April 9, 2024

Cliff Rapp
Logistics Maintenance Manager
Puyallup Fred Meyer Distribution Center
2200 North Meridian
Puyallup, Washington 98371

RE: Geotechnical Exploration and Recommendation
Puyallup Fred Meyer Distribution Center – Truck Entrance
2200 North Meridian
Puyallup, Washington 98371
RGI Project No. 2017-206-2

Dear Mr. Rapp:

As requested, The Riley Group, Inc. (RGI) has performed a geotechnical exploration at the site. This report summarizes our findings and recommendations for the proposed truck entrance with related guard house.

Site Observations

On March 27, 2024, RGI observed the site condition and performed a subsurface exploration by observing excavation of two test pits excavated to a maximum depth of 12.5 feet below ground surface (bgs) in the proposed truck entrance and guard house in the northwest corner of the site. The test pit locations are shown on the site plan. The following presents our findings of the soil conditions and recommendations for the proposed project.

Subsurface Soil and Groundwater

Test pits TP-1 and TP-2 located near the east edge of the existing entrance driveway encountered 5 to 10 feet of fill consisting of medium dense to very dense gravelly sand with varying amounts of silt over native soils including loose to medium dense silty sand, medium stiff sandy silt, and soft organic silt. Light ground water seepage was encountered at 1.5 feet below the ground surface (bgs) at TP-2 that appears to be perched over dense soils.

Static ground water was not encountered during our exploration to a maximum depth of 12.5 feet bgs. RGI expects that the static ground water should be deeper.

More detailed descriptions of the subsurface conditions encountered are presented in the attached logs.

Summary and Recommendations

Based on the explorations, the site is underlain by compressible soil below the upper 5 to 10 feet. If the proposed guard building foundation is supported on shallow footings, it will experience a significant amount of post-construction settlement due to consolidation. To avoid the potential damages due to settlements, building is typically supported on a deep foundation system bearing on competent native soil. Due to the building is lightweighted, if it can be designed to tolerate some differential settlement (or 1.5 inch every 20 feet), the foundation and floor slab can be supported on 36 inches of reinforced structural fill.

RGI recommends that the pavement section be supported on 18 inches of structural fill. The onsite fill is expected to be suitable for being reused as structural fill if the construction occurs in dry season. If the construction occurs in winter season and the onsite fill cannot be properly compacted, import structural fill should be considered. Alternatively, cement treatment of onsite fill can be considered.

Detailed recommendations regarding the above issues and other geotechnical design considerations are provided in the following sections. These recommendations should be incorporated into the final design drawings and construction specifications.

RGI expects that site grading will consist of shallow cuts and fills to achieve building and pavement grades and excavation for utilities including storm, water, sanitary sewer, and other utilities.

<u>Seismic Considerations</u>

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations from a seismic event. Liquefaction mainly affects geologically recent deposits of fine-grained sands that are below the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction, thus reducing or eliminating the soil's strength.

Review of the Liquefaction Susceptibility Map of Pierce County, Washington by Stephen P. Palmer, etc. (2004) indicates the site is mapped as having a high susceptibility to liquefaction.

Since the site has the potential for soil liquefaction during seismic event, it is should be classified as site class F. Per ASCE 7-16, Section 20.3, buildings that have fundamental periods of less than 0.5 second, site response analysis is not required.

Based on the International Building Code (IBC), RGI recommends the follow seismic parameters for design.

Table 1 IBC Seismic Parameters

2021 IBC Parameter	Value
Site Soil Class[1]	E[2]
Site Latitude	47.210217 N
Site Longitude	-122.2940066 W
Maximum considered earthquake spectral response acceleration parameters (g)	S_s =1.277, S_1 =0.439
Spectral response acceleration parameters adjusted for site class (g)	S_{ms} =1.534, S_{m1} =1.02[3]
Design spectral response acceleration parameters (g)	S_{ds} =1.021, S_{d1} =0.68[3]

. Note: In general accordance with Chapter 20 of ASCE 7-10. The Site Class is based on the average characteristics of the upper 100 feet of the subsurface profile.

2. Note: The 2021 IBC and ASCE 7-16 require a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope of our services does not include the required 100 foot soil profile determination. Test pit explorations extended to a maximum depth of 12.5 feet, and this seismic site class definition considers that similar soil continues below the maximum depth of the subsurface exploration. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration.

3. Note: In accordance with ASCE 11.4.8, a ground motion hazard analysis is not required for the following cases:

- Structures on Site Class E sites with S_S greater than or equal to 1.0, provided the site coefficient Fa is taken as equal to that of Site Class C.
- Structures on Site Class D sites with S_1 greater than or equal to 0.2, provided that the value of the seismic response coefficient Cs is determined by Eq. 12.8-2 for values of T ≤ 1.5Ts and taken as equal to 1.5 times the value computed in accordance with either Eq. 12.8-3 for $T_L \geq T > 1.5T_s$ or Eq. 12.8-4 for T > TL.
- Structures on Site Class E sites with S_1 greater than or equal to 0.2, provided that T is less than or equal to T_s and the equivalent static force procedure is used for design.

The above exceptions do not apply to seismically isolated structures, structures with damping systems or structures designed using the response history procedures of Chapter 16.

Erosion and Sediment Control

Potential sources or causes of erosion and sedimentation depend on construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. The impacts on erosion-prone areas can be reduced by implementing an erosion and sedimentation control plan. The plan should be designed in accordance with applicable city and/or county standards.

RGI recommends the following erosion control Best Management Practices (BMPs):

- Scheduling site preparation and grading for the drier summer and early fall months and undertaking activities that expose soil during periods of little or no rainfall
- Establishing a quarry spall construction entrance
- Installing siltation control fencing or anchored straw or coir wattles on the downhill side of work areas
- Covering soil stockpiles with anchored plastic sheeting

- Revegetating or mulching exposed soils with a minimum 3-inch thickness of straw if surfaces will be left undisturbed for more than one day during wet weather or one week in dry weather
- Directing runoff away from exposed soils and slopes
- Decreasing runoff velocities with check dams, straw bales or coir wattles
- Confining sediment to the project site
- Inspecting and maintaining erosion and sediment control measures frequently (The contractor should be aware that inspection and maintenance of erosion control BMPs is critical toward their satisfactory performance. Repair and/or replacement of dysfunctional erosion control elements should be anticipated.)

