

# GEOTECHNICAL REPORT PROPOSED OLYMPIA COMMONS 318 State Avenue Northeast Olympia, Washington

PROJECT NO. 15-135  
July 2015



Prepared for:

**LIHI Olympia**

**PanGEO**  
INCORPORATED

*Geotechnical & Earthquake  
Engineering Consultants*

July 8, 2015  
PanGEO Project No. 15-135

Ms. Whitney Rearick  
**LIHI Olympia**  
2407 First Avenue, Suite 200  
Seattle, Washington 98121

Subject: Geotechnical Report  
Olympia Commons: 318 State Avenue Northeast, Olympia, Washington

Dear Ms. Rearick:

As requested, PanGEO, Inc. is pleased to present this geotechnical report to assist the project team with the design and construction of the proposed Olympia Commons low-income residential development located in Olympia, Washington.

In preparing this report, we observed and logged the excavation of seven test pits at the site and conducted our engineering analyses. In summary, the site is immediately underlain by fill and beach deposits. In our opinion, the site can be developed generally as planned. Building support may be provided using conventional spread and continuous footings bearing on competent existing fill or on structural fill after the overexcavation and replacement of the existing fill. Please refer to Section 4.1 of this report regarding selection of appropriate foundation system, and the potential risks associated with conventional footings.

We appreciate the opportunity to be of service. Should you have any questions, please do not hesitate to call.

Sincerely,



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

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### ATTACHMENTS:

Figure 1	Vicinity Map
Figure 2	Site and Exploration Plan
Appendix A	Test Pit Logs
	Figure A-1 Terms and Symbols for Boring and Test Pit Logs
	Logs of Test Pits TP-1 through TP-7

**GEOTECHNICAL REPORT  
PROPOSED OLYMPIA COMMONS  
318 STATE AVENUE NORTHEAST  
OLYMPIA, WASHINGTON**

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**1.0 GENERAL**

As requested, PanGEO, Inc. is pleased to present this report to assist the project team with the design and construction of the proposed Olympia Commons low-income multi-family residential development located at 318 South State Avenue in Olympia, Washington. This study was performed in general accordance with our mutually agreed scope of services outlined in our proposal dated May 21, 2015. Our scope of services included reviewing readily available geologic and geotechnical data, conducting a site reconnaissance, observing the excavation of seven test pits, and evaluating the feasibility of developing the site as planned.

**2.0 SITE AND PROJECT DESCRIPTION**

The subject site is located at 318 State Avenue South in Olympia, Washington, approximately as shown on Figure 1, Vicinity Map. The rectangular-shaped site is bordered to the north by a one story warehouse building, to the east by Adams Street, to the south by State Avenue, and to the west by an at grade asphalt paved parking lot. The proposed development area comprises 22,810 square feet. The layout of the site is shown on Figure 2, Site and Exploration Plan.

The site is currently undeveloped and is mostly surfaced with gravel with a sparse covering of grass. The site topography is relatively level, with less than two feet of elevation change across the length of the site. An overview of the general site conditions is shown on Plate 1, following page.

It is planned to develop the site with an at-grade, four story, 43-unit low-income housing development. The proposed building will be of relatively lightly loaded wood frame construction. The proposed building will be located in the south portion of the site, approximately as shown on Figure 2, attached. The north portion of the site will be improved with shared outdoor space.

We anticipate the proposed building will be constructed at or near existing site grades, with cuts and fills planned to achieve construction subgrade elevation of less than five feet.

The conclusions and recommendations in this report are based on our understanding of the proposed development, which is in turn based on the project information provided. If the above project description is incorrect, or the project information changes, we should be consulted to



**Plate 1:** View from south to north providing overview the site conditions.

review the recommendations contained in this study and make modifications, if needed. In any case PanGEO should be retained to provide a review of the final design to confirm that our geotechnical recommendations have been correctly interpreted and adequately implemented in the construction documents.

### **3.0 SUBSURFACE EXPLORATION**

#### **3.1 SITE GEOLOGY AND SOILS**

General geologic information for the project area was obtained based on review of the Geologic Maps of the Tumwater 7.5 Minute Quadrangle, Thurston County, Washington (Walsh 2003). Based on our review of the map, near-surface deposits in the vicinity of the site consist of Vashon recessional sand and minor silt (Geologic Map Unit Qgos) and fill (Qf). Vashon recessional sand and minor silt typically consists of a fine to medium sand with minor amounts of silt.

The fill geologic unit is described as consisting of clay, silt, sand and gravel contains shells, organic matter, and rip rap. The fill was placed to raise grades.

