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GEOTECHNICAL ENGINEERING EVALUATION

City of Mukilteo Decant Facility

4206 78th Street SW
Mukilteo, Washington

Prepared for: Mr. Kenneth Nilsen, Vice President
PACE Engineers, Inc.

Project No. 170419 • May 25, 2018

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Aspect CONSULTING

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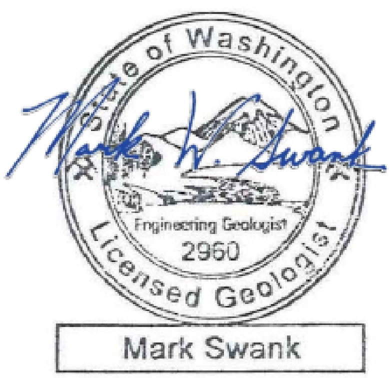

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1 Introduction

1.1 General

This report summarizes Aspect Consulting, LLC's (Aspect) geotechnical engineering evaluation for the property located at 4206 78th Street SW, in Mukilteo, Washington (Site). We performed our services in accordance with our agreed-upon scope of work and signed contract dated March 19, 2018. The Site location is shown on Figure 1, Site Location Map.

1.2 Scope of Services

Our scope of services included a literature review, Site reconnaissance, subsurface explorations, and geotechnical engineering evaluations. This report includes:

- Site and project descriptions.
- Distribution and characteristics of shallow subsurface soils and groundwater, based on three borings and one test pit.
- Exploration logs and a Site plan showing approximate exploration locations.
- Groundwater conditions, flow, and drainage considerations.
- Infiltration test results and stormwater management considerations.
- Seismic design criteria in accordance with the current International Building Code (IBC) with State of Washington amendments.
- Suitable foundation types and associated design considerations.
- Site preparation recommendations and general construction recommendations.

1.3 Project Description

Aspect has been requested by the PACE Engineers, Inc. (herein referred to as the Client) to complete a geotechnical evaluation of the Site for use in developing the property for a decant facility. Table 1 provides current development and Site information, based on the Proposed Site Plan (SP1) dated February 14, 2018.

Table 1. Summary of Project Plans and Site Information

Detail	Description
Site Layout	Property is an approximately 4.9-acre, rectangular-shaped lot (Snohomish County Parcel 28041000302100) located on the south side of 78th Street SW. The Site is currently one of the City of Mukilteo's Public Works maintenance and storage yards. (Figure 2, Site Exploration Map).
Structures and Site Plans	Development plans consist of a decant facility, material storage bays, retaining walls up to 14 feet high, and may include an infiltration swale. The proposed decant facility will have a footprint of approximately 13,000 square feet (ft^2) with a 14-foot-tall cast-in-place retaining wall on the west side, situated along the south property line. The material storage bays will be constructed along the west property line and have an approximate footprint of 7,500 ft^2 with 6-foot-tall ecology-block retaining walls on the north and south ends. The remainder of the Site will be primarily gravel lot or paved asphalt.
Site Grading	The building will be cut into the slope on its west and south sides with the retained height tapering down to the south. We anticipate fills of less than a few feet throughout the Site.

2 Site Conditions

2.1 Site Description

The Site is currently one of the City of Mukilteo's Public Works maintenance and storage yards that includes wetlands, a detention pond, vehicle garages, main administration building, and existing gravel and material storage areas. The property is bounded to the north by a 78th Street SW and to the south by 80th Street SW.

The Site groundcover is primarily a gravel and asphalt-paved lot with shrubs, grasses and trees in the southwestern corner. The northeast approximately 1.2 acres is heavily vegetated with small trees and shrubs.

The ground surface is relatively flat with elevations (EL, NAVD88) between approximately EL 559 feet and EL 561 over most of the Site. The northeast portion of the Site is a shallow depression, and the southwest and southern property boundary, where the new building will be constructed, is a mound with a peak at approximately EL 575.

2.2 Geologic Setting

2.2.1 Geology

Based on our review of the geology map (Minard, 1982), the Site is underlain by Quaternary Vashon till (Qvt). Vashon till mostly mantles upland surfaces and crops out in road cuts, pits, and valley sides, either as the topmost unit or beneath recessional outwash and associated deposits. The Vashon till is a nonsorted mixture of clay, silt, sand, pebbles, cobbles, and boulders (diamicton), all in variable amounts. Distinctive features of the Vashon till are its compactness, the vertical slopes it maintains, a fissility or sheeting developed near and parallel to the ground surface, and its heterogeneous internal structure that resembles a concrete mix.

In addition, the near-surface soils in the vicinity of the development also consist of loose to very dense silty SAND (SM) with variable amounts of gravel and cobbles, as shown in a geotechnical report (Landau, 1998) prepared for the City of Mukilteo Public Works (PW) Department for the Site.

2.2.2 Faults and Seismicity

The Site area is located within the Puget Lowland physiographic province, an area of active seismicity that is subject to earthquakes on shallow crustal faults and deeper subduction zone earthquakes. The Site area lies within the Southern Whidbey Island fault zone (Sherrod et al., 2008) with the nearest trace 0.8 miles to the southwest. The Southern Whidbey Island fault zone consists of shallow crustal tectonic structures that are considered active (evidence for movement within the Holocene [since about 15,000 years ago]). The recurrence interval of earthquakes on this fault zone is believed to be on the order of 500 years or more. Based on paleoseismologic investigations, the southern Whidbey Island fault had at least four earthquakes since deglaciation (Sherrod et al., 2008). There are also several other shallow crustal faults in the region capable of producing earthquakes and strong ground shaking.

The Site area also lies within the zone of strong ground shaking from earthquakes associated with the Cascadia Subduction Zone (CSZ). Subduction-zone earthquakes occur due to rupture between the subducting oceanic plate and the overlying continental plate. The CSZ can produce earthquakes up to magnitude 9.3, and the recurrence interval is thought to be on the order of about 500 years. A recent study estimates the most recent subduction zone earthquake occurred on January 26, 1700 (Atwater et al., 2015).

