Exhibit 12.D.1

Geotechnical Engineering Report

Costco Wholesale CW# 17-0230

Lake Stevens, Washington

May 29, 2018

Terracon Project No. 81185028

Prepared for:

Costco Wholesale

Issaquah, Washington

Prepared by:

Terracon Consultants, Inc.

Mountlake Terrace, Washington

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May 29, 2018

Costco Wholesale
999 Lake Drive
Issaquah, Washington 98027

Attn: Mr. Peter Kahn
P: (425) 313-6052
E: pkahn@costco.com

Re: Geotechnical Engineering Report
Costco Wholesale CW# 17-0230
20th Street SE and State Route 9
Lake Stevens, Washington
Terracon Project No. 81185028

Dear Mr. Kahn:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PT9185000 dated February 7, 2018 and Contract Amendment No. 1 dated April 13, 2018. This report presents the findings of the subsurface exploration program and provides geotechnical recommendations concerning earthwork and the design and construction of retaining walls, pavements, foundations, and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Tori Hesedahl, P.E.
Senior Staff Engineer

James Schmidt, P.E., P.Eng., D.GE
Principal

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SITE LOCATION AND EXPLORATION PLANS
EXPLORATION AND TESTING PROCEDURES
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HWA GEOSCIENCES PRELIMINARY GEOTECHNICAL ENGINEERING REPORT - 24TH SREET SE
COSTCO WHOLESALE PAVEMENT SPECIFICATION
SUPPORTING INFORMATION (General Notes and Unified Soil Classification System)

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REPORT SUMMARY

Topic	Overview Statement [1]
Project Description	165,266 square foot warehouse with integral loading dock ■ Typical wall loading: 3 kips/foot (metal warehouses) ■ Typical column loading: 150 kips (snow regions) ■ Typical floor slab loading: 500 pounds per square foot (psf) (total), 350 psf Fuel facility with prefabricated metal canopy ■ Typical canopy loading: 50 kips Up to about 30 feet of cut and 20 feet of fill to achieve final grade Expected traffic for pavement areas: ■ Standard Duty 6,600 automobiles per day, Traffic Index = 5.0 ■ Heavy Duty 30 trucks per day, Traffic Index = 7.0
Geotechnical Characterization	■ Peat encountered at 8 locations around the wetland areas in the southeast quarter of the site to depths ranging from about 2 to 8 feet. ■ Fat clay encountered below peat in two explorations near the southeast corner of the site to a depth about 10 feet below ground surface (bgs). ■ Groundwater encountered at most exploration locations at shallow depths – believed to be localized zones of perched groundwater
Earthwork	■ Remove soft and unsuitable soil, including peat and high plasticity clay. ■ Onsite soil can be used for structural fill ■ Onsite soil is moisture sensitive ■ Winterize the building pad per 2016 Costco Wholesale Development Requirements: o Place 12-inch minimum thickness compacted soil cover blanket, or cut at least 12-inches high o Mixing of 3 to 5 percent portland cement into the upper 12 inches below subgrade elevation to improve resistance to softening and lower permeability of subgrade surface
Shallow Foundations	Shallow foundations will be sufficient ■ Detect and remove zones of soft and unsuitable soil as noted in **Earthwork** ■ Allowable bearing capacity = 3,000 psf ■ Minimum footing depth is 2 feet ■ Expected settlements: < 1 inch total, < ½ inch differential
Seismic Considerations	Site Class D
Below Grade Structures	Underground storage tanks at the fuel facility should be anchored to resist buoyant forces.
North Retaining Wall	Cut wall with maximum exposed height of 20 feet may be constructed as a soil nail or soldier pile wall ■ Soil Nail o Vertical Elements recommended for face stability o 15-foot minimum nail length ■ Soldier Pile o Tiebacks recommended where wall is greater than about 12 feet in height to keep pile sections smaller o 15-foot minimum bonded zone length

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South Retaining Walls	Assuming 12-foot maximum exposed wall height with subgrade prepared, and retained fill placed as noted in **Earthwork** Geogrid reinforced modular block (4,500 pound) wall ■ 2-foot minimum embedment ■ 8-foot or 0.7H minimum grid length, whichever is greater ■ Backfill in reinforced zone: WSDOT SS2016 9-03.14(4) Gravel Borrow for Structural Earth Wall
Pavements	With subgrade prepared as noted in **Earthwork** Concrete: ■ 7 inches portland cement concrete (PCC) over 6 inches crushed stone base course (CSBC) Asphalt: ■ 4 inches asphaltic cement concrete (ACC) over 6 inches CSBC in Standard Duty areas 5 inches ACC over 6 inches CSBC in Heavy Duty areas Install radial finger drains at catch basins per CWDR Detail 16-16
Corrosivity	Moderate sulfate concentration – Type II cement required Moderate corrosion potential to uncoated metal pipes and structural elements
Light Pole Foundations	Allowable lateral bearing capacity of 200 psf per foot of embedment
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

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Geotechnical Engineering Report

Costco Wholesale CW# 17-0230
20th Street SE and State Route 9
Lake Stevens, Washington

Terracon Project No. 81185028
May 29, 2018

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INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Costco Wholesale (Costco) warehouse to be located at 20th Street SE and State Route 9 in Lake Stevens, Washington. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Building pad winterization
- Excavation considerations
- Soil corrosivity
- Permanent fill retaining walls
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per IBC
- Lateral earth pressures
- Pavement design and construction
- Light pole foundations
- Permanent cut wall

This report was prepared following the 2016 version of the Costco Wholesale Development Requirements (CWDR).

The geotechnical engineering scope of services for this project included the advancement of 65 test borings to depths ranging from approximately 10 to 75 feet and 30 test pit explorations to depths ranging from approximately 6 to 13 ½ below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and as separate graphs in the **Exploration Results** section of this report.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed in the project planning stage. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	■ Preliminary Site Plan D11-01 dated April 10, 2018 provided by MG2 ■ Preliminary Grading Plan MA14-CS-SP13940-02 provided by DOWL on March 20, 2018.
Project Description	The presently undeveloped site will be developed for commercial use. Most of the site will be developed into a new Costco warehouse, fuel facility, and parking and drive areas. Portions of the north side of the site will be reserved for possible future expansion of the Costco warehouse parking lot. Other portions at the northeast corner and south sides of the site will remain undeveloped.
Proposed Structures	■ 165,266-square-foot Costco warehouse with an integral receiving dock. ■ A fuel facility is planned in the northeast portion of the site. ■ Paved parking/landscaping areas are planned on much of the site north and east of the proposed warehouse. ■ Stormwater facilities to be provided by others.
Building Construction	We understand the warehouse will be a single-story, steel-framed and metal panel sided structure approximately 30 feet tall with a concrete slab-on-grade floor system. We anticipate the fuel facility will be covered with a pre-manufactured metal canopy.
Finished Floor Elevation	319 feet, as provided by DOWL on the above referenced Preliminary Grading Plan
Maximum Loads	■ Typical wall loading: 3 kips/foot (metal warehouses) ■ Typical column loading: 150 kips (snow regions) ■ Typical canopy loading: 50 kips ■ Typical floor slab loading: 500 lbs/sq. foot (total), 350 lbs/sq. foot (live)
Grading/Slopes	Cut of up to approximately 30 feet in height is anticipated in the northeast corner of the site, with up to approximately 25 feet of fill in the southwest corner of the site. Permanent slopes should be no steeper than 3H:1V (horizontal:vertical)
Below Grade Structures	Fuel facility will contain three 30,000-gallon underground gasoline storage tanks, one 20,000-gallon underground diesel storage tank, one 1,500- to 3,500-gallon underground fuel additive tank.
Free-Standing Retaining Walls	■ North Retaining Wall o Maximum height approximately 20 feet. o Cut Wall ■ South Retaining Wall o Maximum height approximately 12 feet. o Fill Wall
Pavements	Standard Duty 6,600 automobiles per day, Traffic Index = 5.0 Heavy Duty 30 trucks per day, Traffic Index = 7.0

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Item	Description
Estimated Start of Construction	Mass grading Summer 2018, Construction Spring 2019

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at the southwest corner of the intersection of 20th Street SE and State Route 9 in Lake Stevens, Washington. 18.45 acres (Based on MG2 Plan DD11-01 dated April 10, 2018) Latitude 47.9753 Longitude -122.1082 (See Exhibit D)
Existing Improvements	Two single family residences near the southeast corner of the site, at the intersection of State Route 9 and Lake Stevens Road.
Current Ground Cover	Mature forest with large deciduous and conifer trees and dense underbrush.
Existing Topography	The site generally slopes down from about Elevation 350 near the northeast corner down to about Elevation 290 at the southwest corner. Local high and low points are scattered across the site. Slope varies across the site from relatively level to as steep as approximately 2.5H:1V (horizontal to vertical) based on the contours shown in the preliminary grading plan by DOWL. Information provided by the City of Lake Stevens show there are closed depressions within the site that form wetlands. Standing water was observed in these areas during our exploration program. A formal wetlands survey has been performed by others.
Geology	The geologic map (Minard 1985) indicates subsurface conditions consist of glacial till soil across most of the site, with a band of recessional outwash across the northwest corner. *Minard, James P., 1985, Geologic map of the Snohomish quadrangle, Snohomish County, Washington: U.S. Geological Survey Miscellaneous Field Studies Map MF-1745, 1 sheet, scale 1:24,000.*

GEOTECHNICAL CHARACTERIZATION

Subsurface Profile

We have developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned

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construction. The following table provides our geotechnical characterization of the upland areas of the site.

The City of Lake Stevens made available to Terracon the preliminary geotechnical report prepared by HWA GeoSciences (HWA) titled 24th Street SE Extension dated January 15, 2016. Terracon reviewed this report and has incorporated information from the test pit logs into our geotechnical characterization. The HWA report is attached to this report.

Stratum	Approximate Depth to Bottom of Stratum (feet bgs[1])	Material Description	Consistency/Density
Surface	0 to 2.8	Topsoil: brown, silty sand with gravel, with significant organic matter	N/A
1	5 to 10	Red brown sand with variable silt, with gravel, cobbles, and boulders	Loose to Medium Dense
2	Undetermined: Borings terminated within this stratum at the planned depth of approximately 10 to 75 feet	Gray sand, with varying fines content, with gravel, cobbles, and boulders	Dense to Very Dense

1. Below existing ground surface

Peat was encountered at several locations in and around wetland areas near the southeastern corner of the site. Locations and depths of peat are summarized in the table below.

Boring/Test Pit Number	Approximate Depth of Peat (feet bgs)
SW-10	2.7
SW-12	3
SW-13	2.7
SW-14	2.6
TP-28[1]	>6
SP-29	8
HWA-TP-8	4.5
HWA-TP-11	2

1. Test pit TP-6 was terminated in peat after unearthing a clay drain tile.

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Fat clay was encountered below the peat in boring SW-12 to a depth of 10.7 feet bgs, and to a depth of 6 feet bgs in TP-30.

The geotechnical characterization forms the basis of our geotechnical calculations and evaluation of site preparation, foundation options and pavement options. As noted in **General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are likely.

Conditions encountered at each boring location are indicated on the individual boring logs shown in the **Exploration Results** section and are attached to this report. Stratification boundaries on the boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

Groundwater Conditions

The boreholes and test pits were observed while drilling and after completion for the presence and level of groundwater. In addition, delayed water levels were also obtained in some borings. A standpipe piezometer was installed in boring F-4. The water levels observed in the boreholes and test pits can be found on the boring logs in **Exploration Results**, and are summarized below.

Groundwater depths in the table below correspond to a range in groundwater level elevations of approximately 278 feet to 347 feet across the site. Surface water and shallow groundwater were observed at a typical elevation of approximately 297 to 300 feet near the southeast corner of the site at the time of our explorations. Test pit logs prepared by HWA Geosciences and completed in October of 2015 indicate that ground and surface water levels were substantially lower at the southeast corner of the site at that time. Groundwater elevations across the northern side of the site typically ranged from approximately 320 to 325 feet.

Groundwater was not observed in the remaining borings or test pits while drilling, or for the short duration prior to backfilling the borings. However, this does not necessarily mean the borings terminated above groundwater, or the water levels summarized above are stable groundwater levels. Due to the low permeability of the soil encountered in the borings, a relatively long period may be necessary for a groundwater level to develop and stabilize in a borehole. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Terracon recorded water levels in the piezometer in boring F-4 with a data logging pressure transducer from February 23 to May 15, 2018. The data logger was removed for reading from March 27 to April 4, 2018. Groundwater elevation ranged from approximately 321 to 325 feet over this period.

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Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

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Boring/Test Pit Number	Approximate Depth to / Elevation of Groundwater while Drilling (feet) [1]	Approximate Depth to Groundwater after Drilling (feet) [1]
B-1	4.5 / 293.5	17.6 / 280.4 At completion of drilling
B-2	10 / 293	
B-3	7.5 / 297.5	13.2 / 291.8 At completion of drilling
B-4	15 / 299	
B-5	5 / 308	
B-6	7 / 305	
B-7	10 / 298	
B-8	2.5 / 307.5	
B-9	2.5 / 305.5	
B-10	4.5 / 311.5	29.6 / 286.4 At completion of drilling
B-11	8.2 / 301.8	26 / 284 At completion of drilling
B-12	7.6 / 299.4	21.3 / 285.7 At completion of drilling
B-13	7.5 / 299.5	
B-14	12 / 302	29.9 / 284.1 At completion of drilling
B-15	10 / 301	
B-16	2.5 / 290.5	
B-17	11 / 292	
B-18	6.4 / 297.6	14.6 / 289.4 At completion of drilling
B-19	5 / 296	
B-21	8.5 / 295.5	17.1 / 286.9 At completion of drilling
B-22	0 / 297	
F-1	26.2 / 316.8	27.1 / 315.9 At completion of drilling
F-2	37.3 / 307.7	
F-3	31.9 / 309.1	
F-4	30 / 308	22 / 316 After installation of well

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P-1	10 / 315	
P-3	10.2 / 304.8	18.4 / 296.6 At completion of drilling
P-4	10.2 / 316.8	28.4 / 298.6 At completion of drilling
P-5	8 / 314	28.8 / 293.2 At completion of drilling
P-6	3 / 308	8.4 / 302.6 Groundwater Observed
P-7	8 / 291	3.1 / 295.9 After 24 hours
P-8	9.8 / 293.2	
P-9	10.8 / 305.2	18.3 / 297.7 After 24 hours
P-10	20 / 307	17 / 310 At completion of drilling
P-11	10 / 316	
P-12	32.6 / 305.4	36 / 302 At completion of drilling
P-13	25 / 324	19 / 330 At start of drilling on 2/23/18
P-14	2.5 / 301.5	
P-15	6 / 303	
EP-1	15.5 / 312.5	19.7 / 308.3 At completion of drilling
EP-2	19.1 / 311.9	29 / 302 At completion of drilling
EP-3	7 / 324	19.7 / 311.3 At completion of drilling
EP-4	25 / 325	32.8 / 317.2 While drilling
EP-5	47 / 304	
EP-6	14.8 / 337.2	
NW-1	10 / 316	
NW-2	7.5 / 319.5	
NW-3	7.5 / 323.5	
NW-4	7.5 / 326.5	
SW-1	10 / 286	
SW-2	15 / 278	
SW-3	5 / 287	

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SW-4	6 / 285	
SW-6	7.5 / 293.5	
SW-7	9 / 292	
SW-8	5 / 293	
SW-9	7.5 / 294.5	
SW-10	1 / 299	
SW-11	5 / 299	
SW-13	1 / 301	
SW-14	15 / 295	
TP-1	6 / 314	8.5 / 311.5
TP-2	2 / 303	3 / 302 After digging
TP-4	2 / 309	9 / 302 After digging
TP-5	2 / 299	10.6 / 290.4 After digging
TP-6	3 / 297	6 / 294
TP-7	7.5 / 338.5	
TP-8	7 / 306	
TP-9	2.5 / 306.5	8.5 / 300.5 After digging
TP-10	4 / 325	7.5 / 321.5
TP-11	1 / 347	
TP-12	3.5 / 307.5	
TP-13	2.5 / 301.5	
TP-14	3.5 / 294.5	
TP-15	3.5 / 322.5	
TP-16	8 / 322	
TP-17	7 / 326	
TP-18	3 / 296	
TP-19	1.5 / 293.5	
TP-20	2 / 291	
TP-21	2 / 288	
TP-22	2 / 288	
TP-24	3 / 297	
TP-25	2 / 298	
TP-26	1 / 295	
TP-27	3 / 297	
TP-28	0.5 / 298.5	
TP-29	3 / 297	

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TP-30	1.5 / 300.5	6 / 296

1. Depth below existing ground surface (bgs)
2. Red text indicates groundwater encountered was above planned finish grade at that location.

EARTHWORK

Earthwork will include clearing and grubbing, and mass grading of the site. Intensive grading is planned for the site. We understand that the site is to be a balanced cut and fill. Cut of up to approximately 30 feet is anticipated on the north side of the site with up to 26 feet of fill over the southern half of the site.

Peat and soft organic soil will be encountered in wetland areas along the south side of the site will require complete removal.

The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria as necessary to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed warehouse and parking/driveway areas, and in areas that will support structural fill. The range of topsoil depth measured at our explorations was 0.2 to 2.8 feet. Areas of deeper excavation are anticipated to remove the root balls of trees and shrubs.

Soft and unsuitable soil, including peat and fat clay were observed in explorations by Terracon and HWA in and around wetland areas near the southeast corner of the site. Soft and unsuitable soil should be removed from areas that will support structural fill. The range of peat depth shown on the borings and test pit logs is 2 to 8 feet bgs. Fat clay was encountered to a depth of 6 feet and 10.7 feet bgs in test pit TP-7 and boring SW-12, respectively.

We understand mass grading will likely take place during the 2018 dry season, and that construction will likely start the following year's (2019) dry season. With overwintering, rainfall and surface water may be expected to saturate some areas. Heavy traffic from concrete trucks and other delivery vehicles in periods of wet weather tend to disturb the subgrade. Thus, the flatwork and pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement and flatwork construction approaches.

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We recommend the moisture content and density of the top 12 inches of the subgrade be evaluated following overwintering. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and re-compacted. Excessively wet or dry material should either be removed and replaced or modified by stabilizing with portland cement. Chemical modification should be performed by a pre-qualified contractor having experience with successfully stabilizing subgrades in the project area on similar sized projects with similar soil conditions. Attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 10 feet of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural and general fill should meet the following material property requirements:

Soil Type [1]	Weather Conditions for Placement	Acceptable Location for Placement
WSDOT SS2016 9-03.14(3) Common Borrow [2,3]	Dry	Beneath and adjacent to pavements, floor slabs, and foundations. Utility trench backfill under pavements. General fill.
On-Site Soil [2,3,4]	Dry	
WSDOT SS2016 9-03.14(1) Gravel Borrow [5]	Wet or Dry	
WSDOT SS2016 9-03.14(4) Gravel Borrow for Structural Earth Wall [5]	Wet or Dry	In the reinforced zone of geogrid reinforced walls.

1. Structural and general fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site. Referenced specifications come from the Washington State Department of Transportation (WSDOT) *Standard Specifications for Road, Bridge, and Municipal Construction 2016* (SS2016). Peat and fat clay are **not** suitable for use as structural backfill.
2. Fines content makes this material moisture sensitive and therefore unsuitable for use during periods of wet weather. Granular material with less than 5 percent fines per Section 4.2.8 Wet Weather Earthwork should be used during periods of wet weather.
3. Maximum particle size should be limited to 6-inches.
4. In-situ moisture content should be compared to moisture-density (modified Proctor) curves to determine compatibility of onsite soil at the time of construction.
5. Fines content should be limited to no more than 5 percent during periods of wet weather per Section 4.2.8 Wet Weather Earthwork.

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Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Minimum Compaction Requirements[1,2]	Moisture Content Range[1]	Minimum Compaction Testing Frequency per Lift
Under Buildings and Structures	95 percent	-2% to +2% of optimum	1 per 10,000 Square Feet
Beneath Pavements and Walkways	95 percent	-2% to +2% of optimum	1 per 15,000 Square Feet
Behind Retaining Walls (within 5 feet)	92 percent	-2% to +2% of optimum	1 per 15,000 Square Feet
Utility trench backfill	95	-2% to +2% of optimum	1 per 150 Linear Feet
Lawns or Unimproved areas	90	-2% to +2% of optimum	1 per 20,000 Square Feet

2. Maximum density and optimum water content as determined by the modified Proctor test (ASTM D 1557).
3. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254).

Structural fill materials should be placed in horizontal, loose lifts not exceeding 12 inches in thickness and should be thoroughly compacted. Where light compaction equipment is used, as is customary within utility trenches and behind retaining walls, the lift thickness should be reduced to 4 to 6 inches to achieve the desired degree of compaction. Soil removed which will be used as structural fill should be protected from rain to aid in preventing an increase in moisture content.

When placing fill in areas of the site where existing slopes are steeper than 5H:1V the area should be benched to reduce the potential for slippage between existing slopes and fills. Benches should be wide enough to accommodate compaction and earth moving equipment and to allow placement of horizontal lifts of fill.

Utility Trench Backfill

Utility trench backfill should meet the material and compaction requirements recommended in the Fill Material Types and Fill Compaction Requirements sections of this report.

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Grading and Drainage

All grades must provide effective drainage away from the warehouse during and after construction and should be maintained throughout the life of the structure. Water retained next to the warehouse can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the warehouse.

Exposed ground should be sloped and maintained at a minimum 5 percent away from the warehouse for at least 10 feet beyond the perimeter of the warehouse. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After warehouse construction and landscaping, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted as necessary as part of the structure's maintenance program. Where paving or flatwork abuts the structure a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Slopes

Typical slope configurations in unreinforced compacted fill and cuts are generally flatter than 3H:1V in the area of the subject site. If steeper slopes are required for site development, stability analyses should be completed to design the final grading plan. At your request, site specific slope stability analysis could be performed based on the final site grading plans. The face of all fill slopes should be compacted to the minimum specification for fill embankments. Alternately, fill slopes can be overbuilt and trimmed to compacted material.

Wet Weather Earthwork

The near-surface soil has appreciable fines content (silt and clay-sized soil finer than the standard U.S. No. 200 mesh Sieve) based on our visual observations and laboratory testing. As such, this soil is considered to be highly moisture sensitive.

The suitability of soil used for structural fill or utility trench backfill depends primarily on their grain-size distribution and moisture content when they are placed. As the fines content increases, soil becomes more sensitive to small changes in moisture content. Soil containing more than about 5 percent fines (by weight) cannot be consistently compacted to a firm, unyielding condition when the moisture content is more than about 2 percentage points above or below optimum. Optimum moisture content is the moisture content at which the maximum dry density for the material is achieved in the laboratory following ASTM procedures.

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If inclement weather or in situ soil moisture content prevents the use of on-site material as structural fill, we recommend the use of import granular fill containing less than 5 percent by weight passing the U.S. No. 200 sieve, based on the fraction passing the U.S. No. 4 sieve.

To maintain moisture content, we recommend that all stockpiled soil for use as compacted fill be protected with polyethylene sheeting anchored to withstand local wind conditions.

Earthwork Construction Considerations

Earthwork is anticipated to be accomplished with conventional construction equipment. Excavators may be required when excavating the dense native soil in the north portion of the site. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over, or adjacent to, construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted, prior to floor slab or pavement construction.

Groundwater was encountered within the open boreholes and test pits at higher elevation than finish grades at several locations in the northeast quarter of the site. Specific locations and depths/elevations are listed in the groundwater readings table in the Geotechnical Characterization section. Our opinion is that these observations represent localized perched water conditions that tend to develop during extended periods of wet weather as water infiltrating the surface soils becomes trapped above less permeable material. We expect that positively grading excavations to direct flow to sumps that are continuously pumped should be adequate to remove groundwater inflow if encountered. Ultimately, the choice of any necessary dewatering methods is the Contractor's.

Specific recommendations for the underground storage tanks (USTs) are in the Below Grade Structures Section.

The groundwater table could affect over-excavation efforts, especially for over-excavation and replacement of lower strength soils at the southeast corner of the site. A temporary dewatering system consisting of sumps with pumps could be necessary to achieve the recommended depth of over-excavation.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, and/or state regulations.

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Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Building Pad Winterization

Section 03-E of the CWDR gives requirements for winterizing the building pad. The building pad should be considered to be the ground and underlying soil upon which the Costco facility will be built. Winterization effort is to protect the pad from the effects of winter weather and construction traffic during wet weather. The CWDR requires that the entire pad area be covered with 2, 6-inch thick (compacted thickness) lifts of low permeability (greater than 25 percent passing the No. 200 sieve) fill compacted to at least 90 percent of the modified Proctor maximum dry density. The fat clay encountered in the south portion of the site may be used for this cover. It is unknown if there is sufficient fat clay for this purpose.

The borings indicate glacially consolidated silty sand soil across much of the cut (north) portion of the site. Where dense to very dense glacially consolidated silty sand soil is encountered near subgrade elevation, consideration should be given to cutting the pad at least 1 foot higher than subgrade elevation in lieu of placing a cover blanket as required by the CWDR. Our opinion is that this will protect the subgrade at least as well as the required cover blanket while reducing earthwork effort.

To further protect fill subgrade, the upper 12 inches below subgrade elevation may be treated by mixing in portland cement prior to placing the cover blanket. Typical ratios for cement treatment range between 3 and 5 percent by weight. Chemical modification should be performed by a pre-qualified contractor having experience with successfully stabilizing subgrades in the project area on similar sized projects with similar soil conditions.

The cover blanket shall be sloped to prevent water from ponding on the surface and to convey runoff off the sides of the pad. In no case, shall the cover be less than 12 inches thick.

Construction Observation and Testing

Earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and top soil, proof-rolling and mitigation of areas delineated by the proof-roll to require mitigation.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

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Prior to paving or flatwork construction activities, the subgrade should be proof-rolled with an adequately loaded vehicle such as a fully loaded tandem axle dump truck. The proof-rolling should be performed under the observation of the Geotechnical Engineer. Areas excessively deflecting under the proof-roll should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas should either be removed or modified by stabilizing with portland cement. Chemical modification should be performed by a pre-qualified contractor having experience with successfully stabilizing subgrades in the project area on similar sized projects with similar soil conditions. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving or placing concrete for footings and flatwork. The subgrade should be in its finished form at the time of the final review.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Capacity [1, 2]	3,000 psf
Required Bearing Stratum [3]	Dense glacially consolidate soil or structural fill
Minimum Foundation Dimensions	Columns: 30 inches Continuous: 18 inches
Ultimate Passive Resistance [4] **(equivalent fluid pressures)**	400 pounds per cubic foot (pcf)
Ultimate Coefficient of Sliding Friction [5]	0.45
Minimum Embedment below Finished Grade [6]	24 inches

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Item	Description
Estimated Total Settlement from Structural Loads [2]	Less than about 1 inch
Estimated Differential Settlement [2]	Less than L/500 along walls. Less than ½ inch over 50 feet between interior columns.

1. The maximum net allowable bearing capacity is the capacity in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. This bearing pressure can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**.
3. Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the **Earthwork**.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.

Design Parameters - Uplift Loads

Uplift resistance of shallow foundations should be based on the weight of the foundation concrete and the soil overlying the plan area of the foundation. We recommend a soil unit weight of 110 pcf for uplift calculations.

Foundation Construction Considerations

As noted in **Earthwork**, footing excavations should be evaluated by the Geotechnical Engineer immediately after excavation. The base of all foundation excavations should be free of water and loose soil, prior to placing rebar and concrete. Rebar and concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

If unsuitable bearing soil is encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on this soil at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.

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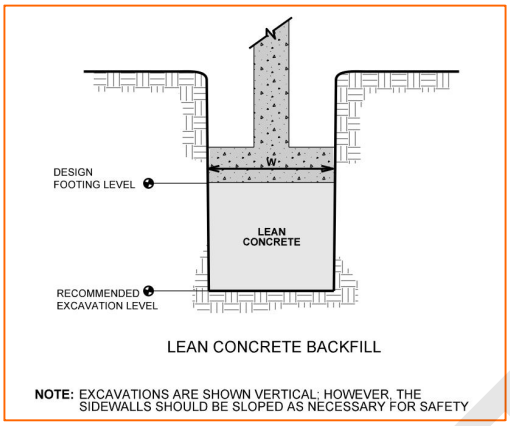
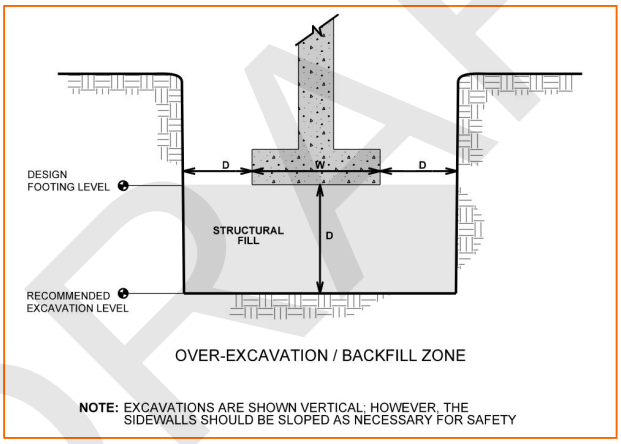


Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation, with structural fill placed, as recommended in the **Earthwork** section.



SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7-10.

Description	Value
2015 International Building Code Site Classification	D [2]
Site Latitude	47.9753

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Description	Value
Site Longitude	-122.1082
S_{DS} Spectral Acceleration for a Short Period [3]	0.812 g
S_{D1} Spectral Acceleration for a 1-Second Period [3]	0.469 g

1. Seismic site classification in general accordance with the *2015 International Building Code*, which refers to ASCE 7-10.
2. The 2015 International Building Code (IBC) uses a site profile extending to a depth of 100 feet for seismic site classification. Borings at this site were extended to a maximum depth of 75 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.
3. These values were obtained using online seismic design maps and tools provided by the USGS (http://earthquake.usgs.gov/hazards/designmaps/).

Based on groundwater conditions observed, on the relative density/consistency of site soil, it is our opinion that the risk of liquefaction of site soil is low.

Based on our review of the available fault information, it is our opinion that the risk of surface rupture due to ground faulting is very low.

FLOOR SLABS

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and. positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support [1]	Minimum 6 inches of WSDOT SS2016 9-03.9(3) Crushed Surfacing compacted to at least 95 percent of ASTM D 1557 placed over dense, native, glacially consolidate soil or structural fill placed and compacted per the requirements noted in **Earthwork**
Reinforcement	Not required per the CWDR given the allowable soil bearing capacity of 3,000 psf
Estimated Modulus of Subgrade Reaction [2]	250 pounds per square inch per inch (psi/in) for point loads

1. Floor slabs should be structurally independent of warehouse footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.

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Item	Description
2.	Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

Terracon typically recommends installation of a vapor barrier beneath the slab to mitigate potential moisture issues such as flooring performance and mold. However, we understand that Costco Wholesale has determined that moisture barriers are not to be used in construction of Costco Wholesale structures because of adverse effects on concrete curing and performance. Therefore, we have provided construction recommendations that do not include installation of a moisture barrier, with the understanding that there will be an increased risk for adverse moisture issues.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Floor Slab Construction Considerations

Finished subgrade within and for at least 10 feet beyond the floor slab should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

BELOW-GRADE STRUCTURES

Underground storage tanks (USTs) are expected to be locates in the northeast corner of the site to provide fuel and additive storage for the fueling facility. We assume that the bottom of the UST excavation will be approximately 20 feet below planned finish grade. Soil logged in the borings at this depth is expected to provide adequate bearing resistance.

Groundwater level data from the piezometer installed in boring F-4 near the expected UST location is above proposed finish grade at the UST location. Terracon did not conduct a groundwater study of sufficient scope or duration to estimate seasonal groundwater level

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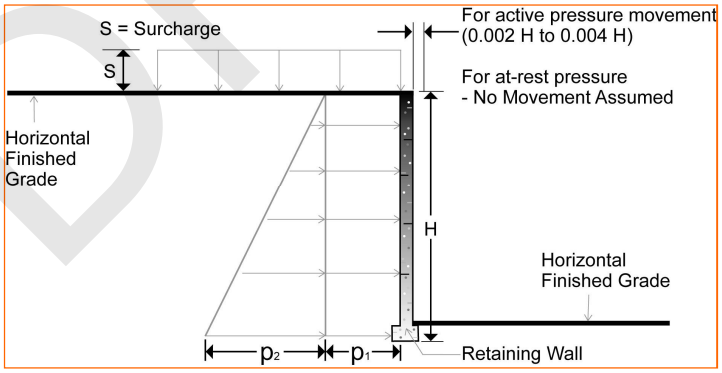
fluctuation or predict how mass grading will affect the groundwater regime at the UST location. The USTs may be submerged below groundwater after construction. We recommend that USTs be anchored against buoyant forces. The USTs should be designed to withstand earth pressures given in the **Lateral Earth Pressures** section. The bottom of the excavation may be below the water table. We anticipate that continuously pumped shallow sumps in the bottom of the excavation will be sufficient to control groundwater in the excavation.

LATERAL EARTH PRESSURES

Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).

The recommendations in this section are not appropriate for structural earth walls, soil nail walls or soldier pile walls. Recommendations for these wall types are given in subsequent sections.



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Lateral Earth Pressure Design Parameters

Earth Pressure Condition [1]	Coefficient [2]	Surcharge Pressure [3, 4, 5] p_1 (psf)	Effective Fluid Pressures p_2 (psf) [2, 4, 5]	
			Unsaturated [6]	Submerged [6]
Active (Ka)	0.29	(0.29)S	(35)H	(85)H
At-Rest (Ko)	0.46	(0.46)S	(55)H	(90)H
Passive (Kp)	3.4	---	(400)H	(265)H

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance.
2. Uniform, horizontal backfill, compacted to at least 95 percent of the ASTM D 1557 maximum dry density, rendering a maximum unit weight of 120 pcf.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. No safety factor is included in these values.
6. In order to achieve "Unsaturated" conditions, follow guidelines in **Subsurface Drainage for Below Grade Walls** below. "Submerged" conditions are recommended when drainage behind walls is not incorporated into the design.

Subsurface Drainage for Below Grade Walls

We recommend foundation drains for exterior footings and walls be constructed in accordance with CWDR Detail 16_17. Drain lines should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5 percent passing the No. 200 sieve, such as AASHTO No. 57 aggregate or WSDOT SS2016 9-03.12(4) Gravel Backfill for Drains. The free-draining aggregate should be encapsulated in a geotextile separator fabric.

NORTH RETAINING WALL

A retaining wall with maximum exposed height of approximately 20 feet and length of approximately 400 feet is planned for the central portion of the north side of the site. The wall will support a cut from existing grade at the south end of 93rd Avenue SE to finish parking lot grade. There is approximately 20 feet behind face of wall to the property line. Exploration logs indicate that retained soil will generally consist of medium dense to dense silty sand with gravel along the west end of the wall. Clean sandy gravel is shown on test pit logs TP-16 and TP-17 along the eastern half of the wall.

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Appropriate wall systems for cut walls of this height and for these soil conditions include soil nail and soldier pile.

For portions of the wall where wall heights are less than about 12 feet, cantilever soldier piles are feasible. Over about 12 feet in height, cantilever soldier pile is still possible but the required steel sections tend to make the price per square foot of wall go up exponentially. Soldier pile with tiebacks tends to keep the unit price of the wall down as compared to cantilevered walls for wall heights more than 12 feet.

Soil Nail Wall

Soil nails are typically installed in sub-horizontal rows of nails (lifts) starting from the top of wall as part of grading activity. Lift heights typically range from 4 to 5 feet. Horizontal spacing between nails is typically 4 to 6 feet. The first row of nails should be set at about ½ the nominal vertical spacing below the finish ground line at back of wall.

We recommend that soil nail shoring be designed in general accordance with local standard of practice and soil surcharge pressures from slopes, construction loads, and traffic be included. Terracon recommends that the following values be used for soil nail design. Ultimate design load transfer should be reduced by a factor of safety of 2.

Native Silty Sand, Silty Sand with Gravel, and Sandy Gravel

- Friction Angle: 34 degrees
- Cohesion: 0 psf
- Moist Unit Weight: 125 pcf
- Ultimate Design Load Transfer (minimum 6-inch diameter soil nail): 2,000 psf

The actual design load transfer will depend on the materials and installation methods and should be confirmed by testing. Larger diameter drill holes and/or secondary grouting may be required to achieve the recommended pull out capacity. The location and presence of existing features should be checked during the design as these may affect the location and lengths of the soil nails. In any case the minimum nail length should be 15 feet.

Since the face is cut prior to placing nails and facing, standup time of the cut face is a key concern. The open time from cutting to install a lift of nails until placing shotcrete for the temporary facing should be limited to no more than about 24 hours.

We expect that standup time of the sandy gravel encountered in test pits TP-16 and TP-17 to be short. Therefore, we recommend vertical elements be installed on a 3-foot typical horizontal spacing. Vertical elements should be designed using the recommendations presented in the soldier pile sections of this report, and should extend from existing grade to the finish ground line

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at front of wall. Vertical elements may be used to provide cantilever support where utilities or adjacent structures prevent installation of soil nails in the upper portion of the shoring wall.

Alternatives to vertical elements successfully used to mitigate short standup time include, but are not limited to, drilling through temporary soil berms prior to making the vertical soil cuts at the face, slot cuts, and flash coating the exposed soil face with shotcrete. Some caving of the excavated soil face should also be expected resulting in additional shotcrete to fill the resulting void.

Relatively clean sand and gravel zones, and occasional zones of perched groundwater, should be expected in the nail zone. Caving of boreholes in relatively clean sand and gravel zones is to be expected. Temporary casing may be required to hold boreholes open during soil nail installation. Grout should be placed from the bottoms of the soil nail holes by tremie method to provide a continuously grouted soil nail. Installation methods should ultimately be the responsibility of the contractor.

Pre-fabricated drainage mat should be placed against the soil face in vertical strips between every column of nails prior to placing each lift of shotcrete. Strips should be overlapped between each lift to provide a continuous drainage path. During construction, the wall drains discharge onto the subgrade in front of the wall. Once the wall is completed, the base of the drains should be directed to discharge through weep holes until the permanent drainage system is installed in front of the wall.

At least 2 successful verification tests to 200 percent of the design load shall be performed in each soil unit into which soil nails are to be installed. Verification tests should be conducted prior to the installation of production nails within each soil unit. Proof tests shall be performed on a number of test nails that is greater than or equal to 5 percent of the number of production nails to 150 percent of design load. Test nail locations should be selected by the contractor and approved by the engineer of record. The drilling method, hole diameter, and depth of test soil nails should be identical to the production soil nails. Test nails shall be located within the nail pattern and shall be considered sacrificial. Proof test nails shall be evenly distributed across the face of the wall.

We recommend that continuous observation of soil nail installation and testing by a Terracon representative. The purpose of this observation is to confirm that subsurface conditions match design assumptions, facing installation conforms to the required reinforcement and shotcrete placement, and soil nail proof and verification tests meet the specified performance criteria.

Soldier Pile Wall

Soldier piles for permanent walls are typically set in drilled holes backfilled with structural concrete up to about the finish ground line in front of wall, the with lean concrete placed above the structural concrete to about existing grade.

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Casing the holes and/or drilling with a mud slurry will likely be required to control caving and to cut-off groundwater seepage. Passive earth pressures acting on the embedded portion of the soldier piles resist horizontal loads on the wall system. We recommend using an allowable equivalent fluid unit weight of 265 and 400 pcf for passive resistance below and above the ground water table, respectively. The passive earth pressure will act over three times the diameter of the concreted soldier pile section, or the pile spacing, whichever is less. The active earth pressures act over the concreted pile diameter below the base of the excavation. A minimum embedment of 10 feet is recommended.

For a shoring system with one or more rows of tieback anchors, we recommend the apparent earth pressure theory for sands (i.e. Figure 24) presented in the Federal Highway Administration *Geotechnical Engineering Circular No. 4: Ground Anchors and Anchors Systems* (FHWA 1999).

- For calculating the maximum ordinate, assume an active earth pressure coefficient of 0.29 and a total unit weight of 130 pcf
- For traffic loads adjacent to the shoring walls, add a uniform surcharge load equivalent to 250 psf;
- For other loads adjacent to the shoring (e.g., heavy construction loads and building foundations), contact Terracon to estimate appropriate surcharge pressures.

Vertical capacity of the soldier piles is provided by a combination of end bearing and side friction below the base of the excavation. The piles can be designed for an allowable end bearing capacity and side friction of 30 kips per square foot (ksf) and 2 ksf, respectively. These values include a factor of safety of 2.

Permanent wall system components exposed to the elements require corrosion protection. Soil nails should be epoxy coated or hot dipped galvanized. Soldier piles should be hot dipped galvanized or have a shop primer coat applied per the requirements of WSDOT SS2016 6-07.3(9)G. The un-bonded length of stranded tieback anchors should be corrosion protected while rebar anchors should be hot dipped galvanized or epoxy coated.

Tieback Anchors

For tieback anchors, the anchor portion of the tieback should be located sufficiently far behind the wall to stabilize the cut face. This “no load” zone is the area behind the soldier pile equal to a lateral distance from the base of the excavation equal to the exposed wall height (H in feet) divided by four, or five feet, whichever is greater, and a line sloping up and back at 60 degrees from horizontal.

The selection of the tieback materials and installation methods should be the responsibility of the contractor. The actual adhesion values will depend on the materials and installation method and should be confirmed by testing. For non-pressure grouted anchors, the allowable design

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concrete/soil adhesion value of 2,000 psf is recommended. For pressure grouted anchors, this value can typically be increased by up to two times. For preliminary design purposes, we recommend an ultimate pullout capacity of 10 kips/foot for 6-inch diameter, secondary pressure grouted anchors. A factor of safety of 2 should be applied to the ultimate pullout capacity. We recommend all tieback anchors be proof tested to at least 130 percent of the design capacity prior to locking off at the specified post-tensioned design load. Prior to installation of production anchors, two verification tests to 200 percent of the design pull out capacity are recommended for each soil type to confirm the design anchor capacity.

The anchor spacing should be at least four feet center to center in order to avoid group effects and the potential for conflict with each other during installation. The anchor holes should be drilled at an angle of 15 to 45 degrees down from horizontal. A minimum anchor bond of 15 feet is recommended. The location and presence of existing features such as utilities should be checked during the design as these may affect the location and length of tieback anchors.

Lagging

Due to soil arching effects, lagging may be design based on the requirements presented in presented in the Federal Highway Administration *Geotechnical Engineering Circular No. 4: Ground Anchors and Anchors Systems* (FHWA 1999).

Lagging should be installed promptly to reduce potential for loss of ground. The requirements for lagging should be made the responsibility of the shoring subcontractor to prevent soil failure, sloughing, and loss of ground. The excavation height prior to lagging installation should not exceed 4 feet to maintain stability of the cut face. Prompt and proper installation of lagging is critical to provide safe working conditions below the wall.

Permanent lagging options include pre-cast concrete and timber lagging. Pre-cast concrete and pressure treated timber lagging have the advantage of not requiring a shotcrete facing to protect them from the elements. Pre-cast concrete lagging is not forgiving of variation from specified pile spacing due to piles being slightly off location or out of plumb while timber lagging is typically cut to fit onsite. Design life of exposed treated timber lagging should be considered. Untreated timber lagging may be used as temporary lagging until a permanent shotcrete facing is installed. Timber lagging should conform to the requirements of WSDOT SS2016 9-09.2(1).

Voids behind the lagging should be backfilled immediately. However, the backfill should not allow potential hydrostatic pressure to build-up behind the wall. Drainage behind the wall must be maintained. We recommend that voids between the lagging and soil be backfilled promptly with a permeable granular soil material or lean concrete.

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Soldier Pile Installation

The contractor should be required to prevent caving and loss of ground in all soldier pile drill holes. The shoring contractor will need to use methods to minimize caving and sloughing of the drill holes, such as the use of augercast methods or installation of casing. If more than one foot of water is present in the bottom of the hole or if a mud slurry is used to stabilize the hole, placement of concrete from the bottom of the hole using tremie methods will be required.

When drilling tieback anchor holes, casing may be required to prevent caving and loss of ground. The anchor grout should be pumped into the anchor zone by tremie methods to remove water from the hole and to provide a continuous grouted anchor.

Monitoring of Soldier Pile or Soil Nail Walls

We recommend that a systematic optical survey program be implemented to make observations to be used in evaluating wall performance during construction. The monitoring program should include measurements of the horizontal and vertical movements of monitoring points placed on the pile tops, or along the top lift of the soil nail wall after placing the construction facing. At least two reference lines should be established adjacent to the excavation at horizontal distances back from the excavation space of about 1/3H and H, where H is the final excavation height. Monitoring of the shoring system should include measurements of horizontal movements at the top of every other soldier pile, or at twice the nominal horizontal nail spacing. If local wet areas are noted within the excavation, additional monitoring points may be recommended by Terracon.

The measuring system used for shoring monitoring should have an accuracy of at least 0.01 feet. All reference points should be read prior to and during critical stages of construction. The frequency of readings will depend on the results of previous readings and the rate of construction. As a minimum, readings should be taken about once a week throughout construction until the wall is completed. All readings should be reviewed by Terracon.

SOUTH RETAINING WALLS

Retaining walls are proposed to support fill on the south side of 24th Street SE wrapping around the corner and up the west side of 91st Avenue SE, and along both sides of the South Lake Stevens Road connector from 24th Street SE. Total length of walls is expected to be about 2,000 feet. Exposed wall heights are expected up to about 12 feet.

We understand that Costco prefers fill walls to be modular block gravity walls where feasible. Our preliminary global stability analysis indicates that a modular block wall is feasible, but geogrid reinforcement will be required. Our analysis considered the following:

- Maximum exposed height of 12 feet

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- Minimum embedment of 2 feet
- Maximum fore-slope of 1H:10V in the 30 feet extending from the bottom of the wall face
- Level back-slope
- Live load traffic surcharge of 250 psf
- Large (approximately 4,500 pound) pre-cast concrete modular blocks
- Retained fill meeting the material requirements, and placement and compaction recommendations contained in the Earthwork section of this report

We used the soil engineering parameters shown in the table below in our slope stability models, and recommend these values be used by the wall designer.

Material	Description	Cohesion (psf)	Angle of Internal Friction (degrees)	Total Unit Weight (pcf)
Subgrade Soil	Medium dense to very dense, native, granular soil, or structural fill placed and compacted per the requirements noted in **Earthwork**	0	34	125
Retained Fill	Structural fill placed and compacted per the requirements noted in **Earthwork**	0	34	125
Reinforced Zone	WSDOT SS2016 9-03.14(4) Gravel Borrow for Structural Earth Wall	0	38	130

Unsuitable subgrade soil should be removed and replaced with structural fill as described in the **Earthwork** section of this report. Peat and fat clay soil were encountered in the explorations near the proposed wall location along 24th Street SE from SR9 west about 800 feet. See subsurface profile H-H' for more detail.

Minimum embedment of retaining walls should be 2 feet below finish ground line at the bottom of the wall. The bottom tier of blocks should bear on a leveling course of at least 1 foot thick of properly placed and compacted crushed stone that meets the requirements for WSDOT SS2016 9-03.9(3) Crushed Surfacing

Geogrid should extend a minimum length behind the back face of the blocks of 8 feet or 0.7 times the wall height, whichever is greater. The wall height should be considered to be the vertical distance from the finish ground line behind the wall to the bottom of the bottom block.

A perforated rigid plastic drain line should be installed behind the base of the retaining wall to prevent hydrostatic loading on the wall face. The drain line should slope to provide positive gravity drainage away from the wall or to a sump pit, where it can be pumped away from the retaining wall face. The drain line should be surrounded by clean, free-draining granular material having

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less than 5 percent passing the No. 200 sieve (based on the fraction passing the ¾-inch sieve). The granular fill should extend to within 2 feet of final grade. The free-draining aggregate should be encapsulated in a filter fabric.

Internal stability analyses for geogrid-reinforced wall should conform to the latest design methodology accepted for use by either the Federal Highway Administration (FHWA), AASHTO or the National Concrete Masonry Association (NCMA). Since these analysis procedures are based on the use of drained strength parameters, the backfill used for the geogrid reinforced backfill section should be a free-draining, granular material to conform with the assumptions of the analysis. Cohesive soil or granular material containing more than 5-percent fines are not considered free-draining and should not be allowed in the geogrid reinforced backfill zone.

During construction, the soil engineering parameters used during design should be confirmed via laboratory testing. The retaining wall designer should be required to perform internal stability analyses based on the planned final cross section. Terracon should be provided the opportunity to review and comment on the final retaining wall system design and analysis and to confirm our global stability analysis is still appropriate prior to construction. Testing and monitoring during construction by qualified geotechnical personnel is recommended.

PAVEMENTS

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs, noted in this section, must be applied to the site, which has been prepared as recommended in the **Earthwork** section.

Pavement Design Parameters

In accordance with the latest version of the CDWR, the design of asphaltic concrete (AC) pavements are based on the procedures outlined in the Asphalt Institute Manual Series MS-1 and MS015, Chapter III. Design of portland cement concrete (PCC) pavements are based upon the procedures in the “Thickness Design for Concrete Highway and Street Pavements” by the Portland Cement Association (PCA), 1995 utilizing the simplified procedure in Chapter 4. Costco’s pavement specifications are attached to this report.

Traffic loading was provided in the CDWR for on-site paving for a minimum twenty-year design life, as shown in the following table. The corresponding traffic designations in the design methods are listed alongside the given traffic values.

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Pavement	Traffic Index (TI)[1]	Traffic[1]	Equivalent Single Axle Loads (ESALs)[2]	PCA Axle Load Category
Standard Duty	5.0	6,600 cars per day	19,219	1 or 2
Heavy Duty	7.0	30 trucks per day	506,033	2 or 3

1. Values provided in the CDWR
2. Estimated using vehicles/day and a 20-year design life with no growth

A subgrade CBR of 12, corresponding to a subgrade resilient modulus of 12,533 pounds per square inch (psi), was used for the AC pavement designs. The values were empirically derived based upon our experience with the subgrade soils and our understanding of the quality of the subgrade as prescribed by the **Site Preparation** conditions as outlined in **Earthwork**.

A subgrade soil support of "high" was selected for the PCC pavement design. A minimum modulus of rupture of 550 psi was used for pavement concrete, based on a compressive strength of 4,000 psi. We have assumed all rigid pavements will not be doweled and will not be tied to a concrete shoulder or curb.

Pavement Section Thicknesses

The following tables provide options for AC and PCC pavement sections:

Asphaltic Concrete Design [1]		
Layer	**Thickness (inches)**	
	Standard Duty	**Heavy Duty**
AC Surface Course [2]	1 lift of 2	1 lift of 2
AC Base Course [3,4]	1 lift of 2	1 lift of 3
Aggregate Base [5]	6	6
Total Thickness [6]	**10**	**11**

1. *Pavement materials and construction must meet the Costco Master Specification for Asphalt Paving that contains very specific pavement material (asphalt, aggregate and concrete) criteria and construction practices to be used with respect to compaction and material sampling. The general contractor and pavement construction subcontractor should be aware that asphalt and concrete mix designs must be submitted to the design architect and Terracon at least 45 days prior to the scheduled production and laydown for review and approval.*
2. ½" or ¾" Maximum Aggregate Size Mix
3. Standard Duty Asphaltic Base – ¾" Maximum Aggregate Size Mix
4. Heavy Duty Asphaltic Base – ¾" or 1" Maximum Aggregate Size Mix
5. Aggregate Base Course should conform to the requirements of WSDOT SS2016 9-03.9(3) Crushed Surfacing Base Course
6. Represents minimum section thicknesses, not averages

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The asphalt binder PG 52-16 was determined from specific climate and temperature data for the site using the LTPPBind Software version 3.1 without any adjustments for vehicle traffic or depth of asphalt layer.

