GEOTECHNICAL ENGINEERING REPORT

Proposed New Parking Lot
18001 NE Union Hill Road
Redmond, WA

PSI PROJECT NO.07121335

February 25, 2016

Prepared for:
United Parcel Service
6177 N Basin Avenue
Portland, Oregon 97217

Prepared by:

Professional Service Industries, Inc.
20508 - 56th Ave W, Suite A
Lynnwood, WA 98036

Information To Build On
Engineering • Consulting • Testing

February 25, 2016

United Parcel Service
6177 N Basin Avenue
Portland, Oregon, 97217

Attention: Buddy Dobberthein,
Project Engineer
odobberthein@ups.com
(360) 901-8236

Subject: **Geotechnical Investigation**
Proposed New Parking Lot
18001 NE Union Hill Road
Redmond, Washington
PSI Project # 07121335

Dear Mr. Dobberthein,

Professional Service Industries, Inc. (PSI) is pleased to submit a report of our geotechnical investigation for a new parking lot for United Parcels Service facility, in Redmond, Washington. This report summarizes the work accomplished and provides our recommendations for design and construction of the proposed project. PSI performed the requested geotechnical investigation services in general accordance with the design services agreement, dated January 21, 2016.

Based on the results of our field investigation, laboratory testing and engineering analysis, the proposed site is suitable for the construction of the proposed improvements from a geotechnical standpoint, provided the recommendations of this report are followed. Recommendations regarding the geotechnical aspects of project design and construction are presented in the attached report.

PSI appreciates the opportunity to contribute our services and looks forward to working with you during design and construction of this project. Please contact the undersigned directly if you have questions pertaining to this project.

Respectfully Submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

MICHAEL S. PLACE
STATE OF WASHINGTON
REGISTERED
PROFESSIONAL ENGINEER

2-25-16

Exp 8-17-16

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Stephen R. Bryant, PE
Senior Vice President

1. PROJECT DESCRIPTION

PSI understands that United Parcel Service (UPS) is planning on constructing a parking lot on the southeast corner of the intersection of NE Union Hill road and 185th Avenue NE, in Redmond, Washington. As part of the new parking lot, a shallow infiltration system will be installed to handle the stormwater runoff from the new asphalt surfaces.

2. SITE DESCRIPTION

2.1. General

The site is located at 18001 NE Union Hill Road in Redmond, Washington. The site is bound by 185th Avenue NE to the west NE Union Hill Road to the north and commercial properties to the south and east. The site is currently covered by minor grasses and patches of exposed sand and gravel soil. Additionally, the site appears to have been excavated 10 feet in places during the expansion of 185th Avenue NE in 2011. This is based on observations made during our field investigation and on historical aerial imagery on Google Earth.

2.2. Topography

Based on our field investigation the site slopes gently down at approximately at 6 horizontal to 1 vertical from east to west towards 185th Avenue NE. Based on the nearby street and adjoining property elevations shown on Google Earth the site elevations appear to vary from 65 to 75 feet above mean sea level.

2.3. Geology

Based upon a review of Washington State Department of Natural Resources Interactive Maps (Reference 1) and the results of our field investigation the site is underlain by outwash deposits. Outwash typically consists of silts sands and gravels deposited by glacial meltwater. The nearest fault zone to the site is the Southern Whidbey Island Fault Zone approximately 4.5 miles north of the site. The Southern Whidbey Island Fault Zone trends northwest to southeast, is of unspecified age and has had no measurable movement recorded since initial monitoring of the fault (Reference 2).

2.4. Subsurface conditions

Subsurface materials and conditions were investigated with three soil borings and five infiltration test borings using hollow stem auger drilling techniques. Soil borings were designated B-1 through B-3 and Infiltration test borings were designated I-1 through I-5 were drilled on February 12, 2016. The three soil borings were drilled to depths of approximately 16½ feet below existing site grades (bgs) and the five infiltration test borings were drilled to approximately 3 feet bgs. The approximate locations of the soil and infiltration test borings are shown on Figure 2.

In general, the soils under the proposed parking lot areas generally consist of medium dense to dense poorly graded sand with silt and gravel and poorly graded gravel with sand. A detailed description of our field investigation and our boring logs are available in Appendix A. A description of the laboratory testing program along with sample test results are available in Appendix B. The terms used to describe material

encountered in the boring are defined in the General Notes, in Appendix A. A summary of the soils as they were encountered from the ground surface is provided below.

OUTWASH: The outwash soil consisted of brown poorly graded sand with gravel and poorly graded gravel with sand. Standard Penetration Test N-Values in the fill ranged from 11 to 55 blows per foot indicating the relative densities of medium dense to very dense soil. The existing moisture content of the fill ranges from 2 to 14 percent.

2.5. Groundwater

Groundwater was not observed onsite during our field investigation or after 24 hour readings obtained from the three soil boring locations. Based on observed groundwater noted in listed wells with the Department of Ecology (Reference 3), groundwater in this area was observed near an elevation of approximately 35 feet above mean sea level. Since site elevation appear to range from 65 to 75 feet above mean sea level, we anticipate that groundwater at the site is approximately 30 feet below the lowest elevation on the property. PSI anticipates that the groundwater table will fluctuate seasonally and in response to significant precipitation events and perched groundwater be present at shallower depths certain times of year.

2.6. Field Infiltration Testing

PSI performed five infiltration tests this investigation. These infiltration tests were conducted at the approximate depths of 3 feet bgs. Infiltration tests were conducted in shallow borings above the groundwater table in 4-inch inside diameter PVC pipes set in contact with the relatively undisturbed soil at the base of the boring. Native soils were then backfilled around the pipes. In the base of the pipe approximately 1-inch of washed pea gravel was placed in the base of the PVC pipe to prevent siltation during testing. In each boring PSI attempted to presoak the soils but the six-inch water column PSI attempted to maintain exited the infiltration test locations in less than 5 minutes and some drained out in a matter of seconds. After each attempted presoak PSI performed infiltration testing by adding a six-inch column of water into the boring and measuring the time required to drain the water out the base of the pipe. Infiltration tests were completed at least two times in each location. Percolation tests conducted in infiltration borings I-1 and I-2 were conducted in poorly-graded sand with gravel soils at their bases. Infiltration tests conducted in infiltration borings I-3, I-4 and I-5 pockets of clean gravel were observed in the base of the borings where infiltration testing was conducted. The Infiltration rates ranged from approximately 50 to over 100 inches per hour. The infiltration rates listed in this report are measured field infiltration rates and do not have a factor of safety applied to them. Infiltration rates are indicative of the soils at the specific location, depth and time in which they were conducted. Variations of any of these factor may alter the observed infiltration rates. Infiltration rates measured during our field investigation are shown in Table 1 below.

Table 1: Summary of Infiltration Rates

Infiltration ID	Infiltration Rate (in./hr)	Latitude	Longitude
I-1	50	47.67506	-122.09340
I-2	55	47.67587	-122.09342
I-3	>100	47.67600	-122.09342
I-4	>100	47.67652	-122.09287
I-5	>100	47.67575	-122.09304

3. CONCLUSIONS AND RECOMMENDATIONS

3.1. General

Subsurface explorations for this investigation indicate that the near surface soil on the site consist of medium dense poorly graded sand with silt and gravel. PSI believe the site is suitable for the specified improvements provided the recommendations stated in this report are followed.

3.2. Site Preparation

We anticipate that clearing and grubbing go the site will disturb approximately 3 to 4 inches of surface soils across the site. PSI further assumes that minor cuts and fills (less than 2 feet thick) will be required to regrade the site for the proposed parking lot.

3.3. Structural Fill

Fill placed beneath sidewalk, and pavement areas should be placed as compacted structural fill. We recommend that structural fill extends at least 2 feet beyond pavement limits where nearby structures do not restrict fill placement. On-site soils, outside of organic materials (such as topsoil) or other deleterious materials can be reused for backfill purposes, provided the material can obtain moisture contents that will allow it to meet compaction requirements. Imported material, if required, should be approved by the geotechnical engineer. Compacted fill should be placed in lifts of 12-inches (loose) or less by heavy compactors such as large vibratory rollers and hoe-packs and lifts of 6-inch (loose) or less for smaller compactors such as small plate compactors and jumping jacks. These soil should be moisture-conditioned to within 3 percent of the optimum moisture content, and compacted to a density of 95% of the maximum dry density as determined by ASTM D 1557.

