GEOTECHNICAL ENGINEERING REPORT

PREPARED BY:

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PREPARED FOR:

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RGI PROJECT NO. 2022-522-1

SHERWOOD CHEVRON
21090 SOUTHWEST PACIFIC HIGHWAY
SHERWOOD, OREGON 97140

NOVEMBER 18, 2022

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RILEYGROUP

November 18, 2022

Mr. Dan Goalwin
Barghausen Consulting Engineers, Inc.
21090 Southwest Pacific Highway
Sherwood, Oregon 97140

Subject: **Geotechnical Engineering Report**
Sherwood Chevron
21090 Southwest Pacific Highway
Sherwood, Oregon 97140
RGI Project No. 2022-522-1

Dear Mr. Goalwin:

As requested, The Riley Group, Inc. (RGI) has prepared this Geotechnical Engineering Report (GER) for the above-referenced site. Our services were completed in accordance with our proposal 2022-522-PRP1 dated August 29, 2022 and authorized by the client on September 19, 2022. The information in this GER is based on our understanding of the proposed construction, and the soil and groundwater conditions encountered in the borings and test pit completed by RGI at the site on October 28, 2022.

RGI recommends the project plans and specifications be submitted for a general review so that RGI may confirm that the recommendations in this GER are interpreted and implemented properly in the construction documents. RGI also recommends that a representative of our firm be present on site during portions of the project construction to confirm that the soil and groundwater conditions are consistent with those that form the basis for the engineering recommendations in this GER.

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

Respectfully submitted,

THE RILEY GROUP, INC.

REGISTERED PROFESSIONAL ENGINEER
19328PE
OREGON
July 15, 1997
RICKY RUNQI WANG
EXPIRES: June 30, 2024

11/18/2022

Eric L. Woods, LG
Project Geologist

Ricky R. Wang, PhD, PE
Principal Engineer

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LIST OF APPENDICES

Executive Summary

This Executive Summary should be used in conjunction with the entire GER for design and/or construction purposes. It should be recognized that specific details were not included or fully developed in this section, and this GER must be read in its entirety for a comprehensive understanding of the items contained herein. Section 7.0 should be read for an understanding of limitations.

RGI's geotechnical scope of work included the advancement of one test pit and five borings to depths up to 31.5 feet below ground surface (bgs).

Based on the information obtained from our subsurface exploration, the site is suitable for development of the proposed project. The following geotechnical considerations were identified.

Soil Conditions: The site is underlain by loose to medium dense silty sand and medium stiff to stiff sandy silt.

Groundwater: Groundwater was encountered at Boring B-3 at a depth of 31 feet bgs during our subsurface exploration.

Foundations: Foundations for the proposed building and canopy foundation can be supported on spread footings bearing on recompacted native soil subgrade or structural fill.

Slab-on-grade: Slab-on-grade floors for the proposed building can be supported on recompacted native soil subgrade or structural fill.

Pavements: The following new pavement sections are recommended:

- **For heavy truck traffic areas**: 4 inches of Hot Mix Asphalt over 8 inches of crushed rock base (CRB) over recompacted native soil
- **For general parking areas**: 3 inches of Hot Mix Asphalt over 6 inches of CRB over recompacted native soil
- **Concrete Pavement**: 5 inches of concrete over 4 inches of CRB over recompacted native soil

1.0 Introduction

This Geotechnical Engineering Report (GER) presents the results of the geotechnical engineering services provided for the proposed Sherwood Chevron in Sherwood, Oregon. The purpose of this GER is to assess subsurface conditions and provide geotechnical recommendations for the construction of a Sherwood Chevron. Our scope of services included field explorations, laboratory testing, engineering analyses, and preparation of this GER.

The recommendations in the following sections of this GER are based upon our current understanding of the proposed site development as outlined below. If actual features vary or changes are made, RGI should review them in order to modify our recommendations as required. In addition, RGI requests to review the site grading plan, final design drawings and specifications when available to verify that our project understanding is correct and that our recommendations have been properly interpreted and incorporated into the project design and construction.

2.0 Project Description

The project site is located at 21090 Southwest Pacific Highway in Sherwood, Oregon. The approximate location of the site is shown on Figure 1.

The site is occupied by an existing Chevron station with a paved parking lot. RGI understands it is proposed to add a new C-store about 4,022 square feet, build a trash enclosure, and landscaping upgrades. It is also understood that new underground storage tanks are to be installed to the south of the existing fuel canopy. RGI's understanding of the project is based on the plan SP1 prepared by Stantec Architecture, Inc.

RGI anticipates that the proposed building will be supported on perimeter foundation and the canopy will be supported with a series of columns. RGI expects that the perimeter wall loading will be 1 to 2 kips per linear foot and maximum column load will be up to 50 kips. Slab-on-grade floor loading of 250 pounds per square foot (psf) are expected. Minor site grading will be needed to reach the final grade.

3.0 Field Exploration and Laboratory Testing

3.1 Field Exploration

On October 28, 2022, RGI observed the excavation of one test pit and the drilling of five borings. The approximate exploration locations are shown on Figure 2.

Field logs of each exploration were prepared by the geologist who continuously observed the drilling and test pit. These logs included visual classifications of the materials encountered during drilling as well as our interpretation of the subsurface conditions between samples. The boring and test pit logs included in Appendix A represent an interpretation of the field logs and include modifications based on laboratory observation and analysis of the samples.

3.2 Laboratory Testing

During the field investigation, a representative portion of each recovered sample was sealed in containers and transported to our laboratory for further visual and laboratory examination. Samples retrieved from the borings were tested for moisture content and grain size analysis to aid in soil classification and provide input for the recommendations provided in this GER. The results and descriptions of the laboratory tests are enclosed in Appendix A.

4.0 Site Conditions

4.1 Surface

The site is bound to the northwest by Southwest Pacific Highway, to the east by Southwest Langer Drive, and to the southwest by Southwest Sherwood Boulevard.

The site is occupied with existing Chevron fuel station with a paved parking lot. Most of the site is relatively level with less than 5 feet of elevation change across the property. The site is mostly paved with asphalt, with grass and decorative plants and trees in planter areas around the site perimeter.

4.2 Geology

Review of the *Generalized Geologic Map of the Willamette Lowland* by Marshall W. Gannett and Rodney R. Caldwell (1998) indicates the soil in the vicinity of the site is mapped as Alluvium and glacial-outburst flood sediment (Map Unit Qs), which is silt, sand, and gravel deposited by glacial-outburst floods. The native soil observed at the boring locations appear to match the descriptions.

