Tab 6.0

6.0 SPECIAL REPORTS AND STUDIES

- Geotechnical Engineering Study prepared by Kleinfelder, Inc.

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October 19, 2011
Kleinfelder Project No.: 121302

Costco Wholesale
999 Lake Drive
Issaquah, WA 98027

Attn: Ms. Kim Sanford, Director of Real Estate Development

Subject: Geotechnical Engineering Report
Proposed Parking Lot Addition (Guynup Property)
Kirkland Costco Warehouse No. 8
8629 120th Avenue, NE
Kirkland, Washington
Costco Wholesale Project CW#11-0157-01

Dear Kim:

This letter transmits one electronic copy (portable document format) of our geotechnical engineering report for the proposed parking lot addition at the Kirkland Costco Warehouse in Kirkland, Washington. This report was prepared in accordance with our proposal dated July 28, 2011.

We appreciate the opportunity to provide geotechnical services to you on this project. Please contact the undersigned at (425) 562-4200, or Andy Franks, Kleinfelder's Senior Client Service Manager at (801) 261-3336 if you have any questions regarding this report, or if we can provide assistance with other aspects of the project.

Sincerely,
KLEINFELDER WEST, INC.

Marcus Byers

Marcus Byers, P.E.
Senior Geotechnical Engineer
Senior Project Manager

Attachment: October 19, 2011, Geotechnical Engineering Report

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Prepared for:
Costco Wholesale
999 Lake Drive
Issaquah, WA 98027

Geotechnical Engineering Report
Proposed Parking Lot Addition (Guynup Property)
Kirkland Costco Warehouse No. 8
8629 120th Avenue, NE
Kirkland, Washington
Costco Wholesale Project CW#11-0157-01

Prepared by:

David M. Cotton, P.E,
Principal Geotechnical Engineer

MARCUS BENNETT BYERS
STATE OF WASHINGTON
37351
REGISTERED
PROFESSIONAL ENGINEER
10/19/11

Marcus B. Byers, P.E.
Senior Geotechnical Engineer
Senior Project Manager

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October 19, 2011
Kleinfelder Project No. 121302

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Appendix C Prior Explorations by Others
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EXECUTIVE SUMMARY

PROPOSED PARKING LOT ADDITION (GUYNUP PROPERTY)
COSTCO WAREHOUSE NO. 8
KIRKLAND, WASHINGTON

The project involves expansion of an existing parking lot by adding four rows of parking to the south, in an undeveloped lot east of the Costco Kirkland Warehouse No. 8, located at 8629 120th Avenue NE in Kirkland, Washington. Site grading will require cuts up to about 7 feet high. Grade transitions will include 2H:1V cut slopes.

Based on the results of our subsurface exploration and engineering analyses, we present the following key geotechnical conclusions:

- Cuts will expose a subgrade consisting of fill and/or the old topsoil horizon. These soils consist of silty sand and silt, with potential for organics or debris. These soils are moisture sensitive and will not be suitable for compaction during wet weather.
- The parking area will be subject to car traffic only. The recommended Standard Duty pavement section is 3 inches of HMA over 6 inches crushed rock in accordance with Costco Wholesale Development Requirements.
- Performance Grade binder (PG) 58-16 is appropriate for the project.
- We recommend a French drain be installed along the south and east perimeter of the parking lot.

This summary should only be used in conjunction with the full text contained in the pavement design report.

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1.0 INTRODUCTION AND SCOPE

1.1 GENERAL

This report presents the results of Kleinfelder's geotechnical engineering study for the design and construction of the proposed parking lot expansion at the Costco Wholesale Warehouse in Kirkland, Washington. The project site is located east of the existing Warehouse at 8629 120th Avenue NE as shown on the Vicinity Map, Figure 1.

Previously, ABPB Consulting prepared a report titled Geotechnical Evaluation, Proposed Parking Lot (Parcel #1238500110), Rose Hill Shopping Center dated November 5, 2010. The ABPB report contains recommendations for development of the Guynup parcel into a parking lot with a fill retaining wall at the north boundary of the parcel.

1.2 PROJECT DESCRIPTION

Our understanding of the project is based on conversations with and information provided by Barghausen Consulting Engineers Inc. (Barghausen), including a site grading plan dated September 23, 2011. As currently envisioned, the project includes expansion of an existing parking lot by adding four rows of parking to the south in an undeveloped lot as shown on the Site and Exploration Plan, Figure 2. At the time of our explorations, preliminary grading plans called for cuts up to 8 feet and construction of a retaining wall on the south and east sides of the parking lot. Current plans call for 2H:1V slopes at the north and south sides of the proposed expansion with no retaining walls. We understand the proposed parking lot will only be subject to passenger vehicle traffic.

1.3 AUTHORIZATION AND SCOPE OF SERVICES

The purpose of our study was to explore subsurface conditions at the site and provide geotechnical recommendations for design and construction of the proposed parking lot. Our scope of services was consistent with that presented in our proposal dated July 28, 2011, and included:

- **Field Exploration:** Soil and groundwater conditions at the Guynup parcel were explored with four borings extending to a depth of 20 feet.
- **Laboratory Testing:** Geotechnical laboratory testing included 12 natural moisture content tests and 5 grain size distribution tests.

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- **Geotechnical Analysis:** Engineering analyses were performed as a basis for developing geotechnical design and construction recommendations.
- **Geotechnical Report:** The results of our study are presented in this geotechnical engineering report.

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2.0 SITE EXPLORATION AND LABORATORY TESTING

2.1 SITE EXPLORATION

The site exploration program was conducted under full-time observation of a Kleinfelder geotechnical engineer on August 9, 2011. The exploration program included four hollow-stem auger borings, designated B-1 through B-4, advanced to a depth of 21½ feet at the locations shown on the Site and Exploration Plan, Figure 2. Borings B-1 and B-2 were advanced on the south side of the Guynup parcel, near a planned cut slope. Borings B-3 and B-4 were advanced on the south edge of the existing employee parking lot near the boundary with the Guynup parcel. Borings were advanced by Geologic Drill, operating under subcontract to Kleinfelder. No survey control was available at the time of our explorations. The exploration locations were determined by taping distances from existing site features and the locations and elevations should be considered approximate.

Soil samples were collected at 2½-foot intervals to a depth of 10 feet and at 5-foot intervals thereafter, using Standard Penetration Test (SPT) sampling techniques (ASTM D1586). The SPT consisted of driving a 1-3/8-inch inside diameter (2-inch outside diameter) split spoon sampler a distance of 18 inches into the bottom of the boring. The sampler was driven with a 140-pound hammer falling 30 inches. The hammer was controlled using a rope and cathead mechanism. The number of blows required to drive the sampler each of three 6-inch increments was recorded on the boring logs. The number of blows required for the last 12 inches of penetration is called the standard penetration resistance (N-value). This value is an indicator of the relative density of granular soils or the consistency of fine-grained soils.

Kleinfelder's geotechnical engineer examined and classified the materials encountered during the field exploration in accordance with ASTM D2487, obtained representative soil samples, and recorded pertinent information including soil sample depths, stratigraphy, soil engineering characteristics, and groundwater occurrence. Kleinfelder classified soil samples collected. All samples were placed in plastic jars to limit moisture loss, labeled, and returned to our laboratory for further examination and testing. Upon completion of drilling, the borings were backfilled with bentonite grout.

Summary logs of the explorations are presented in Appendix A. The stratification lines shown on the individual logs represent the approximate boundaries between soil types;

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actual transitions may be either more gradual or more severe. The conditions depicted are for the date and location indicated only, and it should not necessarily be expected that they are representative of conditions at other locations and times. All depth information is relative to the ground surface with no reference to elevation because survey data was not available at the time of this report.

ABPB Consulting completed a total of four test pits in the Guynup parcel for a prior study in 2010. The test pits were excavated to depths ranging from 12 to 14 feet below the existing site grade. We have included the logs from these borings in Appendix C.

2.2 LABORATORY TESTING

Laboratory tests were performed on selected soil samples in general accordance with ASTM standards to determine index and engineering properties of the site soils. Tests included 12 natural moisture content tests and six grain size distribution tests including fines. Laboratory test results are presented on laboratory test reports included in Appendix B and/or on the summary boring logs in Appendix A.

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3.0 SITE CONDITIONS

3.1 SURFACE CONDITIONS

Guynup parcel slopes down to the north and west with a maximum elevation change of about 10 feet. Slopes are steepest along the north edge of the parcel, where grades decrease and match the south edge of the existing employee parking lot. The site is vegetated with a mix of evergreen and deciduous trees and heavy underbrush, including blackberries.