Deep intraslab earthquakes that occur from tensional rupture of the sinking oceanic plate are also associated with the CSZ. An example of this type of seismicity is the 2001 Nisqually earthquake. Deep intraslab earthquakes typically are magnitude 7.5 or less and occur approximately every 10 to 30 years.

2.3 Subsurface Conditions

2.3.1 Subsurface Explorations

Subsurface conditions were explored by drilling three borings, designated as B-01 through B-03 on April 13, 2018, and excavating a test pit, designated as TP-1 on March 21, 2018, in the locations shown on Figure 2. The borings were advanced to between 10.3 to 21.3 feet below ground surface (bgs) by Boretec1, Inc., with a Volvo EC55 track rig using 6.25-inch-outside-diameter hollow-stem augers (HSA). The test pit was excavated to 8.25 feet bgs by City of Mukilteo PW with a Deere 50G trackhoe equipped with a toothed, 2-foot-wide bucket.

The explorations were logged and representative samples were collected by a member of the Aspect geotechnical engineering staff. Exploration logs summarizing the subsurface conditions are presented in Appendix A. Observations and tests were performed in general accordance with ASTM International (ASTM) D2488, *Standard Practice for Description and Identification of Soils* (Visual-Manual Procedure; ASTM, 2017). The terminology used in the soil classifications and other modifiers are defined and presented on the attached Figure A-1 included in Appendix A.

2.3.2 Soils

The summary of the subsurface units below the existing ground surface encountered in the borings are as follows:

PAVEMENT AND FILL	The three borings were drilled through the 2- to 3-inch-thick paved asphalt lot. Two to three feet of silty SAND (SM) and silty GRAVEL (GM) fill was encountered underlying the asphalt in the borings, and from the ground surface in TP-1. The relative density of the fill was loose to medium dense in the borings and very dense in the test pit.
QUATERNARY VASHON TILL (Qvt)	Vashon till was encountered below the fill. The deposits consist of silty SAND (SM) with gravel and silty SAND (SM) without gravel to at least 21.5 feet bgs. The relative density was dense to very dense with N-values between 35 and greater 100 blows per foot (bpf)[1].

[1] ASTM D1586 method described in Appendix A.

2.3.3 Groundwater

Groundwater seeps were observed at 2.5 and at 10 feet bgs in test TP-1 and in boring B-2, respectively, during the field exploration. The seeps are likely zones of perched groundwater. Groundwater depths will fluctuate due to variations in rainfall, river levels, irrigation, and the season.

2.4 Site Soil Infiltration

2.4.1 Soil Infiltration Test

Field infiltration testing was completed in general accordance with the small-scale pilot infiltration test (PIT) methods described in the *2014 Stormwater Management Manual for Western Washington (SMMWW)* (Washington State Department of Ecology [Ecology], 2012, revision 2014). The PIT was excavated to the approximate proposed receptor depth for the stormwater system being considered, filled with water from a hose, soaked/saturated, and then a constant-head test was performed.

The PIT was performed in TP-1 at a depth of 8.25 feet bgs and dimensions of 2.2 by 5.5 feet (~12 ft^2). After the initial presoak period, we filled the PIT to an initial head of 12-inches and measured the rate of inflow needed to maintain a constant head. Due to the low infiltration rates, no water needed to be added during the test; therefore, the average infiltration rate should be assumed to be less than 0.01 feet/hour through the dense to very dense silty SAND (SM) (refer to TP-1 log in Appendix A.

This infiltration rate is not a permeability or hydraulic conductivity, but is based on field measurements and does not include correction factors related to long-term infiltration rates. We recommend the designer include correction factors to account for the expected level of maintenance, type of test performed, type of system, and sediment control. Our current understanding is that regularly scheduled maintenance will be provided to maintain the system, and sedimentation/filtering will occur prior to stormwater entering the new system.

3 Conclusions and Recommendations

3.1 General

Based on our geotechnical evaluation of the Site, including data review, Site reconnaissance, subsurface explorations, and laboratory testing, the following key findings and conclusions should be included in evaluating the Site:

- The shallow subsurface conditions consist of 2 to 3 feet of fill overlying Vashon till consisting of dense to very dense silty SAND (SM).
- Shallow spread footings are an appropriate foundation type for the building.
- Groundwater is not anticipated within these excavation depths though perched groundwater may be encountered.
- Stormwater infiltration rates are low and may be infeasible.

Although final grading plans had not been completed at the time of this report, we anticipate cuts and fills will generally be less than 2 feet over most of the Site, with up to 8 feet of cut in the southwestern area of the building. From a geotechnical perspective, earthwork excavation using conventional equipment will be feasible during construction though potentially difficult digging may be encountered within the Vashon till.

3.2 Seismic Design

3.2.1 Seismic Design Criteria

It is anticipated that seismic design of structures will conform with the 2015 International Building Code (IBC) and the American Society of Civil Engineers (ASCE) 7-10, *Minimum Design Loads for Buildings and Other Structures* (ASCE, 2013) with State of Washington amendments.

The IBC requires design for a “Maximum Considered Earthquake (MCE)” with a 2 percent probability of exceedance (PE) in 50 years (2,475-year return period; IBC, 2015). The U.S. Geological Survey (USGS) has completed probabilistic ground motion studies and maps for Washington (USGS, 2014).

Current IBC design methodologies express the effects of site-specific subsurface conditions on the ground motion response in terms of the “site class.” The site class can be correlated to the average standard penetration resistance (SPT) or shear wave velocity in the upper 100 feet of the soil profile. Therefore, based on the results of our subsurface exploration program and using the 2015 IBC criteria, the Site can be characterized by Seismic Site Class C.

Based on the Site’s latitude and longitude (47.92642°N, 122.2914°W), the code-based seismic design criteria, in accordance with the 2015 IBC, are summarized in Table 2.