4.3 Soils

The site is underlain by loose to medium dense silty sand and medium stiff to stiff sandy silt.

More detailed descriptions of the subsurface conditions encountered are presented in the boring logs included in Appendix A. Sieve analyses were performed on three selected soil samples. The grain-size distribution curves are included in Appendix A.

4.4 GROUNDWATER

Groundwater was encountered at Boring B-3 at a depth of 31 feet bgs during our subsurface exploration. It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the explorations were performed. In addition, perched water can develop within seams and layers contained in fill soils or higher permeability soils overlying less permeable soils following periods of heavy or prolonged precipitation.

4.5 SEISMIC CONSIDERATIONS

Based on the current International Building Code (IBC), RGI recommends the following seismic parameters provided in Table 1 be used for design.

Table 1 IBC Seismic Parameters

2018 IBC Parameter	Value
Site Soil Class[1]	E[2]
Site Latitude	45.3666304 N
Site Longitude	122.8474798 W
Maximum considered earthquake spectral response acceleration parameters (g)	S_s =0.834, S_1 =0.394
Spectral response acceleration parameters adjusted for site class (g)	S_{ms} =1.056, S_{m1} =0.955[3]
Design spectral response acceleration parameters (g)	S_{ds} =0.704, S_{d1} =0.637[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 2015 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 31.5 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.

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. 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.

RGI reviewed the soil conditions encountered during field exploration and assessed the potential for liquefaction of the site's soil during an earthquake. Due to the depth to groundwater is deep; in our professional opinion, the potential of soil liquefaction during an earthquake event is low.

4.6 Geologic Hazard Areas

Regulated geologically hazardous areas include erosion, landslide, earthquake, or other geological hazards. Based on the mapping information from Oregon Department of Geology and Mineral Industries Statewide Geohazards Viewer, the vicinity of the project site is mapped as a low liquefaction hazard area. Therefore, based our evaluation and analysis, RGI considers that the liquefaction potential for the site is low and it doesn't have any impact to the proposed development.

5.0 Discussion and Recommendations

5.1 Geotechnical Considerations

Based on our study, the site is suitable for the proposed construction from a geotechnical standpoint. The building foundations can be supported on conventional spread footings or structural slab bearing on competent native soil or structural fill. If the native soil at footing subgrade is loose, it should be recompacted.

Slab-on-grade floors and pavements can be similarly supported on recompacted native soil or structural fill. 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.

5.2 Earthwork

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.

5.2.1 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.

5.2.2 EXCAVATIONS

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 loose to medium dense silty sand and medium stiff to stiff sandy 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). 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.

5.2.3 UNDERGROUND STORAGE TANK INSTALLATION

The installation of the underground storage tank (UST) will require an excavation of up to 20 feet bgs. The contractor typically prefers slide rail shoring system for supporting the excavation area.

Slide rail shoring system is a dig-and-push style shoring system. With its modular flexible design, the system can work with a wide variety of shapes and sizes. The system is installed from the top down and removed from the bottom up, minimizing size of excavation, and soil disturbance. Based on the depth of excavation, they are designed as single, double, and triple track system. The double track system can provide protection at depth from 12 feet to 20 feet which is expected to be needed for the project. RGI recommends that double track slide rail system be used for the UST excavation support.

The depth to the top of the USTs is typically 3 feet below finished grade with at least 2 feet of appropriate backfill material. The backfill can be either pea gravel or other material per API specifications for setting the tanks.

The installation will require tank hold down slabs or anchors to accommodate possible buoyant forces. The UST system installation and design must be in accordance with API regulations.

5.2.4 STRIPPING AND SITE PREPARATION

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

5.2.5 STRUCTURAL FILL

Once site preparation is complete, cuts and fills can be made to establish desired building 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 native soils are moisture sensitive and 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	
Foundations	On-site granular or approved imported fill soils	95	+2	-2
Retaining Wall Backfill	On-site granular or approved imported fill soils	92	+2	-2
Slab-on-grade	On-site granular or approved imported fill soils	95	+2	-2
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.

5.3 FOUNDATIONS

The proposed building and canopy foundation can be supported on conventional spread footings bearing on medium dense native soil or structural fill. Where loose soils or other unsuitable soils are encountered in the proposed building footprint, they should be recompacted or overexcavated and backfilled with structural fill.

Perimeter foundations exposed to weather should be at a minimum depth of 18 inches below final exterior grades. Interior foundations can be constructed at any convenient depth below the floor slab. Finished grade is defined as the lowest adjacent grade within 5 feet of the foundation for perimeter (or exterior) footings and finished floor level for interior footings.

Table 4 Foundation Design

Design Parameter	Value
Allowable Bearing Capacity – Native soil or Structural fill	2,000 psf[1]
Friction Coefficient	0.25
Passive pressure (equivalent fluid pressure)	250 pcf[2]
Minimum foundation dimensions	Columns: 24 inches Walls: 16 inches

1 psf = pounds per square foot
2 pcf = pounds per cubic foot

The allowable foundation bearing pressures apply to dead loads plus design live load conditions. For short-term loads, such as wind and seismic, a 1/3 increase in this allowable capacity may be used. At perimeter locations, RGI recommends not including the upper 12 inches of soil in the computation of passive pressures because it can be affected by weather or disturbed by future grading activity. The passive pressure value assumes the foundation will be constructed neat against competent soil or backfilled with structural fill as described in Section 5.2.4. The recommended base friction and passive resistance value includes a safety factor of about 1.5.

With spread-footing foundations designed in accordance with the recommendations in this section, maximum total and differential post-construction settlements of 1 inch and 1/2 inch, respectively, should be expected.

5.4 RETAINING WALL

RGI is not aware of retaining wall that will be needed on the site. If retaining walls are needed for a detention vault or site retaining walls, RGI recommends cast-in-place concrete walls be used. The magnitude of earth pressure development on retaining walls will partly depend on the quality of the wall backfill. RGI recommends placing and compacting wall backfill as structural fill. The retaining wall foundation must be supported on recompacted native soil or structural fill. Wall drainage will be needed behind the wall face. A typical retaining wall drainage detail is shown on Figure 3. The retaining wall foundation subgrade should be supported on competent native soil.

With wall backfill placed and compacted as recommended, and drainage properly installed, RGI recommends using the values in the following table for design.

Table 5 Retaining Wall Design

Design Parameter	Value
Allowable Bearing Capacity – Native soil or Structural fill	2,000 psf
Active Earth Pressure (unrestrained walls)	35 pcf
At-rest Earth Pressure (restrained walls)	50 pcf

For seismic design, an additional uniform load of 7 times the wall height (H) for unrestrained walls and 14H for restrained walls should be applied to the wall surface. Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in the Section 5.3.

