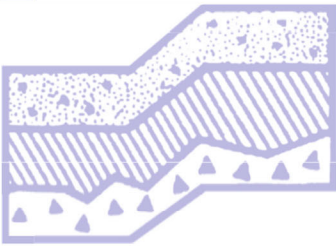


GEOTECHNICAL REPORT

**12844 NE 70th Place
Kirkland, Washington**

Project No. T-8533



Terra Associates, Inc.

Prepared for:

**Murray Franklyn Homes, LLC
Bellevue, Washington**

May 28th, 2021



TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

May 28, 2021
Project No. T-8533

Mr. Trey Woodruff
Murray Franklyn Homes, LLC
14410 Bel-Red Road
Bellevue, Washington 98007

Subject: Geotechnical Report
12844 NE 70th Place
Kirkland, Washington

Dear Mr. Woodruff:

As requested, we conducted a geotechnical engineering study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design and construction.

Site soils generally consist of 2 to 11 inches of topsoil overlying layers of medium dense to dense weathered and unweathered Advance outwash silty sand and sand. Undocumented fill was observed above native soils at the east-central part of the site. No groundwater was observed in any of the site explorations.

In our opinion, there are no geotechnical conditions that would preclude construction of the project as currently planned. The residence can be supported on conventional spread footings bearing on competent native soil or on structural fill placed on competent native soil subgrades. Floor slabs can be similarly supported.

Detailed recommendations addressing these issues and other geotechnical design considerations are presented in the attached report. We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
TERRA ASSOCIATES, INC.

Kevin P. Roberts, P.E.
Geotechnical Engineer



5-28-2021

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Geotechnical Report 12844 NE 70th Place Kirkland, Washington

1.0 PROJECT DESCRIPTION

The proposed project consists of subdividing the property into lots for new single-family residence construction and associated infrastructure improvements. Site development and building plans are currently unavailable for review. We expect the residences will be two- to three-story wood-framed structures constructed over a crawlspace with attached garages constructed at-grade. Foundation loads should be relatively light, in the range of 1 to 2 kips per foot for bearing walls and 25 to 50 kips for isolated columns.

The recommendations in this report are based on the design features discussed above. If actual features vary or changes are made, we should review the plans in order to modify our recommendations, as required. We recommend that we review final design drawings and specifications to verify our recommendations have been properly interpreted and incorporated into the project design.

2.0 SCOPE OF WORK

On April 30, 2021, we explored subsurface conditions at the site by excavating three test pits to depths of 9 and 10 feet below existing grades using a mini excavator. In addition, two small-scale Pilot Infiltration Tests (PITs) and associated test pits were completed at the site. Using the information obtained from our subsurface exploration and laboratory testing, we performed analyses to develop geotechnical engineering recommendations for project design and construction. Specifically, this report addresses the following:

- Soil and groundwater conditions.
- Geologic hazards per the City of Kirkland Zoning Code (KZC).
- Seismic Site Class.
- Site preparation and grading.
- Excavations.
- Foundations.
- Slab-on-grade floors.
- Lateral earth pressures for retaining wall design.
- Infiltration feasibility.
- Drainage.
- Utilities.
- Pavements.

It should be noted, recommendations outlined in this report regarding drainage are associated with soil strength, design earth pressures, erosion, and stability. Design and performance issues with respect to moisture as it relates to the structure environment are beyond Terra Associates, Inc.'s purview. A building envelope specialist or contractor should be consulted to address these issues, as needed.

3.0 SITE CONDITIONS

3.1 Surface

The site consists of four tax parcels totaling approximately 1.27 acres of land occupying the northwest corner of the intersection of NE 70th Place and 130th Avenue NE in Kirkland, Washington. The approximate location of the site is shown on Figure 1.

A single-story, single-family residence currently occupies the northeastern portion of the site. An asphalt driveway extends northward from NE 70th Place to an open, graveled area at the central part of the site. The site's topography is generally flat with 5- to 8-foot-tall west-facing slopes located along the east-central margin adjacent to 130th Avenue NE. We observed automotive junk and debris, including a pile of used engine oil filters in the north-central site location. Vegetation consists of mix of grasses, brush and scattered young to mature conifers and deciduous trees.

3.2 Soils

Organic surface soils at each test pit location consist of approximately 2 to 11 inches of topsoil or sod. Test Pit TP-2 showed fill composed of silty sand with masonry and wood pieces to a depth of 3 feet. Beneath the fill, we observed till-like soil consisting of dense, stratified, cemented silty sand/sand to a depth of 7 feet.

Weathered Advance outwash soil composed of medium dense silty sand was observed to a depth of 3 feet at TP-1, PIT-1 and PIT-2. Unweathered outwash soil consisting of dense sand was observed below the silty sand at these locations, and below the till-like soils at TP-2. Beneath the topsoil layer, TP-3 found Advance outwash soils consisting of dense sand/silty sand that is stratified and weakly cemented.

The *Geologic Map of the Kirkland Quadrangle, Washington*, by James P. Minard (1983), shows the site soils mapped as Till (Qvt). The native soils observed in the test pits are more consistent with the description given for Advance outwash (Qva) mapped approximately 400 feet southeast of the site.

Detailed descriptions of the subsurface conditions observed in our site explorations are presented on the Test Pit Logs in Appendix A. The approximate test pit locations are shown on Figure 2.

3.3 Groundwater

No groundwater was observed during excavation of the site's test pits. In addition, no soil mottling that would be indicative of seasonal fluctuating groundwater was noted in the test pits.

3.4 Geologic Hazards

We evaluated site conditions for the presence of Geologically Hazardous Areas as defined in Chapter 85 of the Kirkland Zoning Code (KZC). Discussions related to erosion, landslide, and seismic hazards are given below.

