GEOTECHNICAL REPORT
Proposed Beaudoin Residence
XXX Ridge Road
Kittitas Co. Parcel No. 950230
Kittitas County, Washington

PROJECT NO. 21-364
September 2021

Prepared for:

Paul Beaudoin

PanGEO INCORPORATED

Geotechnical & Earthquake Engineering Consultants

PanGEO INCORPORATED
Geotechnical & Earthquake
Engineering Consultants

September 10, 2021
PanGEO Project No. 21-364

Paul Beaudoin
phbeaudoin1@gmail.com

Subject: **GEOTECHNICAL REPORT**
Proposed Beaudoin Residence
XXX Ridge Road, Kittitas County, WA

Dear Mr. Beaudoin,

PanGEO has completed a geotechnical study for the proposed single-family residence in unincorporated Kittitas County, Washington. The results of our study and our recommendations are summarized in the attached report.

Based on the results of our subsurface exploration program, the subsurface conditions generally consist of a relatively thin layer of loess underlain by fractured basalt bedrock. It is our opinion that the proposed residence may be supported on conventional footings, provided the footings are founded directly on basalt bedrock, or on properly compacted fill placed on basalt bedrock. Due to the fractured condition of the basalt bedrock, we anticipate excavations for foundation construction can be accomplished using conventional excavation equipment.

Should you have any questions, please do not hesitate to call.

Sincerely,

Steven T. Swenson, L.G.
Project Geologist
(sswenson@pangeoinc.com)

3213 Eastlake Avenue East
Seattle, WA 98102
T. (206) 262-0370

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GEOTECHNICAL REPORT
PROPOSED BEAUDOIN RESIDENCE
XXX RIDGE ROAD
KITTITAS COUNTY, WASHINGTON

1.0 GENERAL

PanGEO completed a geotechnical engineering study for the proposed single-family residence at XXX Ridge Road in unincorporated Kittitas County, Washington. Our work was performed in accordance with our proposal dated July 20, 2021. The purpose of our geotechnical study was to evaluate subsurface conditions at the site and, based on the conditions encountered, provide geotechnical engineering recommendations pertinent to the design and construction of the proposed residence. Our services included conducting a site reconnaissance, reviewing pertinent geologic publications, observing excavation of four test pits, and developing the conclusions and recommendations presented in this report.

2.0 SITE AND PROJECT DESCRIPTION

The subject site is an irregularly-shaped approximately 20-acre parcel located at XXX Ridge Road (Kittitas Co. Parcel No. 950230) in unincorporated Kittitas County, Washington approximately as shown on the attached Figure 1, Vicinity Map. The site is located about 6 miles west of the City of Ellensburg. The undeveloped site is bordered to the north, south, and west by undeveloped parcels, and to the east by a rural single-family residence lot. Vegetation at the site consists grasses and sparse sagebrush. In general, topography at the site consists of south- to east-facing slopes with gradients in the range of about 10 to 20 percent, except for a 30-foot high 50 percent gradient (i.e., 2H:1V) cut slope immediately north of Ridge Road.

Plate 1. Panoramic view of site facing south from the proposed development area.

The project is in an early stage of design at this time but we understand it is planned to construct an at-grade single-family residence at the site approximately as shown on the attached Figure 2, Site and Exploration Plan. The proposed residence is planned is at the top of the ridge in the northern limits of the site, about 450 feet north/northeast of the cul de sac at the terminus of Ridge Road. There is about 80 feet of vertical relief between the cul de sac and the proposed residence.

We anticipate the residence will be of lightly loaded wood-frame construction with slab-on-grade or timber joist floors. Excavations for foundation construction are anticipated to be less than 4 feet deep. Access to the residence will be via a driveway that will likely follow the alignment of an existing dirt road (see Figure 2).

The conclusions and recommendations outlined in this report are based on our understanding of the proposed development, which is in turn based on the project information provided. If the above project description is substantially different from your proposed improvements or if the project scope changes, PanGEO should be consulted to review the recommendations contained in this report and make modifications, if needed.

3.0 SUBSURFACE EXPLORATIONS

Four test pits (TP-1 through TP-4) were excavated on August 30, 2021, to evaluate subsurface conditions at the site. The approximate test pit locations are indicated on Figure 2. The test pits were excavated to depths of 2½ to 4 feet below the existing ground surface using a Deere 75G trackhoe owned and operated by Reecer Creek Excavating of Ellensburg, Washington.