#### **3.2 PREVIOUS GRADING**

We understand that portions of the site were previously graded as part of an environmental remediation. The remediation included the excavation and removal of contaminated soil. The excavation was backfilled with quarry spalls and structural fill.

### 3.3 SUBSURFACE EXPLORATION

We observed and logged the excavation of seven test pits at the site on June 5, 2015. The test pits were excavated using a Kubota BX-161 mini-excavator owned and operated by Bill's Backhoe Service and subcontracted to PanGEO. The field exploration program was overseen by an engineering geologist with our firm who logged and sampled the test pits. The test pits were excavated to a maximum depth of 10 feet below existing grade. The approximate test pit locations were located in the field by measuring from the site boundaries and are shown on Figure 2, Site and Exploration Plan.

Summary test pit logs included in Appendix A provide detailed descriptions of the materials encountered, depths to soil contacts, and depths of seepage or caving, if present. The relative in-situ density of cohesionless soils, or the relative consistency of fine-grained soils, was estimated from the excavating action of the excavator, and the stability of the test pit sidewalls. Where soil contacts were gradual or undulating, the average depth of the contact was recorded on the log.

The soils were logged in general accordance with ASTM D-2487 *Standard Practice for Classification of Soils for Engineering Purposes* and the system summarized on Figure A-1, Terms and Symbols for Boring and Test Pit Logs.

### 3.4 SOIL CONDITIONS

For a detailed description of the subsurface conditions encountered at each exploration location, please refer to our test pit logs provided in Appendix A. The stratigraphic contacts indicated on the test pit logs represent the approximate depth to boundaries between soil units. Actual transitions between soil units may be more gradual or occur at different elevations. The descriptions of groundwater conditions and depths are likewise approximate. The following is a generalized description of the soils encountered in the test pits.

**Fill – Structural:** At the locations of Test Pits TP-1, TP-2, TP-3 and TP-4, we encountered fill consisting of poorly graded medium to coarse sand with gravel and a trace amount of silt. Test Pit TP-1 was terminated in this soil unit at about 10 feet below existing grade. In Test Pits TP-2 through TP-4, the bottom of this soil unit ranged from 7 to 8½ feet deep. It appears this material is consistent with gravel borrow or pit run that was placed to backfill the environmental remediation excavation. Based on the resistance of our excavation equipment, the fill was dense to very dense and appears to have been placed and compacted

as a structural fill. The approximate lateral extent of the existing structural fill area is shown on Figure 2, Site and Exploration Plan.

**Fill – Common:** At the locations of Test Pits TP-5, TP-6, and TP-7 we encountered common or uncontrolled fill consisting of loose silty fine to medium sand with gravel. This unit extended from the ground surface to one to two feet below ground surface. The common fill was characterized by its loose consistency and the presence of organic debris, milled lumber, metal, and plastic. At the location of Test Pit TP-6, we encountered a buried concrete slab at about 1½ feet below grade. The approximate extent of the common fill, as indicated on Figure 2, was delineated based on our test pits, probing with a one-half inch diameter T-handle probe, and vegetation patterns. This unit is considered poor in quality and not suitable for supporting load-bearing elements.

**Fill – Quarry Spalls:** Underlying the existing structural fill in TP-2 through TP-4, we encountered fill consisting of two to four inch quarry spalls. This material was encountered in close contact with the groundwater level at the time of our exploration and is likely backfill from the environmental remediation that was placed below the groundwater table. This was the deepest unit encountered in TP-2 through TP-4.

**Beach Deposits:** Underlying the common fill at the locations of Test Pits TP-5, TP-6, and TP-7 we encountered a horizontally bedded, poorly graded medium sand with trace amounts of silt, and sea fragments. We classified this material as beach deposits based on the horizontal bedding and presence of shell fragments. This soil unit extended to at least the bottom of the TP-5 through TP-7 at 6 to 8 feet deep.

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

### 3.4 GROUNDWATER

Heavy groundwater seepage was encountered in the quarry spall fill at the locations of Test Pits TP-2, TP-3 and TP-4 at about 7 feet below grade. The seepage rapidly filled our test pits up to

within about 6 feet below grade. No evidence of groundwater was observed in the other four test pits.

With the planned construction at or near existing grades, groundwater at 6 to 7 feet below grade will likely not result in significant construction related issues. However, there is a potential for encountering groundwater seepage in deep excavations, such as for underground utilities and connections to existing utility mains.

