Geotechnical Engineering Services Addendum Report No. 1

Pierce College Puyallup
STEM Building Design Services
Puyallup, Washington

for

Absher Construction Co.

June 29, 2022

Provide copy on-site as sheet S0.21 notes to reference soil report per Engineer Theresa Daniel on foundation details.

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services
Addendum Report No. 1

Pierce College Puyallup
STEM Building Design Services
Puyallup, Washington

for
Absher Construction Co.

June 29, 2022

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

PRCNC20221036

Geotechnical Engineering Services
Addendum Report No. 1

Pierce College Puyallup
STEM Building Design Services
Puyallup, Washington

File No. 21342-002-01

June 29, 2022

Prepared for:

Absher Construction Co.
1001 Shaw Road
Puyallup, Washington 98372

Attention: Blaine Wolfe

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Christopher R. Newton, PE
Geotechnical Engineer

Dennis (D.J.) Thompson, PE
Associate Geotechnical Engineer

DENNIS JOHN THOMPSON
STATE OF WASHINGTON
38397
REGISTERED
PROFESSIONAL ENGINEER
6/29/22

CRN:DJT:kjb:leh

GEOENGINEERS

Table of Contents

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION AND PROJECT UNDERSTANDING

This addendum report presents the results of our additional geotechnical engineering services for the proposed Science, Technology, Engineering, Mathematics (STEM) Building at Pierce College Puyallup, as shown on the Vicinity Map, Figure 1. Our previous work for this project includes preparation of a "Geotechnical Engineering Services Report, Pierce College Puyallup – STEM Building Design Study, Puyallup, Washington" dated January 21, 2021 (January 2021 Report). This addendum reflects additional subsurface explorations, information and recommendations not provided in our January 2021 report. This addendum addresses additional stormwater management and pavement design considerations for the parking lot to be located northeast of the STEM Building.

Our project understanding is based on discussions with you, AHBL, Inc. (AHBL; project civil engineer), and Integrus Architecture (Integrus; project structural engineer and architect). We also reviewed the Architectural, Civil, and Structural Plans from the GMP Plan Set dated March 11, 2022 and prepared by Integrus.

The proposed STEM Building is to consist of a 54,748-gross-square-foot, three-story steel frame structure containing classrooms, laboratories, faculty offices, and study spaces. Conventional shallow foundations, mat slabs, and slab-on-grade are planned for building support. The mat slabs will support buckling-restrained brace frames. Other site improvements include a proposed parking lot north of the STEM Building adjacent to Campus Way and Parking Lot C, trenching and utilities, and stormwater management facilities.

Stormwater management facilities currently being considered are Stormtech Chamber systems and bioretention facilities beneath or around the proposed parking lot. Rain gardens are also planned around the building. Stormwater management facilities on site will be designed in accordance with Washington State Department of Ecology's 2019 Stormwater Management Manual for Western Washington (SWMMWW).

Our services have been provided in general accordance with our signed agreement for this project authorized on March 1, 2022. A complete list of our scope of services is provided in our proposal dated February 10, 2022.

2.0 SITE CONDITIONS

2.1. Surface Conditions

The site is bounded by College Way to the north, campus Parking Lot C to the east, existing Pierce College buildings, landscaped and hardscaped common areas to the west and south. The site is currently forested with mature coniferous and deciduous trees and a dense understory layer, including brush, small trees, fallen trees, and forest duff. Site topography generally slopes downward toward the east-northeast from approximate Elevation 532 feet to Elevation 520 feet (The North American Vertical Datum of 1988; NAVD88). Elevations referenced in this report are with respect to NAVD88 unless noted otherwise.

2.2. Literature Review

2.2.1. Geologic and Soil Survey

Based on our additional review, we conclude that the geology description and soil survey descriptions provided in our January 2021 Report remain appropriate except as described below.

2.2.2. Soil Survey

We reviewed the Natural Resources Conservation Service (NRCS) Web Soil Survey (accessed April 18, 2022). According to the survey, the site is underlain by two subunits of Kapowsin gravelly ashy loam: 6 to 15 percent slopes and 30 to 65 percent slopes. Kapowsin gravelly ashy loam is described as moderately well drained with a very low capacity of the most limiting layer to transmit water and categorized as Hydrologic Soil Group B.

2.2.3. Water Well Information

We searched the Washington State Department of Natural Resources Interactive Geologic Information Portal on April 18, 2022 for water well log reports in the project vicinity. Based on our search, we found a water well log report dated May 28, 2002 (Ecology Well ID Tag No. AFR 833) near the southwest corner of the campus property. This well log reported the static groundwater level at about 411 feet below the top of the well (over 100 feet below project site grade). We interpret this static groundwater level to be more representative of the regional groundwater table in the project vicinity.

2.3. Subsurface Conditions

2.3.1. Subsurface Explorations and Laboratory Testing

We explored subsurface conditions at the project site by advancing one boring (MW-1) on March 9, 2022, and six test pit excavations (TP-1 (PIT-1) through TP-6) between April 5 and 6, 2022. The approximate locations of the boring and test pits are shown on the attached Site Plan, Figure 2. A groundwater monitoring well was constructed in the boring after drilling was complete. One small-scale pilot infiltration test (PIT) was completed in TP-1 (PIT-1) at approximately 12 feet below the ground surface (bgs). The test results and methodology for the PIT are discussed in further detail in the "Stormwater Infiltration" section of this report. A description of our subsurface exploration program and summary exploration logs for this study are provided in Appendix A.

Figure 2 also displays the locations of test pit explorations completed as part of our January 2021 Report. We provide this as additional reference when reviewing our January 2021 Report in concert with this report. The subsurface exploration procedures, interpreted conditions, and test pits logs are presented in our January 2021 Report.

Selected samples collected from our boring and test pits were tested in our laboratory to confirm field classifications and to evaluate pertinent engineering properties. Our laboratory testing program included grain-size distribution analyses and moisture content determinations. A summary of our laboratory testing program and the test results are provided in Appendix A.

2.3.2. Soil Conditions

2.3.2.1. General

We observed about 3- to 12-inches of forest duff and/or organic-rich soil at the surface in test pits TP-1 through TP-4. Approximately 6 inches of sod was observed at the surface in test pits TP-5 and TP-6 and boring MW-1. Descriptions of soils encountered below these surface materials are discussed in the following sections.

2.3.2.2. Monitoring Well MW-1

Below the sod at MW-1, we observed what we interpret to be glacial till. Glacial till was typically comprised of silty sand with gravel and silty gravel with sand. The upper approximately 8 feet of glacial till was observed to be in a weathered, loose condition. Below the weathered zone, the glacial till was generally observed to be very dense to the depth explored. MW-1 was terminated in glacial till soils.

2.3.2.3. Test Pits TP-1 (PIT-1) through TP-6

Below the sod, forest duff, and/or organic-rich soils in TP-1 (PIT-1) through TP-6, we observed what we interpret to be glacial till to the depths explored. The upper approximately 4 to 5 feet of glacial till were observed to be weathered and generally ranged between a loose to dense condition. Occasional roots generally extended to on the order of 3 feet depth. Underlying the weathered zone, glacial till generally consisted of dense to very dense silty sand with gravel and silty gravel with sand and variable cobbles and boulders content. In TP-1 (PIT-1) the glacial till gradually changed more course to a gravel with silt and sand at about 11 feet bgs to the full depth explored.

2.3.3. Groundwater Conditions

We did not observe what we interpret to be the regional groundwater table in our explorations. However, we observed groundwater seepage generally in the upper 6 feet and occasionally deeper for the explorations advanced for this report. We interpret the seepage observed to be perched groundwater and was generally within the weathered glacial till, perched near the interface with the intact glacial till and also at times, seeping through intermittent gravel seams.

We typically define slow seepage as less than 1 gallon per minute (gpm), moderate seepage 1 to 3 gpm, and rapid seepage is greater than 3 gpm. During drilling for monitoring well MW-1, we encountered shallow groundwater at about 5 feet depth, which is within the similar zone where groundwater seepage was encountered in nearby test pits TP-5 and TP-6.