3.4.1 Erosion Hazard Areas

Chapter 85.10. of the KZC defines Erosion Hazard Areas as “Those areas containing soils which, according to the United States Department of Agriculture (USDA) Natural Resource Conservation Services (NRCS) Web Soil Survey, may experience severe to very severe erosion hazard.”

The NRCS has mapped the site soils as *Alderwood gravelly sandy loam, 8 to 15 percent slopes* (AgC). The erosion hazard of this soil type is described as slight, and therefore does not meet the above criteria defining an Erosion Hazard Area.

The site soils will be susceptible to erosion when exposed during construction. In our opinion, proper implementation, and maintenance of Best Management Practices (BMPs) for erosion prevention and sedimentation control will adequately mitigate the erosion potential in the planned development area. Erosion protection measures as required by the City of Kirkland will need to be in place prior to and during onsite grading activity.

3.4.2 Landslide Hazard Areas

Landslide Hazard Areas are defined in Chapter 85.10. of the KZC as “Areas at risk of mass movement due to a combination of geologic, topographic, and hydrologic factors. Includes high and moderate landslide hazard areas.”

City of Kirkland GIS Environment mapping published on their Interactive Mapping Portal website shows no landslide hazard areas mapped at the site. In addition, the 5- to 8-foot-tall west-facing slopes located along the site’s east-central margin showed no evidence of past or current soils movements, no zones of emergent groundwater, and are underlain by glacially consolidated Advance outwash and till-like soils. Based on the GIS mapping, and our field observations, the site does not contain landslide hazard areas.

3.4.3 Seismic Hazard Areas

Chapter 85.10. of the KZC defines Seismic Hazard Areas as “Those areas subject to severe risk of earthquake damage as a result of seismically induced ground shaking, slope failure, settlement or soil liquefaction, which typically occurs in areas underlain by cohesionless soils of low density usually in association with a shallow groundwater table.”

A review of a map titled *Faults and Earthquakes in Washington State*, dated 2014 by Jessica L. Czajkowski and Jeffrey D. Bowman shows the nearest fault is categorized as “Class B” and is located approximately two miles north of the site. Accordingly, during a seismic event, the risk of ground rupture along a fault line at the site is low.

City of Kirkland GIS Environment mapping shows the site as a “medium risk” liquefaction potential area. Based on the inherently high shear strength characteristics of the glacially consolidated soils, and the absence of groundwater, it is our opinion that the risk for damage resulting from earthquake-induced slope failure, settlement, lateral spreading, surface failure, or soil liquefaction is negligible. Therefore, in our opinion, unusual seismic hazard areas do not exist at the site and design in accordance with local building codes for determining seismic forces would adequately mitigate impacts associated with ground shaking during the design seismic event.

3.5 Seismic Site Class

Based on the site soil conditions and our knowledge of the area geology, per the 2018 International Building Code (IBC), Site Class “D” should be used in structural design.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 General

Based on our study, the site is suitable for the proposed construction from a geotechnical standpoint. Undisturbed bearing surfaces composed of the native soils, or structural fill placed on these native soils, will provide suitable support for conventional spread footing foundations. Floor slabs can be similarly supported.

Undocumented fill containing construction debris and organics were observed during excavation of Test Pit TP-2. These soils will not be suitable for direct support of buildings and pavements as excessive settlement would be expected. The unsuitable soils will need to be removed and grade restored with structural fill to establish adequate subgrade support.

The site’s soils contain high percentages of fines, (silt- and clay-sized particles) such that they will be difficult to compact as structural fill when too wet or too dry. If earthwork activities will take place during the winter season, the owner should be prepared to import free-draining granular material for use as structural fill and backfill.

Detailed recommendations regarding these issues and other geotechnical design considerations are provided in the following sections of this report. These recommendations should be incorporated into the final design drawings and construction specifications.

4.2 Site Preparation and Grading

To prepare the site for construction, vegetation as well as the sod/fill and topsoil in construction areas should be stripped and removed from the site. Organic soils will not be suitable for use as structural fill but may be used for limited depths in nonstructural areas or for landscaping purposes.

Demolition of the existing structures should include removal of existing foundations and slabs, pavements, and abandonment of underground utilities. Abandoned utility pipes that fall outside of new building areas can be left in place provided they are sealed to prevent intrusion of groundwater seepage and soil.

We recommend supporting the residence's foundations and slabs on competent, inorganic native soils, or structural fill placed on the competent soils. A representative of Terra Associates, Inc. should examine all bearing surfaces to verify conditions encountered are as anticipated and are suitable for placement of structural fill or direct support of building elements. If unstable yielding areas are observed, they should be cut to firm bearing soil and filled to grade with structural fill. As discussed above, undocumented fill containing construction debris and wood pieces was observed at the location of Test Pit TP-2. We recommend removing these soils and replacing with compacted structural fill to establish suitable subgrade support for structures and pavements.

The upper silty sand soils are highly moisture sensitive and will quickly degrade if exposed in wet weather. Placement of a layer of lean mix or crushed rock may be required to protect subgrades in building excavation areas if disturbed during wet weather.

Our study indicates most of the site's upper soils consist of silty sands, which will be difficult to compact as structural fill if they are too wet or too dry. Accordingly, the ability to use these soils from site excavations as structural fill will depend on their moisture content and the prevailing weather conditions when site grading activities take place. Native soils that are too wet to properly compact could be dried by aeration during dry weather conditions, or mixed with an additive such as cement, to stabilize the soil and facilitate compaction. If an additive is used, appropriate BMPs for its use will need to be incorporated into the Temporary Erosion and Sedimentation Control (TESC) Plan for the project.

If grading activities are planned during the wet winter months, or if they are initiated during the summer and extend into fall and winter, the owner should be prepared to import wet weather structural fill. For this purpose, we recommend importing a granular soil that meets the following grading requirements:

U.S. Sieve Size	Percent Passing
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

*Based on the 3/4-inch fraction.