The contractor should be made aware that groundwater levels are not static. There will be fluctuations in the groundwater level depending on the season, tidal fluctuations, amount of precipitation, surface water runoff, and other factors. Groundwater levels are highest during the wet season, typically October through May.

#### **4.0 GEOTECHNICAL RECOMMENDATIONS**

##### **4.1 GENERAL**

Based on our subsurface exploration, most of the proposed building area is primarily underlain by 7 to more than 10 feet of existing structural fill overlying quarry spall fill. Based on our experience with these materials, the finer grained sand (i.e., existing structural fill) can migrate into voids in the very coarse quarry spall fill, resulting in settlement at the ground surface. This situation can be accelerated by the inflow of large volumes of water such as through a water line or water main break, or the improper discharge of surface/roof runoff near the footings.

In our opinion, the risk of settlement induced by the migration of fines into the quarry spalls is low, but cannot be ruled out. If it is desired mitigate the risk for foundation settlement, alternative foundation systems may be considered, such as a structural slab, continuous grade beam foundation, or a pile foundation system. We can provide recommendations for these alternative foundation systems, if desired.

##### **4.2 SEISMIC DESIGN PARAMETERS**

The 2012 International Building Code (IBC) seismic design section provides a basis for seismic design of structures. Table 1 below provides seismic design parameters for the site that are in conformance with the 2012 IBC, which specifies a design earthquake having a 2% probability of occurrence in 50 years (return interval of 2,475 years), and the 2008 USGS seismic hazard maps.



**Table 1 – Seismic Design Parameters**

Site Class	Spectral Acceleration at 0.2 sec. [g]	Spectral Acceleration at 1.0 sec. [g]	Site Coefficients		Design Spectral Response Parameters		Control Periods [sec.]	
	$S_S$	$S_1$	$F_a$	$F_v$	$S_{DS}$	$S_{D1}$	$T_O$	$T_S$
D	1.33	0.546	1.000	1.500	0.887	0.546	0.123	0.616

The spectral response accelerations were obtained from the USGS Earthquake Hazards Program Interpolated Probabilistic Ground Motion website (2008 data) for the project latitude and longitude.

**Liquefaction Potential:** Liquefaction is a process that can occur when soils lose shear strength for short periods of time during a seismic event. Ground shaking of sufficient strength and duration results in the loss of grain-to-grain contact and an increase in pore water pressure, causing the soil to behave as a fluid. Soils with a potential for liquefaction are typically cohesionless, predominately silt and sand sized, must be loose, and be below the groundwater table. The site is predominantly underlain by fill comprised of medium dense to very dense poorly graded sand with gravel. Based on these conditions, in our opinion the liquefaction potential of the site is negligible and design considerations related to soil liquefaction are not necessary for this project.

#### 4.3 BUILDING FOUNDATIONS

Based on the subsurface conditions encountered at the site and our understanding of the planned development, it is our opinion the proposed building may be supported on a conventional spread and continuous footing foundation system. The footings should bear on the medium dense to dense existing structural fill underlying the site. In areas where common fill is encountered, the fill should be removed and replaced with new structural fill. In areas where beach deposits are encountered, the beach deposits should be overexcavated to a depth of two feet below the foundation subgrade elevation and the overexcavation backfilled with structural fill. The overexcavation width should extend at least one foot beyond the width of the foundation elements.

For frost protection considerations, exterior foundation elements should be placed at a minimum depth of 24 inches below final exterior grade. Interior spread foundations should be placed at a minimum depth of 12 inches below the top of concrete slabs.

We recommend a maximum allowable soil bearing pressure of 3,000 pounds per square foot (psf) be used for sizing foundation elements. The recommended allowable bearing pressure is for dead plus live loads. For allowable stress design, the recommended bearing pressure may be increased by one-third for transient loading, such as wind or seismic forces. Continuous and individual spread footings should have minimum widths of 18 and 24 inches, respectively.

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

#### ***4.3.1 Lateral Resistance***

Lateral loads on the structure may be resisted by passive earth pressure developed against the embedded portion of the foundation system and by frictional resistance between the bottom of the foundation and the supporting subgrade soils. For footings bearing on the medium dense sand and gravel soils or on compacted structural fill, a frictional coefficient of 0.30 may be used to evaluate sliding resistance developed between the concrete and the compacted subgrade soil. Passive soil resistance may be calculated using an equivalent fluid weight of 300 pcf, assuming foundations are backfilled with structural fill. The above values include a factor of safety of 1.5. Unless covered by pavements or slabs, the passive resistance in the upper 12 inches of soil should be neglected.

