1/27/2025

Homes by Landmark
Attn: David Litowitz
P.O. Box 26116
Federal Way, WA

c/o: **Apex Engineering**
Attn: Gabe Jellison
2601 S. 35th St. Ste. 200
Tacoma, WA

Subject: **Geotechnical Services Report**
43rd Avenue Apartments Geotechnical Investigation
7th St SW & 43rd Ave SW, Puyallup, WA 98465 (GPS:47.151659, -122.30189)
Project Number: QG24-160

Dear Client,

At your request, Quality Geo NW, PLLC (QG) has completed a soils investigation of the above-referenced project. The investigation was performed in accordance with our proposal for professional services.

We would be pleased to continue our role as your geotechnical consultant of record during the project planning and construction phases, as local inspection firms have not been found to be as familiar or reliably experienced with geotechnical design. This may include soil subgrade inspections, periodic review of special inspection reports, or supplemental recommendations if changes occur during construction. We will happily meet with you at your convenience to discuss these and other additional *Time & Materials* services.

We thank you for the opportunity to be of service on this project and trust this report satisfies your project needs currently. QG wishes you the best while completing the project.

Respectfully Submitted,
Quality Geo NW, PLLC

Luke Preston McCann, L.E.G.
Owner + Principal

Ray Gean II
Staff Geologist/Project Manager

SOILS REPORT

43rd AVENUE APARTMENTS GEOTECHNICAL INVESTIGATION
7TH ST SW & 43RD AVE SW
PUYALLUP, WA

Homes by Landmark
Attn: David Litowitz
P.O. Box 26116
Federal Way, WA

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1/27/2025

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1/27/2025

QG Project # QG24-160

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1.0 INTRODUCTION

This report presents the findings and recommendations of Quality Geo NW's (QG) soil investigation conducted in support of new site surface improvements.

1.1 PROJECT DESCRIPTION

QG understands the project entails construction of a new apartment structure within a currently undeveloped forested property. QG has been contracted to perform a soils investigation of the proposed site to provide stormwater, foundation, erosion hazard protections and earthwork recommendations.

1.2 FIELD WORK

Site exploration activities were performed on 12/16/2024. Exploration locations were marked in the field by a QG Staff Geologist with respect to the map provided and cleared for public conductible utilities. Our exploration locations were selected by a QG Staff Geologist prior to fieldwork to provide safest access to relevant soil conditions. The geologist directed the advancement of 4 excavated test pits (TP). The test pits were advanced within the vicinity of the anticipated development footprint areas, to maximum depths of 10 feet below present grade (BPG) in general accordance with the specified contract depth.

During explorations QG logged and classified each soil horizon encountered in accordance with the Unified Soil Classification System (USCS). Representative soil samples were collected from each unit, identified according to boring location and depth, placed in plastic bags to protect against moisture loss, and were transported to the soil laboratory for supplemental classification and other tests.

QG advanced 1 Wildcat Dynamic Cone Penetrometer (DCP) test at a representative location within the vicinity of the proposed development. The penetrometer test was terminated upon reaching the equipment's maximum practical extent. During penetrometer advancement, blow counts were recorded in 10-centimeter increments as a thirty-five-pound weight was dropped 15 inches. Blow counts were then converted to resistance (kg/cm2), standard penetration blow counts (N-values), and corresponding soil consistency, with complete results shown on the attached logs.

2.0 EXISTING SITE CONDITIONS

2.1 AREA GEOLOGY

QG reviewed available map publications to assess known geologic conditions and hazards present at the site location. The Washington Geologic Information Portal (WGIP), maintained by the Department of Natural Resources Division of Geology and Earth Resources, provides 1:100,000-scale geologic mapping of the region. Geology of the site location and vicinity consists of continental glacial outwash, Fraser-age (Qgo). The deposits on site are described as, "Silt, clay, sand and gravel deposited by glacial meltwater; variably sorted; loose to compact; massive to well stratified; horizontal to steeply dipping beds; includes drumlins, eskers, kettles, kames, and deltas."

The WGIP Map also offers layers of mapped geohazard conditions within the state. According to the regional-scale interactive map, no known geohazards are mapped for the site.

The United States Department of Agriculture portal (USDA) provides a soil mapping of the region. The soils in the vicinity of is mapped as Everett very gravelly sandy loam (13B) which is formed as moraines and eskers derived from sandy and gravelly glacial outwash. The soils are described as slightly decomposed plant material from 0 to 1 inch, very gravelly sandy loam from 1 to 24 inches, very gravelly loamy sandy from 24 to 35 inches and extremely cobbly coarse sand from 35 to 60 inches. Depth to restrictive feature is more than 80 inches. Capacity of most limiting layer to transmit water (ksat) is listed as high (1.98 to 5.95 in/hr). Depth to water table is more than 80 inches.

2.2 SITE & SURFACE CONDITIONS

The proposed building area is within a presently undeveloped parcel that is generally rectangular in shape. The site is bound by existing multi-family residential development to the north, and existing single-family residences to the west, south, and east. The parcel is heavily vegetated with mature trees, brambles and shrubs. No areas of seeps or standing water were observed at the time of our site visit.

2.3 SOIL LOG

Site soil conditions were generally consistent across the property within all test pits. Representative lab samples were taken from TP-1 and TP-2. Soils conditions from the site were as follows:

- **0' to 1.0' – Silty Sand (SM) (Topsoil)**

  An overriding layer of topsoil was present across the site that had a high organic content consisting of humic matter and roots. Few cobbles were found within this layer, the soil was moist and dark brown, and no mottling was observed. The soil was in a generally medium dense condition.

- **1.0’ to 4.0’ – Poorly-Graded Gravel with Sand (GP)**

  Beneath topsoil, the soil grades into a brown poorly graded gravel with sand. Rounded cobbles were encountered in this unit, with maximum diameters of approximately 10-inches. No mottling was observed in this, and in a medium dense condition.

- **4.0’-10.0’– Silty Sand (SM)**
  Beneath the silty gravel, the soil grades to a tan silty sand with few organics. Rounded cobbles were encountered in this unit, with maximum diameters of approximately 8-inches. Light mottling was observed in this unit in the form of nodules in TP-1 and TP-2 and in a medium dense condition. No groundwater was encountered in any of the test pits.

2.4 SURFACE WATER AND GROUNDWATER CONDITIONS

No active surface water features are present on site. During our test pit explorations, no groundwater was encountered in any of the test pits. The regional groundwater table is inferred to exist greater than 276 feet beneath the entire site, based on well logs made publicly available by the WA Department of Ecology.

QG’s scope of work did not include determination or monitoring of seasonal groundwater elevation variations, formal documentation of wet season site conditions, or conclusive measurement of groundwater elevations at depths past the extent feasible for explorations at the time of the field explorations.

3.0 GEOTECHNICAL RECOMMENDATIONS

3.1 SHALLOW FOUNDATION RECOMMENDATIONS

Assuming site preparation is completed as described below, we recommend the following:

- **Subgrade Preparation**

  QG recommends excavating and clearing any loose or organic cover soils, including the thin overriding layer of topsoil where necessary, from areas of proposed pavement construction, down to firm bearing conditions and benching the final bottom of subgrade elevation flat. Excavations should be performed with a smooth blade bucket to limit disturbance of subgrade soils. Vibratory compaction methods are suitable for densification of the non-organic native soils.