Prior to use, Terra Associates, Inc. should examine and test all materials imported to the site for use as structural fill.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soil's maximum dry density, as determined by the American Society for Testing and Materials (ASTM) Test Designation D-1557 (Modified Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this ASTM standard. In nonstructural areas, the degree of compaction can be reduced to 90 percent. Structural fill materials and methods of compaction in rights of way must conform to the standards and specifications of the applicable jurisdiction.

4.3 Excavations

All excavations at the site associated with confined spaces, such as utility trenches, must be completed in accordance with local, state, or federal requirements. Based on current WISHA regulations, the site's medium dense silty sand would be classified as Type C soils. The dense to very dense Advance outwash sands would be classified as Type B soils. Accordingly, for temporary excavations of more than 4 feet and less than 20 feet in depth, the side slopes in Type C soils should be laid back at a slope inclination of 1.5:1 (Horizontal:Vertical) or flatter. Side slopes in Type B soils can be laid back at a slope inclination of 1:1 or flatter.

All exposed temporary slope faces that will remain open for an extended period of time should be covered with a durable reinforced plastic membrane during construction to prevent slope raveling and rutting during periods of precipitation.

This information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Terra Associates, Inc. assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

4.4 Foundations

The residence may be supported on conventional spread footing foundations bearing on competent native soils or on structural fills placed above these native soils. Foundation subgrades should be prepared as recommended in Section 4.2 of this report.

Perimeter foundations exposed to the weather should be at a minimum depth of 18 inches below final exterior grades. Interior foundations can be constructed at any convenient depth below the floor slab.

We recommend designing foundations bearing on competent soil for a net allowable bearing capacity of 2,500 pounds per square foot (psf). For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used in design. With the anticipated loads and this bearing stress applied, building settlements should be less than one-inch total and one-half inch differential.

A base friction coefficient of 0.35 can be used for designing foundations to resist lateral loads. Passive earth pressure acting on the sides of the footings may also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 350 pounds per cubic foot (pcf). We recommend not including the upper 12 inches of soil in this computation because it can be affected by weather or disturbed by future grading activity. This value assumes the foundations will be constructed neat against competent native soil or the excavations are backfilled with structural fill, as described in Section 4.2 of this report. The recommended passive and friction values include a safety factor of 1.5.

4.5 Slab-on-Grade Floors

Slab-on-grade floors may be supported on a subgrade prepared as recommended in Section 4.2 of this report. Immediately below the floor slab, we recommend placing a four-inch thick capillary break layer composed of clean, coarse sand or fine gravel that has less than five percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer, then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction and aid in uniform curing of the concrete slab. It should be noted, if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will be ineffective in assisting uniform curing of the slab and can actually serve as a water supply for moisture seeping through the slab that adversely affects floor coverings. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided if floor slab construction occurs during the wet winter months and the layer cannot be effectively drained.

4.6 Lateral Earth Pressures

The magnitude of earth pressure development on engineered retaining walls will partly depend on the quality of the wall backfill. We recommend placing and compacting wall backfill as structural fill as described in Section 4.2 of this report. For the drained condition, we recommend designing restrained lower-level walls using an at rest earth pressure equivalent to a fluid weighing 50 pounds per cubic foot (pcf). Walls that are free to deflect and support level grades should be designed for an active-earth pressure equivalent to a fluid weighing 35 pounds per cubic foot (pcf). For evaluation of wall performance under seismic loading, a uniform pressure equivalent to $8H$ psf, where H is the height of the below-grade portion of the wall should be applied in addition to the static lateral earth pressure. To guard against hydrostatic pressure development, wall drainage must be installed. A typical recommended wall drainage detail is shown on Figure 3.

Friction at the base of wall foundations and passive earth pressures will provide resistance to lateral loads. Values for these parameters are provided in Section 4.4 of this report.

4.7 Infiltration Feasibility

Based on a review of our field and laboratory data, the native Advance outwash sand soils at the site will support infiltration of project stormwater. We completed two small-scale pilot infiltration tests (PITs) to obtain preliminary infiltration rates for stormwater facility design. The PITs were conducted in general conformance with the procedures outlined in Chapter 5, Section 5.2 of the 2016 King County Surface Water Design Manual and City of Kirkland Policy D-10 Addendum to the 2016 KCSWDM. The soils exposed at the bottom of the PITs consist of dense Advance outwash sand.

The tests were completed at the approximate location shown on attached Figure 2. The Test Pit Logs associated with the PITs are presented in Appendix A. The Pilot Infiltration Test results are presented in Appendix B. The test results are summarized below:

Table A – Small Scale Pilot Infiltration Test Results

Test No.	Test Depth (ft b.g.s.)	Steady State Flow Rate (gpm)	Measured Infiltration Rate ($I_{sat \text{ initial}}$) (in/hr)	Total Combined Correction Factor CF_T^1	Design Infiltration Rate ($I_{sat \text{ design}} = I_{sat \text{ test}} \times CF_T$) (in/hr)
PIT-1	3.0	3.00	9.36	0.40	3
PIT-2	3.5	3.50	10.92	0.40	4

The correction factor for facility geometry incorporated in the above total correction factor assumes that the facility will have an assumed facility width of 10 feet and, based on the absence of groundwater in our explorations, a minimum separation distance of 5 feet between the base of the facility and any groundwater underlying the site. We should review final storm drainage plans to assess the suitability of the design infiltration rate for project infiltration facilities. Additional testing may be required once the facilities have been sized and placed.

4.8 Drainage

Surface

Final exterior grades should promote free and positive drainage away from the building at all times. Water must not be allowed to pond or collect adjacent to foundations or within the immediate building area. We recommend providing a positive drainage gradient away from the building perimeter. If this gradient cannot be provided, surface water should be collected adjacent to the structure and directed to appropriate storm facilities.

