Geotechnical Engineering Report

Evergreen Sustainable Agriculture Laboratory
Olympia, Washington

for
Evergreen State College
c/o HKP Architects

February 24, 2010

GeoEngineers
Earth Science + Technology

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Olympia, Washington

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GEOENGINEERS

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INTRODUCTION AND PROJECT UNDERSTANDING

This report presents the results of our geotechnical engineering services to support design and construction of the proposed Sustainable Agriculture Laboratory Building for The Evergreen State College (Evergreen) located at 2700 Evergreen Parkway in Olympia, Washington. The Vicinity Map, Figure 1, shows the approximate location of the project site.

Our understanding of the project is based on our conversations with Russ Weiser with HKP Architects and a schematic design plan dated January 21, 2010 provided to us. We understand that improvements will consist of constructing an approximate 2,400- to 3,000-square-foot single-story structure with a slab-on-grade. The structure will contain a food-grade teaching laboratory, lecture space and small multi-purpose teaching spaces. During the time this report was prepared, the proposed location for the structure was in the east portion of the property, generally as shown on the Site Plan, Figure 2. Additional improvements will include installation of underground utilities and asphalt concrete parking areas and driveways. The asphalt concrete areas may consist of pervious pavement. The feasibility of infiltrating stormwater on site is also being considered. Civil engineering, pavement and stormwater plans are being completed by 2020 Engineering.

PURPOSE AND SCOPE OF SERVICES

The purpose of our services was to conduct subsurface explorations, and complete laboratory testing as a basis for providing geotechnical recommendations and design criteria for the proposed improvements. Our specific scope of services included the following:

1. Reviewing readily available published geologic data and our in-house files for existing information on soil and groundwater conditions in the project vicinity.
2. Conducting an initial site visit prior to subsurface exploratory work to coordinate subsurface exploration locations with members of Evergreen staff and to procure any underground utility plans provided by Evergreen in the project area.
3. Coordinating clearance and location of existing utilities in the project area. We contacted the Washington Utilities Coordinating Council "One Call" service prior to beginning explorations.
4. Exploring soil and groundwater conditions at the project site by observing six test pit explorations to nominal depths between 6 and 14 feet. Excavation services were subcontracted to GeoEngineers.
5. Performing laboratory tests on selected soil samples obtained from the explorations to evaluate pertinent engineering characteristics. Our laboratory test program consisted of eight moisture content determinations and five grain-size distribution tests (sieve analyses) of selected samples.
6. Providing preliminary results of our findings to optimize the site development. We provided our opinion on locations of the building site within the project boundaries, infiltration rates of selected soil samples, and draft copies of the test pit exploration logs in three separate electronic mail communications dated December 30, 2009, January 11 and February 10, 2010.
7. Providing a discussion of the subsurface conditions encountered including the depth and composition.

8. Providing recommendations for site preparation and earthwork including clearing and stripping, temporary and permanent cut slopes, suitability of on-site soils for use as structural fill, including constraints for wet weather construction, specifications for imported soil for use as structural fill, and fill placement and compaction requirements.
9. Evaluating the results of the sieve analyses with the infiltration criteria presented in the 2005 Washington State Department of Ecology (Ecology) "Stormwater Management Manual for Western Washington" (Ecology Manual).
10. Providing recommendations for shallow foundations and below-grade walls including discussions on subgrade preparation, drainage considerations, allowable soil bearing pressures, settlement (total and differential) estimates, lateral earth pressures and coefficient of friction for evaluating sliding resistance.
11. Providing recommendations for support of on-grade floor slabs including capillary break, vapor retarder, underslab drainage, and modulus of subgrade reaction, as appropriate.
12. Providing seismic design criteria consistent with the International Building Code (IBC) and our opinion of the liquefaction potential of site soils.
13. Providing recommendations for site drainage and control of groundwater that may be encountered.
14. Commenting on anticipated construction difficulties identified from the results of our site studies.
15. Preparing this written report for the project, presenting our conclusions and recommendations together with supporting field and laboratory information for incorporation into design of the project.

GEOLOGIC CONDITIONS

The geologic information we reviewed for this project included the *Geologic Map of Thurston County Washington, West Half (Noble, John B., 1962).* The map generally identifies the soil underlying the project area as Vason Recessional Outwash (Qvr), with adjacent Vashon Till (Qvt) to the East. Recessional Outwash deposits typically consist of stratified sand and gravel; however, silty sand and silt are also identified. Vashon Till typically consists of a mixture of clay, silt, sand and gravel deposited by an advancing glacier and subsequently overridden resulting in very compact soils.

SITE CONDITIONS

Surface Conditions

The project is located in northwest Olympia (Township 18N, Range 2W, Section 6, Willamette Meridian) in the west-central portion of the Evergreen State College Campus in an area designated as the Organic Farm; northeast of the intersection of Simmons Road NW and Lewis Road NW. Lewis Road NW borders the west portion of the property. The project area is irregular in shape. The topography gains in elevation from west to east. The west half is relatively flat or gently sloping up from approximate Elevation 159 feet to 161 feet. The east half of the project area is moderately sloped with a 10 to 15 percent grade change from Elevation 161 feet to 170 feet. A site map of the project area, topography and surrounding features is shown on Figure 2.

A gravel driveway orientated perpendicular to Lewis Road NW divides the project area approximately in half. The south half contains several outbuildings, storage sheds, greenhouses and gravel pathways. The north half is generally unimproved with the exception of a garden area titled Demeters Garden. Remaining areas contain moderate to dense vegetation consisting of evergreen and alder trees, light to medium dense brush and forest debris.

Subsurface Explorations

Our understanding of subsurface conditions at the project site is based on review of published geologic information and conditions disclosed in six test pit explorations. The test pits were excavated on December 21, 2009. The test pit locations are shown on Figure 2. Details of the exploratory program and laboratory testing program completed for this study are presented in Appendix A.

Subsurface Conditions

We encountered less than ½ foot of forest duff test pits TP-2 through TP-6 and approximately 1 inch of sod in test pit TP-1. Underlying the forest duff or sod, we encountered a zone of weathered soil extending to depths between 1 and 3 feet below ground surface (bgs). The weathered soil consists of silt with varying amounts of sand or sand with silt and was delineated based on color and/or density. The weathered soil was observed to be in a soft or loose condition with the exception of test pit TP-5 where medium dense sand with silt and gravel was encountered.

In the explorations (TP-1 through TP-4) completed in the west portion of the project area, where grades were observed to be relatively flat, we encountered medium stiff or stiff silt to the full depth explored with the exception of test pits TP-2 and TP-4. Underlying the silt in test pit TP-2 at a depth of 9 feet, we encountered medium dense sand. This material is likely representative of the recessional outwash mapped in the area. Underlying the silt in test pit TP-4 at a depth of 5 feet, we encountered dense silty sand with gravel to the full depth explored. This material is likely representative of the glacial till mapped in the area.

In test pits TP-5 and TP-6, generally located in the east portion of the project site, we encountered medium dense sand with silt and gravel or sand below the weathered zone to depths of 4 ½ and 4 feet, respectively. This material is likely representative of the recessional outwash mapped in the area. Below 4 ½ and 4 feet, we observed silty sand with gravel in a medium dense to dense condition. This soil type was observed to the full depths explored in the pit TP-6 and to a depth of 7 feet in test pit TP-5. Below 7 feet in test pit TP-5 we observed a stiff silt to the full depth explored. The silty sand is likely representative of the glacial till mapped in the project area.