3.2 GENERAL GEOLOGIC CONDITIONS

General geological information for the project area was obtained from the *Geologic Map of the Kirkland Quadrangle, Washington* (Minard, 1983). According to the map, the project area is underlain by advance outwash. Advance outwash generally consists of glacially overridden sand and gravel soils with low silt content. Fine grained sand and some silt are common in the lower part of the unit but occur sparingly in the upper part.

3.3 SOIL CONDITIONS

Soil conditions encountered in our explorations were generally consistent with those described in the geologic mapping discussed in Section 3.2 as well as those described in the ABPB Consulting report discussed in Section 1.1. Our explorations indicate the site is underlain by fill overlying an old topsoil horizon, which in turn overlies advance outwash. Soils encountered are described in the order encountered as follows:

- **Fill:** Fill was encountered in borings BH-1 and BH-2 and extended to a depth of about 8 feet. The fill generally consisted of gray, medium dense silty sand with gravel. Standard penetration test (SPT) N-values ranged from about 11 blows per foot (b/ft) to 25 b/ft. Fill conditions described in the ABPB report noted scattered fragments of wood, a few tire fragments, and some concrete and asphalt.
- **Old Topsoil Horizon:** An old top soil horizon was encountered below the fill in boring BH-1 and BH-2. The topsoil horizon consisted of dark brown silt with sand and trace organics. Based on SPT N-values ranging from about 12 b/ft to 15 b/ft, the topsoil horizon is interpreted to grade into a weathered advance outwash material. A similar layer of dark brown silt to silty sand was encountered at the ground surface in boring BH-3 and BH-4, though this material did not contain significant organics.

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- **Advance Outwash:** Advance glacial outwash was encountered at depths ranging from 3 to 8 feet. These soils generally consisted of gray, medium dense to dense silty sand to sand with silt. The SPT values ranged from12 b/ft to 40 b/ft. An increase in SPT values was generally observed with increased depth.

3.4 GROUNDWATER CONDITIONS

Groundwater seepage was not encountered in any of our explorations, as evidenced from a wet sampler or free water in the sample. However, soil moisture conditions appeared to increase at about 10 feet below the existing site grades, suggesting the presence of a groundwater table at that depth. In addition, low lying ground north of the existing employee parking lot is often wet during the winter months, suggesting a shallow ground water table. Ground water levels at the site will fluctuate seasonally, generally being highest in the winter and spring, or following periods of prolonged precipitation. Exploration was performed in the season and likely represents a seasonally low groundwater table.

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4.0 DESIGN RECOMMENDATIONS

4.1 ASPHALT AND PORTLAND CEMENT CONCRETE PAVEMENTS

4.1.1 Design Assumptions

We understand that pavements in the parking area will consist of standard duty flexible asphalt. Pavement design recommendations were developed using the following traffic loading assumptions provided in the Costco development guidelines:

- A pavement design life of 20 years; and
- A Traffic Index of 5.0.

Based on the soils encountered in the explorations, we anticipate that cuts will expose a subgrade consisting of fill and/or the old topsoil horizon. Prior to placing crushed surfacing rock, all subgrade should be prepared as discussed in Section 5.1.3 of this report. Our analyses assumed an average subgrade resilient modulus of 6,000 psi, which corresponds roughly to a CBR of 4.

4.1.2 Asphaltic Concrete Pavement

Asphaltic concrete pavement, also referred to as Hot Mix Asphalt (HMA) was designed in accordance with the Asphalt Institute Manual Series MS-1. We recommend that all HMA be compacted to a minimum of 92 percent of the rice maximum density in accordance with ASTM D2041. The recommended heavy duty HMA pavement section is presented in Table 1.

Table 1: Recommended Minimum HMA Pavement Sections

	Material	Layer Thickness (inches)
Standard Duty	HMA	3
	Crushed Surfacing	6

Crushed surfacing should conform to the requirements of Section 9-03.9(3) Crushed Surfacing Top Course or Base Course of the *WSDOT Standard Specifications* and be compacted to a minimum of 95 percent relative compaction per ASTM D1557.

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4.1.3 Asphaltic Performance Grade Binder

Performance Grade binder (PG) 58-16 is appropriate for the project. Binder selection was performed in accordance with Costco Wholesale Specifications Section 02741. Air temperature data for the five data stations nearest the project site was averaged and the PG was selected using the FHWA program LTTPBind Version 3.1. The high-end temperature rating was selected as one grade higher that the 98% reliability binder and the low-end temperature was selected to provide a reliability of at least 90%.

4.2 PERMANENT SLOPES

We recommend that permanent slopes be graded no steeper than 2H:1V for long-term stability and that slopes be vegetated or otherwise protected to minimize erosion. However, establishing vegetation on 2H:1V slopes can be difficult and irrigation could contribute to erosion and sloughing. Therefore, it may be desirable to grade slopes at a flatter 3H:1V to reduce erosion potential and provide for easier vegetation.

4.3 DRAINAGE CONSIDERATIONS

We recommend a French drain be installed along the south and east perimeter of the parking lot to intercept potential seepage. The drain should be installed to a minimum depth of 18 inches, consist of a minimum 4-inch diameter slotted pipe, and be surrounded with a minimum 6 inches of drain rock.

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5.0 CONSTRUCTION RECOMMENDATIONS

5.1 EARTHWORK

5.1.1 Excavation

We anticipate that excavation of the on-site fill soils can generally be performed with conventional earthmoving equipment such as bulldozers and trackhoe excavators. The contractor should be prepared to excavate boulders, cobbles, stumps or potential debris that may be encountered.

5.1.2 Clearing, Grubbing and Demolition

Prior to site grading, all grass, brush, and trees should be removed and properly disposed of offsite. Roots greater than 1-inch in diameter should be removed along with all root balls. We estimate topsoil stripping will generally be 6 inches deep with some localized areas up to 12 inches deep.

5.1.3 Subgrade Preparation

After excavations have been completed to the planned subgrade elevations the entire exposed subgrade should be evaluated by a Kleinfelder representative. Subgrade should be evaluated by proof-rolling with two passes of a fully-loaded dump truck or water truck. Any soft, yielding or unsuitable areas identified by the Kleinfelder representative should be over-excavated to the depth determined by the geotechnical engineer and replaced with compacted structural fill.

If excessively soft or yielding subgrade, fill debris or organic materials are encountered, the soils should be over-excavated as directed by a Kleinfelder representative. Following over-excavation and prior to placement of structural fill, the subgrade should be covered with a geotextile fabric conforming to the requirements of Section 9-33 Geotextile for Soil Stabilization of the Washington Department of Transportation (WSDOT) *Standard Specifications*.

Following subgrade evaluation, all exposed subgrade areas should be thoroughly compacted with a vibratory drum roller or vibratory hoepack compactor. The purpose of the recompaction is to compact any loose soils that may be present below the exposed subgrade and minimize potential for future settlement.

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5.1.4 Weather Considerations

The on-site soils contain a high amount of fines and are expected to be moisture sensitive. These soils will only be suitable for re-use as structural fill during dry weather. If major earthwork is planned during the drier summer months, use of imported soils will likely not be required. However, we recommend that a unit cost and contingency for import of granular structural fill and export of on-site soils be included in the contract documents.

During wet weather, the contractor should take measures to protect the exposed subgrade and limit construction traffic once the geotechnical engineer has approved them. These measures could include, but are not limited to, placing a layer of crushed rock or covering the exposed subgrade with a plastic tarp. If additional over-excavation is required because the subgrade was not protected, the cost of such additional work should be borne by the contractor.

5.2 STRUCTURAL FILL MATERIALS AND COMPACTION

Material placed below pavements should be considered structural fill. Structural fill should consist of well-graded, free-draining sand and gravel free from organics or other deleterious matter and have a maximum particle size of 6 inches. Imported structural fill material should conform to Section 9-03.14(1), Gravel Borrow, of the *WSDOT Standard Specifications.*

The contractor should submit samples of each of the required earthwork materials to the geotechnical engineer for evaluation and approval prior to use. The samples should be submitted at least 4 days prior to their use and sufficiently in advance of the work to allow the contractor to identify alternative sources if the material proves unsatisfactory.

Structural fill should be moisture conditioned to within 3 percent of the optimum moisture content prior to compaction and should be placed in maximum 8-inch thick lifts.

All structural fill should be compacted to a dense and unyielding condition and to a minimum of 95 percent of the modified Proctor maximum dry density as determined per ASTM D1557.