Subsurface

We recommend installing a continuous drain along the outside lower edge of shallow perimeter building foundations. Foundation drains should be tightlined to an approved point of controlled discharge independent of the roof drain system. Subsurface drains must be laid with a gradient sufficient to promote positive flow to the point of discharge. All drains should be provided with cleanouts at easily accessible locations. These cleanouts should be serviced at least once every year.

4.9 Utilities

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA) or local jurisdictional requirements. At a minimum, trench backfill should be placed and compacted as structural fill as described in Section 4.2 of this report. With proper moisture conditioning, we anticipate soils excavated from the site will generally be suitable for use as backfill material during dry weather conditions.

4.10 Pavements

Pavement subgrades should be prepared as described in Section 4.2 of this report. Regardless of the degree of relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. The subgrade should be proofrolled with heavy rubber-tired construction equipment such as a loaded 10-yard dump truck to verify this condition.

The pavement design section is dependent upon the supporting capability of the subgrade soils and the traffic conditions to which it will be subjected. For residential access, with traffic consisting mainly of light passenger vehicles with only occasional heavy traffic and with a stable subgrade prepared as recommended, we recommend the following options for pavement sections:

- Two inches of hot mix asphalt (HMA) over four inches of crushed rock base (CRB)
- Full depth HMA – 3.5 inches

The paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for half-inch class HMA and CRB.

Long-term pavement performance will depend on surface drainage. A poorly-drained pavement section will be subject to premature failure resulting from surface water infiltrating the subgrade soils and reducing their supporting capability. For optimum performance, we recommend surface drainage gradients of at least two percent. Some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks as they occur.

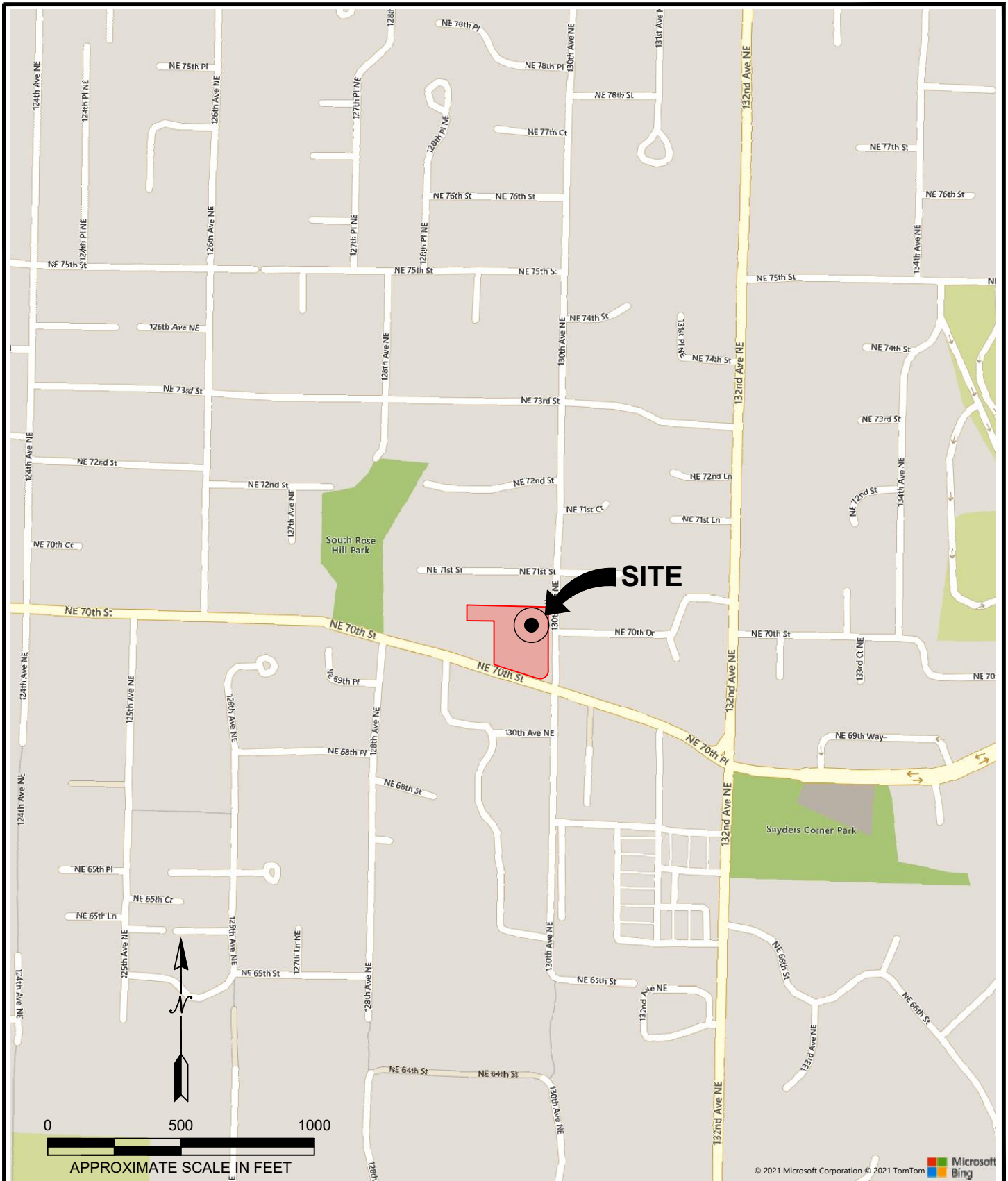
5.0 ADDITIONAL SERVICES

Terra Associates, Inc. should review the final designs and specifications to verify earthwork and foundation recommendations have been properly interpreted and implemented in project design. We should also provide geotechnical services during construction to observe compliance with our design concepts, specifications, and recommendations. This will allow for design changes if subsurface conditions differ from those anticipated prior to the start of construction.