Based on our experience, it is not uncommon for glacial soils to contain isolated zones of perched groundwater. We anticipate that perched groundwater could be present in other areas or depths at the project site depending on soil conditions, rainfall amounts and irrigation activities. We anticipate that perched groundwater levels will generally be highest during the wet season, typically October through May.

We tracked groundwater levels in monitoring well MW-1 using a pressure transducer data logger from March 10 through May 18, 2022. The pressure transducer was programmed to collect a groundwater level reading once a day. This data is presented in the Groundwater Hydrograph, Figure A-11 of Appendix A. Table 1 below presents our groundwater elevation summary for MW-1.

TABLE 1. GROUNDWATER LEVELS FROM MONITORING WELL MW-1

Approx. Ground Surface Elevation (feet)	Approx. Maximum Elevation (feet)	Date and Time of Maximum Elevation	Approx. Average Elevation (feet)[1]
522	504.6	3/27/22 12:00 PM	503.5

Notes: [1] Average groundwater elevation from March 10 through May 18, 2022.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1. Primary Geotechnical Considerations

Based on our understanding of the project, the explorations performed for this study and our January 2021 Report, it is our opinion that the proposed improvements can be designed and constructed generally as envisioned with regard to geotechnical considerations. A summary of the primary geotechnical considerations for the project is provided below and is followed by our detailed recommendations. The conclusions and recommendations provided in our January 2021 Report remain valid except as modified herein. Our January 2021 Report should also be reviewed in its entirety and should be presented with this report when reviewed by others.

- Clearing and stripping depths for forest duff in the proposed parking lot area will typically be on the order of about 12 inches. Greater clearing and stripping depths may be required when establishing subgrades in areas of heavier vegetation or relatively lower lying areas. Adjacent to Parking Lot C, clearing and stripping depths will be on the order of 6 inches to remove sod.
- Most of the soils observed in our explorations for this study contain a significant quantity of fines and, therefore, could be difficult or impossible to work with when wet or become easily disturbed if exposed to wet weather.
- Isolated perched groundwater zones were commonly present in the explorations where wet conditions were typically encountered. Depending on the intended use of material generated in this area, and the moisture/weather conditions, it may be difficult to process and/or re-use on-site soils as structural fill and backfill.
- Based on our experience, subsurface conditions observed in our explorations, and results from our infiltration testing, it is our opinion that stormwater infiltration within proposed development areas related to this study is generally infeasible. We provide additional discussion in the "Stormwater Infiltration" section below.

3.2. Mat Foundations

We provide additional considerations below for mat foundation design. The shallow foundation bearing surface preparation recommendations outlined in our January 2021 Report should also be followed. We have assumed that mat foundation bearing surfaces will consist of thoroughly compacted, firm, and unyielding inert native soil or structural fill extending to such soil.

A modulus of subgrade reaction of 250 pounds per cubic inch (pci) may be used for structural design of mat foundations. This value is for a 1-foot by 1-foot square plate. The modulus of subgrade reaction for a mat foundation will vary based on its minimum width and is computed according to the following equation:

$$k_s = k_{s1}[(B+1)/2B]^2$$

Where k_s is the computed modulus of subgrade reaction, k_{s1} is the modulus of subgrade reaction for a 1- foot by 1-foot plate, and B is the minimum width or lateral dimension of the mat.

For bearing surfaces prepared as recommended, we estimate the total static settlement of mat foundations will be on the order of 1 inch or less for the modulus of subgrade reaction presented above. Differential settlements could be on the order of ¼ to ½ inch between similarly loaded foundations or over about 20 feet across a foundation dimension, such as along the width or length of the mat. The settlements should occur rapidly, essentially as loads are applied. Settlements could be greater than estimated if disturbed or saturated soil conditions are present below foundations.

The lateral resistance design parameters outlined in our January 2021 Report remain applicable to mat foundation design.

3.3. Luminaire Poles

3.3.1. Design Parameters

We understand that luminaire poles are planned for site improvements. It is our opinion that Washington State Department of Transportation (WSDOT) Standard Plans may be used, as applicable, for design of luminaire poles. Recommended soil properties and design parameters are provided in Table 2 below. Other jurisdictional design criteria or other methods of design may also be applicable and may take precedence. We can assist with other design methods, as requested.

Recommended values are based on our experience in the area, subsurface explorations, and review of the February 2022 WSDOT Geotechnical Design Manual (WSDOT GDM), Chapter 17, "Foundation Design for Signals, Signs, Noise Barriers, Culverts, and Buildings," and Table 17.2 of the same. We recommend that this document be referenced and reviewed during the design and selection process for luminaire pole foundations. The WSDOT GDM, Chapter 17 also provides design guidance if foundations other than indicated in the Standard Plans are required.

The allowable lateral bearing pressure listed below is for foundations constructed in relatively flat ground conditions, which is anticipated for this project. Special design considerations for foundations constructed on or near slopes are provided in WSDOT GDM, Chapter 17. We should be consulted further if sloping conditions are anticipated around luminaire poles.

TABLE 2. LUMINAIRE POLE DESIGN PARAMETERS

Soil Unit Weight (pcf)	Soil Friction Angle (deg)	Allowable Lateral Bearing Pressure (psf)
125	34	2,500

3.3.2. Construction and Additional Design Considerations

We present two conditions to consider when designing and constructing luminaire pole foundations (pole foundations).

- Condition #1, an excavation the same dimension as the designed pole foundation is developed, and the foundation is cast directly against undisturbed earth. Or,

- Condition #2, an excavation larger than the designed dimension of the pole foundation is developed, a corrugated metal pipe is placed into the excavation, and the foundation concrete is cast inside the metal pipe. The corrugated metal pipe is left in place after pouring the foundation concrete. Any overexcavated area outside of the corrugated metal pipe is backfilled with controlled density fill (CDF) or structural fill.

Construction of foundation Condition #1 requires the sidewalls of the excavation to stay stable and not cave into the excavation. In the case of drilling installation methods, temporary steel casing or drill slurry can also be used if caving soil conditions are encountered. Excavations made for foundation Condition #2 should be in accordance with the “Temporary Excavations and Cut Slopes” section of our January 2021 Report if workers are expected to enter the excavation. Recommendations regarding backfilling around pole foundations are included in the “Backfill Placement and Compaction Around Luminaire Pole Foundations” section of this report.

In general, we expect that the majority of the luminaire pole foundations will be constructed in fill and/or weathered soil overlying glacial till. We expect that the majority of the excavations for the foundations could remain open for a short period of time, but ultimately, we expect the potential for raveling, dislodged cobbles and oversized particles and seepage. At this time, we suggest Condition #2 be considered for budgeting and design purposes. Additional sumps/pumps and some dewatering or capture of decanted water, or other means of groundwater seepage management may be required. At a minimum, the contractor should be prepared to use casing, as necessary, to stabilize the hole, especially within the upper approximate 5 feet.

3.3.3. Backfill Placement and Compaction Around Luminaire Pole Foundations

Backfill in overexcavated areas and around pole foundations must be compacted in accordance with WSDOT Standard Specifications Section 2-09.3(1)E. If the overexcavated area is large enough for compaction equipment to access, import structural fill material should be used to backfill the excavations. Backfill material around pole foundations must be compacted to at least 95 percent of the theoretical maximum dry density (MDD) per ASTM International (ASTM) D 1557.

Alternatively, CDF may be used to backfill the excavation in accordance with WSDOT Standard Specification Section 2-09.3(1)E. CDF is a self-compacting, cementitious, flowable material requiring no subsequent vibration or tamping to achieve consolidation. CDF is included as an option for backfilling around pole foundations in the WSDOT Standard Signal Foundation Plans. If the area to backfill is too small for compaction equipment to access, CDF should also be used. Additionally, we recommend that CDF be used to backfill any large voids created during excavation if compaction equipment cannot access the void area.

3.4. Site Development and Earthwork

3.4.1. General

The recommendations provided herein are to supplement the “Site Development and Earthwork” section of our January 2021 Report, which remains applicable to this project.

3.4.2. Groundwater Handling Considerations

The isolated perched groundwater zones (shallow groundwater) observed in our explorations are common within glacial deposits encountered at this campus and in general, sites with similar soil conditions.