The condition of the subgrade should be evaluated by a PSI representative before fill placement or construction begins. Fill compaction should be evaluated by in-place density tests performed during fill placement so that the adequacy of soil compaction efforts may be evaluated as earthwork progresses.

3.4. Utility Trench Excavations and Backfill

Excavations should be made in accordance with applicable Federal and State Occupational Safety and Health Administration regulations. Utility trenches in the near surface sand soils at the site will need to be slopes or shored from the ground surface due to the potential for caving. Actual inclinations will ultimately depend on the soil conditions encountered during earthwork. While we may provide certain approaches for trench excavations, the contractor should be responsible for selecting the excavation technique, monitoring the trench excavations for safety, and providing shoring, as required, to protect personnel and adjacent improvements. The information provided below is for use by the owner and engineer and should not be interpreted to mean that PSI is assuming responsibility for the contractor's actions or site safety. The soils PSI encountered within the upper 26 feet should be classified as Type C soil according to the most recent OSHA regulations. In our opinion, excavations should be safely sloped or shored. The contractor should be aware that excavation and shoring should conform to the requirements specified in the applicable local, state, and federal safety regulations, such as OSHA Health and Safety Standards for

Excavations, 29 CFR Part 1926, or successor regulations. We understand that such regulations are being strictly enforced, and if not followed, the contractor may be liable for substantial penalties.

Excavation and construction operations may expose the on-site soils to inclement weather conditions. The stability of exposed soils may deteriorate due to a change in moisture content or the action of heavy or repeated construction traffic. Accordingly, foundation and pavement area excavations should be protected from the elements and from the action of repetitive or heavy construction loadings.

Utilities trenches within the pavement, and sidewalk areas should be backfilled with granular structural fill such as sand, sand and gravel, crushed rock, or recycled concrete of up to 2 inches maximum size with less than 5 percent passing the No. 200 sieve (washed analysis). Granular backfill should be placed in lifts and compacted to 95 percent of the maximum dry density as determined by ASTM D 1557.

3.5. Pavement

We have made our design recommendations for new pavement sections assuming subgrade will be similar to the near-surface soils described in the boring logs. If the site soil conditions are different than those described in this report, we should be contacted so that we may confirm or modify the recommended pavement sections.

The soil type selected for the design subgrade consists of disturbed silty sand with gravel compacted to the requirements for structural fill outlined above. Based on our review of site soil conditions and the results of the California bearing ratio (CBR) testing, PSI has utilized a CBR value of 30 percent for our designs. This which is based on approximately 95% compaction.

The pavement section is dependent on the supporting capability of the subgrade soils and the traffic conditions to which it will be subjected. This parking lot is anticipated to cater small personal vehicles with only minor periods of time where heavier vehicles such as fire truck and bussed will enter the site. It should be recognized that standard pavement design methods are intended for through streets where accelerations are relatively low (i.e. velocities are relatively constant). Starting, stopping, and turning involve high accelerations. In these situations, the average daily traffic volume alone is insufficient to characterize the pavement loading. The Washington State Department of Transportation (WSDOT) Design Manual provides some guidance for designing pavement sections subjected to these higher accelerations.

As requested in the “Proposal Bid Package for Soil/Materials Engineering and Testing Services” provided by UPS for the Redmond Site, Dated December 16, 2015, PSI has prepared pavement design sections for 10-year and 20-year pavement section with overlay recommendation to make a 10-year pavement section into a 20-year pavement section, for Asphaltic Concrete (AC) with Crushed Rock Base (CRB), full depth AC, and Portland Cement Concrete (PCC) with CRB. PSI’s designed pavement sections are listed in Table 2 Below.

Table 2: Pavement Design Sections				
Pavement Life	ESAL's Used in Design	Type of Pavement	Layer Thicknesses (Inches)	
			AC	CRB
10-year	39500	AC and CRB	2	4
		Full Depth AC	3.5	-
		Concrete	4	4
Overlay to Make 10 year a 20 year	87500	AC and CRB	+1	-
		Full Depth AC	+1	-
		Concrete	-	-
20-year	87500	AC and CRB	2.5	4
		Full Depth AC	4	-
		Concrete	4	4

Paving materials used should conform to the specifications. We recommend that aggregate for AC should meet the Class ½-inch grading requirements specified in Section 9-03.8(6), aggregate for CRB should conform to Section 9-03.9(3) Top Course of Crushed Surfacing.

Long-term pavement performance will depend on surface drainage. A poorly-drained pavement section will be subject to premature failure because of surface water infiltrating into the subgrade soils and reducing their supporting capability. If practical, we recommend new pavements be placed with surface drainage gradients of at least two percent for better long-term performance. Some longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

New pavement sections must be installed over firm subgrade. This means that the top 12 inches of subgrade should be free of organics and other debris and compacted in conformance with our recommendations in section 3.3 (Structural Fill). Paving should be performed as soon as practical after subgrade preparations are completed. Pavement subgrade surfaces should be proof-rolled and re-compacted a second time with a heavy roller or equivalent immediately prior to constructing the pavement section if the prepared subgrade has been left unprotected for more than a few days or if it appears to have been disturbed from climatic conditions, excessive traffic, or other causes. We recommend that proof rolling be observed by a representative of the geotechnical engineer.

3.6. Drainage

We recommend pavement surfaces and open space areas be sloped such that surface water runoff is collected and routed to suitable discharge points. PSI recommends that any infiltration system used on this site be placed near the depth of the infiltration test performed for this investigation.

Our infiltration testing measured infiltration rates ranging from 50 to over 100 inches per hour. In our experience infiltration systems are not typically designed with rates exceeding 20 inches per hour, and as a

result we would recommend that the infiltration system be designed utilizing an infiltration rate of 20 inches per hour. This will allow for a factor of safety of at least 2.5 in the areas tested, but may not fully account of siltation of the designed infiltration system over time.

4. DESIGN REVIEW AND CONSTRUCTION MONITORING

We welcome the opportunity to review and discuss construction plans and specifications as they are being developed. We are of the opinion that to observe compliance with the design concepts, specifications, and recommendations, construction operations dealing with earthwork and pavement installation should be observed by a qualified geotechnical engineer. We would be pleased to provide these services to you.

5. REPORT LIMITATIONS

The recommendations submitted in this report are based on the subsurface information obtained by PSI and design details furnished by representatives of the client, United Parcels Service, for the proposed improvements at 18001 East Union Hill Road in Redmond, Washington. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation and/or pavement recommendations are required. If PSI is not retained to review these changes, PSI will not be responsible for the impact of those conditions on the project.

After the plans and specifications are more complete, PSI should be retained and provided the opportunity to review the final design plans and specifications to verify that our engineering recommendations have been properly incorporated into the design.

REFERENCES

Reference 1: Washington Department of Natural Recourses Interactive Geologic Map, http://www.dnr.wa.gov/researchscience/topics/geosciencesdata/pages/geology_portal.aspx