6.0 LIMITATIONS

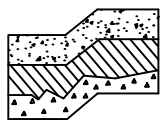
We prepared this report in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made. This report is the copyrighted property of Terra Associates, Inc. and is intended for specific application to the 12844 NE 70th Place project in Kirkland, Washington. This report is for the exclusive use of Murray Franklyn Homes, LLC, and their authorized representatives. No other warranty, expressed or implied, is made.

The analyses and recommendations presented in this report are based on data obtained from the test pits excavated at the site. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, Terra Associates, Inc. should be requested to reevaluate the recommendations in this report, prior to proceeding with construction.



REFERENCE: <https://www.bing.com/maps>

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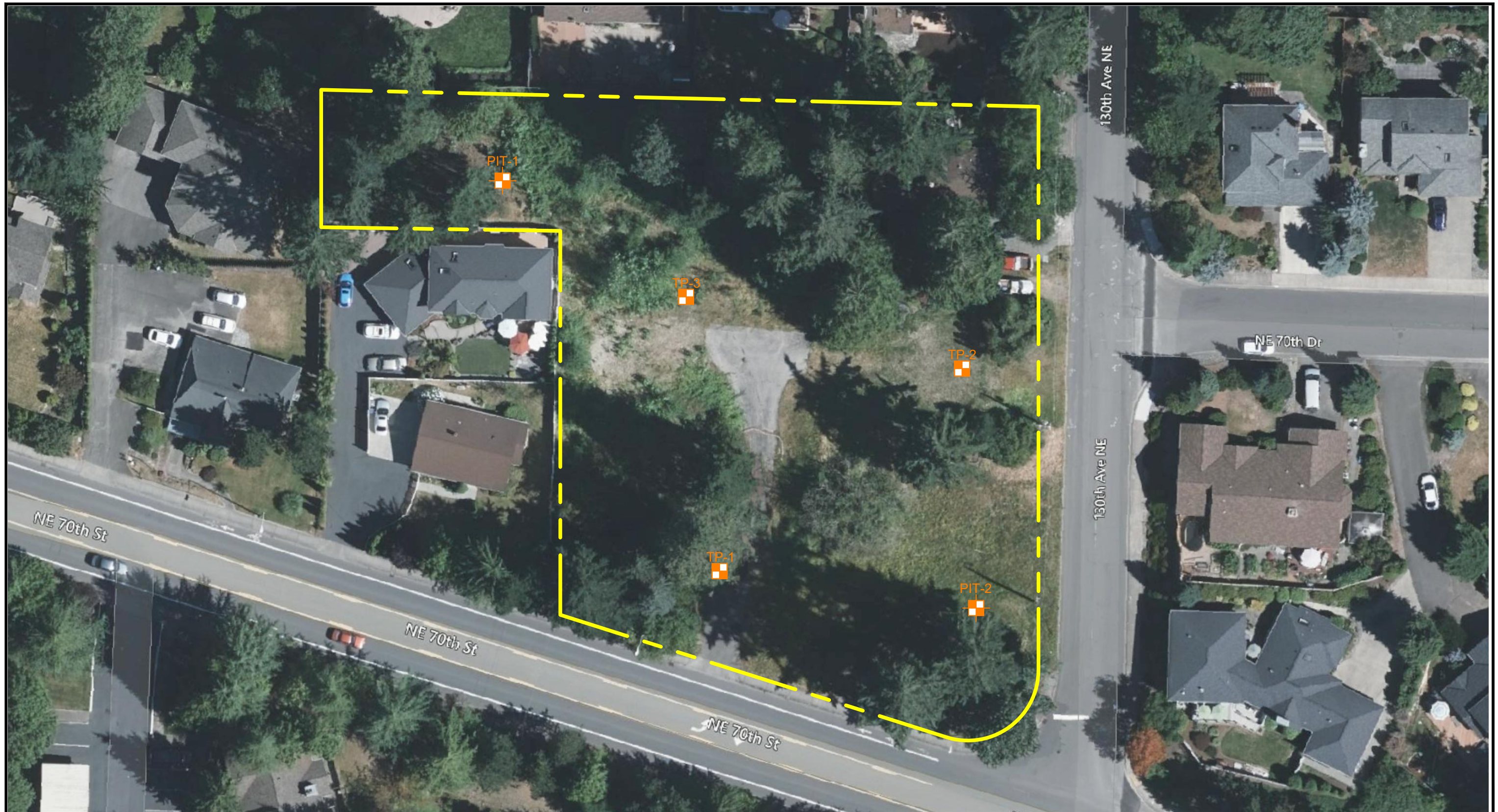
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VICINITY MAP
 12844 NE 70TH PLACE
 KIRKLAND, WASHINGTON

Proj.No. T-8533

Date: MAY 2021

Figure 1





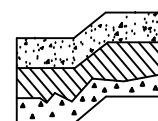
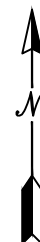
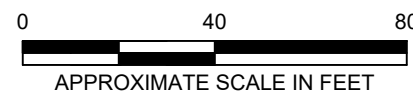
NOTE:

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

REFERENCE: SITE PLAN PROVIDED BY BING MAPS.