Portland Cement Concrete Design	
Layer	**Thickness (inches)**
	Heavy Duty [1]
PCC [2]	7
Aggregate base [3]	6
Total Thickness [4]	**13**

1. In areas of anticipated heavy traffic, fire trucks, delivery trucks, or concentrated loads (e.g. dumpster pads), and areas with repeated turning or maneuvering of heavy vehicles
2. All materials should meet the current WSDOT Standard Specifications for Road, Bridge, and Municipal Construction. For Concrete Pavement use WSDOT Cement Concrete Pavement Section 5-05
3. Aggregate Base Course should conform to the requirements of WSDOT SS2016 9-03.9(3) Crushed Surfacing Base Course
4. Represents minimum section thicknesses, not averages

The estimated pavement sections provided in this report are minimums for the assumed design criteria, and as such, periodic maintenance should be expected. Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles. A maintenance program including surface sealing, joint cleaning and sealing, and timely repair of cracks and deteriorated areas will increase the pavement's service life. As an option, thicker sections could be constructed to decrease future maintenance.

Concrete for rigid pavements should have a minimum 28-day compressive strength of 4,000 psi, and be placed with a maximum slump of 4 inches. Although not required for structural support, a minimum 4-inch-thick base course layer is recommended to help reduce potential for slab curl, shrinkage cracking, and subgrade pumping through joints. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

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Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. This is especially applicable for islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils. The civil design for the pavements with these conditions should include features to restrict or to collect and discharge excess water from the islands. Examples of features are edge drains connected to the storm water collection system, longitudinal subdrains, or other suitable outlet and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

The pavement surfacing and adjacent sidewalks should be sloped to provide rapid drainage of surface water. Water should not be allowed to pond on or adjacent to these grade-supported slabs, since this could saturate the subgrade and contribute to premature pavement or slab deterioration.

The pavement surfacing and adjacent sidewalks should be sloped to provide rapid drainage of surface water. Water should not be allowed to pond on or adjacent to slabs, since it could saturate the subgrade and contribute to premature pavement or slab deterioration.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

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- Final grade adjacent to paved areas should slope down from the edges at a minimum 2 percent.
- Install radial finger drains at catch basins per CWDR Detail 16-16.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.

CORROSIVITY

The table below lists the results of laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH testing. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Corrosivity Test Results Summary						
Boring	**Sample Depth (feet)**	**Soil Description**	**Soluble Sulfate (mg/kg)**	**Soluble Chloride (mg/kg)**	**Electrical Resistivity (Ω-cm)**	**pH**
F-1	30	Silty sand, trace gravel	200	63	6305	8.11
F-4	25	Silty sand with gravel	200	25	8730	8.25

Based on our review of the laboratory testing results, site soil have a moderate corrosive potential to uncoated metal pipes and structures in contact with on-site soil.

Results of soluble sulfate testing indicate samples of the on-site soils tested possess moderate sulfate concentrations when classified in accordance with Table 4.2.1 of the ACI Design Manual. Per Table 4.3.1 of the ACI Design Manual, Type II cement is required. Concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

LIGHT POLE FOUNDATIONS

Light poles are expected to be installed in landscaped and pavement areas. Pole foundations should be designed assuming unconstrained conditions. The soils surrounding the pole foundations / bases are expected to consist of stiff or medium dense to dense native residual soils

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or controlled, structural fill material. Pole foundations should be designed using an allowable lateral bearing capacity of 200 psf per foot of embedment.

POTABLE WATER QUALITY

We have assumed that domestic water for the development will be provided from the Snohomish County Public Utility District. A copy of their annual water quality report (as posted on their internet site) is included in **Exploration Results**.

GENERAL COMMENTS

As the project progresses, we address assumptions by incorporating information provided by the design team. Revised project information that reflects actual conditions important to our services is reflected in the final report. The design team should collaborate with Terracon to confirm these assumptions and to prepare the final design plans and specifications. This facilitates the incorporation of our opinions related to implementation of our geotechnical recommendations.

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in the final report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our scope of services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration are intended for the sole benefit and exclusive use of our client, Costco Wholesale, for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site

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characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

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ATTACHMENTS

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SITE LOCATION AND EXPLORATION PLANS

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SITE LOCATION

Costco Wholesale CW# 17-0230 ■ Lake Stevens, Washington
May 29, 2018 ■ Terracon Project No. 81185028

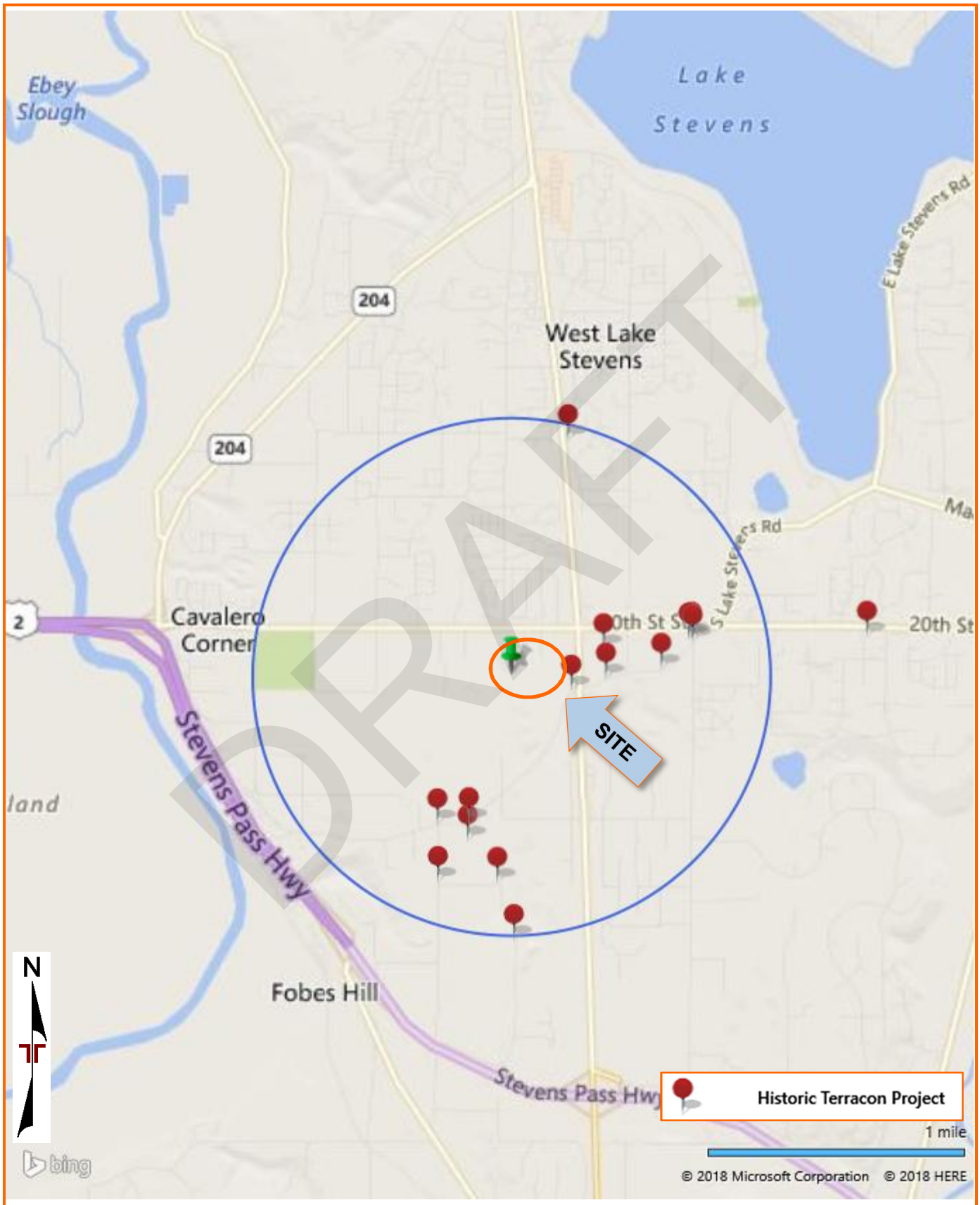

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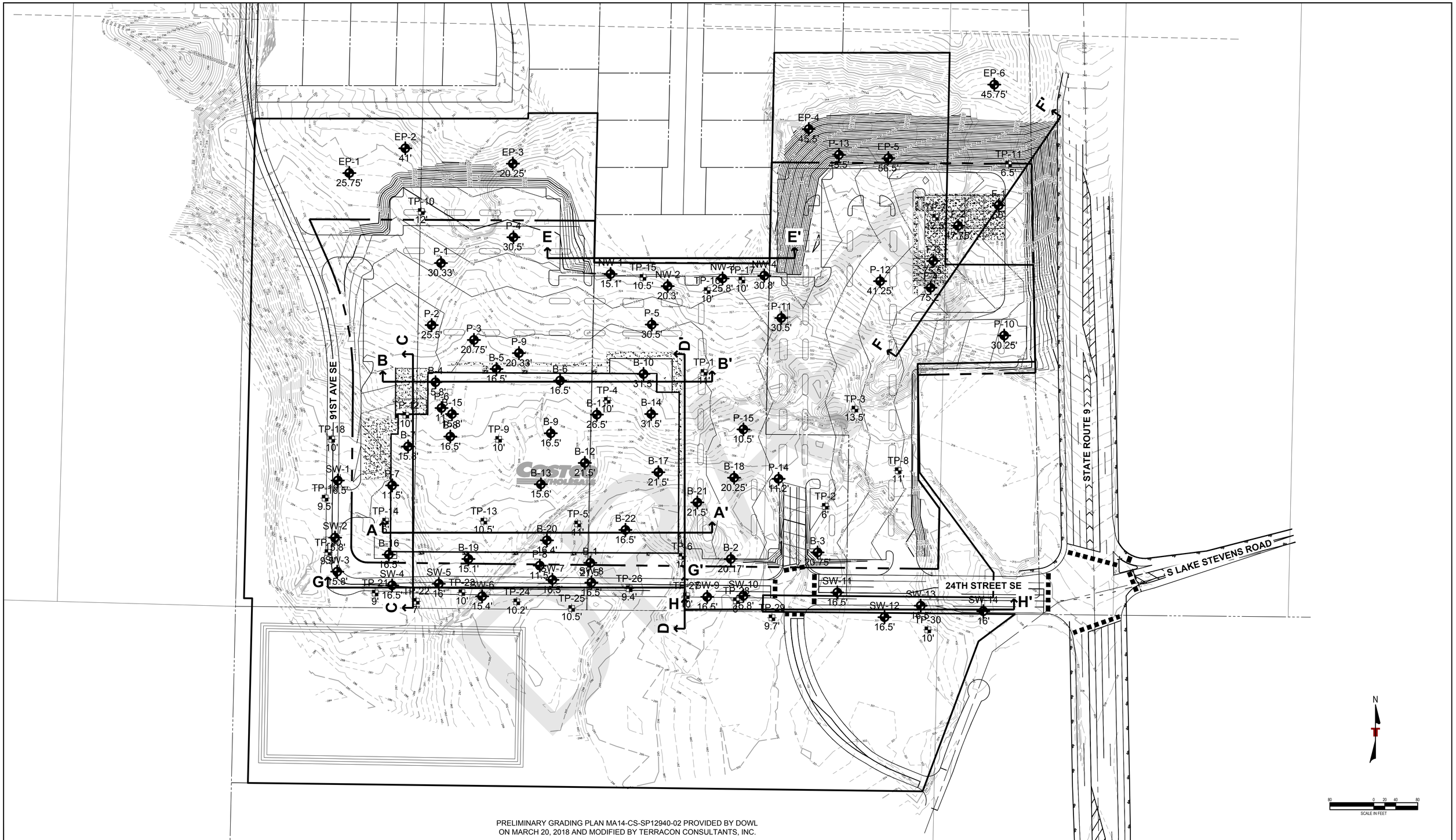
DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS



PRELIMINARY GRADING PLAN MA14-CS-SP12940-02 PROVIDED BY DOWL
ON MARCH 20, 2018 AND MODIFIED BY TERRACON CONSULTANTS, INC.

LEGEND

B-1 / 16.5' — APPROXIMATE BORING LOCATION AND TERMINATION DEPTH

TP-1 / 10.5' — APPROXIMATE TEST PIT LOCATION AND TERMINATION DEPTH

A — A' — CROSS SECTION APPROXIMATE LOCATION

Project Mngr:	JMS
Drawn By:	AMP
Checked By:	TLH
Approved By:	JMS
Project No.	81185028
Scale:	AS SHOWN
File No.	Exhibit 2
Date:	May 2018

Terracon
Consulting Engineers and Scientists
21905 64th Avenue W, Ste 100 Mountlake Terrace, WA 98043
PH. (425) 771-3304 FAX. (425) 771-3549

SITE AND EXPLORATION PLAN

Costco CW # 17-0230
20th Street SE and State Route 9
Lake Stevens, Washington

EXHIBIT 2

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
22	15 to 20	Warehouse
4	45 to 75	Fuel Facility
15	10 to 45	Parking Lot
6	20 to 45	Slopes on North side of Site
4	15 to 30	North Retaining Wall
14	15	South Retaining Wall

Number of Test Pits	Test Pit Depth (feet)	Planned Location
4	6 to 11	Warehouse
1	10	POS Freezer
1	10	Loading Dock
7	10 to 45	Parking Lot
1	12 ½	Fuel Facility
3	10	North Retaining Wall
13	6 to 10	South Retaining Wall

Exploration Layout and Elevations: Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±6 feet after post processing) and approximate elevations are obtained by interpolation from the preliminary grading plan provided by DOWL. Standing water and soft ground conditions near the southeast corner of the site made 4 of the planned boring locations and 5 of the planned test pit explorations inaccessible to tracked equipment at the time of exploration.

Subsurface Exploration Procedures: We advanced the borings with a track-mounted, rotary drill rig using continuous flight hollow stem augers. Four samples are obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter using split-barrel sampling procedures.
In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch O.D. split-barrel sampling spoon with 2.5-inch I.D. was used for sampling at selected locations where gravel was indicated. 3-inch O.D. split-barrel sampling procedures are similar to

DRAFT

standard split spoon sampling procedure; however, blow counts are typically recorded for 6-inch intervals for a total of 12 inches of penetration.

We observed and recorded groundwater levels during drilling and sampling. A standpipe piezometer was installed in boring F-4. A data-logging pressure transducer was used to collect water level measurements.

All borings were backfilled in accordance with Washington Administrative Code (WAC) requirements upon their completion.

The sampling depths, penetration distances, and other sampling information are recorded on the field boring logs. The samples are placed in appropriate containers and taken to our soil laboratory for testing and classification by a geotechnical engineer. Field boring logs are prepared by a Terracon geotechnical engineer or geologist as part of the drilling operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs are prepared from the field logs. The final boring logs represent the geotechnical engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviews the field data and assigns various laboratory tests to better understand the engineering properties of the various soil strata as necessary for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods are applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
- ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
- ASTM D1883 California Bearing Ratio (CBR) of Laboratory-Compacted Soils
- ASTM G57 Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method
- AWWA 4500 H Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing
- ASTM D516 Standard Test Method for Sulfate Ion in Water
- ASTM D512 Standard Test Method for Chloride Ion in Water

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The laboratory testing program often includes examination of soil samples by an engineer. Based on the material's texture and plasticity, we describe and classify the soil samples in accordance with the Unified Soil Classification System.

Other Testing:

- A&L Western Laboratories of Tigard, Oregon was selected to run topsoil analysis for the parameters detailed in the CWDR. The analysis was performed on a composite of selected samples advanced from the ground surface at the site.
- Water quality information was obtained from the Snohomish County Public Utility District.

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EXPLORATION RESULTS

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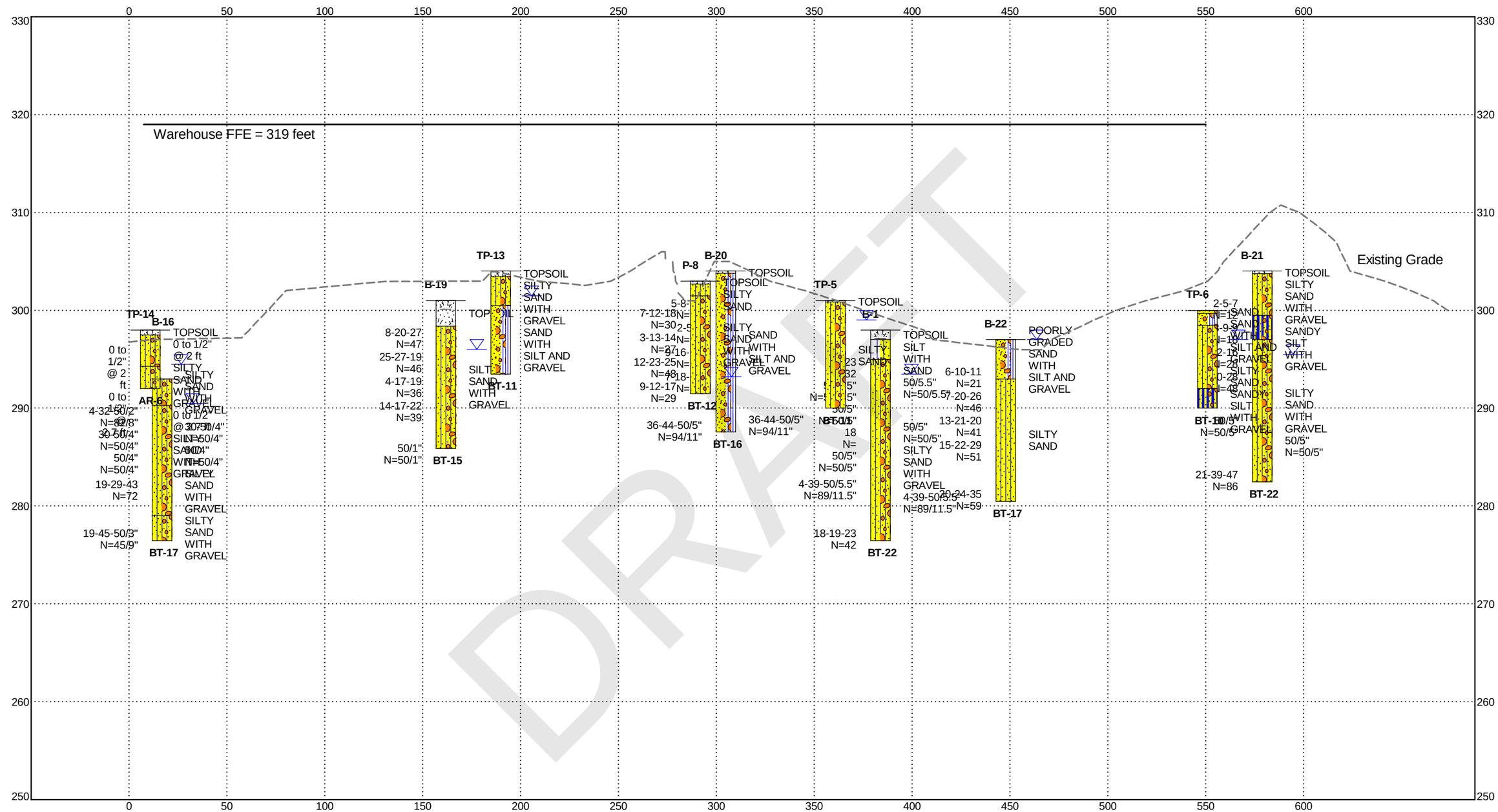

Explanation

B-1 — Borehole Number

Borehole Lithology

AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.

Water Level Reading after drilling.

Topsoil

Silt with Sand

Silty Sand with Gravel

Poorly-graded Sand with Silt and Gravel

Sandy Silt with Gravel

Silty Sand

NOTES:

See Exhibit A-XXX for orientation of soil profile.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: T. Hesedahl	Project No.: 81185028	
Drawn by: T. Hesedahl	Scale: Horiz. 1":50' Vert. 1":10'	
Approved by: J. Schmidt	File Name: 81185028 A-A	
Date: 5/23/2018		

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA
PH. 425-771-3304 FAX. 425-771-3549

SUBSURFACE PROFILE

Section A-A'
COSTCO CW# 17-0230
20TH STREET SE AND SR9
LAKE STEVENS, WA

EXHIBIT 3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COSTCO 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/23/18

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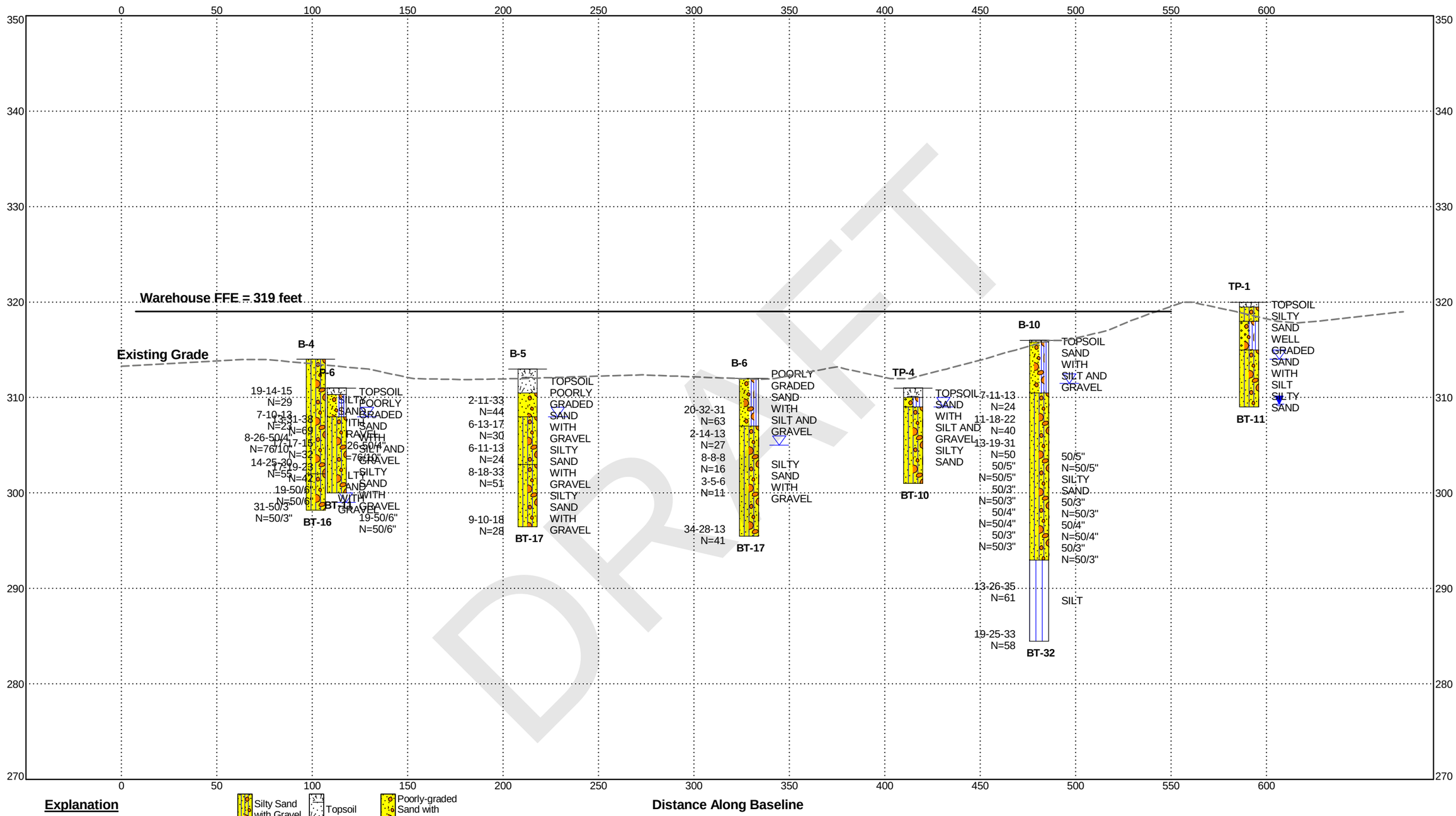
B (W)
North Warehouse Wall
B' (E)
North Warehouse Wall'
Elevation
Distance Along Baseline
Warehouse FFE = 319 feet
Existing Grade
B-4
BT-16
B-5
BT-17
B-6
BT-17
TP-4
BT-10
B-10
BT-32
TP-1
BT-11
TOPSOIL
POORLY GRADED SAND WITH SILT AND GRAVEL
SILTY SAND WITH GRAVEL
SILTY SAND
SAND WITH SILT AND GRAVEL
SILT
WELL GRADED SAND WITH SILT
SILTY SAND
19-14-15
N=29
7-10-13
N=23
13-31-38
N=69
8-26-50/4"
N=76/10"
17-17-15
N=32
14-25-30
N=55
17-19-23
N=42
19-50/6"
N=50/6"
31-50/3"
N=50/3"
26-50/4"
N=76/10"
19-50/6"
N=50/6"
2-11-33
N=44
6-13-17
N=30
6-11-13
N=24
8-18-33
N=51
9-10-18
N=28
20-32-31
N=63
2-14-13
N=27
8-8-8
N=16
3-5-6
N=11
34-28-13
N=41
7-11-13
N=24
11-18-22
N=40
13-19-31
N=50
50/5"
N=50/5"
50/3"
N=50/3"
50/4"
N=50/4"
50/3"
N=50/3"
13-26-35
N=61
19-25-33
N=58
50/5"
N=50/5"
SILTY SAND
50/3"
N=50/3"
50/4"
N=50/4"
50/3"
N=50/3"
SILT
Explanation
B-4
Borehole Number
Borehole Lithology
AR
BT
Borehole Termination Type
Water Level Reading at time of drilling.
Water Level Reading after drilling.
Silty Sand with Gravel
Topsoil
Poorly-graded Sand with Gravel
Poorly-graded Sand with Silt and Gravel
Silt
Well-graded Sand with Silt and Gravel
NOTES:
See Exhibit A-XXX for orientation of soil profile.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination
Project Manager: T. Hesedahl
Drawn by: T. Hesedahl
Approved by: J. Schmidt
Date: 5/23/2018
Project No.: 81185028
Scale: Horiz. 1":50' Vert. 1":10'
File Name: 81185028 B-B
Terracon
21905 64th Ave W Ste 100
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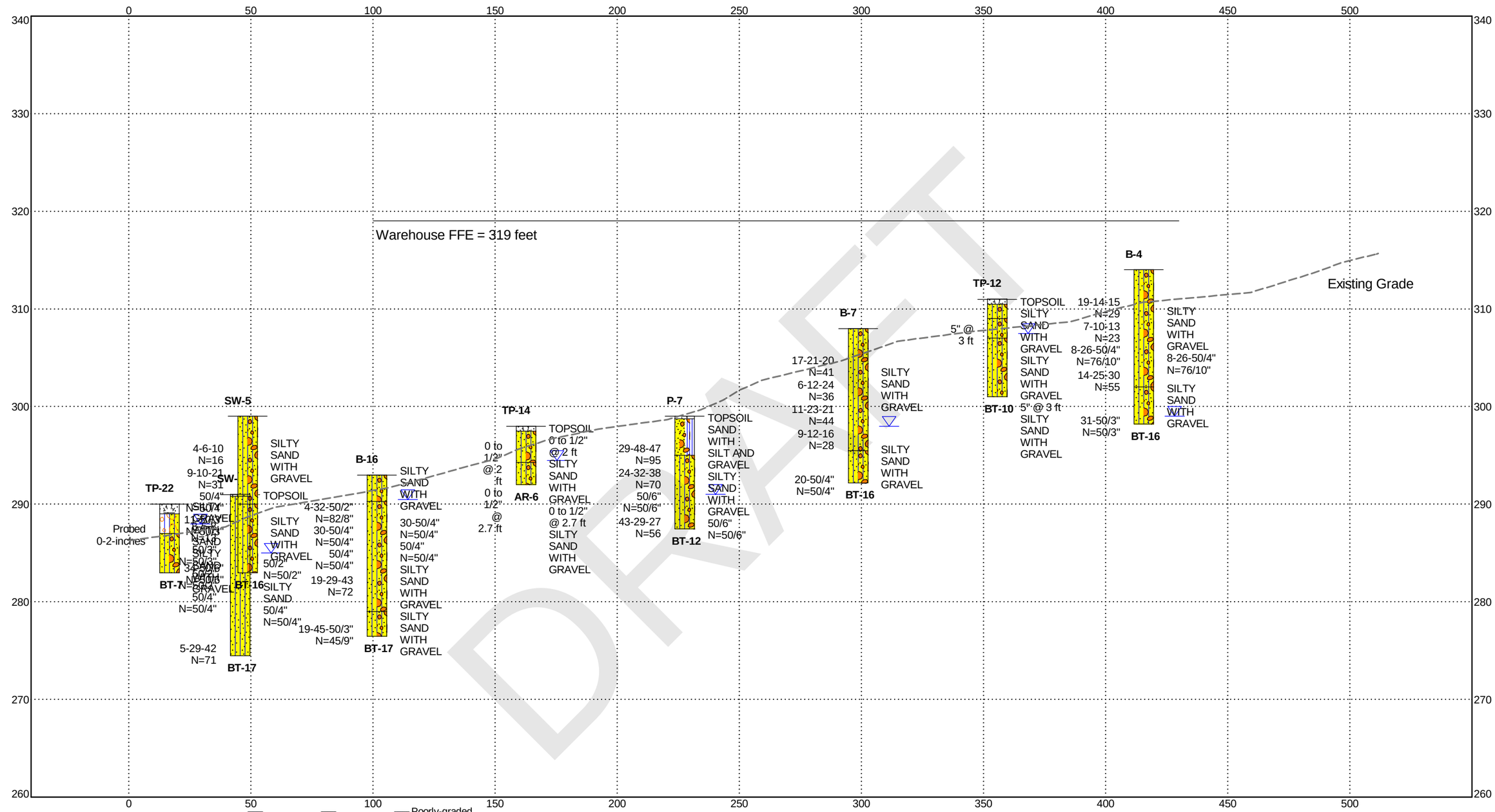
SUBSURFACE PROFILE
Section B-B'
COSTCO CW# 17-0230
20TH STREET SE AND SR9
LAKE STEVENS, WA
EXHIBIT
4
DRAFT
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COSTCO 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/23/18

C (W)
Warehouse West Wall

C' (E)
Warehouse West Wall'



Explanation

B-4 — Borehole Number
Borehole Lithology
AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.
Water Level Reading after drilling.

Silty Sand with Gravel
Topsoil
Poorly-graded Sand with Silt and Gravel
Silty Sand
Silty Gravel with Sand

NOTES:
See Exhibit A-XXX for orientation of soil profile.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: T. Hesedahl	Project No.: 81185028	
Drawn by: T. Hesedahl	Scale: Horiz. 1":40' Vert. 1":10'	
Approved by: J. Schmidt	File Name: 81185028 B-B	
Date: 5/23/2018		

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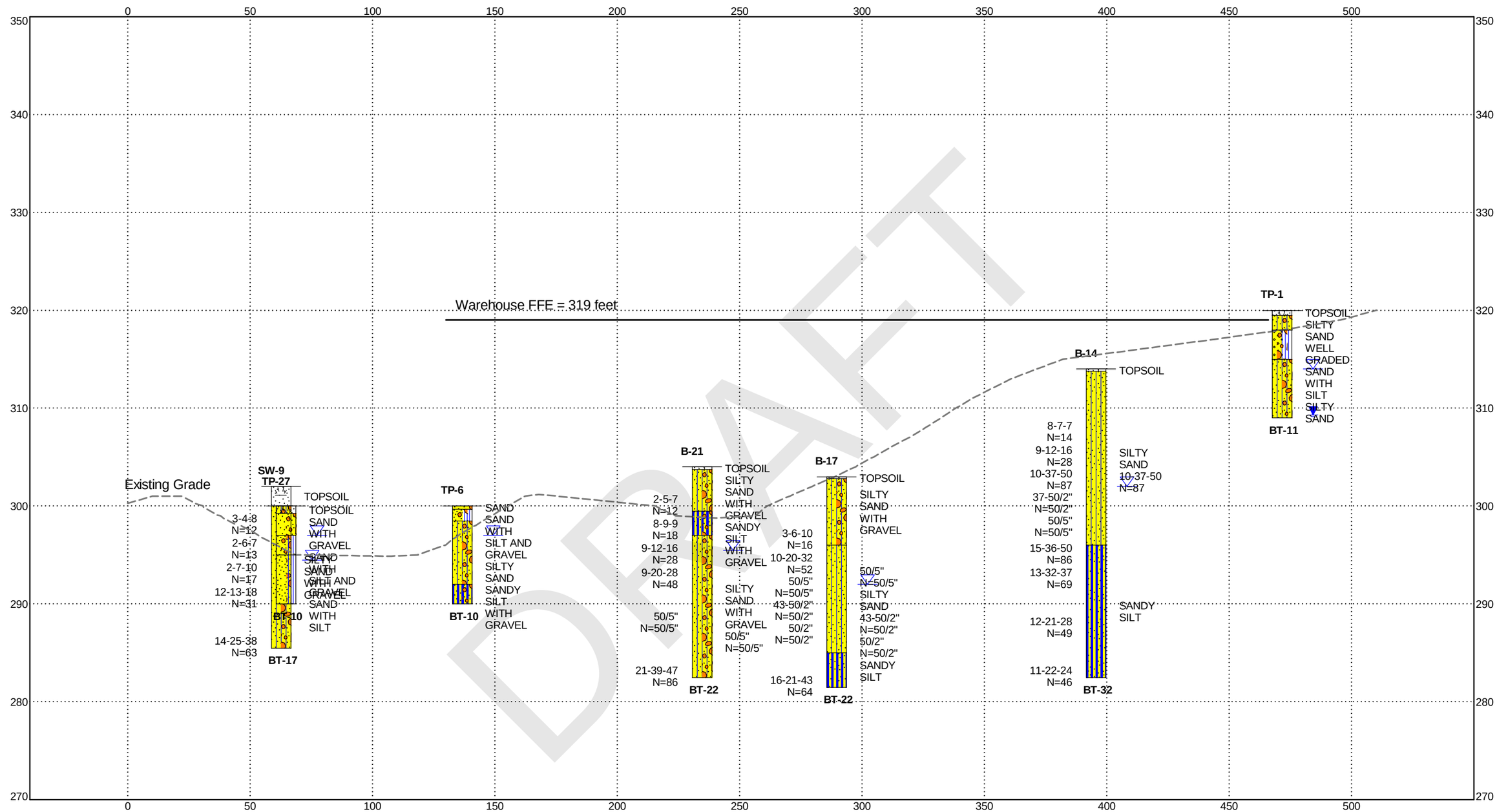
SUBSURFACE PROFILE

Section C-C'
COSTCO CW# 17-0230
20TH STREET SE AND SR9
LAKE STEVENS, WA

EXHIBIT
5

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COSTCO 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/23/18



Explanation

B-14 — Borehole Number

Borehole Lithology

AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.

Water Level Reading after drilling.

Topsoil

Silty Sand

Sandy Silt

Silty Sand with Gravel

Sandy Silt with Gravel

Well-graded Sand with Silt and Gravel

NOTES:

See Exhibit A-XXX for orientation of soil profile.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: T. Hesedahl	Project No.: 81185028	
Drawn by: T. Hesedahl	Scale: Horiz. 1":40' Vert. 1":10'	
Approved by: J. Schmidt	File Name: 81185028 D-D	
Date: 5/23/2018		

Terracon
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Mountlake Terrace, WA
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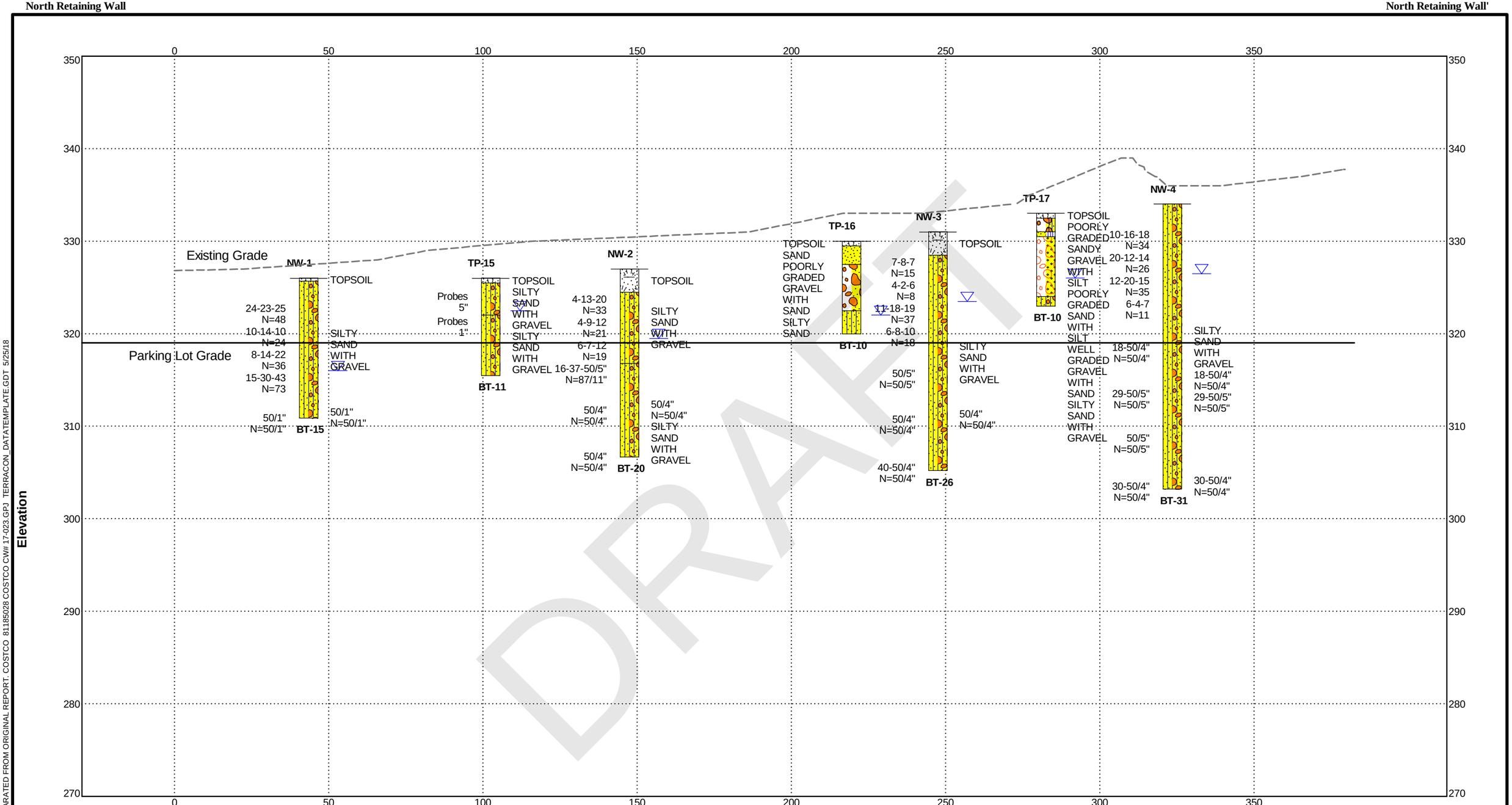
SUBSURFACE PROFILE

Section D-D'
COSTCO CW# 17-0230
20TH STREET SE AND SR9
LAKE STEVENS, WA

EXHIBIT 6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COSTCO 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/23/18



Explanation

NW-1 — Borehole Number

Borehole Lithology

AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.

Water Level Reading after drilling.

Topsoil

Silty Sand with Gravel

Poorly-graded Sand

Poorly-graded Gravel with Sand

Silty Sand

Poorly-graded Gravel with Silt and Sand

NOTES:

See Exhibit A-XXX for orientation of soil profile.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: T. Hesedahl	Project No.: 81185028	
Drawn by: T. Hesedahl	Scale: Horiz. 1":30' Vert. 1":10'	
Approved by: J. Schmidt	File Name: 81185028 B-B	
Date: 5/25/2018		

Terracon
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Mountlake Terrace, WA
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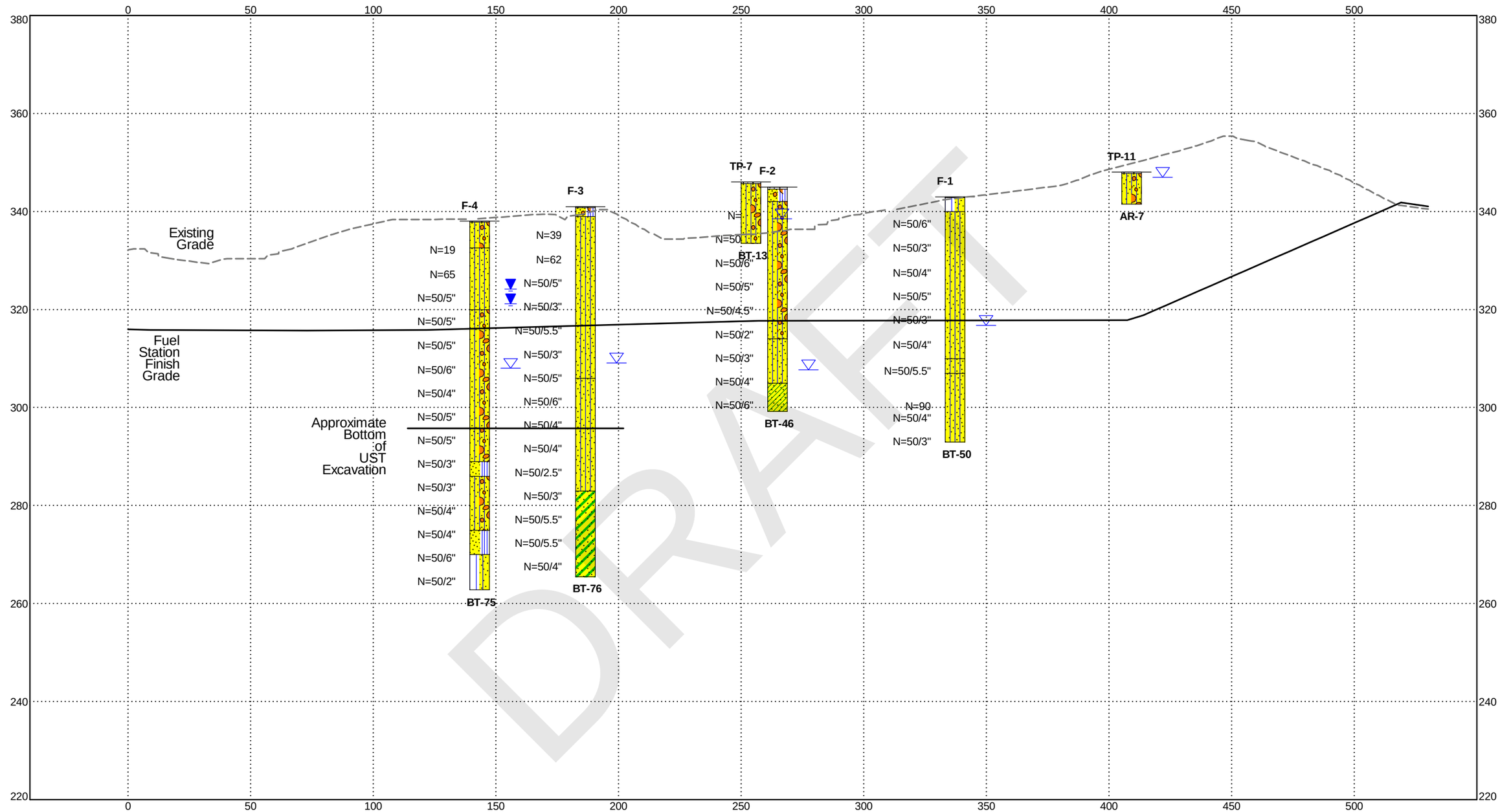
SUBSURFACE PROFILE

Section E-E'
COSTCO CW# 17-0230
20TH STREET SE AND SR9
LAKE STEVENS, WA

EXHIBIT 7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COSTCO 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/25/18



Explanation

F-1 — Borehole Number

Borehole Lithology

AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.

Water Level Reading after drilling.

Topsoil

Silt with Sand

Silty Sand

Poorly-graded Sand with Silt and Gravel

Silty Sand with Gravel

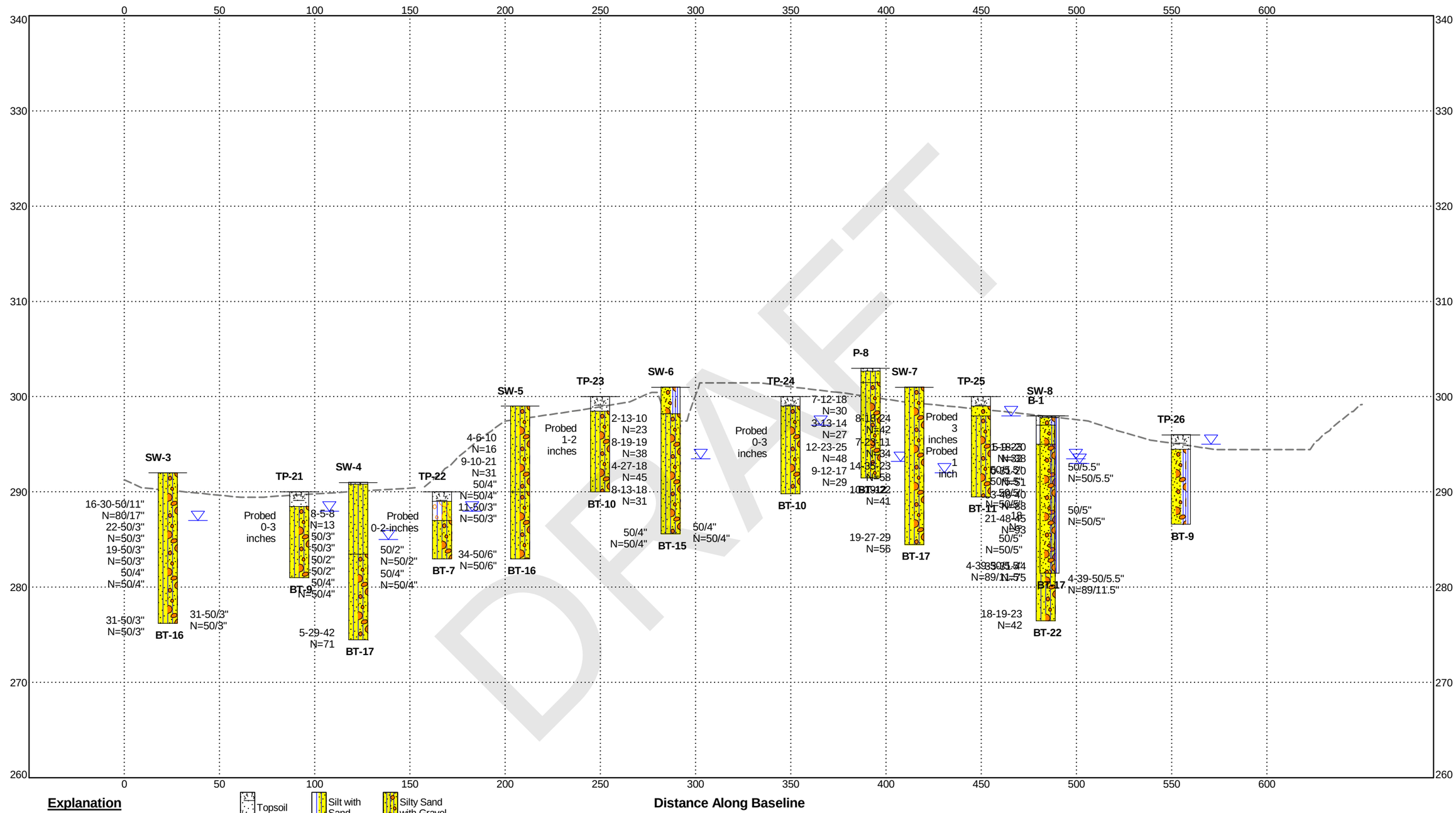
Sandy Lean Clay

NOTES:

See Exhibit A-XXX for orientation of soil profile.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: T. Hesedahl	Project No.: 81185028	Terracon	SUBSURFACE PROFILE	EXHIBIT
Drawn by: T. Hesedahl	Scale: Horiz. 1":40' Vert. 1":20'	21905 64th Ave W Ste 100 Mountlake Terrace, WA	Section F-F' COSTCO CW# 17-0230 20TH STREET SE AND SR9 LAKE STEVENS, WA	8
Approved by: J. Schmidt	File Name: 81185028 F-F	PH. 425-771-3304 FAX. 425-771-3549		
Date: 5/24/2018				

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COSTCO 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/24/18



Explanation

B-1 — Borehole Number

Borehole Lithology

AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.

Water Level Reading after drilling.

Topsoil

Silt with Sand

Silty Sand with Gravel

Silty Sand

Poorly-graded Sand with Silt and Gravel

Silty Gravel with Sand

NOTES:

See Exhibit 2 for orientation of soil profile.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: T. Hesedahl	Project No.: 81185028	
Drawn by: T. Hesedahl	Scale: Horiz. 1":50' Vert. 1":10'	
Approved by: J. Schmidt	File Name: 81185028 G-G	
Date: 5/29/2018		

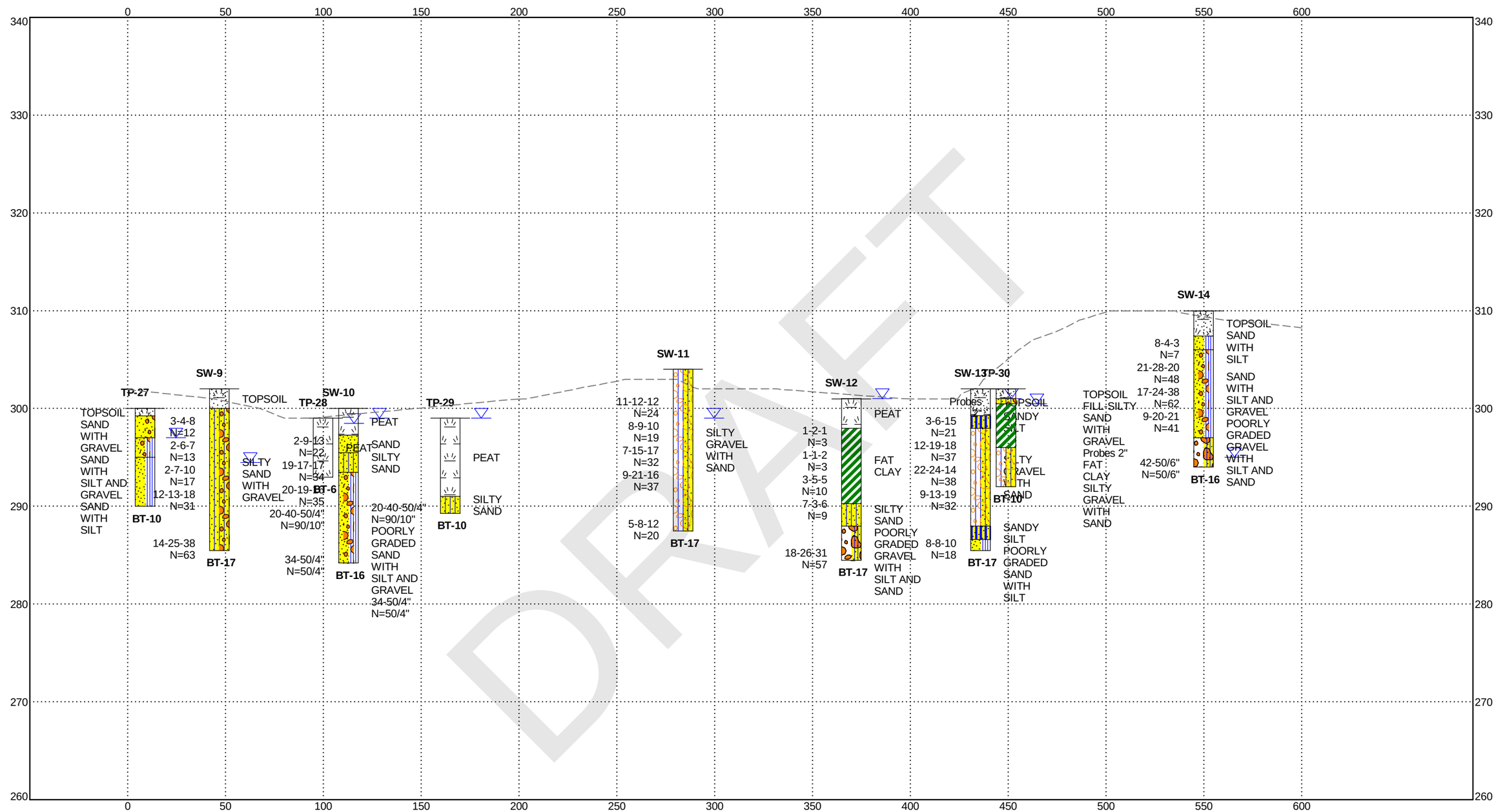
Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA
PH. 425-771-3304 FAX. 425-771-3549

SUBSURFACE PROFILE

Section G-G'
COSTCO CW# 17-0230
20TH STREET SE AND SR9
LAKE STEVENS, WA

EXHIBIT 9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COSTCO 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18



Explanation

SW-9 — Borehole Number

Borehole Lithology

AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.