Table 2. 2015 IBC Seismic Design Parameters

Parameter	Short Period	1 Second
Maximum Credible Earthquake Spectral Acceleration	S_s = 1.45 g	S_1 = 0.57 g
Site Class	C	
Site Coefficient	F_a = 1.0	F_v = 1.3
Adjusted Spectral Acceleration	S_{MS} = 1.45 g	S_{M1} = 0.73 g
Design Spectral Response Acceleration Parameters	S_{DS} = 0.97 g	S_{D1} = 0.49 g
Design Spectral Peak Ground Acceleration	0.618 g	

Notes: g = acceleration due to gravity

3.2.2 Liquefaction

Liquefaction is defined as a decrease in stiffness and shear strength of relatively loose, saturated, cohesionless soil (i.e., sand) or low plasticity silt soils, due to the buildup of excess pore-water pressures generated during an earthquake. This results in a temporary transformation of a soil deposit into a viscous fluid. The temporary loss of soil shear strength brought on during soil liquefaction can cause bearing capacity failure and permanent ground deformation. The Site is mapped as having “very low” susceptibility to liquefaction (Palmer et al., 2004), which is supported by the subsurface conditions encountered in our borings and test pit.

3.2.3 Other Seismic Hazards

The general topography of the Site is relatively flat, the nearest fault trace is approximately 0.8 miles away, and it is not shown within the potential tsunami zone. Therefore, earthquake-induced landslides, ground fault rupture, and inundation are not considered significant hazards.

3.3 Foundation Design

3.3.1 Shallow Foundations

The proposed decant facility can be supported on spread footings bearing on undisturbed, dense to very dense Vashon till. The exposed subgrade surface of all footings should be evaluated by a qualified geotechnical engineer. Design parameters are provided in Table 3.

Table 3. Spread Footing Foundation Design Recommendations[1]

Design Item	Design Information
Structures	Decant Facility
Bearing Material	Undisturbed, dense to very dense Vashon till (Qvt)
Allowable Bearing Pressure[1,2]	5.0 ksf
Minimum Embedment Depth[3]	18 inches
Total Estimated Settlement Differential Settlement	Less than 1 inch Less than 0.5 inches between adjacent footings

Notes: [1] Designs are based on the subsurface conditions encountered in the explorations and assumes the recommendations in the Construction Considerations Section will be adhered to.

[2] Allowable bearing pressure assumes spread or strip footings with minimum footing width of 24 inches.

[3] The recommended allowable bearing pressure applies to the total of dead plus long-term-live loads. Allowable bearing pressures may be increased by one-third (⅓) for seismic and wind loads.

For use in design, an ultimate coefficient of friction of 0.50 may be assumed along the interface between the base of a cast-in-place concrete footing and undisturbed Vashon till subgrade. An ultimate passive earth pressure of 550 pounds per cubic foot (pcf) may be assumed for undisturbed Vashon till adjacent to below-grade elements. The recommended coefficient of friction and passive pressure values are ultimate values that do not include a safety factor. We recommend applying a factor of safety of at least 1.5 in design for determining allowable values for coefficient of friction and passive pressure.

3.3.1.1 Floor Slabs and Modulus of Subgrade Reaction

Concrete slabs-on-grade should be designed in accordance with the American Concrete Institute (ACI) Committee's *360R-10 Guide to Design of Slabs-on-Ground* (ACI, 2010). For slabs that are designed as beam-on-elastic foundation, a modulus of vertical subgrade reaction of 250 pounds per cubic inch may be utilized. Satisfactory support for building floor slabs can be obtained from the Vashon till subgrade prepared in accordance with our recommendations presented in the Site Preparation and/or Wet-Weather/Wet-Soil Conditions sections of this report. A minimum 6-inch-thick layer of imported granular material should be placed and compacted over the prepared subgrade. Imported granular material should be composed of crushed rock or crushed gravel that is relatively well-graded between coarse and fine, contains no deleterious materials, has a maximum particle size of 1 inch, and has less than 5 percent by dry weight passing the U.S. Standard No. 200 Sieve.

3.4 Embedded Building Walls

Yielding walls, such as the embedded retaining walls along the west and south sides of the proposed building, should be designed using a lateral earth pressure based on an equivalent fluid having a unit weight of 35 pcf. Nonyielding walls, such as basement walls, should be designed using a lateral earth pressure based on an equivalent fluid having a unit weight of 55 pcf. For these earth pressure values to be used, a subsurface drain combined with a free draining wall backfill material that meets the gradation requirements described in Section 9 03.12(2) of the Washington State Department of Transportation (WSDOT) Standard Specifications for Gravel Backfill for Walls should be utilized. Refer to Drainage Considerations for subsurface drain recommendations.

The lateral seismic soil pressure for design of the retaining walls was derived using the Mononobe Okabe method. Taking into account the possible backfill soil properties, ground shaking representing the calculated PGA, and assuming a relatively flat backslope behind the retaining wall, the average lateral seismic soil pressure is equivalent to 14H (where H is the height of the wall). The lateral seismic soil pressure is represented by a uniform pressure distribution along the height of the wall.

Due to equipment access constraints, the subsurface conditions were not explored in the material that will be retained by the proposed walls. We anticipate the walls will retain primarily fill or Qvt deposits. However, Aspect should be present during the excavation to observe the exposed materials and confirm our assumptions above are correct. If the materials differ, Aspect can provide additional recommendations related to allowable cut slopes within the retained soils to facilitate forming and constructing the walls.

Overcompaction of the backfill behind walls should be avoided. In this regard, we recommend compacting the backfill to about 90 percent of the maximum dry density (MDD;ASTM D1557). Heavy compactors and large pieces of construction equipment should not operate within 5 feet of any embedded wall to avoid the buildup of excessive lateral pressures. Compaction close to the walls should be accomplished using hand-operated vibratory plate compactors.

Lateral forces that may be induced on the wall due to surcharge loads should be considered by the structural engineer.

3.5 Pavement Design

Traffic volume estimates and loading patterns were not provided at the time of this report. The following general pavement design recommendations are intended for planning purposes. In nonroadway parking areas, a pavement section consisting of 3 inches of hot mix asphalt (HMA) over 6 inches of CSBC would be appropriate. However, along access drives or in areas where heavy trucks may be traveling or turning at a tight radius, we recommend a minimum section of 4 inches of HMA over 8 inches of CSBC.