A geologist from PanGEO was present during the field explorations to observe the test pit excavations, to obtain representative soil samples, and to describe and document the soil and rock encountered in the explorations. The soil samples were described using the system outlined on Figure A-1. The test pit logs are presented in Appendix A as Figures A-2 through A-5, and provide descriptions of the materials encountered, depths to soil and rock contacts, and depths of seepage or caving observed in the test pit sidewalls. The relative in-situ density of cohesionless soils, or the relative consistency of fine-grained soils, was estimated from the excavating action of the excavator, the stability of the test pit sidewalls, and probing with a ½-inch diameter steel rod (T-probe). Where soil or rock contacts were gradual or undulating, the average depth of the contact was recorded in the log. After each test pit was logged, the excavation was backfilled with the excavated soils and the surface was tamped and re-graded smooth.

4.0 SUBSURFACE CONDITIONS

4.1 GEOLOGY

Subsurface conditions in the vicinity of the site were evaluated by reviewing the *Geologic Map of the Wenatchee 1:100,000 Quadrangle, Washington* (Tabor et al., 1982). Based on our review, the primary geologic unit at the site is upper flows of the middle Miocene-aged Grand Ronde basalt (Geologic Map Unit Tgn2). This unit forms the most widespread and thickest unit of basalt in the quadrangle. Grande Ronde basalt in the Wenatchee quadrangle typically flowed into rivers draining the ancestral Cascade Range forming pillow basalt, hyalociastite (breccia), and invasive flows. Pillows and intermixed hyalociastite formed when lava was quenched as it entered water.

4.2 SOIL AND ROCK CONDITIONS

For a detailed description of the subsurface conditions encountered at each exploration location, please refer to the test pit logs provided in Appendix A. The stratigraphic contacts indicated on the test pit logs represent the approximate depth to boundaries between soil and rock units.

Based on the subsurface conditions encountered at our test pit locations, the materials appear generally consistent with the mapped geology. The following is a generalized description of the materials encountered in the test pits:

> **Loess:** Near the ground surface at all of our test pit locations, an approximately 6-inch-thick layer of loose silt with gravel was encountered. We interpret this layer as loess (wind-blown silt) intermixed with weathered basalt.
>
> **Grande Ronde Basalt:** Underlying the surficial layer of loess, strong reddish gray to gray slightly vesicular basalt bedrock consistent with the geologic mapping of the area was encountered. The basalt bedrock was highly fractured and the excavator was typically able to penetrate the bedrock except at test pit TP-3 where practical excavation refusal was encountered around 2½ feet below grade.

Our subsurface descriptions are based on the conditions encountered at the time of our exploration. Soil conditions between our exploration locations may vary from those encountered. The nature and extent of variations between our exploratory locations may not become evident until construction. If variations do appear, PanGEO should be requested to reevaluate the recommendations in this report and to modify or verify them in writing prior to proceeding with earthwork and construction.

4.3 Groundwater

Groundwater seepage was not encountered within the depth of our test pits at the time of exploration in August 2021. Groundwater levels and seepage rates may vary depending on the season, local subsurface conditions, and other factors. Groundwater levels and seepage rates are normally highest during the winter and early spring

5.0 GEOTECHNICAL RECOMMENDATIONS

5.1 Seismic Design Considerations

We anticipate that the proposed residence will be designed in accordance with the 2018 edition of the International Building Code (IBC). Based on the results of our test pits, it is our opinion that Site Class B is appropriate for the project site due to the presence of basalt bedrock near the ground surface.

Seismically induced liquefaction typically occurs in loose, saturated, sandy and silty materials. Because the subject site is underlain by basalt bedrock at shallow depths, in our opinion the liquefaction potential at the site is negligible, and design considerations related to soil liquefaction are not necessary for this project.

5.2 Foundation Support

Based on the subsurface conditions encountered in the test pits, competent basalt bedrock is anticipated at the foundation subgrade elevation. It is our opinion that conventional spread footings are an appropriate foundation type to support the proposed residence. The following recommendations should be incorporated into design and construction of the foundation.

Allowable Bearing Pressure – We recommend that a maximum allowable bearing pressure of 4,000 pounds per square foot (psf) be used to size the footings. For allowable stress design, the recommended bearing pressure may be increased by one-third for transient loading, such as wind or seismic forces. Continuous and individual spread footings should have minimum widths of 18 and 24 inches, respectively.

Footing Embedment – Exterior footings should be placed at a minimum depth of 24 inches below final exterior grade. Interior spread foundations should be placed at a minimum depth of 12 inches below the top of slab.