Groundwater was observed in test pit TP-2 at a depth of 10 feet within the sand layer previously described. Soil conditions were observed to grade to a wet condition at an approximate depth of 12 feet in test pit TP-3, however, no groundwater was observed. Perched groundwater seepage was observed in test pit TP-4 at 5 feet. Based on our explorations, we estimate that the static groundwater table is on the order of 10 to 12 feet below surrounding grades in the west portion of the site, near Elevation 148 to 149 feet. The depths to static groundwater levels will vary slightly with season and precipitation; however, are not expected to rise much more than observed in the explorations. Seasonal perched groundwater will likely occur throughout areas within the project site where relatively permeable native soil is underlain by less permeable material. The amount of perched groundwater will also vary with season and precipitation.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on the results of our study and subsurface explorations, it is our opinion that the site is generally suitable for the proposed development with regard to geotechnical considerations. We present the following summary:

- The proposed structure can be supported on continuous and isolated shallow foundations bearing on medium dense or medium stiff native soil or on structural fill extending to these soils. We encountered between 1 and 3 feet of loose sand or soft silt overlying the medium dense or medium stiff deposits. In general, we recommend that the soft silt be removed from below foundation elements for the structure; however, if sand is encountered, it may be possible to compact any loose sand to a suitable density for foundation support, depending on the condition observed during construction and the time of year.
- The upper silt, if encountered in slab and pavement areas, is generally soft and has a moisture content well above optimum. During the summer, it may be possible to aerate and compacted these subgrades in accordance with our recommendations. Or, at least 12 inches of the soft silt could be removed below the building slab and pavement subbase and replaced with granular structural fill placed on suitable subgrade. This should be expected if earthwork is completed during the wetter time of the year. Where medium dense or better sand is encountered, such as anticipated at the location of the building, floor slabs may be supported on properly prepaired native soils or structural fill prepared and compacted as recommended.
- Infiltration rates have been provided for the soil samples tested. We recommend that the test pit explorations, soil types, thickness of soil layers and infiltration elevations be considered when determining locations and depths to infiltrate stormwater. In some instances, soil units with the potential for higher infiltration rates are thin and/or underlain by impermeable layers. In addition, infiltration is not suitable for some of the soils based on the criteria presented in the Ecology Manual.
- The majority of the soil encountered in the explorations contains an abundant amount of fines (silt and clay-sized particles passing the U.S. Standard No. 200 sieve) and will be highly susceptible to disturbance when wet. Site soils will also be difficult to work and compact and can easily become disturbed from construction traffic when wet or if handled during wet weather.
- The use of on-site material as a structural fill should be limited to extended periods of dry weather. Some re-working and drying of the on-site material should be expected prior to re-use as a structural fill, even during periods of dry weather. If wet weather construction is anticipated, we recommend that import granular fill be considered as structural fill for site grading and development.

Site Development and Earthwork

General

We anticipate that site development work will include clearing and stripping, placing and compacting fill and backfill materials, excavating for foundations, excavating for utility trenches and subgrade development for asphalt concrete pavements. We expect that the majority of site grading can be accomplished with conventional earthmoving equipment. The following sections provide recommendations for earthwork and site development.

Stripping and Clearing

The existing trees, brush, duff, sod and organic-rich soil should be stripped and removed from proposed pavement and structural areas. Stripped material should be transported off site for disposal or processed and used as fill in landscaping areas. The primary root systems for trees and shrubs should be completely removed.

Required stripping depths should be evaluated based on observations during the stripping operation. We estimate stripping depths to be on the order of ½ foot to remove the surficial organic material. Greater stripping depths may be required to remove localized zones of loose or organic soil and tree roots. In addition, it is common during stripping and clearing activities to encounter perched groundwater seepage at shallow depth within the soil deposits encountered at this site. The extent of the seepage and depth at which it might be encountered often depends on the time of year of construction. Groundwater seepage can soften soil and could create construction difficulties. Additional stripping depths may be required if subgrades become disturbed during stripping operations, which is more likely during winter and spring seasons.

Subgrade Preparation, Evaluation and Protection

We recommend compacting exposed soil to a uniformly firm and unyielding condition prior to placement of fill or structural elements. We recommend that prepared subgrades be observed by a member of our firm, prior to placement of fill or structures. Our representative will evaluate the suitability of the subgrade and identify areas of yielding, which are indicative of soft or loose soil. The exposed subgrade soil should be proof-rolled with heavy rubber-tired equipment and/or probed with a ½-inch-steel rod, as necessary. If soft or otherwise unsuitable areas are revealed during proof-rolling or probing that cannot be compacted to a stable and uniformly firm condition, we recommend that: 1) the subgrade soils be scarified (e.g., with a ripper or farmer's disc), aerated and recompacted; or 2) the unsuitable soils be removed and replaced with structural fill, as needed.

The soft silt encountered at the site has an in-situ moisture content well above the optimum such that we expect it will not respond to compaction and require aeration. This will require significant time and effort on the contractor's part and must be included in the plans and specifications. Alternatively, we suggest 12 inches of excavation and replacement with structural fill, or as directed by the geotechnical engineer's field representative. If loose sand is encountered at the surface, we recommend that the contractor be required to compact to a minimum 95 percent of the maximum dry density (MDD) based on ASTM International (ASTM) D 1557, or to a suitably firm and unyielding condition in accordance with the geotechnical engineer's field representative. We recommend that a contingency be included in the earthwork budget for working with the soft surficial soils.

Soil encountered in the explorations contains a significant percentage of fines. This material is very sensitive to small changes in moisture content and may be difficult, if not impossible, to work and compact during wet weather conditions. Soil encountered at the project site is susceptible to disturbance from construction traffic when wet or if earthwork is performed during wet weather. We recommend that earthwork proceed in the summer and early fall months if possible to minimize earthwork costs.

If grading takes place during periods of wet weather, protective surfacing such as placing asphalt-treated base (ATB) or haul roads made of quarry spalls or a layer of free-draining material such as well-graded pit-run sand and gravel may be necessary to protect completed areas. Typically, minimum gravel

thicknesses on the order of 24 inches are necessary to provide adequate subgrade protection for construction traffic areas. Additionally, completed areas should be restricted from traffic during wet weather conditions.

Boulders are occasionally present in glacial deposits and could be encountered during grading and/or during other excavations. Accordingly, the contractor should be prepared to remove boulders, if encountered. Boulders may be removed from the site or buried in landscape areas. Voids caused by boulder removal should be backfilled with structural fill.

Temporary Excavations and Dewatering

Excavations deeper than 4 feet must be shored or laid back at a stable slope if workers are required to enter. Shoring and temporary slope inclinations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls will be required under Washington Industrial Safety and Health Act (WISHA) if the excavation is deeper than 4 feet. The contract documents should specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety and providing shoring, as required, to protect personnel and structures.

In general, temporary cut slopes should be inclined no steeper than about 1.5H:1V (horizontal to vertical), which is consistent with Type C soils in the regulations. This guideline assumes that all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope and that significant seepage is not present on the slope face. Flatter cut slopes will be necessary where significant seepage occurs or if large voids are created during excavation. Some sloughing and raveling of the cut slopes should be expected. Temporary covering with heavy plastic sheeting should be used to protect these slopes during periods of wet weather.

Groundwater was observed in test pit TP-2 at a depth of 10 feet and wet conditions were observed at an approximate depth of 12 feet in test pit TP-3. Perched groundwater seepage was observed in test pit TP-4 at 5 feet. We anticipate that groundwater handling needs will generally be lower during the late summer and early fall months. Based on our explorations, we anticipate that shallow perched groundwater can be handled adequately with sumps, pumps and/or diversion ditches, as necessary. If excavations are anticipated to extend to depths that groundwater was observed in the explorations, it may not be practical to dewater the deeper excavations using sumps or diversion ditches and/or additional testing and observations of groundwater may be necessary. Ultimately, we recommend that the contractor performing the work be made responsible for controlling and collecting groundwater encountered.

Permanent Cut and Fill Slopes

We recommend permanent cut and fill slopes be constructed at a maximum inclination of 2H:1V. Where 2H:1V permanent slopes are not feasible, protective facings and/or retaining structures should be considered. Cut areas should be re-vegetated as soon as practical to reduce the surface erosion and sloughing. Temporary protection should be used until permanent protection is established.