To provide for quality construction practices and materials, we recommend all pavement work and mix-design considerations conform to WSDOT standards.

4 Construction Considerations

4.1 General

Earthwork is typically most economical when performed under dry weather conditions. Appropriate erosion control measures should be implemented prior to beginning earthwork activities in accordance with the local regulations. In our opinion, excavation can generally be accomplished using standard excavation equipment. While not directly observed in our subsurface explorations, the presence of potential obstructions, such as small boulders in the Vashon till, or buried logs and other debris in the fill should be anticipated.

4.2 Site Preparation

Site preparation within the proposed construction footprint should include removal of fill and soils containing roots, organics, debris, and any other deleterious materials. The contractor must use care during Site preparation and excavation operations, so that any bearing surfaces are not disturbed. If disturbance does occur, the disturbed material should be removed to expose undisturbed material or be compacted in place to acceptable criteria as determined by the geotechnical engineer.

All foundation excavations should be trimmed neat and the bottom of the excavation should be carefully prepared. All loose or softened soil should be removed from the foundation excavation or compacted in place prior to placing reinforcing steel bars. We recommend that foundation excavations be observed by the geotechnical engineer prior to placing steel and concrete to verify the recommendations in this report have been followed.

The subgrade under the HMA pavement section areas should be prepared by scarifying, moisture conditioning, and recompacting a minimum of 12 inches below the bottom of the base course. Materials generated during earthwork should be transported off-Site or stockpiled in areas designated by the owner’s representative.

4.3 Proof rolling and Subgrade Verification

Following Site preparation, and prior to placing an aggregate base for the pavement sections, the exposed subgrade should be evaluated either by proof rolling or another method of subgrade verification. The subgrade should be proof rolled with a fully loaded dump truck or similar heavy, rubber-tire construction equipment to identify unsuitable areas. If evaluation of the subgrades occurs during wet conditions, or if proof rolling the subgrades will result in disturbance, they should be evaluated by Aspect using a steel foundation probe. We recommend that Aspect be retained to observe the proof rolling and perform the subgrade verifications. Unsuitable areas identified during the field evaluation should be compacted to a firm condition or be excavated and replaced with structural fill.

4.4 Wet-Weather Earthwork

If earthwork is to be performed or fill is to be placed in wet weather or under wet conditions, when soil moisture content is above optimum and difficult to control, the following recommendations apply:

- Earthwork should be performed in small areas to minimize exposure.
- Structural fill placed during wet weather should consist of material meeting the criteria for Gravel Borrow as specified in Section 9-03.14(1) of the WSDOT Standard Specifications (WSDOT, 2016).
- Excavation or the removal of unsuitable soils should be followed promptly by the placement and compaction of the specified structural fill.
- The size, type, and access of construction equipment used may have to be limited to prevent soil disturbance.
- The ground surface within the construction area should be graded to promote runoff of surface water away from the slopes and to prevent water ponding.
- The ground surface within the construction area should be properly covered and under no circumstances should be left uncompacted and/or exposed to moisture. Soils that become too wet for compaction should be removed and replaced with specified structural fill.
- Excavation and placement of fill should be observed by the geotechnical engineer to verify that all unsuitable materials are removed prior to placement, compaction requirements are met, and site drainage is appropriate.
- Erosion and sedimentation control should be implemented in accordance with best management practices (BMPs).

4.5 Excavations

4.5.1 General

The near-surface soils at the Site can be excavated with conventional earthwork equipment. Sloughing and caving should be anticipated in loose, noncohesive materials. Aspect should be retained to review the grading and utility plans when they become available for comparison with encountered field conditions; additional work may be required to better define the impact on the Project.

All excavations should be made in accordance with applicable Occupational Safety and Health Administration (OSHA) and State regulations. Maintenance of safe working conditions, including temporary excavation stability, is the sole responsibility of the contractor. All temporary cuts in excess of 4 feet in height that are not protected by trench boxes, or otherwise shored, should be sloped in accordance with Part N of Washington Administrative Code (WAC) 296-155 (WAC, 2009).

4.5.2 Trenches

Trench cuts should stand relatively vertical to a depth of approximately 4 feet bgs, provided no groundwater seepage is present in the trench walls. Open excavation techniques can typically be used in clay, silt, silty sand, and sandy silt soils, provided the excavation is configured in accordance with the OSHA requirements, groundwater seepage is not present, and with the understanding that some sloughing may occur. The trenches should be flattened if sloughing occurs or seepage is present. If shallow groundwater is observed during construction, use of a trench shield or other approved temporary shoring is recommended for cuts that extend below groundwater seepage, or if vertical walls are desired for cuts deeper than 4 feet bgs. If dewatering is used, we recommend that the type and design of the dewatering system be the responsibility of the contractor, who is in the best position to choose systems that fit the overall plan of operation.

4.5.3 Temporary and Permanent Slopes

With time and the presence of seepage and/or precipitation, the stability of temporary unsupported cut slopes can be significantly reduced. We recommend planning the construction schedule to have excavation occur during the summer months and to minimize the amount of time that the temporary slopes will be unsupported during construction. The contractor should monitor the stability of the temporary cut slopes and adjust the construction schedule and slope inclination accordingly. Vibrations created by traffic and construction equipment may cause caving and raveling of the face of the temporary slopes. At no time should soil stockpiles, equipment, and other loads be placed immediately adjacent to an excavation.

In general, shallow surface soils, such as topsoil and unconsolidated soils that will be subject to excavation and sloping on the Site classify as OSHA Soil Classification Type C. These soils are expected to fail at steep angles. Glacially consolidated soils, such as the unweathered Vashon till (Qvt), that will be subject to excavation on the Site classify as OSHA Soil Classification Type B. Temporary excavation side slopes (cut slopes) are anticipated to stand as steep as 1.5H:1V (Horizontal:Vertical) within the topsoil and weathered soils. Temporary excavation side slopes (cut slopes) are anticipated to stand as steep as 1H:1V within the unweathered Vashon till (Qvt). The cut slope inclinations estimated above are for planning purposes only and are applicable to excavations without inflowing perched groundwater or runoff.