Permanent erosion protection should be provided by reestablishing vegetation using hydroseeding and/or landscape planting. Until the permanent erosion protection is established, site monitoring should be performed by qualified personnel to evaluate the effectiveness of the erosion control measures. Provisions for modifications to the erosion control system based on monitoring observations should be included in the erosion and sedimentation control plan.

Excavation

All temporary cut slopes associated with the site and utility excavations should be adequately inclined to prevent sloughing and collapse. The site soils consisted of medium dense to very dense fill comprised of gravelly sand with varying amounts of silt over native soils including loose to medium dense silty sand, medium stiff sandy silt, and soft organic silt.

Accordingly, for excavations more than 4 feet but less than 20 feet in depth, the temporary side slopes should be laid back with a minimum slope inclination of 1.5:1 (Horizontal:Vertical) in upper loose soil and 3H:4H in native glacial till. If there is insufficient room to complete the excavations in this manner, or excavations greater than 20 feet in depth are planned, using temporary shoring to support the excavations should be considered. For open cuts at the site, RGI recommends:

- No traffic, construction equipment, stockpiles or building supplies are allowed at the top of cut slopes within a distance of at least 5 feet from the top of the cut.
- Exposed soil along the slope is protected from surface erosion using waterproof tarps and/or plastic sheeting.
- Construction activities are scheduled so that the length of time the temporary cut is left open is minimized.
- Surface water is diverted away from the excavation.
- The general condition of slopes should be observed periodically by a geotechnical engineer to confirm adequate stability and erosion control measures.

In all cases, however, appropriate inclinations will depend on the actual soil and groundwater conditions encountered during earthwork. Ultimately, the site contractor must be responsible for maintaining safe excavation slopes that comply with applicable OSHA or WISHA guidelines.

Stripping and Site Preparation

Stripping efforts should include removal of pavements, vegetation, organic materials, and deleterious debris from areas slated for pavement and utility construction.

RGI anticipates that some areas of loose soil may be present on the site after stripping operations are complete. Prior to placement of structural fill, RGI recommends proofrolling building and pavement subgrades and areas to receive structural fill. These areas should be proofrolled under the observation of RGI and compacted to a firm and unyielding condition in order to achieve a minimum compaction level of 95 percent of the modified proctor maximum dry density as determined by the American Society of Testing and Materials D1557-09 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (ASTM D1557).

Proofrolling and adequate subgrade compaction can only be achieved when the soils are within approximately ± 2 percent moisture content of the optimum moisture content. Soils may be proofrolled with a heavy compactor, loaded double-axle dump truck, or other heavy equipment under the observation of a RGI representative. This observer will assess the subgrade conditions prior to filling.

Subgrade soils that become disturbed due to elevated moisture conditions should be overexcavated to reveal firm, non-yielding, non-organic soils and backfilled with compacted structural fill. In order to maximize utilization of site soils as structural fill, RGI recommends that the earthwork portion of this project be completed during extended periods of warm and dry weather, if possible. If earthwork is completed during the wet season (typically November through May) it will be necessary to take extra precautionary measures to protect subgrade soils. Wet season earthwork will require additional mitigative measures beyond what would be expected during the drier summer and fall months.

Structural Fill

Once site preparation is complete, cuts and fills can be made to establish desired pavement grades. Prior to placing fill, RGI recommends proof-rolling as described above. RGI recommends fill below the foundation and floor slab, behind retaining walls, and below pavement and hardscape surfaces be placed in accordance with the following recommendations for structural fill.

The suitability of excavated site soils and import soils for compacted structural fill use will depend on the gradation and moisture content of the soil when it is placed. As the amount of fines (that portion passing the U.S. No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult or impossible to achieve. Soils containing more than about 5 percent fines cannot be consistently compacted to a dense, non-yielding condition when the moisture content is more than 2 percent above or below optimum. Optimum moisture content is the moisture that results in the greatest compacted dry density with a specified compactive effort.

The onsite fill may be suitable for use as structural fill if the moisture can be properly controlled at the time of compaction if the construction occurs in dry weather. If the construction occurs in winter or extended to wet season, it may be necessary to import clean, granular soils to complete site work that meets the grading requirements listed in Table 2.

Table 2 Structural Fill Gradation

U.S. Sieve Size	Percent Passing
4 inches	100
¾ inch	70 minimum
No. 4	35 to 60
No. 200	0 to 5*

*Based on minus 3/4 inch fraction.

Prior to use, a RGI representative should observe and test all materials imported to the site for use as structural fill. Structural fill materials should be placed in uniform loose layers not exceeding 12 inches and compacted as specified in Table 3. The soil's maximum density and optimum moisture should be determined by ASTM D1557.

Table 3 Structural Fill Compaction ASTM D1557

Location	Material Type	Minimum Compaction Percentage	Moisture Content Range	
General Fill (non-structural areas)	On-site granular or approved imported fill soils	90	+3	-2
Pavement, Subgrade and Base Course	On-site granular or approved imported fill soils	95	+2	-2

Placement and compaction of structural fill should be observed by RGI. A representative number of in-place density tests should be performed as the fill is being placed to confirm that the recommended level of compaction is achieved.

<u>Guard House</u>

The proposed guard house foundations may be supported on at least 36 inches of reinforced structural fill. The reinforcing should consist of TenCate Mirafi® BXG12 Biaxial Geogrid or equivalent every 12 inches vertically with the first layer placed on the native soil or structural fill surface. The reinforced structural fill should extend a minimum distance of three feet beyond the foundations and should be installed and compacted following the recommendations above.

Typically, a reinforced concrete slab foundation with thickened edge is able to spread the building load and reduce the amount of settlement. The reinforced slab will carry the building load and transfer it to the bearing soil below it. With site preparation and structural fill completed as described above, suitable support for slab-on-grade construction should be provided.

Perimeter thickened edge foundations exposed to the weather should be at a minimum depth of 18 inches below final exterior grades. RGI recommends designing reinforced slab for a net allowable bearing capacity of 1,000 pounds per square foot (psf) on structural fill. For short-term loads, such as wind and seismic, a 1/3 increase in this allowable capacity can be used. For thickness design of the slab subjected to point loading, RGI recommends using a subgrade modulus (K_S) of 150 pounds per square inch per inch of deflection.