To achieve uniform compaction, we recommend that fill slopes be overbuilt slightly and subsequently cut back to expose well-compacted fill. Fill placement on slopes steeper than 5H:1V should be benched into

the slope face and include keyways. The configuration of the bench and keyway depends on the equipment being used. Bench excavations should be level and extend into the slope face. We recommend that a vertical cut of about 3 feet be maintained for benched excavations. Keyways should be about 1 ½ times the width of the equipment used for grading or compaction.

Surface Drainage Control

Surface water from roofs, driveways and landscape areas should be collected and controlled. Curbs or other appropriate measures such as sloping pavements, sidewalks and landscape areas should be used to direct surface flow away from the buildings, erosion sensitive areas and from behind retaining structures. Roof and catchment drains should not discharge into wall or foundation drains.

Erosion and Sedimentation Control

The potential for erosion and sedimentation can be influenced by construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. Implementing an erosion and sedimentation control plan will reduce the project impact on erosion-prone areas. The plan should be designed in accordance with applicable jurisdictional standards. The plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure;
- Retaining existing asphalt concrete surfacing whenever feasible;
- Revegetating or mulching denuded areas;
- Directing runoff away from denuded areas;
- Reducing the length and steepness of temporary slopes where soil will be exposed;
- Decreasing runoff velocities;
- Preparing drainage ways and outlets to handle concentrated or increased runoff;
- Confining sediment to the project site; and
- Inspecting and maintaining control measures frequently.

In addition, we recommend that sloped surfaces in exposed or disturbed soil be restored so that surface runoff does not become channeled. Some sloughing and raveling of temporary slopes should be expected. Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce erosion and reduce transport of sediment to adjacent areas and receiving waters. Permanent erosion protection should be provided by paving, structure construction or landscape planting.

Until the permanent erosion protection is established and the site is stabilized, site monitoring may be required by qualified personnel to evaluate the effectiveness of the erosion control measures and to repair and/or modify them as appropriate. Provisions for modifications to the erosion control system based on monitoring observations should be included in the erosion and sedimentation control plan.

Fill Materials

General

Material used for fill should be free of debris, organic contaminants and rock fragments larger than 6 inches. As the amount of fines (silt and clay-sized particles passing the U.S. Standard No. 200 sieve) increases, soil becomes increasingly more sensitive to small changes in moisture content. If construction is performed during wet weather conditions, we recommend using select granular fill described further. If prolonged dry weather prevails during the earthwork phase of construction, a somewhat higher fines content may be acceptable.

On-Site Soils

Surficial duff and sod are not suitable for structural fill and should be removed from areas to be improved or used in landscaping areas. On-site materials used as structural fill should be free of roots, organic matter and other deleterious materials and particles larger than 6 inches in diameter.

In general, two types of soils were encountered at the site within the assumed excavation depths for foundations and utilities. The silt encountered (TP-1 through TP-4) has a moisture content significantly higher than optimum such that these soils can be difficult if not impossible to adequately compact. For planning and cost estimating purposes, we recommend assuming that re-use of these soils is not practical in these areas and assume imported soils for structural fill in those areas. The other soil encountered (TP-5 and TP-6) is a sand that has a relatively low fines content that we expect to be suitable for re-use as structural fill during most weather conditions.

Select Granular Fill or Wet Weather Fill

For backfill in the silt areas or construction during wet weather conditions, we recommend using fill consisting of well-graded sand and gravel or crushed rock with a maximum particle size of 6 inches and containing less than 5 percent fines by weight based on the minus ¾-inch fraction. Organic matter, debris or other deleterious material should not be present. In our opinion, material conforming to Washington State Department of Transportation (WSDOT) *Standard Specifications* 9-03.9 (Aggregates for Ballast and Crushed Surfacing), 9-03.10 (Aggregate for Gravel Base), and 9-03.14 (Borrow) are suitable for use as import fill material during wet weather with the exception that the fines content should be limited to 5 percent or less. In addition, some larger particle sizes up to about 6 inches in diameter are acceptable. If prolonged dry weather prevails during the earthwork phase of construction, select granular fill containing a somewhat higher fines content may be acceptable provided that the material is predominately sand and gravel.

Fill Placement and Compaction

General

To obtain proper compaction, fill material should be compacted near optimum moisture content and in uniform horizontal lifts. Lift thickness and compaction procedures will depend on the moisture content and gradation characteristics of the soil and the type of equipment used. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Silty soil and other fine granular soil may be difficult or impossible to compact during persistent wet conditions. Generally, 12-inch loose lifts are appropriate for large steel drum vibratory roller compaction equipment. The lift thickness should be appropriate for the compaction equipment used. Compaction should be

achieved by mechanical means. During fill and backfill placement, sufficient testing of in-place density and observation by a qualified person should be conducted to check that adequate compaction is being achieved.

Area Fills and Bases

Fill placed to raise site grades and materials under pavements should be placed on a prepared subgrade approved by the geotechnical engineer's representative that consists inorganic native soils or compacted structural fill. In general, we recommend structural fill be compacted to at least 95 percent of the MDD determined by ASTM International (ASTM) Test Method D 1557 (modified Proctor), except in utility trenches and in certain instances below the building slab, as discussed further.

Trench Backfill

For utility excavations, we recommend that the initial lift of fill over the pipe be thick enough to reduce the potential for damage during compaction but generally should not be greater than about 18 inches. In addition, rock fragments greater than about 1 inch in maximum dimension should be excluded from this lift.

In paved roadway areas, trench backfill should be uniformly compacted in horizontal lifts to at least 95 percent of the MDD (ASTM D 1557) in the upper 2 feet below subgrade. Fill placed below a depth of 2 feet from subgrade in paved areas should be compacted to at least 90 percent of the MDD (ASTM D 1557). In building areas, all trench backfill should be compacted to 95 percent of the MDD (ASTM D 1557) except in certain instances below the building slab, as discussed further. In nonstructural areas, trench backfill should be compacted in lifts and to a firm condition that will support construction traffic.

Stormwater Infiltration

General

We recommend that the test pit explorations, soil types, thickness of soil layers and infiltration elevations be reviewed and considered when determining locations and depths to infiltrate stormwater. In some instances, soil units with the potential for higher infiltration rates were observed to be thin and/or underlain by impermeable layers. In addition, infiltration is not suitable in some soils based on the criteria presented in the Ecology Manual. Additional criteria for design, as presented in the Ecology Manual, should be followed, where applicable, including the vertical separation from the bottom of the facility to impermeable layers or groundwater. Site- and location-specific testing may be required by local jurisdictions. Stormwater should be treated in accordance with current regulations prior to infiltration. We are available to review proposed infiltration areas if requested. We also recommend that we observe infiltration facilities during excavation and construction to determine if soil conditions are as anticipated and/or to provide recommendations should conditions vary in the field.

Soil Infiltration Rates

Infiltration rates have been provided in the table below for the soil samples tested and are based on the criteria presented in the Ecology Manual. In our opinion, the infiltration rates presented may be used for preliminary design for the soil type tested. A higher infiltration rate was obtained for the sand samples for test pits TP-5 and TP-6 compared with the other samples. It should be noted that the sand is underlain by glacial till, which is relatively impermeable at respective depths of 4 ½ and 4 feet. So water from

infiltration facilities within the sand could migrate horizontally along this boundary layer. This condition should be considered in design of any infiltration facilities.

TABLE 1. SOIL INFILTRATION RATE ANALYSIS[1]

Test Pit No.	Soil Sample No.	Soil Sample Depth (feet)	Approximate[2] Elevation of Sample (feet)	Percent Fines[3]	USCS[4] Soil Classification	USDA[5] Soil Classification	Estimated Long-Term (Design) Infiltration Rate[6] (Inches per Hour)
TP-3	1	2	158	91.5	ML	Clay	N/A
TP-4	2	4	157	96	ML	Clay	N/A
TP-4	3	6.5	154.5	20.5	SM	Sandy Loam	0.25
TP-5	2	3.5	166	6	SP-SM	Sand	2
TP-6	2	2.5	166.5	4.5	SP	Sand	2

Notes:
[1] For selected soil samples.
[2] Based on Survey provided by HKP Architects.
[3] Fines = Silt and clay-sized particles passing U.S. No. 200 sieve.
[4] Unified Soil Classification System (USCS).
[5] General classification Based on the United States Department of Agriculture (USDA) System.
[6] Based on grain-size analysis and the procedures outlined in the 2005 Department of Ecology Stormwater Management Manual for Western Washington.

