N1)60	CSR	CRR	FS	Nreq
3	11.17	0.257	0.152	0.59	21.7

===== Mean Mw and FS ==============
---Boulanger and Idriss Model------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
3	11.36	0.303	0.153	0.51	25.0

===== Mean Mw and FS ==============
---Cetin et al. Model------------
--- PGA = 0.418 Mw = 6.46---------

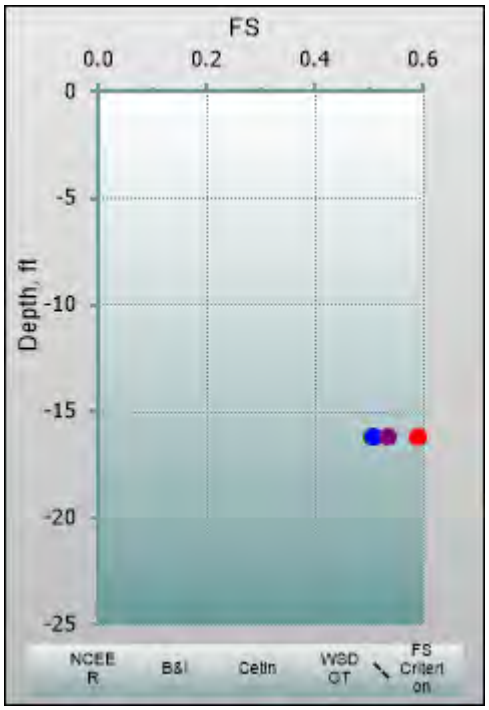
Layer	(N1)60	CSR	CRR	FS	Nreq
3	11.17	0.382	0.194	0.51	20.1

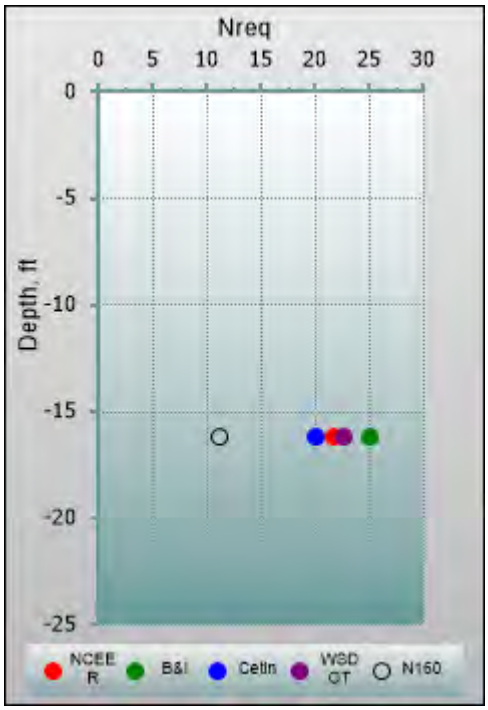
---WSDOT Recommended------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
3	11.17	0.300	0.161	0.54	22.7

Table of FS

#	Depth ft	NCEER	B&I	Cetin PL=0.60	WSDOT PL=0.60
3	-16.25	0.59	0.51	0.51	0.54





=== Effects ===

** Settlement **

>>>Multiple Scenario Results
Groud Surface Settlement MULTIPLE Scenario
Return Period (yrs) = 2475
Model Selected :
   Use all deterministic models.

Tokimatsu & Seed
==========
Total ground surface settlement = 0.13 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.75	5.5	0.001	0.00	0.00
3	16.25	7.5	1.786	0.97	0.13
4	25.00	10.0	0.001	0.00	0.00

Ishihara & Yoshimine
==========
Total ground surface settlement = 0.24 ft

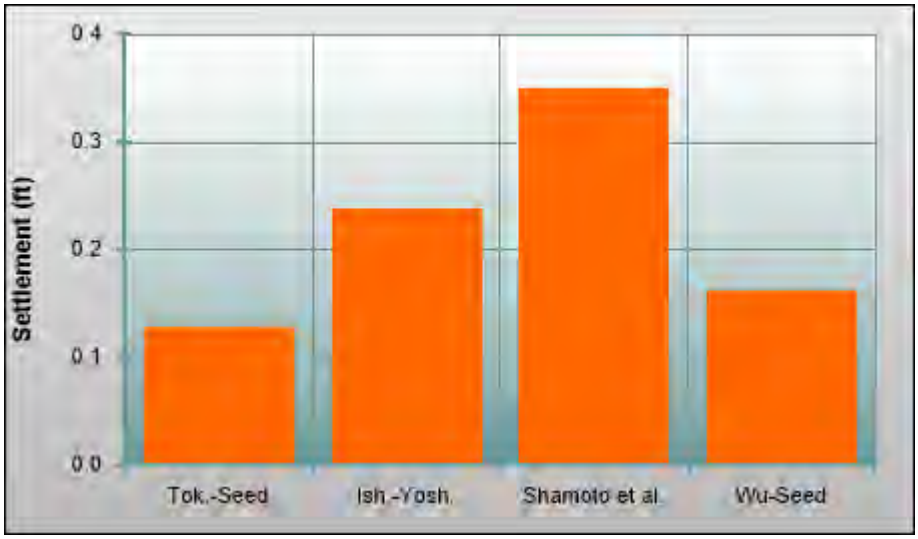
#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.75	5.5	0.001	0.00	0.00
3	16.25	7.5	3.278	0.97	0.24
4	25.00	10.0	0.001	0.00	0.00

Shamoto et al.
==========
Total ground surface settlement = 0.35 ft

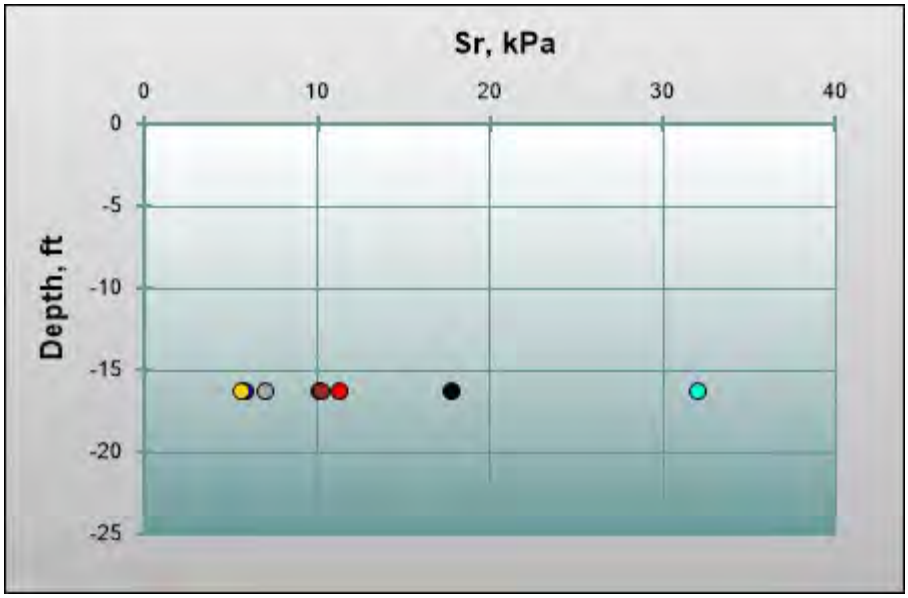
#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.75	5.5	0.000	0.00	0.00
3	16.25	7.5	5.045	0.93	0.35
4	25.00	10.0	0.000	0.00	0.00

Wu & Seed
==========
Total ground surface settlement = 0.16 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.75	5.5	0.000	0.00	0.00
3	16.25	7.5	2.369	0.92	0.16
4	25.00	10.0	0.000	0.00	0.00




```
=== Effects ===
-----------------------------------------------------


** Residual Strength **
-----------------------
====== Soil Layers Selected ==================
Select All Soil Layers (under GWT and susceptible).

====== Models Selected ========================
Use All Residual Strength Models.


-----------------------------------------------------------

###### Unweighted Residual Strength ####################

Idriss Model:
   Layer 3:  Sr =   371 psf =  17.8 kPa = 0.176 atm
-----------------------------------------------------
Kramer & Wang Median Model:
   Layer 3:  Sr =   236 psf =  11.3 kPa = 0.111 atm
-----------------------------------------------------
Kramer & Wang Deterministic Model:
   Layer 3:  Sr =   211 psf =  10.1 kPa = 0.100 atm
-----------------------------------------------------
Olson & Stark Model:
   Layer 3:  Sr =   123 psf =   5.9 kPa = 0.058 atm
-----------------------------------------------------
Seed & Harder Upper Bound Model:
   Layer 3:  Sr =   669 psf =  32.0 kPa = 0.316 atm
-----------------------------------------------------
Seed & Harder Lower Bound Model:
   Layer 3:  Sr =   214 psf =  10.2 kPa = 0.101 atm
-----------------------------------------------------
Idriss & Boulanger Model:
   Layer 3:  Sr =   147 psf =   7.1 kPa = 0.070 atm
-----------------------------------------------------
Idriss & Boulanger VR Model:
   Layer 3:  Sr =   118 psf =   5.6 kPa = 0.056 atm
-----------------------------------------------------
```


Sr, kPa
0
10
20
30
40
Depth, ft
0
-5
-10
-15
-20
-25

Liquefaction Hazard Evaluation Report
by WSLiq Program beta (May, 2009)

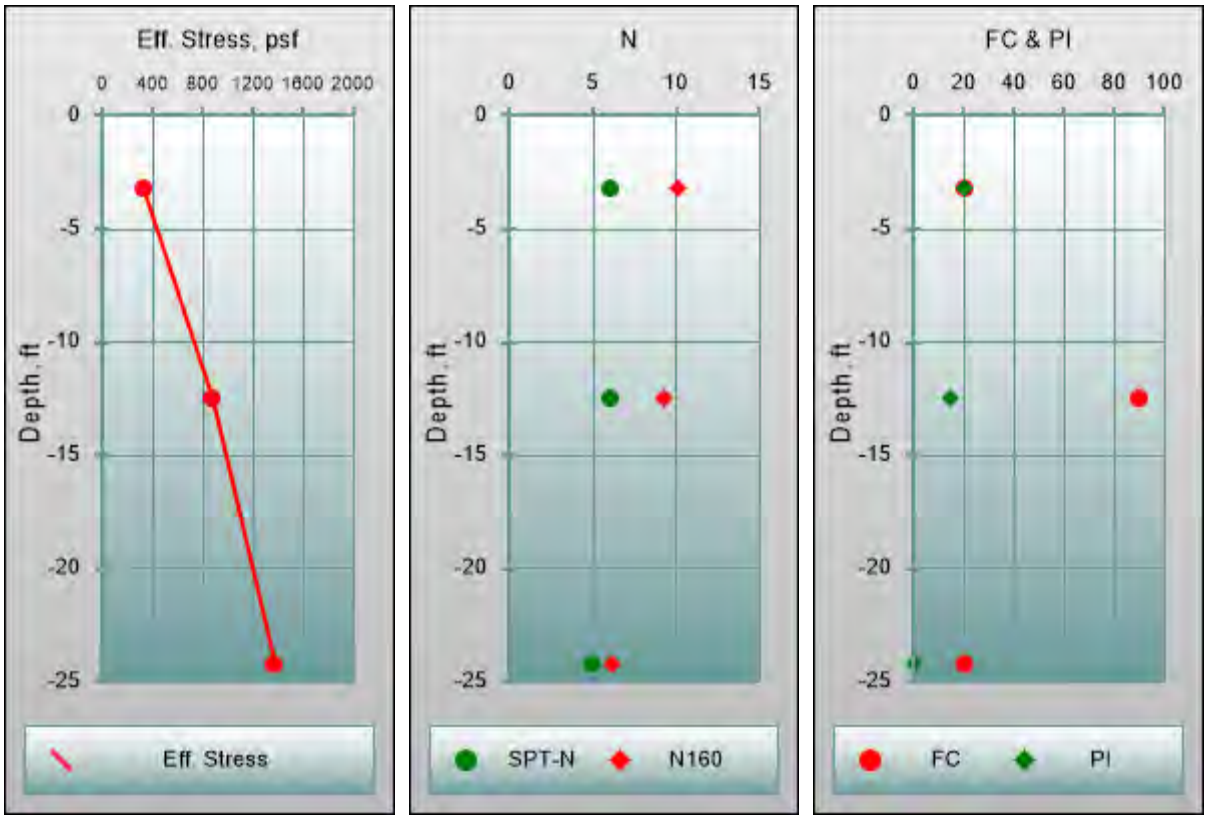
Site Name: Sedro Woolley BESS (Boring-7)
Site Location (N,W) = 48.508 , 122.202
Job No: 00223
Analyst: Willman
Date: 6/19/2023 4:18:14 AM

=== Soil Profile ===
Unit: ft
The number of soil layers: 5
GWT at top of layer: 2
GWT depth: 7.00
SPT Energy Ratio (%): 60.00
Amplification Factors: a= -0.1500 b= -0.1300
Elevation: 55.00
Ground Surface: Level

Layer	Descpt.	Thickness (ft)	Unit Weight (lb/ft3)	Nm	N160	Vs ft/sec
1	SANDY_SILT	7	100.00	3	5.1	453.8
2	SANDY_SILT	5.5	100.00	3	4.9	453.8
3	SILTY_SAND_WITH_GRAVEL	7.5	110.00	12	16.8	678.4
4	SILTY_SAND_WITH_GRAVEL	6.5	110.00	12	14.7	678.4
5	SILTY_SAND	3.5	110.00	22	24.9	808.8