Estimated Settlement - Footings designed and constructed in accordance with the above recommendations should experience total settlement of less than one inch and differential settlement less than about ½ inch. Most of the anticipated settlement should occur during construction as dead loads are applied.

Lateral Load Resistance - Lateral loads on the structure may be resisted by passive earth pressure developed against the embedded near-vertical faces of the foundation system and by frictional resistance developed between the bottom of the foundation and the supporting subgrade soils. For footings bearing on bedrock or on granular soils placed upon bedrock, a frictional coefficient of 0.4 may be used to evaluate sliding resistance developed between the concrete and the subgrade material. Passive soil resistance may be calculated using an equivalent fluid weight of 350 pounds per cubic foot (pcf), assuming the footings are backfilled with structural fill. The above values include a factor of safety of 1.5. Unless covered by pavements or slabs, the passive resistance in the upper 12 inches of soil should be neglected.

Footing Drains - We recommend that a 4-inch diameter, schedule 40 PVC or SDR 35, perforated pipe embedded in pea gravel or clean crushed rock and wrapped in filter fabric be installed at the base of the footings to direct collected water to an appropriate outlet. Under no circumstances should roof downspout drain lines be connected to the footing drain system. Roof downspouts must be separately tightlined to an appropriate discharge. Cleanouts should be installed to allow for periodic maintenance of the footing drain and downspout tightline systems.

Footing Excavation and Subgrade Preparation - All footing excavations should be carefully prepared. The basalt bedrock is highly fractured and rock will likely get loosened during excavation activities. To provide a firm and stable base for foundation construction, a layer of lean mix concrete at least 4 inches thick may be placed on competent bedrock to provide a stable working surface. The lean mix concrete should have at least 1½ sacks of cement per cubic yard. Alternatively, in lieu of the lean-mix concrete, a layer of leveling course such as crushed rock may be placed.

Footing subgrade should be observed by PanGEO to confirm that the exposed footing subgrade is consistent with the expected conditions and adequate to support the proposed residence.

5.3 Foundation Wall and Retaining Wall Design Parameters

Retaining walls should be properly designed to resist the lateral earth pressures exerted by the soils behind the wall. Adequate drainage provisions should also be provided behind the walls to intercept and remove groundwater that may be present behind the wall. Our geotechnical recommendations for the design and construction of new retaining walls are presented below.

Wall Foundation- The recommendations outlined in the *Foundation Support* section of this report remain applicable for retaining wall design and construction.

Lateral Earth Pressures – Foundation walls with level backslopes should be designed for a static at-rest lateral earth pressure based upon an equivalent fluid weight of 50 pcf. Cantilevered site retaining walls with level backslopes should be designed for a static active earth pressure based upon an equivalent fluid weight of 35 pcf. Walls retaining sloping backfills or surcharge loads should be designed for higher forces. PanGEO is available to provide additional recommendations if needed.

In addition, permanent walls should be designed for an incremental uniform lateral pressure of 7H psf for seismic loading, where H corresponds to the retained height of the wall. The recommended lateral pressures assume that the backfill behind the wall consists of a free draining and properly compacted fill with adequate drainage provisions.

Surcharge – Surcharge loads, where present, should be included in the design of retaining walls. We recommend that a lateral load coefficient of 0.35 be used to compute the lateral pressure on the wall face resulting from surcharge loads located within a horizontal distance of one-half wall height.

Wall Drainage – Provisions for wall drainage should consist of a rigid 4-inch diameter perforated drainpipe at the base of the wall footings. The drainpipe should be embedded in 12 to 18 inches of pea gravel. A minimum 12-inch wide layer of open-graded, free draining granular material (i.e. pea gravel or washed rock) is recommended adjacent to the wall for the full height of the wall. Alternatively, a composite drainage material, such as Miradrain 6000 may be used in lieu of open-graded, free draining granular material. The composite drainage material should be installed per the manufacturer’s recommendations. The drainpipe at the base of the wall should be graded to direct water to a suitable outlet.

Wall Backfill – It is our opinion that the excavated basalt bedrock would be suitable for wall backfill provided the excavated bedrock has a maximum particle size of about 6 inches. Large cobble and boulder sized particles should be screened and removed from wall backfill. Alternatively, imported granular material meeting the requirements for gravel borrow as specified in Section 9-03.14(1) of the 2021 WSDOT *Standard Specifications* or an approved equivalent may be considered. In areas where the space is limited between the wall and the face of excavation, pea gravel may be used as backfill without compaction.