Groundwater seepage was generally observed between about Elevation 518 and 522 feet. The interface between more permeable and less permeable soil types such as the contact between weathered glacial till and glacial till are common conditions where perched groundwater can be present. As such, perched groundwater could be encountered in other excavations outside of our explorations, especially where more permeable sand and gravel seams may overlie less permeable materials.

Groundwater handling needs for excavations anticipated at this site will typically be lower during the summer and early fall months. Due to some of the variable soil layering and isolated, intermittent perched groundwater zones observed, it is our opinion that wells and well point systems will not be practical for dewatering of shallow excavations. It is our opinion that handling of shallow groundwater will be more practical with the use of larger sumps/pumps, diversion ditches, drain/collector systems, and/or combinations of methods.

We noted slow to rapid seepage rates in our explorations completed for this study. For preliminary dewatering considerations, we estimate seepage rates into shallow excavations could be on the order of 2 to 3 gpm. We recommend that additional test pits/explorations for critical excavation areas, primarily the location of the Stormtech Chambers be considered, especially in the wetter times of year, prior to primary earthwork activities. This will allow observation of seepage flow rates at current time, and the ability to consider any additional shallow groundwater management and handling criteria. Ultimately, we recommend that the contractor performing the work be responsible for controlling and collecting groundwater encountered. We are available to provide additional assistance on planning of shallow groundwater management, as requested.

3.5. Fill Materials

3.5.1. On-Site Soil

Most of the site soils observed in our explorations contain a significant quantity of fines and are difficult or impossible to work with when wet or become easily disturbed if exposed to wet weather. Isolated perched groundwater zones were commonly present in our explorations and the soil conditions encountered within these zones were typically wet.

Based on our subsurface explorations and experience, it is our opinion that existing site soils, excluding the forest duff and/or organic-rich soil and sod, could be considered for use as structural fill and trench backfill, provided that they can be adequately moisture conditioned, placed and compacted as recommended and do not contain organic or other deleterious material.

During excavation activities, seepage observed at the site could saturate drier soil located below or in between these seepage zones. In addition, some of the existing soils outside of the seepage zones will be generated at moisture contents above optimum (OMC) . The severity of this will depend on time of year of excavation and overall handling techniques. As such, we suggest earthwork activities take place in the middle of summer. In any event, segregation of dryer material from wetter material should be expected for use of on-site material at any time of year. Additionally, drying and staging of these materials may be required to spread material out and condition soil to a proper moisture content before use.

It should be expected and planned for that some on-site material will not be suitable for immediate use as a structural fill, especially during the wet season. Provisions for removal of on-site material and import structural and/or select granular fill should be expected on this project. Imported structural fill or select granular fill materials are described in the “Fill Materials” section of our January 2021 Report. Ultimately, we recommend that the use of on-site soils be evaluated on a case-by-case basis during construction. We are available to assist with additional consultation and considerations when planning to use on-site material.

3.6. Stormwater Infiltration

3.6.1. General

It is our understanding that stormwater management facilities will be designed in general accordance with the Washington State Department of Ecology’s 2019 SWMMWW. According to the SWMMWW, design infiltration rates in glacially consolidated soils (i.e., glacial till) should be determined via in-situ infiltration testing such as a PIT. The sections below further describe our PIT methodology, infiltration suitability of site soils, and recommendations for stormwater management facility design.

We completed a small-scale PIT, PIT-1, during excavation of TP-1. PIT-1 was located approximately within the basal footprint of the larger grouping of planned Stormtech Chambers for the proposed parking lot.

A PIT was originally planned at each TP-2 and TP-5 (both are approximately within basal footprints of the planned Stormtech Chambers); however, due to moderate to rapid groundwater seepage observed in the excavations, we were not able to complete these PITs. We also observed moderate to rapid groundwater seepage at TP-4 and TP-6, so we were not able to perform a PIT at those test pits either.

3.6.2. Pilot Infiltration Tests

3.6.2.1. Methodology

We completed the PIT generally following GeoEngineers’ standard methodology for PITs, which is a synthesis of best practices and, in our opinion, meets the intended procedures for small-scale PITs set forth in the SWMMWW. PIT-1 was completed at about 12 feet bgs or Elevation 512 feet (NAVD88), which is roughly the proposed bottom of Stormtech Chamber system elevation per the Civil GMP Plan Set. The approximate basal area of the PIT excavation was at least 16 square feet. Upon reaching the target depth, a piezoelectric pressure transducer was lowered to near the floor of the test pit to record water level readings during the PIT. A separate piezoelectric pressure transducer was secured to a tree branch near the test pit to record barometric pressure during the PIT. The piezoelectric pressure transducers were programmed to record water level/barometric pressure readings at 20-second intervals. Water was pumped into the PIT-1 excavation from a water tank trailer generally to depths of about 16 inches.

GeoEngineers’ PIT procedure consists of a 6-hour (minimum) saturation period where the water depth in the PIT is raised and lowered, generally over intervals of 6 inches or less, in a series of falling-head stages. Water level measurements collected by the pressure transducer during each falling-head stage are used to calculate the apparent infiltration rate for each stage. Manual water level measurements are also recorded in the event a transducer malfunctions during the test. The falling-head stage methodology is intended to fully saturate the soils below the base of the PIT while allowing for a direct measurement of the infiltration rate to help determine when saturated or near-saturated conditions have been achieved. This is usually manifested by a progressive decline in the apparent infiltration rate until the rate approximately stabilizes. The stabilized rate corresponds to the saturated infiltration rate or the measured (initial) infiltration rate of the soil.

Generally, once a stabilized infiltration rate is observed and a minimum of 6 hours of saturation time has elapsed, the PIT is continued for one or more falling-head cycles or is left undisturbed until the water drains away completely. If left to drain away completely, the final drain-down period shows how infiltration changes over a continuous range of declining water depths. Sixteen falling-head stages were recorded for the PIT.

3.6.2.2. Test Results

The SWMMWW recommends that correction factors be applied to the measured (initial) infiltration rate determined in the PIT to establish a long-term design infiltration rate. The correction factors account for uncertainties in site variability, testing procedures, and long-term reduction in permeability due to plugging. Table 3 below provides a summary of the correction factors outlined in the SWMMWW that are, in our opinion, appropriate for use at this site. The total correction factor is equal to the product of the individual factors.

TABLE 3. CORRECTION FACTORS FOR FIELD INFILTRATION MEASUREMENTS

Correction Factor	Recommended Value
Site Variability and Number of Locations Tested	CF_v=0.33 Selected because of number of test locations
Test Method	Small-scale PIT, CF_t = 0.50
Degree of Influent Control to Prevent Siltation and Bio-buildup	CF_m= 0.9
Total Correction Factor (CF_v x CF_t x CF_m)	CF_T= 0.15

The long-term design infiltration rate (K_{sat_design}) is obtained by multiplying the measured (initial) infiltration rate ($K_{sat\_initial}$) by the total correction factor:

$$K_{sat\_design} = K_{sat\_initial} * CF_T$$

Table 4 summarizes the measured (initial) and long-term design infiltration rates for PIT-1.

TABLE 4. INFILTRATION RATE SUMMARY FOR PIT-1

Approximate Depth of PIT (feet bgs)	Approximate Elevation of PIT[1] (feet; NAVD88)	Measured (Initial) Infiltration Rate ($K_{sat\_initial}$; in/hr)	Long-Term Design Infiltration Rate[2] (K_{sat_design}; in/hr)
12	512	13.6	2.0

Notes:

[1] Elevation should be considered approximate.

[2] Long-term design infiltration rate with appropriate correction factors applied.

3.6.2.3. Conclusions of PIT Results and Stormwater Infiltration Feasibility

Based on the subsurface conditions observed in our explorations and our experience on campus, it is our opinion that stormwater infiltration is generally infeasible for this project. We do not recommend using the long-term design infiltration rate listed in Table 4 above. This PIT was completed in a more permeable gravel seam at depth. Glacial till soils in the project vicinity and at the site are undifferentiated and commonly include isolated and/or discontinuous seams of cleaner sand and gravel. During our studies, we did not observe this unit to be consistent across the area and at similar depths and did not observe conclusive evidence of suitable horizontal bedding layers in our explorations. As such, we recommend that infiltration not be considered as an option for stormwater management on this project. If a small amount of infiltration is necessary (i.e., small shallow bio-swales, yard drains, etc.), we recommend we be consulted first to review proposed location, design, and overall use before final determination.