For designing foundations to resist lateral loads, a base friction coefficient of 0.25 can be used for compacted structural fill. Passive earth pressures acting on the side of the thickened edge can also be considered for resisting lateral loads. RGI recommends calculating this lateral resistance using an equivalent fluid weight of 250 pounds per cubic foot (pcf). At perimeter locations, RGI recommends not including the upper 12 inches of soil in this computation because it can be affected by weather or disturbed by future grading activity. This value assumes the foundation will be constructed neat against competent fill soil or backfilled with structural fill as described above. The recommended friction coefficient and passive resistance value includes a safety factor of 1.5.

The purpose of this option is to develop a firm base below the building to reduce the damages caused by differential settlements due to consolidation settlement and during a seismic event. It will not avoid or reduce the total settlement across the entire site. RGI recommends that the building be designed to tolerate differential settlement of 1.5 inches every 20 feet along the building length.

Slab-on-Grade

As described above, the slab-on-grade supported on shallow soil will be subject to a significant amount of consolidation and liquefaction induced settlement during a seismic event. RGI recommends that the slab be supported 3 feet reinforced structural fill.

Immediately below the floor slab, RGI recommends placing a 4-inch-thick capillary break layer of clean, free-draining pea gravel, washed rock, or crushed rock that has less than 5 percent passing the U.S. No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab. Where moisture by vapor transmission is undesirable, an 8- to 10-mil thick plastic membrane should be placed on the 4-inch-thick layer of clean gravel or rock.

Drainage

Final exterior grades should promote free and positive drainage away from the building area. Water must not be allowed to pond or collect adjacent to foundations or within the immediate building area. For non-pavement locations, RGI recommends providing a minimum drainage gradient of 3 percent for a minimum distance of 10 feet from the building perimeter. In paved locations, a minimum gradient of 1 percent should be provided unless provisions are included for collection and disposal of surface water adjacent to the structure.

Perimeter foundation drains shown on Figure 3 are typically installed around the perimeter of the buildings. The foundation drains and roof downspouts should be tightlined separately to an approved discharge facility. Subsurface drains must be laid with a gradient sufficient to promote positive flow to a controlled point of approved discharge.

<u>Pavement</u>

Regardless of the relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. This condition should be verified by proofrolling with heavy construction equipment or hand probe by inspector.

With the pavement subgrade prepared as described above, RGI recommends the following new pavement sections for truck entrance paved with flexible asphalt concrete surfacing.

- **For heavy truck traffic areas**: 4 inches of Hot Mix Asphalt (HMA) over 8 inches of crushed rock base (CRB) over 18 inches of structural fill over a woven fabric

The asphalt paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for Hot Mix Asphalt Class 1/2 inch and CRB surfacing.

RGI understands that concrete pavement is being considered by the design team. If concrete pavement is used, RGI recommends the following new pavement section.

- **For heavy truck traffic areas**: 5 inches of concrete over 4 inches of CRB over 18 inches structural fill over a woven fabric

Long-term pavement performance will depend on surface drainage. A poorly-drained pavement section will be subject to premature failure as a result of surface water infiltrating into the subgrade soils and reducing their supporting capability.

For optimum pavement performance, surface drainage gradients of no less than two percent are recommended. Also, some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

<u>Cement Treatment</u>

As discussed above, if the onsite fill cannot be properly compacted, import structural fill needs to be used below the pavement section. As an alternative, cement treatment can be considered for pavement subgrade support. If cement treatment will be used, the mix shall consist of onsite fill Portland cement, and water (if necessary) uniformly mixed, graded, compacted, finished, and compacted in accordance with these recommendations.

Portland Cement: Portland cement shall be Type II and shall be provided in accordance with Section 9-01 of the 2012 Washington State Department of Transportation (WSDOT) Standard

Specifications. Cement may be stored on site for use during the treatment process in a closed container

Water: Water shall be provided by the contractor and shall be free from substances deleterious to the hardening of the soil-cement.

Soil Material: Soil material shall consist of native subgrade material, of selected excavation material, or of a combination of these materials. The soil shall not contain roots, topsoil, or any material deleterious to its reaction with cement.

Equipment: Mixing shall be accomplished by equipment that will produce soil-cement mixing meeting the requirements for soil pulverization, cement and water application, mixing, transporting, placing, compacting, finishing, and curing as recommended herein. Agricultural disks or motor graders shall not be acceptable mixing equipment. The equipment shall have the ability to supply metered water and have the ability to adjust the supply of water to the material during the mixing procedure. While moving, the water supply shall deliver water evenly across the full width of the machine, if water is necessary to be added. If, in the opinion of the Engineer, the equipment is not equal to the above, the Contractor shall remove said equipment from the jobsite and replace it with equipment meeting the requirements above.

Cement Spreading and Mixing: Mixing of the soil material, cement, and water shall be accomplished by the mixed-in-place method. Cement shall be 3 to 6 percent by weight and may vary depending on the moisture content of the soil.

No cement shall be spread more than 500 feet beyond the mixing operation, unless approved by the Engineer. The mixing operation shall not exceed more than 500 feet beyond the grading, shaping, and compaction operation. The operation of cement application, mixing, spreading, compacting and finishing shall be continuous and completed within 4 hours from the start of mixing. Any soil-cement mixture that has not been compacted shall not be left undisturbed for longer than 30 minutes.

The operations of cement spreading, water application, and mixing shall be continuous and completed in daylight. No cement spreading shall be allowed during high winds. No cement shall be spread or soil-cement mixture mixed when the soil or subgrade is frozen.

Cement Spreading and Mixing Methods: Mixing shall be continued until the mixture is uniform in color and at the required moisture content throughout. Operations of cement spreading, water application, mixing, and grading mixed material shall result in a uniform soil, cement, and water mixture for the full depth and width.

The cement shall be uniformly distributed and mixed with the pulverized material and any existing underlying material or imported material as specified. The mixing operation may be accomplished by using either the same machine used for the pulverizing operation or a separate machine designed for in-place continuous mixing as approved by the Engineer. Regardless of which method is used, a control system capable of metering or measuring the cement application rate to an accuracy of plus/minus one pound per square yard shall be used. The equipment used to spread the cement shall have weighing scales, a foot per minute gauge, and a RPM vane feeder in order to provide control of the cement distribution process.

Compaction: The cement-stabilized base will be uniformly compacted to a minimum of 95 percent of maximum density based on a moving average of five consecutive tests with no individual test below 92 percent. Field density of compacted soil-cement shall be determined by the nuclear method in the direct transmission mode (American Society for Testing and Materials D6938-10 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) (ASTM D6938).