#### ***4.3.2 Footing Subgrade Preparation***

All footing excavations should be in a dense and unyielding condition prior to setting forms and placing rebar. Loose soil encountered at foundation subgrade elevations should be compacted in-place to the requirements of structural fill. Any loose or soft soils that cannot be compacted should be overexcavated and replaced with structural fill.

We encountered common fill at the locations of Test Pits TP-5, TP-6, and TP-7. The fill contained debris, including wood, concrete, glass, brick and asphalt rubble. The fill is not suitable for support of structural loads and is not suitable for use as structural fill. Due to the loose condition of the fill and the presence of organic and inorganic debris, the fill should be

overexcavated from structural areas and exported from the site or wasted in non-structural areas. The overexcavations should be backfilled with structural fill.

It should also be noted that the backfill of our test pits, although tamped into place with the bucket of an excavator, were not compacted as a structural fill. We recommend locating our test pits during construction and recompacting the backfill to the requirements of structural fill.

The adequacy of the footing subgrade soils should be verified by a representative of PanGEO prior to placing forms or rebar. In the event that the exposed soils are significantly different than those described in this report, additional subsurface exploration may be needed.

#### 4.4 FLOORS SLABS

The floor slabs for the proposed buildings may be constructed using conventional concrete slab-on-grade floor construction. The floor slabs should be supported on competent native soil or structural fill. Any over-excavations, if needed, should be backfilled with structural fill. Construction joints should be incorporated into the floor slab to control cracking.

Interior concrete slab-on-grade floors should be underlain by a capillary break consisting of at least of 4 inches of pea gravel or compacted ¾-inch, clean crushed rock (less than 3 percent fines). The capillary break material should meet the gradational requirements provided in Table 2, below.

**Table 2 – Capillary Break Gradation**

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

The capillary break should be placed on the subgrade that has been compacted to a dense and unyielding condition. Design of waterproofing and damp proofing measures are the responsibility of others.

#### **4.5 PERMANENT CUT AND FILL SLOPES**

Based on the anticipated soil that will be exposed in the planned excavation, we recommend permanent cut and fill slopes be constructed no steeper than 2H:1V (Horizontal:Vertical).

### **5.0 EARTHWORK CONSIDERATIONS**

#### **5.1 TEMPORARY EXCAVATIONS**

Temporary excavations should be constructed in accordance with Part N of the WAC (Washington Administrative Code) 296-155. The contractor is responsible for maintaining safe excavation slopes and/or shoring.

Based on the soil conditions encountered in the test pits, it is our opinion that temporary excavations less than about 8 feet deep may be cut at a maximum 1H:1V inclination. If deeper excavations will be needed, PanGEO will be available to provide additional recommendations.

Temporary excavations should be evaluated in the field during construction based on actual observed soil conditions. If seepage is encountered, excavation slope inclinations may need to be reduced. During wet weather, the cut slopes may need to be flattened to reduce potential erosion or should be covered with plastic sheeting.

#### **5.2 STRUCTURAL FILL AND COMPACTION**

Structural fill, should be free of organic and inorganic debris, be near the optimum moisture content and be capable of being compacted to the recommendations provided below. If the site soils cannot be compacted, then an imported structural fill may be needed. Fill for use during wet weather should consist of a well graded soil free of organic material with less than 5 percent fines (silt and clay sized particles passing the U.S. 200 sieve).

Structural fill should be moisture conditioned to within about 3 percent of optimum moisture content, placed in loose, horizontal lifts less than 8 inches in thickness, and compacted to at least 95 percent maximum density, determined using ASTM D-1557 (Modified Proctor). The contractor should include costs for moisture conditioning the native soils by adding water as needed to achieve moisture conditions that will facilitate proper compact as a bearing subgrade or utility trench backfill.

The procedure to achieve proper density of a compacted fill depends on the size and type of compaction equipment, the number of passes, thickness of the lifts being compacted, and certain

soil properties. If the excavation to be backfilled is constricted and limits the use of heavy equipment, smaller equipment can be used, but the lift thickness will need to be reduced to achieve the required relative compaction.

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

### **5.3 WET WEATHER CONSTRUCTION**

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

- Earthwork should be performed in small areas to minimize subgrade exposure to wet weather. Excavation or the removal of unsuitable soil should be followed promptly by the placement and compaction of clean structural fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance.
- During wet weather, the allowable fines content of the structural fill should be reduced to no more than 5 percent by weight based on the portion passing the 0.75-inch sieve. The fines should be non-plastic.
- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water.
- Geotextile silt fences should be installed at strategic locations around the site to control erosion and the movement of soil.
- Excavation slopes and soils stockpiled on site should be covered with plastic sheeting.