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5.3 TEMPORARY EXCAVATIONS AND SLOPES

All excavations and slopes must comply with applicable local, state, and federal safety regulations including the current OSHA Excavation and Trench Safety Standards and WISHA Safety Standards for Construction Work. Construction site safety is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. We are providing soil type information solely as a service to our client for planning purposes. Under no circumstances should the information be interpreted to mean that Kleinfelder is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

The soils encountered in our explorations generally classify as Type C soils and excavations in these materials should be inclined no steeper than 1½H:1V per WAC 295-115. Heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed near the top of any excavation. Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning may be required to provide structural stability and to protect personnel working within the excavation. Earth retention, bracing, or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Washington.

Temporary excavations and slopes should be protected from the elements by covering with plastic sheeting or some other similar impermeable material. Sheeting sections should overlap by at least 12 inches and be tightly secured with sandbags, tires, staking, or other means to prevent wind from exposing the soils under the sheeting.

Trench and excavation backfill should be placed and compacted as described in Section 5.2. Pipe bedding material should conform to the manufacturers' recommendations. Particular care should be taken to make sure bedding or fill material is properly compacted in place to provide adequate support to the pipe. Jetting or flooding is not a substitute for mechanical compaction and should not be allowed.

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6.0 ADDITIONAL SERVICES

The recommendations made in this report are based on the assumption that an adequate program of tests and observations will be made during construction to verify compliance with these recommendations. Testing and observations performed during construction should include, but not necessarily be limited to, the following:

- Observations and testing during site preparation, earthwork, structural fill, and pavement section placement;
- Testing and inspection of asphalt and concrete; and
- Consultation as may be required during construction.

We further recommend that project plans and specifications be reviewed by us to verify compatibility with our conclusions and recommendations.

Also, Kleinfelder retains fully accredited, WABO-certified laboratory and inspection personnel, and are available for this project's testing and inspection needs. Information concerning the scope and cost for these services can be obtained from our office.

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7.0 LIMITATIONS

Recommendations contained in this report are based on the field explorations and our understanding of the proposed project. The investigation was performed using a mutually agreed upon scope of services. It is our opinion that this study was a cost-effective method to explore the subject site and evaluate the potential geotechnical concerns.

The soils data used in the preparation of this report were obtained from exploratory borings completed for this study. It is possible that variations in soil and groundwater conditions exist between the points explored. The nature and extent of these variations may not be evident until construction occurs. If soil or groundwater conditions are encountered at this site that are different from those described in this report, our firm should be immediately notified so that we may make any necessary revisions to our recommendations. In addition, if the scope of the proposed project, locations of facilities, or design building loads change from the descriptions given in this report, our firm should be notified.

The scope of our services does not include services related to construction safety precautions and our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.

This report has been prepared for use in design for development of the subject property by Costco Wholesale, MulvannyG2 and their design consultants in accordance with the generally accepted standards of practice at the time the report was written. No warranty, express or implied, is made.

This report may be used only by Costco Wholesale, MulvannyG2 and their design consultants and only for the purposes stated within a reasonable time from its issuance, but in no event should this time exceed 12 months from the date of the report. Land or facility use, site conditions (both on- and off-site), regulations, advances in man's understanding of applied science, and/or other factors may change over time and could materially affect our findings and may require additional work. Therefore, this report should not be relied upon after 12 months from its issue. Kleinfelder should be notified if the project is delayed by more than 12 months from the date of this report so that a

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review of site conditions can be made, and recommendations revised if appropriate. Any party other than Costco Wholesale and MulvannyG2, or their design consultants who wishes to use this report, shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued.

It is the responsibility of Costco Wholesale and MulvannyG2 to see that all parties to the project including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk. Further guidelines and information on this geotechnical report can be found in the ASFE publication entitled Important Information About Your Geotechnical Engineering Report, which is included for your reference in Appendix E of this report.

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8.0 REFERENCES

Geologic Map of the Kirkland Quadrangle, Washington ,Minard, 1983.

2009 International Building Code, International Code Council.

Washington State Department of Transportation *Standard Specifications for Road, Bridge, and Municipal Construction 2010.*

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ENCLOSURE 4

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Figures

PLOTTED: 18 Oct 2011, 4:50pm, JStewart

LAYOUT: Vicinity

CAD FILE: C:\Users\JStewart\appdata\local\temp\AcPublish_7008\

Images: Aerial.jpg Images: Guynup Prelim Grading.png Images: Vicinity.tif

ATTACHED IMAGES:
ATTACHED XREFS:
SEATTLE, WA

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PROJECT NO.	121302
DRAWN:	September 2011
DRAWN BY:	J.S.
CHECKED BY:	S.F.
FILE NAME:	121302_Figs.dwg

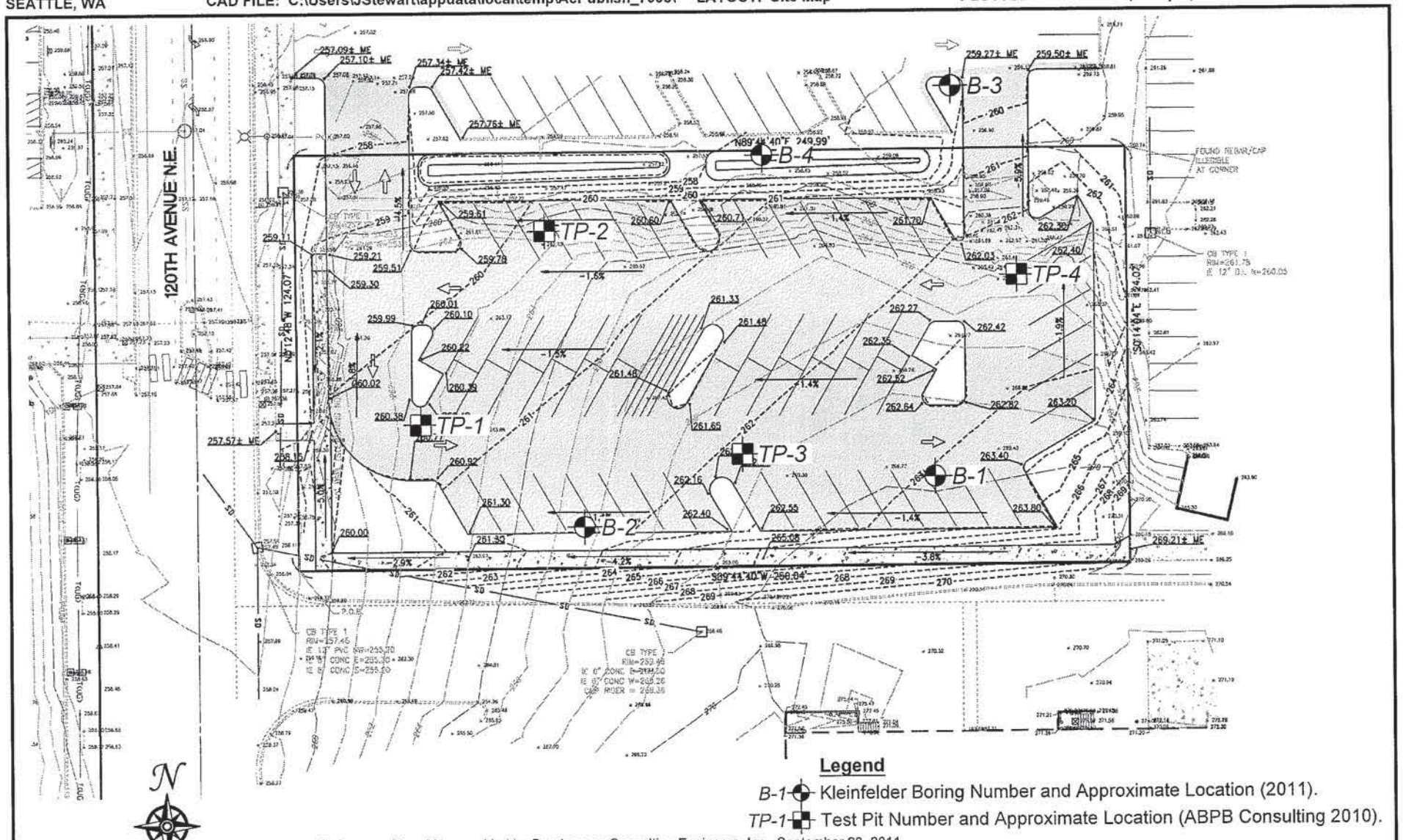
Vicinity Map

Proposed Parking Lot
Costco Warehouse #8
8629 120th Avenue NE
Kirkland, Washington

FIGURE

1

ATTACHED IMAGES: Images: Aerial.jpg Images: Guynup Prelim Grading.png Images: Vicinity.tif
ATTACHED XREFS:
SEATTLE, WA CAD FILE: C:\Users\JStewart\appdata\local\temp\AcPublish_7008\ LAYOUT: Site Map PLOTTED: 18 Oct 2011, 4:50pm, JStewart



Legend

B-1 Kleinfelder Boring Number and Approximate Location (2011).