Water Level Reading after drilling.

Topsoil

Silty Sand with Gravel

Peat

Poorly-graded Sand

Silty Sand

Poorly-graded Sand with Silt and Gravel

NOTES:

See Exhibit 2 for orientation of soil profile.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: T. Hesedahl	Project No.: 81185028	
Drawn by: T. Hesedahl	Scale: Horiz. 1":50' Vert. 1":10'	
Approved by: J. Schmidt	File Name: 81185028 H-H	
Date: 5/29/2018		

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA
PH. 425-771-3304 FAX. 425-771-3549

SUBSURFACE PROFILE

Section H-H'
COSTCO CW# 17-0230
20TH STREET SE AND SR9
LAKE STEVENS, WA

EXHIBIT 10

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COSTCO 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

DRAFT

BORING LOG NO. B-1

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9747° Longitude: -122.1063°
Northing: 358120 Easting: 1328628

Approximate Surface Elev: 298 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
1.0	297+/-	**TOPSOIL**, dark brown, moist, loose
3.0	295+/-	**SILT WITH SAND (ML)**, brown
		SILTY SAND WITH GRAVEL (SM), fine to medium grained sand, light gray, wet, dense, rust mottling
		no recovery
		blue gray, increasing sand and gravel content, rock fragment in tip
		drill chattering
		very dense, increasing sand content
		dense, mottling, interbedded 1/2-in. lenses of sand and gravel
21.5	276.5+/-	***Boring Terminated at 21.5 Feet***

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER
		6	5-9-23 N=32	S-1
5		0	50/5.5" N=50/5.5"	S-2
		1	50/5" N=50/5"	S-3
10		4	18 50/5" N=50/5"	S-4
15		8	4-39-50/5.5" N=89/11.5"	S-5
20		7	18-19-23 N=42	S-6

WATER LEVEL OBSERVATIONS

WATER CONTENT (%)

ATTERBERG LIMITS LL-PL-PI

PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:
Hole collapsed between abandonment and 24 hr reading

WATER LEVEL OBSERVATIONS

4.5' While drilling

17.6' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-19-2018 | Boring Completed: 02-19-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-2

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9747° Longitude: -122.1053°
Northing: 358127 Easting: 1328884

Approximate Surface Elev: 303 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.3	302.5+/-	**TOPSOIL**, dark brown, moist
		SILTY SAND (SM), trace gravel, reddish brown, moist
		fine to coarse grained sand, light gray, moist, loose, reddish brown mottling
4.5	298.5+/-	**SILTY SAND (SM)**, fine to medium grained sand, gray, wet, medium dense
		with gravel, drill chattering
9.0	294+/-	**SILTY SAND WITH GRAVEL (SM)**, fine to coarse grained sand, gray, wet, medium dense, gray mottling
		becomes moist, very dense, thin 1/2 in. lense of interbedded silt with sand
		drill chattering
20.2	283+/-	rock fragment in tip
		Boring Terminated at 20.17 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			14	3-2-2 N=4	S-1			
5			14	3-4-7 N=11	S-2	16		22
			8	9-11-21 N=32	S-3			
10	▽		16	8-11-11 N=22	S-4			
15			10	14-50/6" N=50/6"	S-5			
20			1	50/2" N=50/2"	S-6			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *10' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-02-2018
Boring Completed: 03-02-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-3

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9748° Longitude: -122.1046°
Northing: 358139 Easting: 1329042

Approximate Surface Elev: 305 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.2	305+/-	**TOPSOIL**, dark brown, moist
		SILTY SAND WITH GRAVEL (SM), fine to coarse sand, reddish brown to brown gray, moist, cobbles in cuttings
		rock fragment in tip, hammer bouncing, blow counts may be overstated
		brown gray, medium dense, rust mottled
7.0	298+/-	**SILTY GRAVEL WITH SAND (GM)**, fine gravel, gray, wet, very dense
		driller notes heave
		grades to light gray
19.0	286+/-	**SILTY SAND WITH GRAVEL (SM)**, light gray, moist to wet, rust mottled, flushed borehole with water
20.8	284.5+/-	moist, very dense
		Boring Terminated at 20.75 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS
		0	50/2" N=50/2"
5		5	9-11-11 N=22
		8	43-50/5" N=50/5"
10		13	13-20-40 N=60
15		4	50/4" N=50/4"
20		9	34-50/3" N=50/3"

WATER LEVEL OBSERVATIONS: 7.5' While drilling; 13.2' At completion of drilling

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

7.5' While drilling

13.2' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-02-2018 | Boring Completed: 03-02-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9756° Longitude: -122.1075°
Northing: 358449 Easting: 1328346

Surface Elev.: 314 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
		SILTY SAND WITH GRAVEL (SM), trace organics, light brown and gray with mottled rusty orange, moist, medium dense, rock fragments in sampler
		no recovery
		light gray, very dense, rock fragments in sampler
12.0	302	**SILTY SAND WITH GRAVEL (SM)**, trace silt, bluish gray, moist, very dense drill chatter
15.8	298	***Boring Terminated at 15.8 Feet***

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		18	19-14-15 N=29	S-1	12		31
5		9	7-10-13 N=23	S-2			
		0	8-26-50/4" N=76/10"	S-3			
10		17	14-25-30 N=55	S-4			
15		9	31-50/3" N=50/3"	S-5	9		30

WATER LEVEL OBSERVATIONS: ▽ 15' While drilling

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

15' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-10-2018
Boring Completed: 04-10-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-5

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9757° Longitude: -122.107°
Northing: 358473 Easting: 1328457

Surface Elev.: 313 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		TOPSOIL, dark brown and mineral soil, moist, loose									
2.5	310.5										
		POORLY GRADED SAND WITH GRAVEL (SP), with silt, coarse, orangey brown, wet, dense				17	2-11-33 N=44	S-1			
5.0	308			▽							
		SILTY SAND WITH GRAVEL (SM), light brown and gray, moist to wet	5			7	6-13-17 N=30	S-2			
		gravel content increases				9	6-11-13 N=24	S-3			
10.0	303										
		SILTY SAND WITH GRAVEL (SM), light brown and gray, moist to damp, dense	10			12	8-18-33 N=51	S-4			
		drill chatter									
		trace silt, gray and brown, moist to wet, medium dense 6-in. seam of coarse sand at 15.5 ft.	15			18	9-10-18 N=28	S-5			
16.5	296.5										
		Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-10-2018 | Boring Completed: 04-10-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-6

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9756° Longitude: -122.1066°
Northing: 358452 Easting: 1328573

Surface Elev.: 312 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
					17	20-32-31 N=63	S-1	8		10
5.0	307	5								
					11	2-14-13 N=27	S-2			
					9	8-8-8 N=16	S-3			
		10								
					15	3-5-6 N=11	S-4			
		15			9	34-28-13 N=41	S-5	24		39
16.5	295.5									

POORLY GRADED GRAVELLY SAND WITH SILT (SP-SM), gray and brown with mottled orange, moist, very dense

2-in. thick coarse sand seam at 2.5 ft.

SILTY SAND WITH GRAVEL (SM), gray, moist, medium dense

becomes wet, rock fragments in sampler

trace gravel, fine, becomes dark gray, dense

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

7' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-10-2018 | Boring Completed: 04-10-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-7

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9753° Longitude: -122.1077°
Northing: 358332 Easting: 1328296

Surface Elev.: 308 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SILTY SAND WITH GRAVEL (SM), light brown and gray with mottled rusty orange, moist, dense										
with organics, gray					18	17-21-20 N=41	S-1	13		37
rock fragments		5			15	6-12-24 N=36	S-2			
gray, moist, dense, rock fragments					4	11-23-21 N=44	S-3			
light gray with mottled rusty orange, medium dense, top 5" of sample is wet		10	▽		8	9-12-16 N=28	S-4			
trace silt, light brown and gray, very dense drill chatter		15			7	20-50/4" N=50/4"	S-5	11		35
15.8	292									
Boring Terminated at 15.8 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *10' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-11-2018 | Boring Completed: 04-11-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-8

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9753° Longitude: -122.1074°
Northing: 358350 Easting: 1328373

Surface Elev.: 310 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SILTY SAND WITH GRAVEL (SM), light brown and gray with mottled orange, wet, very dense, rock fragments, varying fines content			▽							
				X	8	14-33-35 N=68	S-1	11		
fine to coarse grained sand		5								
				X	9	8-18-18 N=36	S-2	13		
fine to medium sand, siltier				X	9	5-8-10 N=18	S-3			
		10		X	15	4-11-18 N=29	S-4			
becomes moist, very dense		15		X	18	13-36-43 N=79	S-5			
16.5	293.5									
Boring Terminated at 16.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *2.5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-10-2018 | Boring Completed: 04-10-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-9

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9753° Longitude: -122.1066°
Northing: 358356 Easting: 1328556

Surface Elev.: 308 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
		SILTY SAND WITH GRAVEL (SM), light brown with mottled rusty orange, moist, medium dense
		wet, rock fragments in sampler
		silt and gravel content decreases
		sand seam between 8.5 and 9 ft.
		brown and gray, dense
14.0	294	
		SILTY SAND (SM), trace gravel, fine grained, dark gray with purple-brown streaks, wet, very dense, drill chatter
16.5	291.5	
		Boring Terminated at 16.5 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	▽							
		X	14	19-14-10 N=24	S-1	9		
5		X	6	3-5-7 N=12	S-2			
		X	12	7-9-12 N=21	S-3			
10		X	12	14-20-16 N=36	S-4			
15		X	6	25-45-39 N=84	S-5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *2.5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-10-2018 | Boring Completed: 04-10-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-10

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9756° Longitude: -122.1059°
Northing: 358464 Easting: 1328725

Approximate Surface Elev: 316 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.2	316+/-	**TOPSOIL**, dark brown, moist
		POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), fine to coarse grained, yellow brown, moist
		gravel with sand in barrel @ 5 ft.
5.5	310.5+/-	**SILTY SAND WITH GRAVEL (SM)**, fine to medium grained, light gray, wet, medium dense, rock fragments in tip
		dense, rock fragments in tip, water in spoon
		gravel up to 5 in. dia. in cuttings
		very dense, rock fragments in tip
		light gray, mottled, rock fragments
		moist, mottled, rock fragments
		gray, 1/2-in. lense of interbedded sand
		mottled
23.0	293+/-	**SILT (ML)**, trace sand, blue gray, moist, hard

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER
5		4	7-11-13 N=24	S-1
		1	11-18-22 N=40	S-2
10		0.5	13-19-31 N=50	S-3
		4	50/5" N=50/5"	S-4
15		3	50/3" N=50/3"	S-5
		4	50/4" N=50/4"	S-6
20		3	50/3" N=50/3"	S-7
25				

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

4.5' While drilling

29.6' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-01-2018 | Boring Completed: 03-01-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-10

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9756° Longitude: -122.1059°
Northing: 358464 Easting: 1328725

Approximate Surface Elev: 316 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILT (ML), trace sand, blue gray, moist, hard *(continued)*										
						16	13-26-35 N=61	S-8			
			30			18	19-25-33 N=58	S-9			
	31.5	284.5+/-									
	Boring Terminated at 31.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

4.5' While drilling

29.6' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-01-2018 | Boring Completed: 03-01-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-11

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9754° Longitude: -122.1063°
Northing: 358390 Easting: 1328640

Approximate Surface Elev: 310 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.1	310+/-	**TOPSOIL**, moist
		SILTY SAND WITH GRAVEL (SM), fine to coarse grained sand, reddish brown, moist
3.5	306.5+/-	**SILTY SAND (SM)**, light gray, wet, mottled, rock fragments
		medium dense
		becomes wet, very dense
		moist
		fine grained sand, blue gray, rock fragments
		increasing silt content
18.0	292+/-	**SANDY SILT (ML)**, trace gravel, fine grained sand, moist, rock fragments

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			14	9-26-24 N=50	S-1	9		22
5			5	17-16-10 N=26	S-2			
	▽		12	12-19-50 N=69	S-3			
10			10	27-50/4" N=50/4"	S-4			
			12	20-50/6" N=50/6"	S-5			
15			16	18-27-34 N=61	S-6			
20			8	11-31-50/5" N=81/11"	S-7			
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *8.2' While drilling*

▽ *26' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-01-2018 | Boring Completed: 03-01-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-11

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9754° Longitude: -122.1063°
Northing: 358390 Easting: 1328640

Approximate Surface Elev: 310 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	26.5	283.5+/-		▽		18	11-17-24 N=41	S-8			

SANDY SILT (ML), trace gravel, fine grained sand, moist, rock fragments *(continued)*

Boring Terminated at 26.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *8.2' While drilling*

▽ *26' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-01-2018 | Boring Completed: 03-01-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-12

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9752° Longitude: -122.1064°
Northing: 358302 Easting: 1328618

Approximate Surface Elev: 307 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	307+/-	**TOPSOIL**, dark brown, moist
		SILTY SAND WITH GRAVEL (SM), fine to coarse grained, reddish brown, moist
		light gray, dense
		medium dense, mottled
		wet, dense, (S-3A)
		moist, mottled, siltier (S-3B)
		gray, very dense, mottled
14.0	293+/-	**SANDY SILT (ML)**, fine grained sand, gray, moist, hard
21.5	285.5+/-	***Boring Terminated at 21.5 Feet***

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		12	7-21-26 N=47	S-1	15		
5		10	4-7-13 N=20	S-2			
		14	17-20-23 N=43	S-3A			
				S-3B			
10		12	43-50/6" N=50/6"	S-4			
15		16	20-38-50/5" N=88/11"	S-5	19	23-21-2	
20		18	14-28-33 N=61	S-6			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

7.6' While drilling

21.3' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-01-2018 | Boring Completed: 03-01-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-13

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9751° Longitude: -122.1067°
Northing: 358263 Easting: 1328538

Surface Elev.: 307 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
		TOPSOIL, dark brown, moist
2.8	304	
		SILTY SAND WITH GRAVEL (SM), orangey brown, moist, medium dense
		light brown and gray
		brown, wet, dense
		rusty orange mottling
		bluish gray, very dense, drill chatter
15.6	291.5	
		Boring Terminated at 15.6 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			17	2-10-10 N=20	S-1	14		
5			14	2-7-10 N=17	S-2			
	▽		18	10-14-16 N=30	S-3			
10			18	10-15-18 N=33	S-4			
15			7	33-50/2" N=50/2"	S-5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *7.5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-10-2018 | Boring Completed: 04-10-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-14

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9754° Longitude: -122.1059°
Northing: 358391 Easting: 1328739

Approximate Surface Elev: 314 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.2	314+/-	**TOPSOIL**, dark brown, moist
		SILTY SAND WITH GRAVEL (SM), yellow brown, moist
		light gray, medium dense, mottled
		very dense, interbedded sand with silt
		thin interbedded 1/4-in. lenses of sand
18.0	296+/-	**SANDY SILT (ML)**, blue gray, moist, hard

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5			5	8-7-7 N=14	S-1	16		
			14	9-12-16 N=28	S-2			
10			12	10-37-50 N=87	S-3A			
					S-3B			
	▽							
			6	37-50/2" N=50/2"	S-4			
15			5	50/5" N=50/5"	S-5			
			14	15-36-50 N=86	S-6			
20			18	13-32-37 N=69	S-7			
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *12' Groundwater Observed*

▽ *29.9' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-01-2018 | Boring Completed: 03-01-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-14

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9754° Longitude: -122.1059°
Northing: 358391 Easting: 1328739

Approximate Surface Elev: 314 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY SILT (ML), blue gray, moist, hard *(continued)*									
					18	12-21-28 N=49	S-8			
		30	▽							
					18	11-22-24 N=46	S-9			
31.5	282.5+/-									
	Boring Terminated at 31.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *12' Groundwater Observed*

▽ *29.9' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-01-2018 | Boring Completed: 03-01-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-15

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9751° Longitude: -122.1074°
Northing: 358259 Easting: 1328376

Surface Elev.: 311 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.4	310.5	**TOPSOIL**, dark orangish brown, moist
		SILTY SAND (SM), trace gravel, light gray and brown, moist, dense, rock fragments in shoe
		rock fragments
		light gray and orangey brown, gravel content increases
		brown and gray with mottled rusty orange, drill chatter, rock fragments
15.8	295	brown and gray, very dense, rock fragments in shoe and sampler
		Boring Terminated at 15.8 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		18	12-11-19 N=30	S-1	14		
5		12	4-10-22 N=32	S-2			
		10	18-24-14 N=38	S-3			
10		10	7-11-23 N=34	S-4			
15		9	36-50/3" N=50/3"	S-5			

WATER LEVEL OBSERVATIONS: 10' While drilling

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

10' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-11-2018
Boring Completed: 04-11-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-16

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9747° Longitude: -122.1078°
Northing: 358135 Easting: 1328261

Surface Elev.: 293 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
		SILTY SAND WITH GRAVEL (SM), dark gray, wet
2.7	290.5	
		SILTY SAND WITH GRAVEL (SM), trace silt, orange brown, moist, dense, rock fragments, blow counts may be overstated
		bluish gray, very dense, rock fragments, blow counts may be overstated
		gray
		wet
14.0	279	
		SILTY SAND WITH GRAVEL (SM), gray, moist, very dense, rock fragments
16.5	276.5	
		Boring Terminated at 16.5 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	▽							
			5	4-32-50/2" N=82/8"	S-1			
5			9	30-50/4" N=50/4"	S-2			
			5	50/4" N=50/4"	S-3	18		
10			18	19-29-43 N=72	S-4			
15			1.5	19-45-50/3" N=45/9"	S-5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *2.5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-09-2018 | Boring Completed: 04-09-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-17

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9752° Longitude: -122.1058°
Northing: 358285 Easting: 1328752

Approximate Surface Elev: 303 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.2	303+/-	**TOPSOIL**, dark brown, moist
		SILTY SAND WITH GRAVEL (SM), fine to coarse grained sand, reddish brown, moist
		gravel in cuttings
		medium dense, no recovery
7.0	296+/-	**SILTY SAND (SM)**, with gravel, fine to medium grained sand, gray, wet, hard
		mottled, increasing gravel content
		drill chattering
		light gray, 2 interbedded 1/2-in. sand lenses
		fine grained sand, gray, moist
18.0	285+/-	**SANDY SILT (ML)**, medium plasticity, blue gray, moist, hard
21.5	281.5+/-	***Boring Terminated at 21.5 Feet***

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER
5		0	3-6-10 N=16	S-1
		2	10-20-32 N=52	S-2
10		2	50/5" N=50/5"	S-3
		6	43-50/2" N=50/2"	S-4
15		2	50/2" N=50/2"	S-5
20		18	16-21-43 N=64	S-6

WATER LEVEL OBSERVATIONS: 11' While drilling

WATER CONTENT (%) / ATTERBERG LIMITS LL-PL-PI / PERCENT FINES: not measured

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

11' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-01-2018
Boring Completed: 03-01-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-18

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9751° Longitude: -122.1053°
Northing: 358275 Easting: 1328890

Approximate Surface Elev: 304 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.3	304+/-	**TOPSOIL**, dark brown, moist
		SILTY SAND WITH GRAVEL (SM), fine to coarse grained sand, reddish brown to gray, moist to wet, medium dense to very dense
		dense, gravel in tip
		cuttings grade to gray
		wet, mottled
		medium dense
		light gray
		trace gravel, very dense
20.3	284+/-	***Boring Terminated at 20.25 Feet***

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER
		1	6-18-23 N=41	S-1
5		9	11-27-28 N=55	S-2
		10	9-10-12 N=22	S-3
10		12	7-11-15 N=26	S-4
15		12	25-50/6" N=50/6"	S-5
20		3	50/3" N=50/3"	S-6

WATER LEVEL OBSERVATIONS: 6.4' While drilling; 14.6' At completion of drilling

WATER CONTENT (%) / ATTERBERG LIMITS LL-PL-PI / PERCENT FINES: not measured

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

6.4' While drilling

14.6' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-02-2018
Boring Completed: 03-02-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-19

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9747° Longitude: -122.1072°
Northing: 358127 Easting: 1328406

Surface Elev.: 301 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
2.6	298.5	**TOPSOIL**, dark brown, moist
		SILTY SAND WITH GRAVEL (SM), light brown and gray with rusty orange mottling, moist, dense
		brown, moist to wet, rock fragments
		3-in. coarse sand layer at 10 ft. 1/2-in. sand seam at 10.3 ft.
15.1	286	***Boring Terminated at 15.1 Feet***

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			17	8-20-27 N=47	S-1	14		31
5	▽		0	25-27-19 N=46	S-2			
			12	4-17-19 N=36	S-3			
10			18	14-17-22 N=39	S-4			
15			0	50/1" N=50/1"	S-5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-09-2018 | Boring Completed: 04-09-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-20

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9748° Longitude: -122.1066°
Northing: 358161 Easting: 1328549

Surface Elev.: 304 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	304									
TOPSOIL, brown										
SAND WITH SILT AND GRAVEL (SP-SM), light gray and brown, moist, medium dense, 2-in. coarse sand seam at 2.7 ft.										
					18	5-8-10 N=18	S-1	14		
wet		5			16	2-5-7 N=12	S-2			
rock in shoe					12	9-16-15 N=31	S-3			
		10			11	7-18-19 N=37	S-4			
light gray brown, moist, very dense, rock fragments in sampler		15			17	36-44-50/5" N=94/11"	S-5			
16.4	287.5									
Boring Terminated at 16.4 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-10-2018 | Boring Completed: 04-10-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-21

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.975° Longitude: -122.1055°
Northing: 358230 Easting: 1328823

Approximate Surface Elev: 304 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	304+/-	**TOPSOIL**, dark brown, moist
		SILTY SAND WITH GRAVEL (SM), fine to coarse grained sand, reddish brown, moist
		medium dense
4.5	299.5+/-	
		SANDY SILT WITH GRAVEL (ML), fine to medium grained sand, light brown, moist, very stiff, mottled
7.0	297+/-	
		SILTY SAND WITH GRAVEL (SM), fine to coarse grained sand, light gray, wet, medium dense
		dense, mottled, increasing silt content
		fine to coarse grained sand, light gray, very dense, mottled
21.5	282.5+/-	
		Boring Terminated at 21.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		7	2-5-7 N=12	S-1			
5		9	8-9-9 N=18	S-2	18	NP	
		6	9-12-16 N=28	S-3			
10		6	9-20-28 N=48	S-4			
15		5	50/5" N=50/5"	S-5			
20		18	21-39-47 N=86	S-6			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

8.5' While Drilling

17.1' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 03-02-2018 | Boring Completed: 03-02-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. B-22

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9749° Longitude: -122.1061°
Northing: 358180 Easting: 1328692

Surface Elev.: 297 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		POORLY GRADED SAND WITH SILT AND GRAVEL (SM), brown, wet, medium dense, rock in sampler tip, blow counts may be overstated									
					X	2	6-10-11 N=21	S-1			
4.0	293	**SILTY SAND (SM)**, bluish gray, dense, large rock fragments									
			5		X	4	7-20-26 N=46	S-2			
		dark gray, rock fragments in sampler			X	2	13-21-20 N=41	S-3			
		gray, sand with gravel layer between 10 and 10.4 ft.	10		X	18	15-22-29 N=51	S-4			
		very dense									
		gravel content decreases	15		X	15	20-24-35 N=59	S-5			
16.5	280.5	***Boring Terminated at 16.5 Feet***									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

0' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-10-2018 | Boring Completed: 04-10-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-1

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9765° Longitude: -122.1033°
Northing: 358771 Easting: 1329372

Approximate Surface Elev: 343 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.2	343+/-	**TOPSOIL**, moist
		SILT (ML), with sand and gravel, brown, moist
3.0	340+/-	**SILTY SAND (SM)**, trace gravel, olive gray, moist, very dense
		mottled
		rock fragment in tip
		interbedded thin lenses of sand. mottled
		lighty gray, rock fragment in tip

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5			10	36-50/6" N=50/6"	S-1	11		
10			9	38-50/3" N=50/3"	S-2			
15			10	31-50/4" N=50/4"	S-3	9		
20			5	50/5" N=50/5"	S-4			
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

26.2' While drilling

27.1' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-26-2018 | Boring Completed: 02-26-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-1

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9765° Longitude: -122.1033°
Northing: 358771 Easting: 1329372

Approximate Surface Elev: 343 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER
		SILTY SAND (SM), trace gravel, olive gray, moist, very dense *(continued)*			3	50/3" N=50/3"	S-5
		fine grained sand, gray, green mottling					
		drill chattering from 27 ft to 29 ft					
		drill chattering and jumping at 29 ft					
		green mottling	30		6	50/4" N=50/4"	S-6
		drill chattering and jumping from 30 ft to 35 ft					
33.0	310+/-	**SILTY SAND (SM)**, trace gravel, fine sand, light gray, moist, very dense					
			35		11	31-50/5.5" N=50/5.5"	S-7
		mottled, 6" lense of sand with silt at 37.5 ft to 38 ft (S-8A)					
					6	17-27-50/6" N=90/12"	S-8A
					12		S-8B
		sand with silt and gravel at 40 ft. to 40.5 ft. (S-9A)	40		6	37-50/4" N=50/4"	S-9A
		olive gray, mottled (S-9B)			4		S-9B
		light gray, water in spoon			3	50/3" N=50/3"	S-10
		interbedded lenses of sand with silt	45		18	17-27-50/6" N=90/12"	S-11
		gray, wet, water in spoon, increasing gravel content			3	50/3" N=50/3"	S-12
		drill chattering and jumping					
50.0	293+/-	driller said boulder at 50 ft, rods bouncing when dropped in, no	50				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

26.2' While drilling

27.1' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-26-2018 | Boring Completed: 02-26-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-1

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9765° Longitude: -122.1033°
Northing: 358771 Easting: 1329372

Approximate Surface Elev: 343 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	recovery					0	50/0" N=50/0"	S-13			
	Boring Terminated at 50 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

26.2' While drilling

27.1' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-26-2018 | Boring Completed: 02-26-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

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BORING LOG NO. F-2

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9764° Longitude: -122.1036°
Northing: 358734 Easting: 1329298

Approximate Surface Elev: 345 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.4	344.5+/-	**TOPSOIL**, dark brown, moist
		SAND WITH SILT AND GRAVEL (SP-SM), brown, moist, trace organics
3.0	342+/-	**SILTY SAND WITH GRAVEL (SM)**, fine to coarse grained sand, brown to gray, moist, dense to very dense
		fine to medium grained sand, very dense
		mottled, rock fragments
		thin lenses of interbedded sand, rock fragments in tip

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5		X	7	2-6-29 N=35	S-1			
10		X	8	45-50/3" N=50/3"	S-2			
15		X	0	30-50/6" N=50/6"	S-3			
20		X	5	50/5" N=50/5"	S-4			
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

37.3' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-21-2018
Boring Completed: 02-21-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-2

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9764° Longitude: -122.1036°
Northing: 358734 Easting: 1329298

Approximate Surface Elev: 345 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
		SILTY SAND WITH GRAVEL (SM), fine to coarse grained sand, brown to gray, moist, dense to very dense *(continued)* gray, slightly mottled, no recovery
31.0	314+/-	**SILTY SAND (SM)**, trace gravel, gray, moist, very dense, increasing fines content
		rock fragments
40.0	305+/-	**SANDY CLAY (CL)**, trace gravel, gray, hard, rock fragments in tip, water in sampler
45.8	299.5+/-	***Boring Terminated at 45.75 Feet***

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			50/4.5" N=50/4.5"	S-5			
30		2	50/2" N=50/2"	S-6			
		2	50/3" N=50/3"	S-7			
35		7	50/4" N=50/4"	S-8			
		6	50/6" N=50/6"	S-9			
40		5	50/5" N=50/5"	S-10			
		5	50/3" N=50/3"	S-11			
45		12	49-50/3" N=50/3"	S-12			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

37.3' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-21-2018
Boring Completed: 02-21-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-3

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9762° Longitude: -122.1038°
Northing: 358670 Easting: 1329253

Approximate Surface Elev: 341 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	341+/-	**TOPSOIL**, dark brown
2.0	339+/-	**SAND WITH SILT AND GRAVEL (SP-SM)**, with organics, reddish brown, moist
		SILTY SAND (SM), trace gravel, fine grained sand, brown gray, moist
		drill chattering
		dense, mottled, rock fragments in barrel
		drill chattering from 5 ft to 10 ft
		fine to medium grained sand, very dense, mottled, rock fragment in tip
		mottled, increasing gravel, broken rock fragments
		drill chattering
		very dense, increasing fines content, mottled

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5		X	12	30-19-20 N=39	S-1			
10		X	18	17-30-32 N=62	S-2			
15		X	0	9-50/5" N=50/5"	S-3			
20		X	9	38-50/3" N=50/3"	S-4			
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

31.9' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-20-2018
Boring Completed: 02-20-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-3

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9762° Longitude: -122.1038°
Northing: 358670 Easting: 1329253

Approximate Surface Elev: 341 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), trace gravel, fine grained sand, brown gray, moist *(continued)*				5	50/5.5" N=50/5.5"	S-5			
		sand fines with depth									
		olive gray	30			3	50/3" N=50/3"	S-6			
		wet, mottled gray silt from 37.5 ft to 33 ft (S-7A), silty sand from 33 ft to 33.5 ft (S-7B)		▽		10	30-50/5" N=50/5"	S-7			
35.0	306+/-	**SILTY SAND (SM)**, trace gravel, fine grained sand, blue gray, wet, very dense	35			6	50/6" N=50/6"	S-8			
		moist, no mottling				0	50/4" N=50/4"	S-9			
		wet, thin lense of sand with silt	40			4	50/4" N=50/4"	S-10			
		no recovery, rock fragment in tip				0	50/2.5" N=50/2.5"	S-11			
			45			9	42-50/3" N=50/3"	S-12			
		moist				5.5	50/5.5" N=50/5.5"	S-13			
			50								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *31.9' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-20-2018 | Boring Completed: 02-20-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-3

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9762° Longitude: -122.1038°
Northing: 358670 Easting: 1329253

Approximate Surface Elev: 341 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER
				5.5	50/5.5" N=50/5.5"	S-14
				0	50/4" N=50/4"	S-15
		55		5	50/5" N=50/5"	S-16
58.0	283+/-					
		60		5	46-50/5.5" N=50/5.5"	S-17
		65		4	50/4" N=50/4"	S-18
		70		3	50/3" N=50/3"	S-19
		75				

SILTY SAND (SM), trace gravel, fine grained sand, blue gray, wet, very dense *(continued)*
fine to coarse grained sand

wet, increasing sand and gravel content

drill chattering from 53 ft to 55 ft

very dense, green mottling

CLAYEY SAND (SC), trace gravel, blue gray, moist, very dense, interbedding thin lenses clay

interbedding thin lenses clay

little recovery, rock fragment stuck in tip

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

31.9' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-20-2018
Boring Completed: 02-20-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-3

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9762° Longitude: -122.1038°
Northing: 358670 Easting: 1329253

Approximate Surface Elev: 341 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	75.5	265.5+/-				0	50/5" N=50/5"	S-20			
	Boring Terminated at 75.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

31.9' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-20-2018 | Boring Completed: 02-20-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION: See Exploration Plan

Latitude: 47.9761° Longitude: -122.1038°
Northing: 358621 Easting: 1329248

Approximate Surface Elev: 338 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.2	338+/-	**TOPSOIL**, light brown
		SILTY SAND WITH GRAVEL (SM), brown, moist
5.4	332.5+/-	**SILTY SAND (SM)**, trace gravel, olive gray, moist, medium dense
		very dense
		no recovery
18.0	320+/-	**SILTY SAND WITH GRAVEL (SM)**, dark gray, moist, very dense

INSTALLATION DETAILS: Flush monument; Concrete; Bentonite

DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	PERCENT FINES
5	17	4-14-5 N=19	S-1	12	39
10	18	12-23-42 N=65	S-2		
15	0	50/5" N=50/5"	S-3		
20	8	50/5" N=50/5"	S-4		
25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

- *30' While drilling*
- *4/4/2018*
- *5/14/2018*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-21-2018
Boring Completed: 02-21-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION: See Exploration Plan

Latitude: 47.9761° Longitude: -122.1038°
Northing: 358621 Easting: 1329248

Approximate Surface Elev: 338 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), dark gray, moist, very dense *(continued)* increasing sand content, gravel fragments				10	50/5" N=50/5"	S-5			
30.0	308+/-		30	▽		9	50/6" N=50/6"	S-6			
		SILTY SAND (SM), gray, moist, very dense, water in sampler									
		mottled, interbedded layers of silty sand				10	50-50/4" N=50/4"	S-7	13		48
		wet, 2-in. lense of interbedded sand with silt, rock fragment	35			5	50/5" N=50/5"	S-8			
		trace gravel, interbedded layers of increasing sand content				5	50/5" N=50/5"	S-9	15		
			40			4	50/3" N=50/3"	S-10			
		gray, moist, rock fragments				3	50/3" N=50/3"	S-11			
			45			4	50-50/4" N=50/4"	S-12			
		interbedded layers of increasing sand content				4	50-50/4" N=50/4"	S-13			
49.0	289+/-										
			50								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

- ▽ *30' While drilling*
- ▽ *4/4/2018*
- ▼ *5/14/2018*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-21-2018 | Boring Completed: 02-21-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION: See Exploration Plan

Latitude: 47.9761° Longitude: -122.1038°
Northing: 358621 Easting: 1329248

Approximate Surface Elev: 338 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	Sample Type	Recovery (In.)	Field Test Results	Sample Number
		SAND WITH SILT (SP-SM), trace gravel, gray brown, wet, very dense, 5-in. interbedded lense of silty sand		18	31-50/6" N=50/6"	S-14
52.0	286+/-	driller added water to hole *(continued)*				
		SILTY SAND WITH GRAVEL (SM), gray, moist, very dense, rock fragments		2	50-50/2" N=50/2"	S-15
55				3	50/3" N=50/3"	S-16
60		increasing sand content		8	50/3" N=50/3"	S-17
63.0	275+/-	**SAND WITH SILT (SP-SM)**, gray, moist, very dense				
65		driller noted heave		3	50/3" N=50/3"	S-18
68.0	270+/-	**SILT WITH SAND (ML)**, gray, moist, hard				
70				3	50/3" N=50/3"	S-19
75		no recovery				

Sand

slotted screen

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

- *30' While drilling*
- *4/4/2018*
- *5/14/2018*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-21-2018
Boring Completed: 02-21-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. F-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION: See Exploration Plan

Latitude: 47.9761° Longitude: -122.1038°
Northing: 358621 Easting: 1329248

Approximate Surface Elev: 338 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	75.2	263+/-					50-50/2" N=50/2"	S-20			
	Boring Terminated at 75.2 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

30' While drilling

4/4/2018

5/14/2018

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-21-2018 | Boring Completed: 02-21-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-1

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9762° Longitude: -122.1075°
Northing: 358666 Easting: 1328356

Approximate Surface Elev: 325 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.2	325+/-	**TOPSOIL**, dark brown, moist
		SILTY SAND (SM), fine to coarse sand, reddish brown to blue gray, moist, medium dense to very dense
		fine to medium grained, olive gray, medium dense, rust mottling
8.0	317+/-	**SILTY SAND WITH GRAVEL (SM)**, light gray
		wet, very dense, interbedded with thin 1/2-in. lenses of sand with silt
		olive gray
		drill chattering
		gray
		green mottling
		blue gray, moist, thin interbedded lense of fine gravel
		drill chattering

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
					S-1			
5			13	9-11-13 N=24	S-2	15		39
10	▽		10	13-50/6" N=50/6"	S-3			
15			4	50/4" N=50/4"	S-4			
			5	50/5.5" N=50/5.5"	S-5			
20			2	50/2" N=50/2"	S-6			
			3	50/3" N=50/3"	S-7			
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *10' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-28-2018
Boring Completed: 02-28-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-1

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9762° Longitude: -122.1075°
Northing: 358666 Easting: 1328356

Approximate Surface Elev: 325 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND WITH GRAVEL (SM), light gray *(continued)*					4	50/4" N=50/4"	S-8			
	30.3	294.5+/-	30			4	50/4" N=50/4"	S-9			
	Boring Terminated at 30.33 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

10' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-28-2018
Boring Completed: 02-28-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-2

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9759° Longitude: -122.1075°
Northing: 358553 Easting: 1328339

Approximate Surface Elev: 321 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	321+/-	**TOPSOIL**, dark brown, moist						S-1			
		SILTY SAND WITH GRAVEL (SM), fine to coarse grained sand, reddish brown to blue gray, moist, dense to very dense, mottled									
		fine to medium grained sand, brown gray, moist, mottled	5			18	7-11-20 N=31	S-2			
		fine grained, light gray, mottled	10			10	20-50/4" N=50/4"	S-3			
		blue gray				3	50/3" N=50/3"	S-4			
		hard drilling 15 ft. to 25 ft.	15			5	50/5" N=50/5"	S-5			
		with green mottling drill chattering and jumping to 20 ft				5	50/5" N=50/5"	S-6			
			20			4	50/4" N=50/4"	S-7			
		increasing sand and gravel content				5	50/5" N=50/5"	S-8			
			25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-28-2018
Boring Completed: 02-28-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-2

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9759° Longitude: -122.1075°
Northing: 358553 Easting: 1328339

Approximate Surface Elev: 321 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	25.5	295.5+/-				6	50/6" N=50/6"	S-9			
	Boring Terminated at 25.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-28-2018
Boring Completed: 02-28-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-3

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9758° Longitude: -122.1072°
Northing: 358526 Easting: 1328416

Approximate Surface Elev: 315 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	314.5+/-	**TOPSOIL**, dark brown, wet
		SILT (ML), with sand and gravel, fine to medium grained gravel, reddish brown, wet
3.0	312+/-	**SILTY SAND WITH GRAVEL (SM)**, fine to coarse sand, light gray to blue gray, wet, medium dense to very dense, mottled
		increasing fines content
		fine grained sand, blue gray, moist, hard drilling 15 ft. to 20 ft.
		wet, increasing gravel content
		drill chattering to 20 ft
20.8	294.5+/-	rock fragments in sampler
		Boring Terminated at 20.75 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
					S-1			
5			8	8-8-12 N=20	S-2			
10	▽		6	11-50/6" N=50/6"	S-3			
			4	50/4" N=50/4"	S-4			
15			4	50/4" N=50/4"	S-5			
	▽		2	50/4" N=50/4"	S-6			
20			9	10-50/3" N=50/3"	S-7			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *10.2' While drilling*

▽ *18.4' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-28-2018
Boring Completed: 02-28-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9763° Longitude: -122.1069°
Northing: 358713 Easting: 1328488

Approximate Surface Elev: 327 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	327+/-	**TOPSOIL**, dark brown, moist
		SILTY SAND WITH GRAVEL (SM), reddish brown to blue gray, moist, dense to very dense
		brown gray, mottled, thin interbedded 1/4-in. lenses of sand
		drill rig chattering
8.0	319+/-	**SILT WITH SAND (ML)**, gray, moist, hard
		becomes wet, increasing sand and gravel content
		blue gray, increasing gravel content
		becomes moist, decreasing sand content

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
					S-1			
5			12	11-22-23 N=45	S-2			
10	▽		11	13-50/5" N=50/5"	S-3	13		50
15			3	50/3" N=50/3"	S-4			
20			6	20-50/2" N=50/2"	S-5			
			5	50/5" N=50/5"	S-6			
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *10.2' While drilling*

▽ *28.4' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-28-2018
Boring Completed: 02-28-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9763° Longitude: -122.1069°
Northing: 358713 Easting: 1328488

Approximate Surface Elev: 327 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SILT WITH SAND (ML), gray, moist, hard *(continued)* fine grained sand					3	50/5" N=50/5"	S-7			
			▽		4	50/4" N=50/4"	S-8			
30.5 interbedded 2-in. sand with silt lense @ 30 ft.	296.5+/-	30			5	50/5" N=50/5"	S-9			
Boring Terminated at 30.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *10.2' While drilling*

▽ *28.4' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-28-2018 | Boring Completed: 02-28-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-5

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9759° Longitude: -122.1059°
Northing: 358554 Easting: 1328740

Approximate Surface Elev: 322 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.2	322+/-	**TOPSOIL**, dark brown, moist
		SILTY SAND WITH GRAVEL (SM), fine to medium grained sand, reddish brown, moist, dense
		transitions to light gray
		light gray, mottled
		wet, interbedded silty sand with gravel lense from 10.5 to 11.0 ft.
		wet, very dense, increasing sand and gravel content, 3-in. lense of interbedded sand with silt
18.0	304+/-	**SAND WITH SILT AND GRAVEL (SP-SM)**, gray, wet, very dense, drill chattering
20.5	301.5+/-	**SANDY SILT WITH GRAVEL (ML)**, gray, wet, hard, water in spoon, no mottling, sand content decreases
		gravel in tip

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
				S-1			
5		14	6-17-24 N=41	S-2	14		34
10		12	12-17-24 N=41	S-3			
15		9	32-50/3" N=50/3"	S-4			
20		10	34-50/6" N=50/6"	S-5A			
				S-5B			
		5	47-50/2" N=50/2"	S-6			
25							

WATER LEVEL OBSERVATIONS

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

8' While drilling

28.8' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-27-2018 | Boring Completed: 02-27-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-5

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9759° Longitude: -122.1059°
Northing: 358554 Easting: 1328740

Approximate Surface Elev: 322 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY SILT WITH GRAVEL (ML), gray, wet, hard, water in spoon, no mottling, sand content decreases *(continued)*					2	50/4" N=50/4"	S-7			
	bluish gray, moist					10	44-50/4" N=50/4"	S-8			
	trace sand, light blue gray, 1/2-in. lense of interbedded sand at 30 ft.		30			5	50/5" N=50/5"	S-9			
	30.5	291.5+/-									
	Boring Terminated at 30.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

8' While drilling

28.8' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-27-2018 | Boring Completed: 02-27-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-6

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9755° Longitude: -122.1074°
Northing: 358402 Easting: 1328357

Approximate Surface Elev: 311 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.7	310.5+/-						S-1			
TOPSOIL, dark brown, wet										
POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), fine to coarse grained sand, brown, moist										
3.0	308+/-									
SILTY SAND WITH GRAVEL (SM), gray, wet, very dense, little recovery, rock fragment in tip, blowcounts may be overstated					1	13-31-38 N=69	S-2			
dense, mottled, rock fragments in sampler		5			7	17-17-15 N=32	S-3			
brown gray, increasing sand content					8	17-19-23 N=42	S-4			
moist, very dense		10			9	19-50/6" N=50/6"	S-5			
11.0	300+/-									
Boring Terminated at 11 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

3' Groundwater Observed

8.4' Groundwater Observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-19-2018 | Boring Completed: 02-19-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-7

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9751° Longitude: -122.1078°
Northing: 358261 Easting: 1328267

Approximate Surface Elev: 299 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.3	299+/-	**TOPSOIL**, dark brown, moist
		SAND WITH SILT AND GRAVEL (SW-SM), fine to coarse grained sand, reddish brown, moist
		very dense, rock fragments in sampler
4.0	295+/-	**SILTY SAND WITH GRAVEL (SM)**, fine to medium grained sand, brown gray, moist, very dense, mottled, rock fragments in sampler
		gray, slightly mottled
		rock fragments in sampler
11.5	287.5+/-	***Boring Terminated at 11.5 Feet***

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
					S-1			
	▽		12	29-48-47 N=95	S-2			
5			12	24-32-38 N=70	S-3			
	▽		6	50/6" N=50/6"	S-4			
10			15	43-29-27 N=56	S-5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *8' While drilling*

▽ *3.1' After 24 hours*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-28-2018 | Boring Completed: 02-28-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-8

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9747° Longitude: -122.1067°
Northing: 358115 Easting: 1328536

Approximate Surface Elev: 303 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3 **TOPSOIL**, dark brown, moist	302.5+/-						S-1			
1.5 **SILTY SAND (SM)**, brown, moist	301.5+/-									
SILTY SAND WITH GRAVEL (SM), fine to medium grained sand, gray, moist, dense										
rock fragment in tip					1	7-12-18 N=30	S-2			
medium dense		5			6	3-13-14 N=27	S-3			
dense, no recovery, increasing sand content (cuttings)					0	12-23-25 N=48	S-4			
wet, medium dense		10			12	9-12-17 N=29	S-5			
11.5	291.5+/-									
Boring Terminated at 11.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

9.8'While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-19-2018
Boring Completed: 02-19-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-9

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9757° Longitude: -122.1069°
Northing: 358502 Easting: 1328498

Approximate Surface Elev: 316 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	315.5+/-	**TOPSOIL**, dark brown, moist						S-1			
		SILTY SAND WITH GRAVEL (SM), fine to coarse grained sand, reddish brown to blue gray, moist to wet, medium dense to very dense									
		brown gray, moist, mottled	5	▼		10	4-27-32 N=59	S-2			
		light brown gray, wet, decreasing sand content, interbedded thin 1/2-in. lenses of sand with silt	10	▽		12	6-10-12 N=22	S-3			
						3	50/3" N=50/3"	S-4			
		blue gray, moist, rock fragments	15			2	50/2" N=50/2"	S-5			
		hard drilling 16 to 20 ft.		▽		2	50/2" N=50/2"	S-6			
20.3	295.5+/-	increasing sand and gravel content, fine to coarse sand	20			4	50/4" N=50/4"	S-7			
		Boring Terminated at 20.33 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

- ▽ *10.8' While drilling*
- ▽ *18.33' At completion of drilling*
- ▼ *5.8' After 24 hours*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-27-2018 | Boring Completed: 02-27-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-10

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9759° Longitude: -122.1033°
Northing: 358534 Easting: 1329382

Approximate Surface Elev: 327 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.1	327+/-	**TOPSOIL**, dark brown, wet
		SILTY GRAVEL WITH SAND (GM), light gray, moist, gravel in cuttings, cobbles from 1 ft to 3 ft
3.0	324+/-	drill chattering
		SILTY SAND WITH GRAVEL (SM), fine to medium grained gravel, light gray, moist, very dense
		mottled
		drill chattering
		increasing gravel content
		drill chattering
		fine grained sand, mottled, rock fragments in tip, 2-in. lense of sand with silt at 20 ft, increasing sand content
		no mottling

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
				S-1			
5		3	50/3" N=50/3"	S-2			
10		6	50/6" N=50/6"	S-3	8		36
15		6	50/6" N=50/6"	S-4			
20		8	43-50/3" N=50/3"	S-5			
		5	50/5" N=50/5"	S-6			
25							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

20' While drilling

17 ' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-27-2018
Boring Completed: 02-27-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-10

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9759° Longitude: -122.1033°
Northing: 358534 Easting: 1329382

Approximate Surface Elev: 327 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), fine to medium grained gravel, light gray, moist, very dense *(continued)* hard drilling down to 27.5 ft.				5	50/5" N=50/5"	S-7			
	27.0	300+/-									
		SAND WITH GRAVEL (SP), with interbedded silt, fine to coarse grained, gray, wet, very dense, 6-in. lense of sand at 27.5 ft to 28 ft, 4-in. lense of plastic silt at 28 ft				10	21-50/4" N=50/4"	S-8A S-8B			
	30.3	297+/- rock fragments in tip	30			3	50/3" N=50/3"	S-9			
		Boring Terminated at 30.25 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

20' While drilling

17 ' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-27-2018 | Boring Completed: 02-27-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-11

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9759° Longitude: -122.1049°
Northing: 358566 Easting: 1328976

Approximate Surface Elev: 326 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.2	326+/-	**TOPSOIL**, dark brown, moist
		SANDY SILT WITH GRAVEL (ML), reddish brown, moist
2.0	324+/-	**SILTY SAND WITH GRAVEL (SM)**, fine to coarse grained sand, yellow brown to gray, moist to wet, dense to very dense

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
					S-1			
5			8	12-17-18 N=35	S-2	11		
10	▽		0	14-16-16 N=32	S-3			
15			5	50/5" N=50/5"	S-4			
20			12	27-50/6" N=50/6"	S-5			
			6	36-50/6" N=50/6"	S-6A			
			6		S-6B			
25								

dense, rock fragments

wet, no recovery

trace gravel, fine grained sand, moist, very dense

with gravel, fine to coarse grained sand, wet, mottled

interbedded sand with silt and gravel at 22.5 ft. to 23 ft. (S-6A), silty sand at 23 ft. to 23.5 ft. (S-6B)

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *10' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-27-2018
Boring Completed: 02-27-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-11

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9759° Longitude: -122.1049°
Northing: 358566 Easting: 1328976

Approximate Surface Elev: 326 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER
	SILTY SAND WITH GRAVEL (SM), fine to coarse grained sand, yellow brown to gray, moist to wet, dense to very dense *(continued)* gray, moist, interbedded with 1/2-in. lense of fine sandy gravel			3	50/3" N=50/3"	S-7
				12	47-50/5" N=50/5"	S-8
30.5	295.5+/-	30		5	50/5" N=50/5"	S-9
	Boring Terminated at 30.5 Feet					

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

10' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-27-2018 | Boring Completed: 02-27-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-12

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9761° Longitude: -122.1042°
Northing: 358633 Easting: 1329156

Approximate Surface Elev: 338 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	338+/-									
TOPSOIL, dark brown, moist							S-1			
SILTY SAND WITH GRAVEL (SM), fine to medium grained sand, reddish brown to gray, moist to wet, dense to very dense										
drill chattering from 2 ft. to 5 ft., gravel and cobbles in cuttings										
light gray, moist, mottled, rock fragments		5			14	6-20-22 N=42	S-2	14		38
		10			10	7-11-47 N=58	S-3	13		
rock fragments		15			6	50/6" N=50/6"	S-4			
rock fragments		20			5.5	50/5.5" N=50/5.5"	S-5	9		
		25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

32.6' While drilling

36' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-27-2018
Boring Completed: 02-27-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-12

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9761° Longitude: -122.1042°
Northing: 358633 Easting: 1329156

Approximate Surface Elev: 338 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), fine to medium grained sand, reddish brown to gray, moist to wet, dense to very dense *(continued)* rock fragments				4	50/4" N=50/4"	S-6			
		increasing sand and gravel content, rock fragments	30			4	50/5" N=50/5"	S-7			
		gray, wet				3	50/3" N=50/3"	S-8			
		drill chattering	35			2	50/2" N=50/2"	S-9			
		rock fragments				3	50/3" N=50/3"	S-10			
41.3	297+/-	gray sand with silt at 40 ft to 41 ft (S-11A), light gray silty sand at 41 ft to 41.25 ft (S-11B), mottled	40			12	23-27-50/3" N=77/9"	S-11A			
						3		S-11B			
		Boring Terminated at 41.25 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

32.6' While drilling

36' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-27-2018 | Boring Completed: 02-27-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-13

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9768° Longitude: -122.1045°
Northing: 358863 Easting: 1329081