Layer	FC (%)	PI	wc/LL	D50 (mm)	Ini. Eff. Stress (psf)	Ini. Total Stress (psf)
1	60	Unsat	Unsat	0.000	350.0	350.00
2	60	11	1	0.000	803.4	975.00
3	12	15	1	0.000	1085.3	1662.50
4	20	0	1	1418.5	1418.5	2432.50
5	20	7	1	1548.5	1656.5	2982.50

Soil Profile Plots




```
=== Susceptibility Evaluation ===
-----------------------------------------------------------
Threshold: 0.5
Weighting factors: B-I= 0.50  B-S= 0.50
-----------------------------------------------------------
Layer     PI  wc/LL   B-I   B-S  Suscep. Index  Potential
    1  20.00   0.50  0.00  0.00          0.00         NO
    2  11.00   1.00  0.03  0.63          0.33         NO
    3  15.00   1.00  0.01  0.37          0.19         NO
    4   0.00   1.00  1.00  0.76          0.88        YES
    5   7.00   1.00  0.24  0.74          0.49         NO


=== Initiation ===
-----------------------------------------------------

Initiation - Multiple Scenario
----------------------------------------
Retrun Period (yrs) = 2475
Models Selected :
Use All Deterministic Models.
--WSDOT Recommended--
   Use NCEER, Boulanger & Idriss, and
   Cetin's model with weighting factors
   of 0.4, 0.4, and 0.2 respectively.
----------------------------------------


===== Mean Mw and FS ==============
---NCEER Model------------
--- PGA = 0.418  Mw = 6.46---------
```

Layer	(N1)60	CSR	CRR	FS	Nreq
4	14.66	0.276	0.209	0.76	22.7

===== Mean Mw and FS ==============
---Boulanger and Idriss Model------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
4	14.60	0.325	0.195	0.60	25.8

===== Mean Mw and FS ==============
---Cetin et al. Model------------
--- PGA = 0.418 Mw = 6.46---------

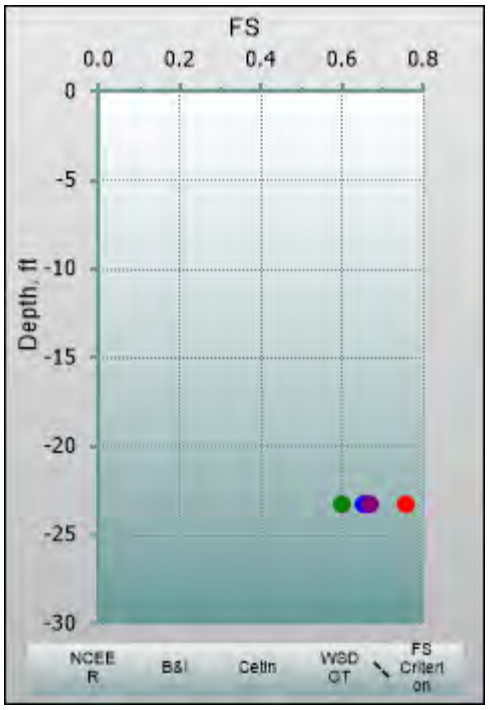
Layer	(N1)60	CSR	CRR	FS	Nreq
4	14.66	0.379	0.248	0.65	20.3

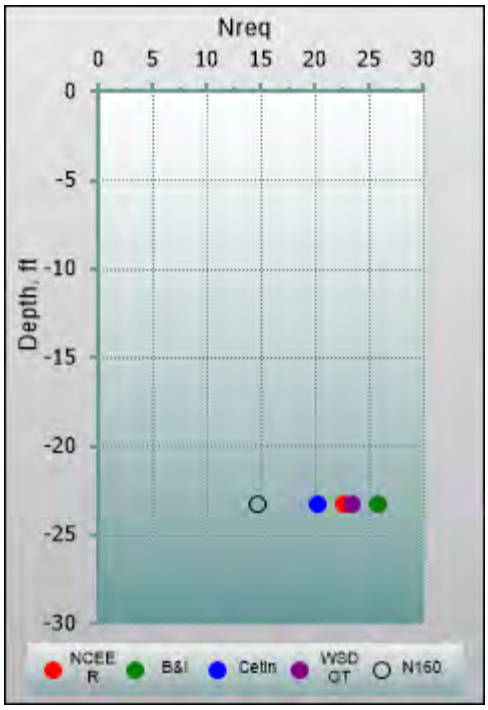
---WSDOT Recommended------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
4	14.66	0.316	0.211	0.67	23.5

Table of FS

#	Depth ft	NCEER	B&I	Cetin PL=0.60	WSDOT PL=0.60
4	-23.25	0.76	0.60	0.65	0.67





=== Effects ===

** Settlement **

>>>Multiple Scenario Results
Groud Surface Settlement MULTIPLE Scenario
Return Period (yrs) = 2475
Model Selected :
   Use all deterministic models.

Tokimatsu & Seed
==========
Total ground surface settlement = 0.08 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.75	5.5	0.001	0.00	0.00
3	16.25	7.5	0.001	0.00	0.00
4	23.25	6.5	1.168	0.99	0.08
5	28.25	3.5	0.001	0.00	0.00

Ishihara & Yoshimine
==========
Total ground surface settlement = 0.14 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.75	5.5	0.001	0.00	0.00
3	16.25	7.5	0.001	0.00	0.00
4	23.25	6.5	2.305	0.95	0.14
5	28.25	3.5	0.001	0.00	0.00

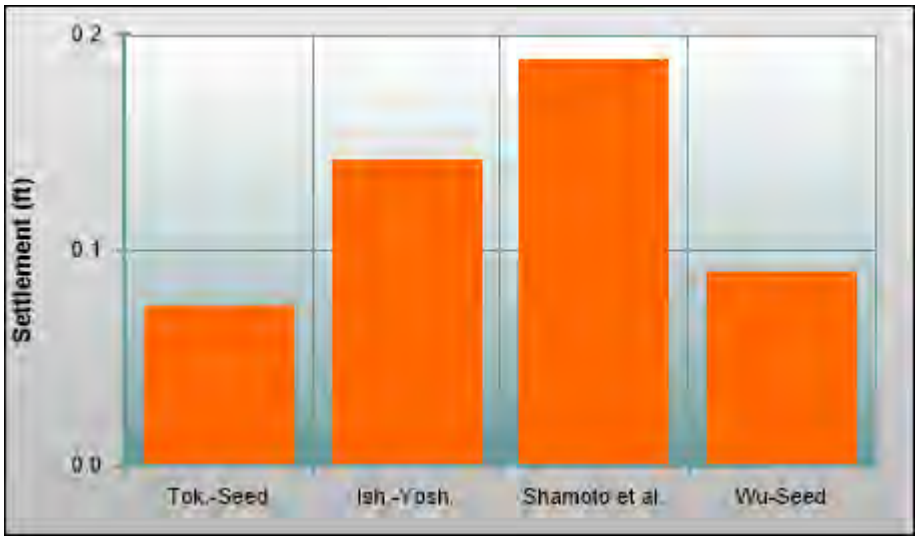
Shamoto et al.
==========
Total ground surface settlement = 0.19 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	9.75	5.5	0.000	0.00	0.00
3	16.25	7.5	0.000	0.00	0.00
4	23.25	6.5	3.403	0.85	0.19
5	28.25	3.5	0.000	0.00	0.00

Wu & Seed
==========
Total ground surface settlement = 0.09 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft

```
  2     9.75        5.5   0.000     0.00     0.00
  3    16.25        7.5   0.000     0.00     0.00
  4    23.25        6.5   1.637     0.86     0.09
  5    28.25        3.5   0.000     0.00     0.00
-------------------------------------------------
```



Liquefaction Hazard Evaluation Report
by WSLiq Program beta (May, 2009)

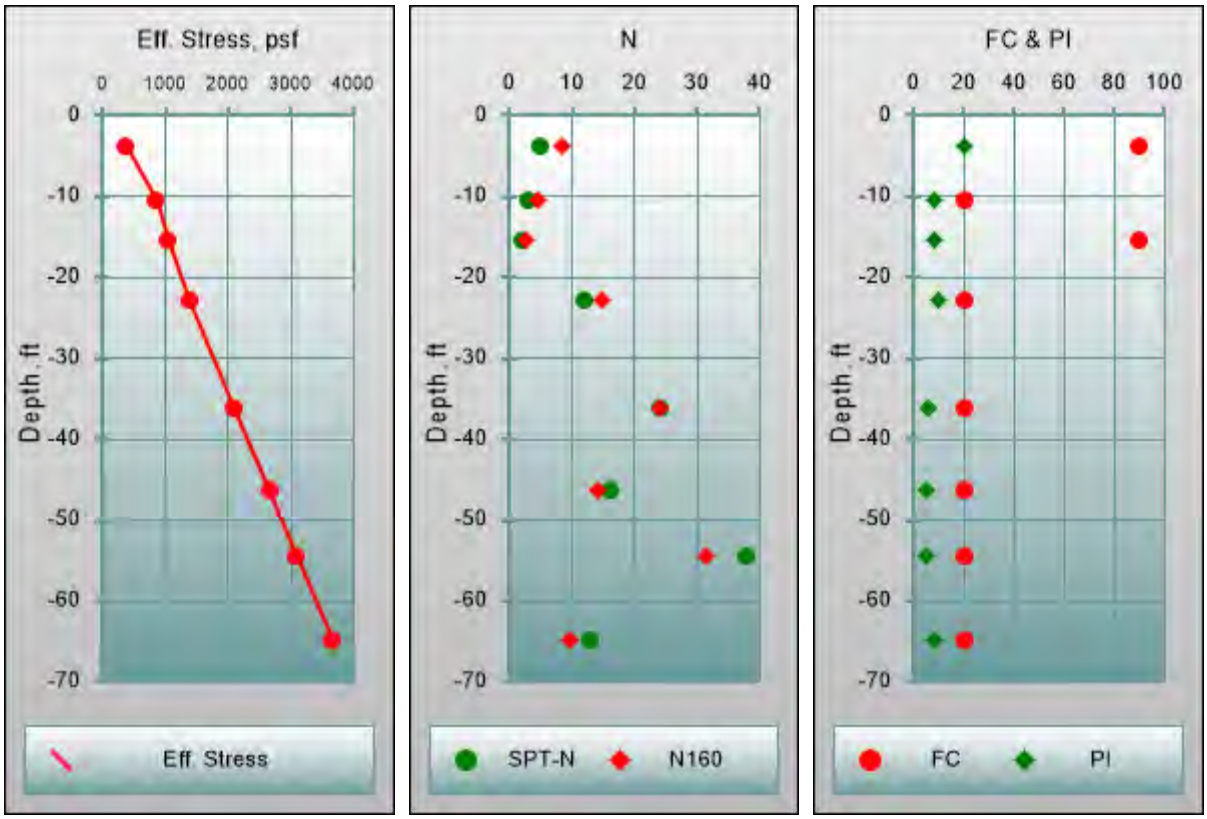
Site Name: Sedro Woolley BESS (Boring-8)
Site Location (N,W) = 48.508 , 122.202
Job No: 00223
Analyst: Willman
Date: 6/18/2023 7:03:19 AM

=== Soil Profile ===
Unit: ft
The number of soil layers: 4
GWT at top of layer: 2
GWT depth: 5.00
SPT Energy Ratio (%): 60.00
Amplification Factors: a= -0.1500 b= -0.1300
Elevation: 55.00
Ground Surface: Level

Layer	Descpt.	Thickness (ft)	Unit Weight (lb/ft3)	Nm	N160	Vs ft/sec
1	SILTY_SAND_WITH_GRAVEL	5	110.00	10	17.0	643.4
2	SILTY_SAND_WITH_GRAVEL	7	110.00	8	13.6	603.1
3	SILT	5	100.00	4	5.9	493.3
4	SILTY,_CLAYEY_SAND_W/GRAVEL	13	110.00	12	14.9	678.4

Layer	FC (%)	PI	wc/LL	D50 (mm)	Ini. Eff. Stress (psf)	Ini. Total Stress (psf)
1	20	Unsat	Unsat	0.000	275.0	275.00
2	20	7	1	0.000	716.6	935.00
3	90	15	1	0.000	977.2	1570.00
4	20	6	1	1548.5	1380.6	2535.00

Soil Profile Plots




```
=== Susceptibility Evaluation ===
-----------------------------------------------------------
Threshold: 0.5
Weighting factors: B-I= 0.50  B-S= 0.50
-----------------------------------------------------------
Layer     PI  wc/LL   B-I   B-S  Suscep. Index  Potential
    1  20.00   0.50  0.00  0.00          0.00         NO
    2   7.00   1.00  0.24  0.74          0.49         NO
    3  15.00   1.00  0.01  0.37          0.19         NO
    4   6.00   1.00  0.40  0.75          0.58        YES


=== Initiation ===
-----------------------------------------------------

Initiation - Multiple Scenario
----------------------------------------
Retrun Period (yrs) = 2475
Models Selected :
Use All Deterministic Models.
--WSDOT Recommended--
   Use NCEER, Boulanger & Idriss, and
   Cetin's model with weighting factors
   of 0.4, 0.4, and 0.2 respectively.
----------------------------------------


===== Mean Mw and FS ==============
---NCEER Model------------
--- PGA = 0.418  Mw = 6.46---------
```

Layer	(N1)60	CSR	CRR	FS	Nreq
4	14.86	0.295	0.211	0.72	23.6

===== Mean Mw and FS ==============
---Boulanger and Idriss Model------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
4	14.79	0.348	0.197	0.57	26.6