TP-1 Test Pit Number and Approximate Location (ABPB Consulting 2010).

Reference: Base Map provided by Barghausen Consulting Engineers, Inc., September 23, 2011.

N

0 40

Scale in Feet

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PROJECT NO.	121302
DRAWN:	September 2011
DRAWN BY:	J.S.
CHECKED BY:	M.B.
FILE NAME:	121302_Figs.dwg

Site and Exploration Plan

Proposed Parking Lot
Costco Warehouse #8
8629 120th Avenue NE
Kirkland, Washington

FIGURE
2

ENCLOSURE 4

ENCLOSURE 4

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Appendix A

APPENDIX A
FIELD EXPLORATIONS

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Boring Number: B-1	**Location:** SE Guynup Property	**Drilling Method:** Hollow-stem auger
Boring Total Depth: 21.5 ft	**Coordinates (X/Y, Lat/Long):** ft / ft	**Drilling Equipment:** XL Trailer Drill
Depth to Rock: No Rock was Encountered	**Datum/Coordinate System:** No Survey	**Drilling Company:** Geologic Drill
Date Begin/End: 08-09-11 / 08-09-11	**Top of Boring Elevation:** 269.0 ft	**Bit Size/Type:** 8-inch
Surface Conditions: Grass	**Coordinate Data Source:** None	**Hammer Type/Method:** Cathead
WL Measurement Point: Ground Surface	**Depth to Groundwater Initial/Time:**	**Hammer Drop/Weight:** 30 in. / 140 lbs.
Logged By: S. Flowers	**Depth to Groundwater Final/Time:**	**Angle From Horizontal/Bearing:** -90°

Depth (ft)	Elevation (ft)	Sample Type Symbol	Sample Number	Blows per 6 in.	Pocket Pen. (tsf)	Graphic Log	ASTM Symbol	Field Soil Description & Classification: Description (The report and log key are an integral part of these logs. All data and interpretations in this log are subject to those stated explanations and limitations.)	Consistency / Apparent Density	Plasticity	Laboratory: Plasticity Index	Liquid Limit	Water Content (%)	Dry Unit Weight (pcf)	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests and Field Notes
							SM	3-inch sod mat **Silty SAND** (SM): gray, moist, fine to coarse sand, some fine, subangular gravel (FILL)	Md								
			S1	8 10 13									6				
5	264.0		S2	9 11 14									8		85	26	
			S3	12 10 9			ML	**SILT With Sand** (ML): dark brown, moist to wet, fine to medium sand, trace to some organic content (OLD TOPSOIL HORIZON)	Md	Np			20				
10	259.0		S4	5 7 8			SM	**Silty SAND** (SM): gray, wet, fine to medium sand (ADVANCE OUTWASH)	D				16				
15	254.0		S5	12 14 17			SP-SM	**SAND With Silt** (SP-SM): gray, wet, fine to medium sand (ADVANCE OUTWASH)	D				15		90	7	
20	249.0		S6	12 14 18				Grades to brown									The boring was backfilled with bentonite chips.
								Boring completed at a depth of 21.5 ft below existing site grade.									

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Project Number: 121302	**BORING LOG B-1**
Date: 08-09-11	
Entry By: S. Flowers	Proposed Parking Lot Costco Wholesale No. 8 8629 120th Avenue NE Kirkland, Washington
Checked By: K. Deputy	
File Name:	

Plate 1 of 1 **3**

SOIL BORING LOG KLEINFELDER_GINT_TEMPLATE_VER_2.GDT KLEINFELDER GINT STD LIBRARY R4.GLB 121302 COSTCO KIRKLAND GUYNUP.GPJ 10/18/11

Boring Number: B-2	**Location:** SW Guynup Property	**Drilling Method:** Hollow-stem auger
Boring Total Depth: 21.5 ft	**Coordinates (X/Y, Lat/Long):** ft / ft	**Drilling Equipment:** XL Trailer Drill
Depth to Rock: No Rock was Encountered	**Datum/Coordinate System:** No Survey	**Drilling Company:** Geologic Drill
Date Begin/End: 08-09-11 / 08-09-11	**Top of Boring Elevation:** 266.0 ft	**Bit Size/Type:** 8-inch
Surface Conditions: Grass	**Coordinate Data Source:** None	**Hammer Type/Method:** Cathead
WL Measurement Point: Ground Surface	**Depth to Groundwater Initial/Time:**	**Hammer Drop/Weight:** 30 in. / 140 lbs.
Logged By: S. Flowers	**Depth to Groundwater Final/Time:**	**Angle From Horizontal/Bearing:** -90°

Depth (ft)	Elevation (ft)	Sample Type Symbol	Sample Number	Blows per 6 in.	Pocket Pen. (tsf)	Graphic Log	ASTM Symbol	Field Soil Description & Classification: *The report and log key are an integral part of these logs. All data and interpretations in this log are subject to those stated explanations and limitations.* Description	Consistency / Apparent Density	Plasticity	Laboratory: Plasticity Index	Liquid Limit	Water Content (%)	Dry Unit Weight (pcf)	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests and Field Notes
								5-inch sod mat									
							SM	**Silty SAND** (SM): gray, moist, fine and medium sand, some fine gravel (FILL)	Md								
			S1	10 7 8									10				
5	261.0		S2	5 5 6									14				
			S3a	5 4	2.0			Becomes wet					31		96	32	
			S3b	3/0"			ML	**SILT With Sand** (ML): dark brown, moist to wet, trace to some organic content (OLD TOPSOIL HORIZON)	Md	Np							
10	256.0		S4	4 5 7									20				
							SP-SM	**SAND With Silt** (SP-SM): gray, wet (ADVANCE OUTWASH)	Md								
15	251.0		S5	10 12 16				grades to gray	Md								
20	246.0		S6	15 17 17				grades to brown	D								The boring was backfilled with bentonite chips.
								Boring completed at a depth of 21.5 ft below existing site grade.									

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Project Number: 121302	**BORING LOG B-2**	**Plate** 1 of 1
Date: 08-09-11		**4**
Entry By: S. Flowers	Proposed Parking Lot Costco Wholesale No. 8 8629 120th Avenue NE Kirkland, Washington	
Checked By: K. Deputy		
File Name:		

SOIL BORING LOG KLEINFELDER_GINT_TEMPLATE_VER_2.GDT KLEINFELDER.GINT STD LIBRARY R4.GLB 121302 COSTCO KIRKLAND GUYNUP.GPJ 10/18/11

Boring Number: B-3	**Location:** E Employee Parking	**Drilling Method:** Hollow-stem auger
Boring Total Depth: 21.5 ft	**Coordinates (X/Y, Lat/Long):** ft / ft	**Drilling Equipment:** XL Trailer Drill
Depth to Rock: No Rock was Encountered	**Datum/Coordinate System:** No Survey	**Drilling Company:** Geologic Drill
Date Begin/End: 08-09-11 / 08-09-11	**Top of Boring Elevation:** 258.0 ft	**Bit Size/Type:** 8-inch
Surface Conditions: Soil	**Coordinate Data Source:** None	**Hammer Type/Method:** Cathead
WL Measurement Point: Ground Surface	**Depth to Groundwater Initial/Time:**	**Hammer Drop/Weight:** 30 in. / 140 lbs.
Logged By: S. Flowers	**Depth to Groundwater Final/Time:**	**Angle From Horizontal/Bearing:** -90°

Depth (ft)	Elevation (ft)	Sample Type Symbol	Sample Number	Blows per 6 in.	Pocket Pen. (tsf)	Graphic Log	ASTM Symbol	Field Soil Description & Classification: Description (The report and log key are an integral part of these logs. All data and interpretations in this log are subject to those stated explanations and limitations.)	Consistency / Apparent Density	Plasticity	Laboratory: Plasticity Index	Liquid Limit	Water Content (%)	Dry Unit Weight (pcf)	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests and Field Notes
							ML	**SILT** (ML): dark brown, moist, some fine and medium sand	F	Np							
			S1	2 4 8	3.0										100	50	
							SM	**Silty SAND** (SM): gray, wet, fine and medium sand (ADVANCE OUTWASH)	Md								
5	253.0		S2	6 6 6													
			S3	10 11 14													
10	248.0		S4	13 17 21									16		99	26	
							ML	**SILT With Sand** (ML): gray, wet, fine and medium sand	Md	Np							
15	243.0		S5	6 8 11									14				
20	238.0		S6	8 6 10	2.5			Grades to moist									The boring was backfilled with bentonite chips.
								Boring completed at a depth of 21.5 ft below existing site grade.									