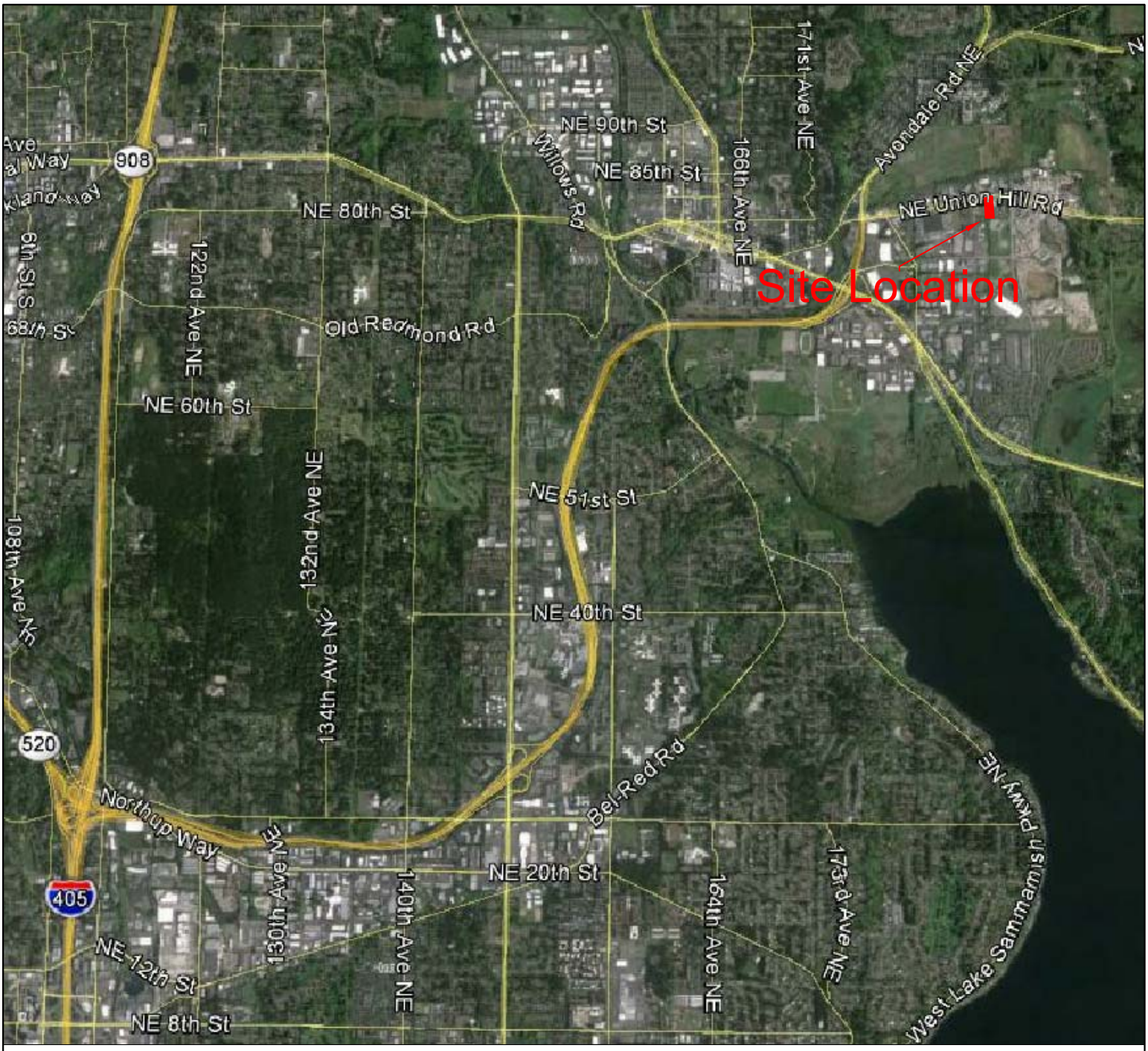
Reference 2: Sherrod, Brian L.; Blakely, Richard J.; Weaver, Craig S.; Kelsey, Harvey M.; Barnett, Elizabeth; Liberty, Lee; Meagher, Karen L.; Pape, Kristin, 2008, Finding concealed active faults--Extending the southern Whidbey Island fault across the Puget Lowland, Washington: Journal of Geophysical Research, v. 113,

Reference 3: Washington State Department of Ecology, Washington State Well Log Viewer, https://fortress.wa.gov/ecy/waterresources/map/WCLSWebMap/WellConstructionMapSearch.aspx

FIGURES

VICINITY MAP

SITE EXPLORATION LOCATION MAP



LEGEND:

= SITE LOCATION

NOTES

SIte underlay provided by Google Earth

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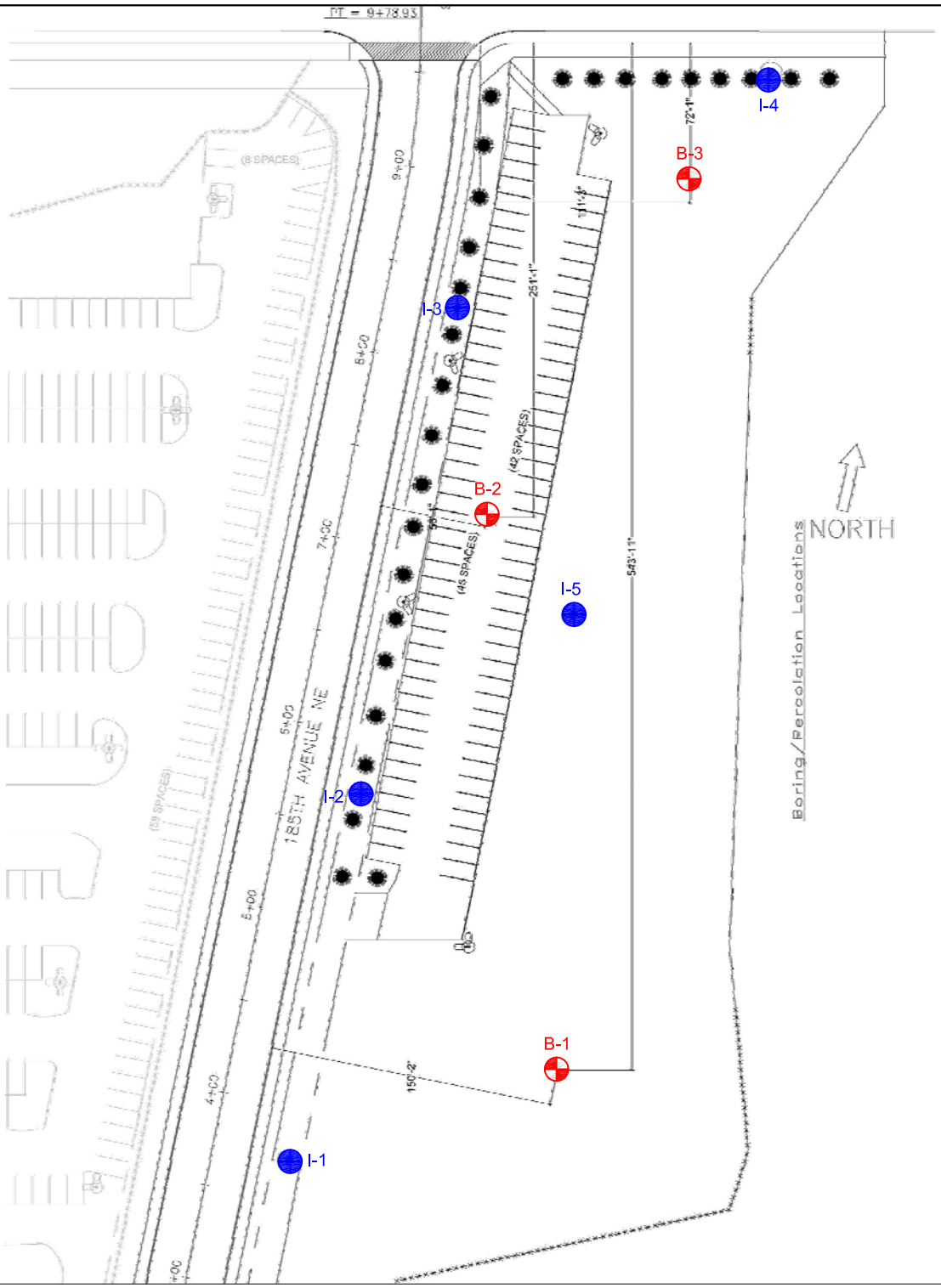
psi Information To Build On Engineering • Consulting • Testing	PROJECT NAME: UPS Parking Lot 18001 NE Union Hill Road Redmond, Washington	DRAWN BY: MSP	DATE: February, 2016	FIGURE: 1
20508 56th Ave W Sulte A **Lynwood, WA 98036** **(425)409-2504**	DESCRIPTION: Vicinity Map	APPROVED BY: MSP	PSI PROJECT NUMBER: 07121335	



LEGEND:

- Soil Boring Location
- Infiltration Test Boring Location

NOTES

Site underlay provided by UPS

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Information To Build On Engineering • Consulting • Testing	PROJECT NAME: UPS Parking Lot 18001 NE Union Hill Road Redmond, Washington	DRAWN BY: MSP	DATE: February, 2016	FIGURE: 2
20508 56th Ave W Sulte A **Lynwood, WA 98036** **(425) 409-2504**	DESCRIPTION: Site Exploration Map	APPROVED BY: MSP	PSI PROJECT NUMBER: 07121335	

APPENDIX A

FIELD EXPLORATION PROGRAM

GENERAL NOTES

SOIL CLASSIFICATION CHART

BORING LOGS

FIELD EXPLORATION PROGRAM

General

We explored the site by drilling three soil borings (B-1 to B-3) to depths of approximately 16½ feet bgs and five infiltration test boring to a depth of approximately 3 feet using a trailer mounted drill rig, were advanced for this project. The locations of the borings and Soil and infiltration borings are shown on Figure 2. A representative of PSI's geotechnical staff was present during the explorations to record soil and groundwater conditions encountered in the exploration and to obtain soil samples for laboratory testing.