  After excavations have been completed to the planned subgrade elevations, but before placing fill or structural elements, the exposed subgrade should be evaluated under the periodic guidance of a QG representative. Any areas that are identified as being soft or yielding during subgrade evaluation should be brought to the attention of the geotechnical engineer. Where over excavation is performed below a structure, the over excavation area should extend beyond the outside of the footing a distance equal to the depth of the over excavation below the footing. The over-excavated areas should be backfilled with properly compacted structural fill.

  The proposed buildings may utilize either stepped or continuous footings with slab-on-grade elements. For continuous footing elements, upon reaching bearing strata, we recommend benching foundation lines flat. Continuous perimeter and strip foundations may be stepped as needed to accommodate variations in final subgrade level. We also recommend maximum steps of 18 inches with spacing of at least 5 feet be constructed unless specified otherwise by the design engineer. Structural fill may then be placed as needed to reestablish final foundation grade.

- **Allowable Bearing Capacity:**

  A bearing capacity of up to 1,500 pounds per square foot (psf) may be considered for foundations placed on **12-inches of compacted structural fill** over compacted native soils. Bearing capacities, at or below 1,500 psf may eliminate the need additional inspection requirements if approved by the permitting authority. The allowable bearing capacity may be increased by 1/3 for transient loading due to wind and seismic events.

- **Minimum Footing Depth:**

  For a shallow perimeter and spread footing system, all exterior footings shall be embedded a minimum of 18 inches and all interior footings shall be embedded a minimum of 12 inches below the lowest adjacent finished grade, but not less than the depth required by design. However, all footings must also penetrate to the prescribed bearing stratum cited above. Minimum depths are

referenced per IBC requirements for frost protection; other design concerns may dictate greater values be applied.

- **Minimum Footing Width:**

  Footings should be proportioned to meet the stated bearing capacity and/or the IBC 2018 (or current) minimum requirements. For a shallow perimeter and spread footing system, continuous strip footings should be a minimum of 16 inches wide and interior or isolated column footings should be a minimum of 24 inches wide.

- **Estimated Settlements:**

  All concrete settles after placement. We estimate that the maximum settlements will be on the order of 0.5 inch, or less, with a differential settlement of ½ inch, or less, over 50 linear feet. Settlement is anticipated to occur soon after the load is applied during construction.

3.2 LATERAL SOIL & CONCRETE FOUNDATION CONSIDERATIONS

The results of QG's investigation indicate shallow and deep subsurface conditions at the proposed building area consist of generally silty sand and poorly graded gravel with sand.

The finished grade is assumed to be similar to the existing grade. In general, native soils may be considered suitable for use as backfill against new in-ground structures or direct bearing. QG understands that the building structures may likely incorporate continuous perimeter grade beams as well as isolated footings, incorporating soil amendment as determined by the structural design team. For lateral support of these structures, the following soil parameters should be considered regarding any structural fill against these features (ignoring the upper 18 inches, due to freeze/thaw softening, unless covered in concrete or asphalt).

Table 1. Lateral Earth Pressures

Soil Type	Active Pressure (PSF*H)	At-Rest Pressure (PSF*H)	Seismic Surcharge (PSF*H)	Grade Beam Passive Equivalent Fluid Weight (PCF)	Grade Beam Coefficient of Friction
Existing SM Soils	45	60	8	195*	0.35**
Existing GP Soils	30	60	13	221*	0.38**
New Structural Fill	35	55	10	200	0.35

*Factor of Safety: 2.0
**Factor of Safety: 1.5

All concrete foundation elements may bear directly on compacted native soils or approved, imported, granular, structural fill per the requirements of *Section 4.2 Structural Fill Materials and Compaction*.

To ensure adequate friction, no fabric shall be placed between the structural fill and native soils when placed under primary building foundations & grade beams.

The proposed buildings may utilize continuous grade beams with slab-on-grade, where appropriate, depending on the chosen development style. For continuous footing elements, upon reaching bearing strata, we recommend benching foundation lines flat.

SEISMIC DESIGN PARAMETERS AND LIQUEFACTION

According to the Liquefaction Susceptibility Map of Seismic Design Maps Portal, the site is identified as having low susceptibility. This is generally consistent with the findings of QG's investigation to date. Liquefaction is a phenomenon typically associated with a subsurface profile of relatively loose, cohesionless soils saturated by groundwater. Under seismic shaking the pore pressure can exceed the soil's shear resistance and the soil 'liquefies', which may result in excessive differential settlements that are damaging to structures and disruptive to exterior improvements. *The Washington Interactive Geologic Map - Seismic Site Class Map* classifies the project regional vicinity as *Site Class C to D.* As is common for Washington, we have identified the site as Site Class D due to the sandy nature of soils on site.

The USGS Seismic Design Map Tool was used to determine seismic design coefficients and spectral response accelerations assuming Site Class D, representing a generally stiff soil profile (upper 100 feet). Parameters in Table 2 were calculated using 2014 USGS hazard data and ASCE 7-16 was referenced for site Peak Ground Acceleration.

Table 2. Seismic Design Parameters

Seismic Design Category		D	D	D-Default
Reference		ASCE 7-10	ASCE 7-16	ASCE 7-16
Risk Category		II	II	II
MCE_R ground motion (period=0.2s)	S_S	1.247	1.264	1.264
MCER ground motion (period=1.0s)	S_1	0.48	0.436	0.436
Site-modified spectral acceleration value	S_{MS}	1.249	1.264	1.517
Site-modified spectral acceleration value	S_{M1}	0.729	NULL	NULL
Numeric seismic design value at 0.2s SA	S_{DS}	0.832	0.843	1.011
Numeric seismic design value at 1.0s SA	S_{D1}	0.486	NULL	NULL
Site amplification factor at 0.2s	F_a	1.001	1.0	1.2
Site amplification factor at 1.0s	F_v	1.52	NULL	NULL
Site modified peak ground acceleration	PGA_M	0.5	0.55	0.6

Based on the findings of this study, the site is generally considered to have a low risk of liquefaction-induced settlement.

3.2.1 BUILDING SLAB ON GRADE FLOOR

QG anticipates that slab-on-grade floors are planned for the interior of the proposed building. Based on typical construction practices, we assume finished slab grade will be similar to or marginally above present grade for the below recommendations. If floor grades are planned to be substantially raised or lowered from existing grade, QG should be contacted to provide revised or alternative recommendations.

- **Capillary Break:**

  A capillary break will be helpful to maintain a dry slab floor and reduce the potential for floor damage resulting from shallow perched water inundation. To provide a capillary moisture break, a 6-inch thick, properly compacted granular mat consisting of open-graded, free-draining angular aggregate is recommended below floor slabs. To provide additional slab structural support, or to substitute for a structural fill base pad where specified, QG recommends the capillary break should consist of crushed rock all passing the 1-inch sieve and no more than 3 percent (by weight) passing the U.S. No. #4 sieve, compacted in accordance with *Section 4.2.2* of this report.