### **5.4 EROSION CONSIDERATIONS**

Surface runoff can be controlled during construction by careful grading practices. Typically, this includes the construction of shallow, upgrade perimeter ditches or low earthen berms in conjunction with silt fences to collect runoff and prevent water from entering excavations or to

prevent runoff from the construction area leaving the immediate work site. Temporary erosion control may require the use of hay bales on the downhill side of the project to prevent water from leaving the site and potential storm water detention to trap sand and silt before the water is discharged to a suitable outlet. All collected water should be directed under control to a positive and permanent discharge system.

Permanent control of surface water should be incorporated in the final grading design. Adequate surface gradients and drainage systems should be incorporated into the design such that surface runoff is collected and directed away from the structures and to a suitable outlet. Potential issues associated with erosion may also be reduced by establishing vegetation within disturbed areas immediately following grading operations.

## **6.0 ADDITIONAL SERVICES**

To confirm that our recommendations are properly incorporated into the design and construction of the proposed development, PanGEO should be retained to conduct a review of the final project plans and specifications, and to monitor the construction of geotechnical elements. PanGEO can provide you a cost estimate for construction monitoring services at a later date.

## **7.0 CLOSURE**

We have prepared this report for the LIHI Olympia and the project design team. Recommendations contained in this report are based on a site reconnaissance, a subsurface exploration program, review of pertinent subsurface information, and our understanding of the project. The study was performed using a mutually agreed-upon scope of services.

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

The scope of our work does not include services related to construction safety precautions. Our recommendations are not intended to direct the contractors' methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design. Additionally, the scope of our services specifically excludes the assessment of environmental characteristics, particularly those involving hazardous substances. We are not mold consultants

nor are our recommendations to be interpreted as being preventative of mold development. A mold specialist should be consulted for all mold-related issues.

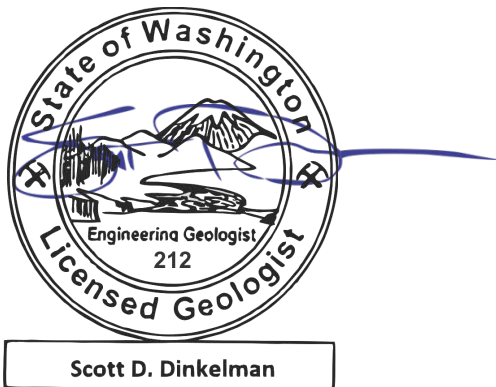
This report has been prepared for planning and design purposes for specific application to the proposed project in accordance with the generally accepted standards of local practice at the time this report was written. No warranty, express or implied, is made.

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

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

Sincerely,

**PanGEO, Inc.**



Scott D. Dinkelman, LEG, LHG  
Senior Engineering Geologist



Siew L Tan, P.E.  
Principal Geotechnical Engineer

## 8.0 REFERENCES

International Code Council, 2012, *International Building Code (IBC), 2012*.

Walsh, T. J., Logan, R.L., Shasse, H. W., Polenz, M, 2003, *Geologic Map of the Tumwater 7.5-minute Quadrangle, Thurston County, Washington*, Washington Department of Natural Resources, Open File Report, 2003-25.

WSDOT, 2014, *Standard Specifications for Road, Bridge and Municipal Construction, M 41-10*, Washington Department of Transportation.