Sampling Procedures

Throughout the drilling operation, soil samples were obtained from the borings using a 2-inch OD Split Spoon in general conformance with guidelines presented in ASTM D1586, *Standard Test Method for Penetration Test and Split Barrel Sampling of Soils*. The samplers were driven into the soil a distance of 18 inches or to refusal with a 140-pound hammer free falling a distance of 30 inches. The sum of the blows required to drive the sampler in three 6-inch increments is provided in the boring logs. If the sampler met refusal, the number of inches driven and the number of blows is recorded. No sample are recovered from CPT's but data is available in this appendix.

The boring was drilled to observe the stratigraphy, density, and variability of subsurface soil conditions. Soil samples recovered from the explorations were sealed in airtight plastic jars to retain moisture and carefully transported to PSI's laboratory for additional examination and testing.

Field Classification

Soil samples were initially classified visually in the field. Consistency, color, relative moisture, degree of plasticity, peculiar odors and other distinguishing characteristics of the soil samples were noted. The terminology used in the soil and rock classifications and other modifiers are defined in the General Notes in this Appendix.

Exploration Logs

Summary boring log follows in this appendix. The left-hand portion of the boring log gives our interpretation of the soil encountered in the soil boring, sample locations and depths, and groundwater information. The right-hand portion of the log shows the results of the sample water contents, and other laboratory information.

The soil profile shown on the boring logs represent the conditions only at actual exploration location. Variations may occur and should be expected. The stratifications represent the approximate boundary between subsurface materials; the actual transition may be gradual.

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System (USCS), AASHTO 1988 and ASTM designations D2487 and D-2488 are used to identify the encountered materials unless otherwise noted. Coarse-grained soils are defined as having more than 50% of their dry weight retained on a #200 sieve (0.075mm); they are described as: boulders, cobbles, gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are defined as silts or clay depending on their Atterberg Limit attributes. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size.

DRILLING AND SAMPLING SYMBOLS

SFA: Solid Flight Auger - typically 4" diameter flights, except where noted.
HSA: Hollow Stem Auger - typically 3¼" or 4¼ I.D. openings, except where noted.
M.R.: Mud Rotary - Uses a rotary head with Bentonite or Polymer Slurry
R.C.: Diamond Bit Core Sampler
H.A.: Hand Auger
P.A.: Power Auger - Handheld motorized auger
SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
BS: Bulk Sample
PM: Pressuremeter
CPT-U: Cone Penetrometer Testing with Pore-Pressure Readings

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split-Spoon.
N_{60}: A "N" penetration value corrected to an equivalent 60% hammer energy transfer efficiency (ETR)
Q_u: Unconfined compressive strength, TSF
Q_p: Pocket penetrometer value, unconfined compressive strength, TSF
w%: Moisture/water content, %
LL: Liquid Limit, %
PL: Plastic Limit, %
PI: Plasticity Index = (LL-PL),%
DD: Dry unit weight, pcf
▼,▽,▼ Apparent groundwater level at time noted

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N - Blows/foot
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	50 - 80
Extremely Dense	80+

ANGULARITY OF COARSE-GRAINED PARTICLES

Description	Criteria
Angular:	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular:	Particles are similar to angular description, but have rounded edges
Subrounded:	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges

GRAIN-SIZE TERMINOLOGY

Component	Size Range
Boulders:	Over 300 mm (>12 in.)
Cobbles:	75 mm to 300 mm (3 in. to 12 in.)
Coarse-Grained Gravel:	19 mm to 75 mm (¾ in. to 3 in.)
Fine-Grained Gravel:	4.75 mm to 19 mm (No.4 to ¾ in.)
Coarse-Grained Sand:	2 mm to 4.75 mm (No.10 to No.4)
Medium-Grained Sand:	0.42 mm to 2 mm (No.40 to No.10)
Fine-Grained Sand:	0.075 mm to 0.42 mm (No. 200 to No.40)
Silt:	0.005 mm to 0.075 mm
Clay:	<0.005 mm

PARTICLE SHAPE

Description	Criteria
Flat:	Particles with width/thickness ratio > 3
Elongated:	Particles with length/width ratio > 3
Flat & Elongated:	Particles meet criteria for both flat and elongated

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% Dry Weight
Trace:	< 5%
With:	5% to 12%
Modifier:	>12%

GENERAL NOTES

(Continued)

CONSISTENCY OF FINE-GRAINED SOILS

Q_U - TSF	N - Blows/foot	Consistency
0 - 0.25	0 - 2	Very Soft
0.25 - 0.50	2 - 4	Soft
0.50 - 1.00	4 - 8	Medium Stiff
1.00 - 2.00	8 - 15	Stiff
2.00 - 4.00	15 - 30	Very Stiff
4.00 - 8.00	30 - 50	Hard
8.00+	50+	Very Hard

MOISTURE CONDITION DESCRIPTION

Description	Criteria
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

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term	% Dry Weight
Trace:	< 15%
With:	15% to 30%
Modifier:	>30%

STRUCTURE DESCRIPTION

Description	Criteria
Stratified:	Alternating layers of varying material or color with layers at least ¼-inch (6 mm) thick
Laminated:	Alternating layers of varying material or color with layers less than ¼-inch (6 mm) thick
Fissured:	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided:	Fracture planes appear polished or glossy, sometimes striated
Blocky:	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed:	Inclusion of small pockets of different soils
Layer:	Inclusion greater than 3 inches thick (75 mm)
Seam:	Inclusion 1/8-inch to 3 inches (3 to 75 mm) thick extending through the sample
Parting:	Inclusion less than 1/8-inch (3 mm) thick

SCALE OF RELATIVE ROCK HARDNESS

Q_U - TSF	Consistency
2.5 - 10	Extremely Soft
10 - 50	Very Soft
50 - 250	Soft
250 - 525	Medium Hard
525 - 1,050	Moderately Hard
1,050 - 2,600	Hard
>2,600	Very Hard

ROCK BEDDING THICKNESSES

Description	Criteria
Very Thick Bedded	Greater than 3-foot (>1.0 m)
Thick Bedded	1-foot to 3-foot (0.3 m to 1.0 m)
Medium Bedded	4-inch to 1-foot (0.1 m to 0.3 m)
Thin Bedded	1¼-inch to 4-inch (30 mm to 100 mm)
Very Thin Bedded	½-inch to 1¼-inch (10 mm to 30 mm)
Thickly Laminated	1/8-inch to ½-inch (3 mm to 10 mm)
Thinly Laminated	1/8-inch or less "paper thin" (<3 mm)

ROCK VOIDS

Voids	Void Diameter
Pit	<6 mm (<0.25 in)
Vug	6 mm to 50 mm (0.25 in to 2 in)
Cavity	50 mm to 600 mm (2 in to 24 in)
Cave	>600 mm (>24 in)

GRAIN-SIZED TERMINOLOGY

(Typically Sedimentary Rock)

Component	Size Range
Very Coarse Grained	>4.76 mm
Coarse Grained	2.0 mm - 4.76 mm
Medium Grained	0.42 mm - 2.0 mm
Fine Grained	0.075 mm - 0.42 mm
Very Fine Grained	<0.075 mm

ROCK QUALITY DESCRIPTION

Rock Mass Description	RQD Value
Excellent	90 -100
Good	75 - 90
Fair	50 - 75
Poor	25 -50
Very Poor	Less than 25