To help reduce clogging of infiltration facilities, we recommend they be protected during construction with siltation control facilities such as temporary settling basins, silt fences and hay bales should be provided as appropriate. Suspended solids can clog the soil and reduce the infiltration rate. Periodic sweeping of paved areas, during and following construction, will help extend the life of the infiltration facilities. Equipment should not be permitted in the infiltration facilities after they are excavated to grade because of the potential for compaction of the subgrade that could reduce the infiltration rate of the native soils.

Shallow Foundations

Bearing Surface Preparation and Foundation Excavation

The proposed structure can be supported on continuous and isolated shallow foundations bearing on medium dense or medium stiff to stiff native soil or on structural fill extending to these soils. We encountered between 1 and 3 feet of loose sand and/or soft silt overlying the medium dense or medium stiff deposits. If soft silt is encountered, we recommend that it be removed from below foundation elements for the structure. If loose sand is encountered, we recommend that the loose sand be compacted to 95 percent of the MDD based on ASTM D 1557, if possible. If this density cannot be achieved, then we recommend removing up to approximately 12 inches of sand, compacting that subgrade to at least 90 to 92 percent, and then compacting the 12 inches of structural fill above that to the minimum 95 percent compaction. For the condition where the loose sand and/or soft silt is removed and then structural fill replaces this unit to obtain foundation bearing surface elevation, the overexcavation should extend a minimum lateral distance of 2 feet beyond all edges of the footing element.

Footing excavations should be performed using a smooth-edged bucket to limit bearing surface disturbance. The foundation bearing surface should be thoroughly compacted to a dense, non-yielding condition. Loose or disturbed materials present at the base of footing excavations should be removed or

compacted. Foundation bearing surfaces should not be exposed to standing water. Should water infiltrate and pool in the excavation, it should be removed before placing structural fill and/or concrete. During periods of wet weather, concrete should be placed as soon as practical after preparation of the footing excavations.

Subgrade protection for foundations may consist of overexcavation and placement of a lean concrete mat or weather-resistant granular fill if footing excavations will be exposed to wet weather conditions. Typically, lean concrete mats on the order of 4 inches or gravel thicknesses on the order of 6 to 8 inches will provide adequate protection.

We recommend that a member from our firm observe foundation excavations before placing reinforcing steel in order to confirm that adequate bearing surfaces have been prepared or provide recommendations for removal of unsuitable bearing soil. Unsuitable foundation subgrade soils should be recompacted or removed and replaced with compacted structural fill as recommended by the geotechnical engineer.

Foundation Support

Proposed structures can be satisfactorily founded on continuous wall or isolated column footings supported on soils prepared as recommended or structural fill extending to these soils. The exterior footings should be established at least 18 inches below the lowest adjacent grade. The recommended minimum footing depth is greater than the anticipated frost depth. Isolated column and continuous wall footings should have minimum widths of 24 and 18 inches, respectively.

Bearing Capacity

We recommend that footings founded as recommended be proportioned using an allowable soil bearing pressure of 3,000 pounds per square foot (psf) for the west portion of the site, in the general location proposed. An allowable bearing pressure of 2,500 should be used if the structure will be located in the west portion of the site on medium stiff or stiff silt. The bearing pressures apply to the total of dead and long-term live loads and may be increased by one-third when considering total loads, including earthquake or wind loads. This is a net bearing pressure. The weight of the footing and overlying backfill can be ignored in calculating footing sizes.

Foundation Settlement

Assuming wall and isolated column loads will not exceed 3 kips per foot and 150 kips, respectively, we estimate that settlement of footings founded and designed and constructed as recommended should be less than 1 inch with differential settlements between comparably loaded isolated footings or along 50 feet of continuous footing of ½ inch or less for the anticipated soil conditions. Most of the settlement should occur essentially as loads are being applied. However, loose or soft soil below footings or disturbance of foundation bearing surface during construction could results in larger settlements than predicted.

Lateral Resistance

Lateral load resistance can be obtained by friction on the base of footings and slabs, and by passive resistance on the face of below-grade elements of the structure as these elements tend to move into the soil. For footings and floor slabs founded in accordance with the recommendations presented above, the

allowable frictional resistance may be computed using a coefficient of friction of 0.35 applied to vertical dead-load forces. The allowable passive resistance on the face of footings, grade beams or other embedded foundation elements may be computed using an equivalent fluid density of 300 pounds per cubic foot (pcf) for undisturbed on-site soils or structural fill extending out from the face of the foundation element a distance as recommended previously.

The passive earth pressure value is based on the assumptions that the adjacent grade is level and that groundwater remains below the base of the footing throughout the year. The top foot of soil should be neglected when calculating passive lateral earth pressures unless the foundation area is covered with pavement or slab-on-grade. The lateral resistance values include a safety factor of approximately 1.5.

Building Pads and Floor Slabs

Subgrade Preparation

As previously indicated, we encountered between 1 and 3 feet of loose sand and/or soft silt overlying the medium dense or medium stiff deposits at some locations. If the building slab will be placed at the same elevation as the loose sand and/or soft silt, we recommend that subgrades below the building slab be improved. The silt subgrade could be aerated and compacted; alternatively, we suggest 12 inches of excavation and replacement with structural fill, or as directed by the geotechnical engineer's field representative. If loose sand is encountered at the surface, we recommend that the contractor be required to compact it to a minimum 95 percent of the MDD based on ASTM D 1557, or to a suitably firm and unyielding condition in accordance with the geotechnical engineer's field representative. If wet conditions are encountered and/or subgrades become disturbed, scarification and re-compaction may not be practical; in this instance, overexcavation and replacement with select granular fill will be necessary. If the building slab will be placed upon the medium dense sand/stiff silt at depth, then no excavation is anticipated unless subgrades become disturbed.

Capillary Break

We recommend that on-grade slabs be underlain by a minimum 6- to 8-inch-thick capillary break layer to reduce the potential for moisture migration into the slab. The capillary break material should consist of a well-graded sand and gravel or crushed rock with a maximum particle size of about ¾-inch and contain less than about 5 percent fines. Alternatively, it is our opinion that material conforming to WSDOT 9 03.9(3) for base course (typically described as "1 ¼-inch minus") is suitable. The material should be placed as recommended in the "Fill Placement and Compaction" section of this report. If dry slabs are required (e.g., where adhesives are used to anchor carpet or tile to the slab), a waterproof liner may be placed as a vapor barrier below the slab.

Slab Design

For subgrades and capillary break layers prepared as recommended, a modulus of subgrade reaction of 250 pounds per cubic inch (pci) can be used for slab thickness design. Settlement of a floor slab designed and constructed as recommended is estimated to be less than ¾ inch for a floor load of 500 psf, in the eastern part of the site. We estimate that differential settlement of the floor slabs will be ½ inch or less over a span of 50 feet. The subgrade soils are non-expansive, so heave is not anticipated beneath the floor slab.

Conventional Retaining and Below-Grade Walls

General

Based on our understanding of the proposed project, it does not appear that below grade and/or retaining walls will be required. However, we provide the following recommendations below in the event that underground structures are planned or if design considerations change. We request that we be contacted if retaining walls or vault structures are anticipated to be more than about 8 to 10 feet below current site elevations so that we can review the subsurface conditions and our design considerations and provide revised recommendations, as appropriate.

Drainage

Our recommendations are based on positive drainage behind the retaining structure to prevent buildup of hydrostatic pressure. This can be accomplished by placing free-draining material behind the wall with perforated pipes to collect seepage water. In general, the drainage material should consist of coarse sand and gravel containing less than 5 percent fines based on the fraction of material passing the ¾-inch sieve. A comparable material conforming WSDOT 9-03.12(2), "Gravel Backfill for Walls" is also appropriate. The wall drainage zone should extend horizontally at least 18 inches from the back of the wall.