In structural areas, wall backfill should be moisture conditioned to within about 3 percent of optimum moisture content, placed in loose, horizontal lifts less than 8 inches in thickness, and systematically compacted to a dense and unyielding condition.

Damp Proofing – The exterior of all foundation walls should be protected with a damp proofing compound. Recommendations for damp proofing is beyond our area of expertise. A building envelope specialist or product vendors may be consulted for specific recommendations regarding this matter.

5.4 Floor Slabs

It is our opinion that conventional concrete slab-on-grade floor construction is appropriate for this project. The floor slab should be supported on competent basalt bedrock or on properly compacted granular structural fill placed upon basalt bedrock. If loose or soft soils are present below a portion of the proposed basement floor slab, we recommend that the loose/soft soils be removed and replaced with properly compacted structural fill.

We recommend that the slab-on-grade floors be provided with a minimum 4-inch thick capillary break. The capillary break material should meet the gradational requirements provided in Table 1, on the following page.

TABLE 1: Capillary Break Gradation

Sieve Size	Percent Passing
¾-inch	100
No. 4	0 – 10
No. 100	0 – 5
No. 200	0 – 3

A 10-mil polyethylene vapor barrier should also be placed directly below the slab. Construction joints should be incorporated into the floor slab to control cracking.

6.0 EARTHWORK CONSIDERATIONS

6.1 Rock Excavation

Fractured basalt bedrock was encountered near the ground surface at all of our test pit locations. Practical excavation refusal in strong basalt bedrock was encountered about 2½ feet below grade at test pit TP-3.

Rock rippability is a function of rock hardness, jointing, fracturing, weathering, bedding, equipment, and operator experience. The test pits were excavated using a mid-class Deere 75G trackhoe with an operating weight of about 9 tons. Based on our observations of the test pit excavation and discussions with the excavator operator, site excavations can likely be accomplished by using a larger sized excavator. Additional ripping capability can be achieved by using a ripping bucket with ripping teeth mounted on an excavator or installing ripping shanks on an excavator bucket. Alternative rock excavation measures may include the use of an excavator mounted hydraulic rock breaker or a hydraulic hammer using a chisel or moil bit to break the rock.

6.2 Temporary Excavations

We anticipate site excavations will generally be less than about 4 feet deep. We anticipate that the excavations will largely encounter fractured basalt bedrock.

All temporary excavations should be performed in accordance with Part N of WAC (Washington Administrative Code) 296-155. The contractor is responsible for maintaining safe excavation slopes and/or shoring. For planning purposes, the temporary excavations may be sloped as steep as ¾H:1V in fractured basalt bedrock, but should be re-evaluated in the field during construction based on actual observed soil conditions. During wet weather, the cut slopes may need to be flattened to reduce potential erosion.

6.3 Material Reuse

As seen in the test pit photos in Appendix A, the excavated fractured bedrock generally broke up into gravel to cobble sized pieces with occasional boulder sized pieces. The broken-up bedrock material may be reused as structural fill, however cobbles larger than 6-inches in diameter and boulders should be removed. If imported structural fill is needed, it should consist of a well-graded granular material, such as crushed rock or WSDOT Gravel Borrow.

6.4 Structural Fill and Compaction

In the context of this report, structural fill is defined as compacted fill placed under buildings, roadways, slabs, pavements, or other load-bearing areas. All structural fill should be moisture conditioned to within about 3 percent of optimum moisture content, placed in loose, horizontal lifts less than 8 inches in thickness, and compacted to at least 95 percent maximum dry density as determined using ASTM D 1557 (Modified Proctor). The procedure to achieve proper density of a compacted fill depends on the size and type of compacting equipment, the number of passes, thickness of the layer being compacted, and certain soil properties. In areas where the size of the excavation restricts the use of heavy equipment, smaller equipment can be used, but the soil must be placed in thin enough layers to achieve the required relative compaction.

Generally, loosely compacted soils are a result of poor construction technique or improper moisture content. Soils with high fines contents are particularly susceptible to becoming too wet, and coarse-grained materials easily become too dry, for proper compaction. Silty or clayey soils with a moisture content too high for adequate compaction should be dried as necessary, or moisture conditioned by mixing with drier materials, or other methods.

6.5 Wet Weather Construction

General recommendations relative to earthwork performed in wet weather or in wet conditions are presented below. The following procedures are best management practices recommended for use in wet weather construction:

- Earthwork should be performed in small areas to minimize subgrade exposure to wet weather. Excavation or the removal of unsuitable soil should be followed promptly by the placement and compaction of clean structural fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance.
- During wet weather, the allowable fines content of the structural fill should be reduced to no more than 5 percent by weight based on the portion passing ¾-inch sieve. The fines should be non-plastic.
- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water.
- Bales of straw and/or geotextile silt fences should be strategically located to control surface water and to limit erosion.
- Excavation slopes and soils stockpiled on-site should be covered with plastic sheets during periods of wet weather.