- **Vapor Barrier:**

  A vapor retarding membrane such as 10 mil polyethylene film should be placed beneath all floor slabs to prevent transmission of moisture where floor coverings may be affected. Care should be taken during construction not to puncture or damage the membrane. To protect the membrane, a layer of sand no more than 2 inches thick may be placed over the membrane if desired. If excessive relict organic fill material is discovered at any location, additional sealant or more industrial gas barriers may be required to prevent off-gassing of decaying material from infiltrating the new structure. These measures shall be determined by the structural engineer to meet local code requirements as necessary.

- **Structural Design Considerations:**

  QG assumes the design and specifications of slabs will be assessed by the project design engineer. We suggest a minimum unreinforced concrete structural section of 4.0 inches be considered to help protect against cracking and localized settlement, especially where larger equipment or localized loads are anticipated. It is generally recommended that any floor slabs and annular exterior concrete paving subject to vehicular loading be designed to incorporate reinforcing. Additionally, some level of reinforcing, such as a wire mesh may be desirable to prolong slab life

due to the overwhelming presence of such poor underlying soils. It should be noted that QG does not express any guarantee or warranty for proposed slab sections.

3.3 INFILTRATION RATE DETERMINATION

QG understands the design of on-site stormwater controls are pending the results of this study to confirm design parameters and interpreted depths to perched seasonal groundwater and restrictive soil features.

3.3.1 GRADATION ANALYSIS METHODS & RESULTS

During test pit excavations for general site investigation, QG collected representative samples of native soil deposits among potential infiltration strata and depths. Representative soil samples were selected from native soils within TP-1 and TP-2 to characterize the local infiltration conditions.

We understand the project will be subject to infiltration design based on the Washington Department of Ecology Stormwater Management Manual for Western Washington (DoE SMMWW). For initial site infiltration characterization within the scope of this study, laboratory gradation analyses were completed including sieve and hydrometer tests for stormwater design characterization and rate determination to supplement field observations. Results of laboratory testing in terms of rate calculation are summarized below.

Laboratory results were interpreted to recommended design inputs in accordance with methods of the 2024 DoE SMMWW. Gradation results were applied to the Massmann (2003) equation (1) to calculate Ksat representing the initial saturated hydraulic conductivity.

(1) $\log10(Ksat) = -1.57 + 1.90*D10 + 0.015*D60 - 0.013*D90 - 2.08*ff$

Corrected Ksat values presented below are a product of the initial Ksat and correction factor CFT. For a generalized site-wide design situation, we have applied a site variability factor of CFv = 0.7 along with typical values of CFt = 0.4 (for the Grain Size Method) and CFm = 0.9 (assuming standard influent control).

(2) $CFT = CFv \times CFt \times CFm \times CFb = 0.7 \times 0.4 \times 0.9 \times 1.0 = 0.25$

Results were cross-referenced with test pit logs to determine the validity and suitability of unique materials as an infiltration receptor. Additional reduction factors were applied for practical rate determination based on our professional judgement.

Table 3. Results Of Massmann Analysis

TP #	Sample Depth *(BPG)*	Unit Extent *(ft)*	Soil Type	D10	D60	D90	Fines (%)	Ksat *(in/hr)*	CorrectedKsat *(in/hr)*	LT Design Infiltration Rate*(in/hr)*	Cation Exchange Capacity (meq/100g)	Organic Content %
2	2.5	1.0-3.7	GP	0.439	16.82	38.24	4.2	121.17	57.25	**20.0**	3.7	1.8
1	8.0	0.5-10.0	SM	0.038	0.22	0.81	19.5	17.41	4.39	**4.39**	4.6	0.6

Beneath the topsoil, the SM and GP soils were observed to generally exhibit low fines content and minimal oxidation patterns. In-ground infiltration structures are required to maintain a minimum of 5-feet separation from restrictive soil & groundwater features. Available well logs do not indicate the potential for shallow ground water. Groundwater is inferred to exist greater than 276 feet below existing grade based on public well logs. **For in-ground infiltration galleries, we recommend a maximum design rate of up to 4.39 inches/hour be considered.** The required separation appears generally achievable across the site. Currently, QG does not recommend mounding analysis due to the generally suitable site conditions.

Alternatives to in-ground infiltration include the use of rain gardens, bio-swales, or pervious pavement, which can be considered at the discretion of the designer and client depending on final development needs and constraints. for shallow infiltration features utilizing treatment media, we recommend a maximum design rate of up to 1.0 inch/hour be considered. This considers potential reductions from compaction during construction.

QG recommends the facility designer review these results and stated assumptions per reference literature to ensure applicability with the proposed development, level of anticipated controls, and long-term maintenance plan. The designer may make reasonable adjustments to correction factors and the resulting design values based on these criteria to ensure design and operational intent is met. We recommend that we be contacted if substantial changes to rate determination are considered.

3.3.2 TREATMENT POTENTIAL

Depending on stormwater and runoff sources, some stormwater features, such as rain gardens or pervious pavements may require treatment. Stormwater facilities utilizing native soils as treatment media typically require Cation Exchange Capacities (CEC) of greater than 5 milliequivalents per 100grams (meq/100g) and organic contents greater than 1% (this may vary depending on local code). Native soils beneath topsoil across the site **do not** meet these requirements.

3.4 DRAINAGE RECOMMENDATIONS

QG recommends proper drainage controls for stormwater runoff during and after site development to protect the site. The ground surface adjacent to structures should be sloped to drain away at a 5% minimum to prevent ponding of water adjacent to them.

Foundations shall incorporate a wraparound footing drain composed of imported clean granular drain rock. There shall be a perforated drainpipe connected around the perimeter of the footing drain (within the rock) graded to gravity drain to an outfall pipe, to allow any accumulated water to be released to an approved drainage feature or location. The outfall point must be lower in elevation than the lowest point of possible water accumulation in the mat fill, so as to allow any captured water within the mat or crawlspace to completely drain away from the building footprint preventing standing water from accumulating. QG recommends all stormwater catchments (new or existing) be tightlined (piped) away from structures to an existing catch basin, stormwater system, established channel, or approved outfall to be released using appropriate energy-dissipating features at the outfall to minimize point erosion. Roof and footing drains should be tightlined separately or should be gathered in an appropriately sized catch basin structure and redistributed collectively. If storm drains are incorporated for impervious flatworks (driveways, sidewalks, etc.) collected waters should also be discharged according to the above recommendations. Appropriate measures should be taken by the site designer to consider and allow for an adequate emergency outfall location in the event of a future record stormwater fall that cannot be anticipated.