A perforated smooth-walled rigid PVC pipe having a minimum diameter of 4 inches should be placed at the bottom of the drainage zone along the entire length of the wall, with the pipe invert at or below the elevation of the wall footing base. The drainpipes should discharge to a tightline leading to an appropriate collection and disposal system. An adequate number of cleanouts should be incorporated into the design of the drains in order to provide access for regular maintenance. Roof downspouts, perimeter drains or other types of drainage systems should not be connected to retaining wall drain systems.

Design Parameters

The lateral active soil pressures acting on reinforced concrete retaining walls depend on the type, density, and configuration of the soil behind the wall. The pressures provided are based on backfill placed within 2 feet of the wall being compacted by hand-operated equipment to a density of 90 percent of the MDD and consisting of sand or sand and gravel that is drained as recommended above.

For walls constructed as described, we recommend using an active lateral earth pressure corresponding to an equivalent fluid density of 35 pcf for a level backfill condition. For walls with backfill sloping upward behind the wall at 2H:1V, an equivalent fluid density of 55 pcf should be used. This assumes that the tops of the walls are not structurally restrained and are free to rotate. For the at-rest condition, an equivalent fluid density of 55 pcf should be used for design. For seismic conditions, we recommend a uniform lateral surcharge pressure of 4H (where H is the height of the wall) psf be added to the lateral earth pressures. Note that if the retaining system is designed as a braced system but is expected to yield a small amount during a seismic event, an active earth pressure condition may be assumed and combined with the uniform seismic surcharge pressure.

The recommended pressures provided do not include the effects of other surcharges from surface loads. If vehicles will be operated to within one-half the height of the wall, a traffic surcharge should be added to

the wall pressure. The traffic surcharge can be approximated by the equivalent weight of an additional 2 feet of backfill behind the wall.

The allowable soil bearing values and lateral resistance values presented above in the "Shallow Foundations" section of this report may be used for design of retaining wall foundations provided that bearing surfaces are prepared as recommended. Settlement of retaining structures should be similar to the estimates previously presented for building foundations.

Seismic Design Considerations

General

The site is located within the Puget Sound region, which is seismically active. Seismicity in this region is attributed primarily to the interaction between the Pacific, Juan de Fuca and North American plates. The Juan de Fuca plate is subducting beneath the North American plate. It is thought that the resulting deformation and breakup of the Juan de Fuca plate might account for the deep focus earthquakes in the region. Hundreds of earthquakes have been recorded in the Puget Sound area. In recent history, four of these earthquakes were large events: 1) in 1946, a Richter magnitude 7.2 earthquake occurred in the Vancouver Island, British Columbia area; 2) in 1949, a Richter magnitude 7.1 earthquake occurred in the Olympia area; 3) in 1965, a Richter magnitude 6.5 earthquake occurred between Seattle and Tacoma; and 4) on February 28, 2001, a magnitude 6.8 occurred at Nisqually near Olympia.

Research is currently underway regarding historical large magnitude subduction-related earthquake activity along the Washington and Oregon coasts. Geologists are reporting evidence that suggests several large magnitude earthquakes (Richter magnitude 8 to 9) have occurred in the last 1,500 years, the most recent of which occurred about 300 years ago. No earthquakes of this magnitude have been documented during the recorded history of the Pacific Northwest. Local design practice in Puget Sound assumes that the magnitude felt from such an earthquake is about the same as from the existing design earthquake because of the distance and this consideration is incorporated into building codes.

Seismic Design Criteria

Seismic design may be performed using the equivalent static force procedure outlined in the 2006 IBC using the design parameters provided below.

TABLE 2. SEISMIC DESIGN PARAMETERS

2006 IBC

Spectral Response Accel. at Short Periods (S_S) = 1.163

Spectral Response Accel. at 1 Second Periods (S_1) = 0.488

Site Class = C

Site Coefficient (F_A) = 1.0

Site Coefficient (F_V) = 1.352

Liquefaction Potential

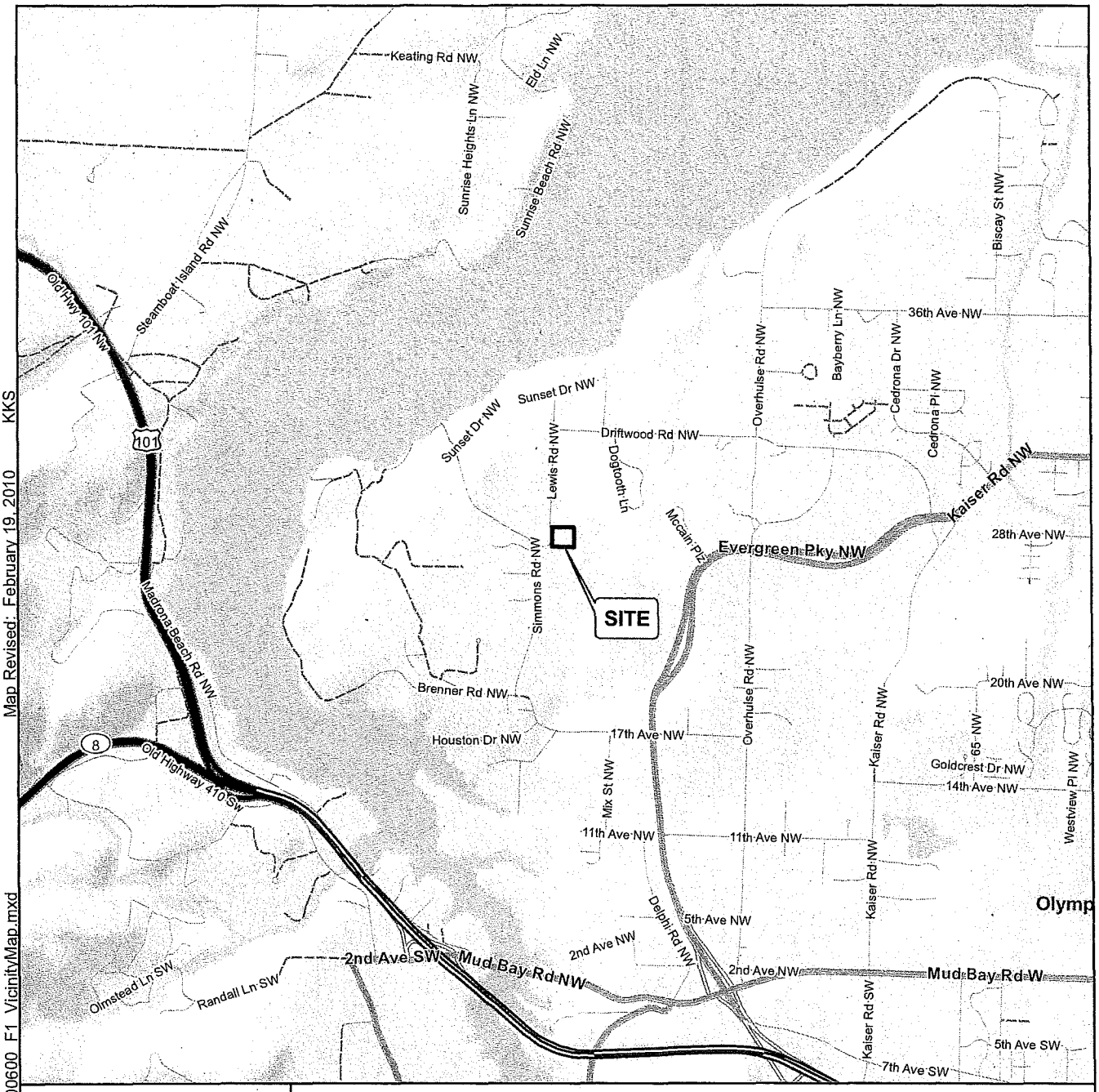
Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in development of excess pore pressures in loose, saturated soils and subsequent loss of strength in the deposit of soil so affected. In general, soils that are susceptible to liquefaction include

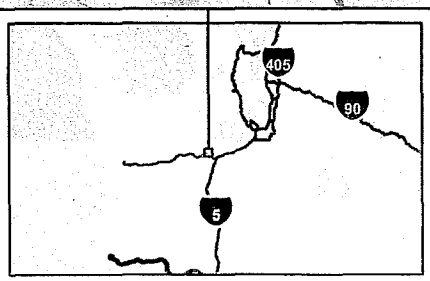
loose to medium dense "clean" to silty sands that are below the water table. In our opinion, the potential for liquefaction at this site is low.