LEGEND:

-  APPROXIMATE TEST PIT LOCATION
-  APPROXIMATE PILOT INFILTRATION TEST LOCATION



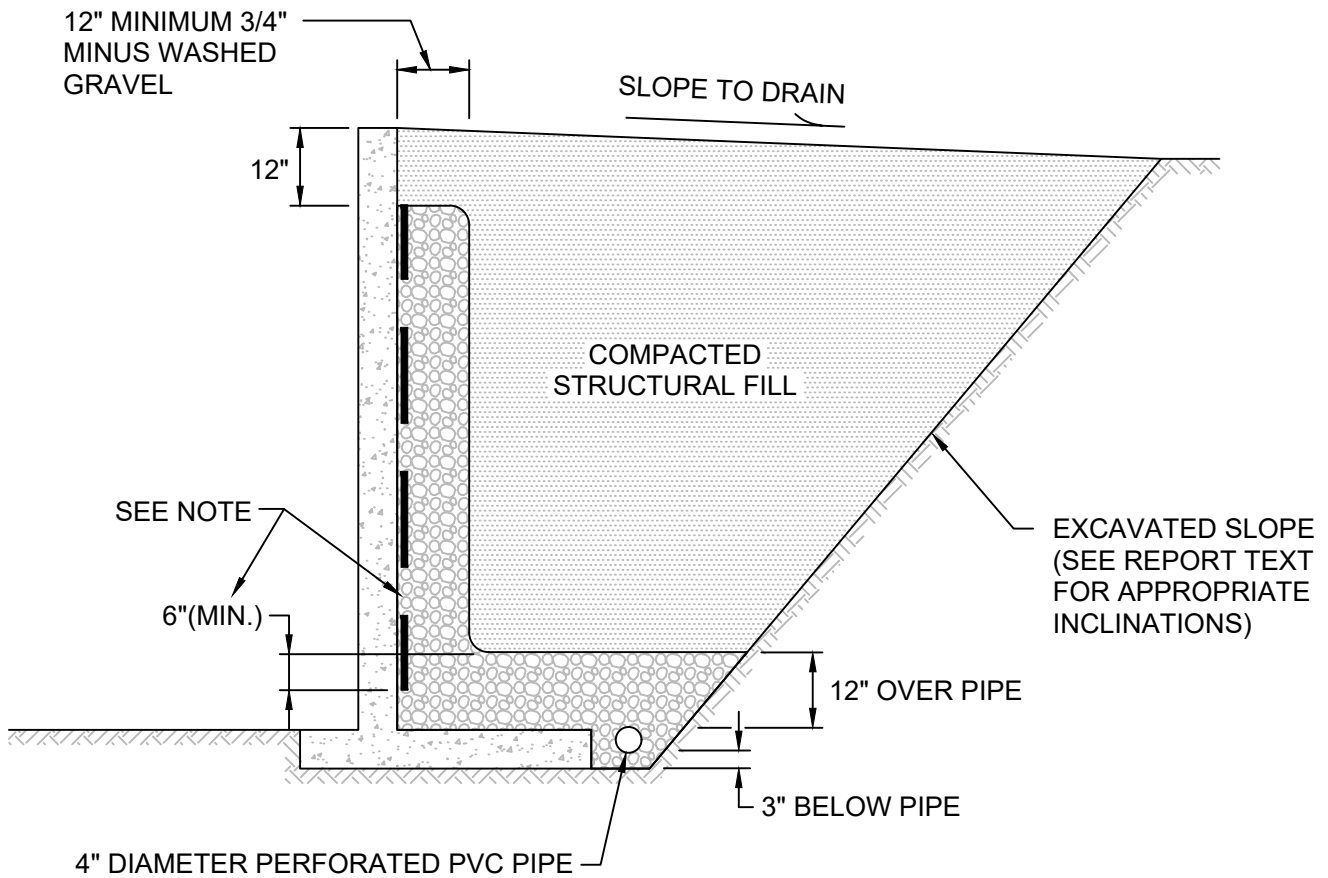
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EXPLORATION LOCATION PLAN
 12844 NE 70TH PLACE
 KIRKLAND, WASHINGTON

Proj.No. T-8533

Date: MAY 2021

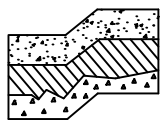
Figure 2



NOT TO SCALE

NOTE:

MIRADRAIN G100N PREFABRICATED DRAINAGE PANELS OR SIMILAR PRODUCT CAN BE SUBSTITUTED FOR THE 12-INCH WIDE GRAVEL DRAIN BEHIND WALL. DRAINAGE PANELS SHOULD EXTEND A MINIMUM OF SIX INCHES INTO 12-INCH THICK DRAINAGE GRAVEL LAYER OVER PERFORATED DRAIN PIPE.



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TYPICAL WALL DRAINAGE DETAIL
 12844 NE 70TH PLACE
 KIRKLAND, WASHINGTON

Proj.No. T-8533

Date: MAY 2021

Figure 3

**APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTING**

**12844 NE 70th Place
Kirkland, Washington**




On April 30, 2021, we explored subsurface conditions at the site by excavating three test pits to depths of 9 and 10 feet below existing grades using a mini excavator. Two small-scale Pilot Infiltration Tests (PITs) and associated test pits were also completed at the site. Our explorations were approximately determined in the field by measuring from existing site features. The approximate test pit and PIT locations are shown on Figure 2.

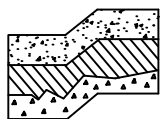
A geotechnical engineer from our office conducted the field exploration, classified the soils observed in the test pits and PITs, maintained a written log of each exploration, collected representative soil samples, and performed a visual site reconnaissance. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1. The Test Pit and PIT Logs are presented as Figures A-2 through A-6.

Representative soil samples collected from the test pits were placed in closed containers and taken to our laboratory for further examination and testing. Laboratory testing consisted of determining the soil moisture content of all samples and grain size distribution analyses of 6 soil samples. The soil moistures are reported on the Test Pit and PIT Logs. The grain size distribution test results are shown on Figures A-7 and A-8.

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTION	
COARSE GRAINED SOILS	More than 50% material larger than No. 200 sieve size	GRAVELS More than 50% of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
			Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
				GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	More than 50% of coarse fraction is smaller than No. 4 sieve	SANDS More than 50% of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, sands with gravel, little or no fines.
				SP	Poorly-graded sands, sands with gravel, little or no fines.
			Sands with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
				SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS	More than 50% material smaller than No. 200 sieve size	SILTS AND CLAYS Liquid Limit is less than 50%	ML	Inorganic silts, rock flour, clayey silts with slight plasticity.	
			CL	Inorganic clays of low to medium plasticity. (Lean clay)	
			OL	Organic silts and organic clays of low plasticity.	
		SILTS AND CLAYS Liquid Limit is greater than 50%	MH	Inorganic silts, elastic.	
			CH	Inorganic clays of high plasticity. (Fat clay)	
			OH	Organic clays of high plasticity.	
HIGHLY ORGANIC SOILS			PT	Peat.	