3.5 EROSION CONTROLS

Erosion is one of the most common driving forces leading to slope instability. In addition to the above commentary, the following general recommendations should be implemented in general to reduce long-term erosion potential of the slope below the project site and maintain slope stability:

- Minimize the volume and velocity of water that travels toward and down the slope face (via proper choice of site development features including stormwater controls discussed above).
- Avoid accelerating slope erosion and mass wasting due to human activity such as:
  - ✓ Adding side-cast such as dumping landscape debris or fallen trees on or above the slopes.
  - ✓ Using heavy construction equipment on or near steep slopes.
  - ✓ Excavating near adjacent steep slopes toe or on slope face.
  - ✓ Placing excavated soil near the steep slope crest.
- Prior to construction, a silt fence and/or a continuous line of straw bales should be placed on the slopeward edge of the construction area. Heavy construction equipment, construction materials, or native and imported soils should not be placed behind the erosion control devices. Suitable temporary erosion and sediment control measures should be implemented at the construction site during and immediately after ground disturbance occurs. Temporary areas bare of vegetation should be protected from erosion via a blanket of straw or rolled erosion control product (RECP) during prolonged breaks in site work and prior to reseeding or revegetation.
- At the end of the project, all bare surfaces and areas of disturbed vegetation should be replanted and maintained until fully reestablished. Concentrated surface water should not be allowed to

traverse the slope during or after the construction phase of the project. Roof downspouts and footing drains should be routed into closed separate pipes which outfall into appropriate drainages. Outlets for these pipes should be protected from erosion through the use of rip-rap (quarry spalls) or some other energy dissipating device. Similarly, concentrated drainages should be captured in closed pipe systems and routed down slope to appropriate outfalls.

- Clearing of existing vegetation outside the proposed building area on and adjacent to the existing slopes should be avoided except as approved by a qualified professional. This provides additional stability to the loose topsoil and minimizes the effects of down-slope water movement. This is excepting removal of problem, dead, or dying, trees if posing a direct hazard to site installations or adjacent roadways.
- Grading or excavation of soils during construction should be accompanied by grass reseeding and re-vegetation as the project is completed. Areas of existing moderate vegetation can also benefit from additional deep rooting plants. According to "Vegetation Management: A Guide for Puget Sound Bluff Property Owners" (Manashe, 1993) the following types of vegetation provide good to excellent erosion control:

Common Name	***Botanical Name***	***Deciduous/Evergreen***	***Mature Height (ft)***
Bigleaf Maple	Acer macrophyllum	Deciduous	60
Douglas Fir	Pseudotsuga menziesii	Evergreen	200+
Evergreen	Vaccinium ovatum	Evergreen	To 8
Oceanspray	Holodiscus discolor	Deciduous	10+
Oregon Grape	Mahonia spp.	Evergreen	To 6
Pacific Madrone	Arbutus menziesii	Evergreen	70
Red huckleberry	Vaccinium parvifolium	Deciduous	To 12
Rose	Rose spp.	Deciduous	2-10
Salal	Gaultheria shallon	Evergreen	To 4
Salmonberry	Rubus spectabilis	Deciduous	To 12
Serviceberry	Amelanchier alnifolia	Deciduous	12+
Snowberry	Symphoricarpos albus	Deciduous	3+
Vine Maple	Acer cricinatum	Deciduous	10+
Willow	Salix spp.	Deciduous	10+

4.0 CONSTRUCTION RECOMMENDATIONS

4.1 EARTHWORK

4.1.1 GRADING & EXCAVATION

A grading plan was not available to QG at the time of this report. However, based on provided conceptual plans, this study assumes finished site grade will approximate current grade. Therefore, depths referred to in this report are considered roughly equivalent to final depths. Excavations can generally be performed with conventional earthmoving equipment such as bulldozers, scrapers, and excavators.

4.1.2 SUBGRADE EVALUATION & PREPARATION

After excavations have been completed to the planned subgrade elevations, but before placing fill or structural elements, the exposed subgrade should be evaluated under the part-time observation and guidance of a QG representative.

The special inspection firm should continuously evaluate all backfilling. Any areas that are identified as being soft or yielding during subgrade evaluation should be over excavated to a firm and unyielding condition or to the depth determined by the geotechnical engineer. Where over excavation is performed below a structure, the over excavation area should extend beyond the outside of the footing a distance equal to the depth of the over excavation below the footing. The over-excavated areas should be backfilled with properly compacted structural fill.

4.1.3 SITE PREPARATION, EROSION CONTROLL, WET WEATHER

Any silty or organic rich native soils may be moisture-sensitive and become soft and difficult to traverse with construction equipment when wet. During wet weather, the contractor should take measures to protect any exposed soil subgrades, limit construction traffic during earthwork activities, and limit machine use only to areas undergoing active preparation.

Once the geotechnical engineer has approved the subgrade, further measures should be implemented to prevent degradation or disturbance of the subgrade. These measures could include, but are not limited to, placing a layer of crushed rock or lean concrete on the exposed subgrade, or covering the exposed subgrade with a plastic tarp and keeping construction traffic off the subgrade. Once the subgrade has been approved, any disturbance because the subgrade was not protected should be repaired by the contractor at no cost to the owner.

During wet weather, earthen berms or other methods should be used to prevent runoff from draining into excavations. All runoffs should be collected and disposed of properly. Measures may also be

required to reduce the moisture content of on-site soils in the event of wet weather. These measures can include, but are not limited to, air drying and soil amendment, etc.

QG recommends earthwork activities take place during the summer dry season.

4.2 STRUCTURAL FILL MATERIALS AND COMPACTION

4.2.1 MATERIALS

All material placed below structures or pavement areas should be considered structural fill. Excavated native soils may be considered suitable for reuse as structural fill on a case-by-case basis. Imported material can also be used as structural fill. Care should be taken by the earthwork contractor during grading to avoid contaminating stockpiled soils that are planned for reuse as structural fill with native organic materials. Frozen soil is not suitable for use as structural fill. Fill material may not be placed on frozen soil.

Structural fill material shall be free of deleterious materials, have a maximum particle size of 4 inches, and be compactable to the required compaction level. Imported structural fill material should conform to the WSDOT manual Section 9-03.14(1) Gravel Borrow, or an approved alternative import material. Controlled-density fill (CDF) or lean mix concrete can be used as an alternative to structural fill materials, except in areas where free-draining materials are required or specified.

Imported materials utilized for trench back fill shall conform to Section 9-03.19, Trench Backfill, of the most recent edition (at the time of construction) of the State of Washington Department of Transportation *Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications)*. Imported materials utilize as grade fill beneath roads shall conform to WSDOT Section 9-03.10, Gravel Base.

Pipe bedding material should conform to the manufacturer's recommendations and be worked around the pipe to provide uniform support. Cobbles exposed in the bottom of utility excavations should be covered with pipe bedding or removed to avoid inducing concentrated stresses on the pipe.

Soils with fines content near or greater than 10% fines content may likely be moisture sensitive and become difficult to use during wet weather. Care should be taken by the earthwork contractor during grading to avoid contaminating stockpiled soils that are planned for reuse as structural fill with native organic materials.

The contractor should submit samples of each of the required earthwork materials to the materials testing lab for evaluation and approval prior to delivery to the site. The samples should be submitted **at least 5 days prior to their delivery** and sufficiently in advance of the work to allow the contractor to identify alternative sources if the material proves unsatisfactory.

4.2.2 FILL PLACEMENT AND COMPACTION

For lateral and bearing support, structural fill placement below footings shall extend at minimum a distance past each edge of the base of the footing equal to the depth of structural fill placed below the footing [i.e. extending at least a 1H:1V past both the interior and the exterior of the concrete footing].