5.5 Slab-on-Grade Construction

Once site preparation has been completed as described in Section 5.2, suitable support for slab-on-grade construction should be provided. The native soil subgrade should be medium dense or recompacted. 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 a 4-inch-thick layer of clean gravel or rock.

For the anticipated floor slab loading, we estimate post-construction floor settlements of ¼- to ½-inch. For thickness design of the slab subjected to point loading from storage racks, RGI recommends using a subgrade modulus (K_S) of 150 pounds per square inch per inch of deflection.

If the buildings will be supported on reinforced slab with thicken edges, a soil bearing capacity of 1,000 pound per square feet (psf) and subgrade modulus of 150 pound per cubic inch (pci) can be used for the concrete slab design. For the anticipated floor slab loading, we estimate post-construction floor settlements of ¼- to ½-inch.

5.6 DRAINAGE

5.6.1 SURFACE

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.

5.6.2 SUBSURFACE

Perimeter foundation drains, details shown on Figure 4, are generally installed around the building. 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. If the building is supported on reinforced slab with thicken edge and paved to the building, the footing drains can be eliminated.

5.6.3 INFILTRATION

RGI excavated test pit (TP-1) to complete infiltration testing. Approximately 4.5 feet of potentially contaminated fill soil (petroleum odor) consisting of silty fine sand with asphalt pieces and construction debris over medium dense silty sand was encountered in test pit TP-1. Due to potentially contaminated fill soils, infiltration testing was not performed.

RGI has reviewed the native soil conditions for the potential for infiltration based on grain size analysis. The native soil at shallow depth is silty sand to silt (with 37.5 to 57.5% of fines), which does not support onsite infiltration systems. Therefore, RGI doesn't recommend onsite infiltration system be used for stormwater disposal.

5.7 UTILITIES

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA) specifications. For site utilities located within the right-of-ways, bedding and backfill should be completed in accordance with City of Sherwood specifications. At a minimum, trench backfill should be placed and compacted as structural fill, as described in Section 5.2.4. Where utilities occur below unimproved areas, the degree of compaction can be reduced to a minimum of 90 percent of the soil's maximum density as determined by ASTM D1557. The native soils may be used as backfill provided they can be adequately moisture conditioned and compacted in dry weather condition. Imported structural fill may be required for trench backfill in winter.

5.8 PAVEMENTS

Pavement subgrades should be prepared as described in Section 5.2 of this GER and as discussed below. 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 parking and drive areas 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 recompacted native soil
- **For general parking areas**: 3 inches of HMA over 6 inches of CRB over recompacted native soil

The asphalt paving materials used should conform to the Oregon State Department of Transportation (ODOT) specifications for Type I asphalt wearing surface and base aggregate.

- **Concrete pavement**: 5 inches of concrete over 4 inches of CRB over recompacted native soil

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.

6.0 Additional Services

RGI is available to provide further geotechnical consultation throughout the design phase of the project. RGI should review the final design and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and incorporated into project design and construction.

RGI is also available to provide geotechnical engineering and construction monitoring services during construction. The integrity of the earthwork and construction depends on proper site preparation and procedures. In addition, engineering decisions may arise in the field in the event that variations in subsurface conditions become apparent. Construction monitoring services are not part of this scope of work. If these services are desired, please let us know and we will prepare a proposal.

7.0 Limitations

This GER is the property of RGI, Barghausen Consulting Engineers, Inc., and its designated agents. Within the limits of the scope and budget, this GER was prepared in accordance with generally accepted geotechnical engineering practices in the area at the time this report was issued. This GER is intended for specific application to the Sherwood Chevron project at 21090 Southwest Pacific Highway, Sherwood, Oregon, and for the exclusive use of Barghausen Consulting Engineers, Inc. and its authorized representatives. No other warranty, expressed or implied, is made. Site safety, excavation support, and dewatering requirements are the responsibility of others.

The analyses and recommendations presented in this GER are based upon data obtained from the exploration performed on site. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, RGI should be requested to reevaluate the recommendations in this GER prior to proceeding with construction.

It is the client's responsibility to see that all parties to the project, including the designers, contractors, subcontractors, are made aware of this GER in its entirety. The use of information contained in this GER for bidding purposes should be done at the contractor's option and risk.