3.7. Pavement Recommendations

3.7.1. General

Pavements for the proposed improvements will include new a new parking lot and driveways. Our recommended pavement sections provided below are based on our explorations and experience in the area. We understand asphalt concrete pavement (ACP) is planned for the proposed improvements.

The recommended pavement sections below may not be adequate for heavy construction traffic loads such as those imposed by concrete transit mixers, dump trucks or cranes. Additional pavement thickness may be necessary to prevent pavement damage during construction. An asphalt-treated base (ATB) section can also be used during construction to protect partially constructed pavement sections and pavement subgrades. The recommended sections assume final improvements surrounding the pavement areas will be designed and constructed such that stormwater or excess irrigation water from landscape areas does not accumulate below the pavement section or pond on pavement surfaces. If pavements in parking areas slope inward (toward the center of the parking area) full depth curbs or other measures should be used to prevent water from entering and ponding on the subgrade and within the base section.

3.7.2. Construction Considerations

Existing pavements, hardscaping or other structural elements should be removed prior to placement of new pavement sections. Pavement subgrade should be prepared to a uniformly firm, dense and unyielding condition as previously described. Crushed surfacing base course (CSBC) and subbase should be moisture conditioned to near optimum moisture content and compacted to at least 95 percent of the MDD (ASTM D 1557).

Crushed surfacing base course should conform to applicable sections of 4-04 and 9-03.9(3) of the WSDOT Standard Specifications. Hot mix asphalt should conform to applicable sections of 5-04, 9-02 and 9-03 of the WSDOT Standard Specifications.

Some areas of pavement may exhibit settlement and subsequent cracking over time. Cracks in the pavement will allow water to infiltrate to the underlying base course, which could increase the amount of pavement damage caused by traffic loads. To prolong the effective life of the pavement, cracks should be sealed as soon as possible.

3.7.3. Asphalt Concrete Pavement Design

3.7.3.1. Standard-Duty ACP – Automobile Driveways and Parking Areas

- 2 inches of hot mix asphalt, class ½ inch, PG 58-22
- 4 inches of CSBC
- 6 inches of subbase consisting of select granular fill, previously described, to provide a uniform grading surface, to provide pavement support, to maintain drainage, and to provide separation from subgrade soil.

- Subgrade consisting of proof-compacted firm and unyielding conditions, or structural fill prepared in accordance with the “Subgrade Preparation” and “Area Fills and Pavement Bases” sections of our January 2021 Report .

3.7.3.2. Areas Subject to Occasional Heavy Truck Traffic

- 3 inches of hot mix asphalt, class ½ inch, PG 58-22
- 6 inches of CSBC
- 6 inches of subbase consisting of select granular fill, previously described, to provide a uniform grading surface, to provide pavement support, to maintain drainage, and to provide separation from subgrade soil.
- Subgrade consisting of proof-compacted firm and unyielding conditions, or structural fill prepared in accordance with the “Subgrade Preparation” and “Area Fills and Pavement Bases” sections of our January 2021 Report.

3.7.3.3. Temporary Construction Surfacing

A temporary surfacing of ATB can be used to protect partially constructed pavement sections and pavement subgrades during construction. This can provide a relatively clean working surface, prevent construction traffic from damaging final paving surfaces and reduce subgrade repairs required for final paving. A 2-inch-thick section of ATB can be substituted for the upper 2 inches of CSBC in either the light-duty or heavy-duty pavement sections. Prior to placement of the final pavement surface sections, we recommend that any areas of ATB pavement failure be removed, and the subgrade repaired. If ATB is used and is serviceable when final pavements are constructed, the design asphalt concrete pavement thickness can be placed directly over the ATB.

Cement treatment of subgrades is sometimes used to create construction surfacing or to control soil moisture during wet weather construction. In our opinion cement treatment would not likely be cost effective for creating a wet weatherproof construction surface due to the high fines content in the soil. Cement treatment or cement stabilization would likely only be cost effective as an emergency or contingency action for reducing soil moisture in the on-site material if excavated and re-used as a structural fill. We estimate that it would take a significant amount of cement, likely on the order of 12 percent by weight, to create a firm and stable working surface that could handle wet weather construction. If used as a structural fill, likely on the order of 6 to 8 percent cement by weight would be required.

4.0 LIMITATIONS

We have prepared this report for Absher Construction for the Pierce College Puyallup - STEM Building project located in Puyallup, Washington. Absher Construction may distribute copies of this report to owner’s authorized agents and regulatory agencies as may be required for the Project.

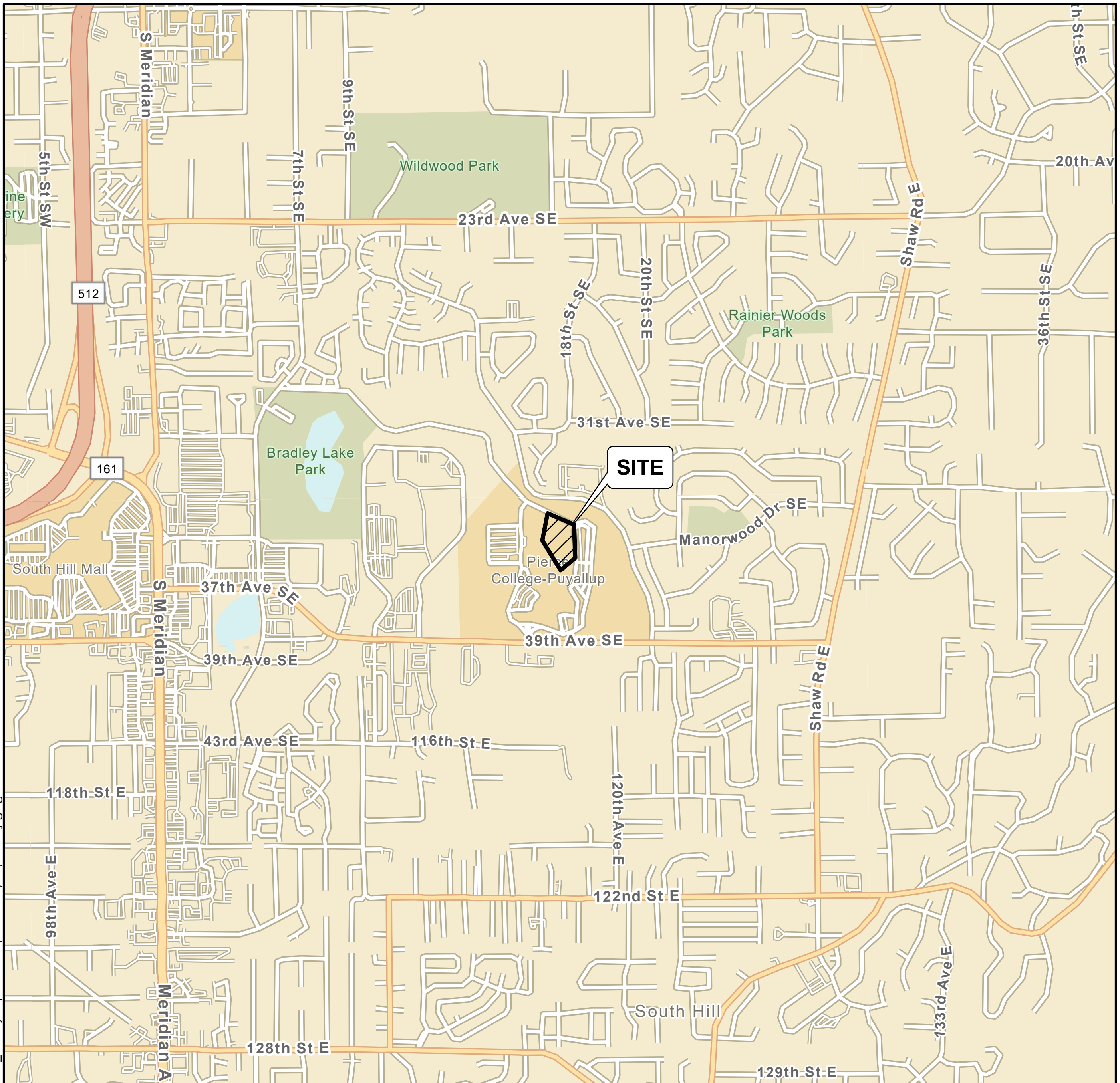
Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to the services or this report.