Approximate Surface Elev: 349 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	349+/-	**TOPSOIL**, dark brown
		SILTY SAND (SM), trace gravel, light brown and gray, moist, dense
7.0	342+/-	**SILTY SAND WITH GRAVEL (SM)**, brown and gray, moist, very dense
		fine grained sand
		rock fragments, decreasing silt content

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5		12	42-34-12 N=46	S-1			
10		10	37-37-31 N=68	S-2	12		
15		12	40-50/5" N=50/5"	S-3			
20		7	50/5" N=50/5"	S-4	8		
25							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

25' While drilling

18.95' At start of drilling on 2/23/18

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-22-2018
Boring Completed: 02-23-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-13

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9768° Longitude: -122.1045°
Northing: 358863 Easting: 1329081

Approximate Surface Elev: 349 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER
SILTY SAND WITH GRAVEL (SM), brown and gray, moist, very dense *(continued)* light gray				6	50/6" N=50/6"	S-5
		30		4	50/3" N=50/3"	S-6
		35		5	50/3" N=50/3"	S-7
				2	50/4" N=50/4"	S-8
gray, wet, rock fragments, drill chattering		40		4	50/5" N=50/5"	S-9
				4	50/3.5" N=50/3.5"	S-10
45.5	303.5+/-	45		6	50/6" N=50/6"	S-11
Boring Terminated at 45.5 Feet						

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

25' While drilling

18.95' At start of drilling on 2/23/18

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-22-2018 | Boring Completed: 02-23-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-14

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9751° Longitude: -122.1049°
Northing: 358273 Easting: 1328971

Surface Elev.: 304 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SAND WITH SILT AND GRAVEL (SP-SM), orange brown and gray, wet, medium dense to very dense		▽							
		rock fragments in sampler, cobbles in cuttings			X	5	9-11-13 N=24	S-1			
		dense, rock fragments in sampler	5		X	8	12-22-20 N=42	S-2			
		rock fragments in sampler			X	5	19-25-23 N=48	S-3			
		brown and gray, very dense, rock fragments in sampler	10		X	13	49-48-50/3" N=98/9"	S-4			
11.2	293	***Boring Terminated at 11.2 Feet***									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *2.5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-12-2018 | Boring Completed: 04-12-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. P-15

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9754° Longitude: -122.1052°
Northing: 358363 Easting: 1328907

Surface Elev.: 309 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), brownish gray, wet, medium dense									
		2-in. seam of silty sand at 3.5 ft.				18	5-6-8 N=14	S-1	18		20
		trace gravel, rock fragments	5	▽		12	5-7-20 N=27	S-2			
7.0	302										
		SILTY GRAVEL WITH SAND (GM), orange brown to gray, wet, very dense, rock fragments				11	17-50/6" N=50/6"	S-3			
10.5	298.5	brown and gray, moist, sand content increases, rock fragments	10			6	50/6" N=50/6"	S-4			
		Boring Terminated at 10.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *6' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-12-2018 | Boring Completed: 04-12-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-1

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9766° Longitude: -122.1082°
Northing: 358830 Easting: 1328189

Approximate Surface Elev: 328 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	328+/-	**TOPSOIL**, black, moist
		SAND WITH SILT (SP-SM), brown, moist
3.0	325+/-	**SILTY SAND WITH GRAVEL (SM)**, fine grained sand, gray, moist, medium dense
		wet, very dense, no recovery
		no recovery, resampled with 3-in. Dames and Moore sampler
20.0	308+/-	**SILTY GRAVEL WITH SAND (GM)**, fine to coarse grained sand, gray, wet, very dense, wet
22.5	305.5+/-	**SILTY SAND WITH GRAVEL (SM)**, fine to coarse grained sand, gray, moist, very dense, increasing silt content

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER
5		7	2-4-10 N=14	S-1
10		0	50/5" N=50/5"	S-2
15		4	50/4" N=50/4" 50/6" N=50/6"	S-3
		3	50/3" N=50/3"	S-4
20		4	50/4" N=50/4"	S-5
25		3	50/4" N=50/4"	S-6

WATER LEVEL OBSERVATIONS: 15.5' While drilling; 19.7' At completion of drilling

WATER CONTENT (%) / ATTERBERG LIMITS LL-PL-PI / PERCENT FINES: not measured

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

15.5' While drilling

19.7' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-19-2018
Boring Completed: 02-19-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-1

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9766° Longitude: -122.1082°
Northing: 358830 Easting: 1328189

Approximate Surface Elev: 328 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	25.8	302.5+/-					50/3" N=50/3"	S-7			
	Boring Terminated at 25.75 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

15.5' While drilling

19.7' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-19-2018
Boring Completed: 02-19-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-2

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9768° Longitude: -122.1078°
Northing: 358875 Easting: 1328291

Approximate Surface Elev: 331 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	330.5+/-	**TOPSOIL**, dark brown, moist
		SILT (ML), with sand and organics, brown, moist
3.0	328+/-	**SILTY SAND WITH GRAVEL (SM)**, fine to medium grained sand, light gray, moist, medium dense to very dense
		mottled, rock fragments in barrel
		rock fragments in barrel
		gray, increasing sand and gravel content, rock fragments
		drill rig chattering
		wet, hard, mottled, sandier fine sand
		drill rig chattering

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
				S-1			
5		8	4-10-17 N=27	S-2			
10		2	13-50/4" N=50/4"	S-3			
15			9-45-50/5" N=90/11"	S-4			
20		6	50/6" N=50/6"	S-5			
25							

WATER LEVEL OBSERVATIONS

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

19.1' While drilling

29' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-19-2018
Boring Completed: 02-19-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-2

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9768° Longitude: -122.1078°
Northing: 358875 Easting: 1328291

Approximate Surface Elev: 331 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND WITH GRAVEL (SM), fine to medium grained sand, light gray, moist, medium dense to very dense *(continued)* rock fragment in sampler								
				3	50/5.5" N=50/5.5"	S-6			
				5	50/5" N=50/5"	S-7			
30.0	301+/-	30							
	SILTY SAND WITH GRAVEL (SM), fine to medium grained sand, bluish gray, wet, hard drill rig chattering								
				3	50/4" N=50/4"	S-8			
				4	50/4" N=50/4"	S-9			
	rock fragments in barrel	35		11	29-50/5.5" N=50/5.5"	S-10			
				16	31-45-50/5" N=90/11"	S-11			
41.0	290+/-	40		10	32-50/6" N=50/6"	S-12			
	Boring Terminated at 41 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

19.1' While drilling

29' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-19-2018 | Boring Completed: 02-19-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-3

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9767° Longitude: -122.1069°
Northing: 358847 Easting: 1328487

Approximate Surface Elev: 331 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	331+/-	**TOPSOIL**, dark brown, moist						S-1			
		SILTY SAND WITH GRAVEL (SM), fine to medium grained, reddish brown, moist									
		fine grained sand, brown gray, medium dense, mottled	5			15	5-9-8 N=17	S-2			
		rods wet at 7 ft.									
		wet, very dense	10			4	32-50/4.5" N=50/4.5"	S-3			
		blue gray, moist	15			3	50/3" N=50/3"	S-4			
20.3	311+/-	wet, mottled	20			3	50/3" N=50/3"	S-5			
		Boring Terminated at 20.25 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

7' While drilling

19.7' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-28-2018 | Boring Completed: 02-28-2018

Drill Rig: D-50 track | Driller: Holocene

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9769° Longitude: -122.1047°
Northing: 358910 Easting: 1329026

Approximate Surface Elev: 350 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	349.5+/-	**TOPSOIL**, black, moist
		SILTY SAND WITH GRAVEL (SM), with cobbles, reddish brown, moist
2.0	348+/-	**SILTY SAND WITH GRAVEL (SM)**, olive gray
		medium dense
		very dense, rock fragments
		drill chattering from 15 ft to 20 ft
		light gray, mottled

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
				S-1			
5		12	11-13-13 N=26	S-2	9		
10		16	14-28-40 N=68	S-3			
15		16	45-50/4" N=50/4"	S-4			
20		10	33-50/6" N=50/6"	S-5			
25							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

- *25' Groundwater observed*
- *32.8' While drilling*
- *38' At completion of digging*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-23-2018
Boring Completed: 02-23-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9769° Longitude: -122.1047°
Northing: 358910 Easting: 1329026

Approximate Surface Elev: 350 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND WITH GRAVEL (SM), olive gray *(continued)* gray				12	50/4" N=50/4"	S-6			
	moist, rock fragments	30			3	29-50/5" N=50/5"	S-7			
	drill chattering		▽							
		35	▼		10	50/4.5" N=50/4.5"	S-8			
		40			4	50/4" N=50/4"	S-9			
					6	50/6" N=50/6"	S-10			
45.5	304.5+/-	45			4	50/3" N=50/3"	S-11			
	Boring Terminated at 45.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

- ▽ *25' Groundwater observed*
- ▽ *32.8' While drilling*
- ▼ *38' At completion of digging*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-23-2018 | Boring Completed: 02-23-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-5

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9767° Longitude: -122.1041°
Northing: 358857 Easting: 1329171

Approximate Surface Elev: 351 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	351+/-	**TOPSOIL**, dark brown, moist
		SAND WITH SILT AND GRAVEL (SP-SM), brown gray, very dense, moist
		cobbles in cuttings
		drill chatter, cobbles and gravel in cuttings
10.0	341+/-	**SILTY SAND WITH GRAVEL (SM)**, brownish gray, moist, very dense
		gray
		no recovery, cuttings are gray silty sand with gravel

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5			8	7-15-50/2" N=65/8"	S-1	4		5
10			13	14-25-50 N=75	S-2	11		44
15			18	29-41-50/3" N=90/3"	S-3			
20			0	50/3" N=50/3"	S-4			
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

47' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-22-2018
Boring Completed: 02-22-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-5

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9767° Longitude: -122.1041°
Northing: 358857 Easting: 1329171

Approximate Surface Elev: 351 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
		SILTY SAND WITH GRAVEL (SM), brownish gray, moist, very dense *(continued)*
		wet seam 30.5 ft. to 31 ft.
33.0	318+/-	**SILTY SAND (SM)**, trace gravel, bluish gray, very dense, moist
		water in sampler

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		7	50/5" N=50/5"	S-5	8		
30		12	28-50/5" N=50/5"	S-6			
35		10	49-50/2" N=50/2"	S-7			
40		18	28-34-46 N=80	S-8			
45		6	50/6" N=50/6"	S-9			
		6	50/5" N=50/5"	S-10			
50							

WATER LEVEL OBSERVATIONS: ▽ 47' While drilling

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

47' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-22-2018
Boring Completed: 02-22-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-5

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9767° Longitude: -122.1041°
Northing: 358857 Easting: 1329171

Approximate Surface Elev: 351 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), trace gravel, bluish gray, very dense, moist *(continued)*				16	49-45-50 N=95	S-11			
		dense				18	32-25-13 N=38	S-12A			
53.3	297.5+/-	**SAND WITH SILT (SP-SM)**, trace gravel, gray and brown, wet, (S-12B)						S-12B			
		fine to coarse grained sand, light brownish gray	55			18	12-50/5" N=50/5"	S-13A			
56.5	294.5+/-							S-13B			
		Boring Terminated at 56.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

47' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-22-2018
Boring Completed: 02-22-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-6

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9771° Longitude: -122.1034°
Northing: 358991 Easting: 1329364

Approximate Surface Elev: 352 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	352+/-	**TOPSOIL**, dark brown, moist						S-1			
		SILTY SAND WITH GRAVEL (SM), reddish brown to gray, moist, very dense, cobbles in cuttings									
		hard drilling to 5 ft, drill rig chattering and jumping									
		fine grained sand, olive gray	5			3	50/3" N=50/3"	S-2			
		hard drilling to 10 ft, drill rig chattering and jumping, cobbles in cuttings									
		light gray, rock fragments	10			7	29-50/3" N=50/3"	S-3			
			15	▽		18	26-34-42 N=76	S-4			
		stopped for day @ 17 ft on 2/23/18, resumed drilling on 2/26/18									
		wet, sandier (S-5B)	20			12	36-50/6" N=50/6"	S-5B			
		fine to medium grained sand, gray, moist, siltier (S-5A)						S-5A			
			25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *14.8' After 3 days*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-23-2018
Boring Completed: 02-26-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. EP-6

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9771° Longitude: -122.1034°
Northing: 358991 Easting: 1329364

Approximate Surface Elev: 352 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), reddish brown to gray, moist, very dense, cobbles in cuttings *(continued)* mottled				6	50/6" N=50/6"	S-6			
		fine grained sand, light gray, slightly mottled	30			5.5	50/5.5" N=50/5.5"	S-7			
		drill chattering									
		4-in. interbedded lense of mottled sandy silt	35			16	32-45-50/4" N=95/10"	S-8			
		slightly mottled, decreasing fines	40			10	32-50/4" N=50/4"	S-9			
		driller notes heave, flushed with water									
44.5	307.5+/-	**SAND WITH SILT (SW-SM)**, fine to medium grained, gray, wet	45			9	43-50/3" N=50/3"	S-10			
45.8	306.5+/-	***Boring Terminated at 45.75 Feet***									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

14.8' After 3 days

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-23-2018 | Boring Completed: 02-26-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. NW-1

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9761° Longitude: -122.1062°
Northing: 358646 Easting: 1328665

Surface Elev.: 326 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	325.5									
TOPSOIL, brown										
SILTY SAND WITH GRAVEL (SM), light gray and brown with mottled orange, moist, dense										
					18	24-23-25 N=48	S-1	14		
medium dense, rock fragment in sampler		5			18	10-14-10 N=24	S-2	14		45
moist to wet, dense, drill chatter, rock fragments in shoe and sampler					10	8-14-22 N=36	S-3	13		
very dense		10	▽		14	15-30-43 N=73	S-4	12		
~1-in. orange and black sand seam, drill chatter										
damp, rock fragments in sampler										
15.1	311	15			0	50/1" N=50/1"	S-5			
no recovery										
Boring Terminated at 15.1 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *10' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-11-2018 | Boring Completed: 04-11-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. NW-2

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9761° Longitude: -122.1058°
Northing: 358624 Easting: 1328769

Surface Elev.: 327 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		TOPSOIL, orangey brown, wet									
2.5	324.5										
		SILTY SAND WITH GRAVEL (SM), gray and brown, moist, dense				11	4-13-20 N=33	S-1			
		trace organics, medium dense	5			9	4-9-12 N=21	S-2			
		with mottled orange, wet		▽		12	6-7-12 N=19	S-3			
10.2	317		10								
		SILTY SAND WITH GRAVEL (SM), light gray and brown, moist, very dense, rock fragment in shoe orange sand seam at 11 ft.				18	16-37-50/5" N=87/11"	S-4			
		drill chatter									
		rock fragments in sampler and shoe	15			3	50/4" N=50/4"	S-5			
		hard drilling									
20.3	306.5		20			4	50/4" N=50/4"	S-6			
		Boring Terminated at 20.3 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *7.5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-11-2018 | Boring Completed: 04-11-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. NW-3

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9761° Longitude: -122.1054°
Northing: 358638 Easting: 1328869

Surface Elev.: 331 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
2.5	328.5	**TOPSOIL**, dark brown with orange, moist, loose to medium dense
		SILTY SAND WITH GRAVEL (SM), brown, moist, medium dense
		gray and brown, wet
		loose
		light gray with mottled rusty orange, moist, dense
		medium grained, gray and brown, wet
		medium dense, rock in sampler tip
		light gray and brown, moist, very dense
		drill chatter
		trace silt
		drill chatter
		medium coarse sand lenses, rock fragment at tip of sampler

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			6	7-8-7 N=15	S-1			
5			1	4-2-6 N=8	S-2			
	▽		15	11-18-19 N=37	S-3			
10			13	6-8-10 N=18	S-4			
15			6	50/5" N=50/5"	S-5			
20			7	50/4" N=50/4"	S-6			
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *7.5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-11-2018
Boring Completed: 04-11-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. NW-3

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9761° Longitude: -122.1054°
Northing: 358638 Easting: 1328869

Surface Elev.: 331 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	25.8	305				9	40-50/4" N=50/4"	S-7			
	Boring Terminated at 25.8 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

7.5' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-11-2018
Boring Completed: 04-11-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. NW-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9761° Longitude: -122.1051°
Northing: 358643 Easting: 1328945

Surface Elev.: 334 (Ft.)

DEPTH ELEVATION (Ft.)

GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SILTY SAND WITH GRAVEL (SM), with organics, orange brown, moist, dense, rock in sampler tip, blow counts may be overstated									
				7	10-16-18 N=34	S-1	8		
brown, wet, medium dense, rock in sampler tip, gravel content increases, cobbles in auger cuttings	5								
				6	20-12-14 N=26	S-2			
light brown and gray, dense, gravel and cobbles in auger cuttings, rock fragment in sampler tip		▽		18	12-20-15 N=35	S-3	13		38
medium dense	10			14	6-4-7 N=11	S-4			
light gray and brown, moist, very dense	15			10	18-50/4" N=50/4"	S-5	12		
drill chatter, silt and gravel content decreases	20			11	29-50/5" N=50/5"	S-6			
trace silt, brown and gray, drill shatter, rock fragment at 20.6 ft.									
	25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *7.5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-11-2018 | Boring Completed: 04-11-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. NW-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9761° Longitude: -122.1051°
Northing: 358643 Easting: 1328945

Surface Elev.: 334 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SILTY SAND WITH GRAVEL (SM), with organics, orange brown, moist, dense, rock in sampler tip, blow counts may be overstated *(continued)*					6	50/5" N=50/5"	S-7			
hard drilling at 27 ft.		30								
30.8 rock fragments in sampler	303				10	30-50/4" N=50/4"	S-8			
Boring Terminated at 30.8 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

7.5' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-11-2018 | Boring Completed: 04-11-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. SW-1

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9751° Longitude: -122.1082°
Northing: 358270 Easting: 1328168

Surface Elev.: 296 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
2.0	294	**TOPSOIL**, dark brown, moist, very loose
		SILTY SAND WITH GRAVEL (SM), gray and light brown, moist, very dense
		rock fragments in sampler gray
		bluish gray
16.5	279.5	***Boring Terminated at 16.5 Feet***

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		18	3-15-42 N=57	S-1	9		31
5		16	3-16-50/4" N=66/10"	S-2			
		16	16-34-43 N=77	S-3			
10		18	35-44-43 N=87	S-4			
15		18	25-34-49 N=83	S-5			

WATER LEVEL OBSERVATIONS: 10' While drilling

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

10' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-09-2018
Boring Completed: 04-09-2018
Drill Rig: D-50 track
Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. SW-2

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9748° Longitude: -122.1082°
Northing: 358166 Easting: 1328163

Surface Elev.: 293 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.0	293	**TOPSOIL**, bluish gray, wet, dense
2.0	291	**SILTY SAND WITH GRAVEL (SM)**, with organics, dark brown, wet, very dense, rock fragments, blow counts may be overstated
5.0	288	**SILTY SAND WITH GRAVEL (SM)**, olive gray, moist, very dense, cobbles in auger cuttings
		gray, rock fragments
15.8	277	coarse grained, rock fragments
		Boring Terminated at 15.8 Feet

Sample Number	Sample Type	Recovery (In.)	Field Test Results	Water Level Observations
S-1		6	5-17-31/5"	
S-2		18	16-47-50/5" N=97/11"	
S-3		8	14-50/4" N=50/4"	
S-4		5	50/4" N=50/4"	
S-5		4	17-50/2" N=50/2"	▽

Depth (Ft.): 5, 10, 15

Water Content (%): | Atterberg Limits LL-PL-PI: | Percent Fines:

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *15' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-09-2018 | Boring Completed: 04-09-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. SW-3

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9746° Longitude: -122.1082°
Northing: 358104 Easting: 1328167

Surface Elev.: 292 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SILTY SAND WITH GRAVEL (SM), light brown and gray, moist, very dense										
					14	16-30-50/11" N=80/17"	S-1	11		37
wet										
		5	▽		7	22-50/3" N=50/3"	S-2			
					8	19-50/3" N=50/3"	S-3			
dark gray, moist		10			5	50/4" N=50/4"	S-4			
15.8 dark gray with green	276	15			9	31-50/3" N=50/3"	S-5			
Boring Terminated at 15.8 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-09-2018 | Boring Completed: 04-09-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. SW-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9746° Longitude: -122.1078°
Northing: 358079 Easting: 1328267

Surface Elev.: 291 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.2	291	**TOPSOIL**, dark brown
		SILTY SAND (SM), with organics, orange brown, wet, medium dense
7.5	283.5	**SILTY SAND WITH GRAVEL (SM)**, bluish gray, moist, very dense, rock fragment in tip, blow counts may be overstated
		gray
16.5	274.5	***Boring Terminated at 16.5 Feet***

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		6	8-5-8 N=13	S-1			
5		0	50/3" N=50/3"	S-2			
		2	50/2" N=50/2"	S-3			
10		6	50/4" N=50/4"	S-4			
15		18	5-29-42 N=71	S-5			

WATER LEVEL OBSERVATIONS: ▽ 6' While drilling

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *6' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-09-2018 | Boring Completed: 04-09-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. SW-5

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9746° Longitude: -122.1074°
Northing: 358082 Easting: 1328352

Surface Elev.: 299 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER
SILTY SAND WITH GRAVEL (SM), with organics, orange brown, moist, loose						
light brown and gray, medium dense				1.1	4-6-10 N=16	S-1
dense		5		14	9-10-21 N=31	S-2
very dense, rock fragments and wood in tip of sampler				2	50/4" N=50/4"	S-3
9.0	290					
SILTY SAND WITH GRAVEL (SM), gray, damp, very dense		10		7	11-50/3" N=50/3"	S-4
		15		14	34-50/6" N=50/6"	S-5
16.0	283					
Boring Terminated at 16 Feet						

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-09-2018 | Boring Completed: 04-09-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

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BORING LOG NO. SW-6

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1071°
Northing: 358059 Easting: 1328431

Surface Elev.: 301 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
		SAND WITH SILT AND GRAVEL (SP-SM), with organics, orange brown, moist, loose
2.8	298	**SILTY SAND WITH GRAVEL (SM)**, light brown and gray, moist, medium dense
		dense
		wet
15.4	285.5	moist, rock fragments in sampler
		Boring Terminated at 15.4 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			15	2-13-10 N=23	S-1			
5			16	8-19-19 N=38	S-2			
	▽		4	4-27-18 N=45	S-3			
10			11	8-13-18 N=31	S-4			
15			5	50/4" N=50/4"	S-5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *7.5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-09-2018 | Boring Completed: 04-09-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. SW-7

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9746° Longitude: -122.1066°
Northing: 358089 Easting: 1328559

Surface Elev.: 301 (Ft.)

DEPTH	ELEVATION (Ft.)	DESCRIPTION
		SILTY SAND WITH GRAVEL (SM), light gray and brown with rusty mottled orange, moist, dense to very dense, broken gravel in sampler tip
		rock fragments in sampler, blow counts may be overstated
		rock fragments in sampler
		fine grained, rock fragments in sampler
16.5	284.5	***Boring Terminated at 16.5 Feet***

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			11	8-18-24 N=42	S-1	11		32
5			9	7-23-11 N=34	S-2			
	▽		7	14-35-23 N=58	S-3			
10			17	10-19-22 N=41	S-4			
15			8	19-27-29 N=56	S-5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *9' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-10-2018 | Boring Completed: 04-10-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. SW-8

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9746° Longitude: -122.1063°
Northing: 358084 Easting: 1328630

Surface Elev.: 298 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	298									
TOPSOIL										
SAND WITH SILT AND GRAVEL (SP-SM), light gray and brown, moist, dense										
					13	11-18-20 N=38	S-1			
		5	▽							
very dense, rock fragments in sampler					8	20-31-20 N=51	S-2			
rock fragments in sampler and shoe					6	33-48-40 N=88	S-3			
		10								
rock fragments in sampler					1	21-48-45 N=93	S-4			
gray, moist to wet, rock in sampler tip		15			3	33-31-44 N=75	S-5			
16.5	281.5									
Boring Terminated at 16.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-10-2018 | Boring Completed: 04-10-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

BORING LOG NO. SW-9

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1054°
Northing: 358058 Easting: 1328841

Surface Elev.: 302 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
TOPSOIL, dark brown, moist										
2.0	300									
SILTY SAND WITH GRAVEL (SM), light gray, moist, medium dense										
				X	7	3-4-8 N=12	S-1			
dark brown sand with gravel seam at 5.5 ft.		5								
				X	13	2-6-7 N=13	S-2			
			▽							
dark brown gray sand seam between 8.1 and 8.8 ft.				X	16	2-7-10 N=17	S-3			
bluish gray, dense		10		X	13	12-13-18 N=31	S-4			
gray, moist to wet, very dense		15		X	11	14-25-38 N=63	S-5			
16.5	285.5									
Boring Terminated at 16.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *7.5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-12-2018 | Boring Completed: 04-12-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

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BORING LOG NO. SW-10

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1052°
Northing: 358060 Easting: 1328907

Surface Elev.: 300 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
2.7	297.5	**PEAT (PT)**, black, moist
4.5	295.5	**SAND (SP)**, trace silt and organics, dark brown to brown, moist to wet, medium dense
6.5	293.5	**SILTY SAND (SM)**, dark purple brown, wet, dense
		POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), brown and gray with orange mottling, coarse sand seams dril chatter
		rock fragments in sampler tip
		drill chatter
15.8	284	trace silt, bluish gray, moist, very dense, rock fragments in sampler
		Boring Terminated at 15.8 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER
		11	2-9-13 N=22	S-1
5		1	19-17-17 N=34	S-2
		13	20-19-16 N=35	S-3
10		16	20-40-50/4" N=90/10"	S-4
15		10	34-50/4" N=50/4"	S-5

WATER LEVEL OBSERVATIONS: ▽ 1' While drilling

GRAPHIC LOG | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

1' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-12-2018 | Boring Completed: 04-12-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

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BORING LOG NO. SW-11

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9746° Longitude: -122.1045°
Northing: 358066 Easting: 1329078

Surface Elev.: 304 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SILTY GRAVEL WITH SAND (GM), brown, wet, medium dense, gravel in cuttings										
large cobble at 2.5 ft.					4	11-12-12 N=24	S-1			
rock fragments in shoe, drill chatter		5	▽							
gravel and cobbles in auger cuttings					2	8-9-10 N=19	S-2			
dark gray, dense					9	7-15-17 N=32	S-3			
		10			9	9-21-16 N=37	S-4			
medium dense		15			12	5-8-12 N=20	S-5			
16.5	287.5									
Boring Terminated at 16.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *5' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-12-2018 | Boring Completed: 04-12-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

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BORING LOG NO. SW-12

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1041°
Northing: 358021 Easting: 1329164

Surface Elev.: 301 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
		PEAT, dark brown, moist, very soft to soft
3.0	298	
		FAT CLAY (CH), trace organics, brown grading to blue, moist, soft
		stiff
		sand with silt layer between 8.5 and 9 ft.
10.7	290.5	
		SILTY SAND (SM), dark bluish gray, wet, loose
13.0	288	
		POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM), dark bluish gray, wet, very dense
16.5	284.5	
		Boring Terminated at 16.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		18	1-2-1 N=3	S-1	35		
5		18	1-1-2 N=3	S-2	34	53-27-26	
		18	3-5-5 N=10	S-3			
10		10	7-3-6 N=9	S-4			
15		18	18-26-31 N=57	S-5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

0' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-12-2018 | Boring Completed: 04-12-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

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BORING LOG NO. SW-13

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1039°
Northing: 358042 Easting: 1329230

Surface Elev.: 302 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
		TOPSOIL, dark brown
2.7	299.5	
		SANDY SILT (ML), brown and orange, moist, very stiff, rock fragments in sampler, blow counts may be overstated
4.0	298	
		SILTY GRAVEL WITH SAND (GM), with cobbles, brown, wet, dense, drill chatter rock fragments in sampler cobbles in cuttings
14.0	288	
		SANDY SILT (ML), brown, wet, medium stiff, grades more sandy
15.4	286.5	
		POORLY GRADED SAND WITH SILT (SP-SM), gray, wet, medium dense sandy silt seam at 16 ft.
16.5	285.5	
		Boring Terminated at 16.5 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	▽							
		X	12	3-6-15 N=21	S-1	23		
5		X	6	12-19-18 N=37	S-2			
		X	18	22-24-14 N=38	S-3			
10		X	10	9-13-19 N=32	S-4			
15		X	12	8-8-10 N=18	S-5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *1' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-12-2018 | Boring Completed: 04-12-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

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BORING LOG NO. SW-14

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1034°
Northing: 358032 Easting: 1329344

Surface Elev.: 310 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
		TOPSOIL
2.6	307.5	
		SAND WITH SILT (SP-SM), yellow brown, moist, loose
4.0	306	
		SAND WITH SILT AND GRAVEL (SP-SM), brown, moist, dense
		very dense, drill chatter rock fragments in sampler and shoe
		dense, rock fragments in sampler and shoe
13.0	297	
		POORLY GRADED GRAVEL WITH SILT AND SAND (SP-SM), brown and gray, wet, very dense
16.0	294	
		Boring Terminated at 16 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		5	8-4-3 N=7	S-1			
5							
		12	21-28-20 N=48	S-2			
		12	17-24-38 N=62	S-3			
10		10	9-20-21 N=41	S-4			
15		8	42-50/6" N=50/6"	S-5			

WATER LEVEL OBSERVATIONS: ▽ 15' While drilling

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4 in. ID HSA

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

15' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 04-12-2018 | Boring Completed: 04-12-2018
Drill Rig: D-50 track | Driller: Holocene
Project No.: 81185028

DRAFT

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TEST PIT LOG NO. TP-1

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9757° Longitude: -122.1055°
Northing: 358467 Easting: 1328835

Approximate Surface Elev: 320 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.5	319.5+/-	**TOPSOIL**, dark brown, moist, loose, 6-inches	S-1			
2.0	318+/-	**SILTY SAND WITH GRAVEL (SM)**, with cobbles, reddish brown, moist, loose	S-2			
5.0	315+/-	**POORLY GRADED SAND WITH GRAVEL (SP-SM)**, yellow with gray, moist, medium dense to dense	S-3	3		0
		SILTY SAND WITH GRAVEL (SM), light gray, dense to very dense	S-4			
		wet, laminated, seepage observed at 6 ft.				
		boulder at 6.5 ft.				
		wet, seepage observed at 8.5 ft.	S-5			
		boulder at 8.5 ft.				
11.0	309+/-	***Test Pit Terminated at 11 Feet***				

DEPTH (Ft.): 5, 10

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
2 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

- *6' Light seepage*
- *8.5' Moderate seepage*
- *10.67 ' After digging*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 02-14-2018
Test Pit Completed: 02-14-2018
Excavator: Bobcat E-55 Excavator
Operator: NW Excavating
Project No.: 81185028

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THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-2

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.975° Longitude: -122.1046°
Northing: 358223 Easting: 1329056

Approximate Surface Elev: 305 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	305+/-	**TOPSOIL**, dark brown, moist, loose					S-1			
		SAND WITH SILT AND GRAVEL (SW-SM), trace rootlets, reddish brown, moist, loose								
		gray								
		wet, heavy seepage at 2 ft.								
4.0	301+/-	**SILTY SAND WITH GRAVEL (SM)**, with cobbles, gray, wet								
5.0	300+/-	**POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)**, gray, wet, trace rootlets, cobbly	5				S-2			
6.0	299+/-	***Test Pit Terminated at 6 Feet due to caving from 2 ft to 6 ft***								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

2' Heavy seepage

3' At completion of digging

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 02-14-2018 | Test Pit Completed: 02-14-2018

Excavator: Caterpillar 312D Excavato | Operator: NW Excavating

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-3

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9755° Longitude: -122.1044°
Northing: 358400 Easting: 1329110

Approximate Surface Elev: 319 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	318.5+/-	**TOPSOIL**, dark brown, moist, loose
		SILTY SAND WITH GRAVEL (SM), with cobbles, reddish brown, moist
1.5	317.5+/-	**POORLY GRADED GRAVEL WITH SAND (GP)**, with cobbles, fine to coarse grained sand, grayish brown, moist, medium dense
		increasing gravel content
13.5	305.5+/-	***Test Pit Terminated at 13.5 Feet***

SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
S-1			
S-2			
S-3	3		3
S-4			
S-5			
S-6			
S-7			

DEPTH (Ft.): 5, 10

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 02-16-2018
Test Pit Completed: 02-16-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-4

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9755° Longitude: -122.1062°
Northing: 358416 Easting: 1328659

Approximate Surface Elev: 311 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		TOPSOIL, dark brown to black, moist, loose					S-1			
1.0	310+/-	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, reddish brown, moist, loose					S-2	15		7
2.0	309+/-	**SILTY SAND WITH GRAVEL (SM)**, light gray, moist, very dense, mottled					S-3			
		boulder @ 3 ft.								
		becomes wet, sloughing @ 5 ft.	5				S-4			
		bluish gray								
		very dense, increasing gravel content, sloughing @ 7.5 ft.								
		mottled					S-5			
10.0	301+/-	***Test Pit Terminated at 10 Feet***	10							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
2 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

2' Heavy seepage

9' After digging

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 02-13-2018
Test Pit Completed: 02-13-2018
Excavator: Bobcat E-55 Excavator
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-5

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9749° Longitude: -122.1064°
Northing: 358191 Easting: 1328605

Approximate Surface Elev: 301 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.2	301+/-	**TOPSOIL**, moist, very loose
		SILTY SAND WITH GRAVEL (SM), with cobbles, reddish brown, moist, medium dense, moist
		gray, wet, dense, rust mottled
		light gray, moist, very dense, cobbles, mottled, increasing fines content
		increasing sand content, very hard digging
		sloughing at 7.5 ft.
11.0	290+/-	***Test Pit Terminated at 11 Feet***

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
				S-1			
				S-2			
				S-3			
				S-4			
5							
				S-5			
10				S-6			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

2' Seepage

10.6' After digging

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 02-15-2018
Test Pit Completed: 02-15-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-6

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9747° Longitude: -122.1056°
Northing: 358132 Easting: 1328795

Approximate Surface Elev: 300 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	299.5+/-	**POORLY GRADED SAND WITH GRAVEL (SP)**, with organics, dark brown to black, loose
		SAND WITH SILT AND GRAVEL (SP-SM), trace cobbles, reddish brown, moist
1.5	298.5+/-	**SILTY SAND WITH GRAVEL (SM)**, trace cobbles, fine to coarse grained sand, yellow brown to light gray, wet, dense to very dense, mottled
		caving between 2 and 8 ft.
		increasing fines content
		moderate seepage @ 6 ft.
8.0	292+/-	**SANDY SILT WITH GRAVEL (ML)**, fine grained sand, gray, wet
10.0	290+/-	***Test Pit Terminated at 10 Feet***

SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
S-1			
S-2			
S-3			
S-4			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

3' Light seepage

6' Moderate seepage

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 02-14-2018
Test Pit Completed: 02-14-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-7

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9765° Longitude: -122.1038°
Northing: 358749 Easting: 1329257

Approximate Surface Elev: 346 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3 **TOPSOIL**, dark brown, moist, loose	345.5+/-					S-1			
SILTY SAND WITH GRAVEL (SM), with cobbles, reddish brown, dense						S-2			
fine grained sand, light gray, very dense, increasing silt content, mottled						S-3			
mottled, boulder @ 5 ft.		5							
moist, increasing sand content						S-4			
light seepage @ 7.5 ft.			▽						
cobbles						S-5			
		10				S-6	8		33
very hard digging @ 12.5 ft., increasing silt content						S-7			
12.5	333.5+/-								
Test Pit Terminated at 12.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

▽ *7.5' Light seepage*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 02-16-2018
Test Pit Completed: 02-16-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-8

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9752° Longitude: -122.104°
Northing: 358288 Easting: 1329189

Approximate Surface Elev: 313 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.4	312.5+/-	**TOPSOIL**, dark brown to black, moist, loose	S-1			
0.8	312+/-	**CRUSHED GRAVEL**, gray, 5-in.				
		SAND WITH SILT AND GRAVEL (SP-SM), fine to coarse grained sand, light brown, moist, medium dense, cobbles				
		boulder @ 2.5 ft.	S-2			
		log @ 3.5 ft.				
		dense, wood branches				
		sloughing @ 5.5 ft.				
		light seepage @ 7 ft.				
7.5	305.5+/-	**SILT (ML)**, with organics, trace sand, black, moist, organic odor				
8.0	305+/-	**SILT (ML)**, with sand and gravel, gray, moist, organic odor, cobbles, mottled	S-3	37	NP	
			S-4			
10.0	303+/-	**SILTY SAND WITH GRAVEL (SM)**, fine grained sand, gray, moist	S-5			
11.0	302+/-	***Test Pit Terminated at 11 Feet***				

DEPTH (Ft.): 5, 10

WATER LEVEL OBSERVATIONS: ▽ 7' Light seepage

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

7' Light seepage

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 02-15-2018
Test Pit Completed: 02-15-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-9

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9753° Longitude: -122.107°
Northing: 358345 Easting: 1328461

Approximate Surface Elev: 309 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.5	308.5+/-	**TOPSOIL**, dark brown to black, very loose, 6-in.
1.0	308+/-	**SILTY SAND (SM)**, with organics, reddish brown, moist, loose
		SILTY SAND WITH GRAVEL (SM), reddish brown, moist, very dense
		heavy seepage @ 2.5 ft.
		light gray, dense, mottled
		mottled
		sloughing @ 6.5 ft.
		mottled
		mottled
10.0	299+/-	
		Test Pit Terminated at 10 Feet

SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
S-1			
S-2			
S-3			
S-4			
S-5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
2 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

2.5' Heavy seepage

8.5' After digging

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 02-13-2018
Test Pit Completed: 02-13-2018
Excavator: Bobcat E-55 Excavator
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-10

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9764° Longitude: -122.1076°
Northing: 358760 Easting: 1328320

Approximate Surface Elev: 329 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	SAMPLE NUMBER
		TOPSOIL, dark brown to black, very loose	S-1
1.5	327.5+/-		
		SILTY SAND WITH GRAVEL (SM), trace organics, reddish brown, moist, very loose	S-2
		light sloughing @ 3.5 ft.	
4.0	325+/-		
		SILTY SAND WITH GRAVEL (SM), with cobbles, light gray, wet, very dense, seepage @ 4 ft.	S-3
		light seepage @ 7.5 ft.	S-4
		light sloughing @ 9 ft.	
		light seepage @ 11 ft.	S-5
12.0	317+/-		
		Test Pit Terminated at 12 Feet	

GRAPHIC LOG | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | SAMPLE NUMBER | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
2 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

- *4' Seepage*
- *7.5' Light seepage*
- *11' Light seepage*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 02-13-2018	Test Pit Completed: 02-13-2018
Excavator: Bobcat E-55 Excavator	Operator: NW Excavating
Project No.: 81185028	

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-11

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9767° Longitude: -122.1033°
Northing: 358846 Easting: 1329390

Approximate Surface Elev: 348 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	SAMPLE NUMBER
0.2	348+/-	**TOPSOIL**, brown, moist, loose	S-1
		SILTY SAND WITH GRAVEL (SM), olive gray to gray, moist, mottled	
		light gray to blue gray, very dense, mottled	S-2
		boulder @ 3 ft. (2.5 ft dia.), very hard digging from 2.5 to 6.5 ft.	S-3
		excavator teeth sparking, very hard digging	S-4
6.5	341.5+/-	***Test Pit Refusal at 6.5 Feet***	

GRAPHIC LOG | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | SAMPLE NUMBER | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

DEPTH (Ft.): 5

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

While sampling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 02-16-2018
Test Pit Completed: 02-16-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-12

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9754° Longitude: -122.1077°
Northing: 358389 Easting: 1328292

Surface Elev.: 311 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.5	310.5								
TOPSOIL									
2.0	309								
SILTY SAND WITH GRAVEL (SM), with roots, reddish brown, moist									
4.0	307			Hand		S-1			
SILTY SAND WITH GRAVEL (SM), trace cobbles, with roots, orange brown, moist			▽	Hand	5" @ 3 ft	S-2			
10.0	301	5		Hand		S-3			
SILTY SAND WITH GRAVEL (SM), gray, moist; trace silt, moist to damp		10		Hand		S-4			
Test Pit Terminated at 10 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *3.5' Light seepage*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-05-2018
Test Pit Completed: 04-05-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-13

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9749° Longitude: -122.1071°
Northing: 358196 Easting: 1328434

Surface Elev.: 304 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	303.5	**TOPSOIL**
3.5	300.5	**SILTY SAND WITH GRAVEL (SM)**, with organics, orange brown
10.5	293.5	**SAND WITH SILT AND GRAVEL (SP-SM)**, trace cobbles, gray with orange mottling, moist 2 ft. x 2 ft. boulder at 5 ft.
		Test Pit Terminated at 10.5 Feet

SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
S-1			
S-2	10		25
S-3			
S-4			

DEPTH (Ft.): 5, 10

WATER LEVEL OBSERVATIONS: ▽

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *2.5' Light seepage*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-05-2018
Test Pit Completed: 04-05-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-14

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9749° Longitude: -122.1079°
Northing: 358196 Easting: 1328255

Surface Elev.: 298 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	297.5	**TOPSOIL**, brown
3.7	294.5	**WELL GRADED GRAVEL WITH SAND (GW)**, with organics, trace cobbles, orange brown, moist
6.0	292	**SILTY SAND WITH GRAVEL (SM)**, gray, moist to damp, cobble content increases; bluish gray, moist to dry
		Test Pit Refusal at 6 Feet

SAMPLE NUMBER	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
S-1	0 to 1/2" @ 2 ft	8		3
S-2	0 to 1/2" @ 2.7 ft			
S-3				
S-4				

DEPTH (Ft.): 5

WATER LEVEL OBSERVATIONS: ▽

SAMPLE TYPE: ✋

GRAPHIC LOG: TOPSOIL; WELL GRADED GRAVEL WITH SAND; SILTY SAND WITH GRAVEL

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *3.5' Light seepage*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-05-2018
Test Pit Completed: 04-05-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-15

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9761° Longitude: -122.106°
Northing: 358640 Easting: 1328724

Surface Elev.: 326 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	FIELD TEST RESULTS	WATER CONTENT (%)
0.5	325.5	**TOPSOIL**		
		SILTY SAND WITH GRAVEL (SM), with organics and cobbles, orange brown, moist	Probes 5"	12
		grades to gravelly sand with silt caving in and 40-inches		
4.0	322	**SILTY SAND WITH GRAVEL (SM)**, trace cobbles, gray, moist	Probes 1"	
		caving in at 7 ft.		
		caving in at 8 ft.		
		cobble content increases, harder digging sand layers at 10 ft.		
10.5	315.5	***Test Pit Terminated at 10.5 Feet***		

DEPTH (Ft.): 5, 10

WATER LEVEL OBSERVATIONS: 3.5' Seepage

SAMPLE TYPE: Probes 5"; Probes 1"

SAMPLE NUMBER: | ATTERBERG LIMITS (LL-PL-PI): | PERCENT FINES:

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

3.5' Seepage

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-06-2018
Test Pit Completed: 04-06-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-16

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9761° Longitude: -122.1055°
Northing: 358616 Easting: 1328841

Surface Elev.: 330 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	329.5	**TOPSOIL**, with organics, trace cobbles, dark brown
		SAND (SP), trace gravel, orange brown, moist
2.5	327.5	caving in at 2 ft.
		POORLY GRADED GRAVEL WITH SAND (GP), trace fines, fine to coarse grained, orangy olive brown, moist
		with cobbles
7.5	322.5	**SILTY SAND (SM)**, fine grained, gray, moist
		trace cobbles, gravel content increases
10.0	320	***Test Pit Terminated at 10 Feet***

DEPTH (Ft.)	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	S-1			
	S-2			
5	S-3	5		4
	S-4			
10	S-5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

8' Seepage

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-06-2018
Test Pit Completed: 04-06-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-17

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9761° Longitude: -122.1052°
Northing: 358635 Easting: 1328904

Surface Elev.: 333 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.5	332.5	**TOPSOIL**, dark brown				
2.0	331	**POORLY GRADED SANDY GRAVEL WITH SILT (GP-GM)**, trace cobbles, with organics, orange brown				
2.5	330.5	**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel				
		WELL GRADED GRAVEL WITH SAND (GW), trace fines, caving in at 2.5 ft.	S-1			
		olive brown, moist, silt content decreases	S-2	4		0
		brown gray	S-3			
9.0	324	3 to 4-in. orange gravel seam at 8.5 ft.				
10.0	323	**SILTY SAND WITH GRAVEL (SM)**, gray, moist				
		Test Pit Terminated at 10 Feet	S-4			

DEPTH (Ft.): 5, 10

WATER LEVEL OBSERVATIONS: 7' Seepage

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

7' Seepage

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-06-2018
Test Pit Completed: 04-06-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-18

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9753° Longitude: -122.1083°
Northing: 358345 Easting: 1328157

Surface Elev.: 299 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
TOPSOIL									
1.5	297.5								
SILTY SAND WITH GRAVEL (SM), with cobbles, orangish brown, moist, dense to very dense									
					Probed 4-5 inches	S-1			
becomes gray			▽						
					Probed 0-1 inches	S-2			
		5							
10.0	289	10							
Test Pit Terminated at 10 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *3' While sampling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-04-2018
Test Pit Completed: 04-04-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-19

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.975° Longitude: -122.1083°
Northing: 358238 Easting: 1328145

Surface Elev.: 295 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1.0	294								
			▽						
					Probed 0-2 inches	S-1			
		5			Probed 0-0.5 inches	S-2			
9.5	285.5								

TOPSOIL

SILTY SAND WITH GRAVEL (SM), with cobbles, orangish brown, moist, dense to very dense

gray

very dense, 1.5 ft. boulder

Test Pit Terminated at 9.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *1.5' While sampling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-04-2018
Test Pit Completed: 04-04-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-20

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9747° Longitude: -122.1083°
Northing: 358139 Easting: 1328150

Surface Elev.: 293 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
TOPSOIL									
1.5	291.5								
SILTY SAND WITH GRAVEL (SM), red and orangish brown, moist, dense to very dense			▽						
				Probed 1-5 inches		S-2			
gray and orange, very dense									
				Probed 1/2 inch		S-3			
		5							
9.5	283.5								
Test Pit Terminated at 9.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *2' While sampling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-04-2018
Test Pit Completed: 04-04-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-21

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1079°
Northing: 358065 Easting: 1328236

Surface Elev.: 290 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		TOPSOIL								
1.5	288.5	**SILTY SAND WITH GRAVEL (SM)**, with cobbles, reddish brown, dense to very dense, roots and organics at 2 ft.		▽						
						Probed 0-3 inches	S-1			
		gray, moist, very dense	5							
		bluish gray								
9.0	281	***Test Pit Terminated at 9 Feet***								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *2' While sampling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-04-2018
Test Pit Completed: 04-04-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-22

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1076°
Northing: 358050 Easting: 1328311

Surface Elev.: 290 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1.0	289								
SILTY GRAVEL WITH SAND (GM), trace cobbles, orange and brown, dense to very dense			▽						
3.0	287				Probed 0-2-inches	S-1			
SILTY SAND WITH GRAVEL (SM), with cobbles, gray, moist, very dense									
wet									
bluish gray		5							
7.0	283								
Test Pit Terminated at 7 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *2' While sampling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-04-2018
Test Pit Completed: 04-04-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-23

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1073°
Northing: 358066 Easting: 1328394

Surface Elev.: 300 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	TOPSOIL									
	1.5	298.5								
	SILTY SAND WITH GRAVEL (SM), trace cobbles, bluish gray and orange, moist, dense to very dense									
						Probed 1-2 inches	S-2			
			5							
	light seepage at 8.5 ft.									
	10.0	290	10							
	Test Pit Terminated at 10 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-04-2018
Test Pit Completed: 04-04-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-24

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1069°
Northing: 358049 Easting: 1328494

Surface Elev.: 300 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	TOPSOIL									
	1.0	299								
	SILTY SAND WITH GRAVEL (SM), orangish brown, moist, dense to very dense									
	gray and orangish brown			▽						
						Probed 0-3 inches	S-1			
			5							
	trace cobbles									
	10.2	290	10							
	Test Pit Terminated at 10.2 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *3' While sampling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-04-2018
Test Pit Completed: 04-04-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-25

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1065°
Northing: 358037 Easting: 1328594

Surface Elev.: 300 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
		TOPSOIL
1.0	299	
		POORLY GRADED SAND WITH GRAVEL (SP), orangish brown and red, moist, dense
2.0	298	
		SILTY SAND WITH GRAVEL (SM), trace cobbles, gray and orange, moist, dense to very dense
		gray
		with cobbles, very dense
10.5	289.5	
		Test Pit Terminated at 10.5 Feet

SAMPLE NUMBER	FIELD TEST RESULTS
S-1	Probed 3 inches
S-2	Probed 1 inch

DEPTH (Ft.): 5, 10

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

2' While drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-04-2018
Test Pit Completed: 04-04-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-26

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9746° Longitude: -122.106°
Northing: 358073 Easting: 1328699

Surface Elev.: 296 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	TOPSOIL, with organics, dark brown, moist								
	light brown, wet, caving in between 0 and 3 ft.		▽			S-1			
1.5	294.5								
	SAND WITH SILT AND GRAVEL (SP-SM), gray, moist								
						S-2			
	trace cobbles, gray with orange mottling					S-3			
		5							
	bluish gray, silt content decreases					S-4			
9.4	286.5					S-5			
	Test Pit Terminated at 9.4 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *1' Seepage*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-05-2018
Test Pit Completed: 04-05-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-27

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1056°
Northing: 358060 Easting: 1328803

Surface Elev.: 300 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	SAMPLE NUMBER
0.0	300	**TOPSOIL**, dark brown, moist	
0.8	299.5	**SAND WITH GRAVEL (SP)**, with organics, reddish brown, moist	S-1
3.0	297	**SAND WITH SILT AND GRAVEL (SP-SM)**, gray with orange mottling	
5.0	295	**SAND WITH SILT (SP-SM)**, trace gravel, gray and brown, wet, caving in between 4 and 10 ft.	S-2
10.0	290	bluish gray	S-3
		Test Pit Terminated at 10 Feet	

GRAPHIC LOG | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | SAMPLE NUMBER | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

3' Light seepage

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-06-2018
Test Pit Completed: 04-06-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-28

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9745° Longitude: -122.1052°
Northing: 358051 Easting: 1328894

Surface Elev.: 299 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	PEAT (PT), brown, wet, very soft to soft			▽						
	12-in. long, 6-in. diameter red clay drain tile exposed at west end of pit				✋					
			5							
	6.0	293								
	Test Pit Terminated at 6 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *0.5' Heavy seepage*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-06-2018 | Test Pit Completed: 04-06-2018

Excavator: Caterpillar 312D Excavato | Operator: NW Excavating

Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-29

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale Issaquah, WA

SITE: 20th Street SE and SR9 Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9744° Longitude: -122.105°
Northing: 358020 Easting: 1328959

Surface Elev.: 299 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	PEAT (PT), brown, fibrous									
	8.0	291	5							
	SILTY SAND (SM), with cobbles, trace organics, gray, wet, medium dense to dense									
	9.7	289.5								
	Test Pit Terminated at 9.7 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

0' Seepage

5' Heavy seepage

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-06-2018
Test Pit Completed: 04-06-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 81185028 COSTCO CW# 17-023.GPJ TERRACON_DATATEMPLATE.GDT 5/29/18

TEST PIT LOG NO. TP-30

PROJECT: Costco CW# 17-0230

CLIENT: Costco Wholesale
Issaquah, WA

SITE: 20th Street SE and SR9
Lake Stevens, WA

LOCATION See Exploration Plan

Latitude: 47.9744° Longitude: -122.1038°
Northing: 357998 Easting: 1329243

Surface Elev.: 302 (Ft.)