USGS, 2020, Sherwood, Oregon
USGS, 2020, Beaverton, Oregon
7.5-Minute Quadrangle

Approximate Scale: 1"=1000'
0 500 1000 2000
N

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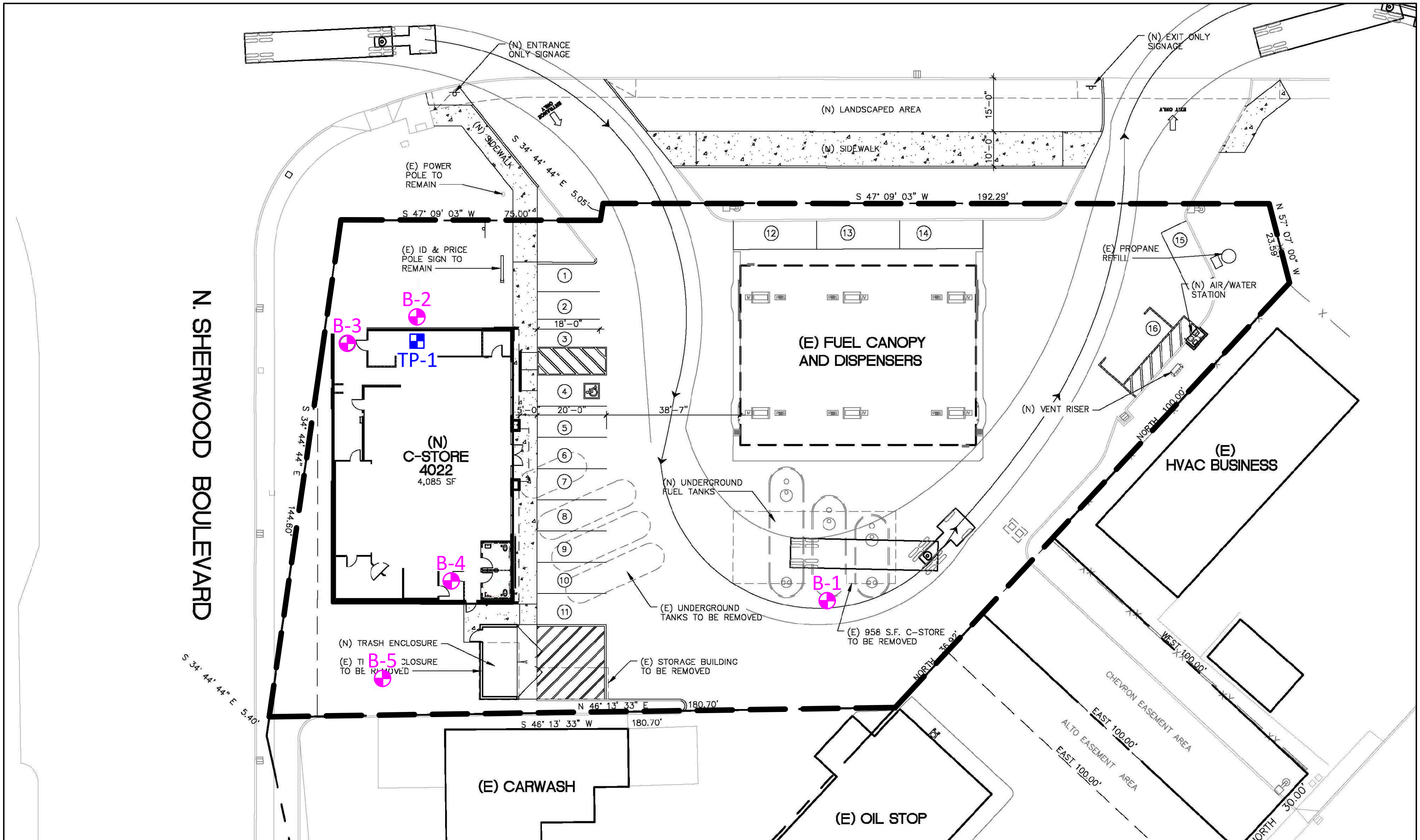
Sherwood Chevron		Figure 1
RGI Project Number: 2022-522-1	Site Vicinity Map	Date Drawn: 11/2022
Address: 21090 Southwest Pacific Highway, Sherwood, Oregon 97140		



= Test Pit by RGI, 10/28/2022

= Boring by RGI, 10/28/2022

= Site boundary

Approximate Scale: 1"=x'

0 x x x

N

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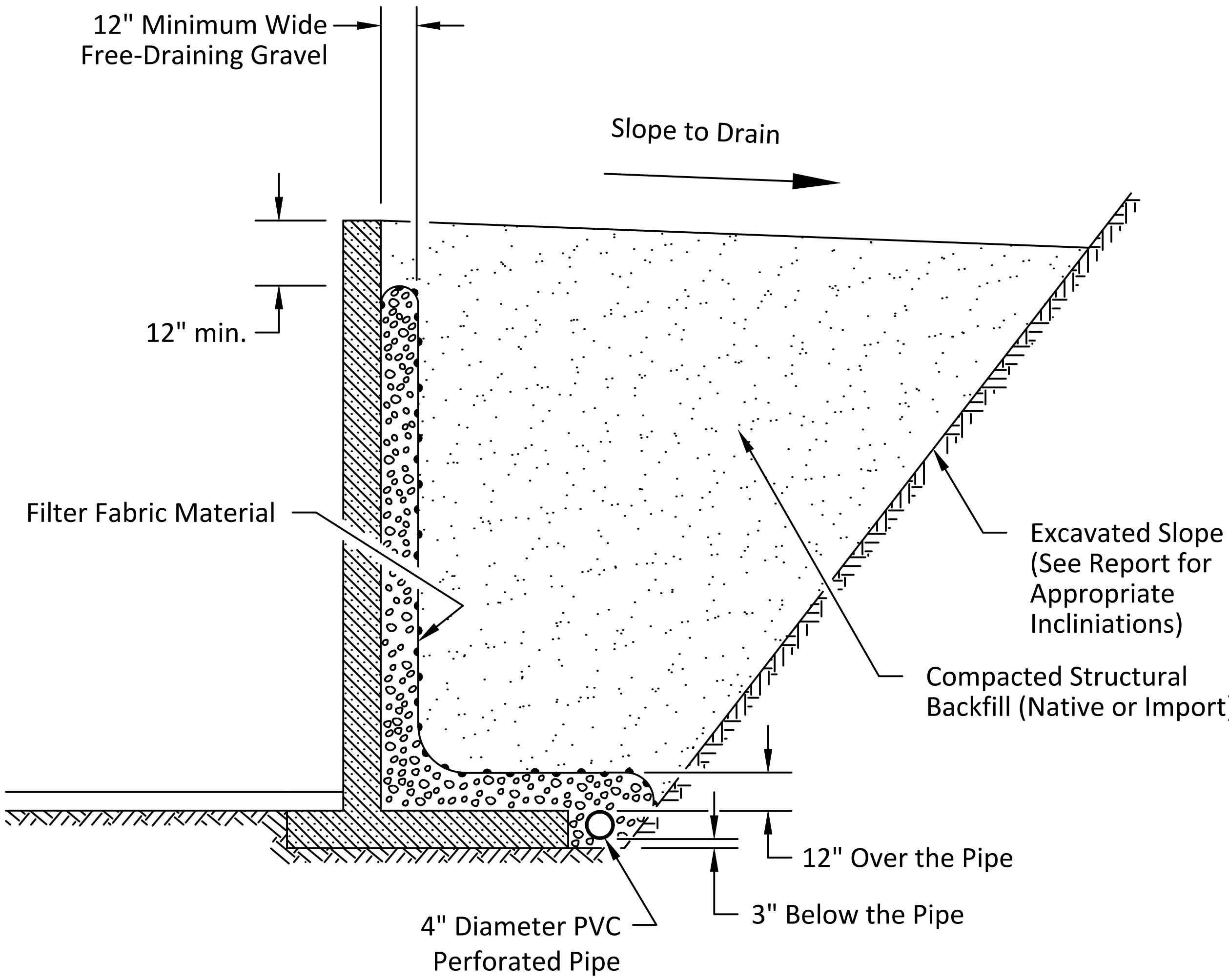
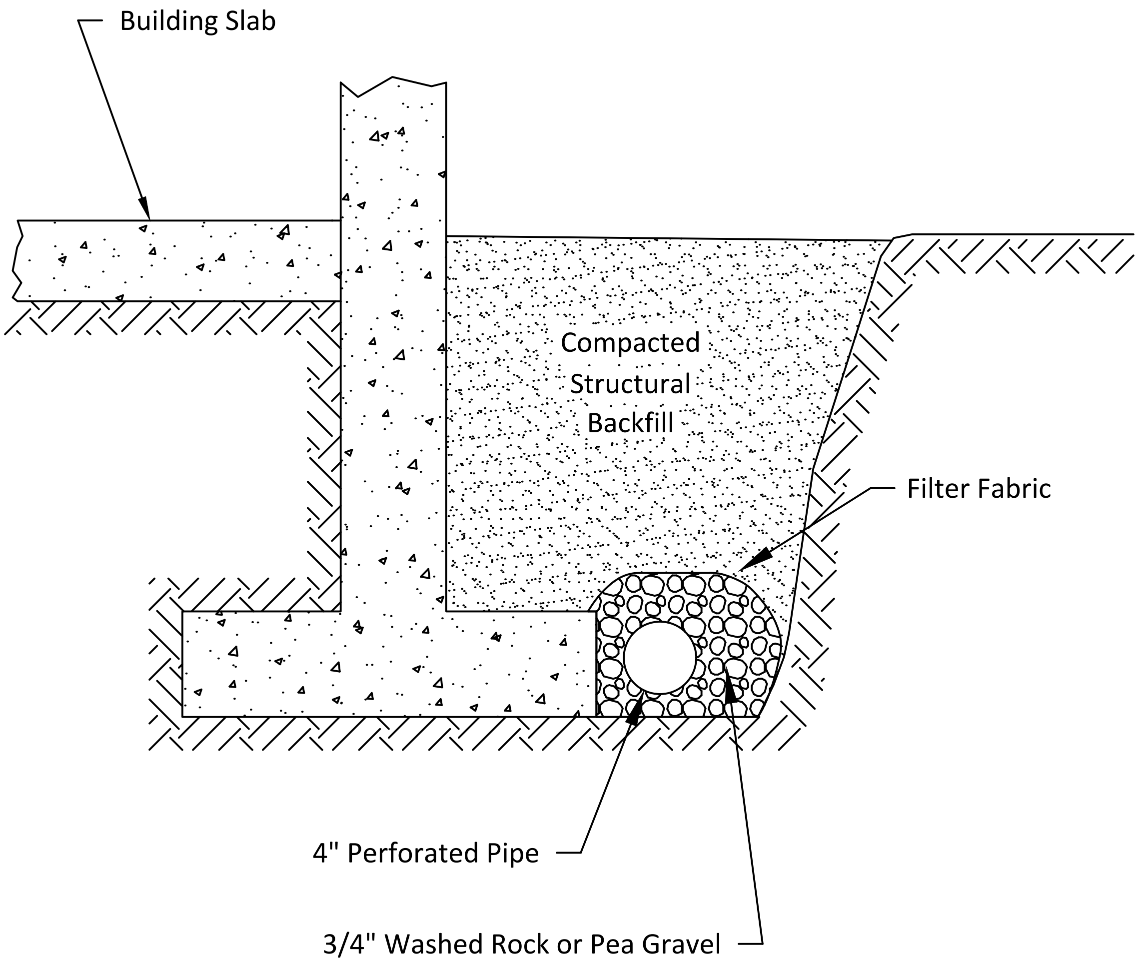
Sherwood Chevron		Figure 2
RGI Project Number: 2022-522-1	Geotechnical Exploration Plan	Date Drawn: 11/2022
Address: 21090 Southwest Pacific Highway, Sherwood, Oregon 97140		