Permanent slopes for the project should have a maximum inclination of 2H:1V. Access roads and pavements should be located at least 5 feet from the top of temporary slopes. Surface water runoff should be collected and directed away from slopes to prevent water from running down the face.

4.6 Structural Fill Material and Compaction

Structural fill, including CSBC, should be placed over subgrades that have been prepared in conformance with the Site Preparation and Wet-Weather Earthwork sections of this report, Sections 4.2 and 4.4, respectively. Source material may be derived from on-Site sources, or imported. The on-Site soils will likely contain oversized materials with fine contents above optimum moisture, but may be suitable for reuse on the project, provided the soil meets the material requirements described below and can be sufficiently screened. Soil derived from saturated excavations should be anticipated to be less suitable for use as fill due to elevated moisture contents.

General fill specifics are provided in Table 4.

Table 4. Fill Type and Compaction Requirements

Fill Type	WSDOT Specification Details	Lift Thickness[1] and Compaction Requirements[2]
On-Site Soil	N/A	8 to 12 inches Dependent on Application
Imported Granular Materials	WSDOT SS 9-03.14(2) – Select Borrow[3]	9 inches 95 percent
Crushed Aggregate Base	WSDOT SS 9-03.9(3) – Crushed Surfacing Top Course or Base Course	9 inches 95 percent
Retaining Walls	WSDOT SS 9 03.12(2) – Gravel Backfill for Walls	90 percent
Foundation Base Aggregate	WSDOT SS 9-03.12(1)A – Gravel Backfill for Foundations (Class A)	9 inches 95 percent
Trench Backfill	WSDOT SS 9-03.12(3) – Gravel Backfill for Pipe Zone Bedding[4]	9 inches 90 percent[7]
	WSDOT SS 9-03.19– Bank Run Gravel for Trench Backfill[5]	9 inches 92 percent[7] 9 inches 95 percent[8]
	WSDOT SS 9-03.14 – Borrow and WSDOT SS 9-03.15 – Native Material for Trench Backfill[6]	9 inches 90 percent[7]

Notes:

1. Maximum uncompacted thickness.
2. MDD, as determined by ASTM D1557.
3. Fraction passing the U.S. Standard No. 4 Sieve, less than 5 percent by dry weight should pass the U.S. Standard No. 200 Sieve.
4. Trench backfill placed beneath, adjacent to, and for at least 2 feet above utility lines (i.e., the pipe zone).
5. Within pavement areas or beneath building pads.
6. Outside of structural improvement areas (e.g., roadway alignments or building pads), trench backfill placed above the pipe zone.
7. Or per manufacturer/local building department.
8. Within 2 feet below pavement.

4.7 Ground Moisture

4.7.1 General

The perimeter ground surface and hard-scaping should be sloped to drain away from all structures and away from adjacent slopes. Gutters should be tightlined to a suitable discharge and maintained as free-flowing. Any crawl spaces should be adequately ventilated and sloped to drain to a suitable, exterior discharge.

4.7.2 Perimeter Footing Drains

Due to the potential for perched groundwater, we recommend perimeter foundation drains be installed around all proposed structures.

The foundation subdrainage system should include a minimum 4-inch-diameter perforated pipe in a drain rock envelope. A nonwoven geotextile filter fabric, such as Mirafi 140N or equivalent, should be used to completely wrap the drain rock envelope, separating it from the native soil and footing backfill materials. The invert of the perimeter drain lines should be placed approximately at the bottom of footing elevation. Also, the subdrainage system should be sealed at the ground surface. The perforated subdrainage pipe should be laid to drain by gravity into a nonperforated, solid pipe and finally connected to the Site drainage stem at a suitable location. Water from downspouts and surface water should be independently collected and routed to a storm sewer or other outlet. This water must not be allowed to enter the bearing soils.

5 Project Design and Construction Monitoring

At the time of this report, Site plans, Site grading, structural plans, and construction methods have not been finalized, and the recommendations presented herein are based on preliminary project information. If project developments result in changes to the assumptions made herein, we should be contacted to determine if our recommendations should be revised. We recommend that once design plans are fully developed, Aspect is consulted in order to verify that our recommendations were properly interpreted and applied.

This report is issued with the understanding that the information and recommendations contained herein will be brought to the attention of the appropriate design team personnel and incorporated into the project plans and specifications, and that the necessary steps will be taken to verify that the contractor and subcontractors carry out such recommendations in the field. We do not direct the contractor's operations, and we cannot be responsible for the safety of personnel other than our own on the Site; the safety of others is the responsibility of the contractor. The contractor should notify the property owner if he considers any of the recommended actions presented herein unsafe.

We are available to provide geotechnical engineering and monitoring services during construction. The integrity of the foundation depends on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent.

6 References

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7 Limitations

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

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

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

It is the Client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, and agents, are made aware of this report in its entirety. At the time of this report, design plans and construction methods have not been finalized, and the recommendations presented herein are based on preliminary project information. If project developments result in changes from the preliminary project information, Aspect should be contacted to determine if our recommendations contained in this report should be revised and/or expanded upon.