DEPTH	ELEVATION (Ft.)	DESCRIPTION	SAMPLE TYPE	FIELD TEST RESULTS	SAMPLE NUMBER	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		TOPSOIL, moist, loose to medium dense						
1.0	301							
1.5	300.5	**FILL - SILTY SAND WITH GRAVEL (SM)**, with cobbles, olive gray with rust mottling, moist, loose to medium dense		Probes 2"	S-2			
		FAT CLAY (CH), trace sand and gravel, gray with rust mottling, moist, soft to medium stiff, seepage at contact						
						38	65-25-40	
6.0	296							
		SILTY GRAVEL WITH SAND (GM), with cobbles, rounded, gray, wet, heavy seepage, caving under silt						
10.0	292							
		Test Pit Terminated at 10 Feet						

DEPTH (Ft.): 5, 10

WATER LEVEL OBSERVATIONS: 1.5' While digging; 6' While digging

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
3 foot bucket

Abandonment Method:
Test pit backfilled with soil upon completion.

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

1.5' While digging

6' While digging

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 04-10-2018
Test Pit Completed: 04-10-2018
Excavator: Caterpillar 312D Excavato
Operator: NW Excavating
Project No.: 81185028

DRAFT

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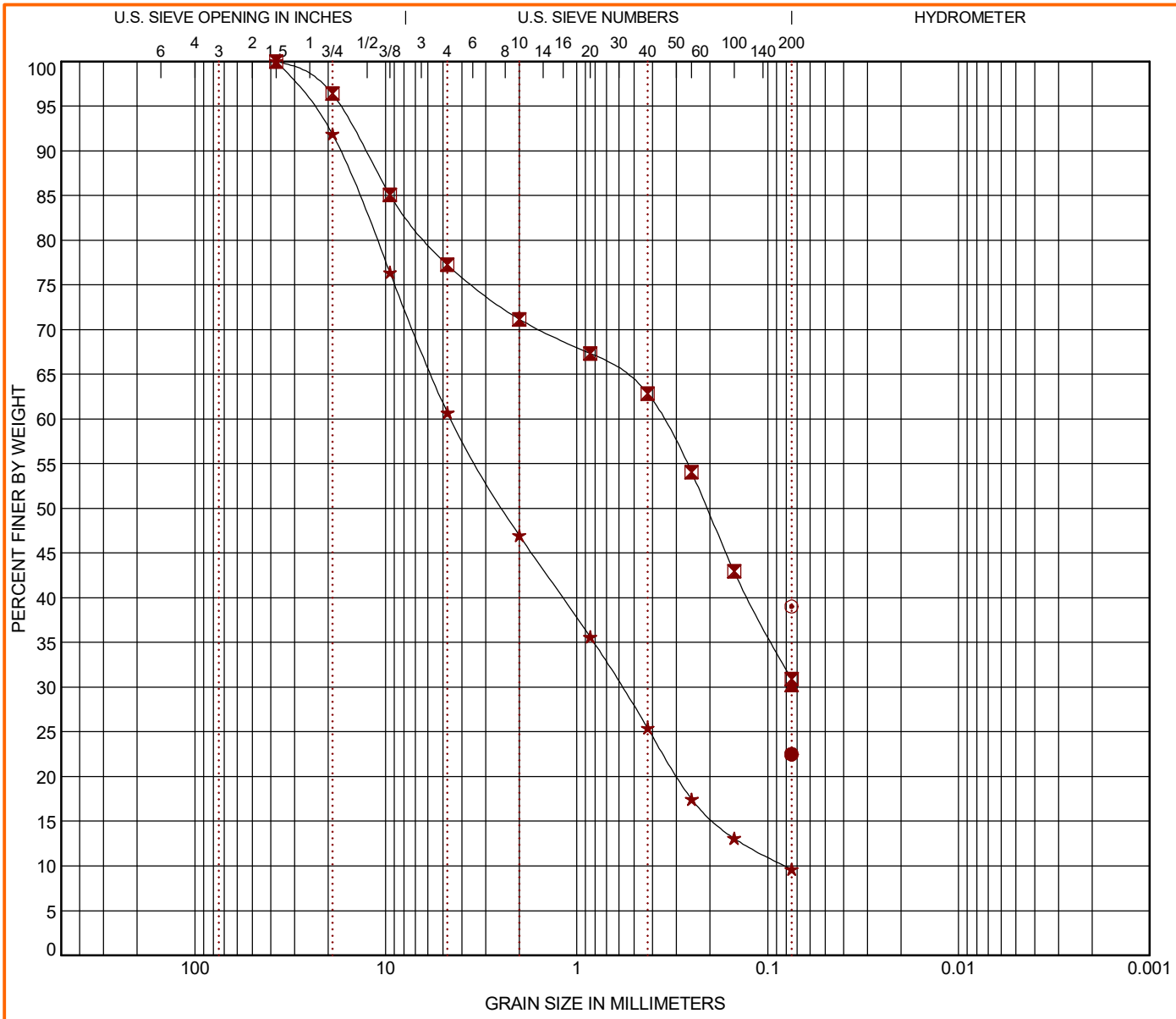
F-4 Groundwater Monitoring Well
Existing Ground Surface
Finish Grade
Data Logger Readings
Manual Groundwater Readings
Elevation (ft.)
345
340
335
330
325
320
315
2/19/2018
2/26/2018
3/5/2018
3/12/2018
3/19/2018
3/26/2018
4/2/2018
4/9/2018
4/16/2018
4/23/2018
4/30/2018
5/7/2018
5/14/2018
5/21/2018
Date

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-2	5 - 6.5							
⊠	B-4	2.5 - 4	SILTY SAND with GRAVEL (SM)	12					
▲	B-4	15 - 15.8							
★	B-6	2.5 - 4	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	8				0.92	56.20
⊙	B-6	15 - 16.5							

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-2	5 - 6.5	0.075				0.0	0.0		22.5	
⊠	B-4	2.5 - 4	37.5	0.357			22.7	46.3		30.9	
▲	B-4	15 - 15.8	0.075				0.0	0.0		30.1	
★	B-6	2.5 - 4	37.5	4.541	0.58	0.081	39.3	51.1		9.6	
⊙	B-6	15 - 16.5	0.075				0.0	0.0		39.0	

PROJECT: Costco CW# 17-0230

PROJECT NUMBER: 81185028

SITE: 20th Street SE and SR9
Lake Stevens, WA

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

CLIENT: Costco Wholesale
Issaquah, WA

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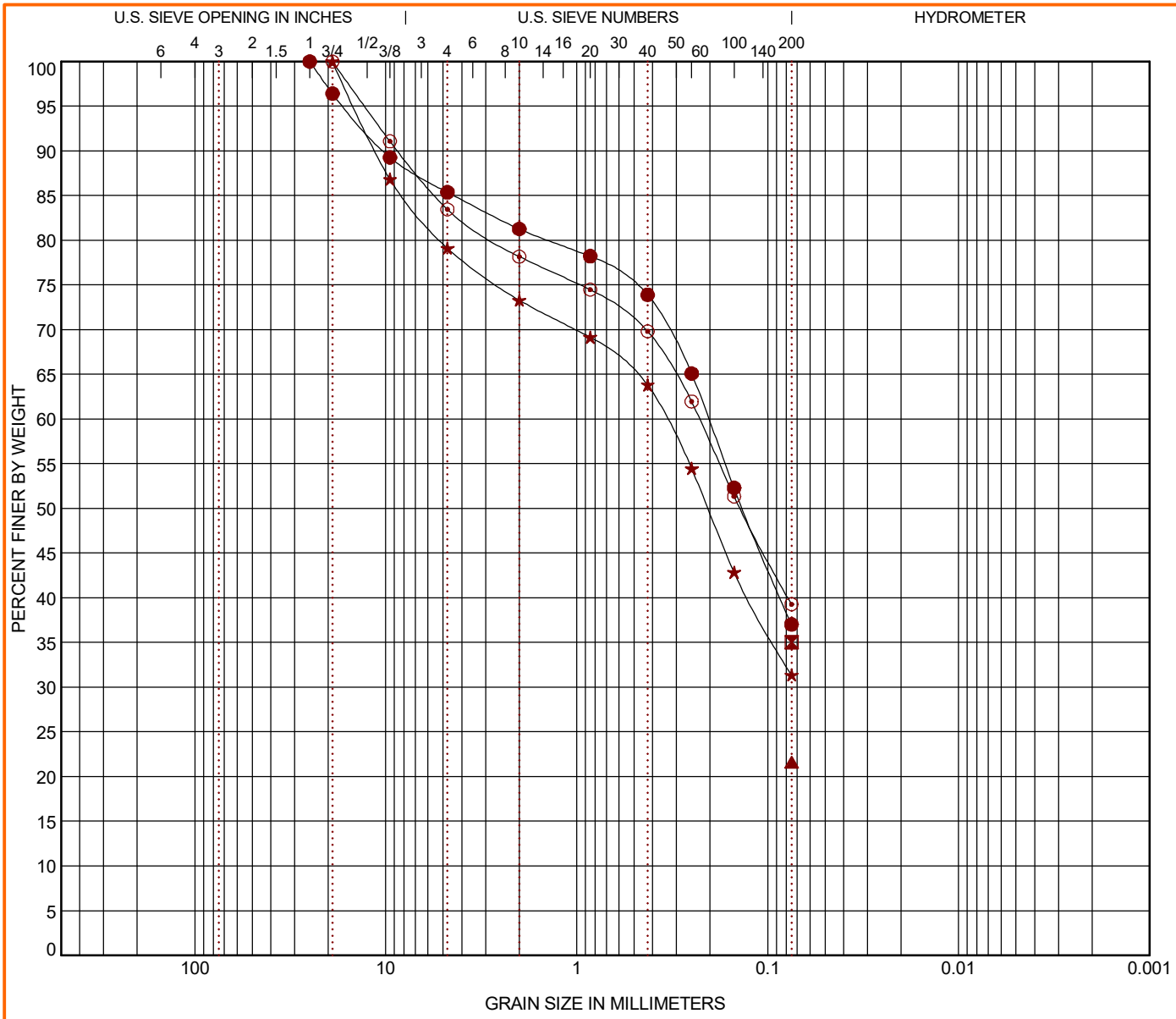
GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-7	2.5 - 4	SILTY SAND (SM)	13					
⊠	B-7	15 - 15.8							
▲	B-11	2.5 - 4							
★	B-19	2.5 - 4	SILTY SAND with GRAVEL (SM)	14					
⊙	F-4	5 - 6.5	SILTY SAND with GRAVEL (SM)	12					

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-7	2.5 - 4	25	0.204			14.6	48.4		37.0	
⊠	B-7	15 - 15.8	0.075				0.0	0.0		35.0	
▲	B-11	2.5 - 4	0.075				0.0	0.0		21.6	
★	B-19	2.5 - 4	19	0.342			20.9	47.8		31.4	
⊙	F-4	5 - 6.5	19	0.227			16.5	44.2		39.3	

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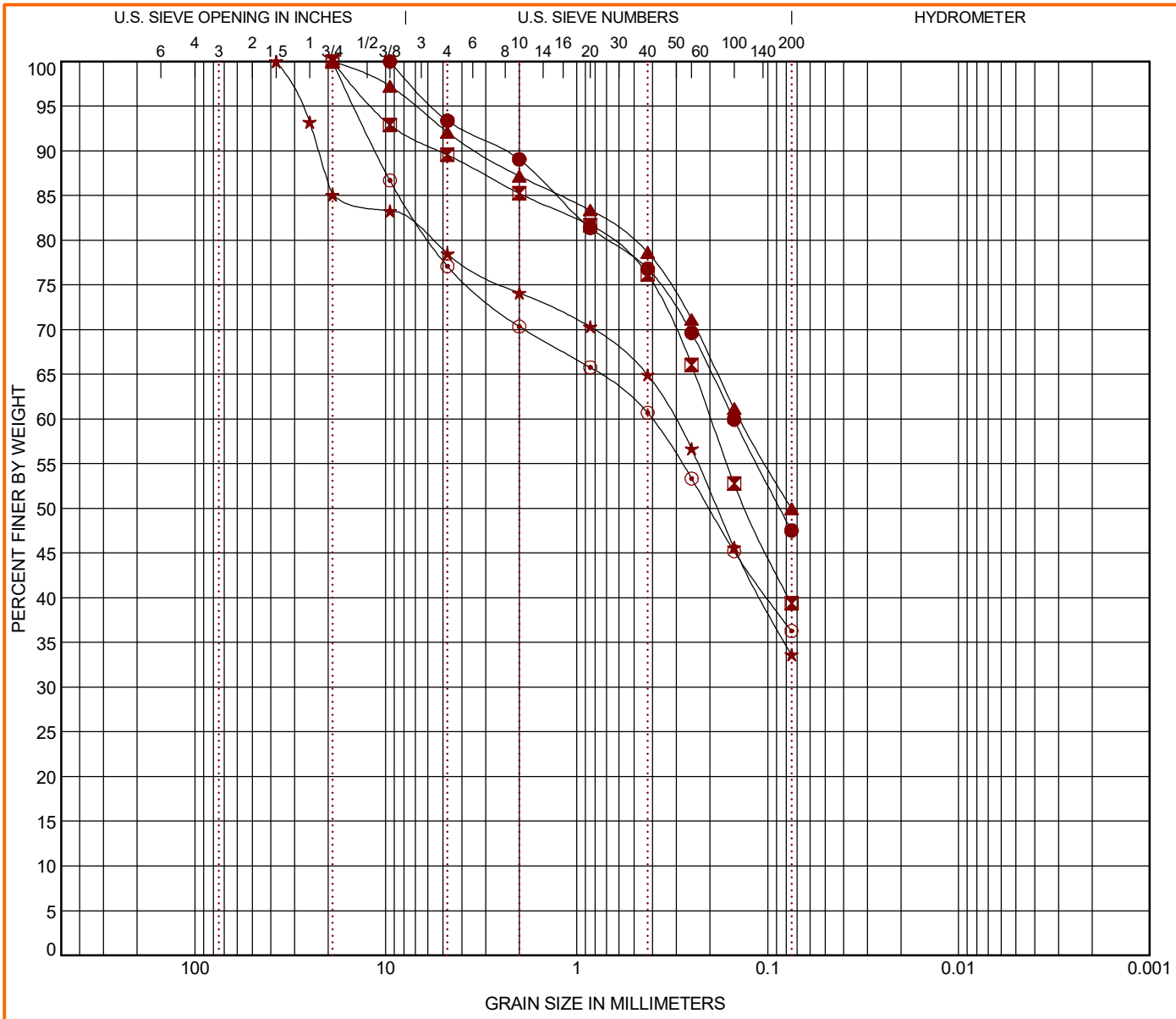
GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	F-4	32.5 - 33.3	SILTY SAND (SM)	13					
⊠	P-1	5 - 6.5	SILTY SAND (SM)	15					
▲	P-4	10 - 10.9	SILT with SAND (ML)	13					
★	P-5	5 - 6.5	SILTY SAND with GRAVEL (SM)	14					
⊙	P-10	10 - 10.5	SILTY SAND with GRAVEL (SM)	8					

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	F-4	32.5 - 33.3	9.5	0.15			6.6	45.9		47.5	
⊠	P-1	5 - 6.5	19	0.198			10.4	50.2		39.4	
▲	P-4	10 - 10.9	19	0.139			7.9	42.1		50.0	
★	P-5	5 - 6.5	37.5	0.309			21.5	44.9		33.6	
⊙	P-10	10 - 10.5	19	0.404			22.9	40.8		36.3	

PROJECT: Costco CW# 17-0230

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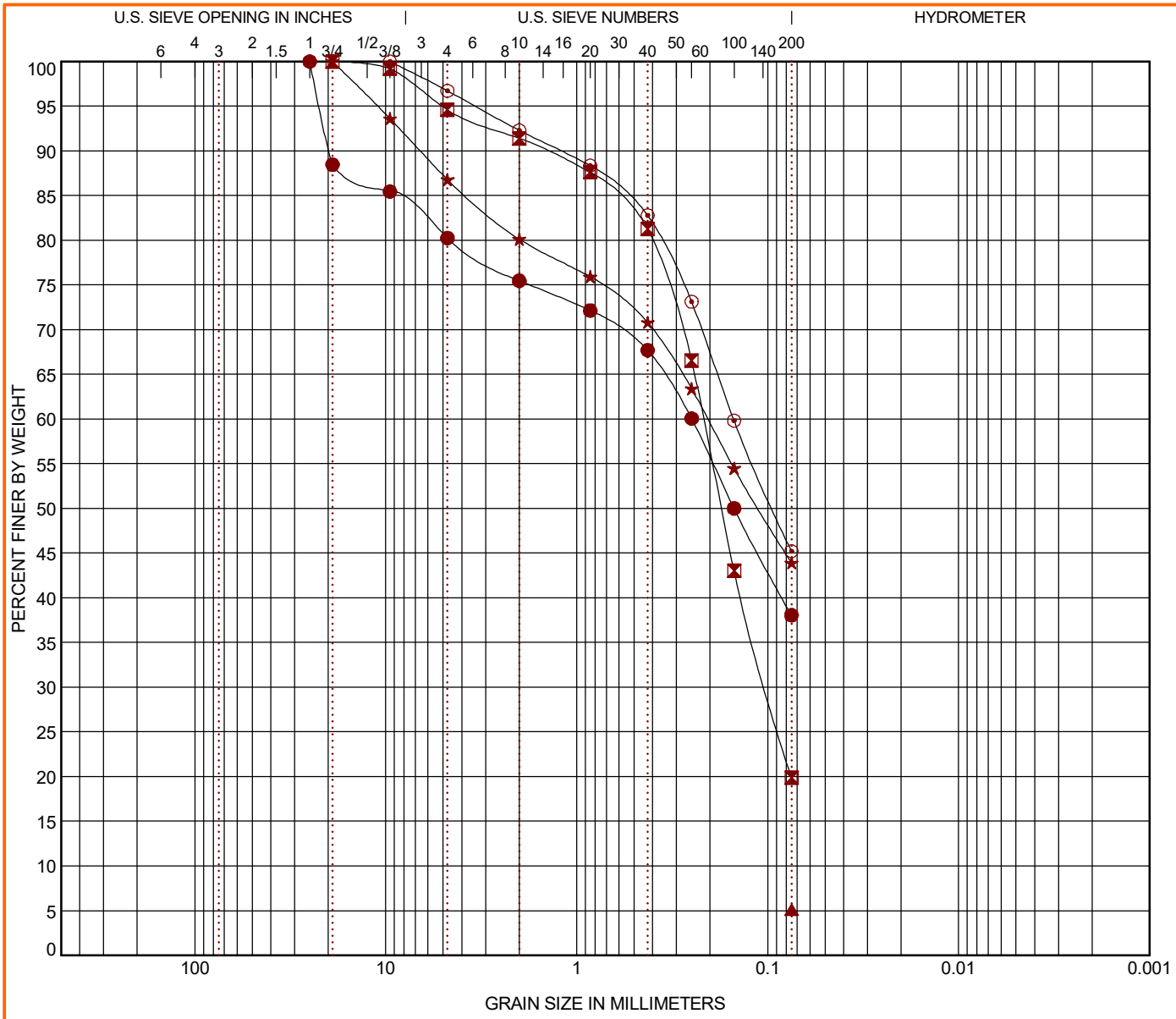

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	P-12	5 - 6.5	SILTY SAND with GRAVEL (SM)	14					
⊠	P-15	2.5 - 4	SILTY SAND (SM)	18					
▲	EP-5	5 - 6.2							
★	EP-5	10 - 11.5	SILTY SAND (SM)	11					
⊙	NW-1	5 - 6.5	SILTY SAND (SM)	14					

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	P-12	5 - 6.5	25	0.249			19.7	42.2		38.1	
⊠	P-15	2.5 - 4	19	0.217	0.102		5.4	74.7		19.9	
▲	EP-5	5 - 6.2	0.075				0.0	0.0		5.1	
★	EP-5	10 - 11.5	19	0.206			13.2	42.9		43.9	
⊙	NW-1	5 - 6.5	9.5	0.151			3.3	51.5		45.2	

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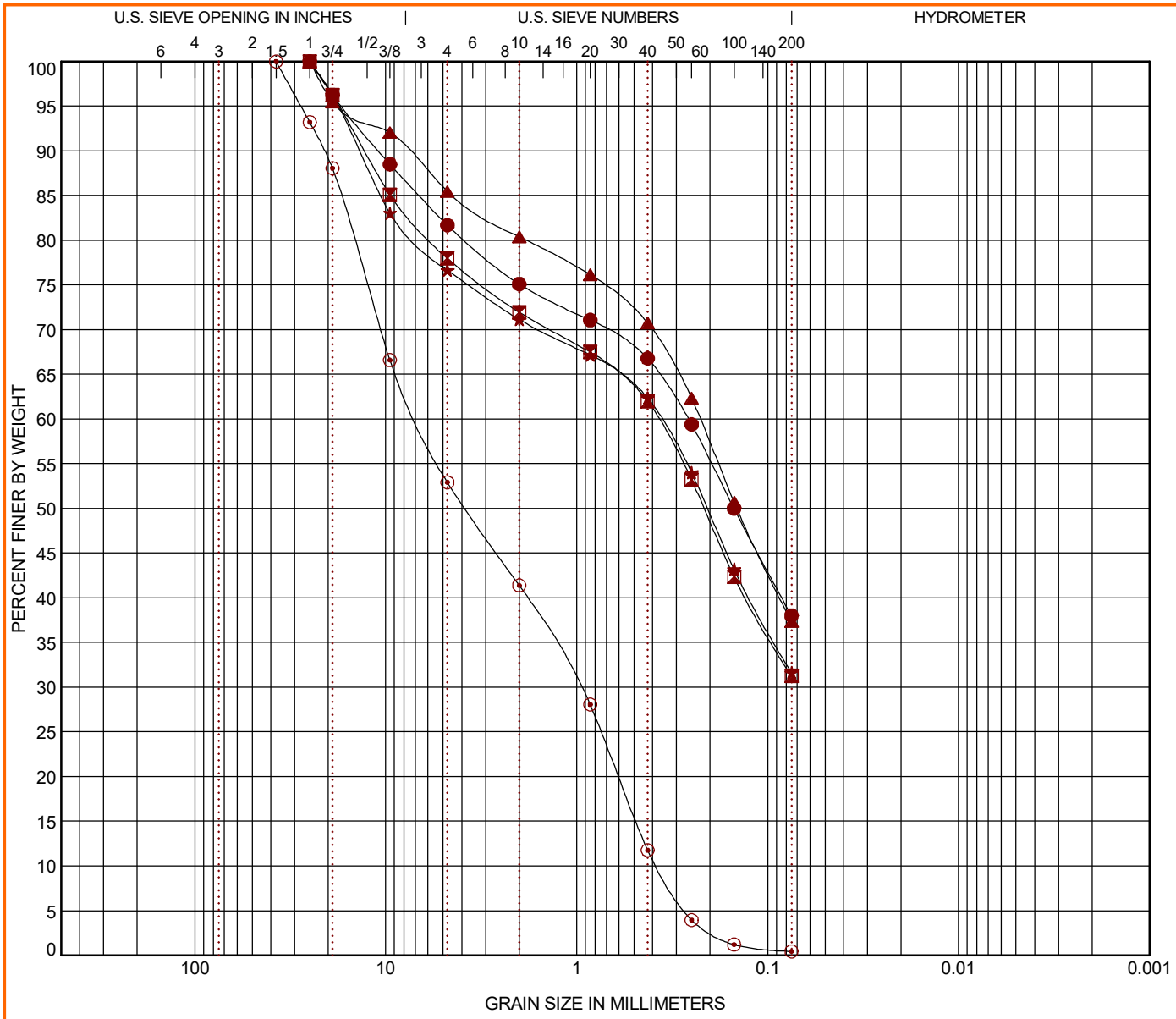
ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	NW-4	7.5 - 9	SILTY SAND with GRAVEL (SM)	13					
⊠	SW-1	2.5 - 4	SILTY SAND with GRAVEL (SM)	9					
▲	SW-3	2.5 - 3.9	SILTY SAND (SM)	11					
★	SW-7	2.5 - 4	SILTY SAND with GRAVEL (SM)	11					
⊙	TP-1	2 - 3	POORLY GRADED SAND with GRAVEL (SP)	3				0.36	18.03

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	NW-4	7.5 - 9	25	0.261			18.3	43.7		38.0	
⊠	SW-1	2.5 - 4	25	0.377			22.0	46.7		31.3	
▲	SW-3	2.5 - 3.9	25	0.225			14.5	48.1		37.4	
★	SW-7	2.5 - 4	25	0.366			23.3	45.0		31.6	
⊙	TP-1	2 - 3	37.5	6.802	0.963	0.377	47.1	52.5		0.4	

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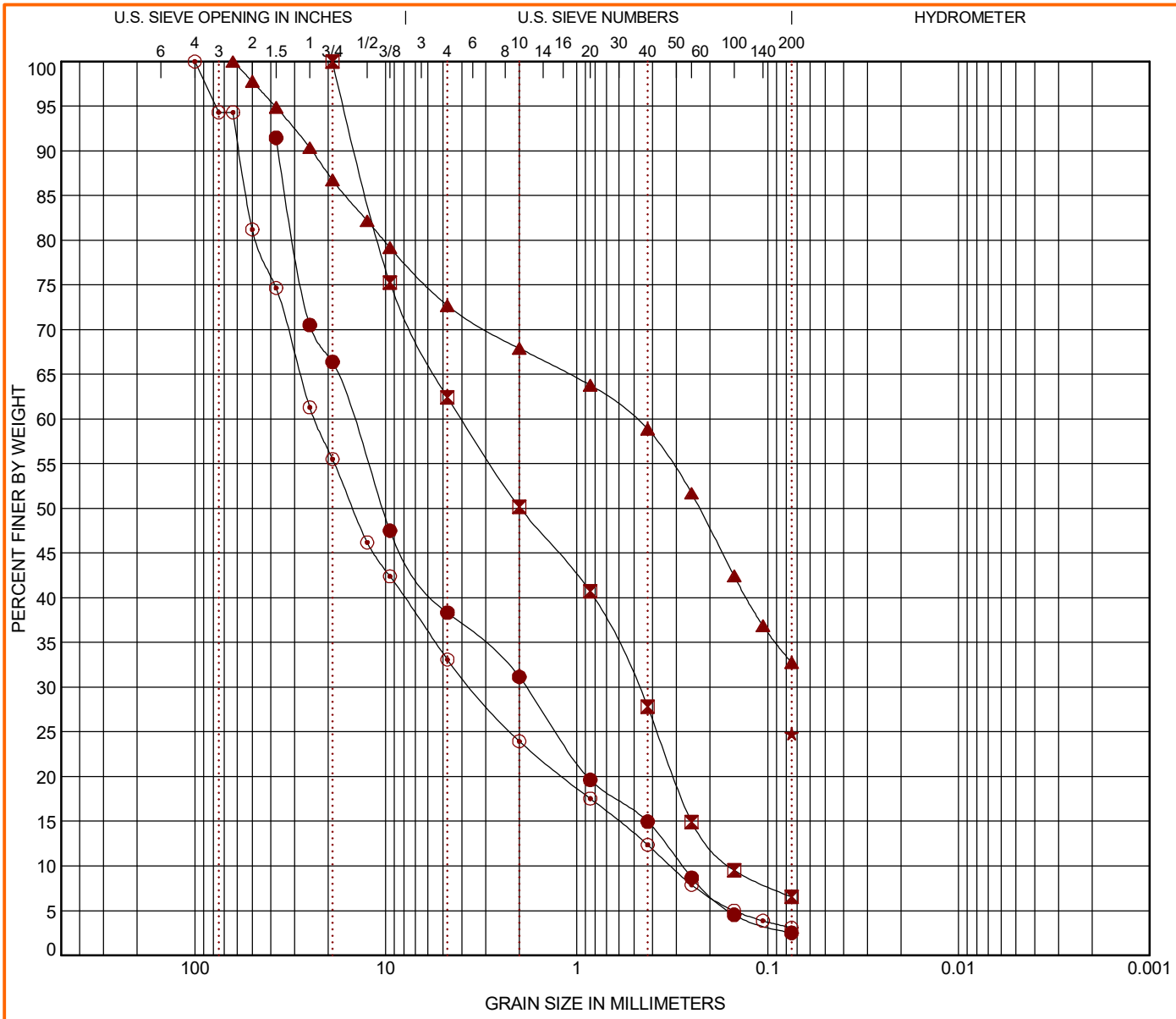

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	TP-3	1.75 - 2.3	POORLY GRADED GRAVEL with SAND (GP)	3				0.80	53.74
⊠	TP-4	1 - 2	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	15				0.36	25.46
▲	TP-7	10 - 11	SILTY SAND with GRAVEL (SM)	8					
★	TP-13	4							
⊙	TP-14	2	WELL-GRADED GRAVEL with SAND (GW)	8				1.67	73.14

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	TP-3	1.75 - 2.3	37.5	15.024	1.836	0.28	53.1	35.8		2.5	
⊠	TP-4	1 - 2	19	3.997	0.478	0.157	37.5	55.9		6.5	
▲	TP-7	10 - 11	63	0.498			27.3	40.0		32.7	
★	TP-13	4	0.075				0.0	0.0		24.8	
⊙	TP-14	2	100	23.497	3.547	0.321	61.2	30.0		3.1	

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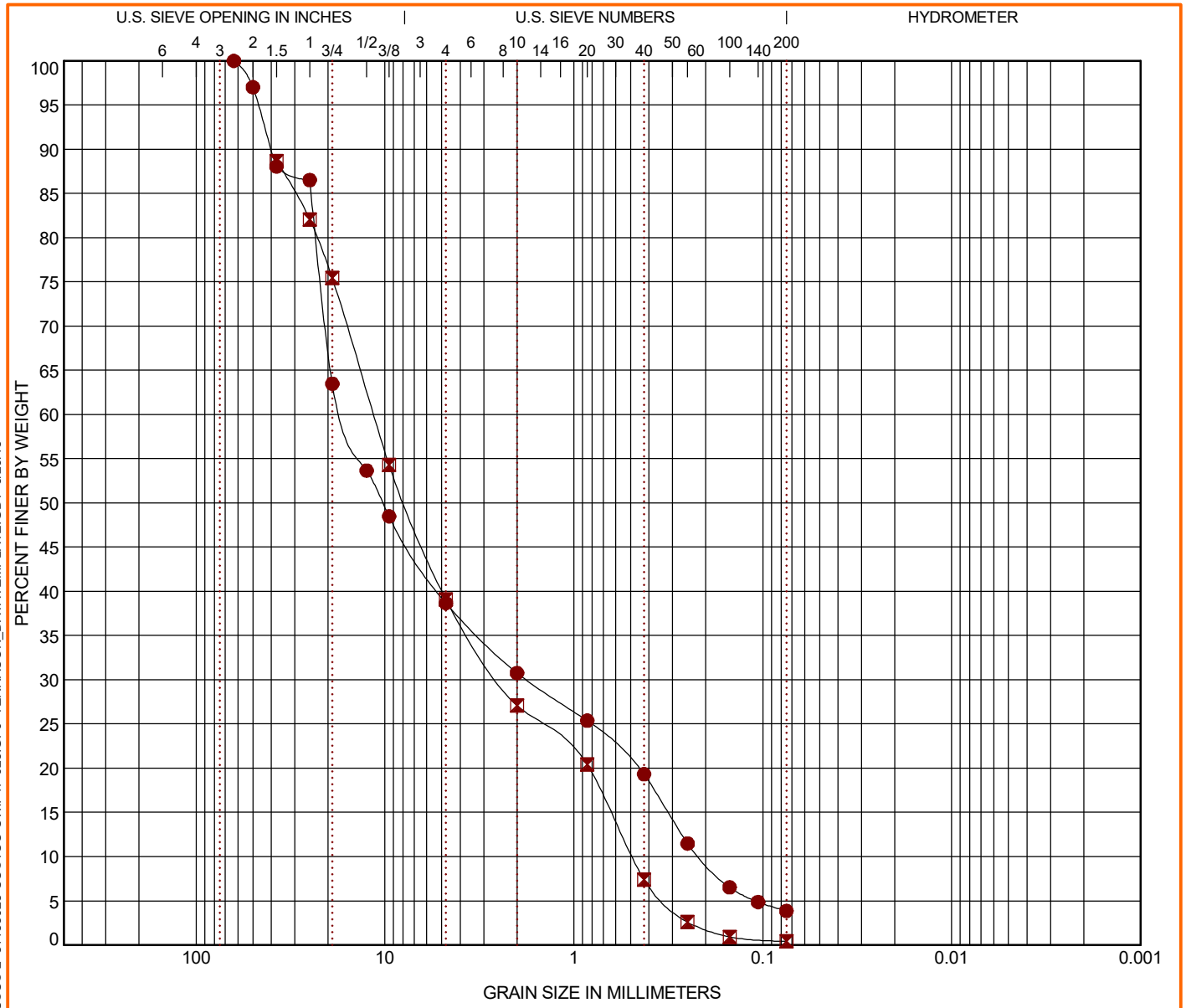

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	TP-16	4.5	POORLY GRADED GRAVEL with SAND (GP)	5				0.89	76.28
⊠	TP-17	4 - 5	WELL-GRADED GRAVEL with SAND (GW)	4				1.09	23.44

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	TP-16	4.5	63	16.378	1.772	0.215	61.3	34.8		3.9	
⊠	TP-17	4 - 5	37.5	11.449	2.466	0.488	49.6	38.7		0.4	

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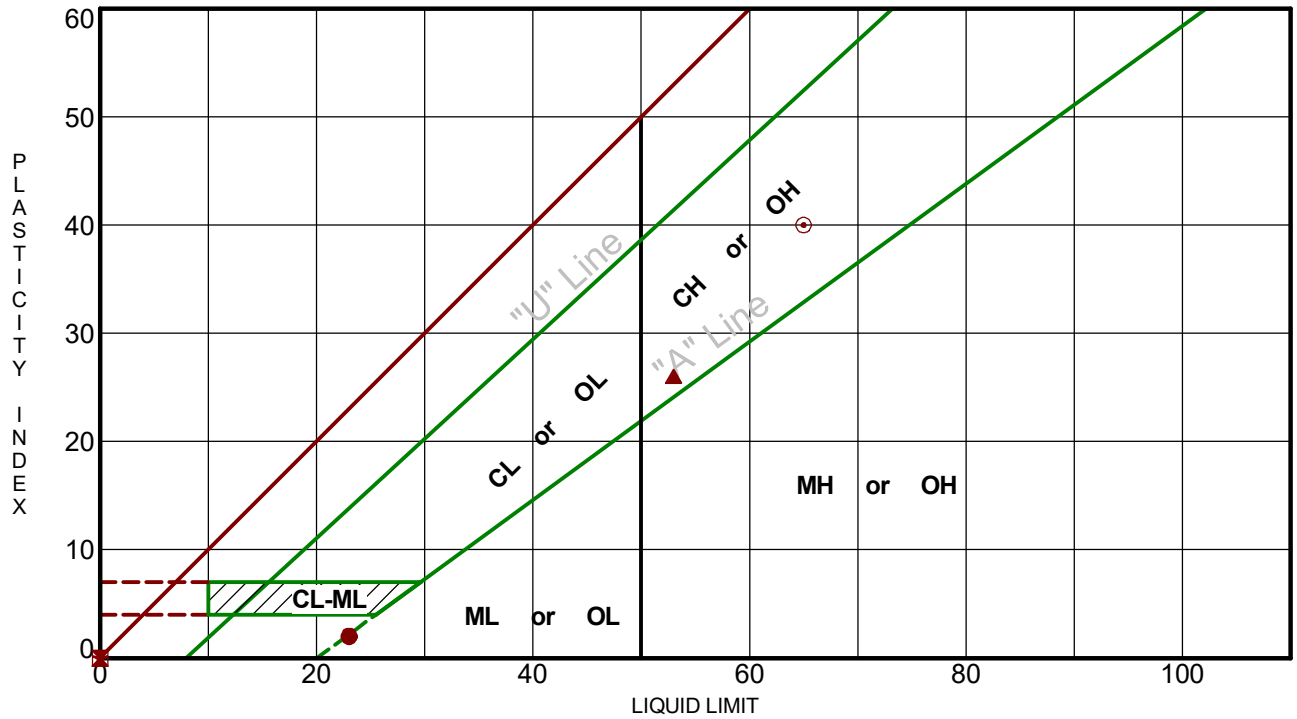
ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth	LL	PL	PI	Fines	USCS	Description
●	B-12	15 - 16.5	23	21	2		ML	SANDY SILT
⊠	B-21	5 - 6.5	NP	NP	NP		ML	SANDY SILT with GRAVEL
▲	SW-12	5 - 6.5	53	27	26		CH	FAT CLAY
★	TP-8	8 - 9	NP	NP	NP		ML	SILT
⊙	TP-30	3.75 - 4	65	25	40		CH	FAT CLAY

PROJECT: Costco CW# 17-0230

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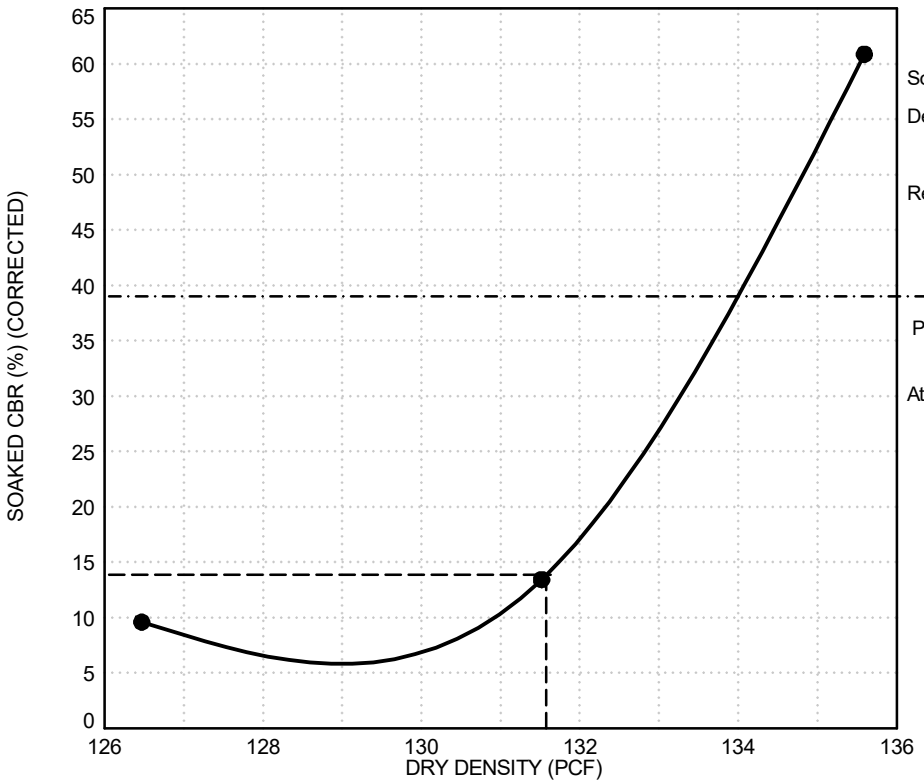
CALIFORNIA BEARING RATIO

ASTM D1883-07[2]



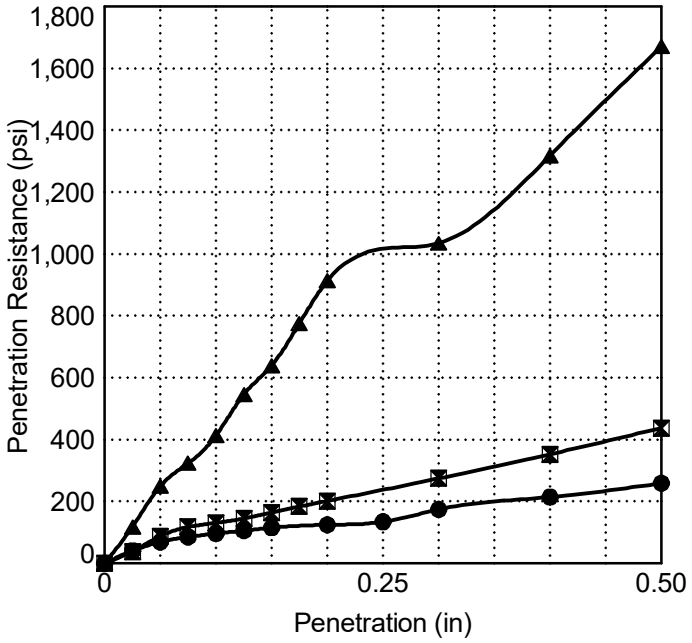
Source of Material **TP-7 10.0**

Description of Material **SILTY SAND with GRAVEL (SM)**

Remarks: **squeezed up mold at 10% moisture content**

Percent Fines **32.7 %**

Atterberg Limits LL PL PI



Sample No.	1	2	3
Sample Condition		Soaked	
Compaction Method		1557C	
Maximum Dry Density, (pcf)	138.5	138.5	138.5
Optimum Moisture Content, (%)	6.6	6.6	6.6
Dry Density before Soaking, (pcf)	126.47	131.52	135.59
Moisture Content, (%)			
After Compaction	6.4	6.5	6.5
Top 1" After Soaking	11.4	8.9	10.2
Surcharge,. (lbs)	10.00	10.00	10.00
Swell, (%)	0.28	0.37	0.42
Bearing Ratio, (%)	8.3	13.4	60.9

Dry Density @ 90% 124.7 pcf

Dry Density @ 95% 131.6 pcf

Dry Density @ 100% 138.5 pcf

CBR @ 90% Density

CBR @ 95% Density 13.8

CBR @ 100% Density

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CHEMICAL LABORATORY TEST REPORT

Project Number: 81185028
Service Date: 04/03/18
Report Date: 04/09/18
Task:

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client

Costco Wholesale

Project

Costco CW#17-0230
Lake Stevens, Washington

Sample Submitted By: Terracon (81) **Date Received:** 3/30/2018 **Lab No.: 18-0360**

Results of Resistivity Analysis

Sample Number	S-6	S-5
Sample Location	F-1	F-4
Sample Depth (ft.)	30	25
pH Analysis, AWWA 4500 H	8.11	8.25
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	200	200
Chlorides, ASTM D 512, (mg/kg)	63	25
Resistivity, ASTM G 57, (ohm-cm)	6305	8730

Analyzed By:

Trisha Campo
Chemist

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

A & L WESTERN AGRICULTURAL LABORATORIES

10220 S.W. NIMBUS AVE I BUILDING K-9 I PORTLAND, OREGON 97223 I (503) 968-9225 I FAX (503) 598-7702

REPORT NUMBER: 18-089-078 **CLIENT:** 99999

SUBMITTED BY:

SEND TO: TERRACON CONSULTANTS INC
21905 64TH AVENUE W, STE 100
MOUNTLAKE TERRACE, WA 98043-

GROWER: #81185028 SR9&20THAVEW

DATE OF REPORT: 04/11/18

SOIL PHYSICAL CHARACTERISTICS

Sample ID	Lab Number	% Sand	% Silt	% Clay	Soil Texture	Moisture @ 1/3 Bar	Moisture @ 15 Bar	Available Water %
6,7,9	59740	69	22	9	SANDY LOAM			

NOTES:

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A & L WESTERN AGRICULTURAL LABORATORIES

10220 S.W. NIMBUS AVE I BUILDING K-9 I PORTLAND, OREGON 97223 I (503) 968-9225 I FAX (503) 598-7702

REPORT NUMBER: 18-089-077

CLIENT NO:

SEND TO: TERRACON CONSULTANTS INC
21905 64TH AVE W, STE 100
MOUNTLAKE TERRACE, WA 98043-

SUBMITTED BY: TORI HESEDAHL

GROWER: #81185028 SR9&20THAVEW

DATE OF REPORT: 04/09/18

SOIL ANALYSIS REPORT

SAMPLE ID	LAB NUMBER	Organic Matter		Phosphorus		Potassium	Magnesium	Calcium	Sodium	pH		Hydrogen	Cation Exchange Capacity	PERCENT CATION SATURATION (COMPUTED)				
		* % Rating	** ENR lbs/A	P1 (Weak Bray) **** * ppm	$NaHCO_3$-P (OlsenMethod) **** * ppm	K ***** * ppm	Mg *** * ppm	Ca *** * ppm	Na *** * ppm	Soil pH	Buffer Index	H meq/100g	C.E.C. meq/100g	K %	Mg %	Ca %	H %	Na %
6,7,9	59740	19.1VH	411	8L	10**	71L	123M	873L	17VL	4.9	5.6	4.4	10.0	1.8	10.1	43.4	44.0	0.7

** NaHCO3-P unreliable at this soil pH

SAMPLE NUMBER	Nitrogen NO_3-N ppm	Sulfur SO_4-S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Excess Lime Rating	Soluble Salts mmhos/cm	Chloride Cl ppm		PARTICLE SIZE ANALYSIS			
												SAND %	SILT %	CLAY %	SOIL TEXTURE
6,7,9	30H	13M	2.3M	6M	105VH	0.7L	0.2VL	L	0.4L						

* CODE TO RATING: VERY LOW (VL), LOW (L), MEDIUM (M), HIGH (H), AND VERY HIGH (VH).
** ENR - ESTIMATED NITROGEN RELEASE
*** MULTIPLY THE RESULTS IN ppm BY 2 TO CONVERT TO LBS. PER ACRE OF THE ELEMENTAL FORM
**** MULTIPLY THE RESULTS IN ppm BY 4.6 TO CONVERT TO LBS. PER ACRE P_2O_5
***** MULTIPLY THE RESULTS IN ppm BY 2.4 TO CONVERT TO LBS. PER ACRE K_2O
MOST SOILS WEIGH TWO (2) MILLION POUNDS (DRY WEIGHT) FOR AN ACRE OF SOIL 6-2/3 INCHES DEEP

This report applies only to the sample(s) tested. Samples are retained a maximum of thirty days after testing.

Rogell Rogers, CCA, PCA
A & L WESTERN LABORATORIES, INC.

A & L WESTERN AGRICULTURAL LABORATORIES

10220 S.W. NIMBUS AVE I BUILDING K-9 I PORTLAND, OREGON 97223 I (503) 968-9225 I FAX (503) 598-7702

REPORT NUMBER: 18-089-077 **CLIENT:** 9999

SUBMITTED BY: TORI HESEDAHL

SEND TO: TERRACON CONSULTANTS INC
21905 64TH AVE W, STE 100
MOUNTLAKE TERRACE, WA 98043-

GROWER: #81185028 SR9&20THAVEW

DATE OF REPORT: 04/09/18

SOIL FERTILITY GUIDELINES

RATE: /1000 sq

Sample ID	Lab Number	Crop	SOIL AMENDMENTS				Nitrogen N	Phosphate P_2O_5	Potash K_2O	Magnesium Mg	Sulfur SO_4-S	Zinc Zn	Manganese Mn	Iron Fe	Copper Cu	Boron B
			Dolomite	Lime	Gypsum	Elemental Sulfur										
6,7,9	59740	LANDSCAPE	230				0.4	4.0	4.5		0.5					*

COMMENTS

LIME REQUIREMENT: Liming may be necessary if buffer index is less than 6.9. Guidelines are based upon common agricultural lime (100-score) per six-inch depth to raise SOIL pH to about 6.5.
PRIOR TO PLANTING: Spread the above requirements per 1000 sq ft and mix into the top 6 inches of soil. Initially, limit nitrogen to 25-30 ppm NO3-N or 1.5 lb N/1000 sq ft, to avoid salt damage. SPLIT any extra nitrogen evenly over the active growing season. Adjust rate according to local conditions and requirements. Allow for adequate establishment first (up to 30 days).
* BORON may not necessarily be deficient in the soil, and it is hard to correct an excessive application. Therefore, apply boron only if confirmed deficient through a leaf analysis.

NOTES:

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1311 WOODLAND AVE #1 • MODESTO, CALIFORNIA 95351 • (209) 529-4080 • FAX (209) 529-4736

REPORT NUMBER: 18-089-077

CLIENT: 99999

SUBMITTED BY: TORI HESEDAHL

SEND TO: TERRACON CONSULTANTS INC
21905 64TH AVE W, STE 100
MOUNTLAKE TERRACE, WA 98043-

GROWER: #81185028 SR9&20THAVEW

DATE OF REPORT: 04/04/18

SOIL SALINITY ANALYSIS REPORT

PAGE: 1

Sample ID	Lab Number	SAR	ESP	Na meq/L	Ca meq/L	Mg meq/L	pH	CO_3 meq/L	HCO_3 meq/L	E.C. dS/m	Cl meq/L	B ppm	Saturation %
6,7,9	59740	0.4	< 0.1	0.5	2.4	1.2	4.9	0.0	0.6	0.4	0.3	0.1	91.2

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1311 Woodland Avenue, Suite 1 · Modesto, California 95351 · (209) 529-4080

Report No: 18-089-078

Account No: 99999-D

Send to: TERRACON CONSULTANTS INC
21905 64TH AVENUE W, STE 100
MOUNTLAKE TERRACE, WA 98043

Grower: #81185028 SR9&20THAVEW

Submitted by: TORI HESEDAHL

Lab Number: 59740

Sample ID: TP967

Date Received: 03/30/2018
Date Reported: 04/11/2018

EPA 503 METALS SOIL ANALYSIS REPORT

Sample Preparation Method: EPA SW846-3050 B

Detection Limit mg/kg	Analyte	Level Found mg/kg	Method Code
0.25	Arsenic	16.34	EPA SW846-6010
0.03	Cadmium	0.24	EPA SW846-6010
0.1	Chromium	42.3	EPA SW846-6010
0.1	Copper	10.5	EPA SW846-6010
0.5	Lead	33.8	EPA SW846-6010
0.05	Mercury	0.10	EPA SW846-7471A
0.1	Molybdenum	0.4	EPA SW846-6010
0.1	Nickel	17.8	EPA SW846-6010
0.5	Selenium	BDL	EPA SW846-6010
0.05	Zinc	35.30	EPA SW846-6010

BDL - INDICATES THE LEVEL FOUND IS BELOW THE ESTABLISHED DETECTION LIMIT FOR THAT ANALYTE.
ANALYZED ON A DRY WEIGHT BASIS

A & L Western Agricultural Laboratories, Inc.

Rogell Rogers, CCA, PCA
Agronomist

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Report No: 18-089-078 **Account No:** 9999

Send to: TERRACON CONSULTANTS INC
21905 64TH AVENUE W, STE 100
MOUNTLAKE TERRACE, WA 98043

Grower: #81185028 SR9&20THAVEW

Submitted by: TORI HESEDAHL

Date Received: 03/30/2018
Date Reported: 04/09/2018

SOIL ANALYSIS REPORT – EXTRACTABLE ALUMINUM

Analyte: **Aluminum**
Detection Limit: **0.5 mg/kg (ppm)**
Method: **1 N KCl extractable aluminum WREP-125, 2nd Ed S -15.10**

Lab Number:	Sample ID:	Level Found mg/kg (ppm)
59740	TP967	56

A & L Western Agricultural Laboratories, Inc.

Rogell Rogers, CCA, PCA
Agronomist

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YOUR WATER IS SAFE TO DRINK!

2016 Annual Water Quality Report

SNOHOMISH COUNTY PUD
PUBLIC UTILITY DISTRICT NO. 1

Integrated System
June 2017

SNOHOMISH COUNTY PUD is pleased to report that your drinking water safely complies with federal and state drinking water quality standards. This report summarizes the key findings of the PUD's 2016 water quality testing program. It illustrates the utility's commitment to delivering the highest quality drinking water.

Each year, the PUD prepares a Water Quality Report for its customers. We want you to know where your water comes from, how it is treated and that it is safe to drink. The purpose of this report is to help people, especially those with special health needs, make informed decisions about their drinking water.

Inside

Where Your Water Comes From p. 2
System Improvements p. 2
General Information p. 3
Definition of Terms p. 4
Testing Results pp. 5 - 7
Contact Us Back page

Special Health Information

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons – such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly and infants – can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water hotline (1-800-426-4791).