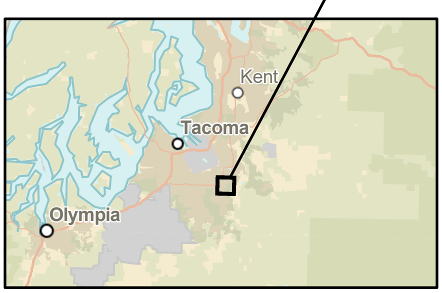
Please refer to Appendix B titled “Report Limitations and Guidelines for Use” of our January 2021 Report for additional information pertaining to use of this report.

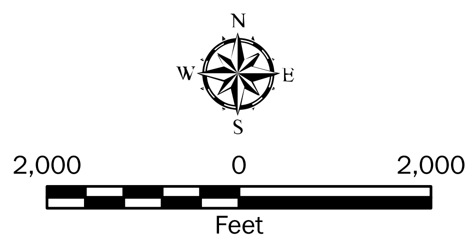
FIGURES

GeoEngineers

PRCNC20221036







Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI

Projection:

Vicinity Map

Pierce College Puyallup - STEM Building Design Services
Puyallup, Washington

GEOENGINEERS

Figure 1

P:\21\21342002\GIS\21342002_Project\21342002_Project.aprx\2134200200_F01_VicinityMap Date Exported: 04/28/22 by gregister

PRCNC20221036

Legend

- TP-1 (PIT-1) — Test Pit by GeoEngineers, Inc., 2022
- MW-1 — Monitoring Well by GeoEngineers, Inc., 2022
- TP-1 — Test Pit by GeoEngineers, Inc., January 2021 Report

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Background from AHBL, Inc., dated 04/19/2022.

Projection: Washington State Plane, South Zone, NAD83, US Foot

N E S W

100 0 100
Feet

Site Plan

Pierce College Puyallup - STEM Building Design Services
Puyallup, Washington

GEOENGINEERS

Figure 2

P:\21\21342002\CAD\01\Geotech Report\2134200201_F02_Site Plan.dwg TAB:F02 Date Exported: 04/28/22 - 7:35 by gregister

PRCNC20221036

APPENDICES

PRCNC20221036

APPENDIX A
Subsurface Explorations and Laboratory Testing

PRCNC20221036

APPENDIX A
SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

Subsurface Explorations

Monitoring Well

Subsurface conditions were explored by advancing one hollow-stem auger boring on March 9, 2022. Subsurface exploratory services were provided by Holocene Drilling, Inc. under subcontract to GeoEngineers, Inc. The boring was advanced to 26½ feet below ground surface (bgs). A 2-inch diameter groundwater monitoring well was constructed after drilling and sampling within the borehole. The well was screened from approximately 10 to 25 feet bgs and a pressure transducer data logger was programmed and installed within the well to record water levels once a day. The groundwater elevations with respect to date are presented in the Groundwater Hydrograph, Figure A-11.

The approximate location of the boring was determined using a tablet equipped with global positioning system (GPS) software and/or pacing off from existing structural features. The exploration locations are included on the Site Plan, Figure 2. The location and elevation of the exploration should be considered approximate. The elevation was estimated based on an existing site topographic map provided by AHBL, Inc.

Our field representative collected samples, classified the soils, maintained a detailed log of the exploration and observed groundwater conditions. The samples were obtained with a standard split spoon sampler in general accordance with ASTM International (ASTM) D 1586. Field blow counts are presented on the log. The soils were classified visually in general accordance with the system described in Figure A-1, which includes a key to the exploration logs. A summary log of the exploration is included as Figure A-2.

The densities noted on the boring exploration log are based on the blow counts produced in the standard penetration test (SPT) and our experience and judgment. The log is based on our interpretation of the field and laboratory data and indicate the depth at which we interpret subsurface materials or their characteristics to change, although these changes might actually be gradual.

Observations of groundwater conditions were made during drilling and are presented on the boring log. Groundwater conditions observed during drilling represent a short-term condition and may or may not be representative of the long-term groundwater conditions at the site. Groundwater conditions observed during drilling should be considered approximate.

Test Pits and Pilot Infiltration Test (PIT)

We also explored subsurface conditions by excavating six test pits between April 5 and 6, 2022 at the approximate locations shown on the Site Plan, Figure 2. The test pits were excavated to depths between about 8¼ and 13¼ feet bgs using an excavator provided and operated by Green Earthworks Construction NW, Inc. under subcontract to GeoEngineers. After each test pit was completed, the excavation was backfilled using the generated material and compacted using the bucket of the excavator. A pilot infiltration test (PIT) was completed at about 12 feet bgs at TP-1 (PIT-1). After completing the PIT, the excavation was extended to observe soil conditions below the test elevation.

During the exploration program, our field representative obtained soil samples, classified the soils encountered, and maintained a detailed log of each exploration. The relative densities noted on the test pit logs are based on the difficulty of excavation and our experience and judgment. The soils were classified visually in general accordance with the system described in Figure A-1, which includes a key to the exploration logs. Summary logs of the explorations are included as Figures A-2 through A-8.

The locations of the test pits were determined using an electronic tablet equipped with GPS software. The locations of the explorations should be considered approximate. The elevations were estimated based on an existing site topographic map provided by AHBL, Inc.

Laboratory Testing

Soil samples obtained from the explorations were transported to GeoEngineers' laboratory. Representative soil samples were selected for laboratory tests to evaluate the pertinent geotechnical engineering characteristics of the site soils and to confirm our field classifications.

Our testing program consisted of the following:

- Six grain-size distribution analyses (sieve analyses [SA])
- Six moisture content determinations (MC)

Tests were performed in general accordance with test methods of ASTM International (ASTM) or other applicable procedures. The following sections provide a general description of the tests performed.

Sieve Analysis (SA)

Grain-size distribution analyses were completed on selected samples in general accordance with ASTM Test Method C 136. This test method covers the quantitative determination of the distribution of particle sizes in soils. Typically, the distribution of particle sizes larger than 75 micrometers (μm) is determined by sieving. The results of the tests were used to verify field soil classifications and determine pertinent engineering characteristics. Figures A-9 and A-10 present the results of our sieve analyses.

Moisture Content (MC)

The moisture content of selected samples was determined in general accordance with ASTM Test Method D 2216. The test results are used to aid in soil classification and correlation with other pertinent engineering soil properties. The results are presented on the test pit and boring logs at the depth tested.