The specified optimum moisture content and maximum density shall be determined prior to the start of construction and also in the field by a moisture-density test, (ASTM D1557), on representative samples of soil-cement mixture obtained from the area being processed at the time compaction begins. The soil-cement shall be compacted by a vibratory roller to the specified density.

Finishing: When initial compaction is nearing completion at subgrade elevations, the surface of the soil cement will be shaped to the required lines, grades, and cross section. The moisture content of the surface material shall be maintained at or not less than 2 percent below or above the specified optimum moisture content during finishing operation. Compaction and finishing shall be done in such a manner as to produce, in not longer than 2 hours, a smooth, dense surface free of compaction planes, cracks, ridges, or loose material.

With the pavement subgrade prepared following the above procedure, RGI recommends the following alternative pavement sections for heavy truck traffic paved with flexible asphalt and concrete surfacing.

- Flexible Asphalt: 4 inches of HMA over 4 inches of CRB over 18 inches of treated soil subgrade
- Concrete Surface: 5 inches of concrete over 4 inches of CRB over 18 inches of treated soil subgrade

If you have any questions or require additional information, please contact us.

Respectfully submitted,

THE RILEY GROUP, INC.

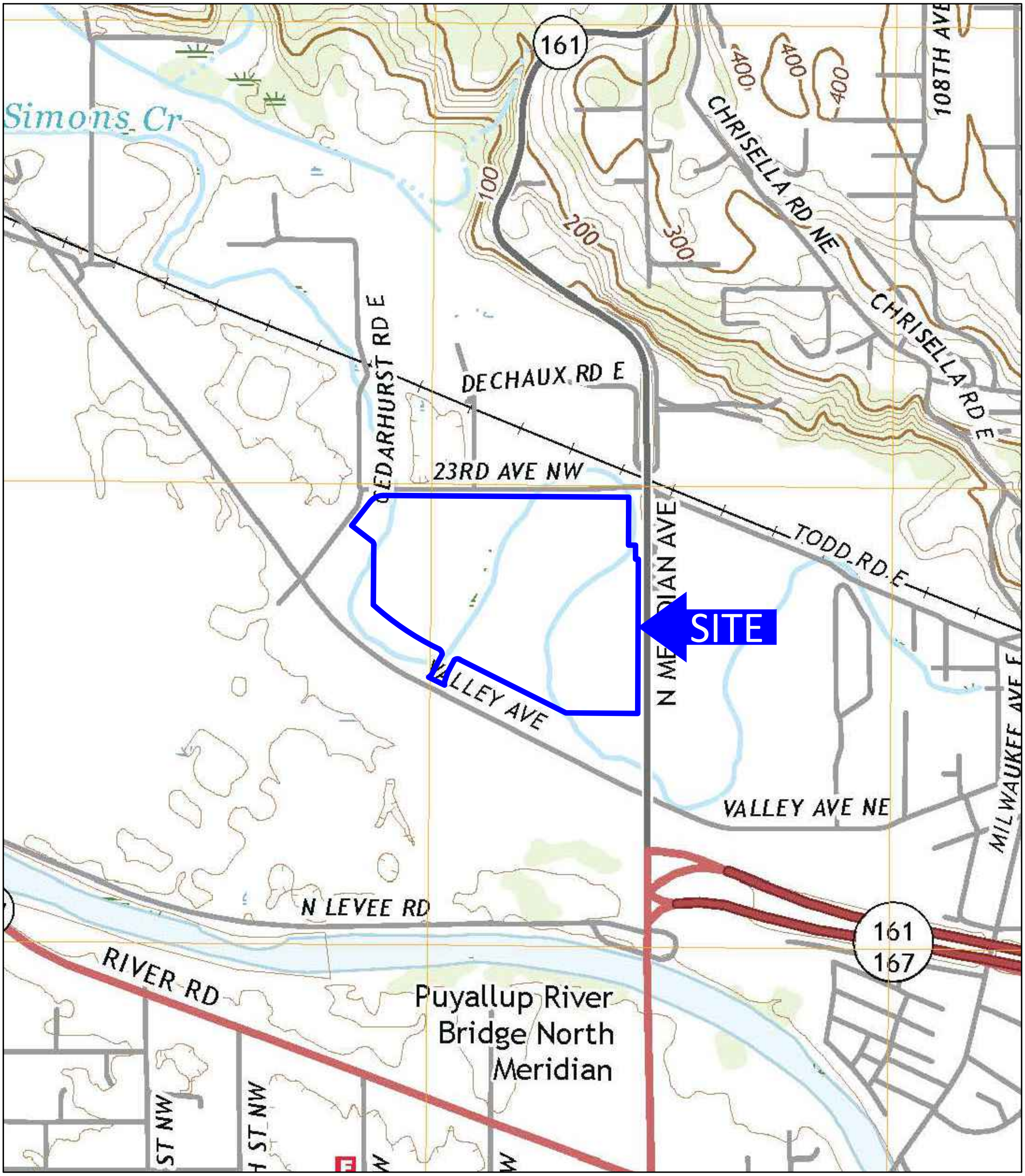
State of Washington Licensed Geologist 2698 ERIC L. WOODS
4/9/2024

Ricky Runqi Wang State of Washington 35013 Registered Professional Engineer
4/9/2024

Eric L. Woods, LG
Senior Project Geologist

Ricky R. Wang, PhD, PE
Principal Engineer

Attachments: Figure 1. Site Vicinity Map
Figure 2. Geotechnical Exploration Plan
Figure 3. Typical Footing Drain Detail
Test Pit Logs



USGS, 2020, Puyallup, Washington
7.5-Minute Quadrangle

Approximate Scale: 1"=1000'