6.6 Surface Drainage

Surface runoff can be controlled during construction by careful grading practices. Typically, this includes the construction of shallow, upgrade perimeter ditches or low earthen berms in conjunction with silt fences to collect runoff and prevent water from entering excavations or to prevent runoff from the construction area from leaving the immediate work site. All collected water should be directed under control to a positive and permanent discharge system.

Permanent control of surface water should be incorporated in the final grading design. Adequate surface gradients and drainage systems should be incorporated into the design such that surface runoff is directed away from the structures.

7.0 UNCERTAINTY AND LIMITATIONS

We have prepared this report for use by Paul Beaudoin and other project team members. Recommendations contained in this report are based on a site reconnaissance, a subsurface exploration program, review of pertinent geologic publications, and our understanding of the project. The study was performed using a mutually agreed-upon scope of work.

Variations in soil conditions may exist between the locations of the explorations and the actual conditions underlying the site. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at the site that are different from those described in this report, we should be notified immediately to review the applicability of our recommendations. Additionally, we should also be notified to review the applicability of our recommendations if there are any changes in the project scope.

The scope of our work does not include services related to construction safety precautions. Our recommendations are not intended to direct the contractors' methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design. Additionally, the scope of our work specifically excludes the assessment of environmental characteristics, particularly those involving hazardous substances. We are not mold consultants nor are our recommendations to be interpreted as being preventative of mold development. A mold specialist should be consulted for all mold-related issues.

This report may be used only by the client and for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both off and on-site), or other factors including advances in our understanding of applied science, may change over time and could materially affect our findings. Therefore, this report should not be relied upon after 24 months from its issuance. PanGEO should be notified if the project is delayed by more than 24 months from the date of this report so that we may review the applicability of our conclusions considering the time lapse.

It is the client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk. Any party other than the client who wishes to use this report shall notify PanGEO of such intended use and for permission to copy this report. Based on the intended use of the report, PanGEO may require that additional work be performed and that an updated report be reissued. Noncompliance with any of these requirements will release PanGEO from any liability resulting from the use this report.

Within the limitation of scope, schedule and budget, PanGEO engages in the practice of geotechnical engineering and endeavors to perform its services in accordance with generally accepted professional principles and practices at the time the Report or its contents were prepared. No warranty, express or implied, is made.

We appreciate the opportunity to be of service to you on this project. Please feel free to contact our office with any questions you have regarding our study, this report, or any geotechnical engineering related project issues.