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Project Number: 121302	**BORING LOG B-3**	**Plate** 1 of 1
Date: 08-09-11		**5**
Entry By: S. Flowers	**Proposed Parking Lot** **Costco Wholesale No. 8** **8629 120th Avenue NE** **Kirkland, Washington**	
Checked By: K. Deputy		
File Name:		

SOIL BORING LOG KLEINFELDER_GINT_TEMPLATE_VER_2.GDT KLEINFELDER GINT STD LIBRARY R4.GLB 121302 COSTCO KIRKLAND GUYNUP.GPJ 10/18/11

Boring Number: B-4	**Location:** S Employee Parking	**Drilling Method:** Hollow-stem auger
Boring Total Depth: 21.5 ft	**Coordinates (X/Y, Lat/Long):** ft / ft	**Drilling Equipment:** XL Trailer Drill
Depth to Rock: No Rock was Encountered	**Datum/Coordinate System:** No Survey	**Drilling Company:** Geologic Drill
Date Begin/End: 08-09-11 / 08-09-11	**Top of Boring Elevation:** 258.0 ft	**Bit Size/Type:** 8-inch
Surface Conditions: Soil	**Coordinate Data Source:** None	**Hammer Type/Method:** Cathead
WL Measurement Point: Ground Surface	**Depth to Groundwater Initial/Time:**	**Hammer Drop/Weight:** 30 in. / 140 lbs.
Logged By: S. Flowers	**Depth to Groundwater Final/Time:**	**Angle From Horizontal/Bearing:** -90°

Depth (ft)	Elevation (ft)	Sample Type Symbol	Sample Number	Blows per 6 in.	Pocket Pen. (tsf)	Graphic Log	ASTM Symbol	Field Soil Description & Classification: Description	Consistency / Apparent Density	Plasticity	Laboratory: Plasticity Index	Liquid Limit	Water Content (%)	Dry Unit Weight (pcf)	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests and Field Notes
								11-inch sod and leaf mat									
							SM	**Silty SAND** (SM): dark brown, moist, fine and medium sand, trace organic content	Md								
			S1	4 5 6	3.0								24				
5	253.0		S2	7 7 10			SP-SM	**SAND** (SP-SM): gray, moist, fine and medium sand, some silt (ADVANCE OUTWASH)	Md								
			S3	10 7 17				Becomes wet	Md								
10	248.0		S4	13 14 19					D								
							SM	**Silty SAND** (SM): gray, moist, fine and medium sand	Md								
15	243.0		S5	7 13 13													
20	238.0		S6	16 18 22					D								The boring was backfilled with bentonite chips.
								Boring completed at a depth of 21.5 ft below existing site grade.									

The report and log key are an integral part of these logs. All data and interpretations in this log are subject to those stated explanations and limitations.

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Project Number: 121302	**BORING LOG B-4**
Date: 08-09-11	
Entry By: S. Flowers	Proposed Parking Lot Costco Wholesale No. 8 8629 120th Avenue NE Kirkland, Washington
Checked By: K. Deputy	
File Name:	

Plate 1 of 1

6

SOIL BORING LOG KLEINFELDER_GINT_TEMPLATE_VER_2.GDT KLEINFELDER GINT STD LIBRARY R4.GLB 121302 COSTCO KIRKLAND GUYNUP.GPJ 10/18/11

ENCLOSURE 4

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Appendix B

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APPENDIX B
GEOTECHNICAL LABORATORY TESTING

B.1 GENERAL

Kleinfelder conducted laboratory tests on selected representative soil samples to better identify the soil classification of the units encountered and to evaluate the material's general physical properties and engineering characteristics. A brief description of the tests performed for this study is provided below. The results of laboratory tests performed on specific samples are provided at the appropriate sample depths on the individual boring logs. However, it is important to note that these test results may not accurately represent in situ soil conditions. All of our recommendations are based on our interpretation of these test results and their use in guiding our engineering judgment.

In accordance with your requirements, the soil samples for this project will be retained a period of 6 months following completion of this report, or until the foundation installation is complete, unless we are otherwise directed in writing.

B.2 SOIL CLASSIFICATION

Our representative visually examined soil samples in the field at the time they were obtained. Our representative subsequently packaged and returned the samples to our laboratory where we reexamined them and checked and verified or modified the original description. With the help of information obtained from the other classification tests, described below, we described the samples in general accordance with the Unified Classification System, ASTM Standard D2487. The resulting descriptions are provided at the appropriate locations on the individual boring logs, located in Appendix A, and are qualitative only.

B.3 GRAIN-SIZE DISTRIBUTION

Klienfelder conducted detailed grain-size distribution analysis on five samples in general accordance with ASTM Standard D422 to determine the grain-size distribution of the on-site soil. Additionally, we analyzed the percent fines to determine the amount of material passing the U.S. Standard No. 200 size sieve (material less than 0.075 mm).

The information gained from this analysis allows us to provide a detailed description and classification of the in-place materials. In turn, this information helps us to understand

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how the in-place materials will react to conditions such as loading, potential liquefaction, and so forth.

B.4 MOISTURE CONTENT

Kleinfleder conducted moisture content tests on 12 samples obtained from the borings. The purpose of these tests is to approximately ascertain the in-place moisture content of the soil sample at the time it was collected. We determined the moisture content in general accordance with ASTM Standard D2216. The information obtained assists us by providing qualitative information regarding soil compactability and fines content. The results of these tests are presented at the appropriate sample depths on the exploration logs. Moisture content ranged from 5.0 to 27.3 percent in the samples tested.

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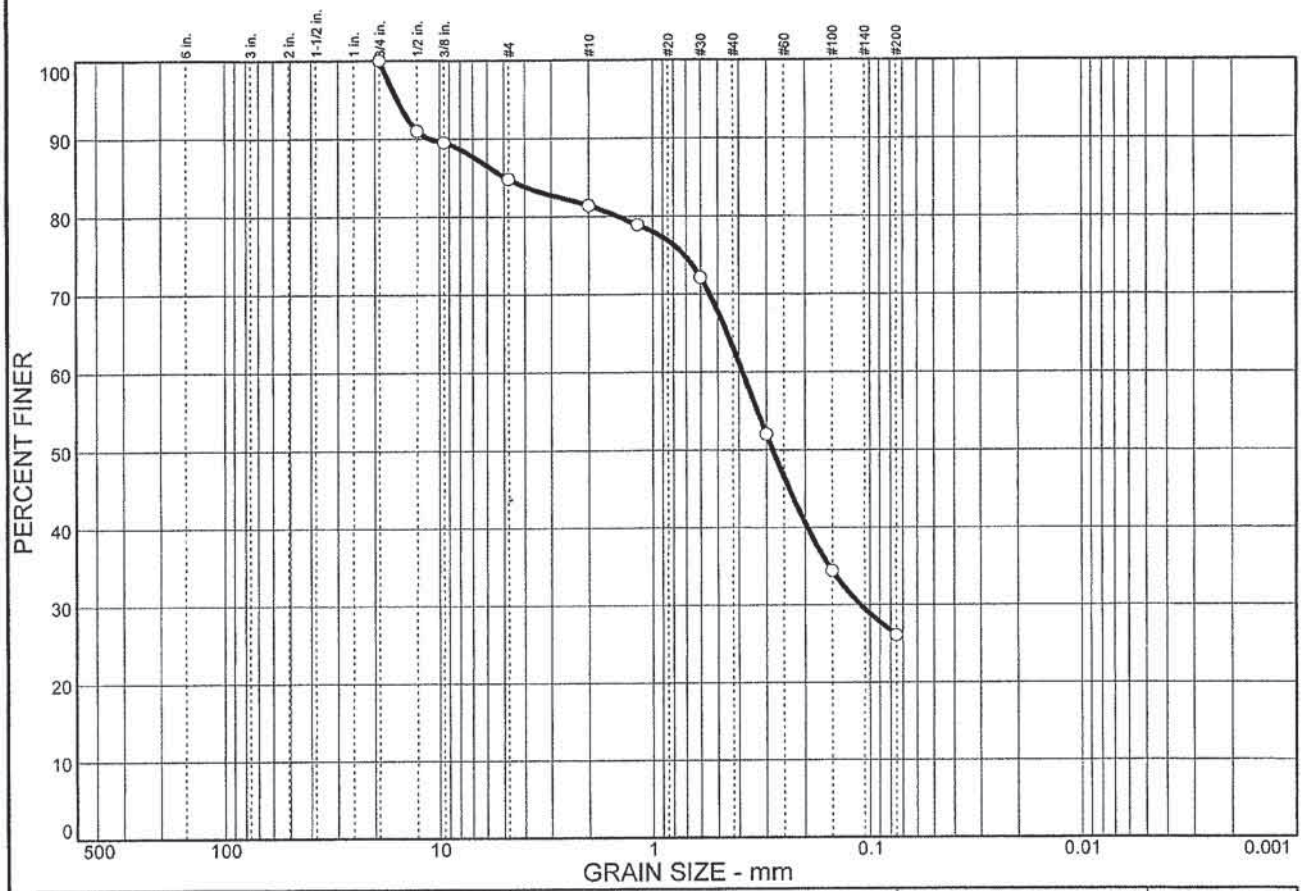
Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	15.2	58.7	26.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	91.0		
.375 in.	89.5		
#4	84.8		
#10	81.4		
#16	78.9		
#30	72.1		
#50	52.0		
#100	34.4		
#200	26.1		