SOIL CLASSIFICATION CHART

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

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel / Dames & Moore (D&M)
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers

Figure A-1

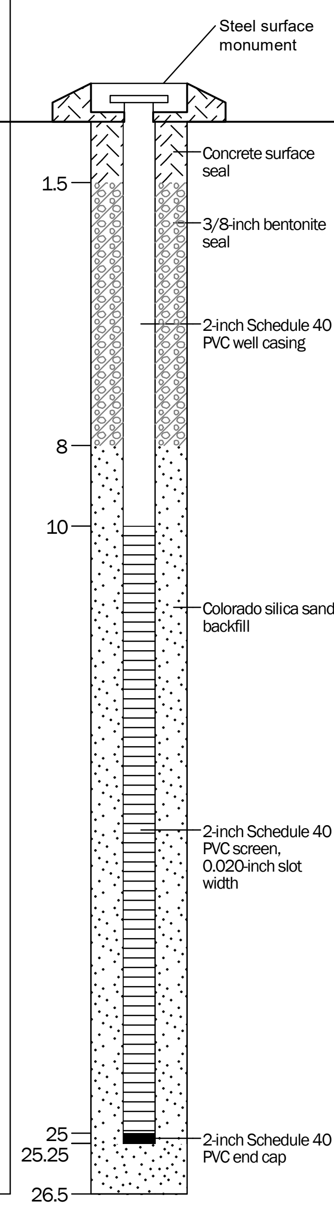
Drilled	Start 3/9/2022	End 3/9/2022	Total Depth (ft) 26.5	Logged By NJO / Checked By CRN	Driller Holocene Drilling, Inc. — Drilling Method Hollow-stem Auger
Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment	Diedrich D-50 (track-mounted)	DOE Well I.D.: BNZ 316 A 2-in well was installed on 3/9/2022 to a depth of 25 ft.
Surface Elevation (ft) Vertical Datum	522 NAVD88		Top of Casing Elevation (ft)		
Easting (X) Northing (Y)	1199790 670600		Horizontal Datum	WA State Plane South NAD83 (feet)	

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
3/9/2022	5.00	517.00

Notes: Samples 3 and 4 combined for one sieve analysis test

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0								SOD	Approximately 6 inches sod		
520									SM	Gray-brown with occasional iron-oxide staining silty fine to medium sand with gravel (loose, moist) (weathered glacial till)		
	5	X	18	7		1	▼			Grades to wet		
515									SM	Gray silty fine to coarse sand with gravel (very dense, moist) (glacial till)		
	10	X	18	88		2						
510									GM	Gray silty fine gravel with sand (very dense, moist)		
	15	X	18	51		3 SA					8	19
505												
	20	X	11	74/11"		4 SA				Nearing wet		
500												
	25	X	18	87		5				Grades to wet		

WELL LOG



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Google Earth. Vertical approximated based on Topographic Survey.

Log of Boring MW-1

GEOENGINEERS

Project: Pierce College Puyallup - STEM Building Design Services
Project Location: Puyallup, Washington
Project Number: 21342-002-01

Figure A-2
Sheet 1 of 1

Date Excavated	4/6/2022	Total Depth (ft)	13.25	Logged By OA Checked By CRN	Excavator Equipment Volvo ECR 88D	See "Remarks" section for groundwater observed Caving not observed

Surface Elevation (ft) Vertical Datum	524 NAVD88	Easting (X) Northing (Y)	1199660 670700	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
524–523.25	0–0.75		Duff	Approximately 9 inches forest duff			
523.25–520.5	0.75–3.5	1 MC (at 2)	SM	Light brown with occasional iron oxide staining silty fine to coarse sand with gravel, occasional cobbles and organics (roots) (loose to medium dense, moist) (weathered glacial till)	14		Roots extend to approximately 3 feet depth
520.5–519.33	3.5–4.67	2	GP-GM	Gray-brown fine to coarse gravel with silt and sand (dense, moist)			
	4.67–5		SP	Approximately 4 inches gray-brown fine to medium sand with trace silt (dense, moist)			
519–513	5–11	3 (at 5); 4 (at 8); 5 (at 10)	SM	Gray silty fine to medium sand with gravel and occasional cobbles (very dense, moist) (glacial till) Becomes nearly wet (at 8) Grades to include fine to coarse grained sand (at 10)			Slow groundwater seepage observed at approximately 6 feet depth
513–510.75	11–13.25	6 SA (at 13)	GP-GM	Gray fine to coarse gravel with silt, sand and occasional boulders (very dense, moist)	9	10	Pilot infiltration test conducted at approximately 12 feet depth on 4/6/2022

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Google Earth. Vertical approximated based on Topographic Survey.

Log of Test Pit TP-1 (PIT-1)

GEOENGINEERS

Project: Pierce College Puyallup - STEM Building Design Services
Project Location: Puyallup, Washington
Project Number: 21342-002-01

Date Excavated	4/6/2022	Total Depth (ft)	12	Logged By: OA Checked By: CRN	Excavator Equipment: Volvo ECR 88D

See "Remarks" section for groundwater observed
Caving not observed

Surface Elevation (ft) Vertical Datum	523 NAVD88	Easting (X) Northing (Y)	1199720 670650	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
523	0			Duff	Approximately 3 inches forest duff			
522	0.25			SM	Dark brown silty fine to medium sand with gravel, occasional cobbles, boulders and organics (roots) (loose, moist) (weathered glacial till)			
521	1.25			GM	Brown silty fine to coarse gravel with sand, occasional cobbles and organics (roots) (loose to medium dense, wet)			Moderate to rapid groundwater seepage observed at approximately 1¼ feet depth Roots extend to approximately 1½ feet depth
	2	▯	1 MC			9		Approximately 1-foot-diameter boulder encountered
520	3	▯	2	SM	Gray-brown with laminations of oxidation staining silty fine to medium sand with gravel and occasional cobbles (dense, moist)			
518	5			GM	Gray silty fine to coarse gravel with sand and occasional cobbles (very dense, moist) (glacial till)			
517	6	▯	3 SA			10	31	
511	12							

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Google Earth. Vertical approximated based on Topographic Survey.

Log of Test Pit TP-2

GeoEngineers

Project: Pierce College Puyallup - STEM Building Design Services
Project Location: Puyallup, Washington
Project Number: 21342-002-01

Figure A-4
Sheet 1 of 1

PRCNC20221036

Date Excavated	4/6/2022	Total Depth (ft)	13	Logged By OA Checked By CRN	Excavator Equipment Volvo ECR 88D

See "Remarks" section for groundwater observed
See "Remarks" section for caving observed

Surface Elevation (ft) Vertical Datum	528 NAVD88	Easting (X) Northing (Y)	1199600 670640	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				Duff	Approximately 12 inches forest duff			
527	1		1		SM	Brown-orange silty fine to coarse sand with gravel, occasional cobbles and organics (roots) (loose, moist) (weathered glacial till)			
526	2				SM	Gray with oxidation laminations silty fine to coarse sand with gravel and occasional cobbles (medium dense, moist)			
525	3		2 MC				20		Roots extend to approximately 3 feet depth Two approximately 1-foot-diameter boulders encountered at 3 feet depth
524	4					Grades to dense with occasional oxidation staining			
523	5				SM	Gray silty fine to coarse sand with gravel and occasional cobbles (very dense, moist) (glacial till)			
522	6		3						
521	7								
520	8								
519	9								
518	10								Slow groundwater seepage observed at approximately 10 feet depth Minor caving observed from approximately 10 to 13 feet depth
517	11								
516	12		4						
	12.5		5 SA		GM	Gray silty fine to coarse gravel with occasional sand (very dense, moist)	27	22	
515	13								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Google Earth. Vertical approximated based on Topographic Survey.

Log of Test Pit TP-3

GEOENGINEERS

Project: Pierce College Puyallup - STEM Building Design Services
Project Location: Puyallup, Washington
Project Number: 21342-002-01

Figure A-5
Sheet 1 of 1

Date Excavated	4/5/2022	Total Depth (ft)	8.25	Logged By OA / Checked By CRN	Excavator Equipment Volvo ECR 88D	See "Remarks" section for groundwater observed / Caving not observed

Surface Elevation (ft) / Vertical Datum	525 / NAVD88	Easting (X) / Northing (Y)	1199720 / 670600	Coordinate System / Horizontal Datum	WA State Plane South / NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
525	0				Duff	Approximately 6 inches forest duff			
524	1				SM	Brown silty fine to coarse sand with gravel and occasional organics (roots) (medium dense, moist) (weathered glacial till)			Roots up to approximately 4 inches in diameter
523	2								Roots extend to approximately 2 feet depth
522	3		1 MC		SM	Light brown-gray silty fine to coarse sand with gravel and occasional cobbles (medium dense, wet)	20		Moderate to rapid groundwater seepage observed from approximately 2½ to 3½ feet
521	4					Grades to with oxidation staining laminations at approximately 3½ feet			
520	5		2		SM	Gray with moderate oxidation staining silty fine to coarse sand with gravel and occasional cobbles (dense, moist) (glacial till)			
519	6								
518	7					Grades to very dense, nearly wet, without oxidation staining			
517	8		3						

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Google Earth. Vertical approximated based on Topographic Survey.