Sincerely,

Steven T. Swenson, L.G.
Project Geologist

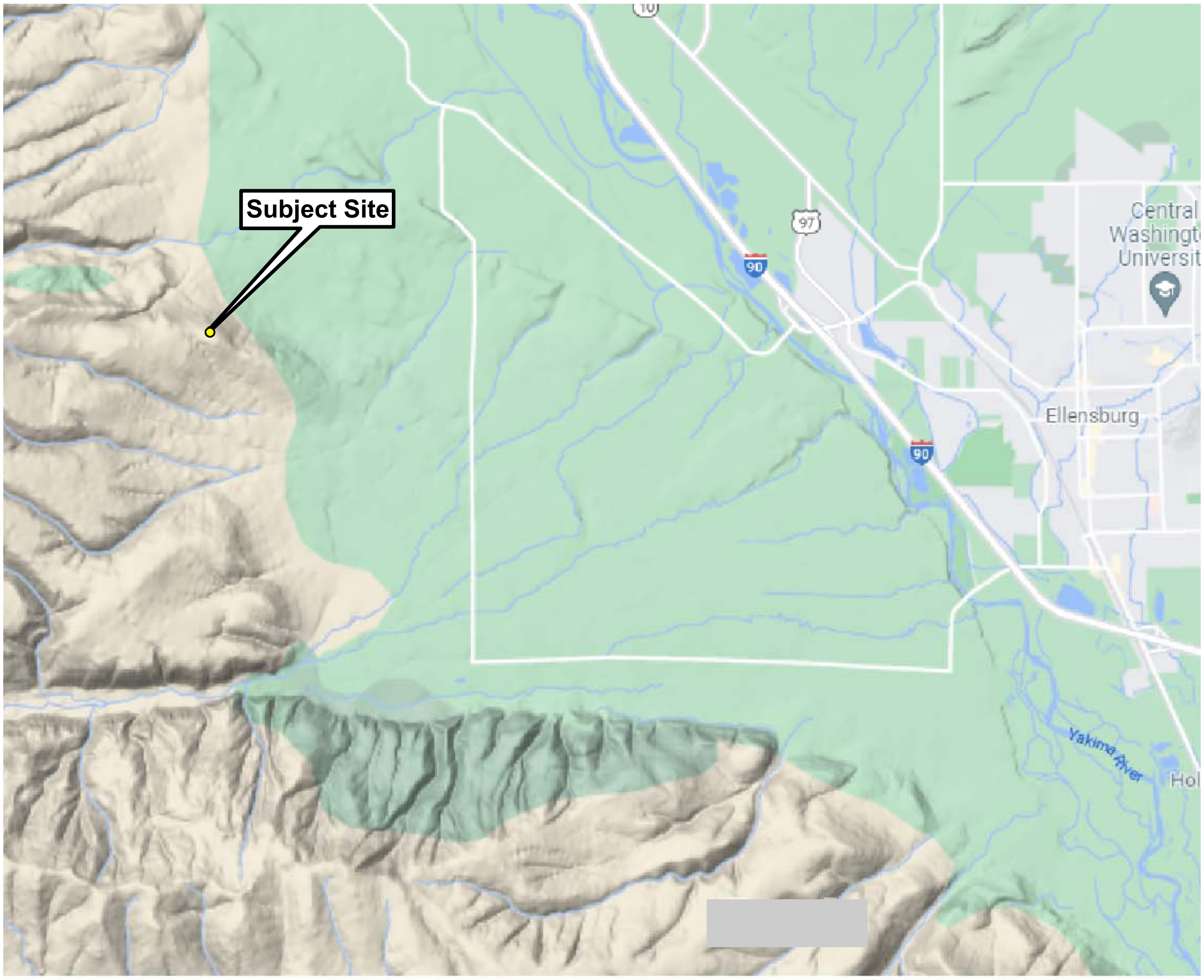
Siew L. Tan, P.E.
Principal Geotechnical Engineer

8.0 REFERENCES

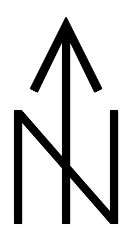
International Building Code (IBC), 2018, International Code Council.

Tabor, R.W., Waitt, R.B., Frizzell Jr., V.A., Swanson, D.A, Byerly, G.R., Bentley, R.D., 1982, *Geologic Map of the Wenatchee 1:100,000 Quadrangle, Central Washington:* U. S. Geological Survey Geologic Miscellaneous Investigations Series Map I-1311, 1 sheet, scale 1:100,000, with 26 p. text.

WSDOT, 2021, *Standard Specifications for Road, Bridges, and Municipal Construction*.