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

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

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

FIGURES

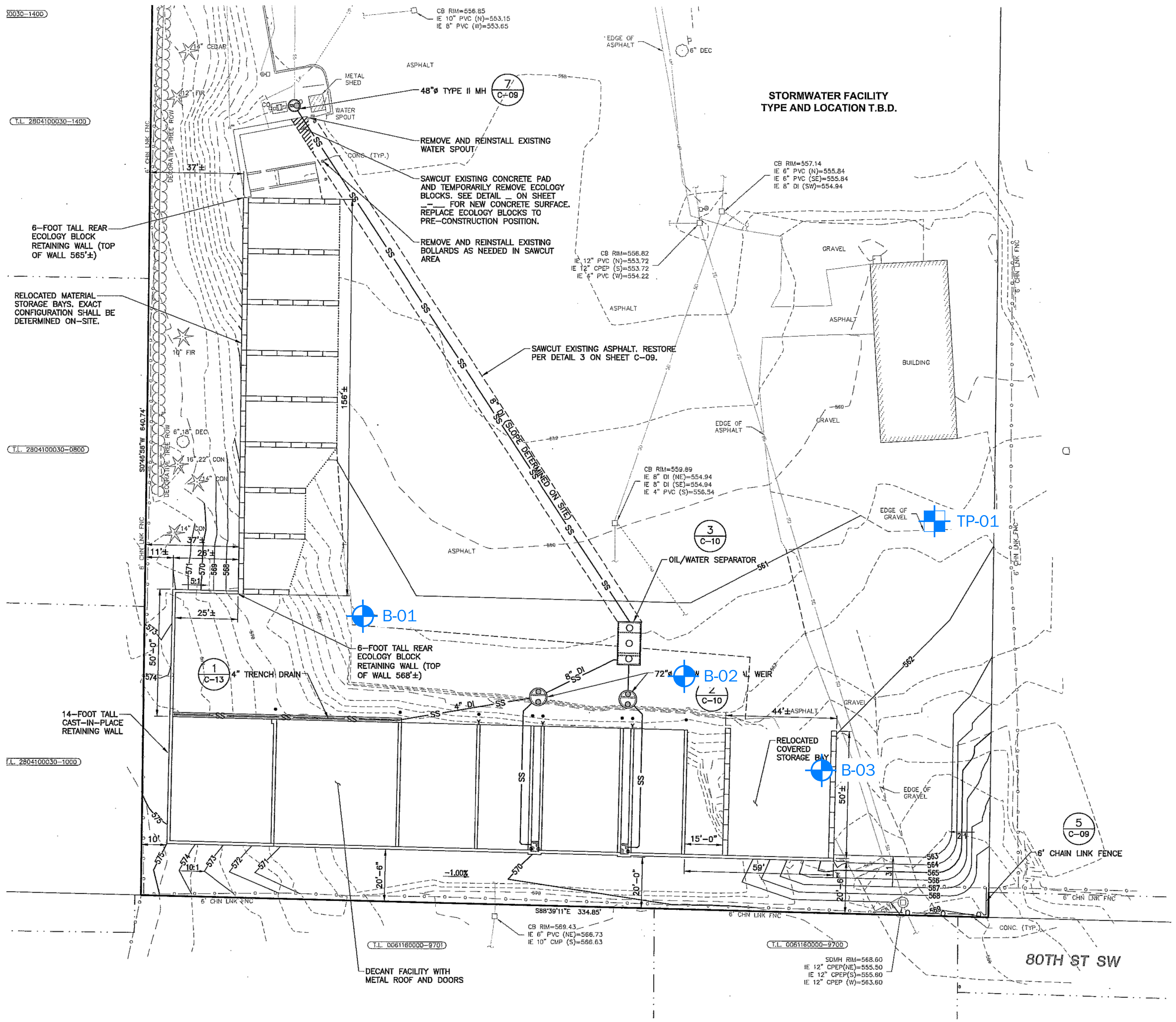
Site Location Map

Geotechnical Engineering Evaluation
City of Mukilteo Decant Facility
4206 78th Street SW
Mukilteo, Washington

Aspect CONSULTING	APR-2018	BY: JSJ / EAC	FIGURE NO.
	PROJECT NO. 170419	REVISED BY: - - -	1

GIS Path: T:\projects_8\MukilteoDecantFacility_170419\Delivered\01 Site Location Map.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 4/26/2018 || User: ecrumbaker || Print Date: 4/26/2018

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



Source: Base map provided by PACE Engineering Services, dated 2/14/18.

Legend

Boring Location

Test Pit Location

Site and Exploration Map

Geotechnical Engineering Evaluation
City of Mukilteo Decant Facility
4206 78th Street SW
Mukilteo, Washington

Aspect CONSULTING

May-2018	BY: JSJ/CMV	FIGURE NO.
PROJECT NO. 170419	REVISED BY: -	2

CAD Path: Q:_GeoTech\170419 Mukilteo Decant Facility\2018-04 Geotechnical Investigation\170419-02.dwg Fig 2 || Date Saved: May 01, 2018 2:12pm || User: cvanslyke

APPENDIX A

Field Exploration Program

A. Field Exploration Program

The field exploration program consisted of three borings (designated as B-01 through B-03) drilled on April 13, 2018, and one test pit (designated as TP-1) excavated on March 21, 2018 . The locations of the explorations are shown on Figure 2. The exploration logs are included in this appendix.

An Aspect geologist was present throughout the field exploration program to observe the drilling procedure, assist in sampling, and to prepare descriptive logs of the exploration. Soils were classified in general accordance with ASTM International (ASTM) D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). The summary exploration logs represent our interpretation of the contents of the field log. The stratigraphic contacts shown on the individual summary logs represent the approximate boundaries between soil types; actual transitions may be more gradual. The subsurface conditions depicted are only for the specific date and locations reported, and therefore, are not necessarily representative of other locations and times.

A.1. Soil Borings

The three machine-drilled borings were advanced using hollow-stem auger (HSA) methods by Boretec1, Inc. (under subcontract to Aspect), using a Volvo EC55 track-mounted drill rig equipped with a 140-pound automatic-safety hammer. Samples were obtained at 2.5- to 5-foot intervals below the ground surface (bgs) to the depths explored, using the Standard Penetration Test (SPT) in general accordance with ASTM D1586. The sampler type used is depicted on the exploration logs in this appendix.

The SPT method involves driving a 2-inch-outside-diameter split-barrel sampler with a 140-pound hammer free-falling from a distance of 30 inches. The number of blows for each 6-inch interval is recorded, and the number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance (“N”) or blow count. The resistance, or N-value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils. If a total of 50 blows are recorded for a single 6-inch interval, the test is terminated and the blow count is recorded as 50 blows for the total inches of penetration.