Log of Test Pit TP-4

GEOENGINEERS

Project: Pierce College Puyallup - STEM Building Design Services
Project Location: Puyallup, Washington
Project Number: 21342-002-01

Figure A-6
Sheet 1 of 1

Date Excavated 4/5/2022	Total Depth (ft) 11	Logged By OA Checked By CRN	Excavator Equipment Volvo ECR 88D	See "Remarks" section for groundwater observed Caving not observed

Surface Elevation (ft) 523 Vertical Datum NAVD88	Easting (X) 1199780 Northing (Y) 670590	Coordinate System WA State Plane South Horizontal Datum NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
523	0				SOD	Approximately 6 inches sod			
522	1				SM	Brown silty fine to coarse sand with gravel, occasional cobbles and organics (fine roots) (medium dense, moist) (weathered glacial till)			
521	2								
520	3	▯	1 MC				23		Roots extend to approximately 3 feet depth West sidewall includes an isolated 1- to 2-foot-thick zone of concentrated roots surrounded by black stained soil
519	4					Grades to wet			Slow to moderate groundwater seepage observed at approximately 4 feet depth on all four sides of excavation
518	5				SM	Gray with moderate oxidation staining silty fine to coarse sand with gravel and occasional cobbles (dense, moist) (glacial till)			
517	6								
516	7					Grades to without oxidation staining			
515	8				GM	Gray silty fine to coarse gravel with sand and occasional cobbles (very dense, moist)			
514	9	▯	2 SA				11	44	Approximately 1½-foot-diameter boulder removed from excavation
513	10								
512	11								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Google Earth. Vertical approximated based on Topographic Survey.

Log of Test Pit TP-5

GeoEngineers

Project: Pierce College Puyallup - STEM Building Design Services
Project Location: Puyallup, Washington
Project Number: 21342-002-01

Figure A-7
Sheet 1 of 1

PRCNC20221036

Date Excavated	4/5/2022	Total Depth (ft)	12.5	Logged By: OA Checked By: CRN	Excavator Equipment: Volvo ECR 88D	See "Remarks" section for groundwater observed Caving not observed

Surface Elevation (ft)	524	Easting (X)	1199780	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	670550	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
524	0				SOD	Approximately 6 inches sod			
523	0.5–2.5		1		SM	Brown silty fine to coarse sand with gravel, occasional cobbles and organics (roots) (loose, moist) (weathered glacial till)			4-inch-diameter root at approximately 2 feet depth
521.5	2.5–5		2 MC		SM	Gray-brown with moderate oxidation staining silty fine to medium sand with gravel, occasional cobbles and organics (roots) (medium dense, wet)	20		Slow groundwater seepage observed at approximately 2½ feet depth Moderate groundwater seepage observed at approximately 4 feet depth Roots extend to approximately 4 feet depth and occasionally surrounded by black stained soil
519	5–12.5		3		SM	Gray silty fine to coarse sand with gravel and occasional cobbles (dense, moist) (glacial till)			
516	8					Grades to very dense			
512	12		4 SA				9	36	

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Google Earth. Vertical approximated based on Topographic Survey.

Log of Test Pit TP-6

GeoEngineers

Project: Pierce College Puyallup - STEM Building Design Services
Project Location: Puyallup, Washington
Project Number: 21342-002-01