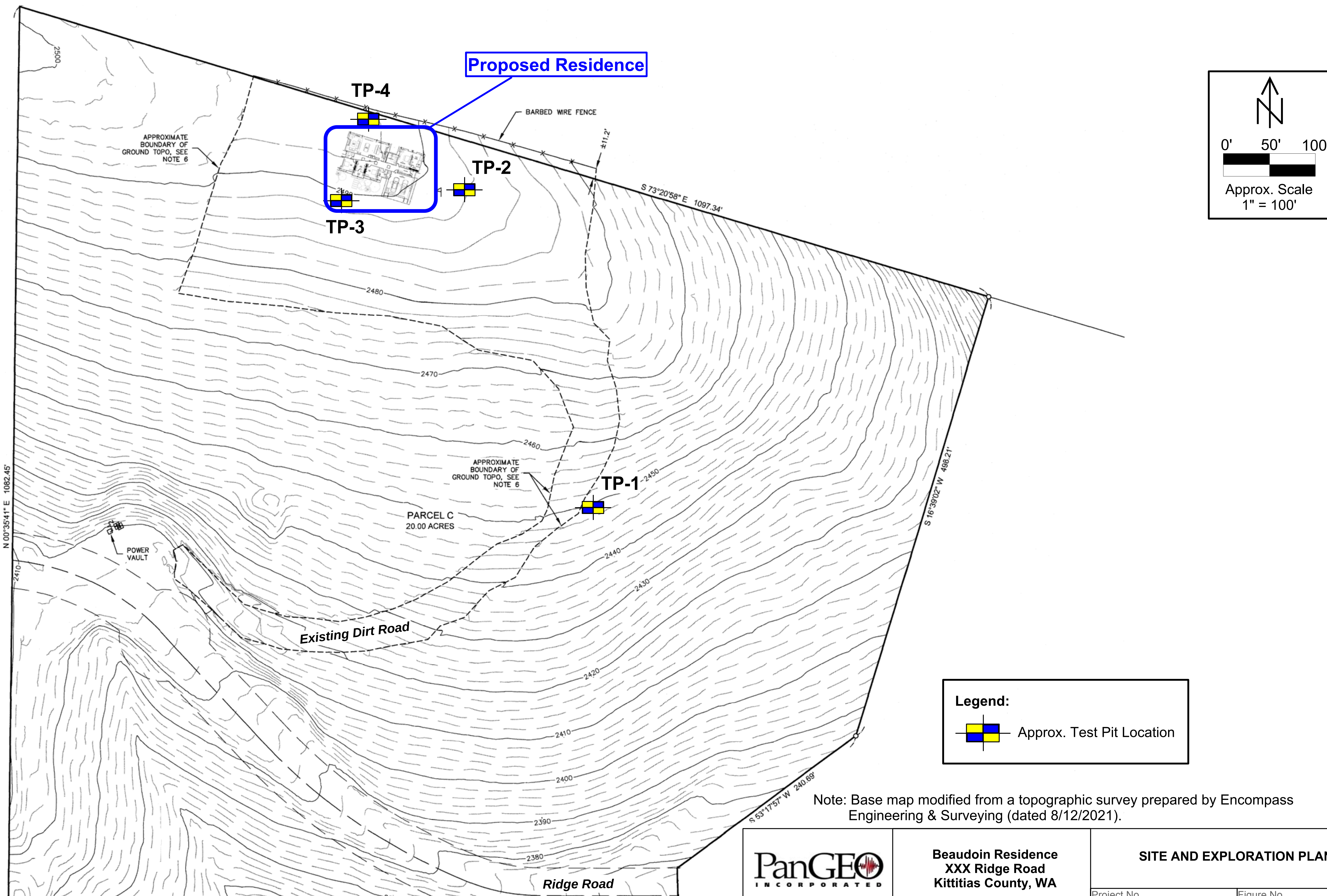


Base map modified from Google Maps (terrain view).



Not to Scale

PanGEO INCORPORATED	Beaudoin Residence XXX Ridge Road Kittitias County, WA	VICINITY MAP Project No. 21-364 / Figure No. 1



Note: Base map modified from a topographic survey prepared by Encompass Engineering & Surveying (dated 8/12/2021).

PanGEO INCORPORATED

Beaudoin Residence
XXX Ridge Road
Kittitias County, WA

SITE AND EXPLORATION PLAN

Project No.	Figure No.
21-364	2

21-364 Fig 2.grf 9/10/21 (08:33) STS

APPENDIX A

SUMMARY TEST PIT LOGS

RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)	GW	Well-graded GRAVEL
		GP	Poorly-graded GRAVEL
	GRAVEL (>12% fines)	GM	Silty GRAVEL
		GC	Clayey GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)	SW	Well-graded SAND
		SP	Poorly-graded SAND
	SAND (>12% fines)	SM	Silty SAND
		SC	Clayey SAND
Silt and Clay 50%or more passing #200 sieve	Liquid Limit < 50	ML	SILT
		CL	Lean CLAY
		OL	Organic SILT or CLAY
	Liquid Limit > 50	MH	Elastic SILT
		CH	Fat CLAY
		OH	Organic SILT or CLAY
Highly Organic Soils		PT	PEAT

Notes: 1. Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.

2. The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

DESCRIPTIONS OF SOIL STRUCTURES

Layered:	Units of material distinguished by color and/or composition from material units above and below	**Fissured:**	Breaks along defined planes
Laminated:	Layers of soil typically 0.05 to 1mm thick, max. 1 cm	**Slickensided:**	Fracture planes that are polished or glossy
Lens:	Layer of soil that pinches out laterally	**Blocky:**	Angular soil lumps that resist breakdown
Interlayered:	Alternating layers of differing soil material	**Disrupted:**	Soil that is broken and mixed
Pocket:	Erratic, discontinuous deposit of limited extent	**Scattered:**	Less than one per foot
Homogeneous:	Soil with uniform color and composition throughout	**Numerous:**	More than one per foot
		BCN:	Angle between bedding plane and a plane normal to core axis

COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel		Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
Coarse Gravel:	3 to 3/4 inches	Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Fine Gravel:	3/4 inches to #4 sieve	Silt	0.074 to 0.002 mm
		Clay	<0.002 mm

TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.