* (no specification provided)

Soil Description

Silty sand with gravel
Laboratory Sample No.: 10521

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 4.90 D_{60}= 0.385 D_{50}= 0.281
D_{30}= 0.111 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

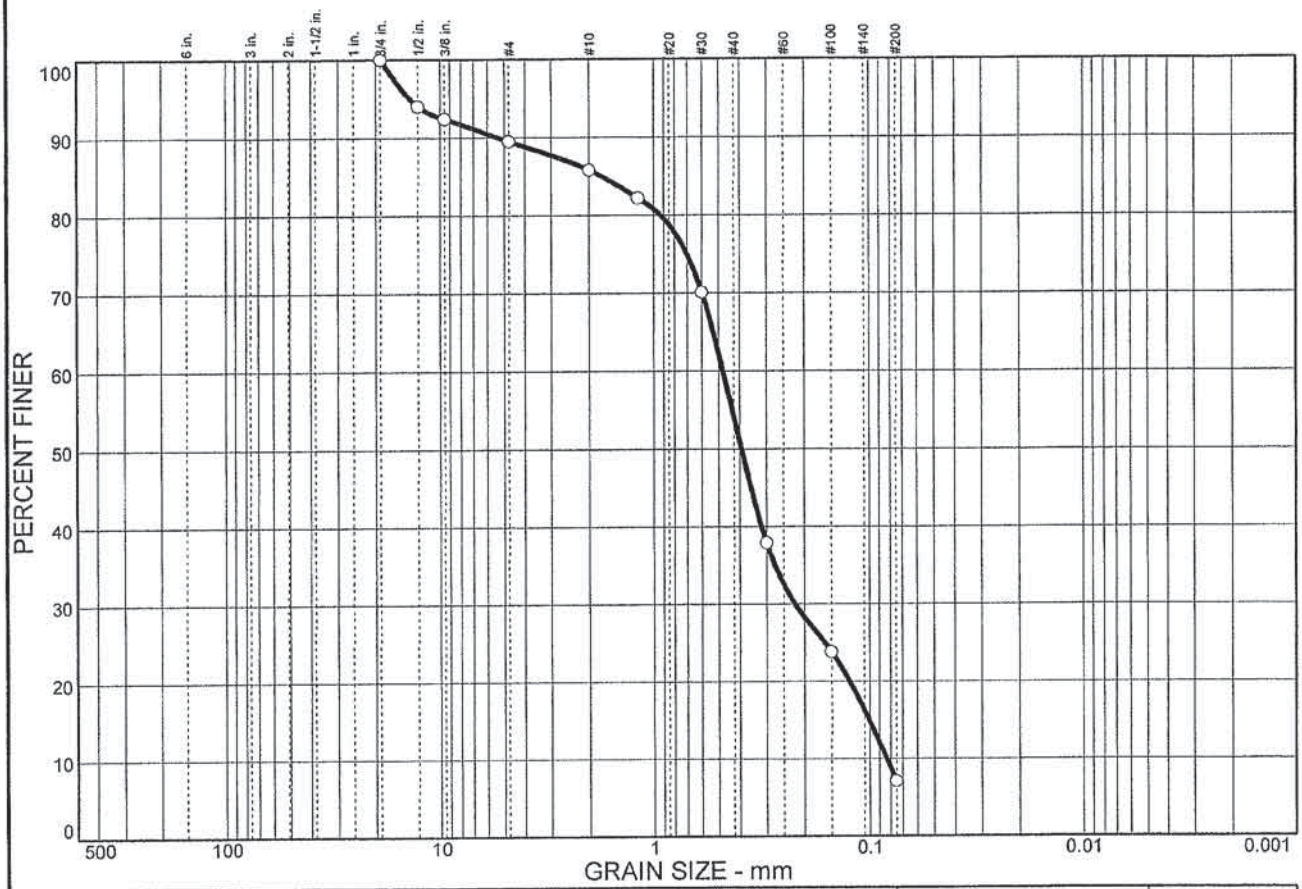
Sampled by: S. Flowers
Tested by: B. Della

Sample No.: S-2 **Source of Sample:** B-1 **Date:** 89/11/11
Location: **Elev./Depth:** 5.0'

KLEINFELDER, INC.

Client: Costco Wholesale
Project: Proposed Parking Lot, Costco Warehouse No. 8 Kirland, WA
Project No: 121302 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	10.5	82.4	7.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	94.0		
.375 in.	92.4		
#4	89.5		
#10	85.8		
#16	82.2		
#30	70.1		
#50	37.9		
#100	23.8		
#200	7.1		

* (no specification provided)

Soil Description

Poorly graded sand with silt
Laboratory Sample No.:10524

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 1.75 D_{60}= 0.478 D_{50}= 0.393
D_{30}= 0.222 D_{15}= 0.101 D_{10}= 0.0834
C_u= 5.73 C_c= 1.24

Classification

USCS= SP-SM AASHTO=

Remarks

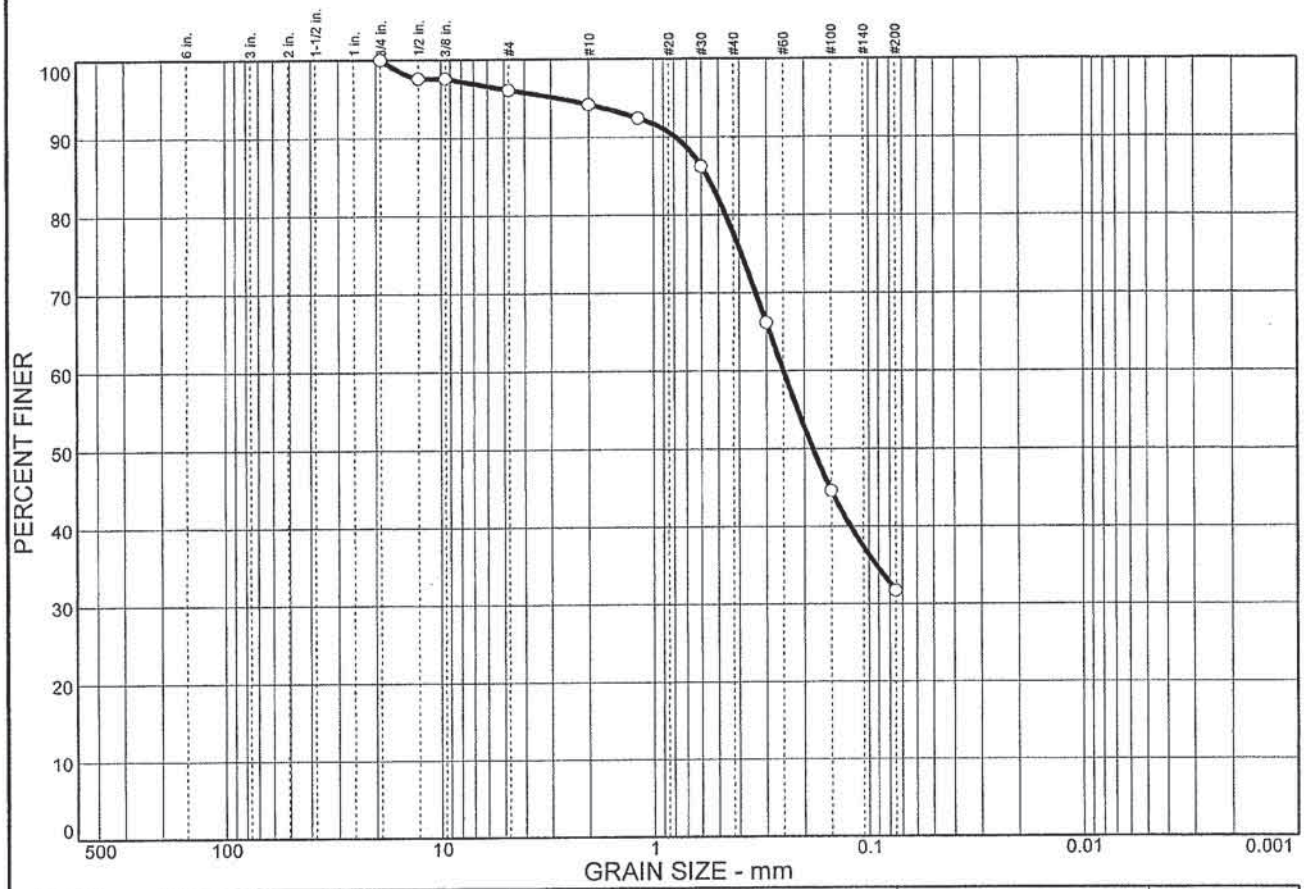
Sampled by: S. Flowers
Tested By: B.Della
Reviewed By: G.Kaechtel,Lab Manager