===== Mean Mw and FS ==============
---Cetin et al. Model------------
--- PGA = 0.418 Mw = 6.46---------

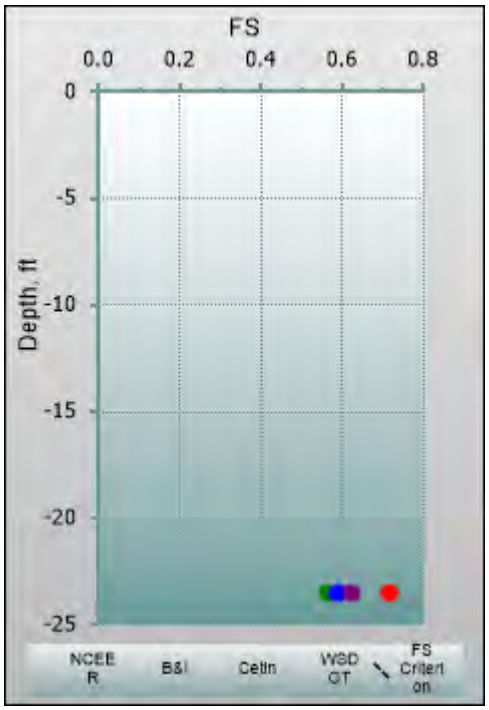
Layer	(N1)60	CSR	CRR	FS	Nreq
4	14.86	0.430	0.254	0.59	21.8

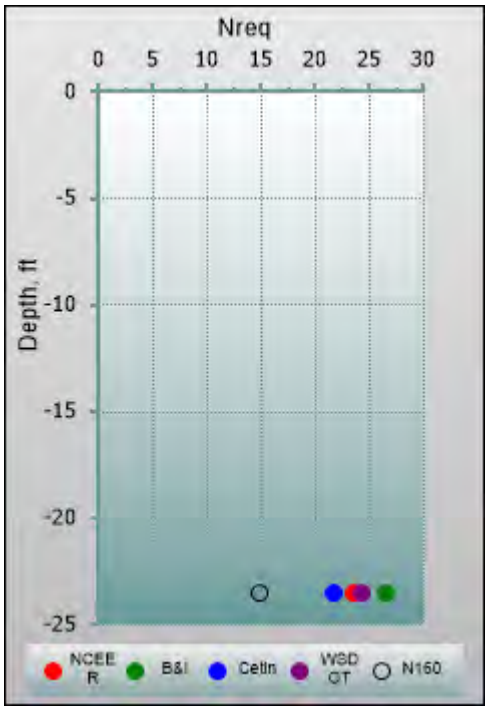
---WSDOT Recommended------------
--- PGA = 0.418 Mw = 6.46---------

Layer	(N1)60	CSR	CRR	FS	Nreq
4	14.86	0.343	0.214	0.62	24.4

Table of FS

#	Depth ft	NCEER	B&I	Cetin PL=0.60	WSDOT PL=0.60
4	-23.50	0.72	0.57	0.59	0.62





=== Effects ===

** Settlement **

>>>Multiple Scenario Results
Groud Surface Settlement MULTIPLE Scenario
Return Period (yrs) = 2475
Model Selected :
   Use all deterministic models.

Tokimatsu & Seed
==========
Total ground surface settlement = 0.15 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	8.50	7.0	0.001	0.00	0.00
3	14.50	5.0	0.001	0.00	0.00
4	23.50	13.0	1.213	0.96	0.15

Ishihara & Yoshimine
==========
Total ground surface settlement = 0.29 ft

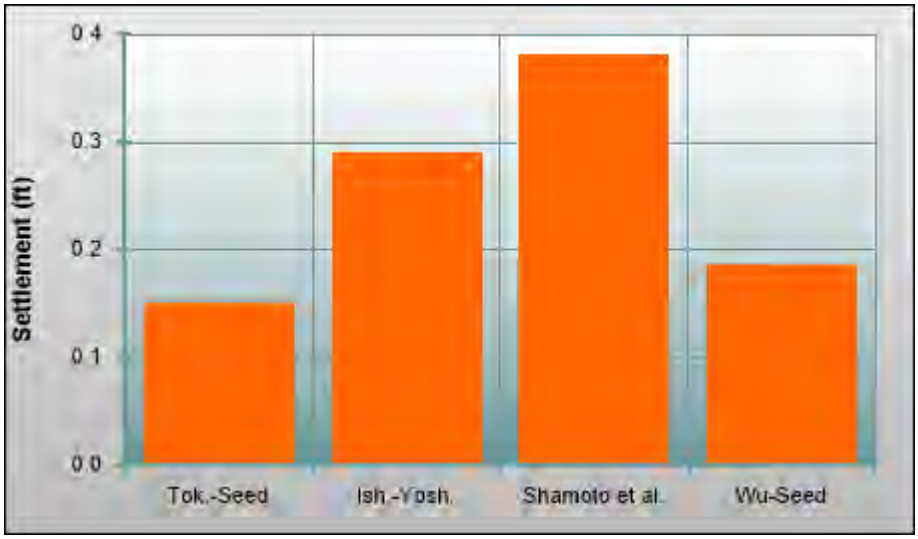
#	Depth ft	thickness ft	ev %	Weight	dh ft
2	8.50	7.0	0.001	0.00	0.00
3	14.50	5.0	0.001	0.00	0.00
4	23.50	13.0	2.370	0.94	0.29

Shamoto et al.
==========
Total ground surface settlement = 0.38 ft

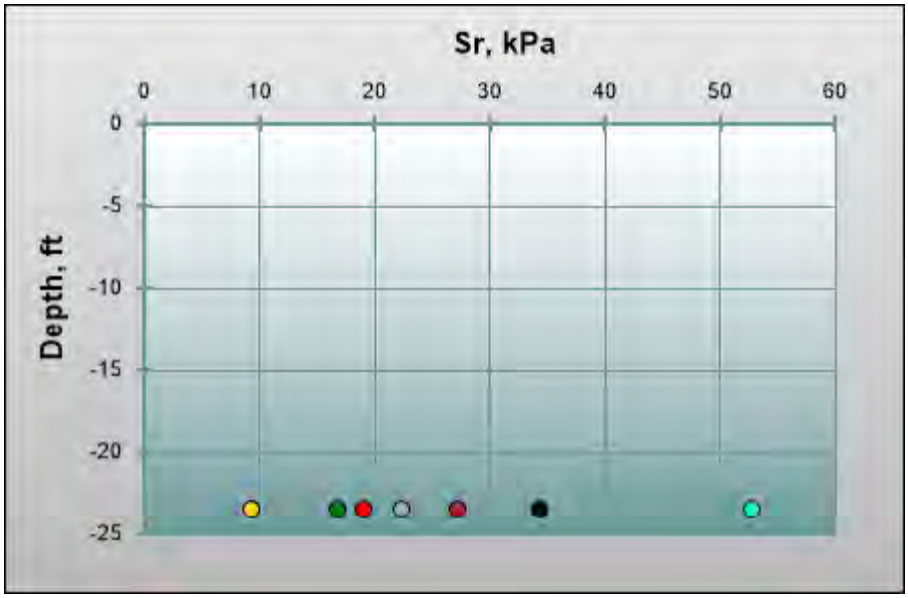
#	Depth ft	thickness ft	ev %	Weight	dh ft
2	8.50	7.0	0.000	0.00	0.00
3	14.50	5.0	0.000	0.00	0.00
4	23.50	13.0	3.450	0.85	0.38

Wu & Seed
==========
Total ground surface settlement = 0.19 ft

#	Depth ft	thickness ft	ev %	Weight	dh ft
2	8.50	7.0	0.000	0.00	0.00
3	14.50	5.0	0.000	0.00	0.00
4	23.50	13.0	1.690	0.85	0.19




```
=== Effects ===
-----------------------------------------------------


** Residual Strength **
-----------------------
====== Soil Layers Selected ==================
Select All Soil Layers (under GWT and susceptible).

====== Models Selected ========================
Use All Residual Strength Models.


-----------------------------------------------------------

###### Unweighted Residual Strength ####################

Idriss Model:
   Layer 4:  Sr =   716 psf =  34.3 kPa = 0.338 atm
-----------------------------------------------------
Kramer & Wang Median Model:
   Layer 4:  Sr =   398 psf =  19.1 kPa = 0.188 atm
-----------------------------------------------------
Kramer & Wang Deterministic Model:
   Layer 4:  Sr =   352 psf =  16.9 kPa = 0.166 atm
-----------------------------------------------------
Olson & Stark Model:
   Layer 4:  Sr =   195 psf =   9.3 kPa = 0.092 atm
-----------------------------------------------------
Seed & Harder Upper Bound Model:
   Layer 4:  Sr =  1101 psf =  52.7 kPa = 0.520 atm
-----------------------------------------------------
Seed & Harder Lower Bound Model:
   Layer 4:  Sr =   570 psf =  27.3 kPa = 0.269 atm
-----------------------------------------------------
Idriss & Boulanger Model:
   Layer 4:  Sr =   465 psf =  22.3 kPa = 0.220 atm
-----------------------------------------------------
Idriss & Boulanger VR Model:
   Layer 4:  Sr =   194 psf =   9.3 kPa = 0.092 atm
-----------------------------------------------------
```


Sr, kPa
0
10
20
30
40
50
60
Depth, ft
0
-5
-10
-15
-20
-25

TERRA-GEO

TECHNICAL MEMORANDUM

Date:	January 6, 2023	**Project No.:**	02422
To:	Brad Cole	**Company:**	Dudek
From:	Brian Willman, PhD, PE, GE		
cc:	Tommy Nelson	**Email:**	brian.willman@terra-geo.com
RE:	**PRELIMINARY PERCOLATION EVALUATION FOR THE GOLDENEYE SITE, SEDRO-WOLLEY WASHINGTON**		

Presented herein is the Terra-Geo, Inc. (Terrageo) engineering review of the subject site in relation to its estimated percolation rate. The project ***did not*** entail conducting a Pilot Infiltration Test (PIT) as the location of the proposed infiltration gallery had not been selected nor was it the correct season to perform such a test. From reviewing the 2019 Stormwater Management Manual for Western Washington, Volume V, Chapter 5.4 Determining the design Infiltration Rate of the Native soils, the timeframe for an Initial Saturated hydraulic conductivity determination through Large Scale Pilot Infiltration Testing (PIT) should be performed between ***December 1 and April 1***, completed at the approximate elevation of proposed infiltration gallery and the approximate area of the runoff should be known to determine the PIT size. At the time of this investigation, the approximate location of the proposed infiltration gallery was known, but the other details were not. Therefore, Terrageo advanced seven test pits outside the wetland areas as shown on the site plans conveyed to us, to depth of about 10 feet each, collected samples for laboratory testing and developed this memo regarding preliminary test pit infiltration rates.

Considering these preliminary results, the stormwater engineer should evaluate the overall effectiveness of a PIT program to support this project before initiating a PIT test.

INTRODUCTION

The Kingfisher BESS site entrance is located at 2580 Minkler Road in Sedro-Wolley, (LAT 48°30'27.83"N, LONG 122°12'4.44"W) Skagit County, Washington (see Figure 1). The cleared, approximately 11-acre site is lightly vegetated and historically farmed with wind break trees about its perimeter and is relatively flat. Hansen Creek runs north south to the west of the proposed site and appears to express the water table locally. Generally, the project entails construction of BESS units (housing the batteries, control systems, HVAC, and fire suppression); MV inverters / transformers; underground MV collection cabling; O&M/fire access roads (compacted gravel or AC paving); project substation including switchgear and HV transformer. Terrageo understands that several feet of fill will be placed at the site, however the thickness of the fill is unknown.

GEOLOGY

The Washington Division of Geology and Earth Resources Open Files Report 99-3, Geologic map of the Sedro-Woolley North and Lyman 7.5-minute quadrangles, western Skagit County, Washington United States (See Figure 3) reveals the site to be underlain by Older alluvium and lahar run-out deposits of the Skagit River valley (Holocene), an Iron-stained sand, silt and clay; minor volcaniclastic sands and gravels of probable Glacier Peak Origin, forms terraces generally 15-50 feet above modern flood plain. Although one boring encountered sand, the site was generally consisted of Silty Sand (ML).

Review of the USDA Natural Resources Conservation Service for Skagit County Washington, the Soil Survey maps the site as Field Silt Loam, Minkler Silt Loam and Sumas Silt Loam. The Soil Survey places

the capacity of the most limiting layer for these soils Ksat at moderately high (0.57 to 1.98 inches/hour), although the field work presented a different condition.

FIELD AND LABORATORY INVESTIGATION

Terrageo mobilized to the site on December 15, 2022 and advanced seven test pits at the locations shown on the attached Figure 2. Each test pit was advanced to 10 feet and logs are attached to this memo. Bag samples were taken from each test pit and returned to Terrageo's Portland Laboratory for gradation testing. The soils onsite were found to be Silty Sand. Collected bucket samples will be retained for later testing.

The test pits showed water stains and mottling within their depths and an artesian groundwater condition was encountered during the subsurface exploration. Water was typically encountered at depths of 7 to 9 feet below grade and started to fill the excavation. Over the next hours, the sidewalls of the excavation would typically begin to collapse, as groundwater rose in the test pit, resulting in final water depths about 2 feet higher than what was encountered during excavation. Without the benefit of survey equipment, the Engineer noted the nearby Hansen Creek had a groundwater elevation similar to the final elevations in the test pits.