Prior to placement and compaction, structural fill should be moisture conditioned to within 3 percent of its optimum moisture content. Loose lifts of structural fill shall not exceed 12 inches in thickness. All structural fill shall be compacted to a firm and unyielding condition and to a minimum percent compaction based on its modified Proctor maximum dry density as determined per ASTM D1557. Structural fill placed beneath each of the following shall be compacted to the indicated percent compaction:

- Foundation and Floor Slab Subgrades: 95 Percent
- Pavement Subgrades & wall backfill (upper 2 feet): 95 Percent
- Pavement Subgrades & wall backfill (below 2 feet): 90 Percent
- Utility Trenches (upper 4 feet): 95 Percent
- Utility Trenches (below 4 feet): 90 Percent

A sufficient number of tests should be performed to verify the compaction of each lift. The number of tests required will vary depending on the fill material, its moisture condition and the equipment being used. Initially, more frequent tests will be required while the contractor establishes the means and methods required to achieve proper compaction.

Jetting or flooding is not a substitute for mechanical compaction and should not be allowed.

4.3 TEMPORARY EXCAVATIONS AND TRENCHES

All excavations and trenches must comply with applicable local, state, and federal safety regulations. Construction site safety is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. We are providing soil type information solely as a service to our client for planning purposes. Under no circumstances should the information be interpreted to mean that QG is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred. The contractor shall be responsible for the safety of personnel working in utility trenches. Given that steep excavations in native soils may be prone to caving, we recommend all utility trenches, but particularly those greater than 4 feet in depth, be supported in accordance with state and federal safety regulations. Heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed near the top of any excavation.

Temporary excavations and trenches should be protected from the elements by covering them with plastic sheeting or some other similar impermeable material. Sheeting sections should overlap by at least 12 inches and be tightly secured with sandbags, tires, staking, or other means to prevent wind from exposing the soils under the sheeting.

5.0 SPECIAL INSPECTION

The recommendations made in this report assume that an adequate program of tests and observations will be made throughout construction to verify compliance with these recommendations. Testing and observations performed during construction should include, but not necessarily be limited to, the following:

- Geotechnical plan review and engineering consultation as needed prior to construction phase,
- Observations and testing during site preparation, earthwork, structural fill, and pavement section placement,
- Consultation on temporary excavation cutslopes and shoring if needed,
- Consultation as necessary during construction.

QG recommends that we be retained for construction phase soils testing and periodic earthwork observation in accordance with the local code requirements. We also strongly recommend that QG be retained as the project Geotechnical Engineering Firm of Record (GER) during the construction of this project to perform periodic supplementary geotechnical observations and review the special inspectors reports during construction.

Our knowledge of the project site and the design recommendations contained herein will be of great benefit in the event that difficulties arise and either modifications or additional geotechnical engineering recommendations are required or desired. We can also, in a timely fashion observe the actual soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

We would be pleased to meet with you at your convenience to discuss the *Time & Materials* scope and cost for these services.

6.0 LIMITATIONS

Upon acceptance and use of this report, and its interpretations and recommendations, the user shall agree to indemnify and hold harmless QG, including its owners, employees and subcontractors, from any adverse effects resulting from development and occupation of the subject site. Ultimately, it is the owner's choice to develop and live in such an area of possible geohazards (which exist in perpetuity across the earth in one form or another), and therefore the future consequences, both anticipated and unknown, are solely the responsibility of the owner. By using this report for development of the subject property, the owner must accept and understand that it is not possible to fully anticipate all inherent risks of development. The recommendations provided above are intended to reduce (but may not eliminate) such risks.

This report does not represent a construction specification or engineered plan and shall not be used or referenced as such. The information included in this report should be considered supplemental to the requirements contained in the project plans & specifications and should be read in conjunction with the above referenced information. The selected recommendations presented in this report are intended to inform only the specific corresponding subjects. All other requirements of the above-mentioned items remain valid, unless otherwise specified.

Recommendations contained in this report are based on our understanding of the proposed development and construction activities, field observations and explorations, and laboratory test results. It is possible that soil and groundwater conditions could vary and differ between or beyond the points explored. If soil or groundwater conditions are encountered during construction that differ from those described herein, or If the scope of the proposed construction changes from that described in this report, QG should be notified immediately in order to review and provide supplemental recommendations.

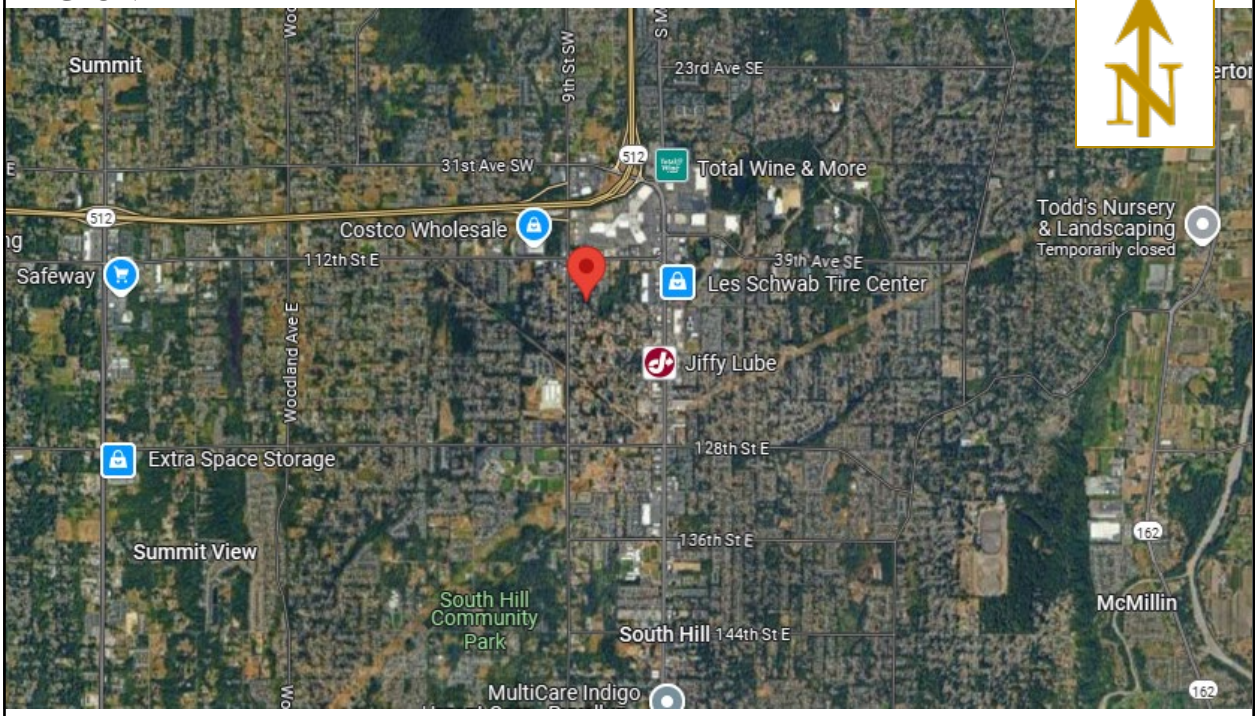
The findings of this study are limited by the level of scope applied. We have prepared this report in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the subject region. No warranty, expressed or implied, is made. The recommendations provided in this report assume that an adequate program of tests and observations will be conducted by a WABO approved special inspection firm during the construction phase in order to evaluate compliance with our recommendations.