LIMITATIONS

We have prepared this report for the exclusive use by HKP Architects, The Evergreen State College, and their authorized agents for the Evergreen Sustainable Agriculture Laboratory located on the Evergreen State College Campus at 2700 Evergreen Parkway in Olympia, Washington. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of 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 or other conditions, express or implied, should be understood.

Please refer to Appendix B titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.





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Feet

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.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps, Street Maps 2008

Transverse Mercator, Zone 10 N North, North American Datum 1983
North arrow oriented to grid north

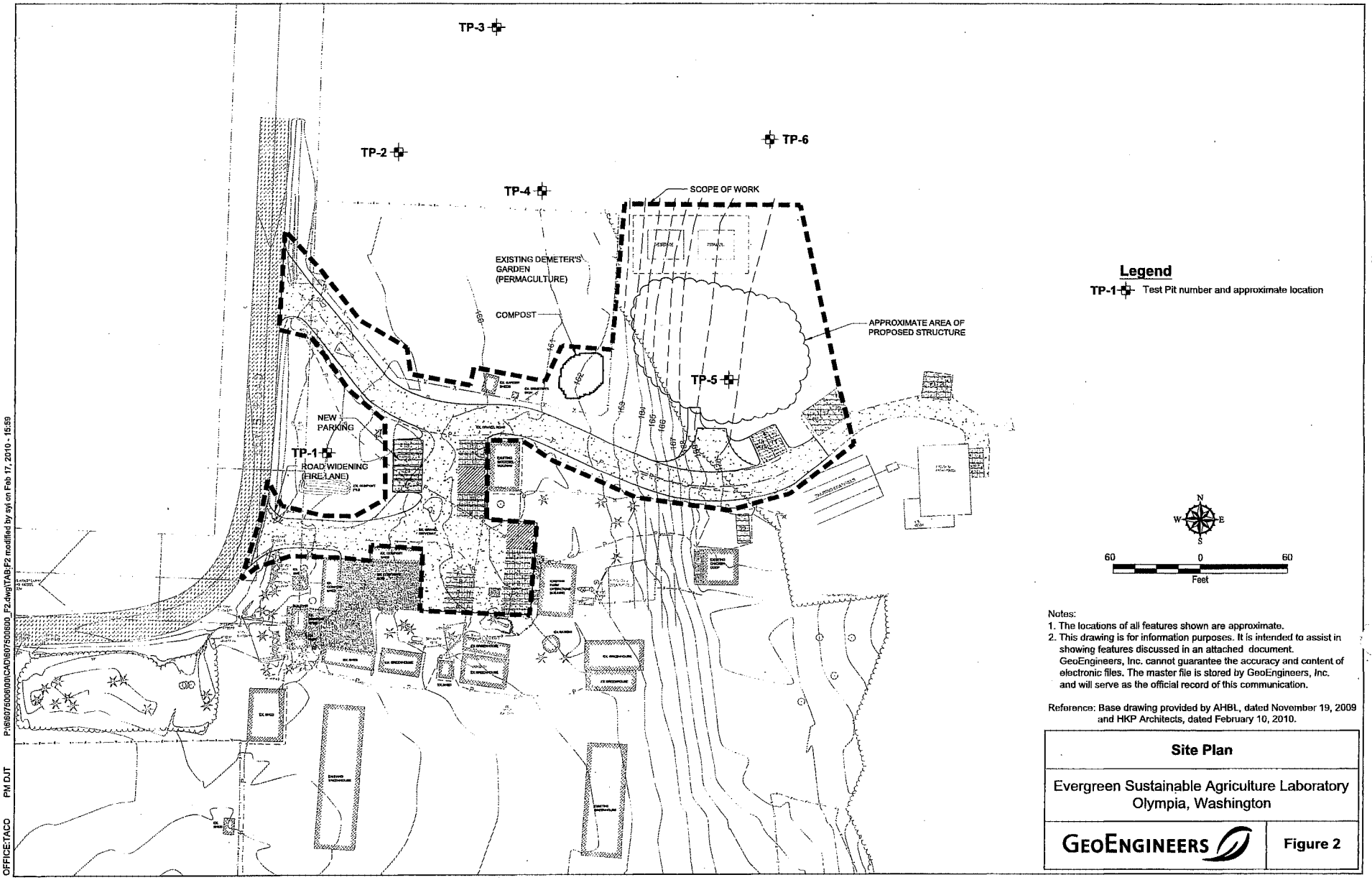
Vicinity Map

Evergreen Sustainable Agriculture Laboratory
Olympia, Washington

GEOENGINEERS

Figure 1

Office: TAC Path: \\Tac\projects\6\6075006\GIS\6075006 00 F1 VicinityMap.mxd Map Revised: February 19, 2010 KKS



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.

Reference: Base drawing provided by AHBL, dated November 19, 2009 and HKP Architects, dated February 10, 2010.

Site Plan

Evergreen Sustainable Agriculture Laboratory
Olympia, Washington

GEOENGINEERS

Figure 2

OFFICE:TACO PM:DJT P:\9\0750060\00\CAD\0750500\00_F2.dwg\TAB:F2 modified by syl on Feb 17, 2010 - 15:59

APPENDIX A
Explorations and Geotechnical Laboratory Testing

APPENDIX A
EXPLORATIONS AND GEOTECHNICAL LABORATORY TESTING

Explorations

Subsurface conditions for the proposed improvements were explored by excavating six test pits at the site on December 21, 2009. The test pits were excavated using a bull-dozer and a backhoe under subcontract to GeoEngineers. The bull-dozer was used to provide pathways to access to the locations with the backhoe. The test pits ranged in depths from 6 feet to 14 feet.

The locations of the test pits were determined by taping and pacing from existing site features such as roadways and fence lines. The elevations presented on the test pit logs were based on the topographic survey data provided by HKP Architects (datum unknown). The locations and elevations of the explorations should be considered approximate. Locations of the explorations are provided on the Site Plan, Figure 2 and include the location of the proposed building provided by HKP Architects and the project area.

Our field representative obtained samples, classified the soils, maintained a detailed log of each exploration and observed groundwater conditions where applicable. The samples were retained in sealed plastic bags. 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-7. The densities noted on the test pit exploration logs are based on the difficulty of excavation and our experience and judgment.

Geotechnical Laboratory Test Results

Soil samples obtained from the test pits were transported to our laboratory and examined to confirm or modify field classifications, as well as to evaluate engineering properties of the soil. Representative samples were selected for laboratory testing. Laboratory testing included moisture content determination and grain-size analysis conducted in general accordance with ASTM D 2216 and C 136, respectively. The test results for moisture content determination sample and depth tested is shown on the respective test pit logs. The grain-size analysis results are shown in Figures A-8 and A-9.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	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
MORE THAN 50% PASSING NO. 200 SIEVE	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

ADDITIONAL MATERIAL SYMBOLS

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

Measured groundwater level in exploration, well, or piezometer

Groundwater observed at time of exploration

Perched water observed at time of exploration

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

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.

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

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

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

Date Excavated: 12/21/2009 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 6.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					SOD		1 inch sod		
					ML		Reddish-brown silt, occasional sand (soft, moist)		Weathered Horizon
158	1	X	1						
157	2								
156	3	X	2					38	
					ML		Gray/orange mottled silt, occasional sand (medium stiff, moist)		
155	4								
154	5								
153	6	X	3						

Test pit completed at 6 feet on 12/21/09
No groundwater seepage observed
No caving observed

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 0.5 foot.