INFILTRATION CALCULATIONS FROM SIEVE ANALYSIS

We used sieve analysis' (reproduced here for convenience) in lieu of onsite infiltration testing. We used the Hazen equation (See Appendix C) to give an average infiltration rate of about 0.188 inches/hour, however, by eliminating TP-3, the sand seam, from this calculation the average infiltration rate is 1.64E-03. There is no correction or safety factor applied to this value. Outside of one sand seam, the variability in soils (gradation, compaction, void space, etc) across the site was minor. Caution should be used if considering a PIT test onsite as due to the limited permeability and artesian conditions encountered.

Test Pit	Hydraulic Conductivity (in/hr)
TP-1	1.42E-04
TP-2	3.54E-05
TP-3	1.31
TP-4	1.42E-04
TP-5	3.19E-04
TP-6	1.42E-04
TP-7	9.07E-03

The results of the Hazen equation applied to the sieve analysis showed that the soils are very silty, compact and of very low permeability. The infiltration rate ranged from 1.31 inches per hour for the sand seam encountered in TP-3 to 3.5E-05 inches per hour (much lower permeability than the Soil Survey value range of 0.57 to 1.98 in/hr) makes the proposed infiltration gallery very difficult if not unfeasible. This is compounded by the artesian condition, which lends evidence to the very low permeability of these soils. The above values should not be used for design but should be used to assist the stormwater engineer when evaluating potential paths forward.

CLOSURE

Terra-Geo, Inc. appreciates the opportunity to provide this field testing and looks forward to working with Dudek in the future. If you have any questions regarding this memo, or need further assistance, please do not hesitate to call (503) 729-9195.

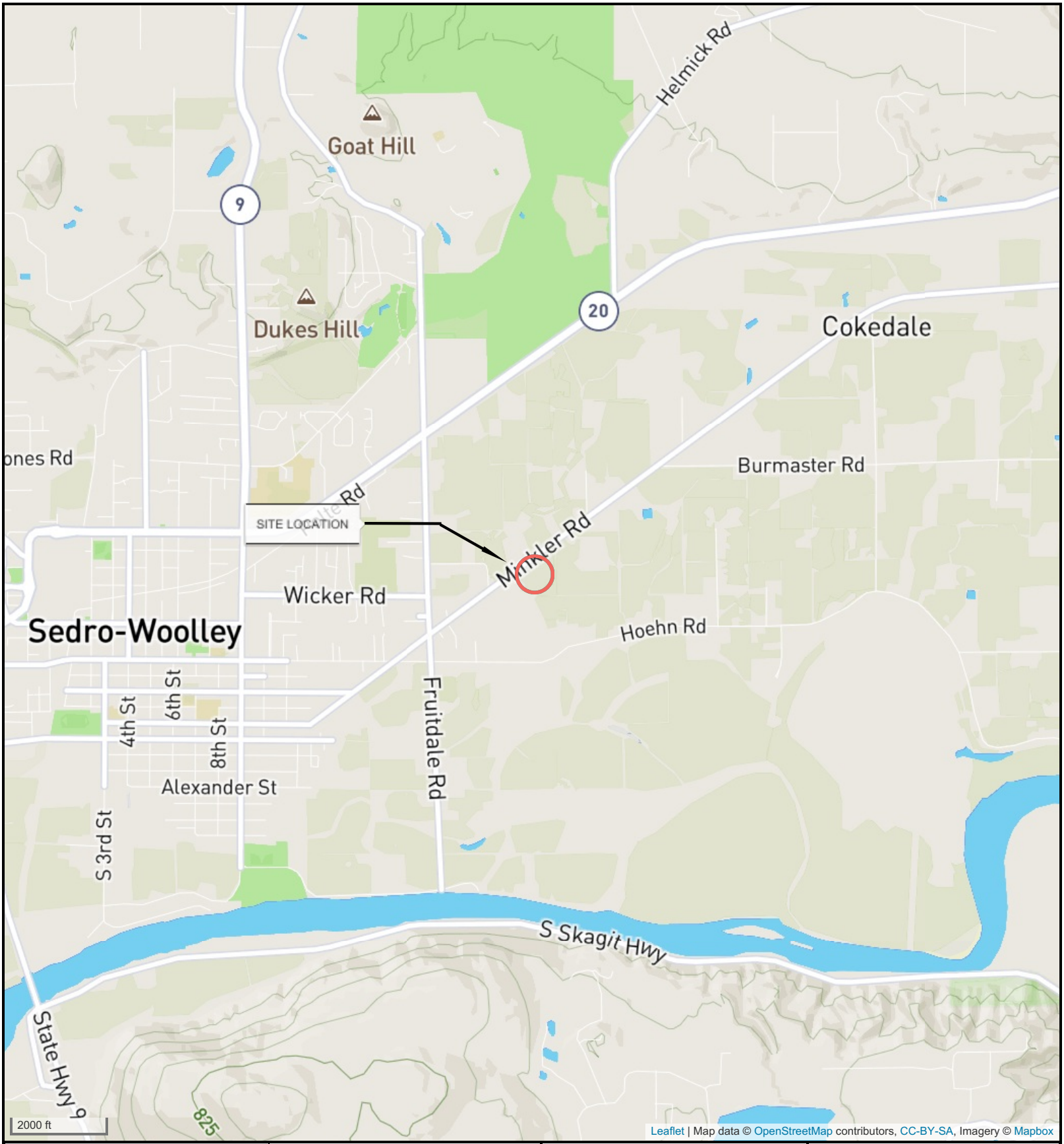
Sincerely,

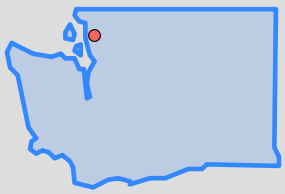
TERRA-GEO, LLC

Brian M. Willman, PhD, PE, GE
Principal Engineer

Attachments:
Figure 1 – Site Location
Figure 2 – Test Pit Locations
Figure 3 – Geology Map

Appendix A – Test Pit Logs and Photos
Appendix B – Sieve Test Results
Appendix C – Hazen Infiltration Calculations





Latitude: 48.50817
Longitude: -122.20125

N
W E
S

TERRA-GEO

Dudek
Goldeneye

FIGURE 1
SITE LOCATION MAP

2580 Minkler Road
Sedro-Wolley, Washington

N
W
E
S

Legend

Test Pit Locations

Site Property Boundary

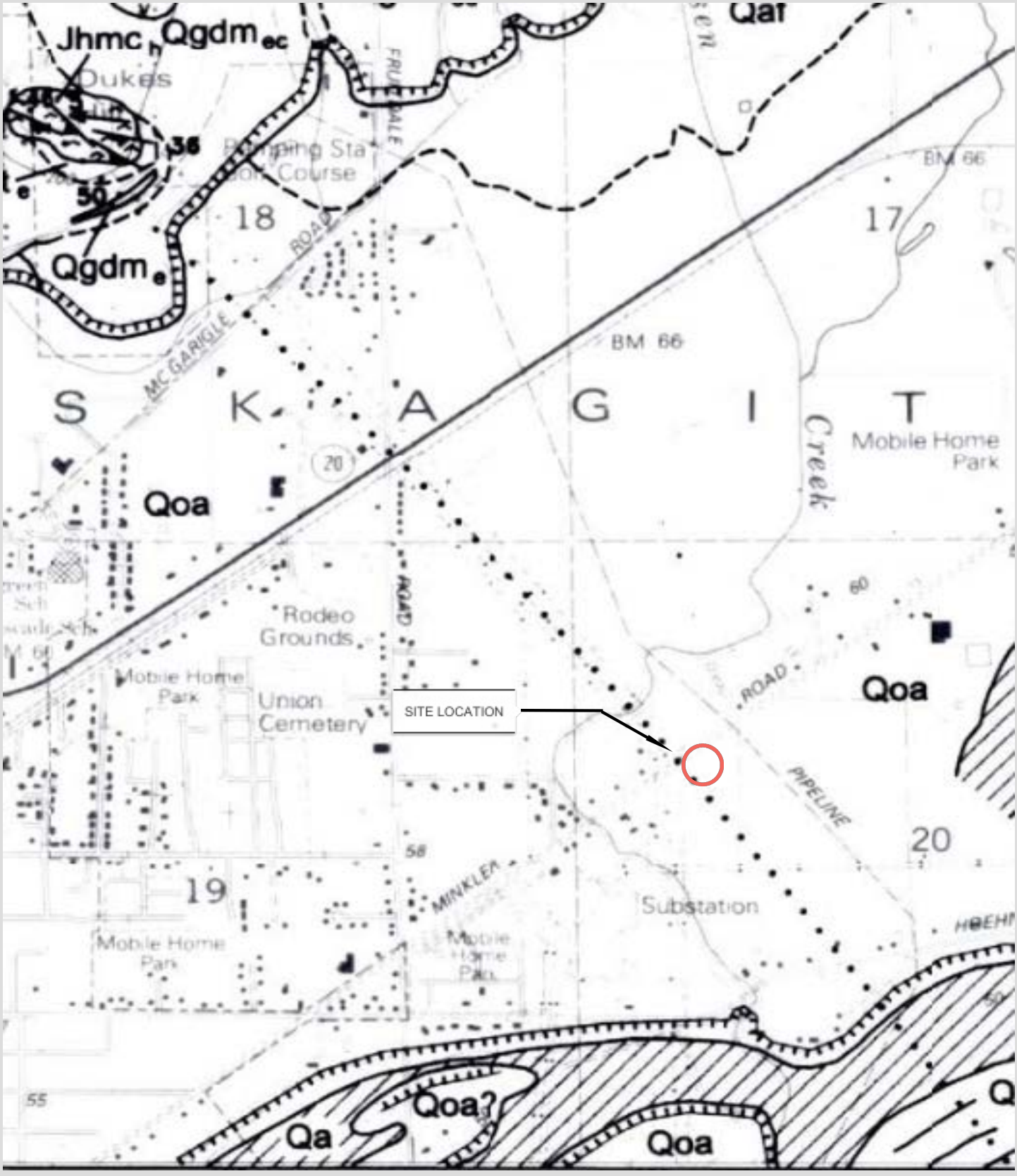
Latitude: 48.50775, Longitude: -122.20148

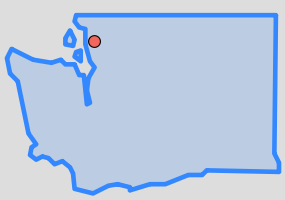
TERRA-GEO

FIGURE 2
SITE MAP

Dudek
Goldeneye

2580 Minkler Road
Sedro-Wolley, Washington





Latitude: 48.50817
Longitude: -122.20125

N
W E
S

TERRA-GEO

Dudek
Goldeneye

FIGURE 3
SITE GEOLOGY MAP

2580 Minkler Road Sedro-Wolley, Washington

APPENDIX A – TEST PITS LOGS AND PHOTOS

TERRA-GEO

BORING AND WELL LOG LEGEND

SURFACE
- ASPHALT
- CONCRETE
- FILL
- TOPSOIL
- AIR
- ICE

USCS
- Well-graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- Silty GRAVEL (GM)
- Clayey GRAVEL (GC)
- Silty, Clayey GRAVEL (GC-GM)
- Well-graded GRAVEL with silt (GW-GM)
- Poorly graded GRAVEL with silt (GP-GM)
- Well-graded GRAVEL with clay (GW-GC)
- Poorly graded GRAVEL with clay (GP-GC)
- Well-graded SAND (SW)
- Poorly graded SAND (SP)
- Silty SAND (SM)
- Clayey SAND (SC)
- Silty, Clayey SAND (SC-SM)
- Well-graded SAND with silt (SW-SM)
- Poorly graded SAND with silt (SP-SM)
- Well-graded SAND with clay (SW-SC)
- Poorly graded SAND with clay (SP-SC)
- SILT (ML)
- Lean CLAY (CL)
- Silty CLAY (CL-ML)
- Organic SOIL (OL)
- Elastic SILT (MH)
- Fat CLAY (CH)
- Organic SOIL (OH)
- Organic SOIL (OL/OH)
- PEAT (PT)
- BEDROCK
- IGNEOUS Rock
- METAMORPHIC Rock
- SEDIMENTARY Rock
- WATER

Non-USCS
- Gravel
- Sand
- Silt
- Clayey Silt
- Silt & Clay
- Clay & Silt
- Silty Clay
- Clay
- Boulders
- Cobbles
- Peastone
- Glacial Till
- Iron Ore
- Wood
- Peat
- Saprolite
- Ash
- Waste

Volume Descriptors
- Trace = <5%
- Few = 5-10%
- Little = 15-25%
- Some = 30-45%
- Mostly = >=50%