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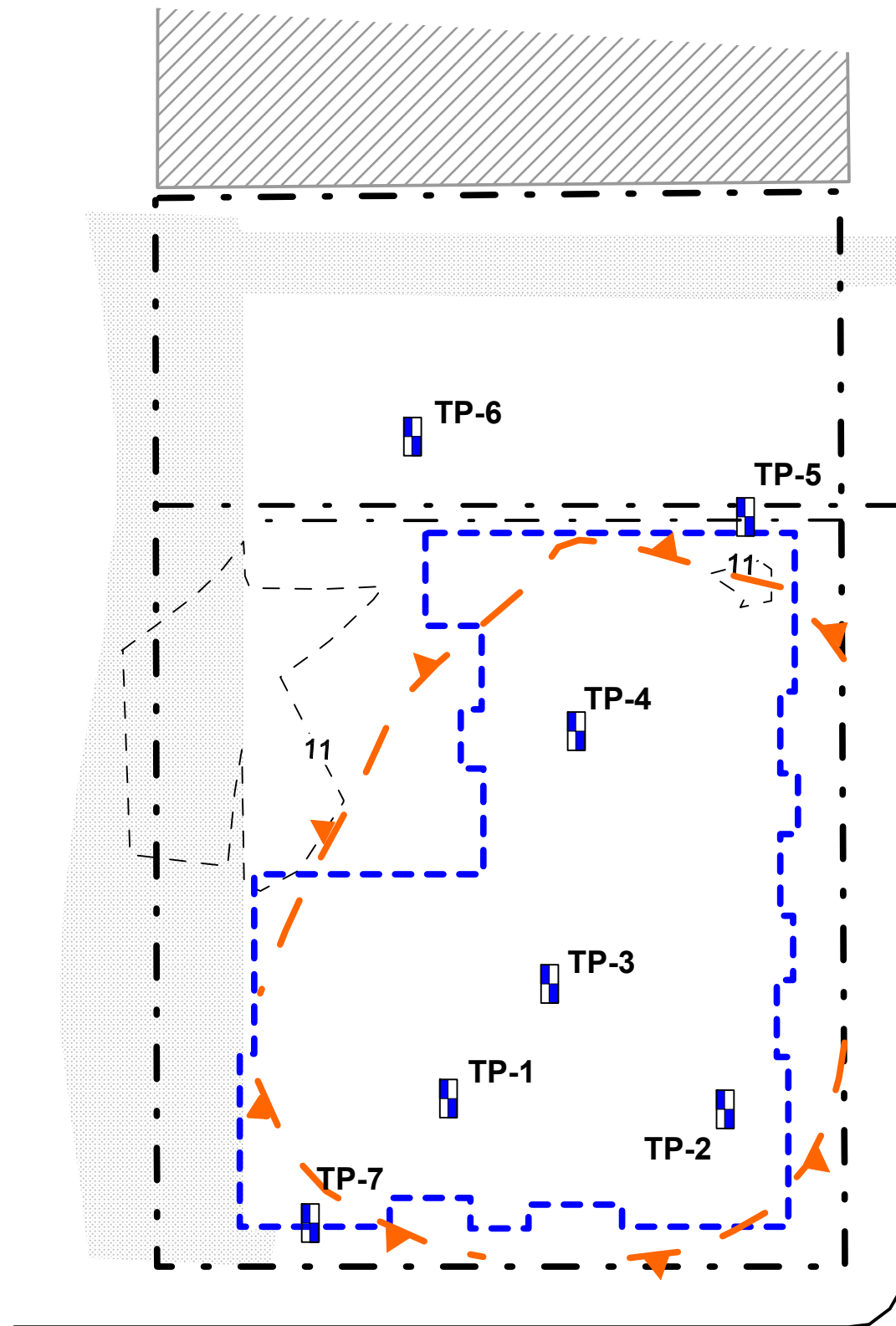
Olympia Commons  
318 State Ave NE  
Olympia, WA

VICINITY MAP

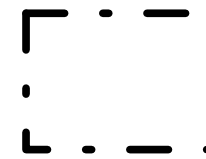
Project No. **15-135**

Figure No. **1**

13-011\_Fig 2 Site & Exploration Plan.grf 7/1/15 JOR



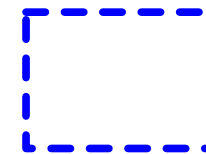
**LEGEND:**



Subject Site



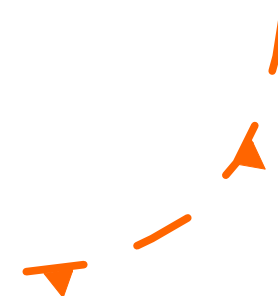
Existing Structures



Proposed Building



Approximate Test Pit Location,  
PanGEO, Inc., May 2015

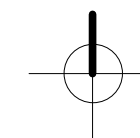


Approximate Extent of Common Fill  
Based on Test Pits, Probing, and  
Vegetation Patterns.  
*(teeth are on Common Fill side of line)*

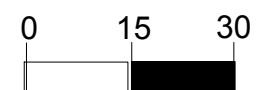
**NE ADAMS ST**

**STATE AVE NE**

NORTH



Approximate  
Scale



Olympia Commons  
318 State Ave NE  
Seattle, WA

**SITE AND EXPLORATION PLAN**

Project No. **15-135**

Figure No. **2**

Note: Site plan modified from ALTA/ACSM Land Title Survey by Hatton Godat Pantier, undated.