0 500 1000 2000

N

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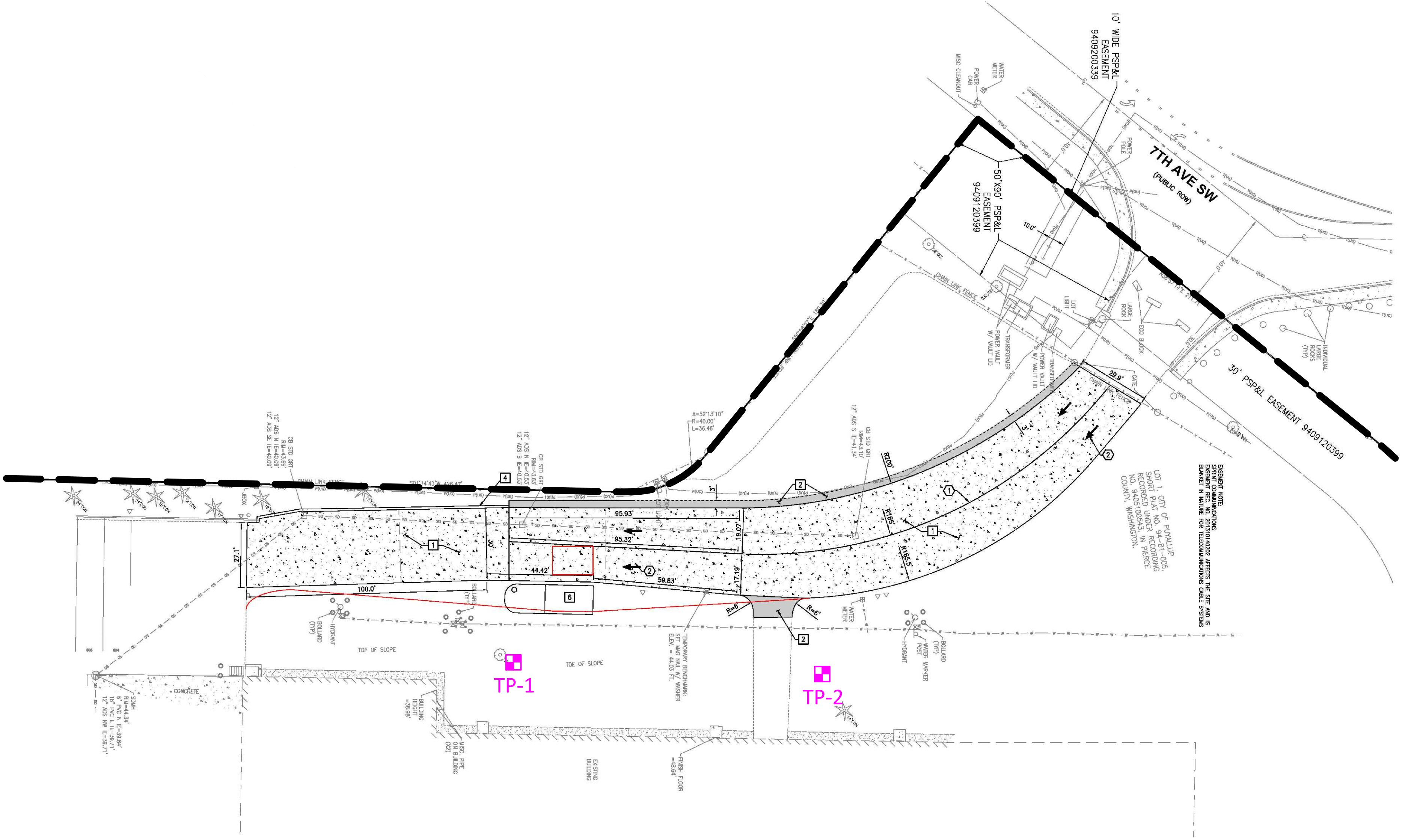
Fred Meyer Distribution Center - Truck Entrance		Figure 1
RGI Project Number 2017-206-2	Site Vicinity Map	Date Drawn: 04/2024
Address: 2200 North Meridian, Puyallup, Washington 98371		



Approximate Scale: 1" = 60'

0 30 60 120

N

= Test pit locations by RGI, 03/27/2024

= Site boundary

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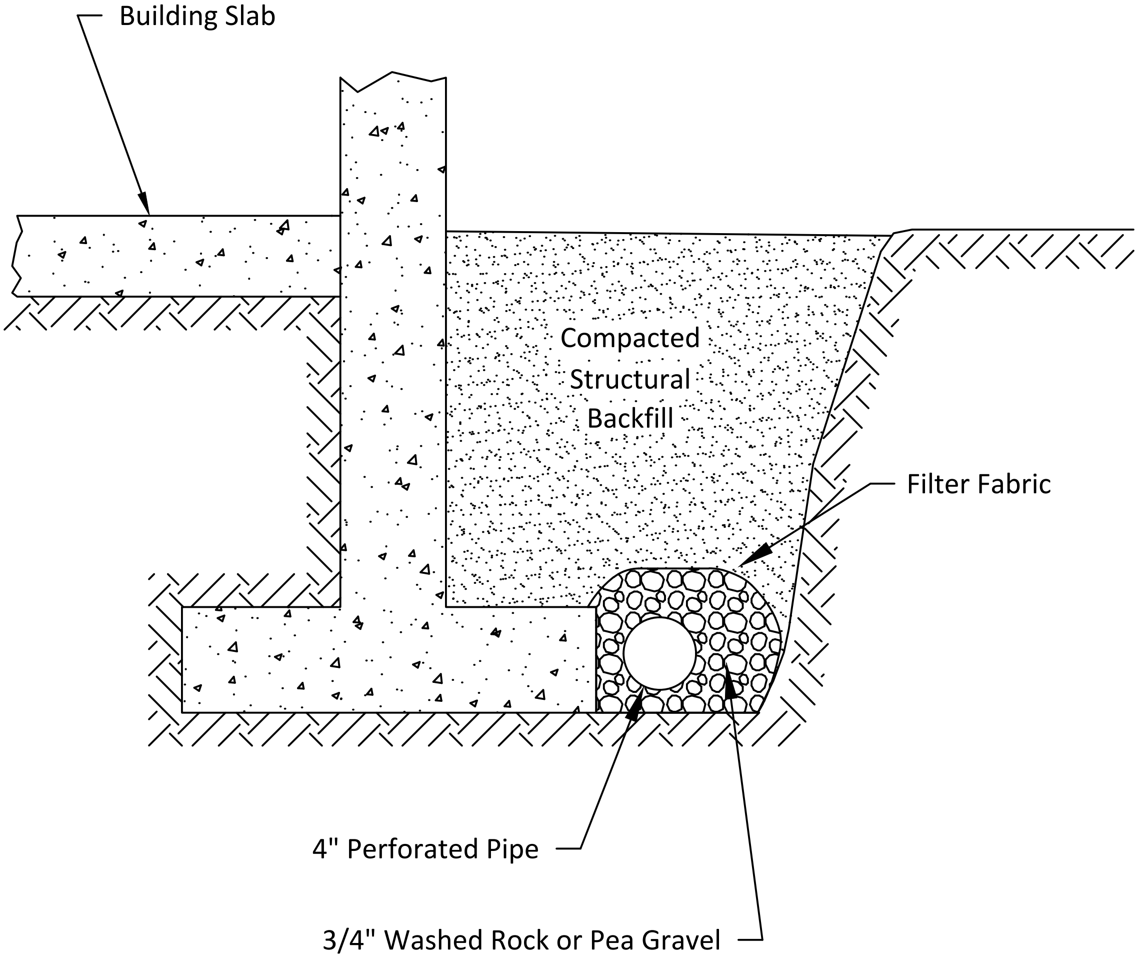
Fred Meyer Distribution Center - Truck Entrance		Figure 2
RGI Project Number 2017-206-2	Geotechnical Exploration Plan	Date Drawn: 04/2024
Address: 2200 North Meridian, Puyallup, Washington 98371		