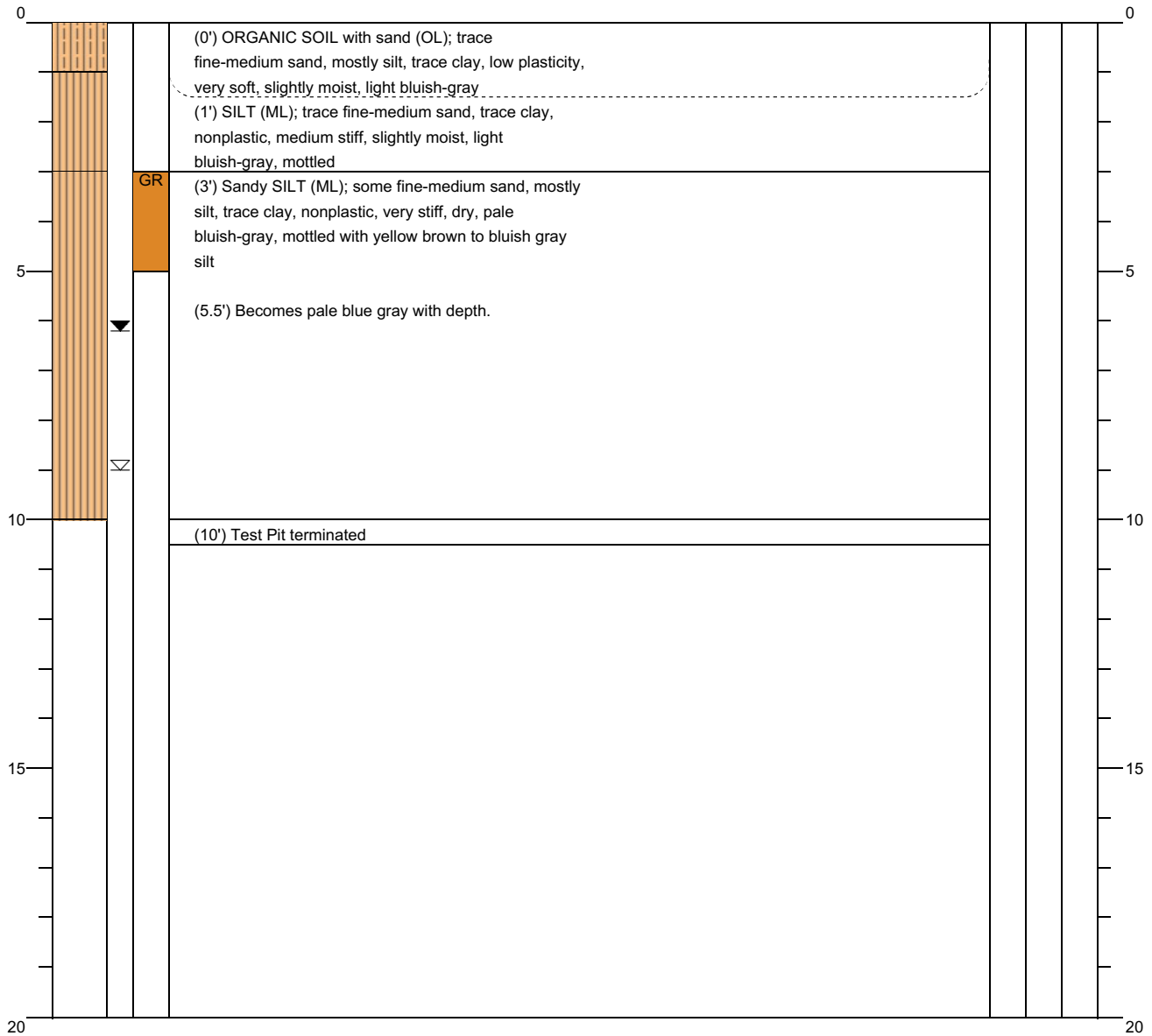
Water Levels
- Water Level During Drilling
- Water Level at End of Drilling/in Completed Well

Well/Boring Completion
- Cap
- Riser
- Screen
- End Plug
- Annular Seal
- Sanitary Seal (Bentonite Slurry/Chips/Pellets/Powder, Other)
- Filter Pack (Sand, Gravel, Other)
- Backfill

Sample Type
- GR — Grab
- EN — Encore
- SS — Split Spoon
- SH — Shelby Tube
- CO — Core Barrel
- DP — Direct Push
- ID — Lab Sample and ID

TERRA-GEO	**Client:** Dudek **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T1 **Page:** 1 of 1

Excavation Date:	**12/16/22 08:00**	Excavation Depth (ft):	**10**
Excavated By:	**Ceader Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**9**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**6.2**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50806, -122.20194**



NOTES: Utility location performed before excavation

TERRA-GEO	**Client:** Dudek **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T2 **Page:** 1 of 1

Excavation Date:		Excavation Depth (ft):	**10**
Excavated By:	**Ceader Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**8**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**5.1**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50833, -122.20139**

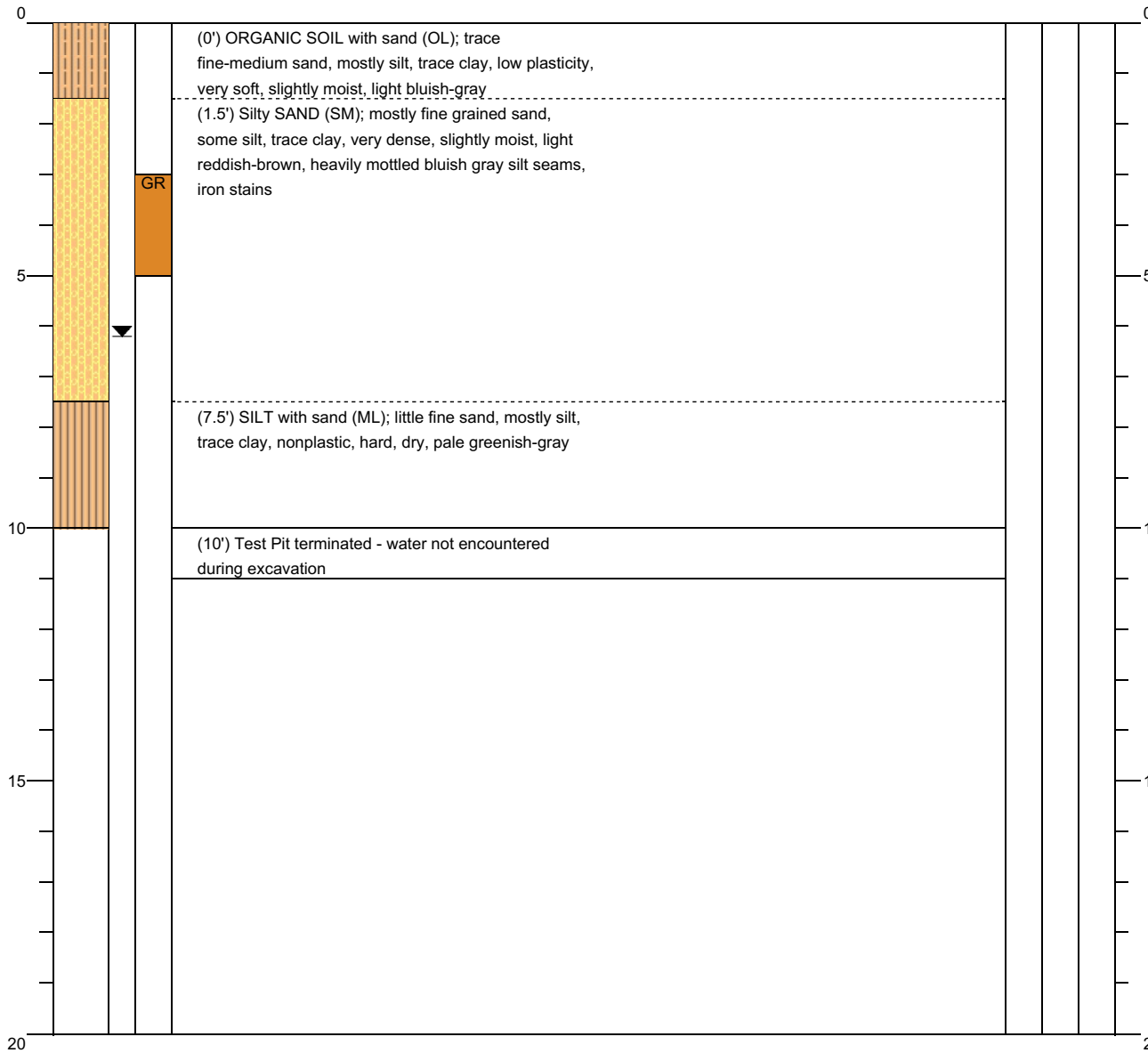
DEPTH (ft)	LITHOLOGY	WATER LEVEL	Sample Type	SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Infiltration (in/hr)	Compressive Strength (tsf)	DEPTH (ft)
0				(0') ORGANIC SOIL with sand (OL); trace fine-medium sand, mostly silt, trace clay, low plasticity, very soft, slightly moist, light bluish-gray				0
				(1') SILT (ML); trace fine-medium sand, trace clay, nonplastic, medium stiff, slightly moist, light bluish-gray, mottled				
			GR	(3') Sandy SILT (ML); some fine-medium sand, mostly silt, trace clay, nonplastic, very stiff, dry, pale bluish-gray, mottled with yellow brown to bluish gray silt				
5		▼		(5.5') Becomes pale blue gray with depth. (6') Becomes Very Hard				5
10				(10') Test Pit terminated				10
15								15
20								20

NOTES: Utility location performed before excavation

TERRA-GEO

Client:	**Dudek**	**TEST PIT**
Project:	**Goldeneye**	**Test Pit No. T3**
Address:	**2580 Minkler Road, Sedro-Wolley, WA**	**Page: 1 of 1**

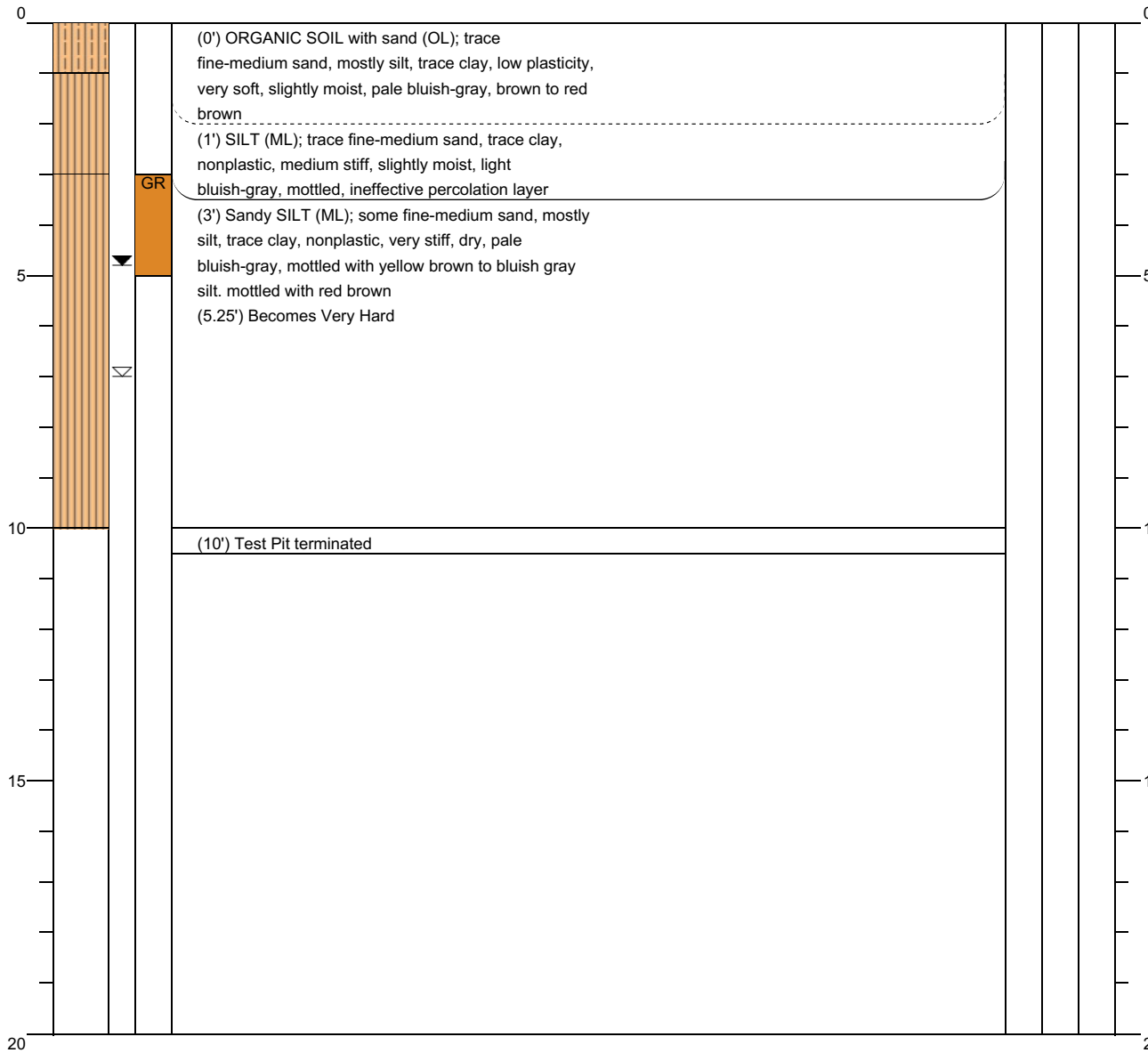
Excavation Date:	**12/16/2022**	Excavation Depth (ft):	**10**
Excavated By:	**Ceader Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**N/A**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**6.2**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50806, -122.20139**



NOTES: Utility location performed before excavation

TERRA-GEO	**Client:** Dudek **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T4 **Page:** 1 of 1

Excavation Date:	**12/16/2022**	Excavation Depth (ft):	**10**
Excavated By:	**Ceader Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**7**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**4.8**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50861, -122.20056**



NOTES: Utility location performed before excavation

TERRA-GEO	**Client:** Dudek **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T5 **Page:** 1 of 1