Not to Scale

RILEYGROUP Corporate Office 17522 Bothell Way Northeast Bothell, Washington 98011 Phone: 425.415.0551 Fax: 425.415.0311	Sherwood Chevron		Figure 3
	RGI Project Number: 2022-522-1	Retaining Wall Drainage Detail	Date Drawn: 11/2022
	Address: 21090 Southwest Pacific Highway, Sherwood, Oregon 97140		



Not to Scale

RILEYGROUP
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Sherwood Chevron		Figure 4
RGI Project Number: 2022-522-1	Typical Footing Drain Detail	Date Drawn: 11/2022
Address: 21090 Southwest Pacific Highway, Sherwood, Oregon 97140		

APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTING

On October 28, 2022, RGI explored the subsurface soil conditions at the site by observing the excavation of one test pit and the drilling of five borings to a maximum depth of 31.5 feet below existing grade. The test pit and boring locations are shown on Figure 2. The test pit and boring locations were approximately determined by measurements from existing property lines and paved roads.

A geologist from our office conducted the field exploration and classified the soil conditions encountered, maintained a log of each exploration, obtained representative soil samples, and observed pertinent site features. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS).

Representative soil samples obtained from the explorations were placed in closed containers and taken to our laboratory for further examination and testing. As a part of the laboratory testing program, the soil samples were classified in our in house laboratory based on visual observation, texture, and the limited laboratory testing described below.

Moisture Content Determinations

Moisture content determinations were performed in accordance with the American Society of Testing and Materials D2216-10 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (ASTM D2216) on representative samples obtained from the exploration in order to aid in identification and correlation of soil types. The moisture content of typical sample was measured and is reported on the test pit and boring logs.

Grain Size Analysis

A grain size analysis indicates the range in diameter of soil particles included in a particular sample. Grain size analyses for the greater than 75 micrometer portion of the samples were performed in accordance with American Society of Testing and Materials D422 Standard Test Method for Particle-Size Analysis of Soils (ASTM D422) on three of the samples, the results of which are attached in Appendix A.

Project Name: **Sherwood Chevron**
Project Number: **2022-522-1**
Client: **Barghausen Consulting Engineers, Inc.**

RILEYGROUP

Boring No.: B-1
Sheet 1 of 1

Date(s) Drilled: **10/28/2022**	Logged By: **ELW**	Surface Conditions: **Asphalt**
Drilling Method(s): **Solid Stem Auger**	Drill Bit Size/Type: **2.25"**	Total Depth of Borehole: **31.5 feet bgs**
Drill Rig Type: **Trailer Rig**	Drilling Contractor: **Dan J Fischer Excavating, Inc.**	Approximate Surface Elevation: **211**
Groundwater Level: **Not Encountered**	Sampling Method(s): **SPT**	Hammer Data : **140 lb, 30" drop, rope and cathead**
Borehole Backfill: **Bentonite Chips**	Location: **21090 Southwest Pacific Highway, Sherwood, Oregon**	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	RQD (%)	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Moisture (%)
211	0					Asphalt		3" asphalt over crushed rock base	
						SM		Brown silty SAND, medium dense, moist	
206	5	SPT	13						22
201	10	SPT	17					45% fines	22
196	15	SPT	15					Becomes gray	16
191	20	SPT	21						15
186	25	SPT	22						15
181	30	SPT	25						15
	31.5							Boring terminated at 31.5'	
176	35								