**APPENDIX A**

**TEST PIT LOGS**

**Test Pit No. TP-1**

Approximate Ground Surface Elevation: 11 feet

Date: June 5, 2015

Surface Conditions: Gravel, sparse vegetation

<u>Depth (ft)</u>	<u>USCS</u>	<u>Material Description</u>
0 – ¼	GP	FILL – Crushed Rock: Loose, poorly graded angular gravel, dry.
¼ – 2	SM	FILL – Structural: Medium dense, brown silty fine to medium SAND with gravel and cobbles, medium dense. <ul style="list-style-type: none"><li>• Silt content decreases with depth.</li></ul>
2-10	SP	FILL – Structural: Dense poorly grade coarse SAND with gravel, trace silt, moist. <ul style="list-style-type: none"><li>• Probes 1 to 2 inches at 3 feet with ½ inch diameter T-handle probe.</li><li>• Moisture content increases below 6 feet.</li></ul>

Test pit terminated at 10 feet below grade.

No groundwater seepage encountered during excavation.



**Test Pit TP-1:** Spoils pile after completion of test pit excavation.

**Test Pit No. TP-2**

Approximate Ground Surface Elevation: 11 feet

Date: June 5, 2015

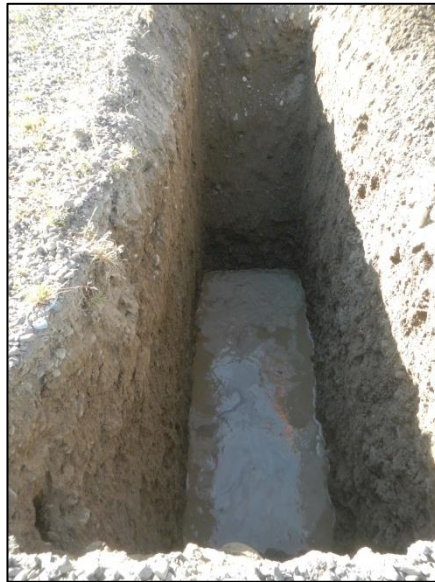
Surface Conditions: Gravel, sparse vegetation

<u>Depth (ft)</u>	<u>USCS</u>	<u>Soil Description</u>
0 – ¼	GP	FILL – Crushed Rock: Loose, poorly graded angular gravel, dry.
¼ – 7	SP	FILL – Structural: Medium dense poorly graded medium to coarse SAND with gravel, trace silt, moist. <ul style="list-style-type: none"> <li>• Becomes dense at 3 feet.</li> <li>• Contains cobbles.</li> <li>• Probes 0 to 1 inches at 4 feet with ½ inch diameter T-handle probe.</li> </ul>
7 – 9	GP	FILL – Quarry Spalls: Dense, gray poorly graded angular gravel with sand, some cobbles. <ul style="list-style-type: none"> <li>• Heavy groundwater seepage at 7 feet. Filled the test pit to 6 feet.</li> </ul>

Test pit terminated at 9 feet below grade.



**Test Pit TP-2:** Test pit during excavation.



**Test Pit TP-2:** After excavation. Groundwater seepage filled the excavation to 6 feet below grade.

**Test Pit No. TP-3**

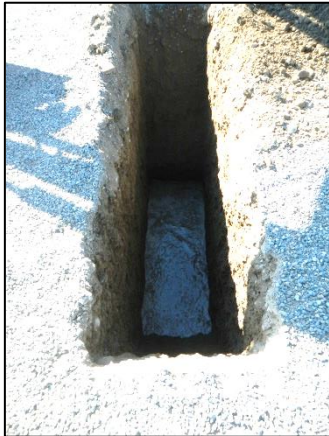
Approximate Ground Surface Elevation: 11 feet

Date: June 5, 2015

Surface Conditions: Gravel, sparse vegetation

<u>Depth (ft)</u>	<u>USCS</u>	<u>Soil Description</u>
0 – ¼	GP	FILL – Crushed Rock: Loose, poorly graded angular gravel, dry.
¼ – 7	SP	FILL – Structural: Medium dense poorly graded medium to coarse SAND with gravel, trace silt, moist. <ul style="list-style-type: none"> <li>• Becomes dense at 3 feet.</li> <li>• Contains cobbles.</li> <li>• Probes 0 to 1 inches at 3 feet with ½ inch diameter T-handle probe.</li> </ul>
7 – 10	GP	FILL – Quarry Spalls: Dense, gray poorly graded angular gravel with sand, some cobbles. <ul style="list-style-type: none"> <li>• Heavy groundwater seepage at 7 feet. Filled the test pit to about 6 feet below grade.</li> </ul>

Test pit terminated at 10 feet below grade.