A.2. Test Pits

The test pit was excavated using a Deere 50G trackhoe equipped with a toothed, 2-foot-wide bucket. Samples were obtained at 3 to 5 feet intervals bgs to the depths explored using the grab method. The sampler type is depicted on the exploration logs in this appendix.

Major Divisions		Fines	Group Symbol	Description
Coarse-Grained Soils - More than 50% (1) Retained on No. 200 Sieve	Gravels - More than 50% (1) of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines (5)	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥15% Fines (5)	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50% (1) or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines (5)	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥15% Fines (5)	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50% (1) or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

	Density	SPT (2) blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50

	Consistency	SPT (2) blows/foot
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

FC = Fines Content
G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Consolidation
DD = Dry Density
K = Permeability
Str = Shear Strength
Env = Environmental
PiD = Photoionization Detector

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

(3) Estimated Percentage

Percentage by Weight	Coarse-Grained Modifier	Fine-Grained Modifier
<5	Trace	Trace
5 to 15	With silt or clay	
16 to 49	Silty or Clayey	
16 to 30		With sand or gravel
31 to 49		Sandy or Gravelly

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols

Sampler Type
Blows/6" or portion of 6"
10
15
20
2.0" OD Split-Spoon Sampler (SPT)
Bulk sample
Grab Sample

Sampler Type Description
Continuous Push
Non-Standard Sampler
3.0" OD Thin-Wall Tube Sampler (including Shelby tube)
Portion not recovered

Cement grout surface seal
Bentonite chips
Grout seal
(4)
Filter pack with blank casing section
(4)
Screened casing or Hydrotip with filter pack
Grouted Transducer
End cap

(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of groundwater
ATD = At time of drilling
Static water level (date)
BGS = below ground surface
(5) Combined USCS symbols used for fines between 5% and 15% as estimated in General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

Aspect CONSULTING

Exploration Log Key

DATE:
DESIGNED BY:
DRAWN BY:
REVISED BY:
PROJECT NO.
FIGURE NO.
A-1

Q:_ACAD Standards\Standard Details\Exploration Log Key A1.dwg

Aspect CONSULTING	Mukilteo Decant Facility - 170419	Geotechnical Exploration Log	
	Project Address & Site Specific Location	*Coordinates (Lat,Lon WGS84)*	*Exploration Number*
	4206 78th St. SW, Mukilteo, WA, SW Portion of Site	47.926, -122.292 (est)	**B-01**

Contractor	*Equipment*	*Sampling Method*	*Ground Surface (GS) Elev. (NAVD88)*
Boretec	HSA Tracked Drill Volvo EC55	Autohammer; 140 lb hammer; 30" drop	561'(est)

Operator	*Exploration Method(s)*	*Work Start/Completion Dates*	*Top of Casing Elev. (NAVD88)*	*Depth to Water (Below GS)*
Maclen	6.25" OD X 3.25" ID Hollow-Stem Auger	4/13/2018	NA	No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Blows/6"	Tests	Description	Depth (ft)
0	561	Boring backfilled with bentonite chips up to 1.5 ft. bgs. and slough from 0.3-1.5 ft. bgs. Boring capped with asphalt from 0-0.3 ft. bgs.				**ASPHALT** Asphalt 3-inches thick.	
1	560					**FILL** Medium dense, very moist, brown, silty SAND (SM) with gravel.	1
2	559					**VASHON TILL** Very dense, moist, brown, silty SAND (SM) with gravel; fine to coarse sand; fine to coarse, subrounded gravel; diamict texture.	2
3	558		S1	14, 50/2"			3
4	557						4
5	556					Becomes gray brown at 5 ft. bgs.	5
6	555		S2	14, 38, 50/5"			6
7	554						7
8	553		S3	25, 50/5"			8
9	552						9
10	551						10
11	550		S4	24, 23, 39			11
12	549					Bottom of exploration at 11.5 ft. bgs.	12
13	548						13
14	547						14
15	546						15
16	545						16
17	544						17
18	543						18
19	542						19
20	541						20
21	540						21
22	539						22
23	538						23
24	537						24

Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50

Material Type

Legend

Sample Method: No Soil Sample Recovery; Split Barrel 2" X 1.375" (SPT)

Plastic Limit ├──┤ Liquid Limit

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: NHC
Approved by: MS 4/21/18

Exploration Log B-01

Sheet 1 of 1

Geotechnical Exploration Log

Aspect CONSULTING

Mukilteo Decant Facility - 170419		Coordinates (Lat,Lon WGS84)	Exploration Number
Project Address & Site Specific Location		47.926, -122.291 (est)	**B-02**
4206 78th St. SW, Mukilteo, WA, 2nd Bay from East			

Contractor	*Equipment*	*Sampling Method*	*Ground Surface (GS) Elev. (NAVD88)*
Boretec	HSA Tracked Drill Volvo EC55	Autohammer; 140 lb hammer; 30" drop	561'(est)
Operator	***Exploration Method(s)***	***Work Start/Completion Dates***	***Top of Casing Elev. (NAVD88)***
Maclen	6.25" OD X 3.25" ID Hollow-Stem Auger	4/13/2018	NA

Depth to Water (Below GS): 2.5' (Seep); 10' (Seep)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Blows/6"	Tests	Description	Depth (ft)
0	561	Boring backfilled with bentonite chips up to 1.5 ft. bgs. and slough from 0.3-1.5 ft. bgs. Boring capped with asphalt from 0-0.3 ft. bgs.				**ASPHALT** Asphalt 2-inches thick.	
1	560					**FILL** Loose, moist, gray, silty GRAVEL (GM) with sand; fine to coarse sand; fine to coarse, rounded to angular gravel; trace plastic fiber	1
2	559	Water level 4/13/2018					2
3	558		S1a/b	3 / 10 / 25		**VASHON TILL** Dense, moist, brown, silty SAND (SM) ; fine to coarse sand; trace rounded gravel; diamict texture.	3
4	557						4
5	556		S2	32 / 50/6"			5
6	555						6
7	554						7
8	553		S3	9 / 18 / 26		Dense, moist, brown, silty SAND (SM) with gravel; fine to coarse sand; rounded gravel; cobbles; diamict texture.	8
9	552					Becomes gray at 9 ft. bgs.	9
10	551	Water level 4/13/2018	S4	17 / 32 / 50/4"		Becomes very dense, wet, and brown at 10 ft. bgs.	10
11	550						11
12	549						12
13	548						13
14	547						14
15	546		S5	20 / 50/6"		Becomes moist and gray at 15 ft. bgs.	15
16	545						16
17	544						17
18	543						18
19	542						19
20	541		S6	39 / 50/5"		Becomes brown at 20.5 ft. bgs.	20
21	540		S7	50/5"		Bottom of exploration at 21.3 ft. bgs.	21
22	539						22
23	538						23
24	537						24