Project Name: **Sherwood Chevron**	Boring No.: B-2
Project Number: **2022-522-1**	**Sheet 1 of 1**
Client: **Barghausen Consulting Engineers, Inc.**	RILEYGROUP

Date(s) Drilled: **10/28/2022**	Logged By: **ELW**	Surface Conditions: **Grass**
Drilling Method(s): **Solid Stem Auger**	Drill Bit Size/Type: **2.25"**	Total Depth of Borehole: **11.5 feet bgs**
Drill Rig Type: **Trailer Rig**	Drilling Contractor: **Dan J Fischer Excavating, Inc.**	Approximate Surface Elevation: **208**
Groundwater Level: **Not Encountered**	Sampling Method(s): **SPT**	Hammer Data : **140 lb, 30" drop, rope and cathead**
Borehole Backfill: **Bentonite Chips**	Location: **21090 Southwest Pacific Highway, Sherwood, Oregon**	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	RQD (%)	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Moisture (%)
208	0					TPSL		3" topsoil	
						Fill		Brown sandy SILT, medium stiff, moist (Fill)	
								58% fines	
		SPT	7						21
203	5					SM		Brown silty SAND with trace gravel, medium dense, moist	
		SPT	11						21
								37% fines	
		SPT	14						24
198	10								
		SPT	13						23
								Test Pit terminated at 11.5'	
193	15								
188	20								
183	25								
178	30								
173	35								

Project Name: **Sherwood Chevron** Project Number: **2022-522-1** Client: **Barghausen Consulting Engineers, Inc.**	RILEYGROUP Boring No.: B-3 **Sheet 1 of 1**

Date(s) Drilled: **10/28/2022**	Logged By: **ELW**	Surface Conditions: **Grass**
Drilling Method(s): **Solid Stem Auger**	Drill Bit Size/Type: **2.25"**	Total Depth of Borehole: **31.5 feet bgs**
Drill Rig Type: **Trailer Rig**	Drilling Contractor: **Dan J Fischer Excavating, Inc.**	Approximate Surface Elevation: **207**
Groundwater Level: **31**	Sampling Method(s): **SPT**	Hammer Data : **140 lb, 30" drop, rope and cathead**
Borehole Backfill: **Bentonite Chips**	Location: **21090 Southwest Pacific Highway, Sherwood, Oregon**	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	RQD (%)	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Moisture (%)
207	0					TPSL		Topsoil	
						SM		Brown silty SAND, medium dense, moist	
202	5	SPT	13						20
197	10	SPT	17						22
192	15	SPT	22						18
187	20	SPT	19					Becomes gray	15
182	25	SPT	23						13
177	30	SPT	21					Becomes brown	25
	▽ 31							Becomes water bearing	
	31.5							Boring terminated at 31.5'	
172	35								

Project Name: **Sherwood Chevron**
Project Number: **2022-522-1**
Client: **Barghausen Consulting Engineers, Inc.**

RILEYGROUP

Boring No.: B-4

Sheet 1 of 1

Date(s) Drilled: **10/28/2022**	Logged By: **ELW**	Surface Conditions: **Grass**
Drilling Method(s): **Solid Stem Auger**	Drill Bit Size/Type: **2.25"**	Total Depth of Borehole: **21.5 feet bgs**
Drill Rig Type: **Trailer Rig**	Drilling Contractor: **Dan J Fischer Excavating, Inc.**	Approximate Surface Elevation: **209**
Groundwater Level: **Not Encountered**	Sampling Method(s): **SPT**	Hammer Data : **140 lb, 30" drop, rope and cathead**
Borehole Backfill: **Bentonite Chips**	Location: **21090 Southwest Pacific Highway, Sherwood, Oregon**	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	RQD (%)	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Moisture (%)
209	0					TPSL		Topsoil	
						SM		Brown silty sand, loose to medium dense, moist	
204	5	SPT	10						16
199	10	SPT	15			ML		Brown sandy SILT, stiff, moist to wet	28
194	15	SPT	13			SM		Brown silty SAND, medium dense, moist	18
189	20	SPT	12						16
	21.5							Test Pit terminated at 21.5'	
184	25								
179	30								
174	35								

Project Name: **Sherwood Chevron**	Boring No.: B-5
Project Number: **2022-522-1**	**Sheet 1 of 1**
Client: **Barghausen Consulting Engineers, Inc.**	

Date(s) Drilled: **10/28/2022**	Logged By: **ELW**	Surface Conditions: **Grass**
Drilling Method(s): **Solid Stem Auger**	Drill Bit Size/Type: **2.25"**	Total Depth of Borehole: **11.5 feet bgs**
Drill Rig Type: **Trailer Rig**	Drilling Contractor: **Dan J Fischer Excavating, Inc.**	Approximate Surface Elevation: **209**
Groundwater Level: **Not Encountered**	Sampling Method(s): **SPT**	Hammer Data : **140 lb, 30" drop, rope and cathead**
Borehole Backfill: **Bentonite Chips**	Location: **21090 Southwest Pacific Highway, Sherwood, Oregon**	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	RQD (%)	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Moisture (%)
209	0					TPSL		Topsoil	
						SM		Brown silty SAND, medium dense, moist	
		SPT	13						15
204	5								
		SPT	12						16
		SPT	16						19
199	10								
		SPT	14						17
								Boring terminated at 11.5'	
194	15								
189	20								
184	25								
179	30								
174	35								

Project Name: **Sherwood Chevron** Project Number: **2022-522-1** Client: **Barghausen Consulting Engineers, Inc.**	RILEYGROUP **Key to Log of Boring** **Sheet 1 of 1**

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	RQD (%)	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Moisture (%)
1	2	3	4	5	6	7	8	9	10

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. Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
5. RQD (%): Rock Quality Designation is a relative index of the rock mass quality calculated by comparing the cumulative length of intact pieces of core exceeding 100 mm in length to the cored interval length.
6. Recovery (%): Core Recovery Percentage is determined based on a ratio of the length of core sample recovered compared to the cored interval length.
7. USCS Symbol: USCS symbol of the subsurface material.
8. Graphic Log: Graphic depiction of the subsurface material encountered.
9. MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
10. Moisture (%): Moisture, expressed as a water content.

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

Asphaltic Concrete (AC)
AF
SILT, SILT w/SAND, SANDY SILT (ML)
Silty SAND (SM)
Topsoil

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)
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.