Not to Scale

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Fred Meyer Distribution Center - Truck Entrance		Figure 3
RGI Project Number 2017-206-2	Typical Footing Drain Detail	Date Drawn: 04/2024
Address: 2200 North Meridian, Puyallup, Washington 98371		

Project Name: **Fred Meyer Distribution Center - Truck Entrance** Project Number: **2017-206-2** Client: **The Kroger Co.**	RILEYGROUP Test Pit No.: TP-1

Date(s) Excavated: **3/27/2024**	Logged By **ELW**	Surface Conditions: **Grass**
Excavation Method: **Test Pit**	Bucket Size: **N/A**	Total Depth of Excavation: **12.5 feet bgs**
Excavator Type: **Mini Excavator**	Excavating Contractor: **Chavira Associates**	Approximate Surface Elevation **N/A**
Groundwater Level: **Not Encountered**	Sampling Method(s) **Grab**	Compaction Method **Bucket**
Test Pit Backfill: **Cuttings**	Location **2200 North Meridian, Puyallup, Washington**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0					6" topsoil	
				Fill		Gray gravelly SAND, medium dense, moist (Fill)	
							8% moisture
						Contains trace concrete and metal debris	
	5			ML		Tan sandy SILT, medium stiff, moist	
							24% moisture, 68% fines
	10						
				SM		Tan silty SAND, loose to medium dense, moist	25% moisture, 33% fines
						Test Pit terminated at 12.5'	

Project Name: **Fred Meyer Distribution Center - Truck Entrance**
Project Number: **2017-206-2**
Client: **The Kroger Co.**

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Test Pit No.: TP-2

Date(s) Excavated: **3/27/2024**	Logged By **ELW**	Surface Conditions: **Grass**
Excavation Method: **Test Pit**	Bucket Size: **N/A**	Total Depth of Excavation: **11 feet bgs**
Excavator Type: **Mini Excavator**	Excavating Contractor: **Chavira Associates**	Approximate Surface Elevation **N/A**
Groundwater Level: **Seepage at 1.5'**	Sampling Method(s) **Grab**	Compaction Method **Bucket**
Test Pit Backfill: **Cuttings**	Location **2200 North Meridian, Puyallup, Washington**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0					6" topsoil	
				Fill		Brown silty gravelly SAND, medium dense, moist (Fill)	
						Light groundwater seepage	
						Becomes gray, very dense	11% moisture, 20% fines
							5% moisture
	5					Becomes dense	
				Fill		Gray gravelly SAND with some silt, medium dense, moist (Fill)	9% moisture, 12% fines
						Fabric at 10 feet	
	10			OL		Black ORGANIC SILT, soft, moist	44% moisture
						Test Pit terminated at 11'	

Project Name: **Fred Meyer Distribution Center - Truck Entrance**
Project Number: **2017-206-2**
Client: **The Kroger Co.**

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Key to Logs

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8

COLUMN DESCRIPTIONS

1 Elevation (feet): Elevation (MSL, feet).
2 Depth (feet): Depth in feet below the ground surface.
3 Sample Type: Type of soil sample collected at the depth interval shown.
4 Sample Number: Sample identification number.
5 USCS Symbol: USCS symbol of the subsurface material.
6 Graphic Log: Graphic depiction of the subsurface material encountered.
7 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
8 REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

AF
SILT, SILT w/SAND, SANDY SILT (ML)
Low plasticity PEAT (OL)
Silty SAND (SM)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting, AW)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
? Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

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GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Fred Meyer Distribution Center - Truck Entrance	**Exploration Type**	TP-1
PROJECT NO.	2017-206-2	**Depth**	6'
TECH/TEST DATE	EW/PL 3/27/2024	**Date Received**	3/27/2024

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	595.1
Wt Dry Soil & Tare (gm)	(w2)	505.3
Weight of Tare (gm)	(w3)	134.9
Weight of Water (gm)	(w4=w1-w2)	89.8
Weight of Dry Soil (gm)	(w5=w2-w3)	370.4
Moisture Content (%)	(w4/w5)*100	24

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

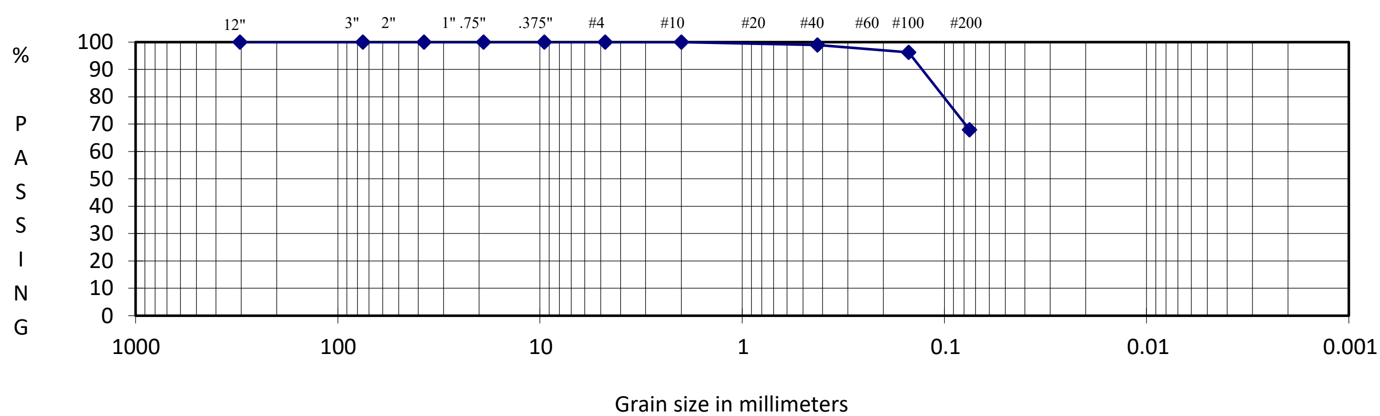
	Weight Of Sample (gm)	505.3
	Tare Weight (gm)	134.9
(W6)	Total Dry Weight (gm)	370.4