**Test Pit TP-3:** Groundwater in bottom of test pit after excavation.



**Test Pit TP-3:** Spoils pile after completion of test pit.

**Test Pit No. TP-4**

Approximate Ground Surface Elevation: 11 feet

Date: June 5, 2015

Surface Conditions: Gravel, sparse vegetation

<u>Depth</u>	<u>USCS</u>	<u>Soil Description</u>
0 – ¼	GP	FILL – Crushed Rock: Loose, poorly graded angular gravel, dry.
¼ – 8½	SP	FILL – Structural: Medium dense poorly graded medium to coarse SAND with gravel, trace silt, moist. <ul style="list-style-type: none"> <li>• Becomes dense at 3 feet.</li> <li>• Contains cobbles.</li> </ul>
8½ – 10	GP	FILL – Quarry Spalls: Dense, gray poorly graded angular gravel with sand, some cobbles. <ul style="list-style-type: none"> <li>• Heavy groundwater seepage at 7 feet. Filled the test pit to 6 feet.</li> </ul>

Test pit terminated at 10 feet below grade.



**Test Pit TP-4:** Spoils pile after completion of test pit.



**Test Pit TP-4:** Soils in excavator bucket from bottom of test pit. Mixture of quarry spalls and gravel borrow fill.

**Test Pit No. TP-5**

Approximate Ground Surface Elevation: 11 feet

Date: June 5, 2015

Surface Conditions: Bare soil, sparse vegetation.

<u>Depth</u>	<u>USCS</u>	<u>Soil Description</u>
0 – 1	SM	FILL – Common: Loose, brown silty medium SAND with some gravel, moist. <ul style="list-style-type: none"> <li>• Contains wood, metal debris, and glass.</li> </ul>
1 – 8½	SP-SM	BEACH DEPOSITS: Loose, poorly graded sand with silt, moist. <ul style="list-style-type: none"> <li>• Horizontally bedded.</li> <li>• Contains shells along bedding planes.</li> <li>• Heavy caving below 3 feet.</li> </ul>

Test pit terminated at 8½ feet below grade.

No groundwater seepage encountered during excavation.



**Test Pit TP-5:** Shells encountered in Beach Deposits.



**Test Pit TP-5:** View of spoils pile after completion of test pit.



**Test Pit No. TP-6**

Approximate Ground Surface Elevation: 11 feet

Date: June 5, 2015

Surface Conditions: Bare soil, sparse vegetation.

<u>Depth</u>	<u>USCS</u>	<u>Soil Description</u>
0 – 2	SM	FILL – Common: Loose, brown silty medium SAND with some gravel, moist. <ul style="list-style-type: none"> <li>• Contains wood and metal debris, concrete and brick rubble, glass, and pipe.</li> <li>• Encountered intact concrete slab at 1½ feet, moved test pit 10 feet northwest.</li> </ul>
2 – 8	SP-SM	Beach Deposits: Loose, poorly graded sand with silt, moist. <ul style="list-style-type: none"> <li>• Horizontally bedded.</li> <li>• Contains shells along bedding planes.</li> <li>• Heavy caving below 3 feet.</li> </ul>

Test pit terminated at 11 feet below grade.  
No groundwater seepage encountered during excavation.



**Test Pit TP-6:** Top of intact concrete slab encountered at 1½ feet below grade. Test pit was moved 10 feet to the northwest.



**Test Pit TP-6:** View of Beach Deposit soils from test pit excavation.

**Test Pit No. TP-7**

Approximate Ground Surface Elevation: 11 feet

Date: May 5, 2015

Surface Conditions Bare soil, sparse vegetation.

<u>Depth</u>	<u>USCS</u>	<u>Soil Description</u>
0 – 2	SM	FILL – Common: Loose, brown silty medium SAND with some gravel, moist. <ul style="list-style-type: none"> <li>• Contains wood debris, concrete and brick rubble, glass, and plastic.</li> </ul>
2 – 6	SP-SM	Beach Deposits: Loose, poorly graded sand with silt, moist. <ul style="list-style-type: none"> <li>• Horizontally bedded with shells along bedding planes.</li> <li>• Heavy caving below 3 feet.</li> </ul>

Test pit terminated at 6 feet below grade due to excessive caving.

No groundwater seepage encountered during excavation.



**Test Pit TP-7:** View of sidewall of completed test pit. Upper portion of photo is fill. Lower portion is beach deposits.