This report may be used only by the Client and their design consultants and only for the purposes stated within a reasonable time from its issuance, but in no event later than 18 months from the date of the report. It is the Client's responsibility to ensure that the Designer, Contractor, Subcontractors, etc. are made aware of this report in its entirety. Note that if another firm assumes Geotechnical Engineer of Record responsibilities, they need to review this report and either concur with the findings, conclusions, and recommendations or provide alternate findings, conclusions and recommendation.

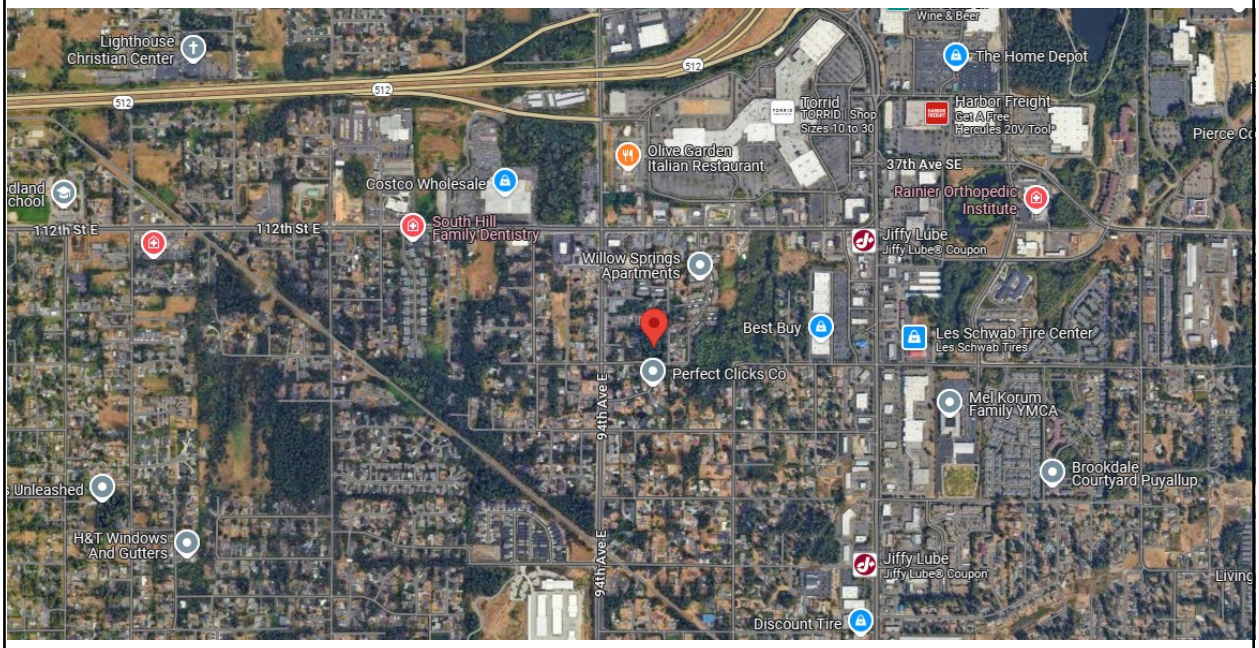
Land or facility use, on- and off-site conditions, regulations, or other factors may change over time, and additional work may be required. Based on the intended use of the report, QG may recommend that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the Client or anyone else will release QG from any liability resulting from the use of this report. The Client, the design consultants, and any unauthorized party, agree to defend, indemnify, and hold harmless QG from any claim or liability associated with such unauthorized use or non-compliance. We recommend that QG be given the opportunity to review the final project plans and specifications to evaluate if our recommendations have been properly interpreted. We assume no responsibility for misinterpretation of our recommendations.

Appendix A. Region & Vicinity Maps

REGION



VICINITY



Quality Geo NW, PLLC	**Site Region** 43rd Ave Apartments Geo	Source: Google Imagery, 2025 **Scale & Locations are approx.** **Not for Construction**	**Figure 1**

Appendix B. Exploration Map

Quality Geo NW, PLLC	**Site Map** 43rd Ave Apartments Geo	Source: Pierce Co. GIS, 2025 **Scale & Locations are approx.** **Not for Construction**	**Figure 2**

Appendix C. Exploration Logs

Test Pit Log TP-1

PROJECT NUMBER QG24-260
PROJECT NAME 43rd Ave Apts Geo
PROJECT LOCATION Puyallup, WA

FIELD WORK DATE 12/16/2024
DRILLING METHOD Excavator

BORING LOCATION Center of parcel, potential infiltration facility
SURFACE ELEVATION Existing
LOGGED BY CA

COMMENTS

Depth (ft)	Samples	Is Analysed?	Graphic Log	USCS	Material Description
0				SM	SILTY SAND (TOPSOIL)
0.5				SM	Dark brown, moist, highly organic (roots, humus), no mottling, cobbles (rounded, to 6-inch diameter), medium dense
1					VISUAL CLASSIFICATION: Gravel= 35%, Sand= 45%, Fines= 20%
1.5					SILTY SAND Tan, moist, few organics (roots), light mottling (nodules), few cobbles (rounded to 8-inch diameter), medium dense
2					Gravel= 6% Sand= 74% Fines= 20%
2.5					
3					
3.5					
4					
4.5					
5					
5.5					
6					
6.5					
7					
7.5					
8	TP-1@8ft	Y			
8.5					
9					
9.5					
10					Terminated at Max Machine Extent No Groundwater Encountered
10.5					

Quality Geo NW, PLLC - Ph: 360-878-9705, qualitygeonw.com, 4631 Whitman Lane SE, Ste D, Lacey, WA
produced by ESlog.ESdat.net on 13 Jan 2025

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Test Pit Log TP-2

PROJECT NUMBER QG24-260
PROJECT NAME 43rd Ave Apts Geo
PROJECT LOCATION Puyallup, WA

FIELD WORK DATE 12/16/2024
DRILLING METHOD Excavator

BORING LOCATION Northeast of TP-1, potential infiltration facility
SURFACE ELEVATION Existing
LOGGED BY CA

COMMENTS

Depth (ft)	Samples	Is Analysed?	Graphic Log	USCS	Material Description
0				SM	SILTY SAND (TOPSOIL) Dark brown, moist, highly organic (roots, humus), no mottling, cobbles (rounded, to 6-inch diameter), medium dense VISUAL CLASSIFICATION: Gravel= 35%, Sand= 45%, Fines= 20%
1				GP	POORLY GRADED GRAVEL with SAND Brown, moist, few organics (roots), no mottling, abundant cobbles (rounded to 10-inch diameter), medium dense Gravel= 69% Sand= 27% Fines= 4%
2.5	TP-2@2.5ft	Y			
4				SM	SILTY SAND Tan, moist, few organics (roots), light mottling (nodules), few cobbles (rounded to 8-inch diameter), medium dense Gravel= 6% Sand= 74% Fines= 20%
10					Terminated at Max Machine Extent No Groundwater Encountered