Blows/foot ▲ Water Content (%) ● 0 10 20 30 40 50

Legend

Sample Method	Water Level
No Soil Sample Recovery	Water Level (Seepage)
Split Barrel 2" X 1.375" (SPT)	

Plastic Limit ├──┤ Liquid Limit

See Exploration Log Key for explanation of symbols

Logged by: NHC
Approved by: MS 4/21/18

Exploration Log B-02

Sheet 1 of 1

Aspect CONSULTING	Mukilteo Decant Facility - 170419	Geotechnical Exploration Log	
	Project Address & Site Specific Location 4206 78th St. SW, Mukilteo, WA, SE Portion of Site	*Coordinates (Lat,Lon WGS84)* 47.926, -122.291 (est)	*Exploration Number* **B-03**

Contractor	*Equipment*	*Sampling Method*	*Ground Surface (GS) Elev. (NAVD88)*
Boretec	HSA Tracked Drill Volvo EC55	Autohammer; 140 lb hammer; 30" drop	566'(est)

Operator	*Exploration Method(s)*	*Work Start/Completion Dates*	*Top of Casing Elev. (NAVD88)*	*Depth to Water (Below GS)*
Maclen	6.25" OD X 3.25" ID Hollow-Stem Auger	4/13/2018	NA	No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Blows/6"	Description
0	566	Boring backfilled with bentonite chips up to 1.5 ft. bgs. and slough from 0.3-1.5 ft. bgs. Boring capped with asphalt from 0-0.3 ft. bgs.			**ASPHALT** Asphalt 2-inches thick.
1	565				**FILL** Moist, brown, silty SAND (SM) with gravel; fine to coarse sand; fine to coarse, angular gravel.
2	564				
3	563		S1	15 / 27 / 33	**VASHON TILL** Very dense, moist, brown, silty SAND (SM) ; fine to coarse sand; trace fine to coarse, subrounded to subangular gravel; diamict texture.
4	562				
5	561		S2	12 / 20 / 27	Becomes dense at 5.5 ft. bgs.
6	560				
7	559				
8	558		S3	21 / 27 / 50/5"	Becomes very dense below 7.5 ft. bgs.
9	557				
10	556		S4	50/3"	Bottom of exploration at 10.3 ft. bgs.
11	555				
12	554				
13	553				
14	552				
15	551				
16	550				
17	549				
18	548				
19	547				
20	546				
21	545				
22	544				
23	543				
24	542				

Blows/foot ▲ Water Content (%) ● 0 10 20 30 40 50 | Tests | Material Type | Depth (ft)

Legend

Sample Method: No Soil Sample Recovery; Split Barrel 2" X 1.375" (SPT)

Plastic Limit ⊢—⊣ Liquid Limit

Water Level: No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: NHC
Approved by: MS 4/21/18

Exploration Log B-03

Sheet 1 of 1

Aspect CONSULTING	Mukilteo Decant Facility - 170419	Geotechnical Exploration Log	
	Project Address & Site Specific Location	*Coordinates (Lat,Lon WGS84)*	*Exploration Number*
	4206 78th St. SW, Mukilteo, WA, South of Covered Parking	47.926, -122.291 (est)	**TP-1**

Contractor	*Equipment*	*Sampling Method*	*Ground Surface (GS) Elev. (NAVD88)*
City of Mulkiteo PW	Deere 50G Excavator	Grab	559'(est)

Operator	*Exploration Method(s)*	*Work Start/Completion Dates*	*Top of Casing Elev. (NAVD88)*	*Depth to Water (Below GS)*
Tyler	Trackhoe	3/21/2018	NA	4.5' (Seep)

Depth (feet)	Elev. (feet)	Exploration Completion and Notes	Sample Type/ID	Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50	Blows/6"	Tests	Material Type	Description	Depth (ft)
		Test pit backfilled with excavated soil and tamped into place with excavator bucket.	S1					**FILL** Very dense, moist, dark brown, silty GRAVEL (GM); fine to coarse angular sand; fine to coarse angular gravel; trace organics.	
1	558							**VASHON TILL** Dense to very dense, moist, blue gray, silty SAND (SM); fine to coarse, subrounded sand; trace fine, rounded gravel; trace rounded cobbles; diamict texture; brown mottling.	1
2	557								2
3	556		S2						3
4	555	3/21/2018							4
5	554							Becomes very dense and brown.	5
6	553								6
7	552		S3						7
8	551							Bottom of exploration at 8.25 ft. bgs. Note: Sidewalls did not cave; very slow excavation from 1 to 8.25 ft bgs. Infiltration test performed at bottom of test pit.	8
9	550								9
10	549								10
11	548								11

Legend

Sample Method: Grab sample

Plastic Limit ├──┤ Liquid Limit

Water Level: Water Level (Seepage)

See Exploration Log Key for explanation of symbols

Logged by: NHC
Approved by: MS 4/21/18

Exploration Log TP-1

APPENDIX B

Report Limitations and Guidelines for Use

REPORT LIMITATIONS AND GUIDELINES FOR USE

Geoscience is Not Exact

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

This Report and Project-Specific Factors

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

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

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

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

Reliance Conditions for Third Parties

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

Property Conditions Change Over Time

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

Geotechnical, Geologic, and Environmental Reports Are Not Interchangeable

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

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