DEFINITION OF TERMS AND SYMBOLS

COHESIONLESS	<u>Density</u>	<u>Standard Penetration Resistance in Blows/Foot</u>		2" OUTSIDE DIAMETER SPILT SPOON SAMPLER
	Very Loose Loose Medium Dense Dense Very Dense	0-4 4-10 10-30 30-50 >50		2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER
COHESIVE	<u>Consistency</u>	<u>Standard Penetration Resistance in Blows/Foot</u>		WATER LEVEL (Date)
	Very Soft Soft Medium Stiff Stiff Very Stiff Hard	0-2 2-4 4-8 8-16 16-32 >32	Tr	TORVANE READINGS, tsf
			Pp	PENETROMETER READING, tsf
			DD	DRY DENSITY, pounds per cubic foot
			LL	LIQUID LIMIT, percent
			PI	PLASTIC INDEX
		N	STANDARD PENETRATION, blows per foot	



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UNIFIED SOIL CLASSIFICATION SYSTEM
12844 NE 70TH PLACE
KIRKLAND, WASHINGTON

Proj.No. T-8533

Date: MAY 2021

Figure A-1

LOG OF PILOT INFILTRATION TEST PIT-1

FIGURE A-2

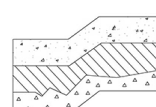
PROJECT NAME: 12844 NE 70th Place **PROJ. NO:** T-8533 **LOGGED BY:** KPR

LOCATION: Kirkland, Washington **SURFACE CONDITIONS:** Brush **APPROX. ELEV:** NA

DATE LOGGED: April 30, 2021 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** 7 Feet

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		5 inches TOPSOIL		
1		Light brown silty SAND with gravel, moist. (SM) (Weathered Advance outwash)	Medium Dense	9.2
2				
3		3 feet: Pilot Infiltration Test		
4		----- Gray SAND with gravel, fine to medium grained, moist. (SP) (Advance outwash)	Dense	14.8
5				
6				
7				
8				
9				
10		Total depth 10 feet. No groundwater. No caving. No groundwater mounding from PIT.		
11				
12				14.7

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF PILOT INFILTRATION TEST PIT-2

FIGURE A-3

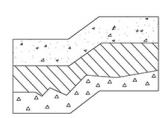
PROJECT NAME: 12844 NE 70th Place **PROJ. NO:** T-8533 **LOGGED BY:** KPR

LOCATION: Kirkland, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: April 30, 2021 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		5 inches SOD		
1		Brown silty SAND with gravel, fine grained, moist. (SM) (Weathered Advance outwash)	Medium Dense	
2				
3		3.5 feet: Pilot Infiltration Test		
4		Brownish-gray SAND with silt, fine to medium grained, stratified, weakly cemented, moist. (SP-SM) (Advance outwash)		
5				
6			Very Dense	
7				
8				
9				
10		Total depth 10 feet. No groundwater. No caving. Groundwater mounding from PIT at 3.5 to 5 feet.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT TP-1

FIGURE A-4

PROJECT NAME: 12844 NE 70th Place **PROJ. NO:** T-8533 **LOGGED BY:** KPR

LOCATION: Kirkland, Washington **SURFACE CONDITIONS:** Brush **APPROX. ELEV:** NA

DATE LOGGED: April 30, 2021 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		11 inches TOPSOIL		
1		Light brown silty SAND with gravel, scattered cobbles, fine to medium grained, moist. (SM) (Weathered Advance outwash)	Medium Dense	
2				
3		Gray SAND with gravel, scattered cobbles, medium grained, moist. (SP) (Advance outwash)		
4				
5				
6			Dense	
7				
8				
9		Test pit terminated at 9 feet. No groundwater. No caving.		
10				
11				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT TP-2

FIGURE A-5

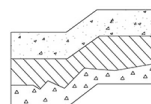
PROJECT NAME: 12844 NE 70th Place **PROJ. NO:** T-8533 **LOGGED BY:** KPR

LOCATION: Kirkland, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: April 30, 2021 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		2 inches FILL/SOD		
1		Brown silty SAND, scattered masonry, concrete and wood pieces, fine to medium sand, moist. (SM)	Medium Dense	
2				
3		Grayish-brown stratified cemented silty SAND and fine to medium-grained SAND, moist. (SP/SM) (Till like)	Dense	
4				
5				
6				
7		Brownish-gray SAND with silt and gravel, fine to medium grained, moist. (SP-SM) (Advance outwash)		
8				
9				
10		Test pit terminated at 10 feet. No groundwater. No caving.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT TP-3

FIGURE A-6

PROJECT NAME: 12844 NE 70th Place **PROJ. NO:** T-8533 **LOGGED BY:** KPR

LOCATION: Kirkland, Washington **SURFACE CONDITIONS:** Sparse Grass **APPROX. ELEV:** NA

DATE LOGGED: April 30, 2021 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