ATT	Atterberg Limit Test
Comp	Compaction Tests
Con	Consolidation
DD	Dry Density
DS	Direct Shear
%F	Fines Content
GS	Grain Size
Perm	Permeability
PP	Pocket Penetrometer
R	R-value
SG	Specific Gravity
TV	Torvane
TXC	Triaxial Compression
UCC	Unconfined Compression

SYMBOLS

Sample/In Situ test types and intervals

- 2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)
- 3.25-inch OD Spilt Spoon (300-lb hammer, 30" drop)
- Non-standard penetration test (see boring log for details)
- Thin wall (Shelby) tube
- Grab
- Rock core
- Vane Shear

MONITORING WELL

- Groundwater Level at time of drilling (ATD)
- Static Groundwater Level
- Cement / Concrete Seal
- Bentonite grout / seal
- Silica sand backfill
- Slotted tip
- Slough
- Bottom of Boring

MOISTURE CONTENT

Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

PanGEO INCORPORATED
Phone: 206.262.0370

Terms and Symbols for Boring and Test Pit Logs

Figure A-1

Test Pit No. TP-1

Location: Proposed Driveway, see Figure 2
Approximate Ground Surface Elevation: 2,450 feet
Approximate Coordinates (WGS84): 47.003826, -120.685690
Date: August 30, 2021

Depth (ft)	Material Description
0 – ½	Loose, brown, SILT with gravel, dry. **[Loess].** -Abundant roots
½ – 3	Strong, reddish gray to gray, BASALT. Weathered. **[Grande Ronde Basalt]** -Highly fractured, breaks up into subangular gravel to cobble sized pieces. Slightly vesicular.

Completed test pit.

Test pit spoils.

TP-1 was terminated approximately 3 feet below ground surface.

No groundwater was observed at the time of excavation.

Figure A-2

Test Pit No. TP-2

Location: East of proposed residence, see Figure 2
Approximate Ground Surface Elevation: 2,488 feet
Approximate Coordinates (WGS84): 47.00827, -120.686070
Date: August 30, 2021

Depth (ft)	Material Description
0 – ½	Loose, brown, SILT with gravel, dry. **[Loess].** -Abundant roots.
½ – 4	Strong, reddish gray to gray, BASALT. Weathered. **[Grande Ronde Basalt]** -Highly fractured, breaks up into subangular gravel to cobble sized pieces. Slightly vesicular. -Occasional boulder sized pieces.

Completed test pit.

Test pit spoils.

TP-2 was terminated approximately 4 feet below ground surface.

No groundwater was observed at the time of excavation.

Figure A-3

Test Pit No. TP-3

Location: South side of proposed residence, see Figure 2
Approximate Ground Surface Elevation: 2,490 feet
Approximate Coordinates (WGS84): 47.004802, -120.686577
Date: August 30, 2021

Depth (ft)	Material Description
0 – ½	Loose, brown, SILT with gravel, dry. **[Loess].** -Abundant roots.
½ – 2½	Strong, reddish gray to gray, BASALT. Weathered. **[Grande Ronde Basalt]** -Highly fractured, breaks up into subangular gravel to cobble sized pieces with occasional boulder sized pieces. Slightly vesicular. -Operator indicated more difficult to excavate than test pits TP-1 and TP-2.

Completed test pit.

TP-3 was terminated approximately 2½ feet below ground surface due to practical excavation refusal.

No groundwater was observed at the time of excavation.

Figure A-3

Test Pit No. TP-4

Location: North side of proposed residence, see Figure 2
Approximate Ground Surface Elevation: 2,492 feet
Approximate Coordinates (WGS84): 47.005053, -120.686456
Date: August 30, 2021

Depth (ft)	Material Description
0 – ½	Loose, brown, SILT with gravel, dry. **[Loess].** -Abundant roots.
½ – 4	Strong, reddish gray to gray, BASALT. Weathered. **[Grande Ronde Basalt]** -Highly fractured, breaks up into subangular gravel to cobble sized pieces with occasional boulder sized pieces. Slightly vesicular.

Completed test pit.

TP-4 was terminated approximately 4 feet below ground surface.

No groundwater was observed at the time of excavation.

Figure A-3

Dates Test Pits Excavated: August 30, 2021 using a Deere 75G track mounted excavator owned and operated by Reecer Creek Excavating.
Test Pits Logged by: Steve Swenson