DEGREE OF WEATHERING

Slightly Weathered:	Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in), open joints may contain clay, core rings under hammer impact.
Weathered:	Rock mass is decomposed 50% or less, significant portions of the rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.
Highly Weathered:	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

psi

Professional Service Industries, Inc.
20508 56th Avenue W, Suite A
Lynnwood, WA 98036
Telephone: (425) 409-2504
Fax: (425) 582-8193

LOG OF BORING B-1

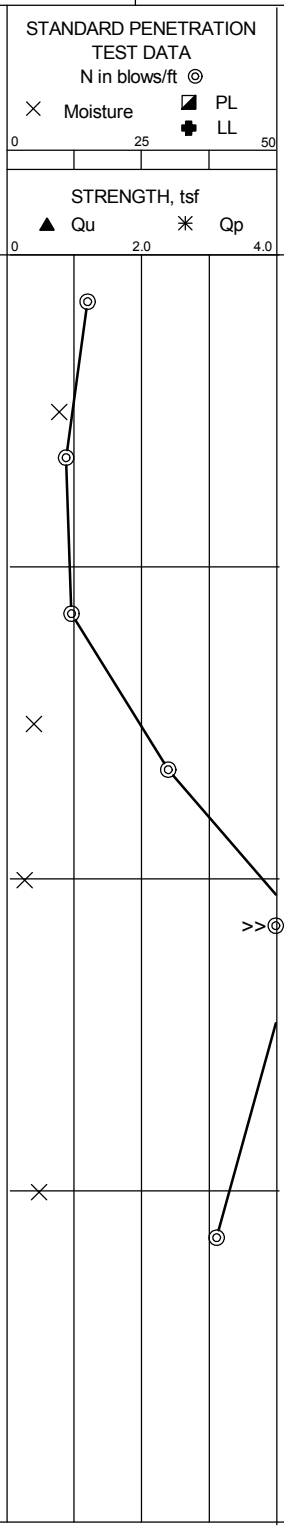
PSI Job No.: 07121335
Project: UPS
Location: 18001 NE Union HIll Rd
Redmond, WA

Drilling Method: Hollow Stem Auger
Sampling Method: SS
Hammer Type: Manual Pulley
Boring Location:

WATER LEVELS

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0				3	**Poorly-graded SAND with silt and gravel:** dark brown, moist, nonplastic, with organics (topsoil)		6-8-7 N=15		
					11	**Poorly graded SAND with silt and gravel:** moist, brown, medium dense, nonplastic, rounded to sub rounded gravel, sub rounded sand	SP-SM	5-5-6 N=11	10	
	5				13			5-5-7 N=12		
					9	**Poorly graded GRAVEL with sand:** moist, brown, dense, nonplastic,	GP	9-13-17 N=30	5	
	10				8	**Poorly-graded SAND with gravel:** moist, brown, dense, nonplastic, rounded to sub rounded gravel, sub rounded sand	SP	16-28-27 N=55	3	>>
	15				4			7-14-25 N=39	6	
						Bottom of boring at 16 ft 6 inches. No ground water observed.				



Completion Depth: 15.0 ft
Date Boring Started: 2/12/16
Date Boring Completed: 2/12/16
Logged By: Sunia Malolo
Drilling Contractor: Geologic Drill

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 47.67547°
Longitude: -122.09304°
Drill Rig: Trailer Mounted
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
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Telephone: (425) 409-2504
Fax: (425) 582-8193

LOG OF BORING B-2

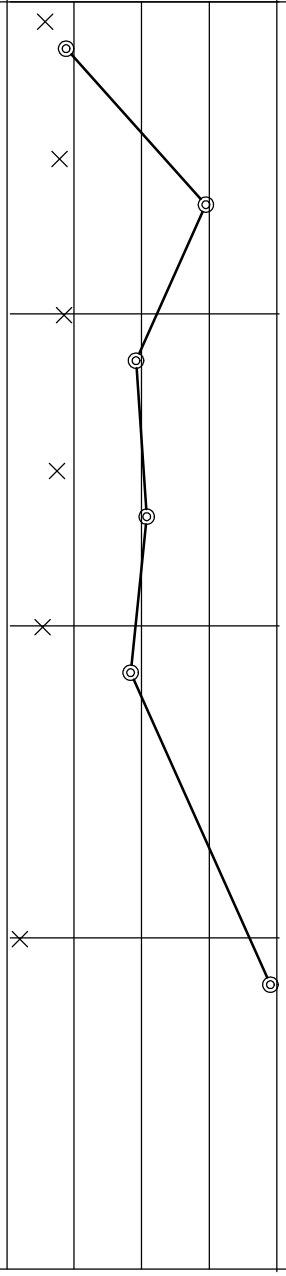
PSI Job No.: 07121335
Project: UPS
Location: 18001 NE Union HIll Rd
Redmond, WA

Drilling Method: Hollow Stem Auger
Sampling Method: SS
Hammer Type: Manual Pulley
Boring Location:

WATER LEVELS

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0				11	**Poorly-graded SAND with silt and gravel:** dark brown, moist, nonplastic, with organics (topsoil)		1-5-6 N=11	7	
						Poorly graded SAND with silt and gravel: moist, brown, medium dense to dense, nonplastic, rounded to sub rounded gravel, sub rounded sand			10	
					4			10-17-20 N=37		
	5								11	
					3			11-12-12 N=24		
							SP-SM		9	
					1			8-12-14 N=26		
	10								7	
					9			8-9-14 N=23		
						Poorly graded GRAVEL with sand: moist, brown, dense, nonplastic,				
	15						GP		2	
					8			37-25-24 N=49		
						Bottom of boring at 16 ft 6 inches. No ground water observed.				



Completion Depth: 15.0 ft
Date Boring Started: 2/12/16
Date Boring Completed: 2/12/16
Logged By: Sunia Malolo
Drilling Contractor: Geologic Drill

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 47.67643°
Longitude: -122.09301°
Drill Rig: Trailer Mounted
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
20508 56th Avenue W, Suite A
Lynnwood, WA 98036
Telephone: (425) 409-2504
Fax: (425) 582-8193

LOG OF BORING B-3

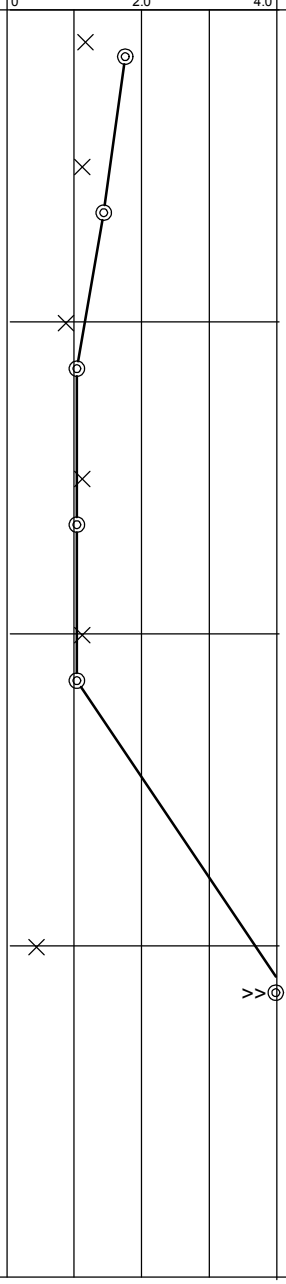
PSI Job No.: 07121335
Project: UPS
Location: 18001 NE Union HIll Rd
Redmond, WA

Drilling Method: Hollow Stem Auger
Sampling Method: SS
Hammer Type: Manual Pulley
Boring Location:

WATER LEVELS

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0				11	**Poorly-graded SAND with silt and gravel:** dark brown, moist, nonplastic, with organics (topsoil)		8-12-10 N=22	15	
						Poorly graded SAND with silt and gravel: moist, brown, nonplastic, medium dense, rounded to sub rounded gravel, sub rounded sand			14	
					9			8-8-10 N=18		
	5								11	
					5			3-4-9 N=13		
							SP-SM		14	
					14			3-4-9 N=13		
	10								14	
					16			6-7-6 N=13		
						Poorly graded GRAVEL with sand: moist, brown, very dense, nonplastic,				
	15						GP		6	
					8			14-41-11 N=52		
						Bottom of boring at 16.5 ft. No ground water observed.				