% COBBLES	0.0
% C GRAVEL	0.0
% F GRAVEL	0.0
% C SAND	0.1
% M SAND	1.0
% F SAND	31.0
% FINES	67.9
% TOTAL	100.0

D10 (mm)	
D30 (mm)	
D60 (mm)	
Cu	
Cc	

SIEVE ANALYSIS

Sieve	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	134.9	0.00	0.00	100.00	cobbles
3.0"	134.9	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"					coarse gravel
1.5"	134.9	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	134.9	0.00	0.00	100.00	fine gravel
0.50"					fine gravel
0.375"	134.9	0.00	0.00	100.00	fine gravel
#4	134.9	0.00	0.00	100.00	coarse sand
#10	135.1	0.20	0.05	99.95	medium sand
#20					medium sand
#40	138.9	4.00	1.08	98.92	fine sand
#60					fine sand
#100	148.7	13.80	3.73	96.27	fine sand
#200	253.8	118.90	32.10	67.90	fines
PAN	505.3	370.40	100.00	0.00	silt/clay



DESCRIPTION	Sandy SILT
USCS	ML

Prepared For:
PanGEO, Inc.

Reviewed By:
ELW

RILEYGROUP

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GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Fred Meyer Distribution Center - Truck Entrance	Exploration Type	TP-1
PROJECT NO.	2017-206-2	Depth	11'
TECH/TEST DATE	EW/PL 3/27/2024	Date Received	3/27/2024

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	540.0
Wt Dry Soil & Tare (gm)	(w2)	458.3
Weight of Tare (gm)	(w3)	126.5
Weight of Water (gm)	(w4=w1-w2)	81.7
Weight of Dry Soil (gm)	(w5=w2-w3)	331.8
Moisture Content (%)	(w4/w5)*100	25

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

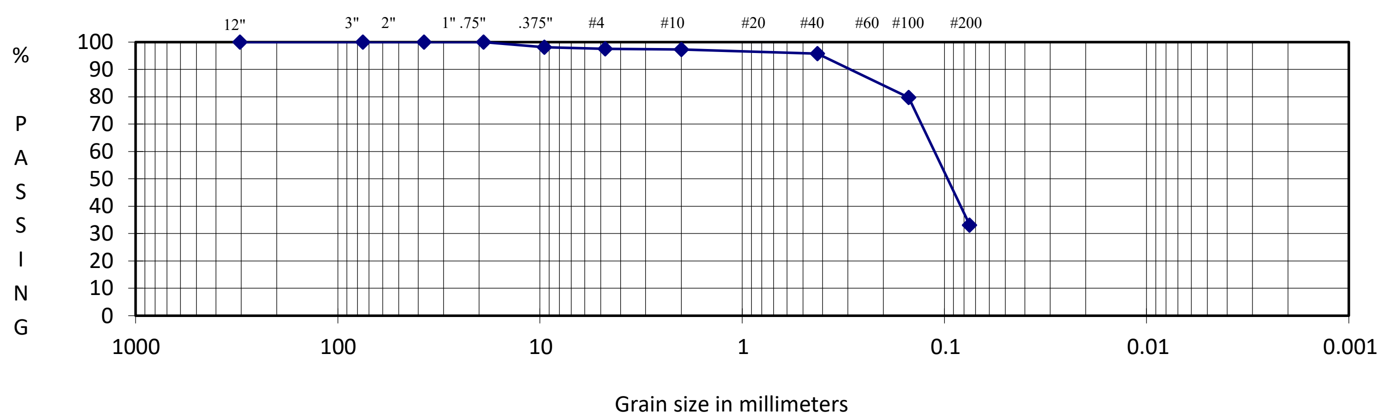
	Weight Of Sample (gm)	458.3
	Tare Weight (gm)	126.5
(W6)	Total Dry Weight (gm)	331.8

% COBBLES	0.0
% C GRAVEL	0.0
% F GRAVEL	2.5
% C SAND	0.2
% M SAND	1.4
% F SAND	62.7
% FINES	33.2
% TOTAL	100.0

D10 (mm)	
D30 (mm)	
D60 (mm)	
Cu	
Cc	

SIEVE ANALYSIS

Sieve	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	126.5	0.00	0.00	100.00	cobbles
3.0"	126.5	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"					coarse gravel
1.5"	126.5	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	126.5	0.00	0.00	100.00	fine gravel
0.50"					fine gravel
0.375"	132.9	6.40	1.93	98.07	fine gravel
#4	134.7	8.20	2.47	97.53	coarse sand
#10	135.5	9.00	2.71	97.29	medium sand
#20					medium sand
#40	140.3	13.80	4.16	95.84	fine sand
#60					fine sand
#100	193.8	67.30	20.28	79.72	fine sand
#200	348.3	221.80	66.85	33.15	fines
PAN	458.3	331.80	100.00	0.00	silt/clay



DESCRIPTION Silty SAND

USCS SM

Prepared For:
PanGEO, Inc.

Reviewed By:
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GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Fred Meyer Distribution Center - Truck Entrance	Exploration Type	TP-2
PROJECT NO.	2017-206-2	Depth	2.5'
TECH/TEST DATE	EW/PL 3/27/2024	Date Received	3/27/2024

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	717.2
Wt Dry Soil & Tare (gm)	(w2)	657.2
Weight of Tare (gm)	(w3)	134.0
Weight of Water (gm)	(w4=w1-w2)	60.0
Weight of Dry Soil (gm)	(w5=w2-w3)	523.2
Moisture Content (%)	(w4/w5)*100	11