Log of Test Pit TP-1

GEOENGINEERS

Project: Evergreen Sustainable Agriculture Laboratory
Project Location: Olympia, Washington
Project Number: 6075-006-00

Figure A-2
Sheet 1 of 1

Tacoma: Date:2/23/10 Path:P:\6\6075006\GINT\6075006.GPJ DBTemplate\LibTemplate\GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 12/21/2009 | Logged By: EAW
Equipment: Case 580 Super M | Total Depth (ft) 12.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					DUF		3 inches duff		
158	1	X	1		ML		Reddish-brown silt, occasional sand (soft, moist)		Weathered Horizon
157	2								
156	3				ML		Gray silt, occasional sand (medium stiff, moist)		
155	4	X	2					35	
154	5								
153	6						Appears to increase in moisture content		
152	7	X	3					38	
151	8								
150	9				SP		Gray fine to coarse sand, occasional gravel, trace silt (medium dense, wet)		
149	10	X	4			▽			
148	11								
147	12								

Test pit completed at 12 feet on 12/21/09
Moderate to rapid groundwater seepage observed at 10 feet
Moderate caving observed at 10 feet

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 0.5 foot.

Log of Test Pit TP-2

GEOENGINEERS

Project: Evergreen Sustainable Agriculture Laboratory
Project Location: Olympia, Washington
Project Number: 6075-006-00

Figure A-3
Sheet 1 of 1

Tacoma: Date:2/23/10 Path:P:\6\6075006\GINT\6075006.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 12/21/2009 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 13.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					DUF		4 inches duff		
					ML		Reddish-brown silt, trace sand (soft, moist)		Weathered Horizon
					ML		Light gray/orange mottled silt, occasional sand (stiff, moist)		
159	1								
158	2	X	1 SA					38	Sieve analysis for infiltration rate
157	3								
156	4								
155	5	X	2						
154	6								
153	7								
152	8								
151	9								
150	10	X	3						
149	11								
148	12						Grades to wet		
147	13								

Test pit completed at 13 feet on 12/21/09
No groundwater seepage observed
No caving observed

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 0.5 foot.

Tacoma: Date:2/23/10 Path:P:\6\6075006\GINT\6075006.GPJ DBTemplate:LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Log of Test Pit TP-3

GEOENGINEERS

Project: Evergreen Sustainable Agriculture Laboratory
Project Location: Olympia, Washington
Project Number: 6075-006-00

Figure A-4
Sheet 1 of 1

Date Excavated: 12/21/2009 | Logged By: EAW

Equipment: Case 580 Super M | Total Depth (ft) 14.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					DUF		4 inches duff		
					ML		Reddish-brown silt, occasional sand (soft, moist)		Weathered Horizon
160	1	X	1		ML		Light brown silt, occasional sand (stiff, moist)		
159	2								
158	3								
157	4	X	2 SA					33	Sieve analysis for infiltration rate
156	5				SM	▽	Gray silty fine to coarse sand with gravel (dense, moist to wet)		
155	6						Grades to moist		
154	7	X	3 SA					11	
153	8								
152	9								
151	10	X	4						
150	11								
149	12	X	5						
148	13								
147	14	X	6						

Test pit completed at 14 feet on 12/21/09
Slow groundwater seepage observed at 5 feet
No caving observed

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 0.5 foot.

Log of Test Pit TP-4

GEOENGINEERS

Project: Evergreen Sustainable Agriculture Laboratory
Project Location: Olympia, Washington
Project Number: 6075-006-00

Figure A-5
Sheet 1 of 1

Tacoma: Date:2/23/10 Path:P:\6\6075006\GINT\6075006.GPJ DBTemplate\.libTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 12/21/2009 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 10.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					DUF		3 inches duff		
169		X	1		SP-SM		Reddish-brown fine to coarse sand with silt and gravel (medium dense, moist)		
	1						Grades to light brown		Weathered Horizon to approximately 1 foot
168									
	2								
167									
	3								
166		X	2 SA					8	Sieve analysis for infiltration rate
	4								Roots observed to 4 feet
165					SM		Gray/orange mottled silty fine to medium sand (medium dense, moist)		
	5								
164		X	3						
	6								
163									
	7				ML		Orange/brown mottled silt with occasional sand (stiff, moist)		
162		X	4						
	8								
161									
	9								
160		X	5						
	10								

Test pit completed at 10 feet on 12/21/09
No groundwater seepage observed
Minor caving observed between 1 to 7 feet

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 0.5 foot.

Log of Test Pit TP-5

GEOENGINEERS

Project: Evergreen Sustainable Agriculture Laboratory
Project Location: Olympia, Washington
Project Number: 6075-006-00

Figure A-6
Sheet 1 of 1

Tacoma: Date:2/23/10 Path:P:\6\6075006\GINT\6075006.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_TESTPIT_1P_GEOTEC

Date Excavated: 12/21/2009 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 11.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					DUF		2 inches duff		
168	1	X	1		SP-SM		Reddish-brown fine to coarse sand with silt (loose, moist)		Weathered Horizon
167	2				SP		Light brown fine to coarse sand, trace silt (medium dense, moist)		
166	3	X	2 SA					9	Sieve analysis for infiltration rate
165	4	X	3		SM		Gray silty fine to coarse sand with gravel (very dense, moist)		Slightly cemented
164	5								
163	6								
162	7	X	4						Less cemented
161	8								
160	9								
159	10	X	5						
158	11								

Test pit completed at 11 feet on 12/21/09
No groundwater seepage observed
No caving observed

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 0.5 foot.

Log of Test Pit TP-6

GEOENGINEERS

Project: Evergreen Sustainable Agriculture Laboratory
Project Location: Olympia, Washington
Project Number: 6075-006-00

Figure A-7
Sheet 1 of 1

Tacoma: Date:2/23/10 Path:P:\6\6075006\GINT\6075006.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEIB_TESTPIT_1P_GEOTEC

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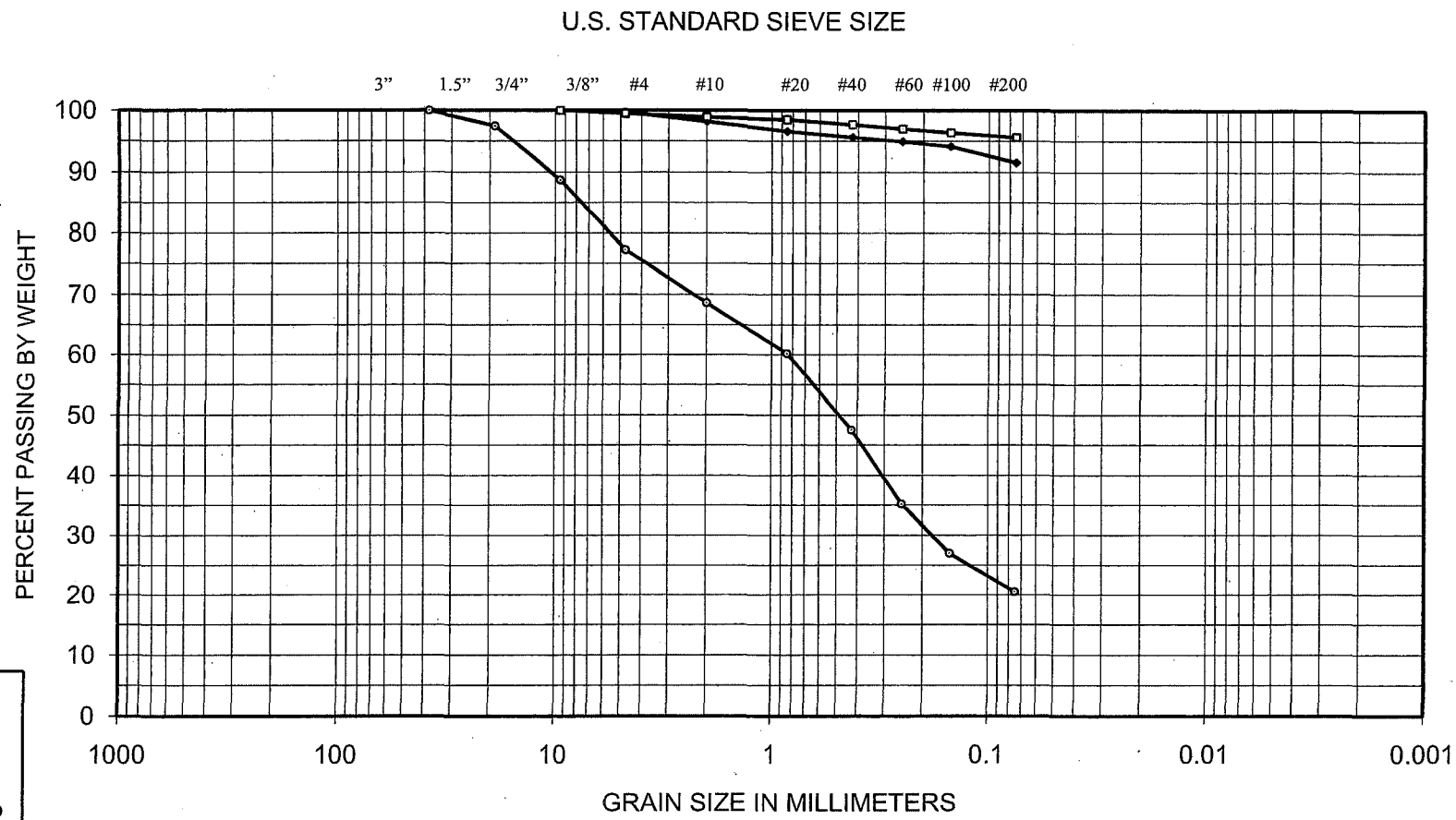