Completion Depth: 15.0 ft
Date Boring Started: 2/12/16
Date Boring Completed: 2/12/16
Logged By: Sunia Malolo
Drilling Contractor: Geologic Drill

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 47.67591°
Longitude: -122.09319°
Drill Rig: Trailer Mounted
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

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Telephone: (425) 409-2504
Fax: (425) 582-8193

LOG OF BORING I-1

PSI Job No.: 07121335
Project: UPS
Location: 18001 NE Union HIll Rd
Redmond, WA

Drilling Method: Hollow Stem Auger
Sampling Method:
Hammer Type:
Boring Location:

WATER LEVELS

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification		Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) / STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					**Poorly-graded SAND with silt and gravel:** dark brown, moist, nonplastic, with organics (topsoil)					
						Poorly graded SAND with silt and gravel: moist, brown, nonplastic, rounded to sub rounded gravel, sub rounded sand	SP-SM				
						Bottom boring 3 feet. No groundwater observed					

Completion Depth: 3.0 ft
Date Boring Started: 2/12/16
Date Boring Completed: 2/12/16
Logged By: Sunia Malolo
Drilling Contractor: Geologic Drill

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 47.67506°
Longitude: -122.0934°
Drill Rig: Trailer Mounted
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

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Fax: (425) 582-8193

LOG OF BORING I-2

PSI Job No.: 07121335
Project: UPS
Location: 18001 NE Union HIll Rd
Redmond, WA

Drilling Method: Hollow Stem Auger
Sampling Method:
Hammer Type:
Boring Location:

WATER LEVELS

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification		Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0–25–50) / STRENGTH, tsf ▲ Qu ✳ Qp (0–2.0–4.0)	Additional Remarks
	0					**Poorly-graded SAND with silt and gravel:** dark brown, moist, nonplastic, with organics (topsoil)					
						Poorly graded SAND with silt and gravel: moist, brown, nonplastic, rounded to sub rounded gravel, sub rounded sand	SP-SM				
						Bottom boring 3 feet. No groundwater observed					

Completion Depth: 3.0 ft
Date Boring Started: 2/12/16
Date Boring Completed: 2/12/16
Logged By: Sunia Malolo
Drilling Contractor: Geologic Drill

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 47.67587°
Longitude: -122.09342°
Drill Rig: Trailer Mounted
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

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Fax: (425) 582-8193

LOG OF BORING I-3

PSI Job No.: 07121335
Project: UPS
Location: 18001 NE Union HIll Rd
Redmond, WA

Drilling Method: Hollow Stem Auger
Sampling Method:
Hammer Type:
Boring Location:

WATER LEVELS

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification		Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50)	STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					**Poorly-graded SAND with silt and gravel:** dark brown, moist, nonplastic, with organics (topsoil)						
						Poorly graded SAND with silt and gravel: moist, brown, nonplastic, rounded to sub rounded gravel, sub rounded sand. Pocket of clean gravel observed near base.	SP-SM					
						Bottom boring 3 feet. No groundwater observed						

Completion Depth: 3.0 ft
Date Boring Started: 2/12/16
Date Boring Completed: 2/12/16
Logged By: Sunia Malolo
Drilling Contractor: Geologic Drill

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 47.646°
Longitude: -122.09342°
Drill Rig: Trailer Mounted
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
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Fax: (425) 582-8193

LOG OF BORING I-4

PSI Job No.: 07121335
Project: UPS
Location: 18001 NE Union HIll Rd
Redmond, WA

Drilling Method: Hollow Stem Auger
Sampling Method:
Hammer Type:
Boring Location:

WATER LEVELS

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification		Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) / STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					**Poorly-graded SAND with silt and gravel:** dark brown, moist, nonplastic, with organics (topsoil)					
						Poorly graded SAND with silt and gravel: moist, brown, nonplastic, rounded to sub rounded gravel, sub rounded sand. Pocket of clean gravel observed near base.	SP-SM				
						Bottom boring 3 feet. No groundwater observed					

Completion Depth: 3.0 ft
Date Boring Started: 2/12/16
Date Boring Completed: 2/12/16
Logged By: Sunia Malolo
Drilling Contractor: Geologic Drill

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 47.67652°
Longitude: -122.09287°
Drill Rig: Trailer Mounted
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
20508 56th Avenue W, Suite A
Lynnwood, WA 98036
Telephone: (425) 409-2504
Fax: (425) 582-8193

LOG OF BORING I-5

PSI Job No.: 07121335
Project: UPS
Location: 18001 NE Union HIll Rd
Redmond, WA

Drilling Method: Hollow Stem Auger
Sampling Method:
Hammer Type:
Boring Location:

WATER LEVELS

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification		Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0–25–50) / STRENGTH, tsf ▲ Qu ✳ Qp (0–2.0–4.0)	Additional Remarks
	0					**Poorly-graded SAND with silt and gravel:** dark brown, moist, nonplastic, with organics (topsoil)					
						Poorly graded SAND with silt and gravel: moist, brown, nonplastic, rounded to sub rounded gravel, sub rounded sand. Pocket of clean gravel observed near base.	SP-SM				
						Bottom boring 3 feet. No groundwater observed					

Completion Depth: 3.0 ft
Date Boring Started: 2/12/16
Date Boring Completed: 2/12/16
Logged By: Sunia Malolo
Drilling Contractor: Geologic Drill

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude: 47.67575°
Longitude: -122.09304°
Drill Rig: Trailer Mounted
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

APPENDIX B

LABORATORY TESTING PROGRAM

LABORATORY TEST RESULTS

Laboratory Testing Program and Procedures

General

Soil samples obtained during the field explorations were examined in our laboratory. The physical characteristics of the samples were noted and the field classifications were modified where necessary in accordance with terminology presented the General Notes included in this appendix.

Representative samples were selected during the course of the examination for further testing. The testing procedures and results of the tests are summarized below. The phrase "In general accordance with guidelines presented in…" means that certain local and common descriptive practices and methodologies have been followed.

Visual-Manual Classification

The soil samples were classified in general accordance with guidelines presented in ASTM D2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*. Certain terminology incorporating current local engineering practice, as provided in the Soil Classification Chart included with or in lieu of ASTM terminology. The term which best described the major portion of the sample was used in determining the soil type (that is, gravel, sand, silt or clay).

Moisture Content

Natural moisture content determinations were made on all samples. The natural moisture content is defined as the ratio of the weight of water to dry weight of soil, expressed as a percentage. The results of the moisture content determinations are presented on the boring logs in this appendix.

Grain Size Analysis

Select samples from the borings were analyzed for grain size in general conformance with ASTM C 136 and ASTM C117. In general, samples were oven dried, weighed then washed over a #200 sieve to remove silt and clay sized particles and then dried again. The samples were separated through a series of sieves of progressively smaller openings for determination of particle size distribution. The material passing and/or retained on each sieve was recorded as a percent of the total sample weight. The results of the sieve analysis are depicted in this Appendix.