Sample No.: S-5 **Source of Sample:** B-1 **Date:** 8-11-11
Location: **Elev./Depth:** 15.0'

KLEINFELDER, INC.

Client: Costco Wholesale
Project: Proposed Parking Lot, Costco Warehouse No. 8 Kirland, WA
Project No: 121302 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	3.9	64.4	31.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	97.6		
.375 in.	97.6		
#4	96.1		
#10	94.2		
#16	92.4		
#30	86.2		
#50	66.2		
#100	44.6		
#200	31.7		

* (no specification provided)

Soil Description

Silty Sand
Laboratory Smaple no.: 10527

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.565 D_{60}= 0.250 D_{50}= 0.183
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

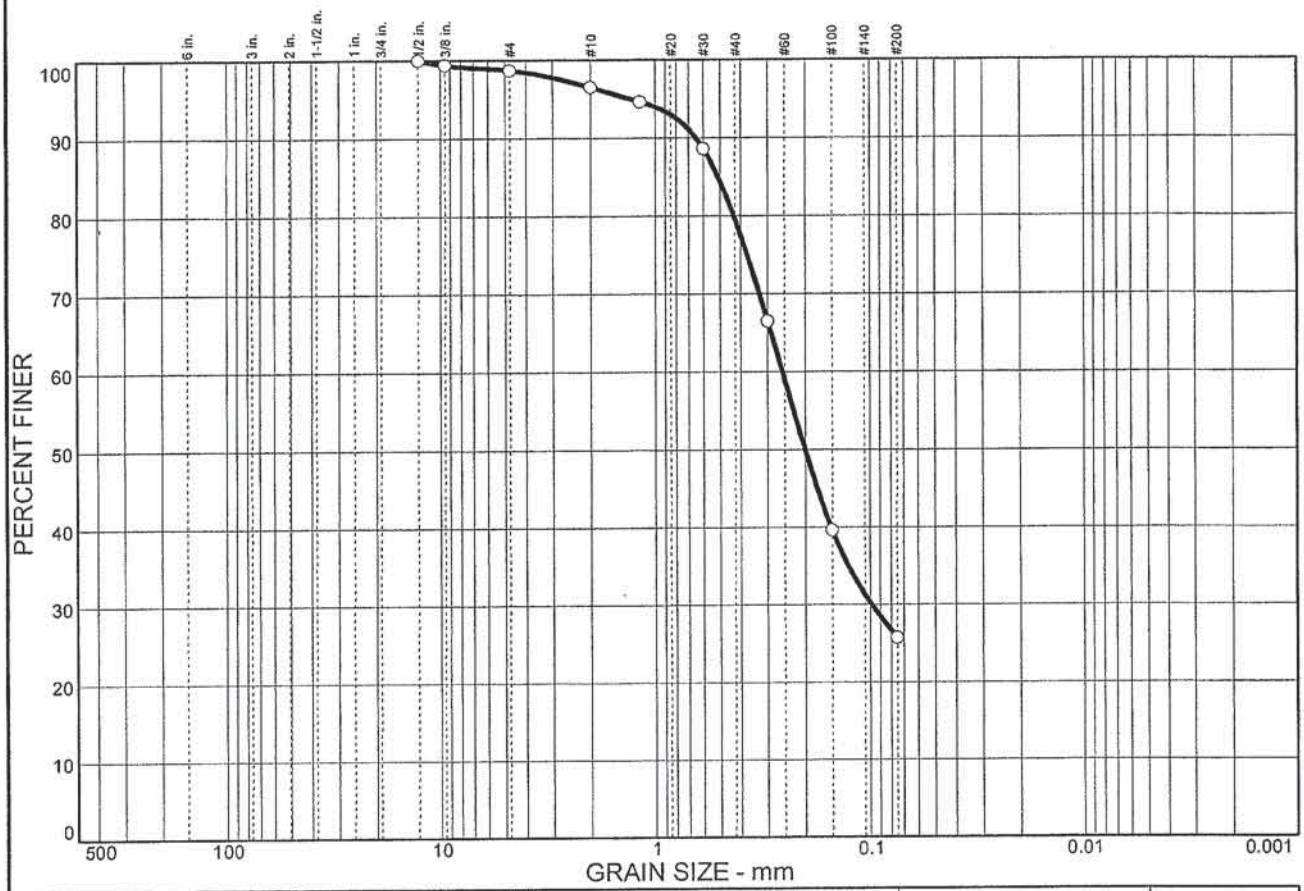
Sampled By: S.Flowers
Tested By: B.Della
Reviewed By: G.Knechtel, Lab Manager

Sample No.: S-3 **Source of Sample:** B-2 **Date:** 8/11/11
Location: **Elev./Depth:** 7.5'

KLEINFELDER, INC.

Client: Costco Wholesale
Project: Proposed Parking Lot, Costco Warehouse No. 8 Kirland, WA
Project No: 121302 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	1.3	73.0	25.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	100.0		
.375 in.	99.4		
#4	98.7		
#10	96.5		
#16	94.6		
#30	88.6		
#50	66.5		
#100	39.6		
#200	25.7		

* (no specification provided)

Soil Description

Silty sand
Laboratory Sample No.: 10529

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.513 D_{60}= 0.256 D_{50}= 0.201
D_{30}= 0.0986 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