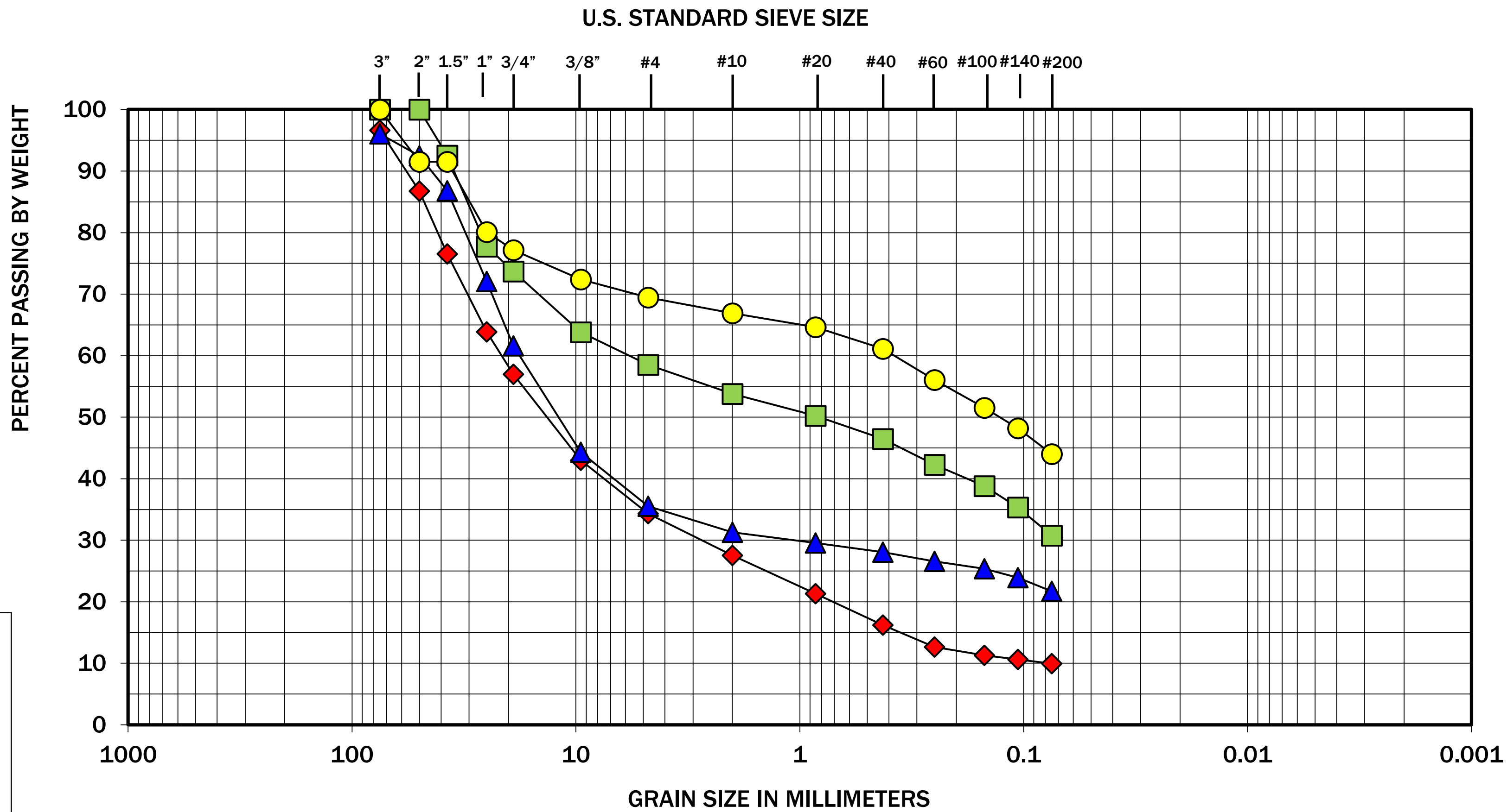
Figure A-8
Sheet 1 of 1

Sieve Analysis Results

Pierce College – STEM Building Design
Puyallup, Washington

GeoEngineers

Figure A–9



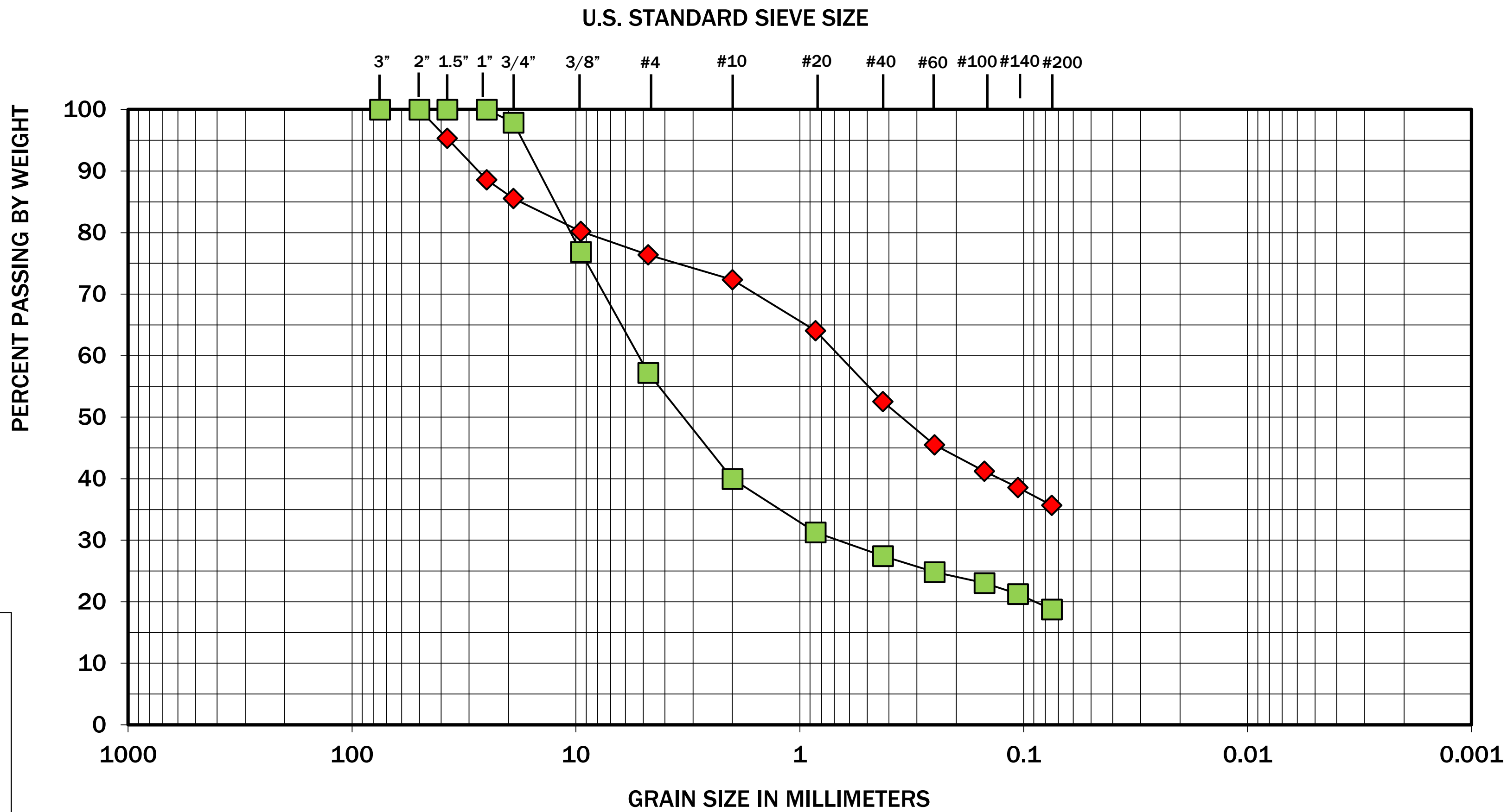
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	TP-1	13	9	Poorly graded gravel with silt and sand (GP-GM)
■	TP-2	6	10	Silty gravel with sand (GM)
▲	TP-3	12.5	27	Silty gravel (GM)
●	TP-5	8.5	11	Silty gravel with sand (GM)

AASHTO ACCREDITED

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

21342-002-01 Date Exported: 04/19/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆ (red)	TP-6	12	9	Silty sand with gravel (SM)
■ (green)	MW-1	15-20	8	Silty gravel with sand (GM)

AASHTO ACCREDITED

Note: This report may not be reproduced, except in full, without written approval of GeoEngineers, Inc. Test results are applicable only to the specific sample on which they were performed, and should not be interpreted as representative of any other samples obtained at other times, depths or locations, or generated by separate operations or processes.

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

Sieve Analysis Results

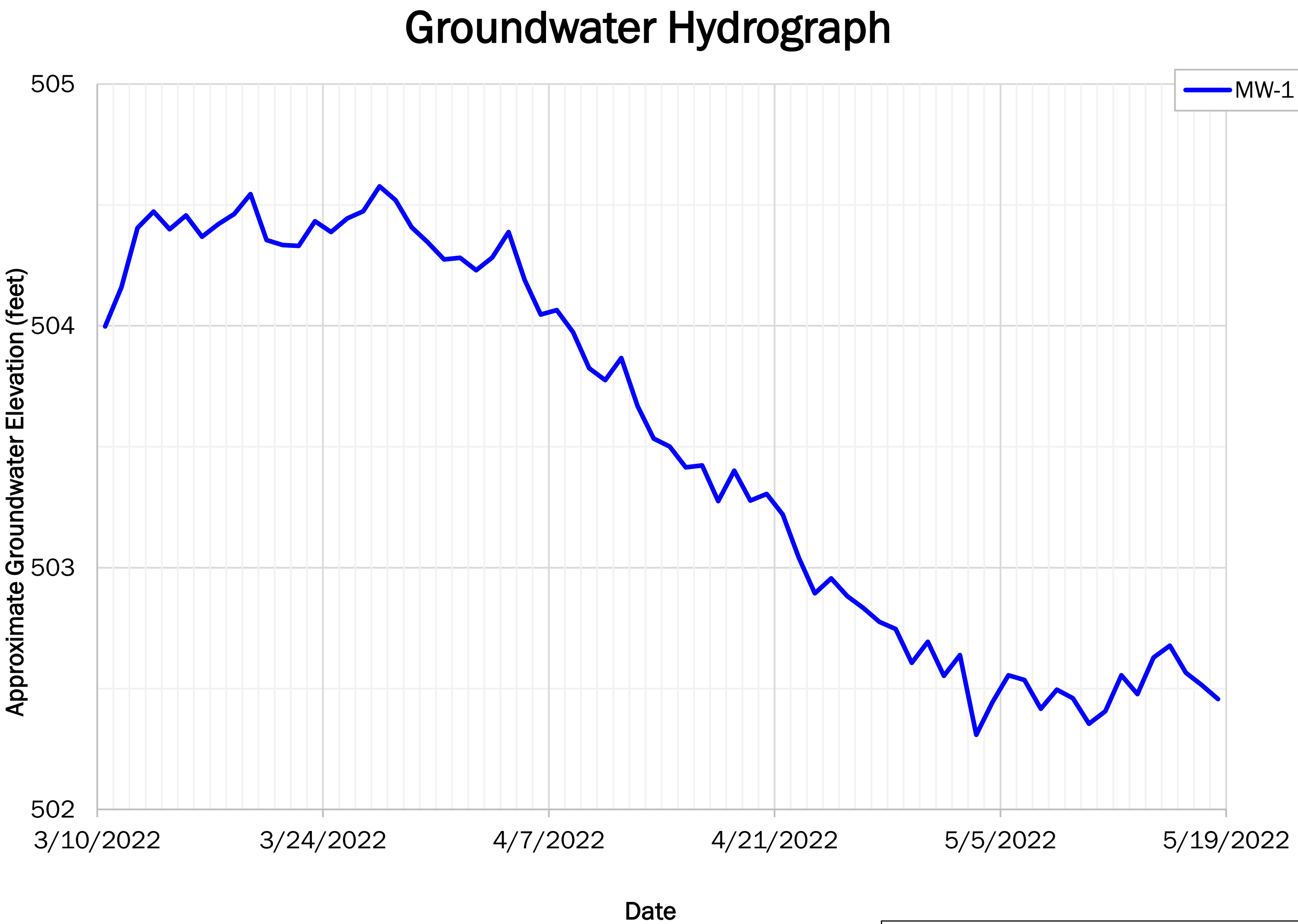
Pierce College – STEM Building Design
Puyallup, Washington

GeoEngineers

Figure A-10

PRCNC20221036

21342-002-01 Date Exported 05/24/22



Note:
1. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Groundwater Hydrograph	
STEM Building Design Services Puyallup, Washington	
GeoEngineers	Figure A-11

PRCNC20221036

PRCNC20221036