Excavation Date:	**12/16/2022**	Excavation Depth (ft):	**10**
Excavated By:	**Ceader Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**7**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**5**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50806, -122.20028**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	Sample Type	SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Infiltration (in/hr)	Compressive Strength (tsf)	DEPTH (ft)
0				(0') ORGANIC SOIL with sand (OL); trace fine-medium sand, mostly silt, trace clay, low plasticity, very soft, slightly moist, light brown, to red brown				0
				(1') SILT (ML); trace fine-medium sand, trace clay, nonplastic, medium stiff, slightly moist, light reddish-brown, mottled with gray brown, Iron stains				
			GR	(3') Sandy SILT (ML); some fine-medium sand, mostly silt, trace clay, nonplastic, very stiff, dry, pale bluish-gray, mottled with yellow brown to bluish gray silt				
5		▼		(4.25') Becomes Very Hard				5
				(6.5') Brown				
10				(10') Test Pit terminated				10
15								15
20								20

NOTES: Utility location performed before excavation

TERRA-GEO	**Client:** Dudek **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T6 **Page:** 1 of 1

Excavation Date:		Excavation Depth (ft):	**0**
Excavated By:	**Ceader Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**8**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**5.8**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50889, -122.19972**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	Sample Type	SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Infiltration (in/hr)	Compressive Strength (tsf)	DEPTH (ft)
0				(0') ORGANIC SOIL with sand (OL); trace fine-medium sand, mostly silt, trace clay, low plasticity, very soft, slightly moist, light brown, to red brown				0
				(1') SILT (ML); trace fine-medium sand, trace clay, nonplastic, medium stiff, slightly moist, light reddish-brown, mottled with gray brown, Iron stains				
			GR	(3') Sandy SILT (ML); some fine-medium sand, mostly silt, trace clay, nonplastic, very stiff, dry, pale bluish-gray, mottled with yellow brown to bluish gray silt				
5				(4.25') Becomes Very Hard				5
				(6.5') Brown with Gray Brown Mottles, some Ironstain				
10				(10') Test Pit terminated				10
15								15
20								20

NOTES: Utility location performed before excavation

TERRA-GEO	**Client:** Dudek **Project:** Goldeneye **Address:** 2580 Minkler Road, Sedro-Wolley, WA	**TEST PIT** **Test Pit No.** T7 **Page:** 1 of 1

Excavation Date:		Excavation Depth (ft):	**0**
Excavated By:	**Ceader Valley Earthworks**	Sampling Method(s):	**Grab**
Excavation Method:	**Track-Mounted Backhoe**	DTW During Drilling (ft):	**N/A**
Excavation Equipment:	**Takeuchi TB280**	DTW After Drilling (ft):	**N/A**
Personnel:	**Dennis Hyatt**	Ground Surface Elev. (ft):	**N/A**
Logged By:	**Brian Willman**	Location (Lat, Long):	**48.50750, -122.19944**

DEPTH (ft)	LITHOLOGY	WATER LEVEL	Sample Type	SOIL/ROCK VISUAL DESCRIPTION	Moisture Content (%)	Infiltration (in/hr)	Compressive Strength (tsf)	DEPTH (ft)
0				(0') ORGANIC SOIL with sand (OL); trace fine-medium sand, mostly silt, trace clay, low plasticity, very soft, slightly moist, light bluish-gray				0
				(1') SILT (ML); trace fine-medium sand, trace clay, nonplastic, medium stiff, slightly moist, light bluish-gray, mottled with some stains				
			GR	(3') Sandy SILT (ML); some fine-medium sand, mostly silt, trace clay, nonplastic, very stiff, dry, pale bluish-gray, mottled with yellow brown to bluish gray silt, color in seams also				
5				(6') Becomes Very Hard				5
				(8') Becomes pale blue gray with depth.				
10				(10') Test Pit terminated				10
15								15
20								20

NOTES: Utility location performed before excavation

PHOTO 1 TP-1 During Excavation	
PHOTO 2 TP-1 Before Backfill	

PHOTO 3 TP-2 During Excavation	
PHOTO 4 TP-2 Before Backfill	

PHOTO 5 TP-3 During Excavation	
PHOTO 6 TP-3 Before Backfill	

PHOTO 7 TP-4 During Excavation		
PHOTO 8 TP-4 Before Backfill		

PHOTO 9 TP-5 During Excavation		
PHOTO 10 TP-5 Before Backfill		

PHOTO 11 TP-6 During Excavation		
PHOTO 12 TP-6 Before Backfill		

PHOTO 13 TP-7 During Excavation		

APPENDIX B – SIEVE TEST RESULTS

Sieve Analysis Data Sheet

ASTM D422-63(2007)

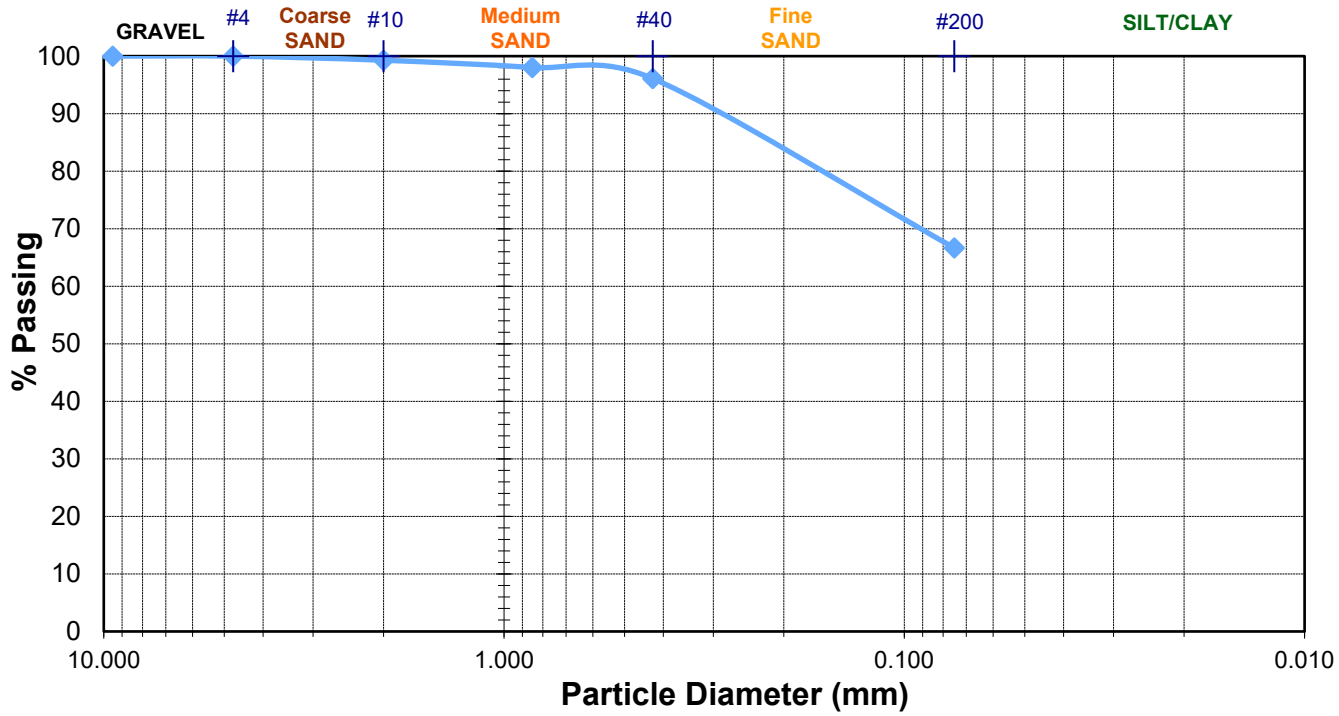
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/28/2022
Location:	Test Pit - 1	**Checked By:**	BMW	**Date:**	12/28/2022
Sample Type:	Grab	**Test Number:**	02422-01		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Sandy Silt (ML)

Weight of Container (g): 17.9 **Weight of Container & Soil (g):** 747.1

Weight of Dry Sample (g): 729.2

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.4	780.4	0.0	0.0	100.0
3/8 in	9.500	740.0	740.0	0.0	0.0	100.0
#4	4.750	756.4	756.4	0.0	0.0	100.0
#10	2.000	686.0	691.2	5.2	0.7	99.3
#20	0.850	617.7	626.9	9.2	1.3	98.0
#40	0.425	560.3	574.3	14.0	1.9	96.1
#200	0.075	515.6	730.3	214.7	29.4	66.7
Pan		485.2	972.6	487.4	66.8	-0.2
			TOTAL:	**730.405**	**100.2**	



Grain Size Distribution Curve Results:

% Gravel:	0.0	**D_{10}:**	0.001	**C_u:**	530.0
% Sand:	33.3	**D_{30}:**	0.01	**C_c:**	0.2
% Fines:	66.7	**D_{60}:**	0.53		

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Sieve Analysis Data Sheet

ASTM D422-63(2007)

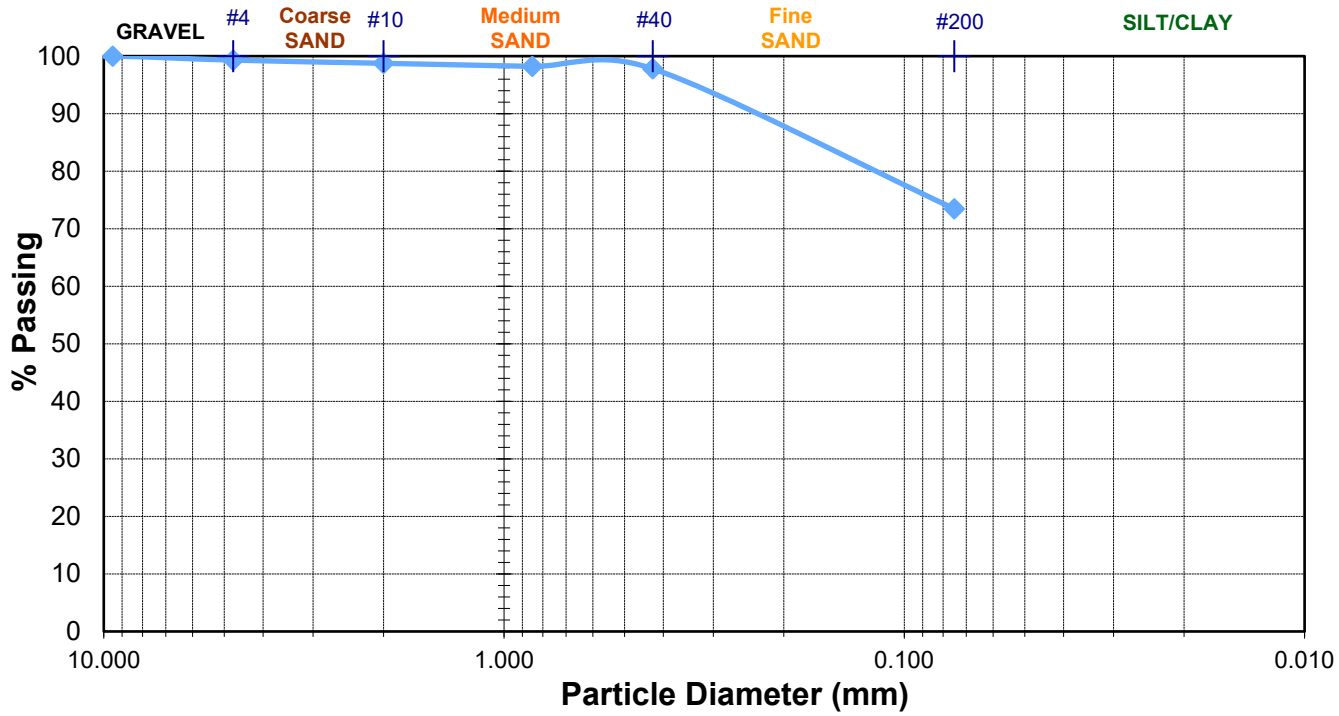
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/28/2022
Location:	Test Pit - 2	**Checked By:**	BMW	**Date:**	12/28/2022
Sample Type:	Grab	**Test Number:**	02422-02		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Sandy Silt (ML)

Weight of Container (g): 16.3 **Weight of Container & Soil (g):** 507.8

Weight of Dry Sample (g): 491.5

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.4	780.4	0.0	0.0	100.0
3/8 in	9.500	740.0	740.0	0.0	0.0	100.0
#4	4.750	756.0	759.4	3.4	0.7	99.3
#10	2.000	686.3	689.0	2.7	0.5	98.8
#20	0.850	617.0	619.6	2.6	0.5	98.2
#40	0.425	560.0	562.1	2.1	0.4	97.8
#200	0.075	515.4	635.0	119.6	24.3	73.5
Pan		484.6	845.7	361.1	73.5	0.0
			TOTAL:	**491.5**	**100.0**	



Grain Size Distribution Curve Results:

% Gravel:	0.7	**D_{10}:**	0.0005	**C_u:**	54.0
% Sand:	25.8	**D_{30}:**	0.0015	**C_c:**	0.2
% Fines:	73.5	**D_{60}:**	0.027		

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Sieve Analysis Data Sheet

ASTM D422-63(2007)