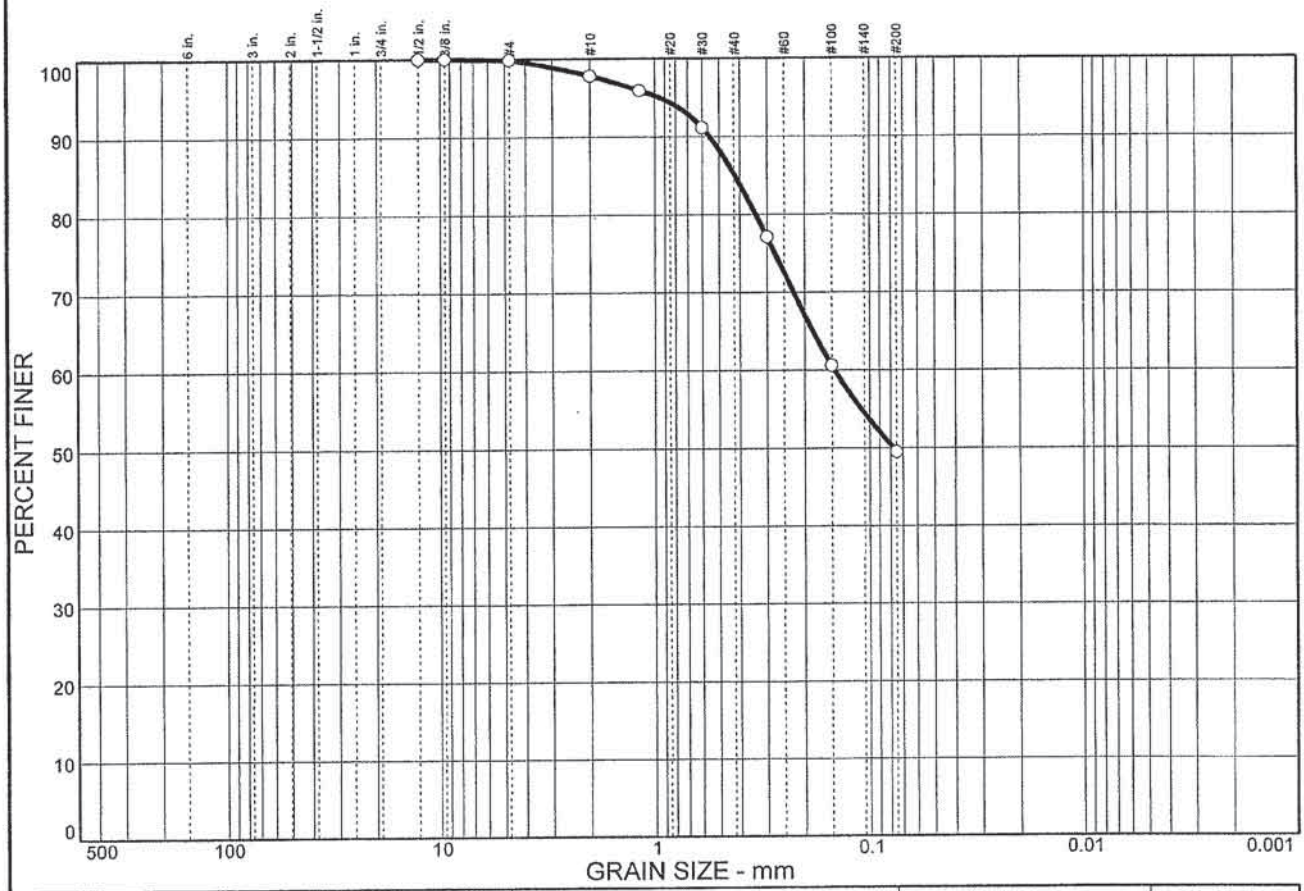
Sampled by: S.Flowers
Tested by: B.Della
Reviewed by:G.Knechtel, Lab Manager

Sample No.: S-4 **Source of Sample:** B-3 **Date:** 8/11/11
Location: **Elev./Depth:** 10'

KLEINFELDER, INC.

Client: Costco Wholesale
Project: Proposed Parking Lot, Costco Warehouse No. 8 Kirland, WA
Project No: 121302 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.1	50.4	49.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.50 in.	100.0		
.375 in.	100.0		
#4	99.9		
#10	97.8		
#16	95.9		
#30	91.1		
#50	77.1		
#100	60.6		
#200	49.5		

* (no specification provided)

Soil Description

Silty sand
Laboratory Sample No.:10530

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.423 D_{60}= 0.146 D_{50}= 0.0777
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sampled by; S.Flowers
Tested by:B.Della
Reviewed by: G.Knechtel,Lab Manager

Sample No.: S-5 **Source of Sample:** B-3 **Date:**
Location: **Elev./Depth:** 2.5'

KLEINFELDER, INC.

Client: Costco Wholesale
Project: Proposed Parking Lot, Costco Warehouse No. 8 Kirland, WA
Project No: 121302 **Figure**

ENCLOSURE 4

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Appendix C

APPENDIX C
PRIOR EXPLORATIONS BY OTHERS

Project :	**Rose Hill Parking Lot**		
Project No.	1233-1	**Date :**	10-26-10
Client :	Rose Hill Shpg. Ctr.	**Elevation**	261 feet
Location:	NW Corner	**Logged By:**	Paul Bonifaci

Test Pit TP - 1

SUBSURFACE PROFILE			SAMPLE			Field Strength Tests	Laboratory Results
Depth (ft)	Soil Lithology	Soil Description	Water Level	Sample	USCS		Moisture Content
0		Fill: (6 inches surface Sod), Tan brown to grey, silty gravelly SAND FILL, with scattered small concrete pieces, tire fragments, and small wood fragments, loose, wet grading to moist			SM		
-1							
-2							
-3							
-4							
-5							
-6							
-7							
-8		Peat: Brown to black brown, organic peaty Topsoil, loose, rooty, wet			PT		
-9							
-10		Sand: Grey tan, clean to slightly silty, fine to medium SAND, small roots, wet, loose to medium dense			SP		
-11							
-12		Groundwater seepage below 8 feet					

ABPB Consulting
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12525 Willows Road, Suite 80, Kirkland, Washington (425) 820-2544

Date : Nov. 2010	Project Name : Rose Hill Parking Lot	Figure 2

Project :	**Rose Hill Parking Lot**		
Project No.	1233-1	**Date :**	10-26-10
Client :	Rose Hill Shpg. Ctr.	**Elevation**	262 feet
Location:	NW Corner	**Logged By:**	Paul Bonifaci

Test Pit TP - 2

SUBSURFACE PROFILE			SAMPLE			Field Strength Tests	Laboratory Results
Depth (ft)	Soil Lithology	Soil Description	Water Level	Sample	USCS		Moisture Content
0		Fill: (6 inches surface Sod),Tan brown to grey, silty gravelly SAND FILL, loose, wet grading to moist					
-1							
-2							
-3					SM		
-4							
-5							
-6							
-7							
-8							
-9		Peat: Brown to black brown, organic peaty Topsoil with straw, loose, rooty, wet	▼				
-10					PT		
-11		Sand: Grey tan, clean to slightly silty, fine to medium gravelly SAND, small roots, wet, loose to medium dense			SP		
-12		Groundwater seepage below 9 feet					

ABPB Consulting
Geotechnical Consultants

12525 Willows Road, Suite 80, Kirkland, Washington (425) 820-2544

Date : Nov. 2010	Project Name : Rose Hill Parking Lot	Figure 3

Project :	**Rose Hill Parking Lot**		
Project No.	1233-1	**Date :**	10-26-10
Client :	Rose Hill Shpg. Ctr	**Elevation**	268 feet
Location:	NW Corner	**Logged By:**	Paul Bonifaci

Test Pit TP - 3

SUBSURFACE PROFILE			SAMPLE				Laboratory Results
Depth (ft)	Soil Lithology	Soil Description	Water Level	Sample	USCS	Field Strength Tests	Moisture Content
0		Fill: (6 inches surface Sod),Tan brown to grey, silty gravelly SAND FILL, loose, wet grading to moist					
-1							
-2							
-3					SM		
-4							
-5							
-6							
-7							
-8							
-9			▼				
-10		Fill: Brown, organic filled silty gravelly SAND FILL, loose, wet			SM		
-11		Peat: Brown black, peaty Topsoil, rooty, loose, wet			PT		
-12		Sand: Grey tan, clean to slightly silty SAND, wet, loose to medium dense			SP		
-13							
-14		Groundwater seepage below 9 feet					

ABPB Consulting
Geotechnical Consultants

12525 Willows Road, Suite 80, Kirkland, Washington (425) 820-2544

Date : Nov. 2010	Project Name : Rose Hill Parking Lot	Figure 4

Project :	**Rose Hill Parking Lot**		
Project No.	1233-1	**Date :**	10-26-10
Client :	Rose Hill Shpg. Ctr.	**Elevation**	266 feet
Location:	NW Corner	**Logged By:**	Paul Bonifaci

Test Pit TP - 4

SUBSURFACE PROFILE			SAMPLE			Field Strength Tests	**Laboratory Results**
Depth (ft)	Soil Lithology	Soil Description	Water Level	Sample	USCS		Moisture Content
0		Fill: (6 inches surface Sod),Tan brown to grey, silty gravelly SAND FILL, loose, wet grading to moist					
-1							
-2							
-3					SM		
-4							
-5							
-6		Fill: Tan, mixed silty gravelly SAND FILL and concrete and asphalt rubble, loose, with water pockets,					
-7							
-8					SM		
-9							
-10		Peat: Brown black, peaty Topsoil, rooty, loose, wet	▼				
-11					PT		
-12		Sand: Grey tan, clean to slightly silty SAND, wet, loose to medium dense Groundwater seepage below 10 feet			SP		
-13							

ABPB Consulting

Geotechnical Consultants

12525 Willows Road, Suite 80, Kirkland, Washington (425) 820-2544

Date : Nov. 2010	Project Name : Rose Hill Parking Lot	Figure 5

ENCLOSURE 4

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Appendix D

APPENDIX D
IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Important Information About Your Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

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