Project Name: **Sherwood Chevron** Project Number: **2022-522-1** Client: **Barghausen Consulting Engineers, Inc.**	RILEYGROUP Test Pit No.: TP-1 **Sheet 1 of 1**

Date(s) Excavated: **10/28/2022**	Logged By **ALG**	Surface Conditions: **Grass**
Excavation Method: **Test Pit**	Bucket Size: **N/A**	Total Depth of Excavation: **5 feet bgs**
Excavator Type: **Rubber Tired Backhoe**	Excavating Contractor: **Dan J Fischer Excavating, Inc.**	Approximate Surface Elevation **208**
Groundwater Level: **Not Encountered**	Sampling Method(s)	Compaction Method **140 lb, 30" drop, rope and cathead**
Test Pit Backfill: **Cuttings**	Location **21090 Southwest Pacific Highway, Sherwood, Oregon**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
208	0			TPSL		3" topsoil	
				Fill		Light brown silty fine SAND, loose, moist (Fill)	
						Contains asphalt and construction debris	
				Fill		Gray to grayish brown silty fine SAND with trace gravel, loose, moist (Fill) Possible contamination, asphalt and construction debris	
				SM		Brown silty SAND, medium dense, moist	
203	5					Test Pit terminated at 5'	
198	10						

Project Name: **Sherwood Chevron**

Project Number: **2022-522-1**

Client: **Barghausen Consulting Engineers, Inc.**

RILEYGROUP

Key to Logs

Sheet 1 of 1

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

Silty SAND (SM)

Topsoil

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)
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.

THE RILEY GROUP, INC.
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GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Sherwood Chevron	**SAMPLE ID/TYPE**	B-1
PROJECT NO.	2022-522	**SAMPLE DEPTH**	10 feet
TECH/TEST DATE	CM 11/2/2022	**DATE RECEIVED**	10/28/2022

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	272.1
Wt Dry Soil & Tare (gm)	(w2)	226.7
Weight of Tare (gm)	(w3)	15.9
Weight of Water (gm)	(w4=w1-w2)	45.4
Weight of Dry Soil (gm)	(w5=w2-w3)	210.8
Moisture Content (%)	(w4/w5)*100	22

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

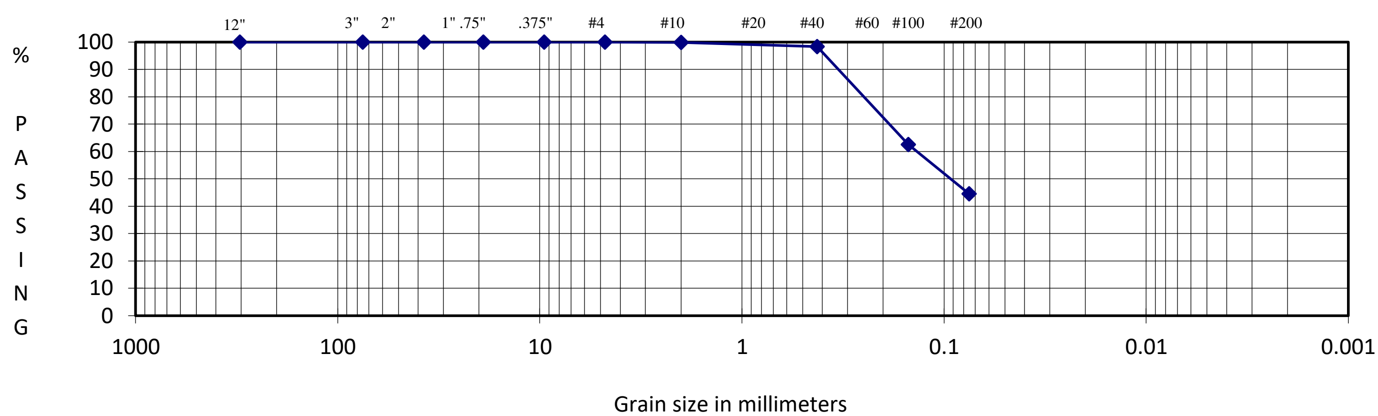
	Weight Of Sample (gm)	226.7
	Tare Weight (gm)	15.9
(W6)	Total Dry Weight (gm)	210.8

% COBBLES	**0.0**
% C GRAVEL	**0.0**
% F GRAVEL	**0.0**
% C SAND	**0.1**
% M SAND	**1.5**
% F SAND	**53.8**
% FINES	**44.5**
% TOTAL	**100.0**

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

SIEVE ANALYSIS

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	15.9	0.00	0.00	100.00	cobbles
3.0"	15.9	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"					coarse gravel
1.5"	15.9	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	15.9	0.00	0.00	100.00	fine gravel
0.50"					fine gravel
0.375"	15.9	0.00	0.00	100.00	fine gravel
#4	15.9	0.00	0.00	100.00	coarse sand
#10	16.1	0.20	0.09	99.91	medium sand
#20					medium sand
#40	19.3	3.40	1.61	98.39	fine sand
#60					fine sand
#100	94.7	78.80	37.38	62.62	fine sand
#200	132.8	116.90	55.46	44.54	fines
PAN	226.7	210.80	100.00	0.00	silt/clay



DESCRIPTION	Silty SAND
USCS	SM

Prepared For:
Barghausen Consulting Services

Reviewed By:
ELW

RILEYGROUP

THE RILEY GROUP, INC.
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Bothell, WA 98011

PHONE: (425) 415-0551
FAX: (425) 415-0311

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

PROJECT TITLE	Sherwood Chevron	SAMPLE ID/TYPE	B-2
PROJECT NO.	2022-522	SAMPLE DEPTH	2.5 feet
TECH/TEST DATE	CM 11/2/2022	DATE RECEIVED	10/28/2022

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	424.8
Wt Dry Soil & Tare (gm)	(w2)	352.8
Weight of Tare (gm)	(w3)	15.9
Weight of Water (gm)	(w4=w1-w2)	72.0
Weight of Dry Soil (gm)	(w5=w2-w3)	336.9
Moisture Content (%)	(w4/w5)*100	21