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	MOISTURE (%)	SOIL CLASSIFICATION
◆	TP-3	2	38	Silt, occasional sand (ML)
□	TP-4	4	33	Silt, occasional sand (ML)
◉	TP-4	7	11	Silty sand with gravel (SM)

Sieve Analysis Results

Evergreen Sustainable Agriculture Laboratory
Olympia, Washington

GEOENGINEERS

Figure A-8

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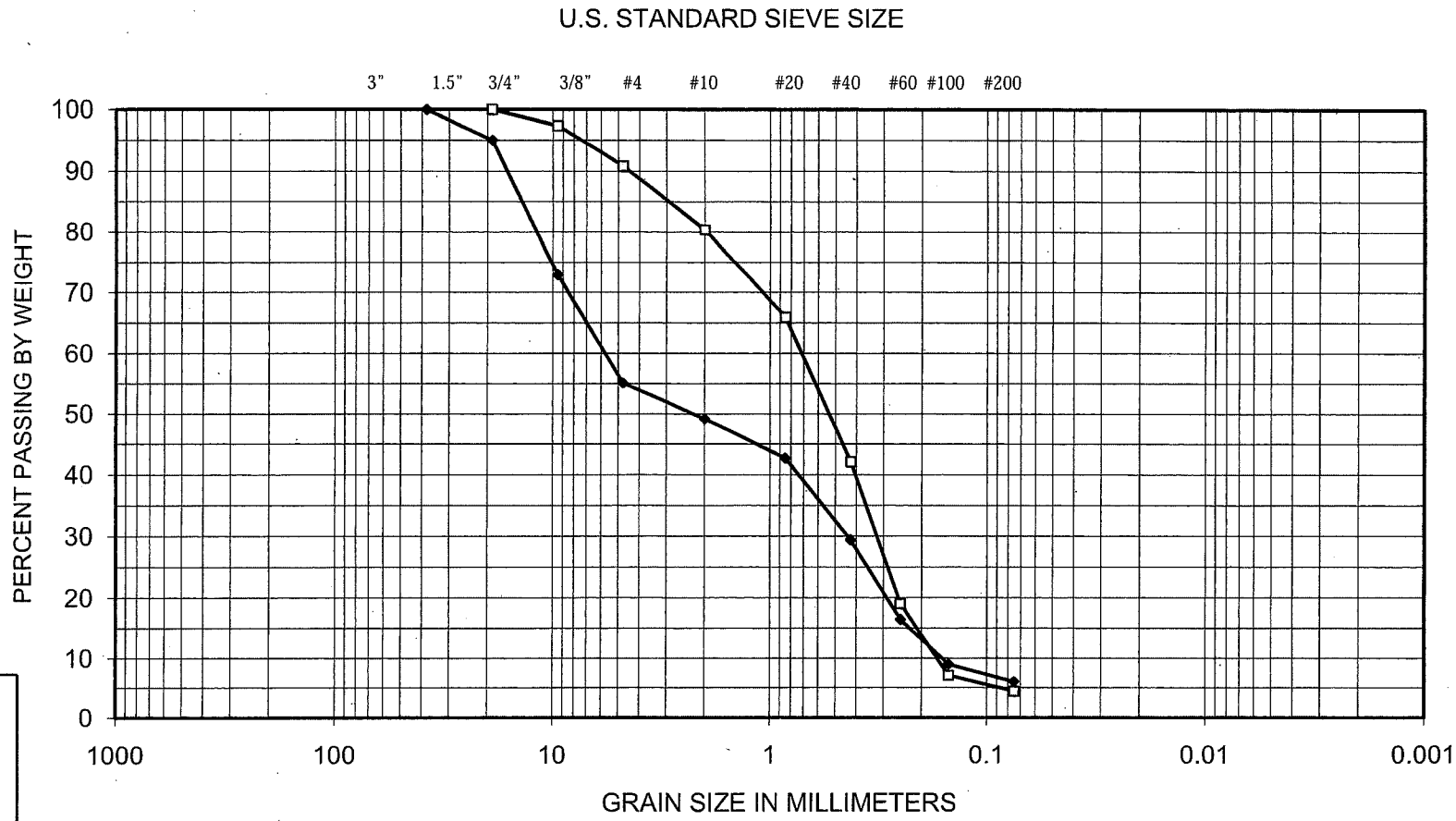

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	MOISTURE (%)	SOIL CLASSIFICATION
◆	TP-5	4	8	Sand with silt and gravel (SP-SM)
□	TP-6	2-1/2	9	Fine to coarse sand, trace silt (SP)

Sieve Analysis Results

Evergreen Sustainable Agriculture Laboratory
Olympia, Washington

GEOENGINEERS

Figure A-9

APPENDIX B
Report Limitations and Guidelines for Use

APPENDIX B
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Geotechnical Services Are Performed for Specific Purposes, Persons and Projects

We have prepared this report for the exclusive use by HKP Architects, The Evergreen State College and their authorized agents for the Evergreen Sustainable Agriculture Laboratory located on the Evergreen State College Campus at 2700 Evergreen Parkway in Olympia, Washington. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of 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 or other conditions, express or implied, should be understood.

This report has been prepared for and their authorized agents and regulatory agencies. The information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. No party other than HKP Architects and The Evergreen State College may rely on the product of our services unless we agree to such reliance in advance and in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client dated October 1, 2009 and generally accepted geotechnical practices in this area at the time this report was prepared. Use of this report is not recommended for any purpose or project except the one originally contemplated.

A Geotechnical Engineering or Geologic Report is Based on a Unique Set of Project-Specific Factors

This report has been prepared for Evergreen Sustainable Agriculture Laboratory. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

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1 Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If important changes are made after the date of this report, we recommend that GeoEngineers be given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Most Geotechnical and Geologic Findings Are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an informed opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Geotechnical Engineering Report Recommendations Are Not Final

The construction recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers is unable to assume responsibility for the recommendations in this report without performing construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

To help prevent costly problems associated with unanticipated subsurface conditions, we recommend giving contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report's accuracy is limited. In addition, encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer.

Contractors Are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) are less exact than other engineering and natural science disciplines. Without this understanding, there may be expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.