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

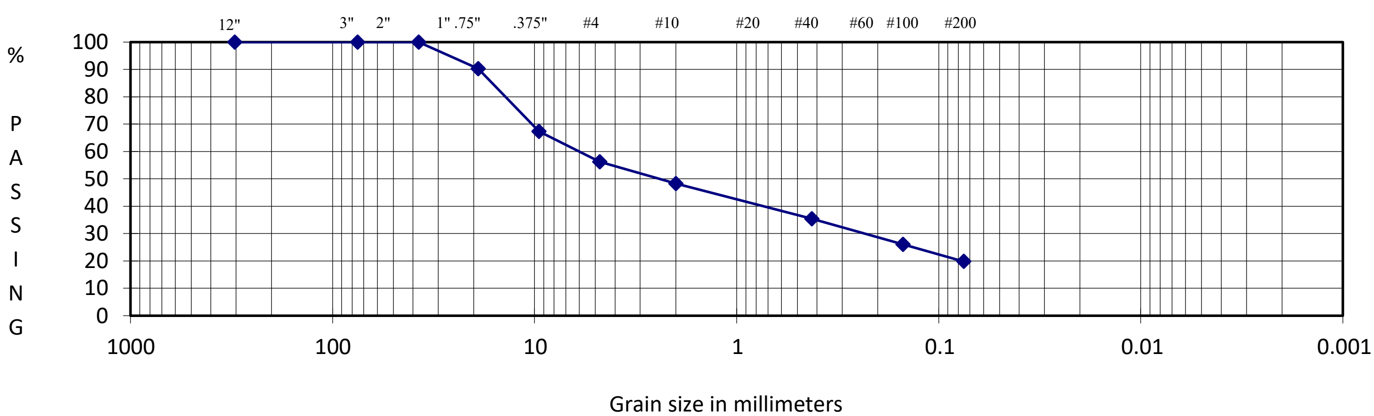
	Weight Of Sample (gm)	657.2
	Tare Weight (gm)	134.0
(W6)	Total Dry Weight (gm)	523.2

% COBBLES	0.0
% C GRAVEL	9.7
% F GRAVEL	34.0
% C SAND	7.9
% M SAND	12.9
% F SAND	15.6
% FINES	19.9
% TOTAL	100.0

D10 (mm)	
D30 (mm)	
D60 (mm)	
Cu	
Cc	

SIEVE ANALYSIS

Sieve	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	134.0	0.00	0.00	100.00	cobbles
3.0"	134.0	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"					coarse gravel
1.5"	134.0	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	185.0	51.00	9.75	90.25	fine gravel
0.50"					fine gravel
0.375"	305.0	171.00	32.68	67.32	fine gravel
#4	362.9	228.90	43.75	56.25	coarse sand
#10	404.3	270.30	51.66	48.34	medium sand
#20					medium sand
#40	471.7	337.70	64.55	35.45	fine sand
#60					fine sand
#100	520.6	386.60	73.89	26.11	fine sand
#200	553.3	419.30	80.14	19.86	fines
PAN	657.2	523.20	100.00	0.00	silt/clay



DESCRIPTION	Silty gravelly SAND
USCS	SM

Prepared For: *PanGEO, Inc.*

Reviewed By: ELW

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GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Fred Meyer Distribution Center - Truck Entrance	**Exploration Type**	TP-2
PROJECT NO.	2017-206-2	**Depth**	9'
TECH/TEST DATE	EW/PL 3/27/2024	**Date Received**	3/27/2024

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	688.8
Wt Dry Soil & Tare (gm)	(w2)	644.2
Weight of Tare (gm)	(w3)	134.4
Weight of Water (gm)	(w4=w1-w2)	44.6
Weight of Dry Soil (gm)	(w5=w2-w3)	509.8
Moisture Content (%)	(w4/w5)*100	9

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

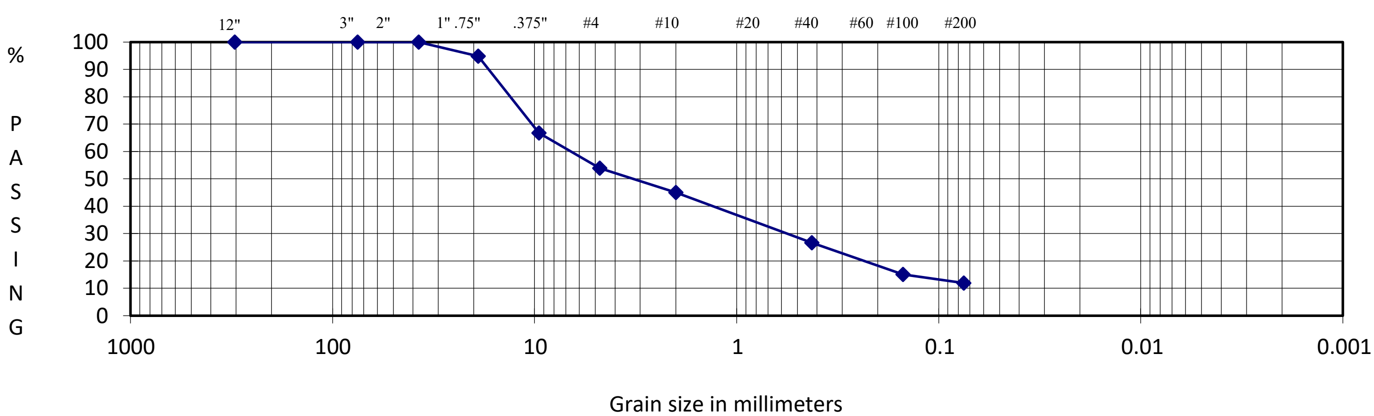
	Weight Of Sample (gm)	644.2
	Tare Weight (gm)	134.4
(W6)	Total Dry Weight (gm)	509.8

% COBBLES	**0.0**
% C GRAVEL	**5.1**
% F GRAVEL	**41.0**
% C SAND	**8.9**
% M SAND	**18.3**
% F SAND	**14.7**
% FINES	**11.9**
% TOTAL	**100.0**

D10 (mm)	0.075
D30 (mm)	0.54
D60 (mm)	6.8
Cu	90.7
Cc	0.6

SIEVE ANALYSIS

Sieve	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	134.4	0.00	0.00	100.00	cobbles
3.0"	134.4	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"					coarse gravel
1.5"	134.4	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	160.5	26.10	5.12	94.88	fine gravel
0.50"					fine gravel
0.375"	303.6	169.20	33.19	66.81	fine gravel
#4	369.5	235.10	46.12	53.88	coarse sand
#10	414.8	280.40	55.00	45.00	medium sand
#20					medium sand
#40	508.2	373.80	73.32	26.68	fine sand
#60					fine sand
#100	567.3	432.90	84.92	15.08	fine sand
#200	583.3	448.90	88.05	11.95	fines
PAN	644.2	509.80	100.00	0.00	silt/clay



DESCRIPTION	Gravelly SAND with some silt
USCS	SP-SM

Prepared For:
PanGEO, Inc.

Reviewed By:
ELW

RILEYGROUP