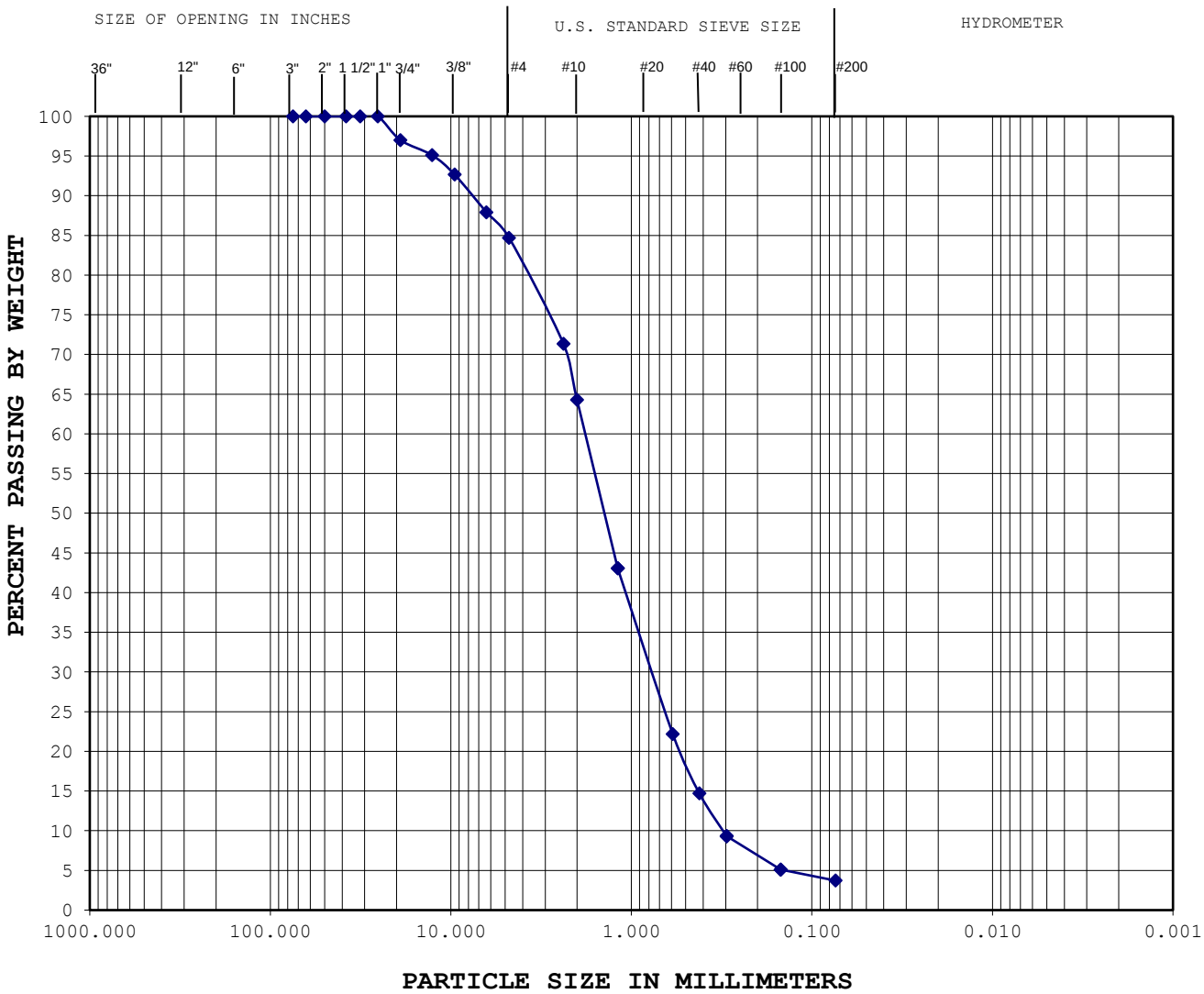
California Bearing Ratio (CBR)

The CBR (ASTM D4429), involve compacting a sample material into several molds at various levels of compaction and saturating them for a period of 96 hours. After saturation the material is placed into a machine that forces a two-inch diameter rod into the soil measurements of the depth of embedment and force exerted on the soil to penetrate the soil to these depths are recorded and then plotted to determine the CBR value at various levels of compactive effort.

Modified Proctor

A sample of soil was analyzed using moisture density test ASTM D1557. The test involves compacting soil into a four or six-inch diameter mold using a ten-pound hammer falling 18 inches for specified number of times in five lifts. The test is rerun at multiple moisture contents and the densities and moisture contents are plotted to determine the maximum dry density and moisture content of the material.

PARTICLE SIZE ANALYSIS - ASTM C136/C117



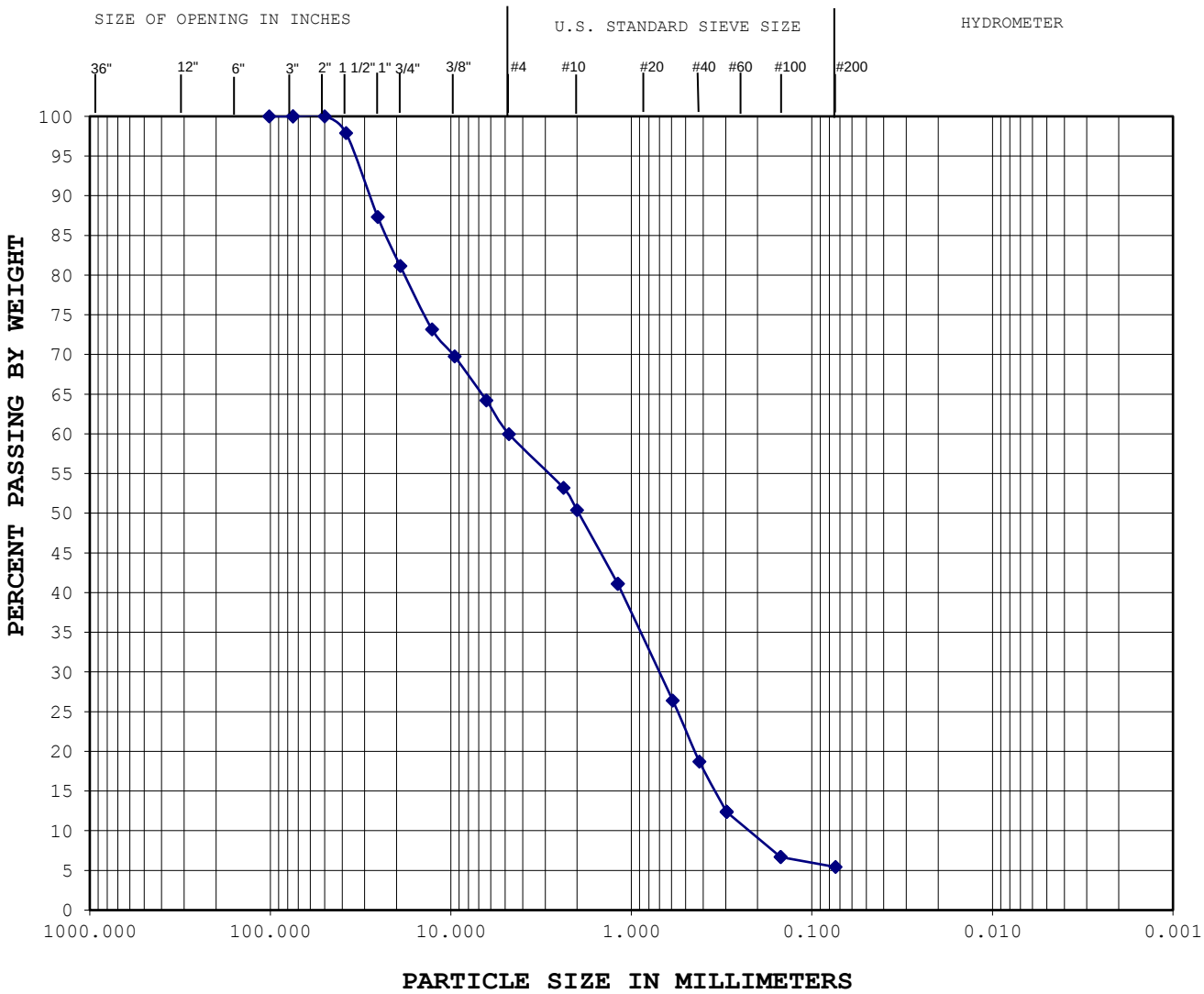
BOULDERS	COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		GRAVEL		SAND			FINE GRAINED	

% Gravel	% Sand	% Fines	PL = NP
15.3%	81.0%	3.7%	LL = NP
Soil Classification Poorly Graded SAND with Gravel			PI = NP

Exploration	Sample	Depth (feet)	Moisture	Reviewed	USCS Symbol
B-1		5 feet	7.6	MSP	SP

psi Information To Build On Engineering • Consulting • Testing	PROJECT NO: 07121235	PROJECT NAME: UPS, Redmond

PARTICLE SIZE ANALYSIS - ASTM C136/C117



BOULDERS	COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		GRAVEL		SAND			FINE GRAINED	

% Gravel	% Sand	% Fines	PL = NP
40.0%	54.5%	5.4%	LL = NP
Soil Classification Poorly Graded SAND with Silt and Gravel			PI = NP

Exploratio	Sample	Depth	Moisture	Reviewed	USCS Symbol
Composite B-1, B-2		Cuttings 0.5-3 feet	2.3	MSP	SP-SM

psi Information To Build On Engineering • Consulting • Testing	PROJECT NO: 07121335	PROJECT NAME: UPS, Redmond