Test Pit Log TP-3

PROJECT NUMBER QG24-260
PROJECT NAME 43rd Ave Apts Geo
PROJECT LOCATION Puyallup, WA

FIELD WORK DATE 12/16/2024
DRILLING METHOD Excavator

BORING LOCATION North of TP-1, potential infiltration facility
SURFACE ELEVATION Existing
LOGGED BY CA

COMMENTS

Depth (ft)	Samples	Is Analysed?	Graphic Log	USCS	Material Description
0				SM	SILTY SAND (TOPSOIL) Dark brown, moist, highly organic (roots, humus), no mottling, cobbles (rounded, to 6-inch diameter), medium dense
0.5				GP	VISUAL CLASSIFICATION: Gravel= 35%, Sand= 45%, Fines= 20%
1					POORLY GRADED GRAVEL with SAND Brown, moist, few organics (roots), no mottling, abundant cobbles (rounded to 10-inch diameter), medium dense Gravel= 69% Sand= 27% Fines= 4%
1.5					
2					
2.5					
3				SM	SILTY SAND Tan, moist, few organics (roots), no mottling, few cobbles (rounded to 8-inch diameter), medium dense Gravel= 6% Sand= 74% Fines= 20%
3.5					
4					
4.5					
5					
5.5					
6					
6.5					
7					
7.5					
8					
8.5					
9					
9.5					
10					Terminated at Max Machine Extent No Groundwater Encountered
10.5					

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Test Pit Log TP-4

PROJECT NUMBER QG24-260
PROJECT NAME 43rd Ave Apts Geo
PROJECT LOCATION Puyallup, WA

FIELD WORK DATE 12/16/2024
DRILLING METHOD Excavator

BORING LOCATION South of TP-1, proposed building area
SURFACE ELEVATION Existing
LOGGED BY CA

COMMENTS

Depth (ft)	Samples	Is Analysed?	Graphic Log	USCS	Material Description
0				SM	SILTY SAND (TOPSOIL) Dark brown, moist, highly organic (roots, humus), no mottling, cobbles (rounded, to 6-inch diameter), medium dense
1				SM	VISUAL CLASSIFICATION: Gravel= 35%, Sand= 45%, Fines= 20% SILTY SAND Tan, moist, few organics (roots), no mottling, few cobbles (rounded to 8-inch diameter), medium dense Gravel= 6% Sand= 74% Fines= 20%
10					Terminated at Max Machine Extent No Groundwater Encountered

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produced by ESlog.ESdat.net on 13 Jan 2025

WILDCAT DYNAMIC CONE LOG

Quality Geo NW, PLLC
Geotechnical Consultants
Lacey, WA

PROJECT NUMBER: QG24-160
DATE STARTED: 12-16-2024
DATE COMPLETED: 12-16-2024

HOLE #: DCP-1
CREW: CA
PROJECT: 43rd Ave Apts
ADDRESS: th St SW & 43rd Ave SW, Puyallup, WA 98465
LOCATION: Proposed building area,

SURFACE ELEVATION: Existing
WATER ON COMPLETION: No
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

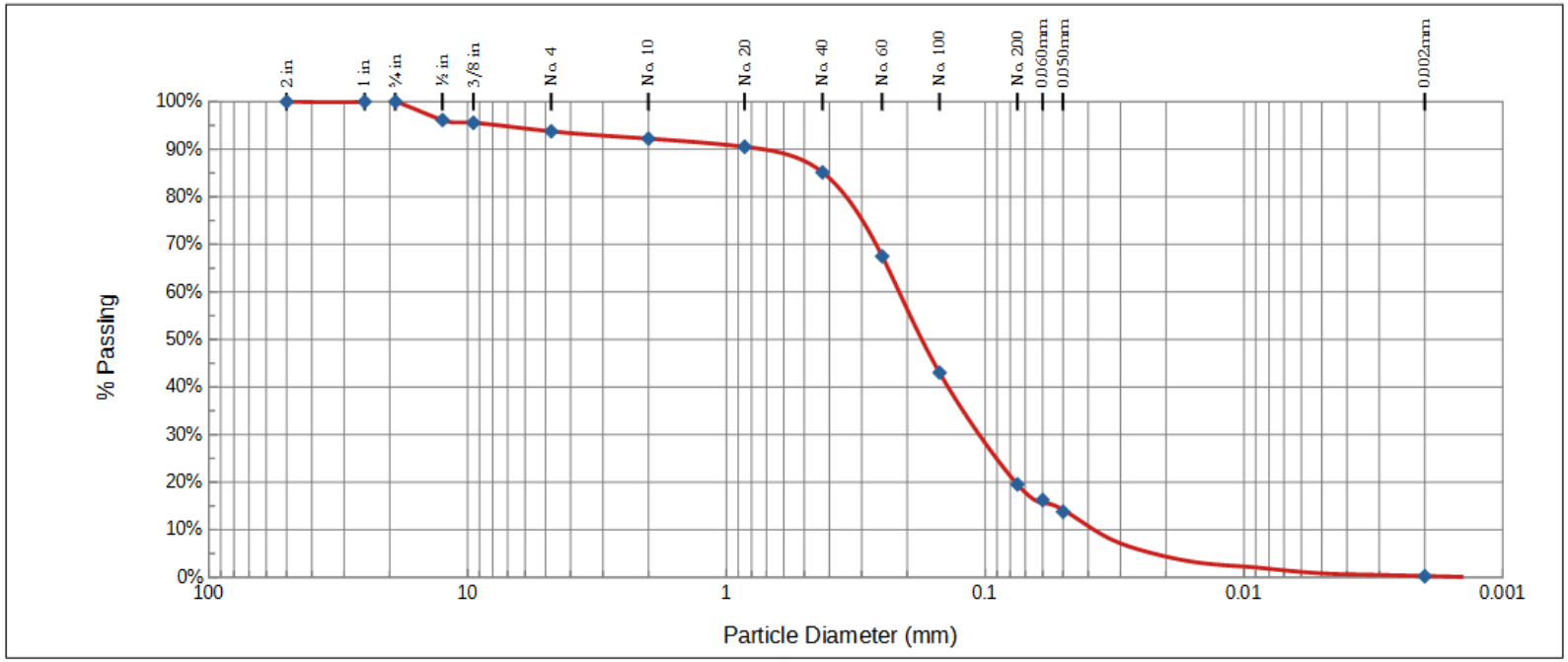
DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
- 1 ft	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	9	40.0	••••••••••	11	MEDIUM DENSE	STIFF
-	13	57.7	••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 2 ft	12	53.3	•••••••••••••	15	MEDIUM DENSE	STIFF
-	14	62.2	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	14	62.2	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 3 ft	14	62.2	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 1 m	19	84.4	•••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	20	77.2	••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 4 ft	14	54.0	•••••••••••••	15	MEDIUM DENSE	STIFF
-	12	46.3	••••••••••••	13	MEDIUM DENSE	STIFF
-	20	77.2	••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 5 ft	15	57.9	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	15	57.9	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	12	46.3	••••••••••••	13	MEDIUM DENSE	STIFF
- 6 ft	16	61.8	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	22	84.9	•••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
- 2 m	16	61.8	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 7 ft	14	47.9	••••••••••••	13	MEDIUM DENSE	STIFF
-	21	71.8	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	14	47.9	••••••••••••	13	MEDIUM DENSE	STIFF
- 8 ft	24	82.1	•••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
-	25	85.5	•••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	31	106.0	••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 9 ft	36	123.1	••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	32	109.4	••••••••••••••••••••••••••••	25+	DENSE	HARD
-	50	171.0	••	25+	DENSE	HARD
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Appendix D. Laboratory Results