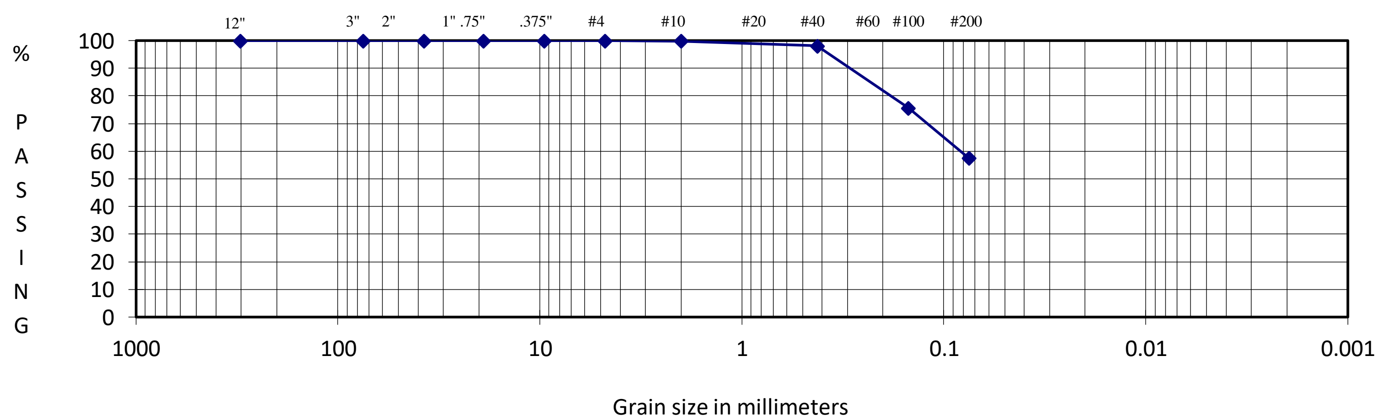
Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	352.8
	Tare Weight (gm)	15.9
(W6)	Total Dry Weight (gm)	336.9

SIEVE ANALYSIS

% COBBLES	0.0		
% C GRAVEL	0.0		
% F GRAVEL	0.0		
% C SAND	0.2		
% M SAND	1.8		
% F SAND	40.5		
% FINES	57.5		
% TOTAL	100.0		
D10 (mm)			
D30 (mm)			
D60 (mm)			
Cu			
Cc			

Sieve	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	15.9	0.00	0.00	100.00	cobbles
3.0"	15.9	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"					coarse gravel
1.5"	15.9	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	15.9	0.00	0.00	100.00	fine gravel
0.50"					fine gravel
0.375"	15.9	0.00	0.00	100.00	fine gravel
#4	15.9	0.00	0.00	100.00	coarse sand
#10	16.6	0.70	0.21	99.79	medium sand
#20					medium sand
#40	22.5	6.60	1.96	98.04	fine sand
#60					fine sand
#100	98.0	82.10	24.37	75.63	fine sand
#200	159.1	143.20	42.51	57.49	fines
PAN	352.8	336.90	100.00	0.00	silt/clay



DESCRIPTION	Sandy SILT
USCS	ML

Prepared For:
Barghausen Consulting Services

Reviewed By:
ELW

RILEYGROUP

THE RILEY GROUP, INC.
17522 Bothell Way NE
Bothell, WA 98011

PHONE: (425) 415-0551
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GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Sherwood Chevron	SAMPLE ID/TYPE	B-2
PROJECT NO.	2022-522	SAMPLE DEPTH	7.5 feet
TECH/TEST DATE	CM 11/2/2022	DATE RECEIVED	10/28/2022

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	357.7
Wt Dry Soil & Tare (gm)	(w2)	291.7
Weight of Tare (gm)	(w3)	15.9
Weight of Water (gm)	(w4=w1-w2)	66.0
Weight of Dry Soil (gm)	(w5=w2-w3)	275.8
Moisture Content (%)	(w4/w5)*100	24

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

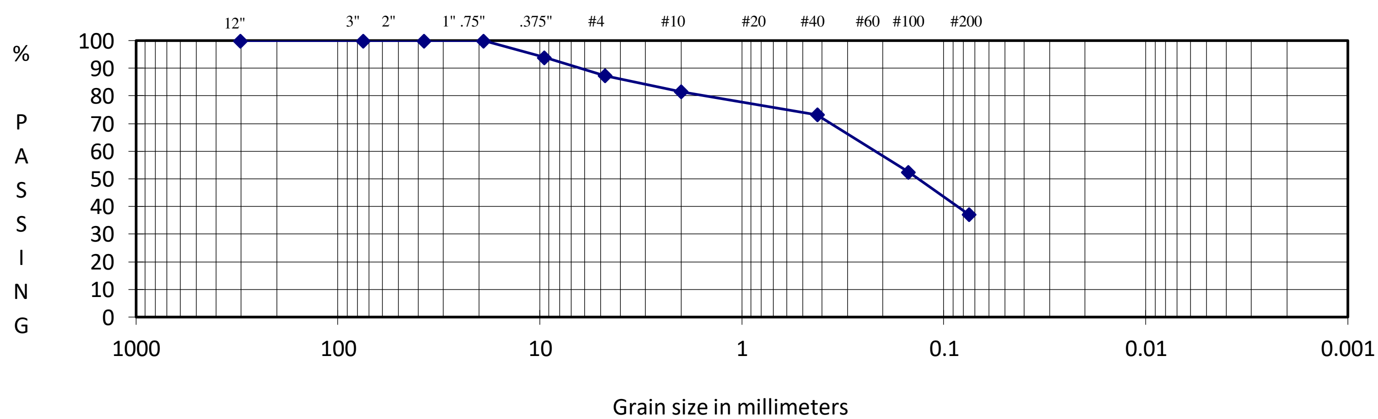
	Weight Of Sample (gm)	291.7
	Tare Weight (gm)	15.9
(W6)	Total Dry Weight (gm)	275.8

% COBBLES	0.0
% C GRAVEL	0.0
% F GRAVEL	12.7
% C SAND	5.8
% M SAND	8.4
% F SAND	36.1
% FINES	37.1
% TOTAL	100.0

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

SIEVE ANALYSIS

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	15.9	0.00	0.00	100.00	cobbles
3.0"	15.9	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"					coarse gravel
1.5"	15.9	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	15.9	0.00	0.00	100.00	fine gravel
0.50"					fine gravel
0.375"	32.7	16.80	6.09	93.91	fine gravel
#4	50.8	34.90	12.65	87.35	coarse sand
#10	66.7	50.80	18.42	81.58	medium sand
#20					medium sand
#40	89.8	73.90	26.79	73.21	fine sand
#60					fine sand
#100	147.0	131.10	47.53	52.47	fine sand
#200	189.3	173.40	62.87	37.13	fines
PAN	291.7	275.80	100.00	0.00	silt/clay



DESCRIPTION	Silty SAND with trace gravel
USCS	SM

Prepared For:
Barghausen Consulting Services

Reviewed By:
ELW

RILEYGROUP