Professional Service Industries, Inc.
20508 56th Avenue, Suite A
Lynnwood, WA 98036

Phone: (425) 409-2504
Fax: (425) 582-8193

California Bearing Ratio Report

Report No: CBR:07121335-1-S2
Issue No: 1

Client: UNITED PARCEL SERVICE
6707 NORTH BASIN AVENUE
PORTLAND, OR 97217

CC:

Project: UPS PARKING LOT REDMOND

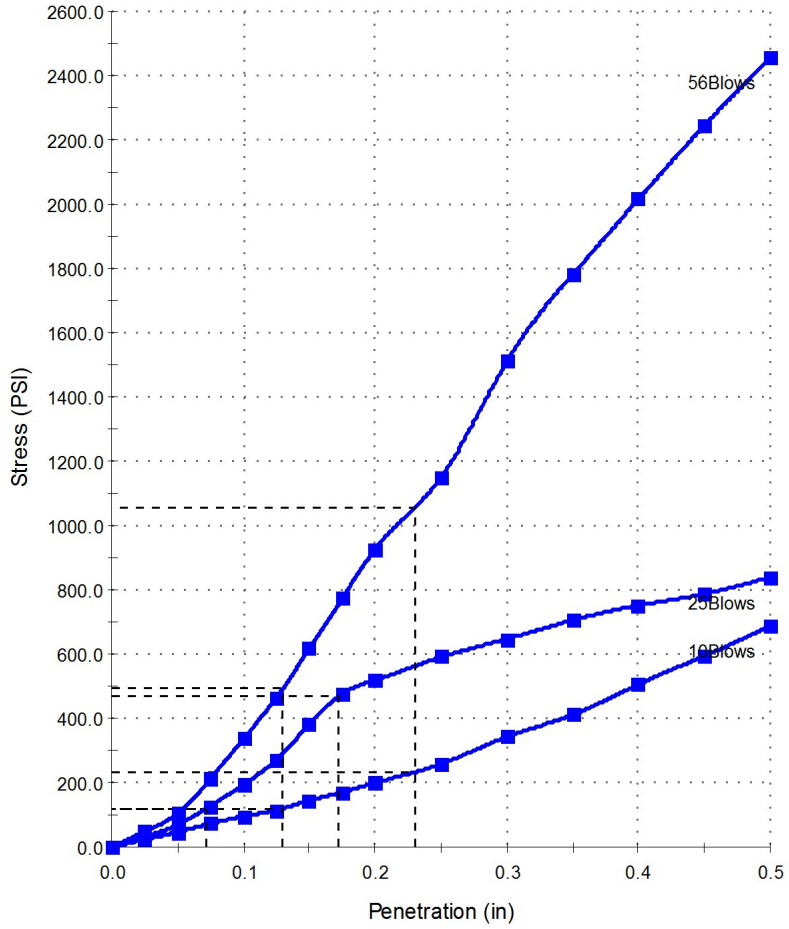
These test results apply only to the specific locations and materials noted and may not represent any other locations or elevations. This report may not be reproduced, except in full, without written permission by Professional Service Industries, Inc. If a non-compliance appears on this report, to the extent that the reported non-compliance impacts the project, the resolution is outside the PSI scope of engagement.

Approved Signatory: Michael Place (Project Engineer)
Date of Issue: 2/24/2016

Sample Details

Sample ID:	07121335-1-S2	Date Sampled:	1/27/2016
Sampling Method:		Source:	
Material:		Specification:	
Location:		Tested By:	(unknown)
Date Tested:			

Stress vs Penetration



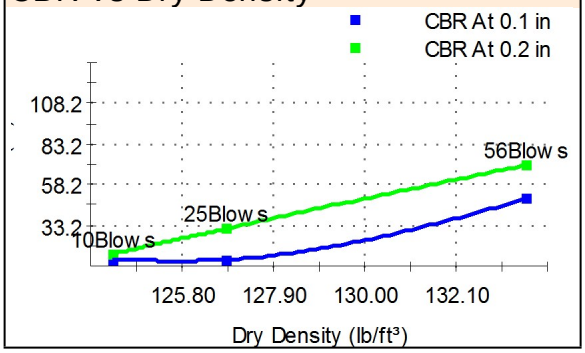
Overall Results

ASTM D 1883

Test Results

Blows	10	25	56
Comp. Eff.	ASTM D 1557	ASTM D 1557	ASTM D 1557
Initial MC (%)	8.9	9.3	8.8
MC of Top 1in (%)	8.9	9.3	8.8
MC After (%)	8.9	9.3	8.8
DD Before (lb/ft³)	124.20	126.81	133.68
DD After (lb/ft³)	124.20	126.32	135.04
CBR (%)	15.5	31.2	70.3
% MDD	92.8	94.8	99.9
Sample Condition	soaked	soaked	soaked
Surcharge (lb)			
Swell (%)			
Oversize (%)			

CBR Vs Dry Density



Comments

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Professional Service Industries, Inc.
20508 56th Avenue, Suite A
Lynnwood, WA 98036

Phone: (425) 409-2504
Fax: (425) 582-8193

Proctor Report

Report No: PTR:07121335-1-S2
Issue No: 1

Client: UNITED PARCEL SERVICE
6707 NORTH BASIN AVENUE
PORTLAND, OR 97217

CC:

Project: UPS PARKING LOT REDMOND

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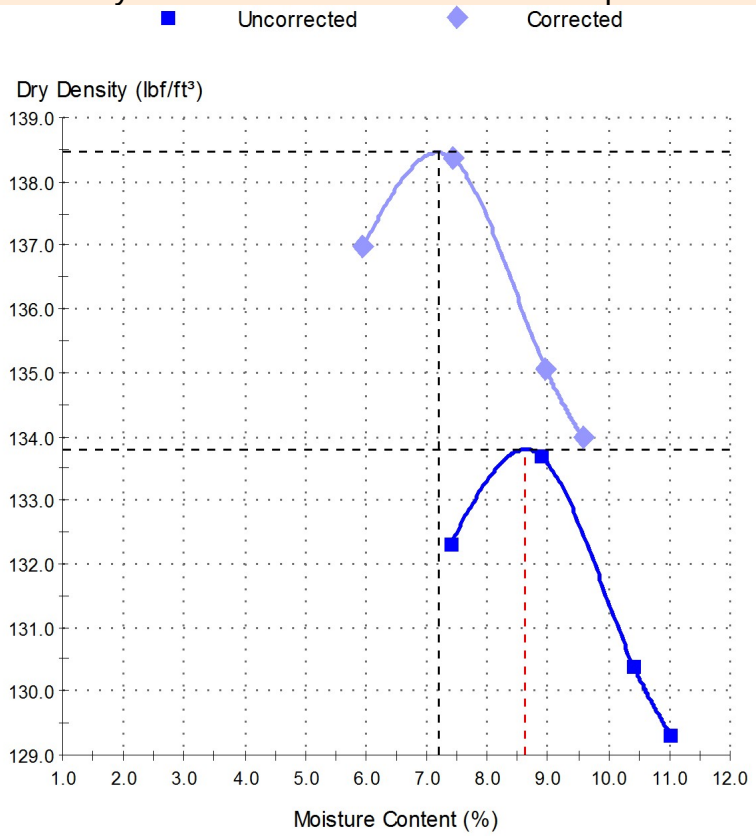
Approved Signatory: Michael Place (Project Engineer)
Date of Issue: 2/24/2016

Sample Details

Sample ID:	07121335-1-S2	Date Sampled:	1/27/2016
Sampled By:	Michael Place	Specification:	no specifications
Material:		Sampling Method:	
Location:		Tested By:	(unknown)

Dry Density - Moisture Content Relationship



Test Results

ASTM D 1557

Maximum Dry Density (lbf/ft³):	133.8
Optimum Moisture Content (%):	8.6
Method:	C
Preparation Method:	
Retained Sieve 3/8" (9.5mm) (%):	47
Retained Sieve 3/4" (19mm) (%):	18
Passing Sieve 3/8" (9.5mm) (%):	53
Passing Sieve 3/4" (19mm) (%):	82
Specific Gravity (Oversize):	2.64

ASTM D 4718

Corrected Maximum Dry Density (lbf/ft³):	138.5
Corrected Optimum Moisture Content (%):	7.2

Comments

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