Where Your Water Comes From

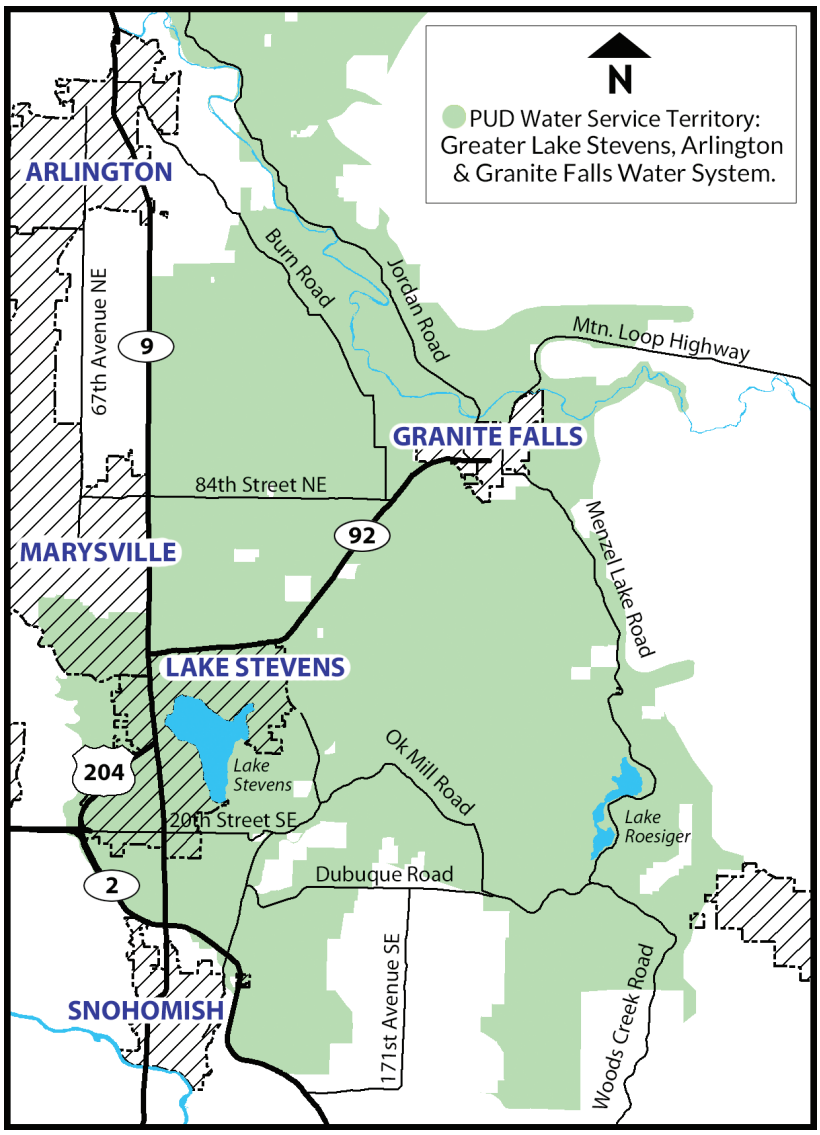
The majority of the water distributed to your home is purchased from the City of Everett. The water comes from the Spada Lake Reservoir, which is located at the headwaters of the Sultan River about 30 miles east of Everett.

Spada Reservoir is located in the Sultan Basin Watershed, which covers nearly 84 square miles. A watershed is a geographic area where all precipitation drains into a single body of water. In the Sultan Basin Watershed, rainfall and snowmelt from the Cascade Mountains flow into Spada Reservoir. One of the wettest watersheds in the continental United States, the basin's average rainfall is about 165 inches.

Created in 1965 by construction of the Culmback Dam, and increased in size in 1984, Spada Lake Reservoir holds approximately 50 billion gallons of water. Water from Spada Lake travels eight miles by tunnel and pipeline to the PUD's Jackson Hydroelectric Project where turbines generate enough power to supply electricity to about 35,800 homes.

The water is then routed by pipeline from the powerhouse to Everett's Lake Chaplain, where it is held in preparation for treatment. Everett's treatment plant uses coagulation and advanced filtration techniques to remove suspended particles that may contaminate the water. The pH (acidity) of the water is adjusted to reduce its corrosiveness, thereby reducing the likelihood of lead and copper being leached from household plumbing. Chlorine is added as a disinfectant to make sure the water is free of harmful microorganisms, and fluoride is added for enhanced dental protection. The levels of these two additives are monitored constantly to assure proper dosages are being used.

In September 2012, the PUD completed the construction of a new treatment facility in Lake Stevens (northeast of the downtown area) and began producing water from two wells. The water from these wells receives treatment for iron and manganese removal and is chlorinated. Fluoride is added to match levels found in the City of Everett drinking water. The water from this treatment facility is then blended with water received from the City of Everett in the distribution system.



System Improvements

The PUD completed several improvement projects last year. Approximately 7,500 lineal feet of aging water main was replaced in the Lake Stevens area: 3,800 lineal feet of water main on 91st Ave SE and 3,700 lineal feet on 123rd Ave SE/12th St SE. The interior of Hillcrest Reservoir Tank #1 was recoated.

General Information About Drinking Water

Substances Expected to be in Drinking Water

To ensure that tap water is safe to drink, the Washington State Department of Health (DOH) and the U.S. Environmental Protection Agency (EPA) set regulations limiting the amount of certain contaminants in the water provided by public water systems. The U.S. Food & Drug Administration (FDA) and the Washington State Department of Agriculture regulations establish limits for contaminants in bottled water that must provide the same protection for public health. Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline at 1-800-426-4791.

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals – in some cases, radioactive material – and substances resulting from the presence of animals or from human activity. The following substances may be present in source water (drinking water quality is determined by testing for these contaminants).

Microbial contaminants *such as viruses and bacteria*	*May come from wildlife, agricultural livestock or septic systems.*
Inorganic contaminants *such as salts and metals*	*Can occur naturally or may result from urban storm-water runoff, industrial or domestic wastewater discharges, mining or farming.*
Pesticides & herbicides	*May come from a variety of sources such as farming, urban stormwater runoff, and homes or businesses.*
Organic contaminants *including synthetic and organic chemicals*	*Are by-products of industrial processes and petroleum production and may also come from gas stations, urban stormwater runoff and septic systems.*
Radioactive contaminants	*Can be naturally occurring or may be the result of oil and gas production and mining activities.*

Water Conservation Requirements

The Water Use Efficiency Rule sets planning requirements, leakage standards and water conservation goal setting and reporting requirements. The PUD's 2016 demand-side and supply-side conservation goal results:

	Goal	2016 Results	How Goal was Met
Demand-Side	Participate in the Everett Water Utilities Committee regional conservation program to help reduce the regional demand for water.	The total regional savings were estimated to be 0.65 MGD.	Public outreach and education, distribution of indoor/outdoor conservation kits, toilet and efficient appliance rebates and leak detection.
Supply-Side	Maintain the PUD's distribution system leakage below the state standard of 10% and strive to progressively achieve lower percentages of non-revenue water, where possible.	8.47% PUD Distribution System Leakage (combined result for all PUD water systems)	Continued emphasis on accurate water usage reporting with PUD crews and local fire departments and with repair of discovered leaks.

Definition of Terms Used in This Report

How Do I Read This Report?

The **Maximum Allowable** column provides you with the maximum level established by the EPA or the DOH. These are standards that all drinking water suppliers serving over 15 customers must meet.

The **Minimum/Maximum Range** and **Average Value** show you the contaminant level detected in the water analysis test.

The **last column tells you whether or not the test complies** with regulations. A "YES" indicates that the range detected is within EPA regulations.

Snohomish County PUD also regularly performs tests for unregulated compounds for which state and federal agencies have not set standards at this time.

AL (Action Level): The concentration of a contaminant, which, if exceeded, triggers treatment or other requirements that a water system must follow.

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible, using the best available treatment technology.

MCLG (Maximum Contaminant Level Goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

MRDL (Maximum Residual Disinfectant Level): The highest level of disinfectant allowed in drinking water. There is convincing evidence that the addition of a disinfectant (e.g., chlorine, chloramines, chlorine dioxide) is necessary for control of microbial contaminants.

MRDLG (Maximum Residual Disinfectant Level Goal): The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

N/A: The EPA has not set MCLGs for these substances.

N/D: Not detected.

NTU (Nephelometric Turbidity Units): Measurement of the clarity, or turbidity, of water.

ppm (parts per million): One part per million (corresponds to one dollar in $1,000,000).

ppb (parts per billion): One part per billion (corresponds to one dollar in $1,000,000,000).

pCi/L (picocuries per liter): a measure of radioactivity.

SMCL (Secondary Maximum Contaminant Level): These standards are developed to protect the aesthetic qualities of drinking water and are not health-based.

TT (Treatment Technique): A required process intended to reduce the level of a contaminant in drinking water.

Turbidity: Has no health effects. However, turbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease-causing organisms that include bacteria, viruses and parasites. These organisms can cause symptoms such as nausea, cramps, diarrhea and associated headaches.

Testing Results

GREATER LAKE STEVENS, ARLINGTON AND GRANITE FALLS WATER SYSTEM

The PUD's Integrated System is supplied water from the City of Everett and a PUD-owned well field. The system provides water to approximately 19,000 connections (estimated customer base of approximately 47,900 people) and includes 360 miles of pipe, 14.1 million gallons of storage, 12 pump stations, 9 City of Everett taps, and 19 major pressure zones.

			EPA Regulations		Your Water Testing Results		
Substance	Major Source	Units	Maximum Goal (MCLG)	Maximum Allowable (MCL)	Min./Max. Range	Average or Highest Value	Comply?
Nitrate	Erosion of natural deposits, animal waste	ppm	10	10	0 – 0.1	0.1	YES
Arsenic	Erosion of natural deposits	ppb	0	10	2	2	YES
Barium	Erosion of natural deposits	ppm	2	2	0.01	0.01	YES
Manganese	Erosion of natural deposits	ppm	N/A	0.05 (SMCL)	0.0 – 0.03	0.02	YES
Iron	Erosion of natural deposits	ppm	N/A	0.3	0.02 – 0.08	0.04	YES
Gross Beta[1]	Decay of man-made & natural deposits	pCi/L	0	50	0 – 1.02	0.26	YES

[1]EPA considers 50 pCi/L to be the level of concern for beta particles.

Total Coliform Bacteria	Naturally present in the environment	% positive	0	Not more than 5% positive per month	0%	0%	YES

Total coliform bacteria testing is used to monitor microbial quality in the water distribution system. The PUD collects 50 coliform samples per month from dedicated sites within the Lake Stevens Integrated Water System. Not more than 5 percent of the monthly total can be positive for total coliforms.

Fluoride	Dental health additive	ppm	2	4	0.5 – 1.0	0.7	YES

Fluoride is added to your water in carefully controlled levels for dental health. In January 2011, the U.S. Dept. of Health & Human Services (HHS) released a proposal to reduce the recommended drinking water fluoride concentration target to a single national standard of 0.7 ppm. The recommendation is based on recent research on changed fluoride and water consumption patterns in the U.S. The recommendation had not been made final, but in the spring of 2011, PUD and other water systems in Washington reduced the target fluoride residual in their drinking water from 1.0 ppm to 0.8 ppm; 0.8 ppm is the lowest level allowed under state regulations. On May 6, 2016, state regulations changed the standard to 0.7 ppm with an operating range of 0.5 to 0.9.

Haloacetic Acids[2]	By-product of drinking water chlorination	ppb	N/A	60	21.5 – 48.1	34.2	YES
Total Trihalomethanes[2]	By-product of drinking water chlorination	ppb	N/A	80	19.2 – 49.8	42.2	YES
Free Chlorine Residual	Measure of disinfectant added to water	ppm	4 (MRDLG)	4 (MRDL)	0.2 – 1.3	0.65	YES

[2]Haloacetic acids and Trihalomethanes form as by-products of the chlorination process that is used to kill or inactivate disease-causing microbes. Although goals have not been set for these compounds as a group, MCLGs for related individual compounds can be seen in the Unregulated Substances table on the next page.

Turbidity	Soil erosion	NTU	N/A	TT	100%	0.06	YES

Turbidity is a measure of the amount of particulates in water measured in Nephelometric Turbidity Units (NTU). Particulates in water can include bacteria, viruses and protozoans that can cause disease. Turbidity measurements are used to determine the effectiveness of the treatment processes used to remove these particulates. Values reported are the lowest monthly percentage of samples that meet the turbidity limit (0.3 NTU for EPA and 0.1 NTU for the state) and the highest filtered water turbidity measurement obtained at the City of Everett Water Filtration Plant in 2015.

			EPA Regulations		Your Water Testing Results		
Substance	Major Source	Units	Maximum Goal (MCLG)	Action Level (AL)	90th % Level	Homes Exceeding the AL	Comply?
Copper	Plumbing, erosion of natural deposits	ppm	1.3	1.3	0.766	None	YES
Lead	Plumbing, erosion of natural deposits	ppb	0	15	4	1	YES

US Environmental Protection Agency (USEPA) and state regulations require Snohomish PUD and the systems it supplies to monitor for the presence of lead and copper at household taps in their service area every three years. The next round of required sampling will be conducted in late summer of 2018. The 90th % Level is the highest result obtained in 90 percent of the samples collected when the results are ranked in order from lowest to highest. The results for water tested before it enters household plumbing were even lower. This indicates that there is virtually no lead or copper in the water you are provided, but your household plumbing may contribute to the presence of lead and copper at your tap.

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Snohomish County PUD is responsible for providing high-quality drinking water but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods and steps you can take to minimize exposure is available from the Safe Drinking Water hotline or at the USEPA's website at www.epa.gov/safewater/lead.

If you are interested in participating in our 2018 Lead & Copper sampling program, please call us at 425-397-3000 during business hours.

(Testing results for this water system continued on next page)

GREATER LAKE STEVENS, ARLINGTON AND GRANITE FALLS WATER SYSTEM (CONT.)

UNREGULATED SUBSTANCES

Substance	Maximum Goal (MCLG)	Your Water Testing Results Min./Max. Range	Your Water Testing Results Average Value
Bromodichloromethane[1] (ppb)	0	1.2 – 2.7	1.8
Chloroform (trichloromethane)[1] (ppb)	70	17.8 – 47.5	33.2
Dichloroacetic Acid[1] (ppb)	0	4.6 – 18.2	12.2
Trichloroacetic Acid[1] (ppb)	20	13.3 – 25.1	18.6
Monochloroacetic Acid[1] (ppb)	None	0 – 2.7	0.3

[1]Although these substances are not regulated individually, their results are added together to obtain the Total Trihalomethane and Haloacetic Acid results in the above table.

VOLUNTARILY MONITORED SUBSTANCES

The information below is voluntary and describes additional characteristics of the drinking water in the PUD distribution system.

	Min./Max. Value	Average Value
Alkalinity (ppm)	18 – 84	60
Aluminum (ppb)	0.01 – 0.2	0.02
pH (standard unit)	7.2 – 8.5	7.5
Sodium (ppm)	8.5	8.5
Total Hardness (ppm)	14 – 89	64
Chloride (ppm)	6	6
Sulfate (ppm)	12	12

The Creswell and Storm Lake Systems are also supplied water from the City of Everett; however, the systems are not hydraulically linked, which makes them separate or isolated systems. Therefore, in addition to the testing results found on pages 5-6, the PUD collects supplementary compliance samples as shown in the following tables.

CRESWELL WATER SYSTEM

The Creswell system supplies water to 15 connections along Dubuque Road and Creswell Road. Water is purchased directly from the City of Everett with taps on Everett's No. 2 and No. 3 pipelines.

Substance	Major Source	Units	EPA Regulations Maximum Goal (MCLG)	EPA Regulations Maximum Allowable (MCL)	Your Water Testing Results Min./Max. Range	Your Water Testing Results Average Value	Comply?
Total Coliform Bacteria	Naturally present in the environment	Samples positive	0	1 positive per month	0%	0%	YES

Total coliform bacteria testing is used to monitor microbial quality in the water distribution system. The PUD collects one coliform sample per month. No unsatisfactory results were detected in 2016.

Haloacetic Acids[2]	By-product of drinking water chlorination	(ppb)	N/A	60	41.3	41.3	YES
Total Trihalomethanes[2]	By-product of drinking water chlorination	(ppb)	N/A	80	33.2	33.2	YES
Free Chlorine Residual	Measure of disinfectant added to water	(ppm)	4 (MRDLG)	4 (MRDL)	0.5 – 0.9	0.7	YES

[2]Haloacetic acids and Trihalomethanes form as by-products of the chlorination process that is used to kill or inactivate disease-causing microbes. Although goals have not been set for these compounds as a group, MCLGs for related individual compounds can be seen in the Unregulated Substances table below.

Substance	Major Source	Units	EPA Regulations Maximum Goal (MCLG)	EPA Regulations Action Level (AL)	Your Water Testing Results 90th % Level	Your Water Testing Results Homes Exceeding the AL	Comply?
Copper	Plumbing, erosion of natural deposits	ppm	1.3	1.3	0.021	None*	YES
Lead	Plumbing, erosion of natural deposits	ppb	0	15	0	None*	YES

US Environmental Protection Agency (USEPA) regulations require monitoring for the presence of lead and copper at household taps in their service area every three years. These results are from 2015. The next round of required sampling will be conducted in 2018.

**The 90th percentile level is the highest result obtained in 90% of the samples collected when the results are ranked in order from lowest to highest.*

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Snohomish County PUD is responsible for providing high-quality drinking water but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods and steps you can take to minimize exposure is available from the Safe Drinking Water hotline or at the USEPA's website at www.epa.gov/safewater/lead.

UNREGULATED SUBSTANCES

Substance	Maximum Goal (MCLG)	Your Water Testing Results Min./Max. Range	Your Water Testing Results Average Value
Bromodichloromethane[3] (ppb)	0	1.6	1.6
Chloroform (trichloromethane)[3] (ppb)	70	34.4	34.4
Dichloroacetic Acid[3] (ppb)	0	17.1	17.1
Trichloroacetic Acid[3] (ppb)	20	20.7	20.7

[3]Although these substances are not regulated individually, their results are added together to obtain the Total Trihalomethane and Haloacetic Acid results in the above table.

STORM LAKE RIDGE WATER SYSTEM

The Storm Lake Ridge system supplies water to almost 200 connections in the Storm Lake Ridge community and surrounding area approximately three miles east of Machias and five miles north of Monroe. Water is purchased directly from the City of Everett's No. 5 pipeline and pumped to the distribution system and a concrete reservoir.

			EPA Regulations		Your Water Testing Results		
Substance	Major Source	Units	Maximum Goal (MCLG)	Maximum Allowable (MCL)	Min./Max. Range	Average Value	Comply?
Total Coliform Bacteria	Naturally present in the environment	Samples positive	0	1 positive per month	0%	0%	YES

Total coliform bacteria testing is used to monitor microbial quality in the water distribution system. The PUD collects one coliform sample per month. No unsatisfactory results were detected in 2016.

Haloacetic Acids[1]	By-product of drinking water chlorination	ppb	N/A	60	41.3	41.3	YES
Total Trihalomethanes[1]	By-product of drinking water chlorination	ppb	N/A	80	33.2	33.2	YES
Free Chlorine Residual	Measure of disinfectant added to water	ppm	4 (MRDLG)	4 (MRDL)	0.4 – 1.4	0.7	YES

[1]*Haloacetic acids and Trihalomethanes form as by-products of the chlorination process that is used to kill or inactivate disease-causing microbes. Although goals have not been set for these compounds as a group, MCLGs for related individual compounds can be seen in the Unregulated Substances table below.*

			EPA Regulations		Your Water Testing Results		
Substance	Major Source	Units	Maximum Goal (MCLG)	Action Level (AL)	90th % Level	Homes Exceeding the AL	Comply?
Copper	Plumbing, erosion of natural deposits	ppm	1.3	1.3	0.149	None*	YES
Lead	Plumbing, erosion of natural deposits	ppb	0	15	3	1	YES

US Environmental Protection Agency (USEPA) regulations require monitoring for the presence of lead and copper at household taps in their service area every three years. These results are from 2015. The next round of required sampling will be conducted in 2018.

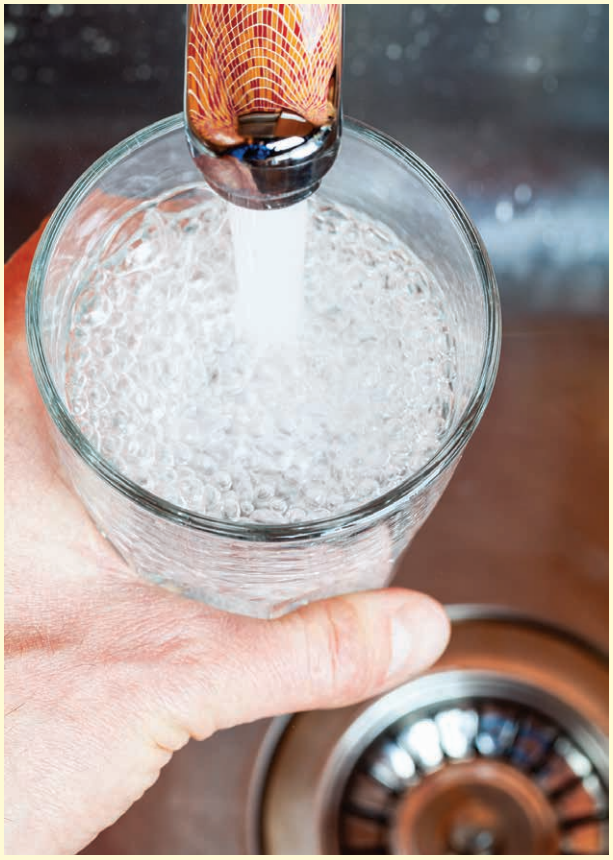
**The 90th percentile level is the highest result obtained in 90% of the samples collected when the results are ranked in order from lowest to highest.*

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Snohomish County PUD is responsible for providing high-quality drinking water but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to two minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods and steps you can take to minimize exposure is available from the Safe Drinking Water hotline or at the USEPA's website at www.epa.gov/safewater/lead.

UNREGULATED SUBSTANCES

		Your Water Testing Results	
Substance	Maximum Goal (MCLG)	Min./Max. Range	Average Value
Bromodichloromethane[2] (ppb)	0	1.6	1.6
Chloroform (trichloromethane)[2] (ppb)	70	31.6	31.6
Dichloroacetic Acid[2] (ppb)	0	18.5	18.5
Trichloroacetic Acid[2] (ppb)	20	22.8	22.8

[2]*Although these substances are not regulated individually, their results are added together to obtain the Total Trihalomethane and Haloacetic Acid results in the above table.*



SNOHOMISH COUNTY PUD
PUBLIC UTILITY DISTRICT NO. 1

Water Utility
PO Box 1107
Everett, WA 98206-1107

Customer Views Welcome

There are several ways you can get involved in water quality issues. You can communicate with elected officials, participate in public hearings and attend Snohomish County PUD Commission meetings. Check the local newspaper for information on public meetings regarding water quality, water policies and other issues, or call us at 425-397-3000.

The Snohomish County PUD Board of Commissioners meets at 1:30 PM on the first and third Tuesday of each month at Snohomish County PUD, 2320 California Street in Everett. Board sessions are open to the public. Please call 425-783-8611 in advance to confirm meeting dates and times, or check the meeting agenda on our website.

You can also find information for water customers at our website: **snopud.com** (click on *Water*).

Safe Drinking Water & Water System Security

The PUD is committed to a strong security program to protect water quality. The PUD's facilities are secured; however, we could use your assistance. If you see suspicious activity in or around PUD pump stations, reservoirs or hydrants, please contact us at 425-397-3000 (after regular working hours, holidays or on weekends, please contact us at 425-783-8000).

For More Information

- PUD website: **snopud.com** (click on *Water*)
- Safe Drinking Water Act (SDWA) hotline: **1-800-426-4791**
  E-mail: **hotline-sdwa@epamail.epa.gov**
- Washington State Department of Health Division of Drinking Water: **253-395-6750**
  Website: **www.doh.wa.gov/ehp/dw**

Este informe contiene información muy importante sobre su agua potable. Tradúzcalo o hable con alguien que lo entienda bien.

Snohomish PUD participates in the AT&T language line service. If you need help with the English language or need an interpreter, please contact a PUD customer service representative at 425-783-1000 (Monday through Friday, 8 AM to 5:30 PM) and an interpreter will be called (*Se llamará a un intérprete*).

Contact Us

Water Utility: 425-397-3000

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Toll-free in Western Washington and outside the Everett local calling area at 1-877-783-1000, extension 3000

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HWA GEOSCIENCES PRELIMINARY GEOTECHNICAL REPORT – 24TH STREET SE

PRELIMINARY GEOTECHNICAL REPORT
24th Street SE Extension
Lake Stevens, Washington

HWA Project No. 2015-098-21

Prepared for
City of Lake Stevens

January 15, 2016

HWA GEOSCIENCES INC.

- Geotechnical Engineering
- Hydrogeology
- Geoenvironmental Services
- Inspection & Testing

HWA GEOSCIENCES INC.
Geotechnical & Pavement Engineering • Hydrogeology • Geoenvironmental • Inspection & Testing

January 15, 2016
HWA Project No. 2015-098-21

City of Lake Stevens
1820 Main Street
Lake Stevens, Washington 98258

Attention: Adam Emerson

Subject: **PRELIMINARY GEOTECHNICAL INVESTIGATION**
24th Street SE Extension
Lake Stevens, Washington

Dear Adam:

We are pleased to submit this geotechnical engineering report for the proposed improvements along the 24th Street SE right-of-way in Lake Stevens, Washington. The project alignment is shown on the Vicinity Map, Figure 1. This draft report includes the results of our field explorations and our engineering analyses for design and construction of the proposed roadway features.

INTRODUCTION

This report presents the results of our subsurface explorations and preliminary geotechnical studies for the proposed 24th Street SE feasibility study in Lake Stevens, Washington. The location of the project site is shown on the Vicinity Map, Figure 1, and on the Site and Exploration Plans, Figure 2. Our work included excavating 15 test pits and conducting 15 dynamic cone penetrometer (DCP) tests at the test pit locations. Appropriate laboratory tests were conducted on selected soil samples to determine relevant engineering properties of the subsurface soils. Geotechnical engineering analyses were conducted to provide recommendations for proposed roadways, retaining structures, roadway embankments, signal pole foundations, luminaires, and seismic considerations. Constructability issues are also discussed herein as related to various aspects of the project.

PROJECT UNDERSTANDING

It is our understanding that the City of Lake Stevens is considering establishing a roadway along the unimproved east-west alignment of 24th Street SE. The proposed alignment is to extend from SR-9 to the crossing of the alignment of 91st Avenue SE. The total distance is approximately 1,400 feet. The alignment is currently wooded and crosses several documented wetlands. The purpose of our work is to assess the soil conditions along the

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alignment and develop the geotechnical considerations required for design of the roadway. It is also our understanding that the City prefers construction solutions that limit impacts to wetland.

FIELD INVESTIGATION

The field exploration program to date has included a review of available geologic and geotechnical data for the project vicinity, surface reconnaissance of the alignment, the excavation of fifteen test pits with Dynamic Cone Penetrometer (DCP) tests, and probing of soils across the wetland portions. The locations of these explorations were selected in the field based on geomorphic variations and are indicated on the site and exploration plans, Figure 2. The test pits, designated TP-1 through TP-15 were excavated with a small rubber-tracked backhoe by the City of Lake Stevens. These test pits were dug to depths ranging from 7 to 9 feet below ground surface. Each exploration was monitored and logged by an engineering geologist from HWA. In addition to excavating test pits along the alignment, HWA probed the subgrade soils along the alignment with a ½ inch diameter T handled probe (T-probe) to determine the depth of soft and loose soils. The results of T-probe penetrations between TP-7 and TP-13 are presented in Figure 3.

Representative soil samples were obtained from the explorations at selected intervals and taken to our laboratory for further examination and testing. Our geologist recorded pertinent information including soil sample depths, stratigraphy, soil engineering characteristics, and ground water occurrence as the explorations were excavated. Soils were classified in general accordance with the classification system described in Figure A-1, which also provides a key to the exploration log symbols. The summary logs are presented on Figures A-2 through A-16. The stratigraphic contacts shown on the individual logs represent the approximate boundaries between soil types. The actual transitions between soil units depicted in the logs may be more gradual.

LABORATORY TESTING

Laboratory tests were conducted at HWA's laboratory in Bothell, Washington, on selected samples to determine relevant index and engineering properties of the soils encountered at the site. The tests included visual classifications, natural moisture content determinations and grain size distribution analyses. The tests were conducted in general accordance with appropriate American Society of Testing and Materials (ASTM) standards. Laboratory test results are presented in Appendix B of this report.

SITE CONDITIONS

GENERAL GEOLOGIC CONDITIONS

General geologic information for the site was obtained from the Geologic Map of the Snohomish Quadrangle, Snohomish County, Washington (Minard, 1985). The map indicates that the geology along the project corridor includes glacial till near the ground surface from the most recent continental glaciation, the Fraser Glaciation. Minard indicates patches of recessional outwash, consisting of predominantly sands and gravels, were observed near the ground surface to the east of 83rd Ave SE. Advance outwash, consisting of mostly clean pebbly sands and gravels, has also been observed at the ground surface between 79th Ave SE and 83rd Ave SE.

SOIL CONDITIONS

Our interpretations of subsurface conditions are based on our exploration data, published geologic information, and our experience in the project vicinity. The exploration data indicate that the soils in the upland areas along western end of the alignment consist of loose to medium dense gravelly, sandy silt (Weathered Drift) over dense to very dense Glacial Till. Low lying wetland areas contain soft peat and/or clay to depths of 2 to 6 feet over water-bearing gravelly sand (Recessional Outwash). Upland areas at the center to east end of the alignment are underlain with silty sand (Weathered Drift) over gravelly sand and sandy gravel (Recessional Outwash). Each of these soil units is described below with the youngest in origin described first.

- **Fill:** Loose fill soils were encountered over buried native organic materials (charcoal or peat) in test pits TP-10 and TP-12. These soils extended from the ground surface to depths ranging from 1.25 to 4.5 feet below ground surface, and consisted of loose, slightly gravelly to gravelly, silty sand with scattered rootlets. Refuse was present in test pit TP-12 located on the western edge of the upland area, at a depth of 3 to 4.5 feet. The fill materials were likely placed during activities associated with the adjacent residence.
- **Duff and Topsoil:** Loose forest litter (duff) and dark brown, sandy silt or silty sand with fine organics and abundant rootlets were encountered in the upper approximately 1 foot in each of the test pits in upland areas.
- **Peat:** Very soft to soft peat was encountered at the ground surface (or below fill) in test pits within low-lying areas. This material consists of partly decomposed organics deposited since glacial retreat in anaerobic wetland environments. It has a very high moisture content and is highly compressible.
- **Clay:** Clay was encountered in TP-13 and TP-14. The clay layer in TP-13 was medium stiff to stiff and extended from a depth of 4 feet below ground surface to 6 feet below ground surface. The material was gray and contained partly decomposed straw. The clay layer in TP-14 was stiff to very stiff and extended from a depth of 1 feet below ground surface to 3.5 feet below ground surface. Scattered gravel was encountered in this layer.

- **Weathered Drift:** Loose to medium dense, silty sand to sandy silt with variable gravel content was encountered below the topsoil in upland areas. This material consists of soils mechanically, chemically, and biologically weathered from the underlying glacial materials.
- **Recessional Outwash:** Medium dense to dense, gravelly sand and sandy gravel were encountered below the fill, peat, or weathered drift along the project alignment. These soils were interpreted as recessional outwash sands that was deposited by glacial meltwater streams as the ice sheet retreated during the last glaciation. The Recessional Outwash extended past the termination depth of most of the test pits in which it was encountered.
- **Glacial Till:** Very dense, silty, gravelly sand was encountered in the western seven test pits (TP-1 through TP-7). This material was deposited as a deforming bed of material along the sole of the glacial ice as lodgment till. It consists of an unsorted mixture of clay, silt, sand and gravel, and is very dense, having been consolidated by the weight of about 4,000 feet of ice. It is also known to contain scattered cobbles and boulders. This unit is locally referred to as "hardpan", because of its induration and an appearance similar to concrete. The Glacial Till extended past the termination depth of the test pits in which it was encountered.

GROUND WATER CONDITIONS

The explorations along the project alignment ranged in depth from 7 to 9 feet. Ground water was not encountered in the western upland test pits that extended into Glacial Till soils (TP-1 through TP-7) at the time that they were conducted. The remainder of the test pits encountered ground water seepage at depths ranging from 4.5 to 8.3 feet, within Recessional Outwash. Based on the soil conditions observed in the test pits, the observed water is believed to represent perched water that collects over the very dense and relatively impermeable glacial till soils. We expect that the level of the perched water will vary seasonally with rainfall. Our explorations were conducted near the end of a relatively dry summer. Therefore, we expect that the groundwater conditions observed at the time of our field explorations are lower than they would be during other times of the year.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

In general, the soils along the project alignment are adequate to support the proposed improvements with some mitigation in wetland areas. Along the alignment the recessional outwash and glacial till soils should be considered the bearing layer for roadway construction. The loose overlying soils in the upland areas should be removed and replaced with structural fill to provide a good base for the proposed roadway. The soft peat and clay in wetland areas will need to be over-excavated and replaced with structural fill to construct the roadway. While the

wetland soils are shallow enough to feasibly over-excavate, ground water conditions may necessitate dewatering to facilitate construction of the roadway within or near existing wetlands.

The soils along the project alignment are highly moisture sensitive, and would best be worked in the dry season. Re-use of the recessional outwash soils as structural fill may be appropriate if construction is to take place during the dry summer months. However, if roadway construction is to extend into the wet weather months, we would recommend that the native soils not be reused as structural fill.

Roadway construction will require over-excavation and replacement of the soft soils within the delineated wetlands. Structural roadway fill placed within the wetlands will act as a dam and limit the ability of water to flow from one side of the proposed roadway to the other. This damming affect can be mitigated by incorporating culverts within the structural roadway fill to promote hydraulic conductivity across the wetlands being bisected by the roadway.

Stormwater infiltration does not appear feasible for the project alignment. Dense, relatively impermeable Glacial Till along the western portion and high ground water in the central to eastern sections make infiltration infeasible.

SEISMIC CONSIDERATIONS

Earthquake loading for the proposed 24th Street SE improvements was developed in accordance with Section 3.4 of the *AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition, 2011* (AASHTO, 2011). For seismic analysis, the Site Class is required to be established and is determined based on the average soil properties in the upper 100 feet below the ground surface. Based on available geotechnical information for the project corridor, the underlying soils represent AASHTO Site Class D. Table 1 presents the seismic coefficients, associated with AASHTO Site Class D that were used for the geotechnical evaluations discussed in this report. These parameters are based upon a design event with a 7 percent probability of exceedance in 75 years (equal to a return period of 1,033 years). Ground motions for the site are based on probabilistic earthquake hazard mapping efforts including those conducted by the United States Geological Survey (Frankel, et al., 2002) and (Leyendecker, et al., 2007). Accordingly, a Seismic Design Category D, as given by AASHTO (AASHTO, 2011), should be used.

Table 1.

Seismic Coefficients for Geotechnical Evaluations Using AASHTO

Site Class	Peak Horizontal Bedrock Acceleration PBA, (g)	Spectral Bedrock Acceleration at 0.2 sec S_s, (g)	Spectral Bedrock Acceleration at 1.0 sec S_1, (g)	Site Coefficients			Peak Horizontal Acceleration PGA, (g)
				F_{pga}	F_a	F_v	
D	0.356	0.803	0.272	1.144	1.179	1.856	0.408

Soil Liquefaction

The potential for soil liquefaction must be considered during the design of any soil-supported structure. Soil liquefaction is a phenomenon where loose, saturated, granular deposits temporarily lose strength and behave as a liquid in response to moderate to strong earthquake shaking. Primary factors controlling the development of liquefaction include the intensity and duration of strong ground motions, the characteristics of subsurface soils, in-situ stress conditions and the depth to ground water. Test-pit data shows the granular layers encountered below the water table are of a dense nature, indicating that liquefaction will likely not be a design consideration for this project.

ROADWAY CONSTRUCTION

In general, the soils along the project alignment are conducive to construction of the proposed roadway. We expect that roadway construction will require over excavation of the soft wetland soils observed within the limits of the delineated wetlands. We also expect that the loose near surface soils encountered in the upland areas will need to be over-excavated and replaced with structural fill to facilitate construction of the roadway and associated improvements. Roadway construction considerations are provided in the following sections.

Over Excavation and Replacement

Based on test-pit explorations, we anticipate the upland areas will generally require 2 to 3 feet of over-excavation to reach suitable subgrade material. We anticipate the low wetland areas will generally require 2 to 5 feet of over-excavation to completely remove the peat and reach suitable subgrade material. All over excavated areas should be replaced to grade with compacted structural fill. All over excavated limits should extend a distance laterally from the edge of the proposed embankment or structures equal to the depth of over excavation to ensure that proposed loads are distributed into competent material.

Dewatering

Groundwater was encountered near the ground surface within the wetland areas and at a depth of approximately 5 feet in the central and eastern upland areas. During the wet seasons, we expect that groundwater raises above the ground surface in the wetland areas. Excavations and roadway construction in these areas will likely require dewatering. We expect that dewatering for the proposed roadway improvements can be accomplished with a series of sumps and pumps. As the observed groundwater is perched on top of the relatively impermeable glacial till soils at depth, dewatering wells will not be an appropriate means of dewatering for this project.

In the wetland areas, we expect that the contractor will likely be required to construct water tight barriers on either side of the roadway during construction to ensure that the dewatering effort does not drain the adjacent wetlands.

Retaining Walls

Construction of the proposed roadway may require construction of retaining walls on one or both sides of the alignment. The location and geometry of these walls is currently not known and will depend on the final grade of the road. We anticipate that both cut and fill walls, with heights ranging from 2 to 8 feet will be required. Cut walls will likely be required in upland areas; while fill walls and/or embankments will likely be constructed in the low areas. Based on the soil conditions we expect that cut walls will likely consist of rockery or gravity block walls. Whereas, fill walls will likely consist of mechanically stabilized earth walls or gravity block walls. Additional retaining wall recommendations can be provided once the location and geometry of the walls are determined.

Embankments side slopes may be constructed in low areas in lieu of retaining walls. Construction of sloped embankments in low lying wetland areas, however, will require more over-excavation and greater wetland impacts. Figure 4 shows the conceptual wetland-area retaining wall and embankment construction process. Retaining wall construction in wetland areas is discussed in the following section.

Wetland Area Retaining Walls

Utilizing retaining walls for wetland-area roadway construction will likely limit wetland impacts in comparison to constructing embankment side slopes. We expect that mechanically stabilized earth walls or gravity block walls will be used in wetland areas. We anticipate these walls may be 6 to 8 feet high.

Construction of wetland-area retaining walls will require over-excavation of the native peat and replacement with structural fill. Dewatering will be required prior to placing structural fill and constructing the retaining wall. We expect that the contractor will likely be required to construct water tight barriers on either side of the roadway during construction to ensure that the dewatering effort does not drain the adjacent wetlands; and that localized sumps and pumps will be used to facilitate the dewatering process.

The retaining wall elements and structural fill will be founded in the recessional outwash layer after the peat is excavated. Water conveyance systems, such as culverts, can be incorporated into the retaining wall and structural fill system to facilitate water flow between the bisected portions of wetland areas.

Subgrade Preparation

Subgrade preparation is important to limit differential settlement and increase stability of the proposed walls and embankments. All organic material should be removed from beneath the entire footprint of proposed walls and embankments. Loose or soft soil, defined as being penetrable more than 1 foot with a 1/2 inch diameter rod pushed in under a 150 lb load (T-probe pushed in by hand), should be removed and replaced with “Structural Backfill” or be suitably compacted.

Post Construction Wetland Water Conveyance

As previously noted, the proposed alignment will bisect multiple delineated wetlands. It is our understanding that the City of Lake Stevens desires to maintain hydraulic conductivity within the wetland areas to the maximum extent possible in order to limit wetland impacts. It is our understanding that surface runoff within the wetlands generally flows from north to south; flowing perpendicular to the proposed roadway.

There are several options to allow water to flow under the proposed roadway and maintain hydraulic conductivity to some extent. These options include installing a series of small diameter culvers in the structural roadway fill, installing larger box culverts or constructing a bridge. Further details associated with each of these options are provided below.

Small Diameter Culverts

A series of small diameter culverts could be installed within the structural roadway fill to allow water to flow from north to south. These culverts would be orientated north-south on relatively tight spacing. Culvert openings would be integrated into the block facing if retaining walls are utilized. Installation of small diameter culverts would allow the most flexibility with respect to the final road grade. Installation of these culverts would be fairly cost effective and would allow some hydraulic conductivity across the roadway.

Box Culverts

Larger box culverts could be installed within the wetland areas to allow water to flow from one side of the roadway to the other. Installation of the box culverts would channelize the flow of water to the locations of the structures. The box culverts would likely be founded on spread footings bearing on the very dense glacial till soils. Installation of box culverts would provide greater hydraulic conductivity and conductivity for wildlife than the use of small diameter culverts.

Bridge the Wetlands

Bridge structures could be used to carry the proposed roadway over the wetlands with very limited impact to the flow of water. The bridge structures would likely be constructed on relatively shallow driven piles or spread footing bearing on the very dense glacial till soils. Although construction of bridge structures over the wetlands would be the least impactful to the wetland flow characteristics, this option would be significantly more costly that the other two options.

LUMINAIRE AND SIGNAL POLE FOUNDATIONS

It is our understanding that the proposed roadway will require lighting and possibly signalization improvements along the corridor. We expect that the foundations associated with these improvements will likely consist of WSDOT standard plan foundations. Based on the soils

encountered in our test pits, we expect that standard plan foundations for luminaries and signal poles will be appropriate for this project. Allowable arterial bearing pressures for design of these foundations are expected to be 1500 psf but should be evaluated on a case by case basis once actual locations are determined.

Several of the test pits exhibited sidewall caving starting at 2 feet below the existing ground surface. It is likely caving will occur when excavating the luminaire foundations. Prospective contractors should be prepared to case or shore the luminaire and signal pole foundation excavations to prevent caving of the native soils.

GENERAL EARTHWORK

Structural Fill

The existing site fill and native soils are highly variable in consistency and are moisture sensitive. If construction is completed during the dry summer months, some of the excavated native material may be suitable for re-use as structural fill. If roadway construction is expected to extend into the wet weather months of October through June, we recommend that imported structural fill be used. Imported structural fill should consist of clean, free-draining, granular soils free from organic matter or other deleterious materials. Such materials should meet the gradation and quality requirements as specified for "Gravel Borrow" in Section 9-03.14(1) of the WSDOT *Standard Specifications* (WSDOT, 2016).

Compaction

Structural fill and CSBC should be moisture conditioned and compacted to the requirements specified in Section 2-03.3(14)C, Method C, of the WSDOT *Standard Specifications* (WSDOT, 2016); except the standard of compaction achieved shall not be less than 95% of the maximum dry density (MDD) determined for the fill material by test method ASTM D1557 (Modified Proctor). Subgrade compaction should conform to the requirements of Section 2-06.3(1) of the WSDOT *Standard Specifications*.

Achievement of proper density of a compacted fill depends on the size and type of compaction equipment, the number of passes, thickness of the layer being compacted, and soil moisture-density properties. In areas where limited space restricts the use of heavy equipment, smaller equipment can be used, but the soil must be placed in thin enough layers to achieve the required relative compaction. Generally, loosely compacted soils result from poor construction technique and/or improper moisture content. Soils with high fines contents are particularly susceptible to becoming too wet, and coarse-grained materials easily become too dry, for proper compaction.

Temporary Excavations

Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. In accordance with Part N of Washington Administrative Code (WAC) 296-155, latest revisions, all temporary cuts in excess of 4 feet in height must be either

sloped or shored prior to entry by personnel. The existing fill, wetland and recessional outwash soils are generally classified as Type C soils, per WAC 296-155. Where shoring is not used, temporary cuts in Type C soils should be sloped no steeper than 1½H:1V (horizontal:vertical). The existing glacial till soils are generally classified as Type A soils, per WAC 296-155. Where shoring is not used, temporary cuts in Type A soils should be sloped no steeper than 3/4H:1V (horizontal:vertical).

Wet Weather Earthwork

General recommendations relative to earthwork performed in wet weather or in wet conditions are presented below. These recommendations should be incorporated into the contract specifications.

- Earthwork should be performed in small areas to minimize exposure to wet weather. Excavation of unsuitable and/or softened soil should be followed promptly by placement and compaction of clean structural fill. The size and type of construction equipment used may need to be limited to prevent soil disturbance.
- For wet weather conditions, the allowable fines content of the structural fill should be reduced to no more than 5 percent by weight of the portion of the fill material passing the ¾-inch sieve. The fines should be non-plastic.
- The ground surface within the construction area should be graded to promote surface water run-off and to prevent ponding.
- Within the construction area, the ground surface should be sealed on completion of each shift by a smooth drum vibratory roller, or equivalent, and under no circumstances should soil be left uncompacted and exposed to moisture infiltration.
- Bales of straw and/or geotextile silt fences should be strategically located to control erosion and the movement of soil

FUTURE PRIVATE DEVELOPMENT

HWA is unaware of the specific future development plans along the proposed alignment. However, we anticipate the upland areas surrounding the proposed alignment are generally suitable for residential and commercial development. We do not anticipate any development within wetland areas will be completed as part of future private development. The following sections discuss conceptual development considerations for the western, central and eastern upland areas. However, these considerations should be considered preliminary and additional geotechnical evaluation of proposed private development should be completed as part of design and construction.

Future Development in Western Upland Areas

We expect that all near surface loose to medium dense material be over-excavated and replaced with suitable structural fill in preparation for development. In the western uplands (located in region spanning TP-1 to TP-7), we expect soils 2 to 4 feet below current grade will provide adequate bearing capacity to support shallow foundations.

Groundwater was not encountered in any western upland test pits, but the water level is expected to fluctuate seasonally. We recommend installation of monitoring wells to measure groundwater level fluctuation in order to determine possible construction impacts. High groundwater is not expected to prevent development of the area, but mitigation techniques may be required to combat a high groundwater level. These mitigations may include dewatering the site prior to development and/or limiting construction to the dry season to the extent possible.

We expect that the soils in these areas are adequate to support utility installation. Dewatering may be required depending on groundwater levels and utility depths.

Future Development in Central and Eastern Upland Areas

We recommend all loose to medium dense material be over-excavated and replaced with suitable structural fill in preparation for development. In the central and eastern uplands, dense material was generally encountered 4 to 5 feet below ground surface. HWA expects that the glacially consolidated soils below this layer will provide adequate bearing capacity to support shallow foundations.

Groundwater was encountered 5 feet below the ground surface in TP-9. This indicates dewatering may be required to support development of these areas depending on the time of year that construction is completed.

CONDITIONS AND LIMITATIONS

We have prepared this report for the City of Lake Stevens for use in planning and pre-design of this project. Additional explorations and analyses may be required for final design and construction. The conclusions and interpretations presented in this report should not be construed as our warranty of the subsurface conditions. Experience has shown that soil and ground water conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations and may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, HWA should be notified for review of the recommendations of this report, and revision of such if necessary.

Within the limitations of scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology in the area at the time the report was prepared. No warranty, express 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 substances in the soil, surface water, or ground water at this site.

We appreciate the opportunity to be of service. If you have any questions regarding this report, please do not hesitate to contact either of the undersigned at (425) 774-0106.

Sincerely,

HWA GEOSCIENCES INC.

CJ Jackson, P.E
Geotechnical Engineer

Donald J. Huling, P.E.
Geotechnical Engineer, Principal

Attachments:

Figure 1	Vicinity Map
Figure 2	Site and Exploration Plans
Figure 3	Probing Depths of Wetland Soils
Figure 4	Conceptual Roadway Prisms in Wetland Areas

Appendices:

Appendix A	Test Pit Logs
Appendix B	Laboratory Data
Appendix C	Cost Estimating Tool for Conceptual Roadway Prism

REFERENCES

AASHTO, 2011, *Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition*, Washington D.C.

Frankel, et al., 2002, *Documentation for the 2002 Update of the National Seismic Hazard Maps*, USGS Open File Report, 02-420.