SAMPLE ID: TP-1@8ft

☑ Sieve Analysis | ☑ Wet Wash | ☑ Hydrometer | ☐ Atterberg Limits

Project Name:	43rd Ave Apartment
Project Number:	QG24-160
Date Collected:	12/16/24
Date Reported:	01/10/25
Boring ID:	TP-1
Boring Depth:	8ft



USCS Scale	Coarse Gravel		Fine Gravel			Coarse Sand		Medium Sand		Fine Sand			(% of Fines Passing #200 Sieve) Hydrometer Method			Sand Total	Gravel Total
Sieve #	2"	1"	¾"	½"	3/8"	4	10	20	40	60	100	200					
Diameter, mm	50	25	19	12.5	9.5	4.75	2	0.85	0.425	0.25	0.15	0.075	0.060	0.050	0.002		
Retained	0.0%	0.0%	0.0%	3.9%	4.4%	6.3%	7.8%	9.5%	14.9%	32.5%	57.0%	80.5%				**74.2%**	**6.3%**
Passing	100.0%	100.0%	100.0%	96.1%	95.6%	93.7%	92.2%	90.5%	85.1%	67.5%	43.0%	**19.5%**	16.2%	13.8%	0.22%		

Graph Values

D90	0.81				
D60	0.22	**Coefficient of Uniformity:**	2.02	**CEC:**	4.6 meq/100g
D30	0.108	**Coefficient of Gradation:**	1.41	**OM (LOI 360):**	0.6 %
D10	0.038				

Unified Soil Classification System (USCS) Description	
SM	SILTY SAND

Staff Initials: T

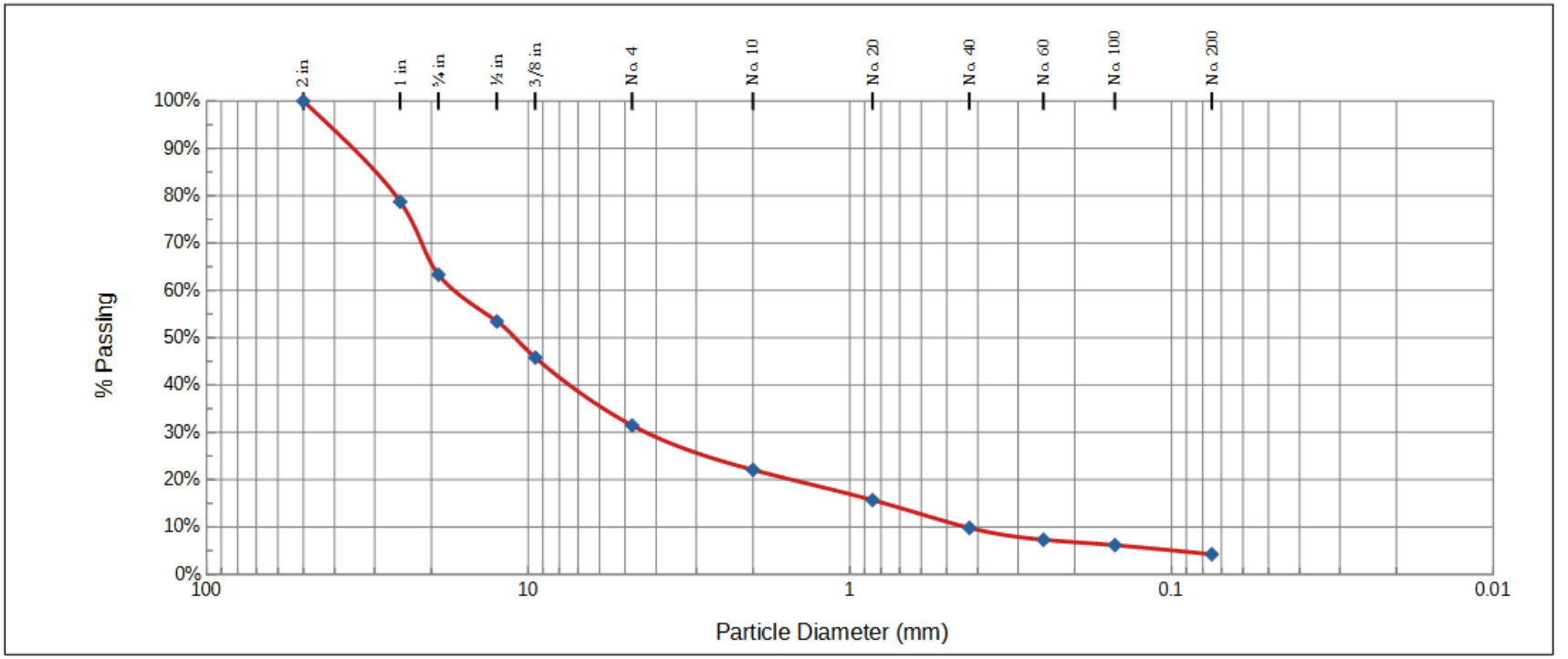
Test Methods: ASTM D6913, ASTM D7928

January 10, 2025

Project Name:	43rd Ave Apartment
Project Number:	QG24-160
Date Collected:	12/16/24
Date Reported:	01/08/25
Boring ID:	TP-2
Boring Depth:	2.5ft

SAMPLE ID: TP-2@2.5ft

☑ Sieve Analysis | ☑ Wet Wash | ☐ Hydrometer | ☐ Atterberg Limits



USCS Scale	Coarse Gravel		Fine Gravel			Coarse Sand		Medium Sand		Fine Sand			(% of Fines Passing #200 Sieve) Hydrometer Method			Sand Total	Gravel Total
Sieve #	2"	1"	¾"	½"	3/8"	4	10	20	40	60	100	200					
Diameter, mm	50	25	19	12.5	9.5	4.75	2	0.85	0.425	0.25	0.15	0.075	0.060	0.050	0.002		
Retained	0.0%	21.3%	36.7%	46.6%	54.2%	68.5%	77.9%	84.3%	90.2%	92.7%	93.9%	95.8%	NA	NA	NA	**27.2%**	**68.5%**
Passing	100.0%	78.7%	63.3%	53.4%	45.8%	31.5%	22.1%	15.7%	9.8%	7.3%	6.1%	**4.2%**					

Graph Values

D90	38.24				
D60	16.82	**Coefficient of Uniformity:**	3.89	**CEC:**	3.7 meq/100g
D30	4.324	**Coefficient of Gradation:**	2.53	**OM (LOI 360):**	1.8 %
D10	0.439				

Unified Soil Classification System (USCS) Description	
GP	POORLY GRADED GRAVEL with SAND

Staff Initials: T

Test Methods: ASTM D6913

January 8, 2025