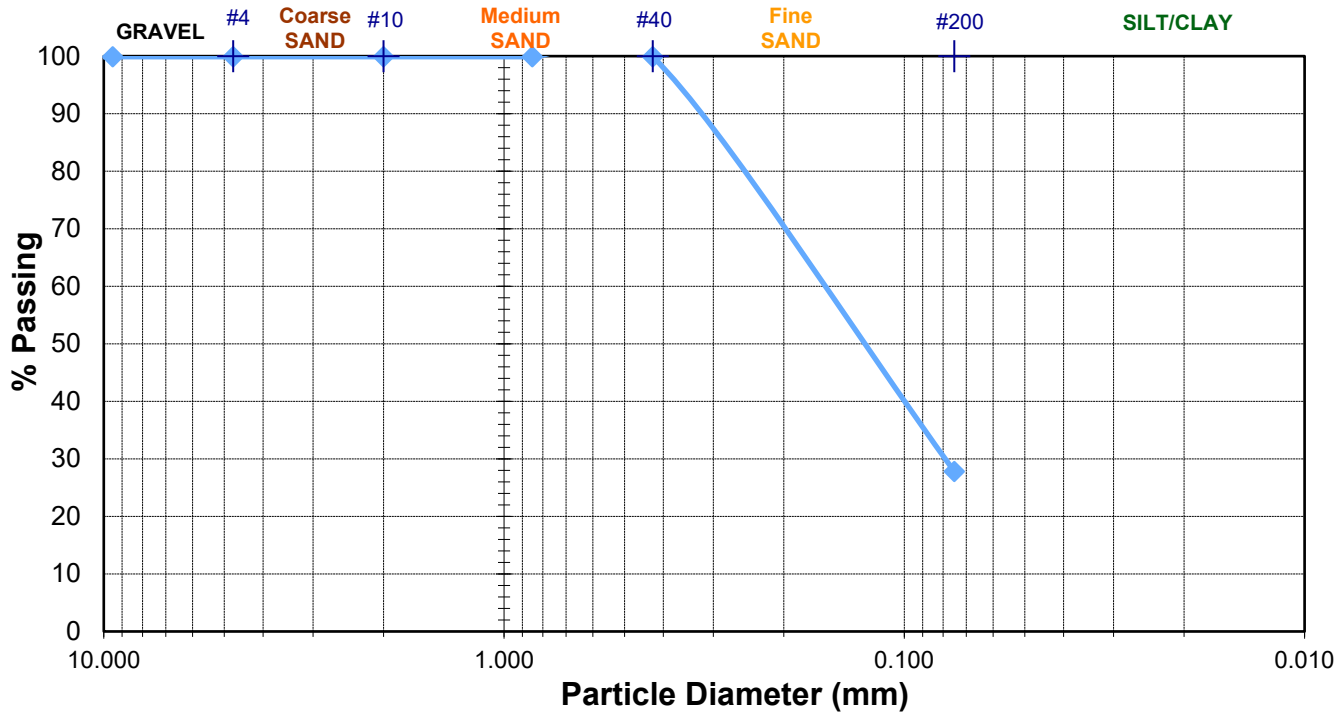
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/28/2022
Location:	Test Pit - 3	**Checked By:**	BMW	**Date:**	12/28/2022
Sample Type:	Grab	**Test Number:**	02422-03		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Sitly Sand (SM)

Weight of Container (g): 14.1 **Weight of Container & Soil (g):** 406.0

Weight of Dry Sample (g): 391.9

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.3	780.5	0.2	0.1	99.9
3/8 in	9.500	739.7	739.9	0.2	0.1	99.9
#4	4.750	756.0	756.0	0.0	0.0	99.9
#10	2.000	685.9	685.9	0.0	0.0	99.9
#20	0.850	617.1	617.1	0.0	0.0	99.9
#40	0.425	560.1	560.1	0.0	0.0	99.9
#200	0.075	515.5	798.0	282.5	72.1	27.8
Pan		485.1	594.4	109.3	27.9	-0.1
			TOTAL:	**392.2**	**100.1**	



Grain Size Distribution Curve Results:

% Gravel:	0.1	**D_{10}:**	0.048	**C_u:**	3.8
% Sand:	72.1	**D_{30}:**	0.08	**C_c:**	0.7
% Fines:	27.8	**D_{60}:**	0.18		

TERRA-GEO

Sieve Analysis Data Sheet

ASTM D422-63(2007)

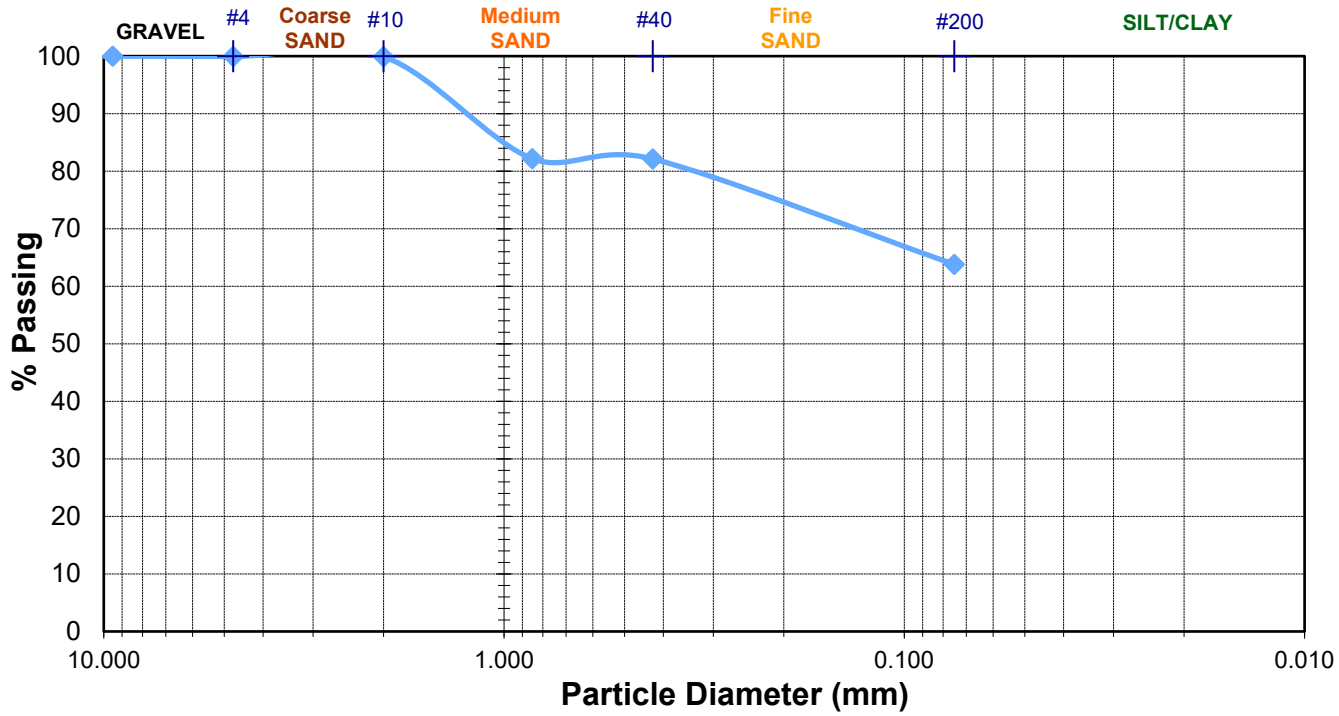
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/29/2022
Location:	Test Pit - 4	**Checked By:**	BMW	**Date:**	12/29/2022
Sample Type:	Grab	**Test Number:**	02422-04		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Sandy Silt (ML)

Weight of Container (g): 16.4 **Weight of Container & Soil (g):** 581.7

Weight of Dry Sample (g): 565.3

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.5	780.5	0.0	0.0	100.0
3/8 in	9.500	739.9	739.9	0.0	0.0	100.0
#4	4.750	756.0	756.3	0.3	0.1	99.9
#10	2.000	686.1	686.3	0.2	0.0	99.9
#20	0.850	617.0	717.2	100.2	17.7	82.2
#40	0.425	560.0	560.3	0.3	0.1	82.1
#200	0.075	515.4	619.0	103.6	18.3	63.8
Pan		484.6	848.5	363.9	64.4	-0.6
			TOTAL:	**568.5**	**100.6**	



Grain Size Distribution Curve Results:

% Gravel:	0.1	**D_{10}:**	0.0015	**C_u:**	53.3
% Sand:	36.1	**D_{30}:**	0.0044	**C_c:**	0.2
% Fines:	63.8	**D_{60}:**	0.08		

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Sieve Analysis Data Sheet

ASTM D422-63(2007)

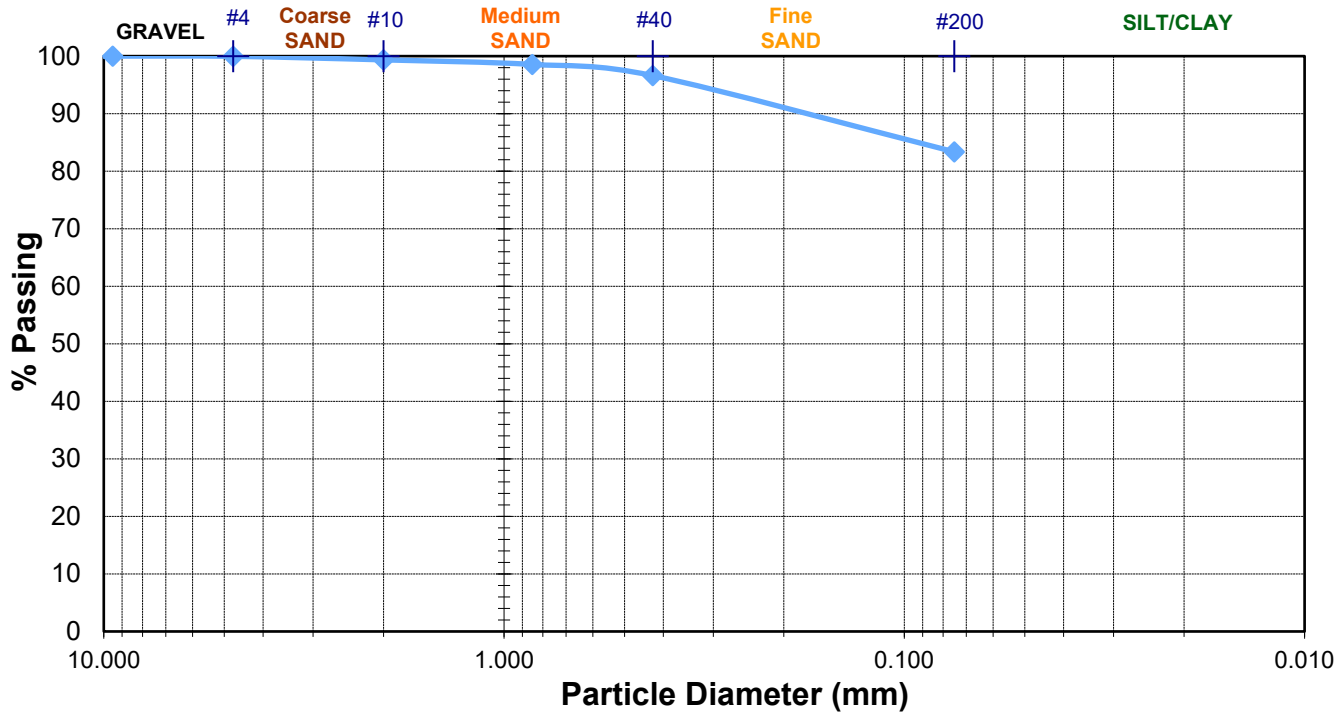
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/29/2022
Location:	Test Pit - 5	**Checked By:**	BMW	**Date:**	12/29/2022
Sample Type:	Grab	**Test Number:**	02422-05		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Sandy Silt (ML)

Weight of Container (g): 14.1 **Weight of Container & Soil (g):** 354.4

Weight of Dry Sample (g): 340.3

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.5	780.5	0.0	0.0	100.0
3/8 in	9.500	780.5	780.5	0.0	0.0	100.0
#4	4.750	739.9	740.0	0.1	0.0	100.0
#10	2.000	755.8	757.9	2.1	0.6	99.4
#20	0.850	617.4	620.1	2.7	0.8	98.6
#40	0.425	560.2	566.8	6.6	1.9	96.6
#200	0.075	516.3	561.4	45.1	13.3	83.4
Pan		485.0	765.1	280.1	82.3	1.1
			TOTAL:	**336.7**	**98.9**	



Grain Size Distribution Curve Results:

% Gravel:	0.0	**D_{10}:**	0.001	**C_u:**	8.0
% Sand:	16.6	**D_{30}:**	0.004	**C_c:**	2.0
% Fines:	83.4	**D_{60}:**	0.008		

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Sieve Analysis Data Sheet

ASTM D422-63(2007)