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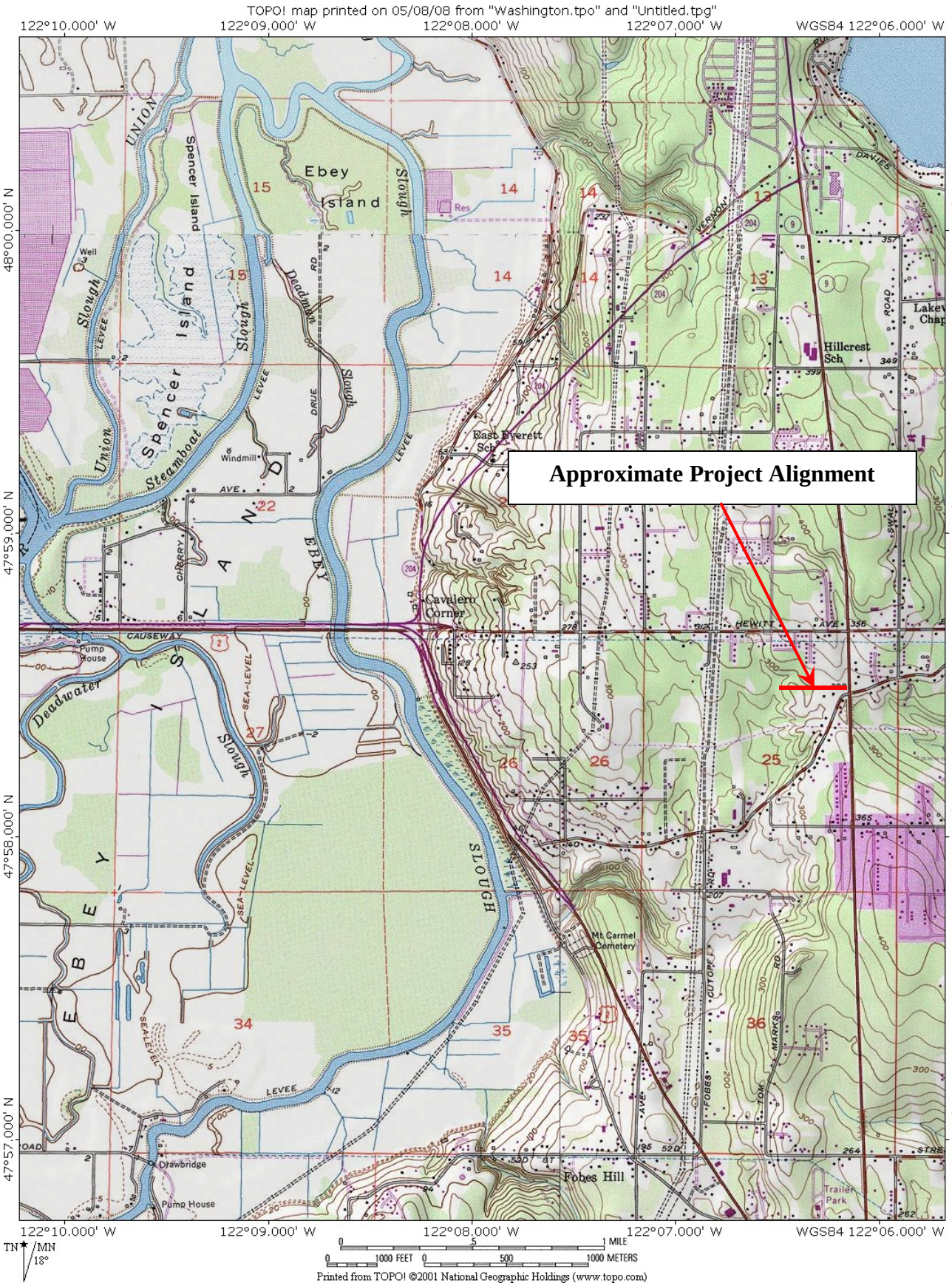


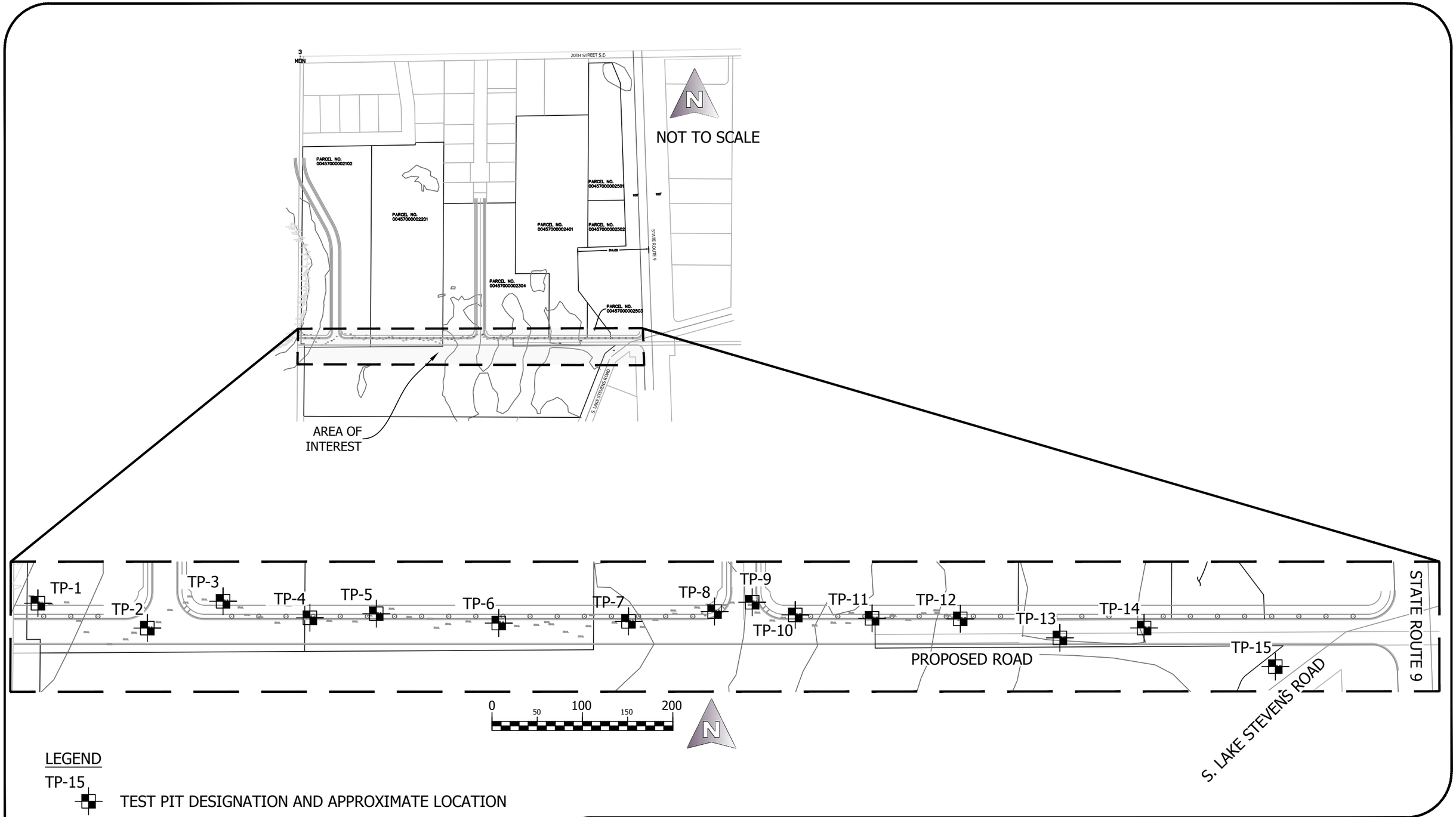
VICINITY MAP

24TH STREET SE EXTENSION
STATE ROAD 9 TO 91ST AVENUE SE
CITY OF LAKE STEVENS, WASHINGTON

FIGURE NO.
1

PROJECT NO.
2015-098

HWA GEOSCIENCES INC.



LEGEND

TP-15 TEST PIT DESIGNATION AND APPROXIMATE LOCATION

BASE MAP PROVIDED BY:

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

SITE AND EXPLORATION PLAN

DRAWN BY	FIGURE #
EFK	2
CHECK BY	PROJECT #
CJ	2015-098-21
DATE: 11.03.15	

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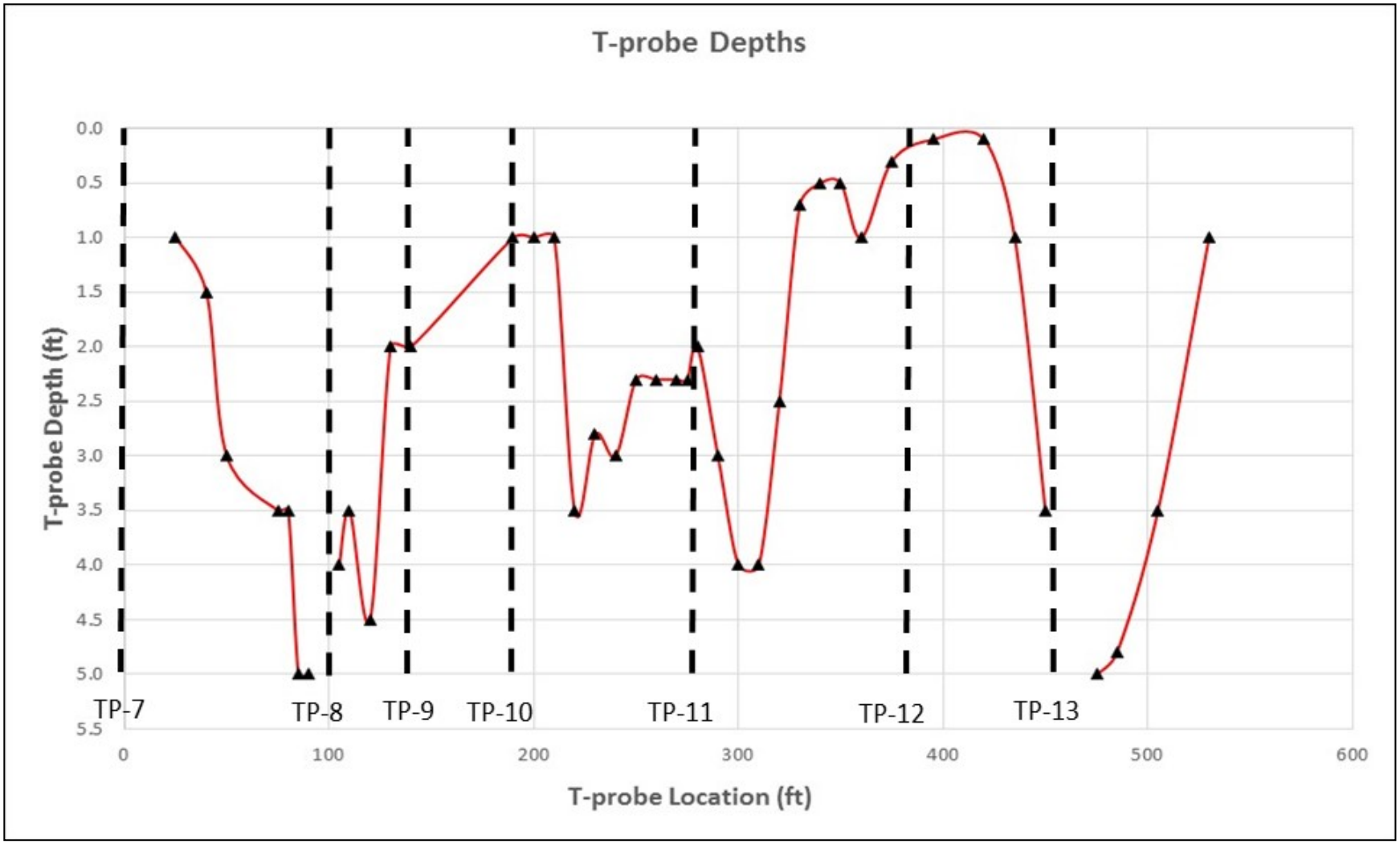


HWA GEOSCIENCES INC.

T-PROBE DEPTHS

24TH STREET SE EXTENSION
STATE ROAD 9 TO 91ST AVENUE SE
LAKE STEVENS, WASHINGTON

FIGURE NO. 3

PROJECT NO. 2015-098

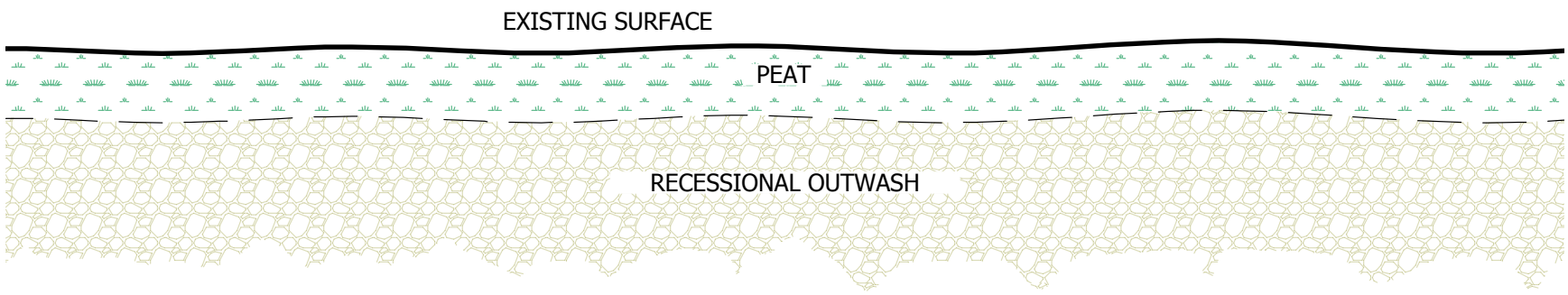
TYPICAL SOIL CROSS-SECTION DETAIL NOTES:

- PEAT = A soft, highly organic soil, consisting of partly decomposed vegetable matter.
- RECESSIONAL OUTWASH = A clean to slightly silty, fine to medium sand with varying amounts of gravel.
- Provided soil profile is general. Actual soil depths may vary significantly over relatively short distances.

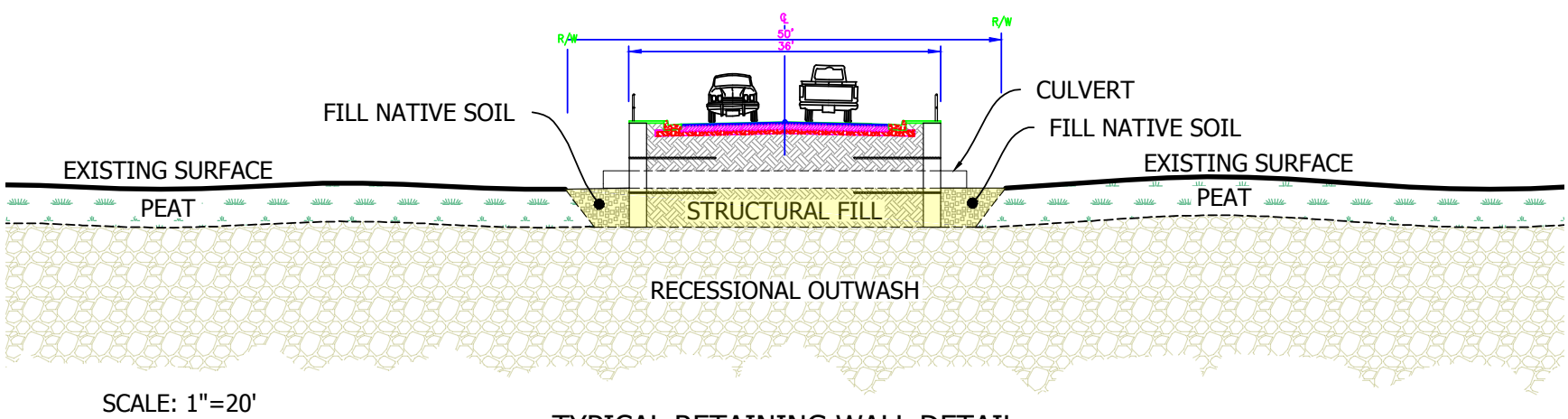
GENERAL CONSTRUCTION STEPS FOR RETAINING WALL AND EMBANKMENT:

- Excavate peat in the wet
- Seal and dewater excavation footprint.
- Construct retaining wall (or embankment) and structural fill section. Install water conveyance systems and utilities during this stage.
- Construct roadway surface and pedestrain features.
- Discontinue dewatering and remove watertight shoring to facilitate water flow through roadway prism.

APPROXIMATE AREA OF SOIL REMOVAL

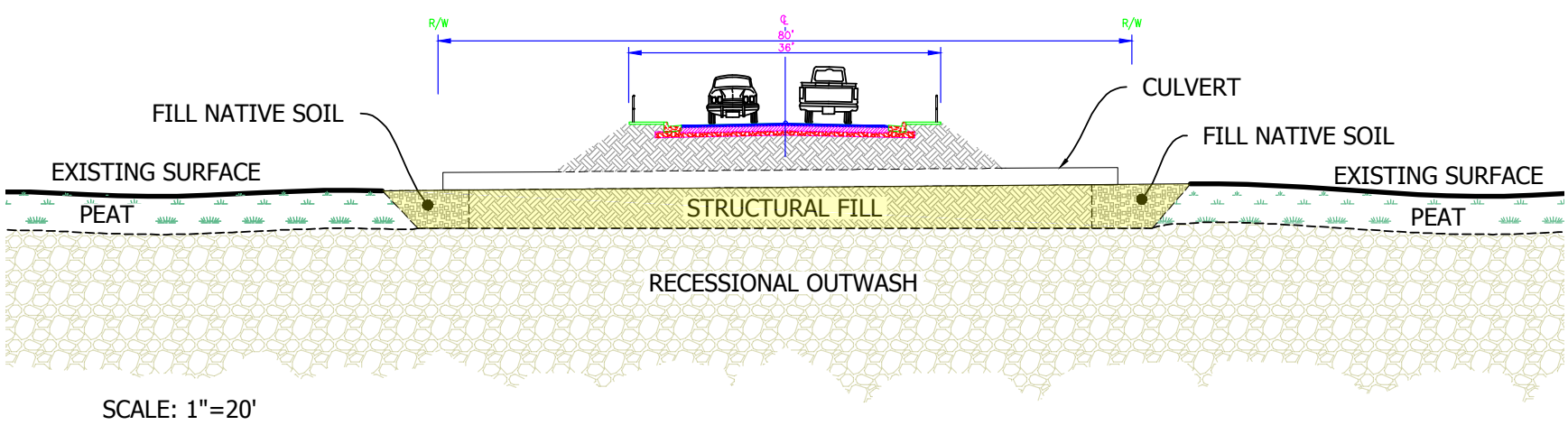


TYPICAL SOIL DETAIL



SCALE: 1"=20'

TYPICAL RETAINING WALL DETAIL



SCALE: 1"=20'

TYPICAL EMBANKMENT DETAIL

BASE MAP PROVIDED BY:

HWA GEOSCIENCES INC.	PRELIMINARY GEOTECHNICAL INVESTIGATION 24th STREET SE - EXTENSION LAKE STEVENS, WASHINGTON	TYPICAL ROAD DETAIL	DRAWN BY EFK CHECK BY CJ DATE: 01.13.15	FIGURE # 4 PROJECT # 2015-098

S:\2015 PROJECTS\2015-098-21-24TH STREET SE LAKE STEVENS\CAD 2015-098\HWA 2015-098 RM.DWG, <Layout2> Plotted: 1/13/2016 6:04 PM

Appendix A:
Test Pit Logs

The test pits were excavated on October 12 through 14, 2015, by City of Lake Stevens public works personnel and HWA personnel. Test pits were excavated using a Yanmar ViC55 trackhoe. Test pits were advanced along the proposed road alignment in wetland and upland areas to depths ranging from 7 to 9 feet below ground surface. Samples were taken based on soil conditions observed in the excavation. The test pit locations are plotted on the site and exploration plans, Figures 2. Logs of these test pits can be found in Figures A-2 through A-16, of Appendix A.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
Density	N (blows/ft)	Approximate Relative Density(%)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

USCS SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP DESCRIPTIONS	
Coarse Grained Soils	Gravel and Gravelly Soils	Clean Gravel (little or no fines)	GW	Well-graded GRAVEL
			GP	Poorly-graded GRAVEL
	More than 50% of Coarse Fraction Retained on No. 4 Sieve	Gravel with Fines (appreciable amount of fines)	GM	Silty GRAVEL
			GC	Clayey GRAVEL
	Sand and Sandy Soils	Clean Sand (little or no fines)	SW	Well-graded SAND
More than 50% Retained on No. 200 Sieve Size			SP	Poorly-graded SAND
	50% or More of Coarse Fraction Passing No. 4 Sieve	Sand with Fines (appreciable amount of fines)	SM	Silty SAND
			SC	Clayey SAND
Fine Grained Soils	Silt and Clay	Liquid Limit Less than 50%	ML	SILT
			CL	Lean CLAY
			OL	Organic SILT/Organic CLAY
50% or More Passing No. 200 Sieve Size	Silt and Clay	Liquid Limit 50% or More	MH	Elastic SILT
			CH	Fat CLAY
			OH	Organic SILT/Organic CLAY
Highly Organic Soils			PT	PEAT

TEST SYMBOLS

%F	Percent Fines
AL	Atterberg Limits: PL = Plastic Limit, LL = Liquid Limit
CBR	California Bearing Ratio
CN	Consolidation
DD	Dry Density (pcf)
DS	Direct Shear
GS	Grain Size Distribution
K	Permeability
MD	Moisture/Density Relationship (Proctor)
MR	Resilient Modulus
PID	Photoionization Device Reading
PP	Pocket Penetrometer Approx. Compressive Strength (tsf)
SG	Specific Gravity
TC	Triaxial Compression
TV	Torvane Approx. Shear Strength (tsf)
UC	Unconfined Compression

SAMPLE TYPE SYMBOLS

- 2.0" OD Split Spoon (SPT) (140 lb. hammer with 30 in. drop)
- Shelby Tube
- 3-1/4" OD Split Spoon with Brass Rings
- Small Bag Sample
- Large Bag (Bulk) Sample
- Core Run
- Non-standard Penetration Test (3.0" OD split spoon)

GROUNDWATER SYMBOLS

- Groundwater Level (measured at time of drilling)
- Groundwater Level (measured in well or open hole after water level stabilized)

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074mm)

COMPONENT PROPORTIONS

PROPORTION RANGE	DESCRIPTIVE TERMS
< 5%	Clean
5 - 12%	Slightly (Clayey, Silty, Sandy)
12 - 30%	Clayey, Silty, Sandy, Gravelly
30 - 50%	Very (Clayey, Silty, Sandy, Gravelly)
Components are arranged in order of increasing quantities.	

NOTES: Soil classifications presented on exploration logs are based on visual and laboratory observation.
Soil descriptions are presented in the following general order:

Density/consistency, color, modifier (if any) GROUP NAME, additions to group name (if any), moisture content. Proportion, gradation, and angularity of constituents, additional comments. (GEOLOGIC INTERPRETATION)

Please refer to the discussion in the report text as well as the exploration logs for a more complete description of subsurface conditions.

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
MOIST	Damp but no visible water.
WET	Visible free water, usually soil is below water table.

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LEGEND OF TERMS AND SYMBOLS USED ON EXPLORATION LOGS

PROJECT NO.: 2015-098-21 FIGURE: A-1

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: W end of alignment
DATE COMPLETED: 10/12/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE / SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0			Loose Duff & Topsoil.			
		SM	Loose, light yellow brown, gravelly, silty, SAND, dry. Abundant roots to 1.5 feet. **(WEATHERED DRIFT)**	S-1		
2		SM	Medium dense, light yellow brown, gravelly, silty, SAND, dry. Non-plastic.	S-2		
4		SM	Dense, olive gray, slightly gravelly, silty, fine to medium SAND, dry.	S-3		
		SM	Very dense, gray, silty, gravelly, fine to medium SAND, moist. Scattered cobbles. Diamicton. **(GLACIAL TILL)**	S-4		
6						
8			Test pit terminated at 7 feet. No ground water seepage. Minor caving from 0.5 to 2.5 feet.			
10						
12						
14						

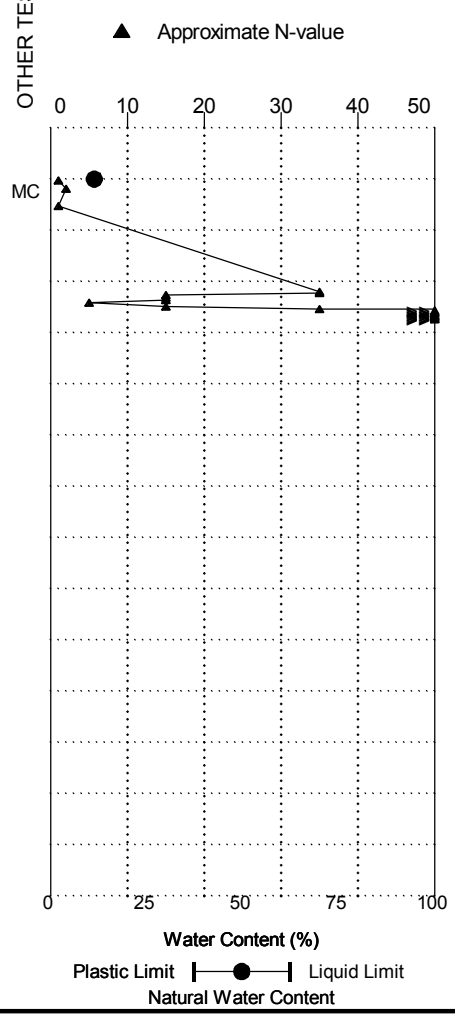


PHOTO OF TEST PIT

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP- 1

PROJECT NO.: 2015-098 FIGURE: A-2

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: 2nd TP from W end, on ridge
DATE COMPLETED: 10/12/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0			Loose Duff and Topsoil. Abundant rootlets. Scattered roots to 4.5 feet.				
		GM	Loose, dark yellow brown, slightly sandy, silty, fine to coarse GRAVEL, dry. Non-plastic. **(WEATHERED DRIFT)**		S-1		GS
2		GM	Medium dense, yellow brown, slightly sandy to sandy, very silty, fine to coarse GRAVEL, dry. Abundant cobbles.		S-2		
4		GP GM	Dense, olive gray, clean to slightly silty, fine to coarse sandy, fine to coarse GRAVEL, dry.				
		SM	**(RECESSIONAL OUTWASH)**				
6			Very dense, gray, fine to coarse gravelly, silty, fine to medium SAND, dry grading to damp. Diamicton. Boulder at 6 feet. **(GLACIAL TILL)**		S-3		
8					S-4		
10			Test pit terminated at 9 feet. No ground water seepage. Minor caving from 3 to 4.5 feet.				
12							
14							

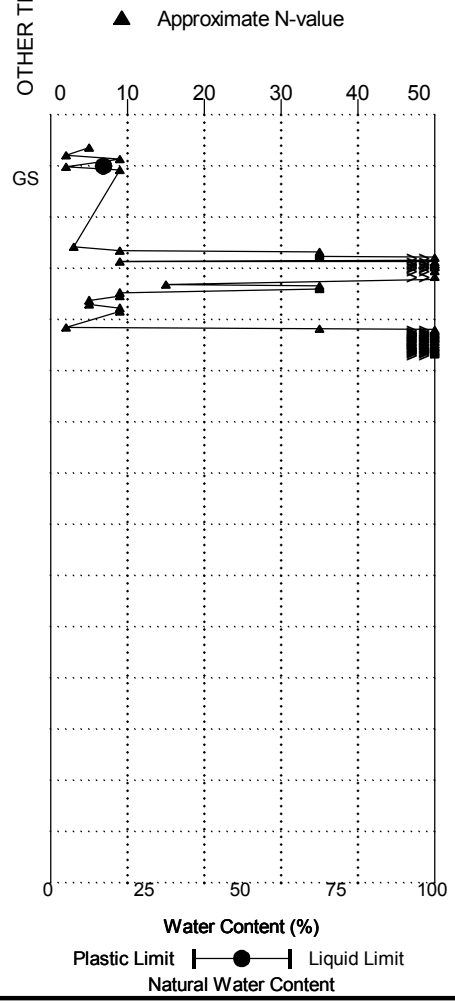


PHOTO OF TEST PIT

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP- 2

PROJECT NO.: 2015-098 FIGURE: A-3

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: W side of low area E of TP-2 ridge
DATE COMPLETED: 10/12/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0			Loose Duff and Topsoil.				
		SM	Loose grading to medium dense, reddish brown, gravelly, silty, fine to medium SAND, moist.		S-1		
2		GM	**(WEATHERED DRIFT)**				
		SM	Dense, rust-mottled light gray, silty, fine to medium sandy, GRAVEL,damp.		S-2	GS	
4			Very dense, gray, gravelly, silty, fine to medium SAND, moist. Diamicton. **(GLACIAL TILL)**		S-3		
6		SM	Very hard digging below 5.5 feet; scraping with bucket teeth.		S-4		
8			Test pit terminated at 7 feet. No ground water seepage. No caving.				
10							
12							
14							

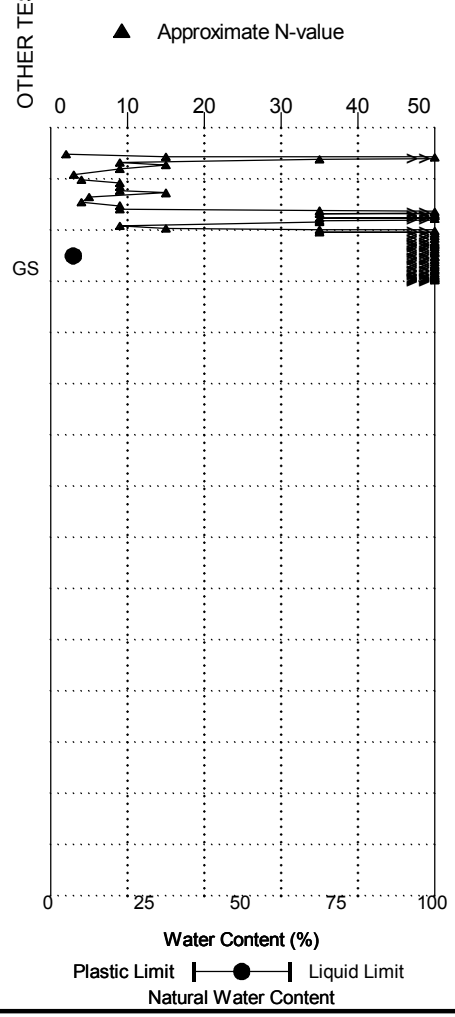


PHOTO OF TEST PIT

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP- 3

PROJECT NO.: 2015-098 FIGURE: A-4

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: East side of low area E of TP-2 ridge
DATE COMPLETED: 10/12/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0			Loose Duff and Topsoil.				
		GM	Loose grading to medium dense, slightly sandy, silty, GRAVEL, damp. Abundant roots to approx. 1.5 feet. **(WEATHERED DRIFT)**		S-1		GS
2		GP GM	Dense grading to very dense, dark olive gray, slightly silty, fine to coarse sandy, fine to coarse GRAVEL, damp. **(RECESSIONAL OUTWASH)**		S-2		
4		SM	Very dense, gray, gravelly, very silty, fine to medium SAND, damp grading to moist. Scattered cobbles. Diamicton. **(GLACIAL TILL)**		S-3		
6					S-4		
8			Test pit terminated at 7 feet. No ground water seepage. No caving.				
10							
12							
14							

▲ Approximate N-value

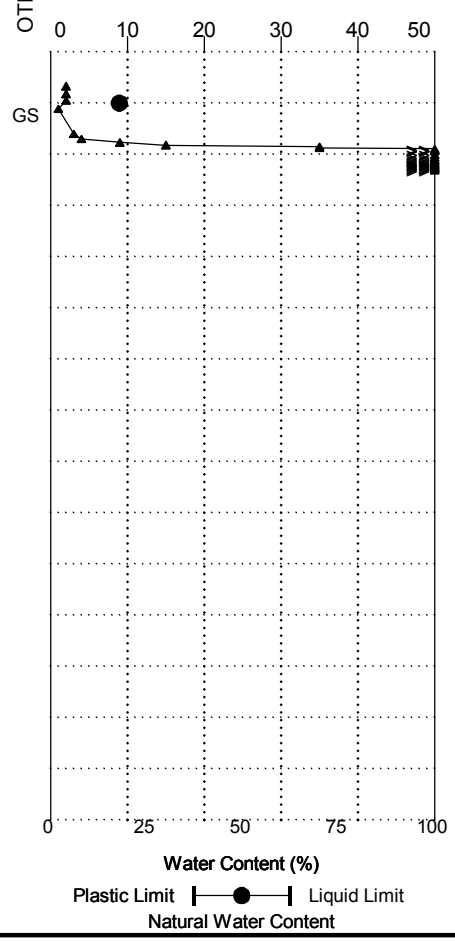


PHOTO OF TEST PIT

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP- 4

PROJECT NO.: 2015-098 FIGURE: A-5

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: On a ridge
DATE COMPLETED: 10/12/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0			Loose Duff and Topsoil. Depth varies from 0.5 to 1.5 feet.				
		SM	Loose grading to medium dense, brown grading to yellow brown, gravelly, silty, fine to mediumSAND, moist.		S-1		MC
2		GM	Abundant roots to 1.5 feet. **(WEATHERED DRIFT)**		S-2		GS
4			Dense, rust-mottled light gray, silty, fine to medium sandy, GRAVEL, damp. Scattered cobbles. Diamicton. **(GLACIAL TILL)** Grades to very dense and olive brown with some rust mottling. Not difficult to dig.				
6					S-3		
8							
10			Test pit terminated at 8.5 feet. No ground water seepage. No caving.				
12							
14							

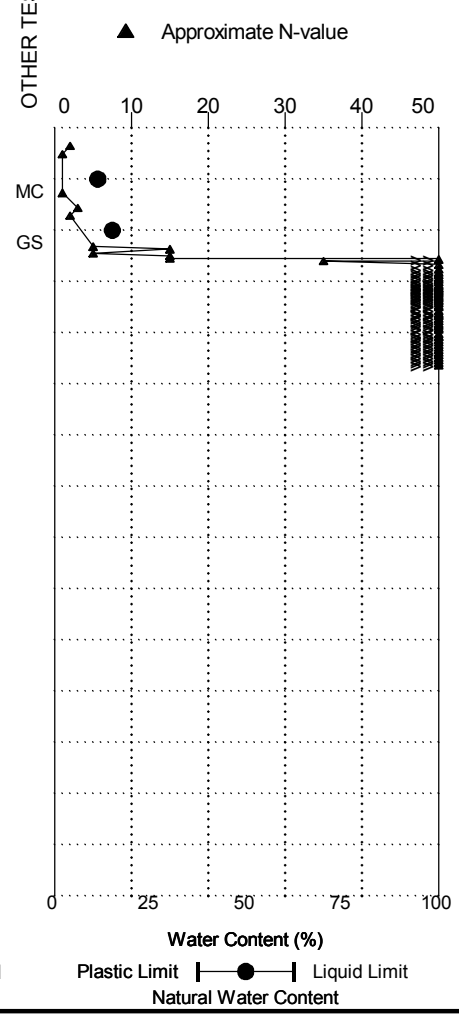


PHOTO OF TEST PIT

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP- 5

PROJECT NO.: 2015-098 FIGURE: A-6

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: On a ridge
DATE COMPLETED: 10/12/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0			Loose Duff and Topsoil.				
		ML SM	Loose, reddish brown, slightly gravelly, sandy SILT, damp. Roots to 1.5 feet. **(WEATHERED DRIFT)**		S-1		MC
2		SM	Dense, rust-mottled light gray, gravelly, very silty, fine to medium SAND, moist. Scattered cobbles. Diamicton. **(GLACIAL TILL)**		S-2		
4			Becomes very dense and olive brown with minor rust mottling. Harder digging.		S-3		GS
6							
8					S-4		
10			Test pit terminated at 8 feet. No ground water seepage. No caving.				
12							
14							

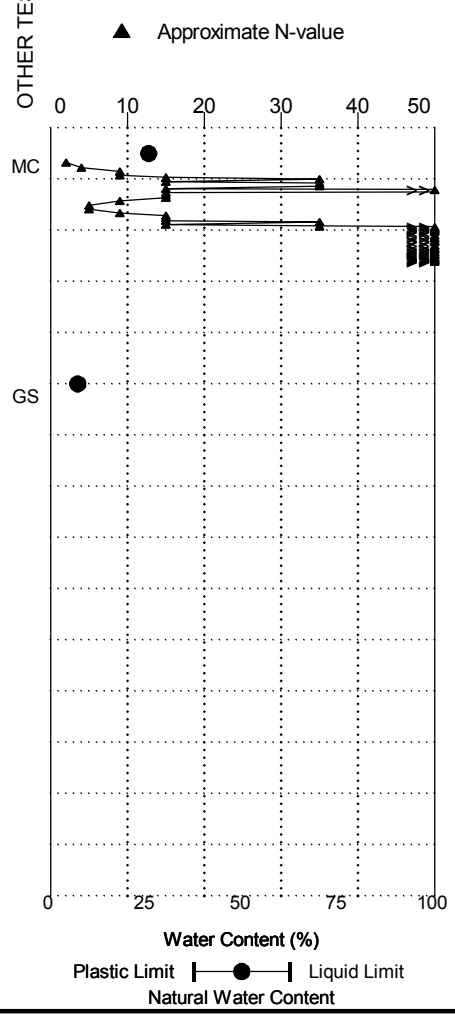


PHOTO OF TEST PIT

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP- 6

PROJECT NO.: 2015-098 FIGURE: A-7

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: Ridge, just W of western wetland
DATE COMPLETED: 10/13/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE / SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0			Loose Duff and Topsoil. Abundant roots.			
		SM	Loose, yellow brown, slightly gravelly, very silty, fine to medium SAND, dry. Scattered cobbles. Abundant roots to 2.5 feet. **(WEATHERED DRIFT)**	S-1, S-2	GS	
2		SM	Medium dense grading to dense, olive gray with olive brown, gravelly, very silty, fine to medium SAND, moist.			
4		SM	Dense grading to very dense, gray, gravelly, silty, fine to coarse SAND, moist. Diamicton. **(GLACIAL TILL)**	S-3		
6			More gravelly from 7 to 7.5 feet.	S-4		
8			Test pit terminated at 8 feet. No ground water seepage. No caving.			
10						
12						
14						

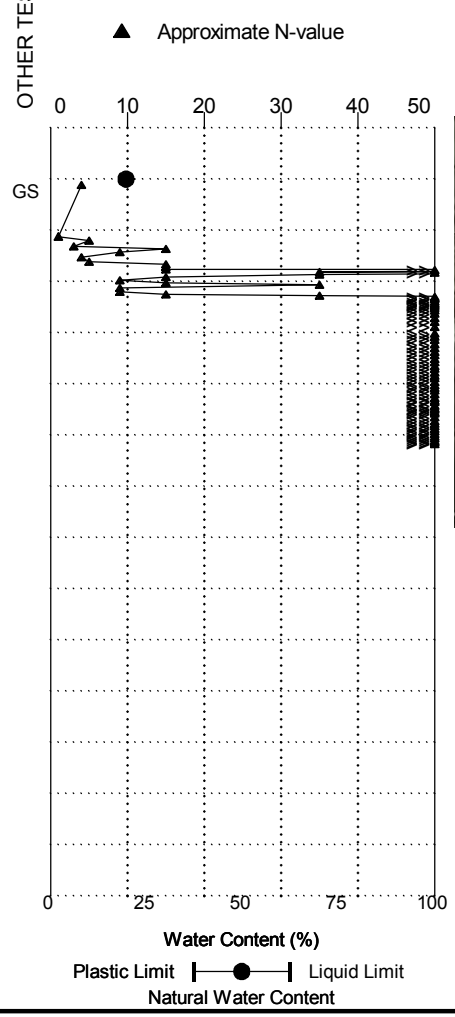


PHOTO OF TEST PIT

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP- 7

PROJECT NO.: 2015-098 FIGURE: A-8

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: W side of western wetland
DATE COMPLETED: 10/13/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0		PT	Very soft, dark brown, PEAT, wet. Scattered partly decomposed wood. **(PEAT)**		S-1		
2		PT	Becomes brown.		S-2		
4		ML	Loose grading to medium dense, gray, sandy SILT grading to silty, fine to medium SAND, wet.		S-3		
		SM	**(RECESSIONAL OUTWASH)**		S-4		
6		SM SP	Dense, rust-mottled olive brown, silty, fine to medium SAND, moist.				
8			Medium dense, rust-mottled olive brown, clean, gravelly, fine to medium SAND, wet. Lens of sandy GRAVEL at 6 to 6.5 feet.				
10			Test pit terminated at 9 feet. Minor ground water seepage at 4.5 feet; heavy below 5.5 feet. Heavy caving, from 5 to 9 feet.				
12							
14							

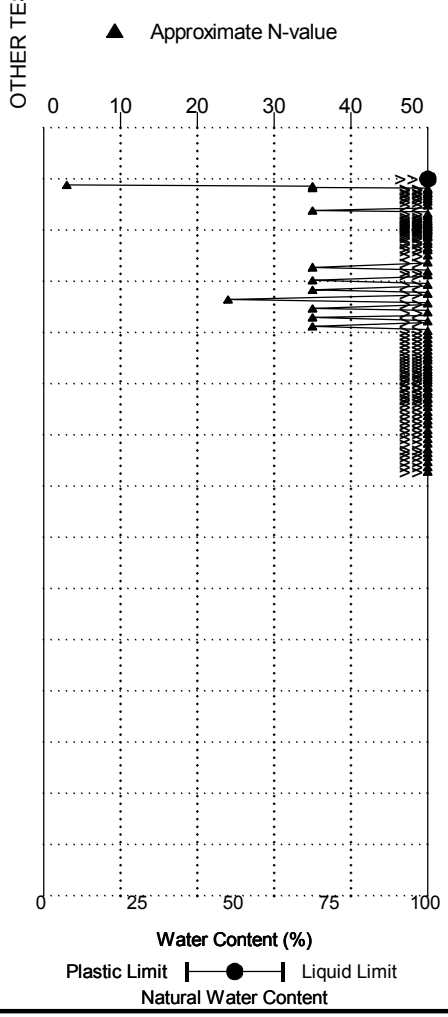


PHOTO OF TEST PIT

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP- 8

PROJECT NO.: 2015-098 FIGURE: A-9

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: W edge of upland, E of western wetland
DATE COMPLETED: 10/13/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0			Loose Duff and Topsoil.				
		SM	Loose, reddish brown grading to dark yellow-brown, silty, fine to medium SAND, moist. Scattered gravel and charcoal. Abundant roots.		S-1		
2		SM	**(WEATHERED DRIFT)**				
			Medium dense, light olive brown, silty, fine to medium SAND, moist. Scattered gravel. **(RECESSIONAL OUTWASH)**		S-2		
4					S-3		
6		GW GM	Medium dense grading to dense, olive gray with rust mottling, slightly silty, sandy, fine to coarse GRAVEL, wet. Abundant cobbles.		S-4		
8							
10							
12							
14							

Test pit terminated at 8 feet.
Moderate ground water seepage at 5 feet.
Moderate caving, 5 to 8 feet.

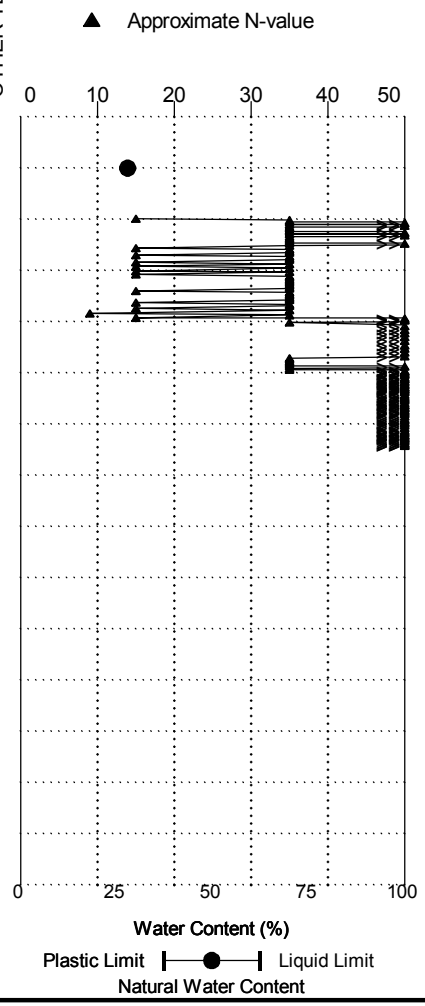


PHOTO OF TESTPIT

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP- 9

PROJECT NO.: 2015-098 FIGURE: A-10

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: Upland; 50 ft E of TP-9
DATE COMPLETED: 10/13/15
LOGGED BY: B. Thurber

DEPTH (feet)	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE / SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0	SM	Loose, brown, slightly gravelly, silty, fine to medium SAND, moist. Scattered roots. **(FILL)**	S-1		
	GM	Charcoal layer up to 3 inches thick, over:	S-2		
2	SM	Medium dense, light gray, silty, fine to medium sandy, fine GRAVEL, moist. **(RECESSIONAL OUTWASH, scorched by fire)**	S-3	GS	
4		Medium dense grading to dense, light olive brown, silty, fine gravelly, fine to medium SAND, moist.			
	GM	**(RECESSIONAL OUTWASH)** Medium dense to dense, dark brown, silty, sandy, fine GRAVEL, moist. Non-organic.	S-4		
6	SP	Medium dense to dense, brown, clean, fine to medium SAND, moist.	S-5		
8		Test pit terminated at 8.5 feet. Moderate ground water seepage at 8.3 feet. No caving.			
10					
12					
14					

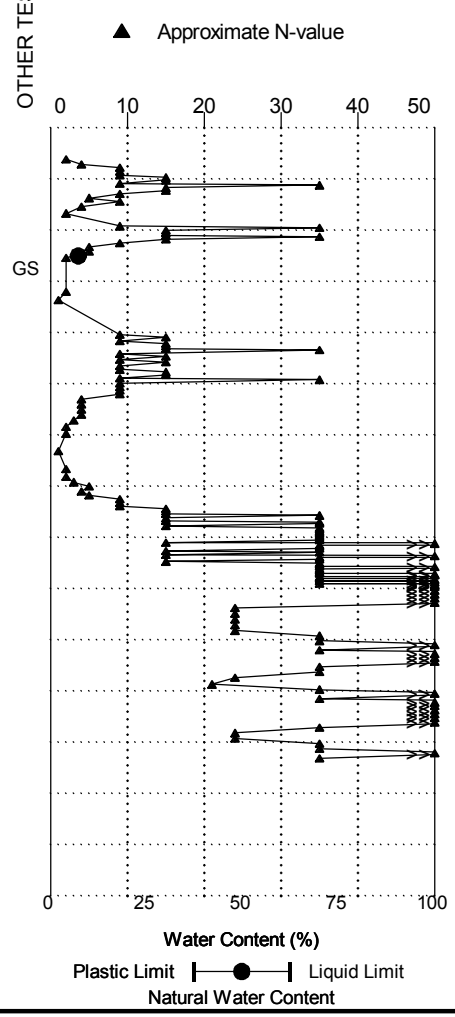


PHOTO OF TEST PIT

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HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP-10

PROJECT NO.: 2015-098 FIGURE: A-11

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: Wetland W of house
DATE COMPLETED: 10/13/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0		PT	Very soft, dark brown, PEAT, moist. Scattered partly decomposed wood. **(PEAT)**				
2		SM	Loose grading to medium dense, olive gray and olive brown, silty, fine to coarse gravelly, fine to medium SAND, moist. Scattered cobbles. **(RECESSIONAL OUTWASH)**		S-1		
4							
5		GW	Medium dense, clean, fine to coarse sandy, fine to coarse GRAVEL, wet. Water bearing.		S-2		
6		SM	Medium dense, gray, silty, gravelly, fine to medium SAND, wet.				
6.5		SP SM	Medium dense, olive brown, clean to slightly silty, fine to medium SAND, wet. Slightly gravelly below approx. 7 feet.		S-3		
8							
10							
12							
14							

Test pit terminated at 8.5 feet.
Moderate ground water seepage at 5.2 feet, east end.
Minor ground water seepage at 3.5 feet, west end.
Heavy caving from 2.5 to 7 feet.

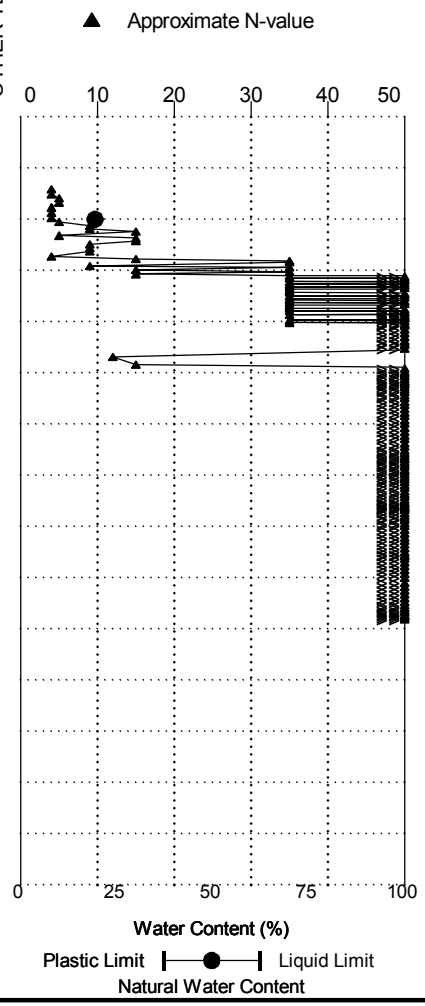

PHOTO OF TEST PIT

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HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP-11

PROJECT NO.: 2015-098 FIGURE: A-12

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: W edge of rise by house
DATE COMPLETED: 10/13/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0		GM	Loose, brown, silty, fine to medium sandy, GRAVEL, damp. Scattered roots. **(FILL)**		S-1		GS
2		GM	Becomes yellow brown, dry.				
4		SM	Loose, brown, silty, gravelly, fine to medium SAND, dry, with Garbage: Steel, glass and glass bottles, sheet metal, tire. **(FILL with REFUSE)**				
		PT	Charcoal layers over Soft, dark brown, PEAT, wet. **(PEAT)**		S-2		
6		SM	Medium dense to dense, gray and olive gray, clayey, silty, fine to coarse gravelly, fine to medium SAND, wet. **(RECESSIONAL OUTWASH)**		S-3		
8					S-4		
10			Test pit terminated at 9 feet. Minor ground water seepage at 6 feet. Moderate caving from 4.5 to 6 feet.				
12							
14							

▲ Approximate N-value

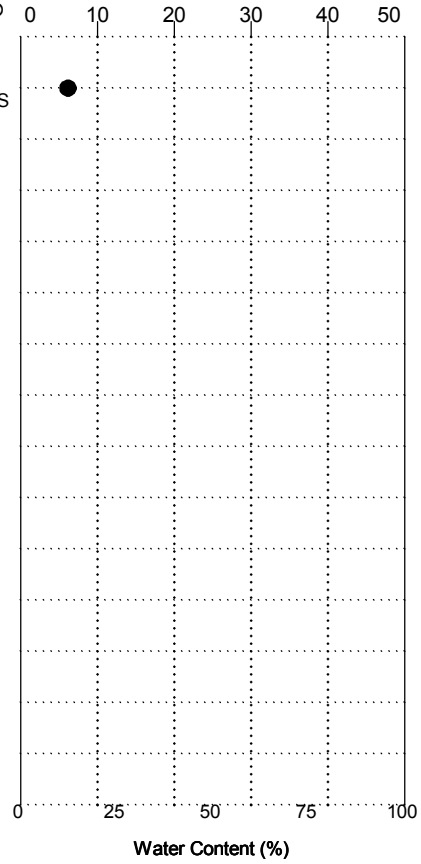

PHOTO OF TEST PIT

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HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP-12

PROJECT NO.: 2015-098 FIGURE: A-13

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: N of driveway, edge of upland
DATE COMPLETED: 10/14/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0			Loose Duff and Topsoil.				
		CL	Stiff, brown, silty CLAY, moist. Scattered gravel.		S-1		AL
2		CL	Very stiff, rust-mottled olive gray, silty CLAY, moist. Scattered gravel.		S-2 S-3		
4		GM	Dense, light brown, silty, sandy, fine to coarse GRAVEL, wet.				
		GM	**(RECESSIONAL OUTWASH)** Becomes olive brown, and slightly silty to clean.				
6							
8					S-4		
10							
12							
14							

Test pit terminated at 8 feet.
Heavy ground water seepage below 2 feet.
Moderate caving within gravel while digging.
Heavy caving when to 6 feet, surface to 6 feet.

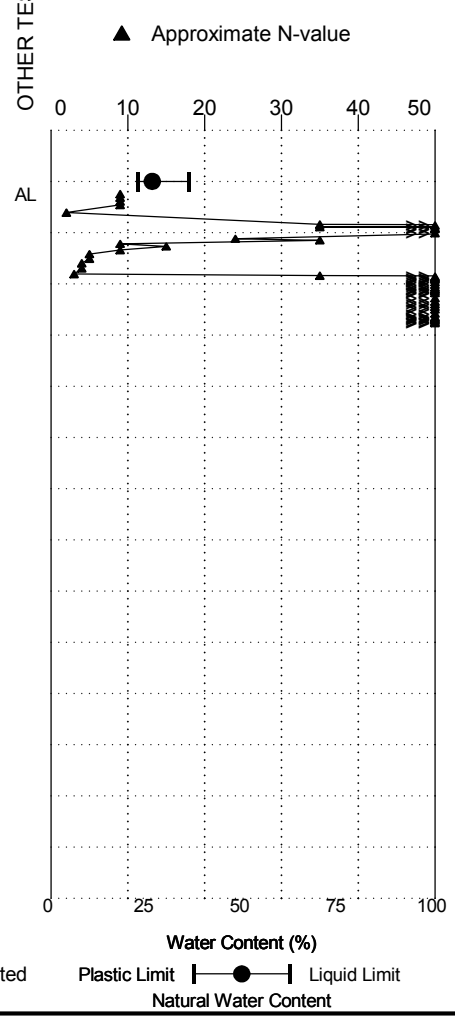

PHOTO OF EAST SIDE OF PIT

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP-14

PAGE: 1 of 1

PROJECT NO.: 2015-098 FIGURE: A-14

DJH TP 2015-098.GPJ 1/13/16

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: N of driveway, edge of upland
DATE COMPLETED: 10/14/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0			Loose Duff and Topsoil.				
		CL	Stiff, brown, clayey SILT, moist. Scattered gravel.		S-1		AL
2		ML	Very stiff, rust-mottled olive gray, clayey SILT, moist. Scattered gravel.		S-2		
		CL			S-3		
		ML					
4		GM	Dense, light brown, silty, sandy, fine to coarse GRAVEL, wet. **(RECESSIONAL OUTWASH)**				
		GM	Becomes olive brown, and slightly silty to clean.				
6							
8					S-4		
10							
12							
14							

Test pit terminated at 8 feet.
Heavy ground water seepage below 2 feet.
Moderate caving within gravel while digging.
Heavy caving when to 6 feet, surface to 6 feet.