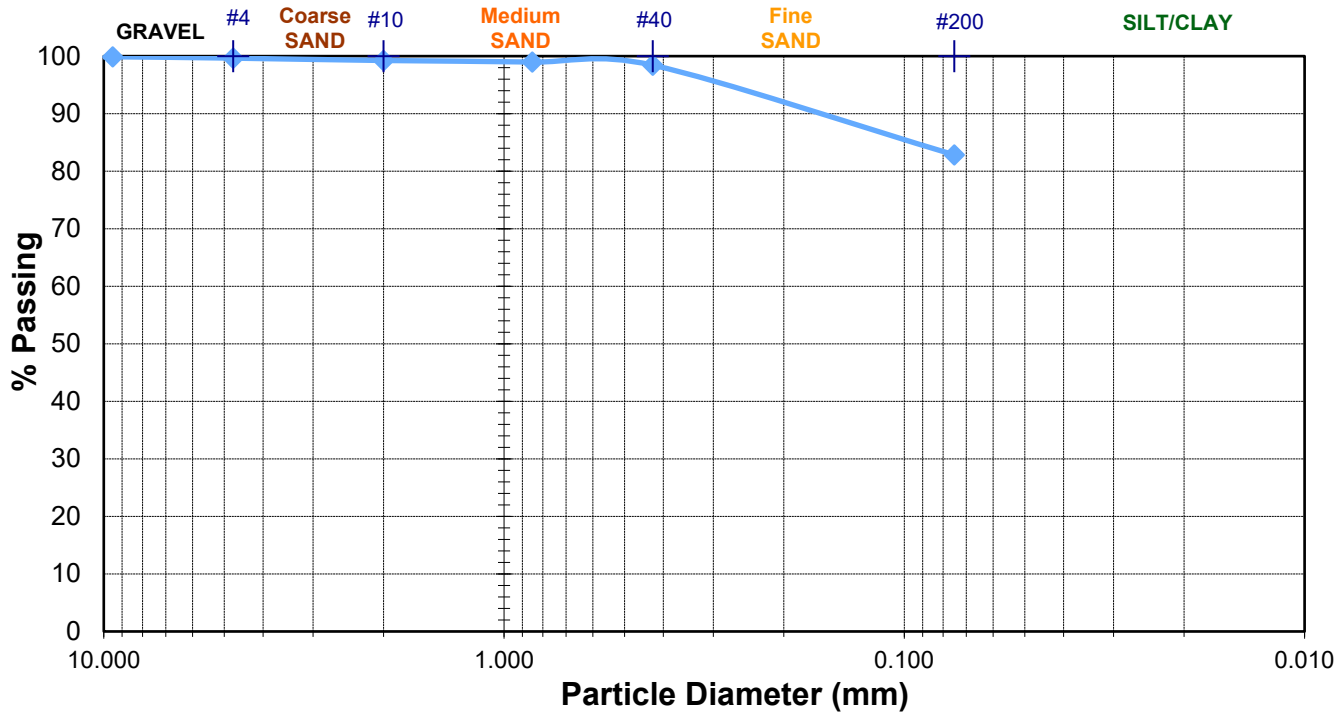
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/29/2022
Location:	Test Pit - 6	**Checked By:**	BMW	**Date:**	12/29/2022
Sample Type:	Grab	**Test Number:**	02422-06		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Sandy Silt (ML)

Weight of Container (g): 17.1 **Weight of Container & Soil (g):** 359.8

Weight of Dry Sample (g): 342.7

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.5	780.5	0.0	0.0	100.0
3/8 in	9.500	739.9	740.3	0.4	0.1	99.9
#4	4.750	756.1	756.9	0.8	0.2	99.6
#10	2.000	685.9	687.3	1.4	0.4	99.2
#20	0.850	617.1	618.0	0.9	0.3	99.0
#40	0.425	560.1	562.0	1.9	0.6	98.4
#200	0.075	515.3	568.7	53.4	15.6	82.8
Pan		485.2	771.8	286.6	83.6	-0.8
			TOTAL:	**345.4**	**100.8**	



Grain Size Distribution Curve Results:

% Gravel:	0.4	**D_{10}:**	0.001	**C_u:**	8.0
% Sand:	16.8	**D_{30}:**	0.004	**C_c:**	2.0
% Fines:	82.8	**D_{60}:**	0.008		

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Sieve Analysis Data Sheet

ASTM D422-63(2007)

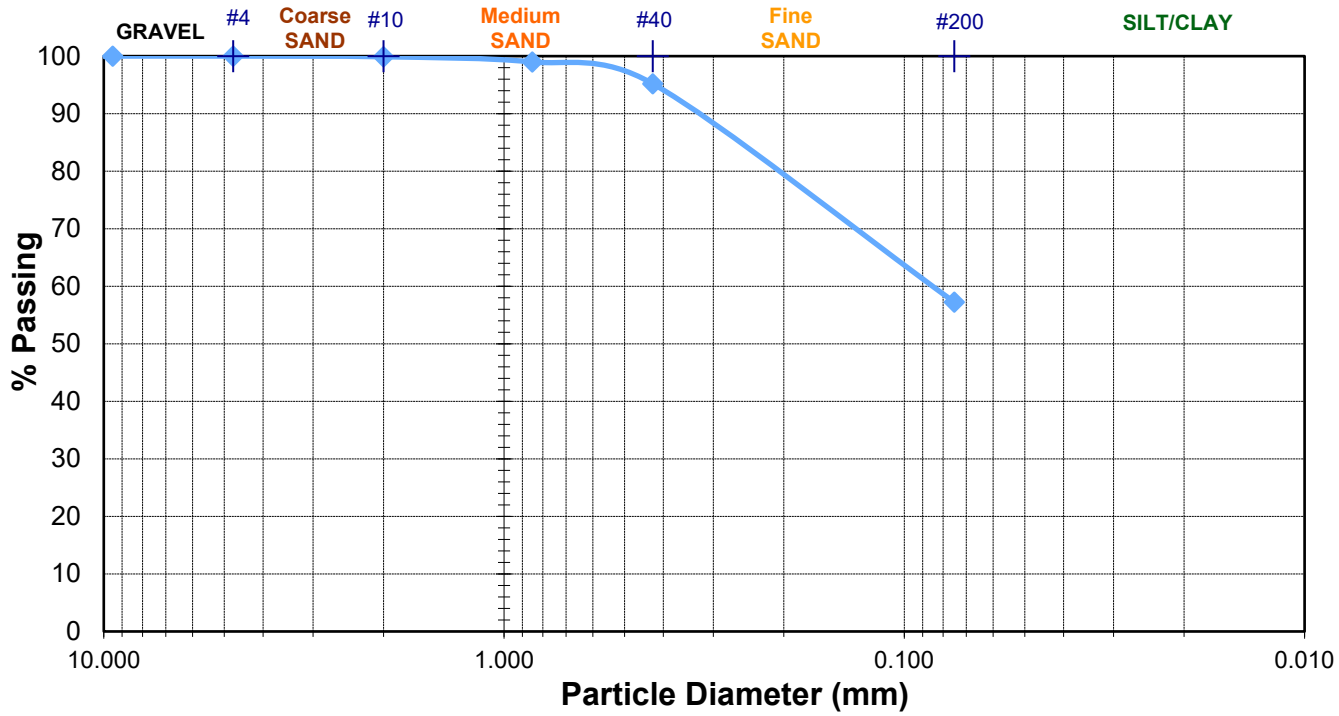
Project Name:	Goldeneye BESS	**Tested By:**	SMW	**Date:**	12/29/2022
Location:	Test Pit - 7	**Checked By:**	BMW	**Date:**	12/29/2022
Sample Type:	Grab	**Test Number:**	02422-07		
Sample Depth:	3-4 feet	**Gnd Elev.:**			

USCS Soil Classification: Sandy Silt (ML)

Weight of Container (g): 15.7 **Weight of Container & Soil (g):** 459.9

Weight of Dry Sample (g): 444.2

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
3/4 in	19.000	780.5	780.5	0.0	0.0	100.0
3/8 in	9.500	739.9	739.9	0.0	0.0	100.0
#4	4.750	756.1	756.1	0.0	0.0	100.0
#10	2.000	686.5	687.0	0.5	0.1	99.9
#20	0.850	617.6	621.6	4.0	0.9	99.0
#40	0.425	560.3	577.1	16.8	3.8	95.2
#200	0.075	515.5	684.1	168.6	38.0	57.2
Pan		485.2	739.8	254.6	57.3	-0.1
			TOTAL:	**444.5**	**100.1**	



Grain Size Distribution Curve Results:

% Gravel:	0.0	**D_{10}:**	0.008	**C_u:**	106.3
% Sand:	42.8	**D_{30}:**	0.018	**C_c:**	0.0
% Fines:	57.2	**D_{60}:**	0.85		

TERRA-GEO

APPENDIX C – HAZEN INFILTRATION CALCULATIONS

Hazen Formula TP-1

$k = C_H D_{10}^2$

where:

k = hydraulic conductivity, cm/s

D_{10} = diameter at which 10 percent of soils is finer, mm

C_H - an emperical coefficient

k=	1E-07	cm/s
k=	0.00000	in/min
k=	423333.3	min/in
k=	1.42E-04	in/hr

D(10)=	0.001	mm
D(30)=	0.01	mm
D(60)=	0.53	mm
D(90)=	0.28	mm
#200 Fines:	67	percent
C_H=	0.1	

Very fine sand, well graded 0.40 - 0.80
Fine sand with appreciable fines 0.40 - 0.80
Medium Sand, poorly graded 0.80 - 1.20
Coarse Sand, well graded 0.80 - 1.20
Coarse Sand, poorly graded, clean 1.2 - 1.5

Hazen Formula TP-2

$k = C_H D_{10}^2$

where:

k = hydraulic conductivity, cm/s

D_{10} = diameter at which 10 percent of soils is finer, mm

C_H - an emperical coefficient

k=	2.5E-08	cm/s
k=	0.00000	in/min
k=	1693333	min/in
k=	3.54E-05	in/hr

D(10)=	0.0005	mm
D(30)=	0.0015	mm
D(60)=	0.027	mm
D(90)=	0.21	mm
#200 Fines:	73.46897	percent
C_H=	0.1	

Very fine sand, well graded 0.40 - 0.80
Fine sand with appreciable fines 0.40 - 0.80
Medium Sand, poorly graded 0.80 - 1.20
Coarse Sand, well graded 0.80 - 1.20
Coarse Sand, poorly graded, clean 1.2 - 1.5

Hazen Formula TP-3

$k = C_H D_{10}^2$

where:

k = hydraulic conductivity, cm/s

D_{10} = diameter at which 10 percent of soils is finer, mm

C_H - an emperical coefficient

k=	0.000922	cm/s
k=	0.02177	in/min
k=	45.93461	min/in
k=	1.306205	in/hr

D(10)=	0.048	mm
D(30)=	0.08	mm
D(60)=	0.18	mm
D(90)=	0.31	mm
#200 Fines:	27.8	percent
C_H=	0.4	

Very fine sand, well graded 0.40 - 0.80
Fine sand with appreciable fines 0.40 - 0.80
Medium Sand, poorly graded 0.80 - 1.20
Coarse Sand, well graded 0.80 - 1.20
Coarse Sand, poorly graded, clean 1.2 - 1.5

Hazen Formula TP-4

$k = C_H D_{10}^2$

where:

k = hydraulic conductivity, cm/s

D_{10} = diameter at which 10 percent of soils is finer, mm

C_H - an emperical coefficient

k=	1E-07	cm/s
k=	0.00000	in/min
k=	423333.3	min/in
k=	1.42E-04	in/hr

D(10)=	0.001	mm
D(30)=	0.004	mm
D(60)=	0.008	mm
D(90)=	1.2	mm
#200 Fines:	63.8	percent
C_H=	0.1	

Very fine sand, well graded 0.40 - 0.80
Fine sand with appreciable fines 0.40 - 0.80
Medium Sand, poorly graded 0.80 - 1.20
Coarse Sand, well graded 0.80 - 1.20
Coarse Sand, poorly graded, clean 1.2 - 1.5

Hazen Formula TP-5

$k = C_H D_{10}^2$

where:

k = hydraulic conductivity, cm/s

D_{10} = diameter at which 10 percent of soils is finer, mm

C_H - an emperical coefficient

k=	2.25E-07	cm/s
k=	0.00001	in/min
k=	188148.1	min/in
k=	3.19E-04	in/hr

D(10)=	0.0015	mm
D(30)=	0.0044	mm
D(60)=	0.08	mm
D(90)=	1.2	mm
#200 Fines:	63.8	percent
C_H=	0.1	

Very fine sand, well graded 0.40 - 0.80
Fine sand with appreciable fines 0.40 - 0.80
Medium Sand, poorly graded 0.80 - 1.20
Coarse Sand, well graded 0.80 - 1.20
Coarse Sand, poorly graded, clean 1.2 - 1.5

Hazen Formula TP-6

$k = C_H D_{10}^2$

where:

k = hydraulic conductivity, cm/s

D_{10} = diameter at which 10 percent of soils is finer, mm

C_H - an emperical coefficient

k=	1E-07	cm/s
k=	0.00000	in/min
k=	423333.3	min/in
k=	1.42E-04	in/hr

D(10)=	0.001	mm
D(30)=	0.004	mm
D(60)=	0.008	mm
D(90)=	0.16	mm
#200 Fines:	82.8	percent
C_H=	0.1	

Very fine sand, well graded 0.40 - 0.80
Fine sand with appreciable fines 0.40 - 0.80
Medium Sand, poorly graded 0.80 - 1.20
Coarse Sand, well graded 0.80 - 1.20
Coarse Sand, poorly graded, clean 1.2 - 1.5

Hazen Formula TP-7

$k = C_H D_{10}^2$

where:

k = hydraulic conductivity, cm/s

D_{10} = diameter at which 10 percent of soils is finer, mm

C_H - an emperical coefficient

k=	6.4E-06	cm/s
k=	0.00015	in/min
k=	6614.583	min/in
k=	9.07E-03	in/hr

D(10)=	0.008	mm
D(30)=	0.018	mm
D(60)=	0.85	mm
D(90)=	0.32	mm
#200 Fines:	57.2	percent
C_H=	0.1	

Very fine sand, well graded 0.40 - 0.80
Fine sand with appreciable fines 0.40 - 0.80
Medium Sand, poorly graded 0.80 - 1.20
Coarse Sand, well graded 0.80 - 1.20
Coarse Sand, poorly graded, clean 1.2 - 1.5