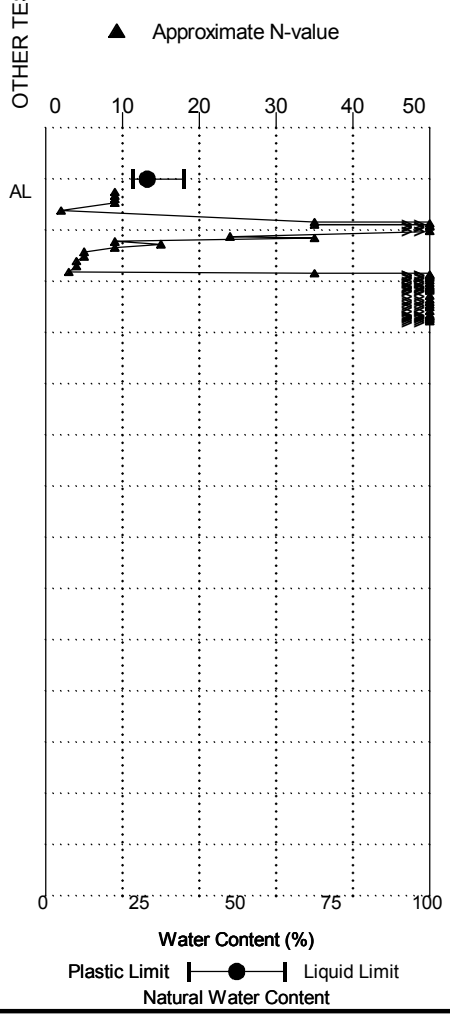

PHOTO OF TEST PIT

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HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP-14

PROJECT NO.: 2015-098 FIGURE: A-15

EXCAVATION COMPANY: City of Lake Stevens
EXCAVATING EQUIPMENT: Yanmar ViC55 trackhoe
SURFACE ELEVATION: ± Feet

LOCATION: E end of alignment, nearS Lk Stevens R
DATE COMPLETED: 10/14/15
LOGGED BY: B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND WATER	OTHER TESTS
0			Loose, dark brown, slightly organic, gravelly, silty SAND, moist. Scattered roots.				
		SW SM	**(TOPSOIL)**		S-1		GS
2			Loose grading to medium dense, reddish brown grading to rust-mottled yellow brown, slightly silty, fine to medium SAND, moist. Scattered gravel.				
		SM	**(WEATHERED DRIFT)**		S-2		
4		GW GM	Medium dense to dense, rust-mottled yellow brown and olive gray, slightly silty, fine to coarse gravelly, fine to medium SAND, moist. Scattered cobbles.		S-3		
			(RECESSIONAL OUTWASH)				
6		SP	Medium dense to dense, slightly silty, sandy, fine to coarse GRAVEL, moist. Scattered cobbles.		S-4		
			Medium dense, olive gray, clean, fine to medium SAND, wet.				
8		GW	Dense, olive brown, clean, fine to coarse sandy, fine to coarse GRAVEL, wet.		S-5		
10			Test pit terminated at 9 feet. Minor ground water seepage at 5.5 feet; heavy below 7.5 feet. No caving.				
12							
14							

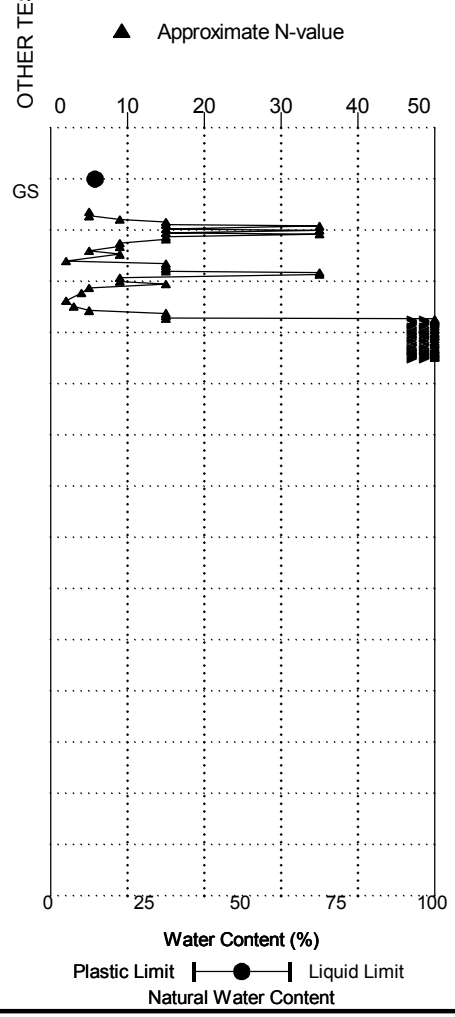

PHOTO OF TEST PIT

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HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

LOG OF TEST PIT
TP-15

PROJECT NO.: 2015-098 FIGURE: A-16

Appendix B:
Laboratory Results

Laboratory tests were conducted on selected soil samples to characterize relevant engineering and index properties of the site soils. Laboratory testing, as described below, consisted of determining soil moisture content, plasticity characteristics (Atterberg Limits), and grain size distribution. All laboratory testing was completed in accordance with ASTM (American Society of Testing Materials) specifications.

Moisture Content

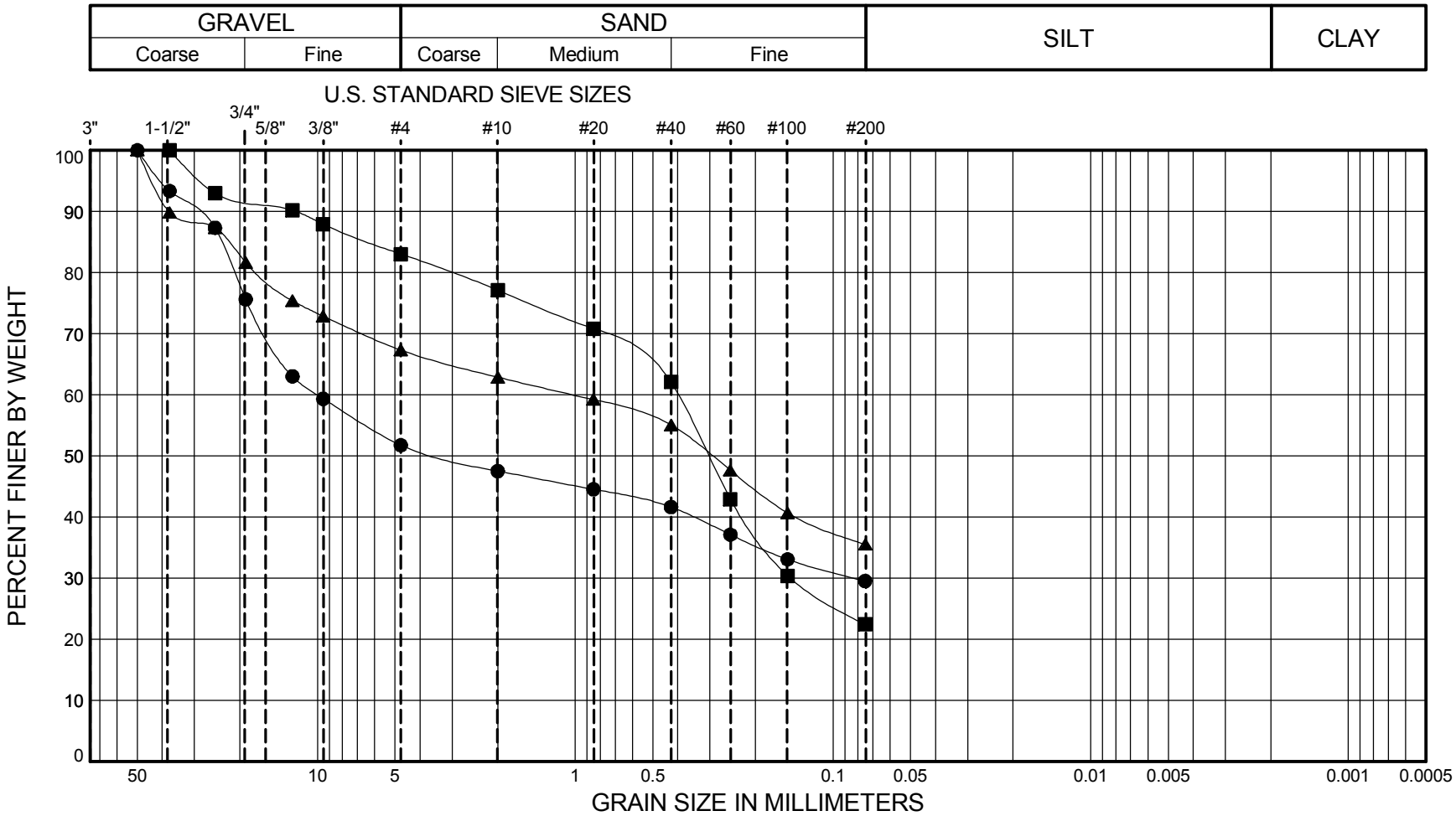
The moisture content for select samples collected from the explorations was determined in general accordance with ASTM D 2216. The results are shown at the sampled interval on the appropriate logs in Appendix A.

Plasticity Characteristics

Plasticity tests (Atterberg Limits) were performed on select samples from TP-13 and TP-14. The tests were conducted in general accordance with ASTM D 4318.

Grain Size Distribution/ Percent Fines Analysis

The grain size distribution and percentage of fines of representative samples from the explorations were determined in general accordance with ASTM D 422 and ASTM D 1140, respectively.



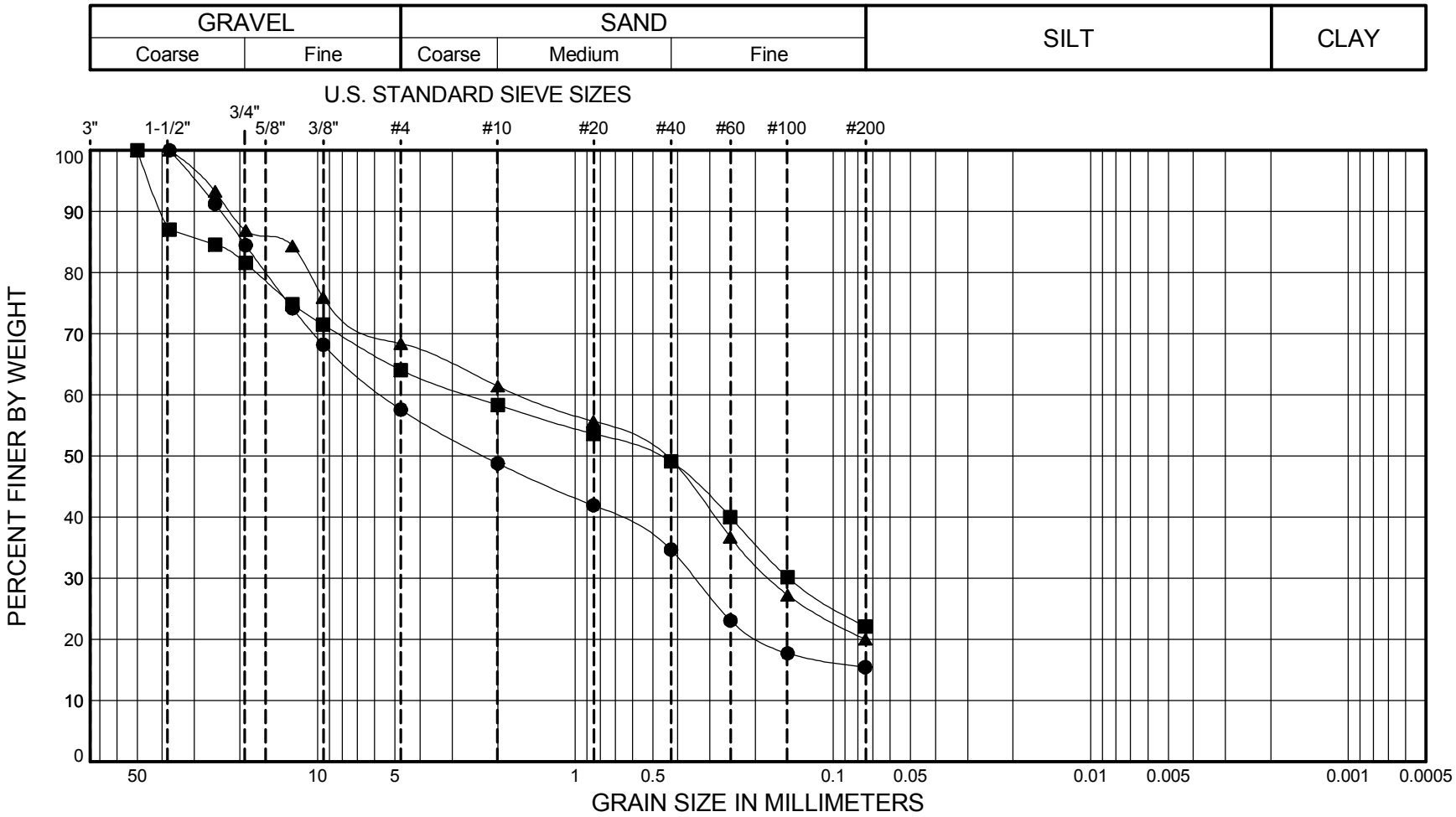
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	TP- 2	S-1	1.0 - 1.5	(GM) Brown, silty GRAVEL with sand	14				48.3	22.2	29.5
■	TP- 3	S-2	2.5 - 3.0	(SM) Olive brown, silty SAND with gravel	6				17.0	60.6	22.4
▲	TP- 4	S-1	1.0 - 1.5	(GM) Brown, silty GRAVEL with sand	18				32.7	31.8	35.5

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2015-098 FIGURE: B-1



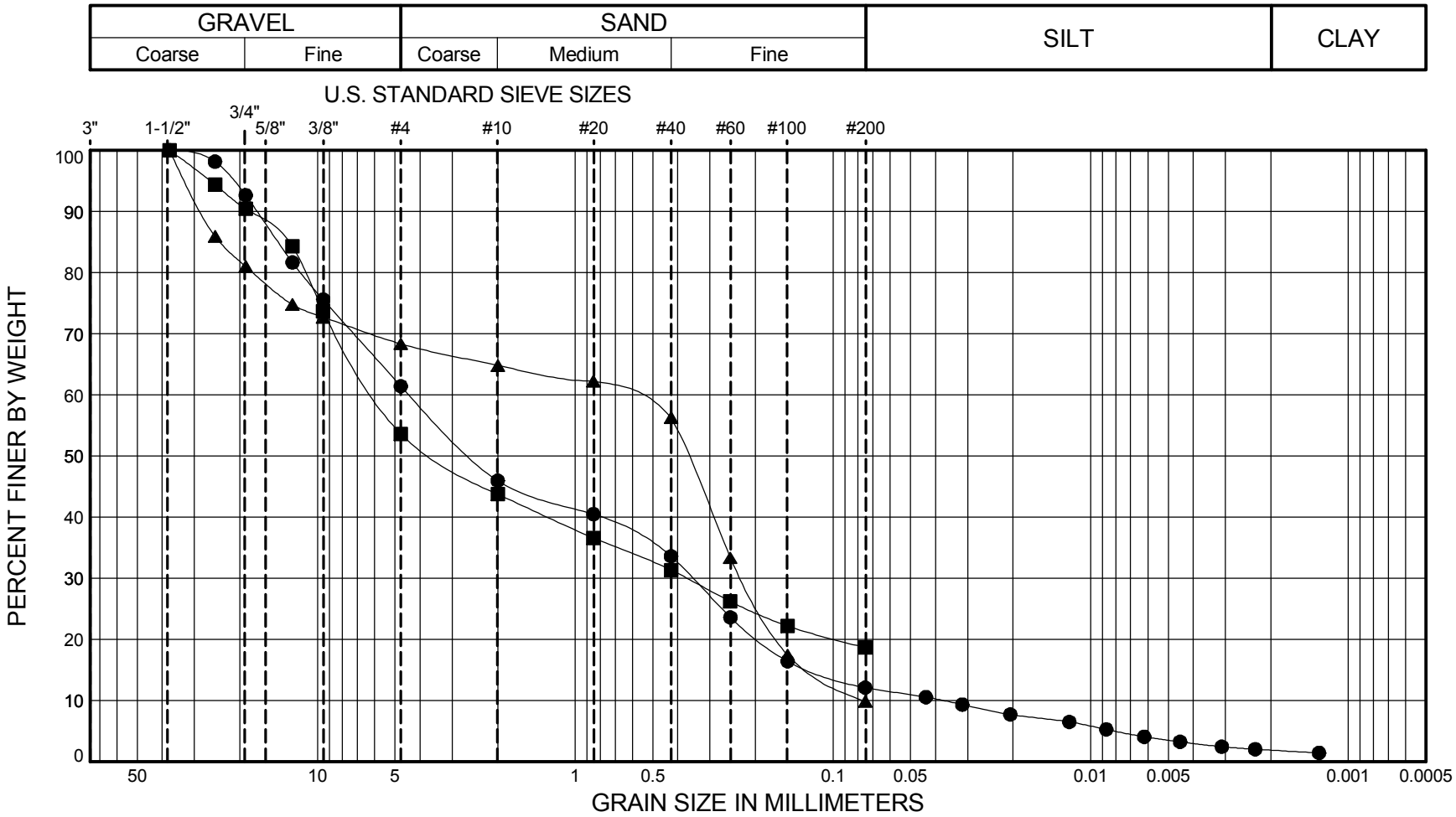
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	TP- 5	S-2	2.0 - 3.0	(GM) Brown, silty GRAVEL with sand	15				42.4	42.1	15.4
■	TP- 6	S-3	5.0 - 5.5	(SM) Yellowish brown, silty SAND with gravel and cobbles	7				36.0	41.9	22.1
▲	TP- 7	S-1	1.0 - 1.5	(SM) Dark yellowish brown, silty SAND with gravel and cobbles	20				31.6	48.4	20.0

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2015-098 FIGURE: B-2



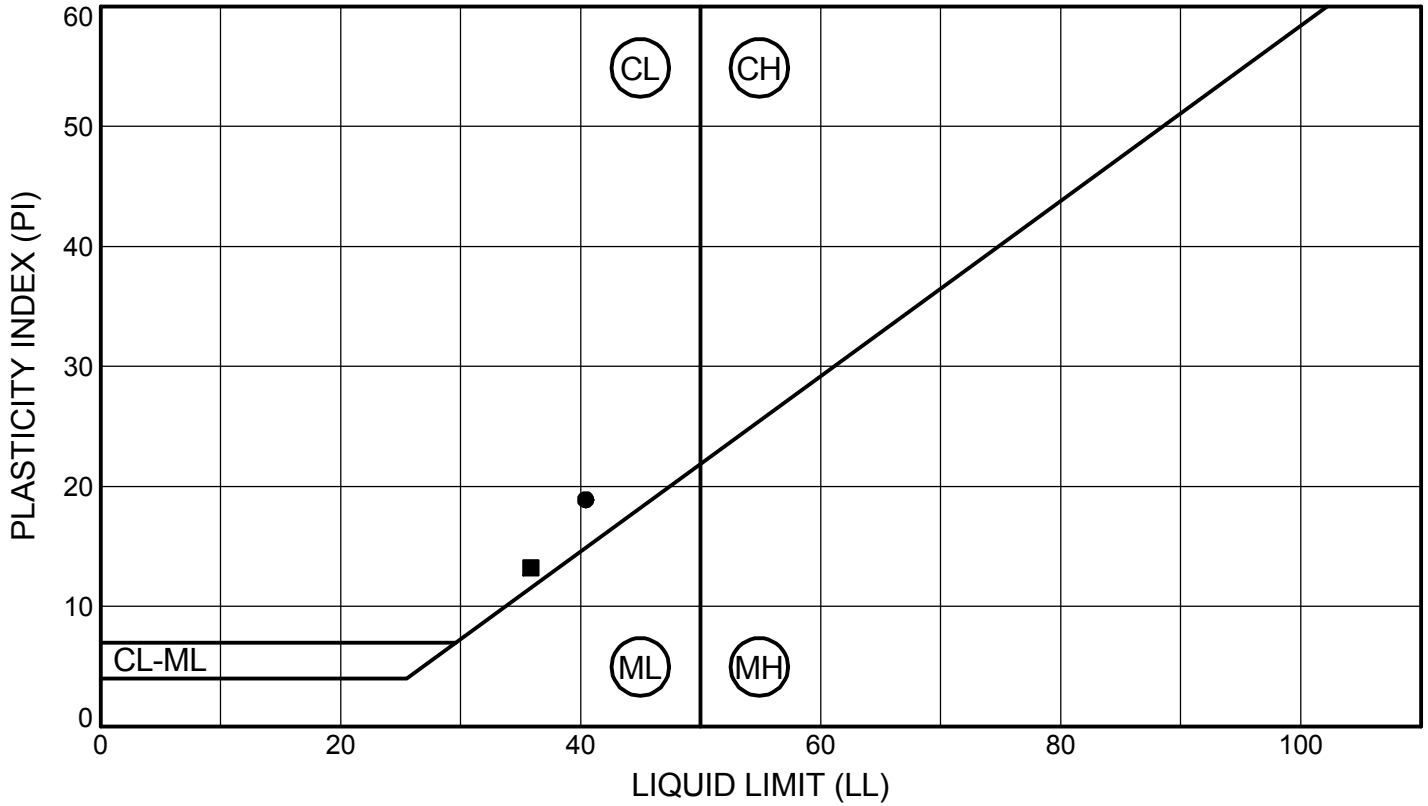
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	TP-10	S-3	2.5 - 3.0	(SM) Olive brown, silty SAND with gravel	7				38.6	49.3	12.1
■	TP-12	S-1	1.0 - 2.0	(GM) Dark brown, silty GRAVEL with sand	12				46.4	35.0	18.7
▲	TP-15	S-1	1.0 - 1.5	(SW-SM) Dark yellowish brown, well graded SAND with silt and gravel	11				31.7	58.4	9.9

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2015-098 FIGURE: B-3



SYMBOL	SAMPLE	CLASSIFICATION	% MC	LL	PL	PI	% Fines
●	TP-13S-2	(CL) Olive gray, lean Clay	33	40	22	18	
■	TP-14S-1	(CL) Grayish brown, lean CLAY	26	36	23	13	

HWA GEOSCIENCES INC.

24th Street SE Extension
Lake Stevens, Washington

PLASTICITY CHART

PROJECT NO.: 2015-098 FIGURE: B-4

Appendix C:
Cost Estimating Tool

The City of Lake Stevens requested that HWA develop a rough order of magnitude costing tool to help estimate the costs required to construct embankment and retaining wall roadway prisms within wetland areas. Tables C-1 and C-2 present those cost estimates. Tables C-1 and C-2 are not intended to be design or bid documents. The cost information presented in Tables C-1 and C-2 is based strictly on conceptual roadway prism design. Further geotechnical investigation is required to develop the finalized roadway prism design. The estimated costs presented Tables C-1 and C-2 should not be construed as our warranty of actual construction costs; the roadway prism may vary during final design.

The basic assumptions used to develop the costing information in Table C-1 are presented below:

- Retaining wall height = 8 feet
- Width of roadway prism = 36 feet
- Length of roadway prism = 100 feet
- Over-excavation depth = 4.5 feet

Table C-1. Estimated Cost to Construct Retaining Prism in Wetland Area

Task:	**Estimated Cost ($):**
Over-excavation	35,000
Dewatering	20,000
Wall Construction	56,000
Structural Fill Placement	45,000
Culvert Installation	15,000
Roadway Construction	22,000
Grand Total ($)	193,000
Cost/Linear Foot ($)	1,930.00

The basic assumptions used to develop the costing information in Table C-1 are presented below:

- Embankment height = 8 feet
- Width of roadway prism = 36 feet
- Length of roadway prism = 100 feet
- Over-excavation depth = 4.5 feet

Table C-2. Estimated Cost to Construct Embankment Prism in Wetland Area

Task:	**Estimated Cost ($):**
Over-excavation	55,000
Dewatering	25,000
Embankment Construction	86,000
Culvert Installation	22,000
Roadway Construction	22,000
Grand Total ($)	210,000
Cost/Linear Foot ($)	2,100.00

COSTCO WHOLESALE PAVEMENT SPECIFICATION

SECTION 321216

ASPHALT PAVEMENT AND SURFACING

PART 1 GENERAL

1.1 SCOPE

A. Onsite paving shall conform to the following requirements; deviations shall only be allowed with written approval from Costco Construction. The asphalt binder oil shall be Performance Grade (PG) asphalt binder as specified herein. The PG binder oil grade shall be verified with the Geotechnical Report for the project.

B. This work shall consist of dense, fine graded, hot, plant-mixed asphalt concrete to produce a very smooth, uniform completed surface that is free from rock pockets and aggregate segregation, providing "void free" appearance and texture. When approved to be placed in multiple lifts, any additional costs shall be the responsibility of the contactor with no additional compensation from the owner.

C. Bidding documents shall include the Contractors proposed Asphalt Mixture Design sheets. (Refer to Mix Design Submittal Checklist sheet at the end of this section). Designs will be for HMA to be placed for each of the uses anticipated on each project; patching, base, leveling, and / or surface course. Each asphalt supplier shall be required to submit its own mix design submittal.

D. Hot Mix Asphalt (HMA) shall be manufactured from a state approved / certified HMA manufacturing facility. Work consists of one or more courses of HMA constructed on a prepared foundation. The asphalt concrete consists of a mixture of aggregates and specified type and grade of asphalt binder. The manufacturing facility shall be capable of producing HMA in accordance with the following requirements and all applicable local agency specifications on an ongoing and consistent basis.

E. Ensuring uniform material is produced and selecting the vendor for these asphalt projects will require timely submittal of documents and qualifications to the satisfaction of the Owner. Contractor / material supplier shall demonstrate the existence of the following documents:
   - Approved vendor certificate for the state where work is being done,
   - Quality Control manual for material production over-site and testing measures being performed both at the asphalt plant as well as on the job site, and
   - List / Organizational Chart showing personnel responsible for use of equipment and actions of the crew on the grade while paving and compacting asphalt.

F. HMA Mix Designs shall be performed by qualified personnel with proven past experience and successes in the mix design and quality control of asphalt production. Resumes of the signing 'individual-in-charge' may be required by the Owner and shall be supplied if requested. The design shall meet the following requirements in this section and be less than 12-months old. However the mix design method used shall be the Contractors option, as stated previously, based on various methods which currently exist around the nation. A completed design shall require submittal of documentation as detailed, requested by the Owner in order for the producer to demonstrate knowledge of design and production.

G. Calibrated equipment and qualified personnel must be accessible at all times during the construction of this HMA. The Contractor shall provide the necessary equipment, materials, and labor to complete the job acceptable to the Owner. Variations in the size

and amount of equipment will depend on the size of the area being paved.

H. It is imperative that all documents list a 'Person-in-Charge' who is responsible for the over-site of the previously listed activities. This individual will be the point of contact for the Owner and they shall work with the Owner to ensure timely project completion and specification compliance. This individual shall be knowledgeable in all aspects of asphalt design, production, and installation and shall be an employee of the company holding the contract with the Owner, even if the HMA is being produced and supplied by a separate vendor.

1.2 DEFINITIONS

A. Nominal Maximum Size of Aggregate (NMSA) is one sieve size larger than the first sieve to retain more than 10 percent.

B. Maximum Size of Aggregate (MSA) is the smallest sieve size through which 100 percent of aggregate sample particles pass.

C. Surface Course – The surface / wearing course shall be installed uniformly, to all finished lines and grades, smooth, durable, skid-resistant, impervious thus protecting lower layers, and stable. Workmanship of the finished surface course shall be of the highest industry standards possible prior to acceptance by the Owner. The surface course shall be built with a MSA of between ½" and ¾". Surface course shall be a nominal 1-3/4" compacted thickness, unless otherwise shown on the scope of work, with no thickness less than 2-times the maximum size of aggregate particle (MSA).

D. Leveling Course – The leveling course is used for the location of the parking area that requires placement of a variable thickness of HMA to 'true up' the lot prior to placement of the surface course. This course has a MSA no greater than that of the surface course.

E. Base Course – The lower courses of the pavement structure below the surface and leveling course with a MSA of between ¾" and 1". Base courses shall not be allowed to remain without the surface course placed over an extended period of time and as approved by the engineer.

F. Tacking / Priming – The process of applying one coat of emulsified asphalt to all horizontal and vertical surfaces of either an existing pavement for an overlay or between lifts while building an improved or new structure (tacking), or upon the aggregate base (priming).

G. Binder replacement is the percentage of binder from RAP expressed as a percent of the total binder content in the mix.

1.3 SUBMITTALS

A. Job-Mix Design (JMD): For every paving project, the contractor shall submit a mix design for review and approval by the Costco's consultant at the time of the bid and at least 30 days prior to the scheduled production and lay down of the asphalt mix. Job Mix Designs should demonstrate proposed mixes are capable of complying with the requirements of these specifications. The costs associated with developing Job-Mix Designs until one is accepted by the Owner shall be at the Contractor's expense with no additional compensation.

The design mix submittal shall meet the following criteria:

a. Mix Design shall be based on Superpave method per the Asphalt Institute

Superpave Series No. 2 (SP-2) or Marshall method per the Asphalt Institute Manual Series No. 2 (MS-2) current edition.

b. Name/type/identification of mix.
c. Source and grade of asphalt binder and modifiers.
d. Source and description of aggregates and mineral fillers.
e. Gradation and bulk specific gravity of each aggregate bin size.
f. The percentage of each bin size used in the Job Mix Design, the combined aggregate gradation and the combined aggregate bulk specific gravities.
g. Reclaimed Asphalt Pavement (RAP) quality, gradation, asphalt content, and bulk (dry) specific gravity.
h. Aggregate quality test results for all aggregates.
i. Plotted mix property curves showing the following mix properties at least four asphalt binder contents: unit weight and bulk specific gravity, maximum theoretical specific gravity, percent of air voids, percent void filled (VFA), and percent voids in mineral aggregates (VMA).
j. Recommended asphalt content recommended for the JMD, which shall result in a mix meeting all properties specified herein at the percent air voids shown in table.
k. The submittal shall list the following mix properties at the JMD recommended asphalt binder content:
   1) Bulk Specific Gravity, Gmb
   2) Maximum Theoretical Specific Gravity, Gmm
   3) Mix Air Voids at Optimum Asphalt Content
   4) Voids Filled with Asphalt (VFA) percent
   5) Voids in Mineral Aggregate (VMA)
   6) Mixing Temperature Ranges
   7) Compaction Temperature Ranges

B. Paving Plan. At least 14 days prior to paving, the Contractor shall submit the asphalt paving plan. As minimum, the plan shall include the following:
a. Paving direction.
b. Location of longitudinal joints.
c. Start time and end time for each paving day.

C. Contractor's Quality Control Plan including testing of the mixture proposed to be used on the project shall be submitted to the Owner prior to acceptance of the proposed mix design. D. Independent Testing Laboratory (ITL). At least 30 days prior to the scheduled production, the contractor shall submit an independent testing laboratory (ITL) for contractor's quality control purpose for review and approval by the Owner. The minimum criteria of the ITL are as follows:
a. Possess the equipment and resources to perform all the required asphalt materials testing procedure.
b. Possess accreditation or certification for State DOT, AASHTO, City, or County

1.4 WARRANTY: The contractor shall provide the owner with a two year warranty after date of acceptance, for the asphalt paving. Warranty shall cover defects related to the product, and the installation of the paving.

1.5 PROJECT CONDITIONS

A. Weather Limitations:
1. Apply prime and/or tack coats when ambient temperature is above 40 degrees F, and when temperature has been above 35 degrees F for 12 hours immediately prior to application. Do not apply when surface is wet, contains excess moisture, during rain, or when frozen.
2. Asphalt pavement shall be placed only when the air temperature is 40 degrees F and rising for base lifts and 50 degrees F for surface lifts, where possible.

B. Cold Weather Paving:

Cold weather paving condition applies when the ambient air temperatures less than 50 degrees F. Under this condition, the following practices shall be required:

1. Compaction time should be conducted in less than 10 minutes of placement.
2. Compaction of the asphalt shall be achieved when the mixture temperature is greater than 185 degrees F.
3. Minimum lift thickness shall be 1.75 inches for surface lifts.
4. Asphalt pavement loads with hauling times greater than 10 minutes shall be tightly tarped. Tarps shall tightly cover the load and seal over the sides of the truck bed.
5. If the asphalt pavement is to be placed on an aggregate base, the base must be solidly compacted at or below optimum moisture and not frozen.
6. Hand-worked areas should be avoided during cold weather conditions.
7. Cold weather paving should only be conducted at the discretion of the Engineer.

C. Traffic Control

Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required. Traffic control equipment shall be in good condition. Erect lighted barrel or scissor type barricades, using caution tape or ribbon or other suitable means to prohibit vehicular and pedestrian traffic from entering the work area while work is being performed

PART 2 PRODUCTS

2.1 ASPHALT CONCRETE

A. Asphalt Binder

Asphalt binder shall be Performance Grade (PG) binder oil per ASTM D 6373. The PG binder grade shall be determined based on the Federal Highway Administration's LTPPBind program version 2.1 or the most recent version, to provide the following:

1. The high-end temperature rating shall be the grade with 98 percent reliability,
2. The low-end temperature rating shall be the grade with a minimum 90 percent reliability,
3. The PG binder grade requirement may be superseded by the project Geotechnical Report.
4. When the mixture contains 20 percent or less RAP, the PG binder grade determined by the previous steps 1 through 3 shall be used.
5. When the mixture contains between 21 to 30 percent of RAP, the required PG binder grade shall be one grade softer on both high and low temperatures than the PG binder grade determined by previous steps 1 through 3. For example, if PG58-28 is required by LTPPBind then PG52-34 is required for high RAP mixtures.

B. Hot Mix Asphalt (HMA)

Provide a plant-mixed dense, fine-graded, hot-mix asphalt designed in accordance with the procedures outlined as follows:

1. Provide a dense fine-graded mix design and as produced complying with the gradation table 2.1 below:

Table 2.1 Aggregate Gradation

Maximum Size of Aggregate (inch)	1	¾	½
Nominal Maximum Size of Aggregate (inch)	¾	½	3/8
Pavement Section Application	Base Course Only	Base or Surface Courses	Surface Courses Only
U.S. Sieve Size	Percent Passing	Percent Passing	Percent Passing
1"	100	100	100
¾"	90 -100	100	100
½"	Maximum 90	90 - 100	100
3/8"	-	Maximum 90	90-100
#4	Minimum 40		Maximum 90
#8		Minimum 40	Minimum 40
#200	3-6	3-6	3-7

2. Provide hot-mix asphalt for onsite paving meeting properties showing in Table 2.2 and the following criteria:
   a. Coarse aggregate angularity (ASTM D5821): 75 percent of coarse aggregate portion should have at least one fractured face
   b. Fine aggregate angularity (AASHTO T304): 40 percent minimum
   c. Flat and elongated pieces, 5:1 ratio (ASTM D4791):10 percent maximum
   d. Sand equivalent (ASTM D2419): 40 percent minimum
   e. Natural sand content: 20 percent maximum

f. Design binder content is selected at air voids shown in the table 2.2.
g. Minimum Voids in Mineral Aggregate (VMA) based on bulk (dry) specific gravity (Gsb) are 13.0 percent for 3/4-inch, 14.0 percent for ½-inch, and 15.0 percent for 3/8-inch Nominal Maximum Size of Aggregate mixes, respectively.
h. Dust proportion based on the effective binder content (Pbe) between 0.6 to 1.2
i. Maximum RAP content 30 percent for base course and 30 percent for surface course.
j. Recycled asphalt shingles (RAS) shall not be allowed.
k. Minimum Tensile Strength Ratio (TSR) is 80 percent.

Table 2.2 HMA Property Criteria

HMA Property	**50-gyration Superpave**	**50-blow Marshall**
Mix Design Method	Superpave	Marshall
Compaction Energy	50 Gyrations	50 Blows per side
Stability, lbs.	n/a	1,200 min.
Flow, 0.01 in.	n/a	8 to 16
Air Voids @ design AC	3.5%	3.5%
VFA	70 to 80	70 to 80
Dust to effective AC Ratio (design & production)	0.6 to 1.2	0.6 to 1.2

C. Reclaimed Asphalt Pavement (RAP)

RAP shall consist of the material obtained from highways, streets, or asphalt parking lots by crushing, milling, or planing existing asphalt concrete pavements. This material shall be transported to the asphalt concrete production facility yard and processed through an appropriate crusher so that the resulting material will contain no particles larger than the maximum aggregate size of the asphalt concrete mixture in which it will be used. All RAP shall be processed across a maximum of a 5/8” screen. The material shall be stockpiled on a free draining base and kept separate from virgin aggregates, dirt, vegetation or rubbish. The material contained in the RAP stockpiles shall have a reasonably uniform gradation from fine to coarse and shall be protected from accumulation of excessive moisture and shall not be contaminated by foreign materials. The use of RAP will be permitted provided that the end product is in conformance with the approved job-mix formula and that the RAP proportions meet the maximum requirements for the appropriate pavement section course. When RAP is used in the mix design, the following recommendations shall be observed:

1. The gradation of the aggregate in the RAP should be used in calculation of the mix gradation and fractured faces. Fine aggregate angularity, sand equivalent and flat and elongated particles shall not be measured for the RAP aggregate.
2. The percentage of asphalt in the RAP shall be considered when determining the optimum asphalt content. The maximum binder replacement from RAP is 30 percent for surface course and 30 percent for base course.
3. Asphalt content of the total mixture for mix batching shall include virgin and reclaimed asphalt binder. The asphalt binder in the RAP shall be considered as part of the trial mix binder content.
4. The specific gravity of the virgin binder shall be used as the specific gravity of the binder in the RAP for mixture design.
5. The bulk specific gravity of the aggregate in the RAP shall be determined and used as the bulk specific gravity of the RAP aggregate for calculation purposes. The bulk specific gravity of the RAP shall be determined by the following steps:
   a. Determine the maximum theoretical specific gravity (Gmm) of the RAP by ASTM D2041.

b. Determine the asphalt content of the RAP (Pb) by extraction following ASTM D2172.
c. Calculate the effective specific gravity (Gse) of the RAP from the Gmm and the RAP asphalt content (Pb).
d. Determine the absorption of the coarse aggregate from the RAP extraction.
e. Determine the bulk specific gravity of the RAP aggregate (Gsb) by the table 2.3.

Table 2.3 Bulk Specific Gravity of RAP Aggregate

Absorption of the RAP coarse aggregate	Absorption Category	Bulk specific gravity of RAP aggregate
>1.5%	High	Gsb = Gse – 0.1
<= 1.5%	Low	Gsb = Gse – 0.05

6. Use mixing and compaction temperatures for intended asphalt binder grade.

2.2 Tack Coat and Prime Coat

A. Tack coat shall be SS-1, SS-1h, CSS-1 or CSS-1h diluted with an equal amount of water, or agency acceptable product.

B. Prime coat shall be MS-2, CMS-2, or HFMS-2s.

C. Tack coat and Prime Coat shall comply with AASTHO M140 or M208

PART 3 EXECUTION

3.1 AGGREGATE BASE:

A. Dense graded mixture of natural or crushed gravel or stone, and natural or crushed sand, ASTM 2940, with at least 90 percent passing a 1-1/2 inch sieve and not more than 12 percent passing a No. 200 sieve.
   1. When thickness of compacted base is 8 inches or less, place materials in a single layer.
   2. When thickness of compacted base exceeds 8 inches, place materials in equal layers, with no layer more than 8 inches thick or less than 4 inches thick when compacted.

B. Aggregate base shall be compacted to the thickness indicated on the paving drawing at near optimum moisture and to at least 95 percent of ASTM D 1557 maximum dry density.

3.2 SURFACE PREPARATION:

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared sub-grade is ready to receive paving.
   1. Sweep loose granular particles, dust from surface of unbound-aggregate base course or previous AC lift.
   2. Remove any water from the existing surface.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions.

C. Tack Coat: Dilute the emulsion with equal parts of water. Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sy and allow to cure.
   1. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillage and clean affected surfaces.
   2. Prohibit traffic from traversing tack-coated area.
   3. Apply tack coat only to area to be paved during that work day.

3.3 HOT-MIX ASPHALT PLACEMENT:

A. Machine place hot-mix asphalt mix on prepared base surface, spread uniformly, and strike off.

B. Regulate paver machine speed to obtain a smooth (tight-mat), continuous surface free of pulls, bumps and tears in asphalt-paving mat.
   1. Place hot-mix asphalt in one single lift. Maximum lift of asphalt surface course shall be four (4”) inches compacted thickness.
   2. Spread and compact asphalt mix with the temperature range specified on the approved Job Mix Design Submittal.
   3. Begin applying mix along centerline of crown and along the high side of one-way slopes, unless otherwise indicated.

C. Place paving in consecutive strips not less than twelve (12’) feet wide, except where infill edge strips of a lesser width are required. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing asphalt surface course.

D. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of the mix. Place each course to required grade, cross section and thickness, when compacted.

E. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material from forming “high” spots. Fill depressions with hot-mix asphalt and prevent segregation of the mix; use suitable hand tools to smooth surface.

3.4 JOINTS:

A. Surface course longitudinal joints shall run with the traffic pattern. Therefore, pulling across the driving lanes shall not be allowed unless express permission is given by the Owner. Detail and submit to the Owner a paving plan on the site plan sheet prior to placement of asphalt.

B. The entire parking lot surface course shall be paved on the same day. The timing and process should be discussed with and approved by the Owner before proceeding with the work. Work in such a manner as to not unduly limit parking or access to the site by customers or employees. Maintain access to at least 50% of usable parking spaces during paving all the time.

C. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat.
   2. Offset longitudinal joints in successive courses a minimum of six (6”) inches.
   3. Offset transverse joints in successive courses a minimum of twenty four (24”) inches.
   4. Construct transverse joints by bulkhead method or sawed vertical face method as described in Asphalt Institute’s “The Asphalt Handbook”.
   5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement, and complete compaction to the specified density before the minimum compaction temperature specified in the JMD is reached.

3.5 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. In areas inaccessible by rollers, compact hot-mix paving with a hot, hand tampers or vibratory-plate compactors. Complete compaction before mix temperature cools to less than the minimum temperature specified in the approved Job Mix Design Submittal.

B. Breakdown Rolling: Accomplish breakdown (or initial) rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated smoothness, crown and grade. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and re-rolling to required elevations and density.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still within the approved Job Mix Design specified compaction temperature range. Continue rolling until hot-mix asphalt course has been uniformly compacted to the required density.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of

pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

F. Repairs: Remove paved areas that are defective, contaminated with foreign materials, or rejected due to surface coarseness or smoothness. Remove paving course over area affected and replace with new, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until paving has adequately cooled. Repair all damaged areas.

H. Density: Compare density of in-place materials for each lot and sublot against ASTM D 2041 maximum specific gravity for the mix. Minimum acceptable density of in-place material shall be: the average density of 93.0 to 97.0 percent of the theoretical maximum density determined by ASTM D2041.

I. Surface course longitudinal joints shall be measured 6” from the joint, centered upon core or density gauge, and shall meet the mat density requirements minus 2.0% as a minimum, but no less than 90.0 percent of the maximum theoretical specific gravity, per ASTM D2041.

J. Base and leveling course longitudinal joint density shall be between 95% - 102% of maximum achievable individually, with an average of 98% on any given day. Base and leveling installation of asphalt shall meet local DOT specifications for in-place density measurement.

.3.6 FINISHED PAVEMENT SURFACES

A. Examine finished surface and verify “tight-mat” finish per Costco’s requirements and expectations, and verify conformance with Owner, or owner’s representative. Open graded (porous) finished surfaces or areas with rock pockets or segregated material will not be accepted.

B. The completed asphalt pavement surface shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, irregularities, rock pockets, coarse aggregate and roller marks. Areas of handwork at joints and miscellaneous structures shall match the smooth surface texture of all other areas of new pavement.

C. Finished paved surface shall be uniform, clean and smooth, with no ponding, pooling or “birdbaths”. Paved surfaces containing “birdbaths” will not be accepted and will be replaced and/or repaired by the Contractor, at no additional cost to the Owner. Patching will not be acceptable.

3.7 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated with the following tolerances:
   1. Aggregate Base Course:_____Plus or minus 1/2”.
   2. Asphalt Surface Course: ..... Plus 1/4”, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a ten (10’) foot straight edge applied transversely or longitudinally to paved areas:
   1. Aggregate Base Course: ..... 1/4” (one-quarter inch)
   2. Asphalt Surface Course:..... 1/8” (one-eighth inch)

C. Final pavement surface (roughness) acceptance shall by the Owner or the Owner's representative.

3.8 FIELD QUALITY ASSURANCE:

A. Testing Agency:
1. The contractor shall be responsible for coordinating paving activities with the owner's testing agency to allow field inspection and testing in conformance with these specifications.
2. The testing agency shall prepare daily test reports, and state in each report whether the tested work complies with the specified requirements. Any additional testing required to verify compliance of corrected work shall be at the contractor's expense.

B. Thickness: In-place compacted thickness of hot-mix asphalt will be determined in accordance with ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course shall be tested for compliance with smoothness tolerances, and shall include a "visual" inspection of the asphalt pavement surface by the Owner or the Owner's representative.

D. Quality Assurance Testing: For the purpose of Quality Assurance Testing and Acceptance Evaluation, the HMA paving work shall be divided into lots and sublots. A lot will be equal to the quantity of paving completed in one working day.

1. For each lot, a sample of HMA will be obtained in accordance with ASTM D 3665 random sampling procedure by the Owner's testing agency and following mix properties determined:

   a. Asphalt Binder Content, ASTM D2172.
   b. Aggregate Gradation, ASTM C136 and C 117.
   c. Maximum Specific Gravity, ASTM D 2041. (Mandatory 2-hour cure time before testing for QC and QA)

2. For the first lot of the project and every third lot thereafter, the following additional properties shall be determined:
   a. Air Voids, percent.
   b. Voids Filled, percent.
   c. Voids in Mineral Aggregate, percent.

3. One location within each sublot shall be randomly selected using ASTM D 3665 procedures for density testing. Two cores shall be obtained at each location and their density determined in accordance with ASTM D 3665a and their thicknesses determined in accordance with ASTM D 3549. The density and thickness for each location shall be the average of the two core samples. The compaction of each sublot shall be the percentage of the average density for the sublot compared to the maximum density of the sample lot determined in accordance with ASTM D 2041.

E. Acceptance Evaluation

The HMA paving for a lot is acceptable if the asphalt binder content is within 0.3 percent of the JMF recommended asphalt content, the aggregate gradation and mix properties meet the requirements of these specifications (or agency requirements for off-site paving), the average compaction for all sublots is 94 percent, with no sublot, compaction less than 92.0 percent or greater than 97.0 percent (or agency compaction requirements for off-site paving).

F. Payment Reduction

Any average in-place density measured for surface course mixtures that is less than required for the day will result in a reduction in HMA pay equal to the following table 3.1. After reaching the 30 percent reduction mark the pavement shall be removed and replaced by the Contractor or at owner permission, left in place with no compensation due the Contractor

Table 3.1 Pay Factor

Pay Factor (%)	In-place Density as Percent of Maximum Theoretical Specific Gravity, Gmm (%)	Pay Factor (%)	In-place Density as Percent of Maximum Theoretical Specific Gravity, Gmm (%)
100	> 93	89.0	91.4
99.5	92.9	88.0	91.3
99.0	92.8	87.0	91.2
98.5	92.7	86.0	91.1
98.0	92.6	85.0	91.0
97.5	92.5	83.5	90.9
97.0	92.4	82.0	90.8
96.5	92.3	80.5	90.7
96.0	92.2	79.0	90.6
95.5	92.1	77.5	90.5
95.0	92.0	76.0	90.4
94.0	91.9	74.5	90.3
93.0	91.8	73.0	90.2
92.0	91.7	71.5	90.1
91.0	91.6	70.0	90.0
90.0	91.5	0	<90.0

G. Removal and Replacement

Remove and replace, or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements, at no additional cost to the Owner.

H. Quality Control Testing and Inspection:

1. The Contractor shall at his own expense perform quality control testing and inspection as necessary for the Contractor to control operations to provide HMA paving meeting the requirements of these specifications.

2. The Contractor shall be responsible to obtain sufficient cores at his own expense, for each sublot, each paving lift, and each paving phase. Payment reduction shall be calculated based on the available core test results.

3. Testing and inspection by the Owner shall not relieve the Contractor of responsibility to control the work quality and performance.

END OF SECTION 02741

SUPPORTING INFORMATION

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Costco CW# 17-0230 ■ Lake Stevens, WA

5/29/2018 ■ Terracon Project No. 81185028

SAMPLING	WATER LEVEL	FIELD TESTS
Modified Dames & Moore Ring Sampler Grab Sample Standard Penetration Test	**Water Initially Encountered** **Water Level After a Specified Period of Time** **Water Level After a Specified Period of Time** Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** Standard Penetration Test Resistance (Blows/Ft.) **(HP)** Hand Penetrometer **(T)** Torvane **(DCP)** Dynamic Cone Penetrometer **UC** Unconfined Compressive Strength **(PID)** Photo-Ionization Detector **(OVA)** Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	19 - 58	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	> 99	Very Stiff	2.00 to 4.00	15 - 30
			Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	**Descriptive Term(s) of other constituents**	**Percent of Dry Weight**
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12

GRAIN SIZE TERMINOLOGY		PLASTICITY DESCRIPTION	
Major Component of Sample	**Particle Size**	**Term**	**Plasticity Index**
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

UNIFIED SOIL CLASSIFICATION SYSTEM

Costco Wholesale CW# 17-0230 ■ Lake Stevens, Washington

May 29, 2018 ■ Terracon Project No. 81185028

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ³ 4 and 1 £ Cc £ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or 1 > Cc > 3 [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ³ 6 and 1 £ Cc £ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or 1 > Cc > 3 [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K, L, M, N]
						Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K, L, M, P]
						Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ³ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ³ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

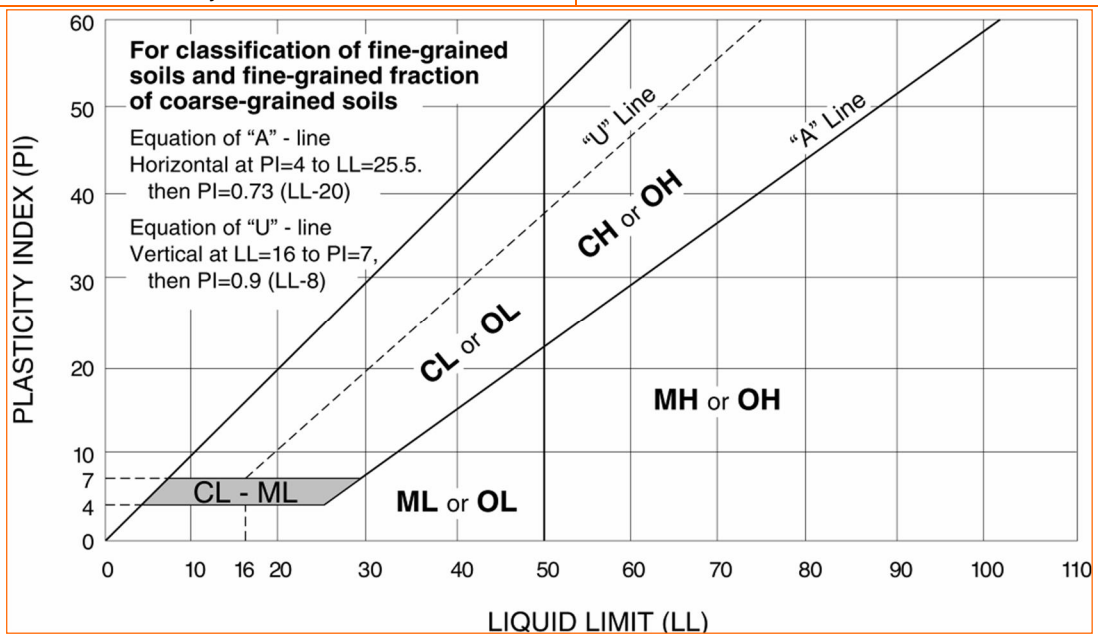
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ³ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ³ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ³ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.