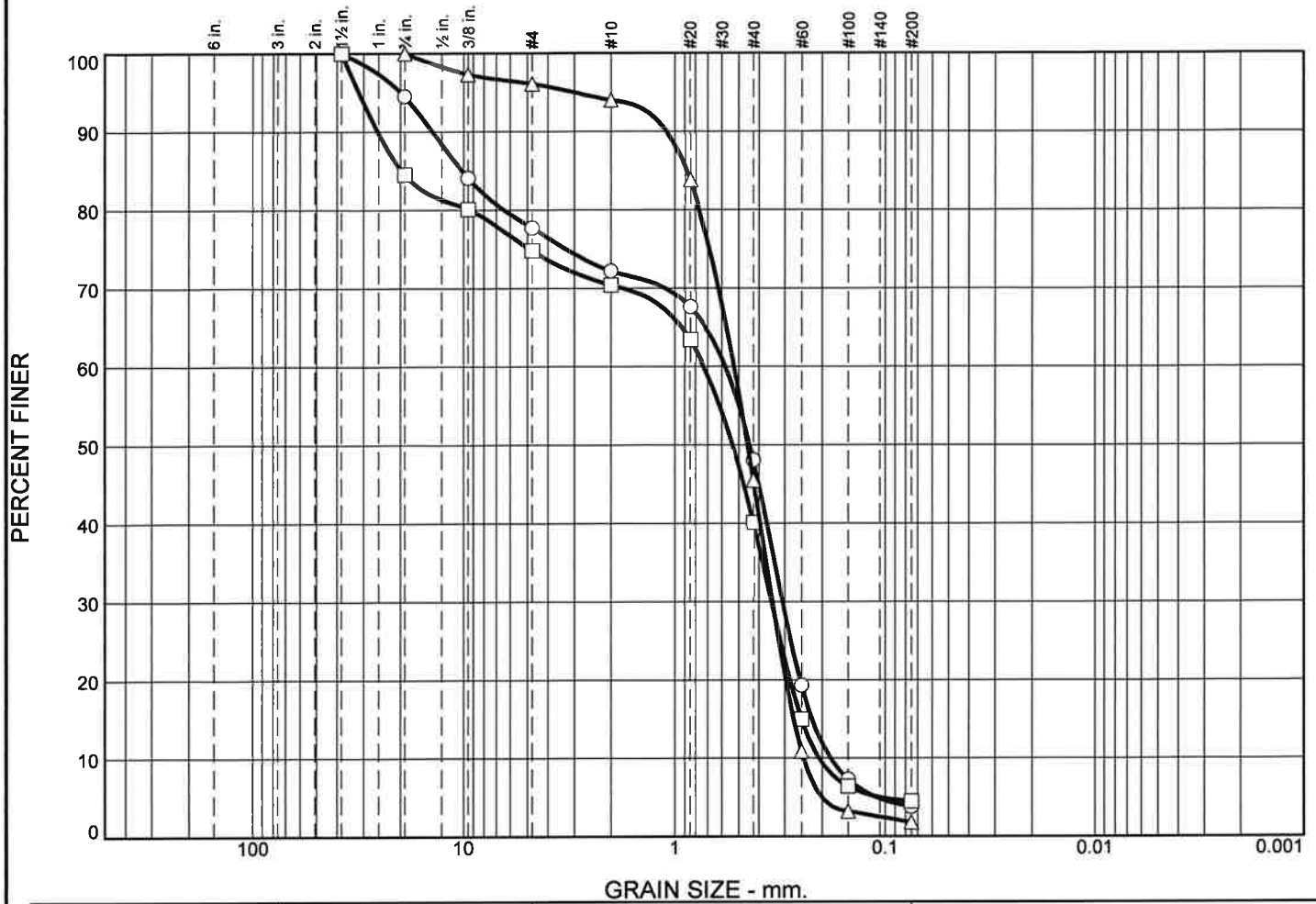
Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		6 inches TOPSOIL		
1		Grayish-brown stratifies SAND with gravel and silty fine SAND, weakly cemented, moist. (SP/SM) (Advance outwash)		
2				
3				
4				
5			Dense	
6				
7				
8				
9				
10		Test pit terminated at 10 feet. No groundwater. No caving.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	5.5	16.8	5.5	24.1	44.3	3.8			
□	0.0	15.5	9.7	4.4	30.3	35.6	4.5			
△	0.0	0.0	3.9	2.1	48.5	43.7	1.8			
×	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○			10.1703	0.5783	0.4422	0.3080	0.2229	0.1821	0.90	3.18
□			19.7326	0.7303	0.5342	0.3482	0.2500	0.2065	0.80	3.54
△			0.8826	0.5257	0.4527	0.3443	0.2726	0.2444	0.92	2.15

Material Description	USCS	AASHTO
○ SAND with gravel	SP	
□ SAND with gravel	SP	
△ SAND	SP	

<p>Project No. T-8533 Client: Murray Franklyn Homes, LLC</p> <p>Project: 12844 NE 70th Place</p> <p>○ Location: PIT-1 Depth: -4 feet</p> <p>□ Location: PIT-2 Depth: -4 feet</p> <p>△ Location: PIT-2 Depth: -10 feet</p> <p style="text-align: center;">Terra Associates, Inc.</p> <p style="text-align: center;">Kirkland, WA</p>	<p>Remarks:</p> <p style="text-align: right;">Figure A-8</p>
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Tested By: FQ _____

APPENDIX B
PILOT INFILTRATION TEST DATA

Test Number: PIT-1
Project Name: 12844 NE 70th Place
Project Number: T-8533
Test Date: 4/30/2021
Test Procedure: Small-Scale PIT, Reference 6A, 2016 KCSWDM

hole dimensions 3'x4'x3'D
 Hole area 12 square feet
 initial meter reading 200 gal

time (minutes)	cum vol (gal)	flow rate (gpm)	Head (feet)	vol reading (gal)
15	38	2.50	1	238
30	90	3.00	1	290
45	132	3.00	1	332
60	378	3.00	1	378

Falling head test

time (minute)	HEAD (feet)
0.00	1
15.00	0.78
30.00	0.58
45.00	0.4
60.00	0.22

Use mean flow rate over final 30 minutes of test as steady state infiltration rate

3.00 gpm

0.40 cfm

Infiltration rate=steady state flow divided by area of pit

0.03 feet per minute

0.40 inches per minute

measured infiltration rate using steady state data 24.06 inches per hour

measured infiltration rate using falling head data 9.36 inches per hour

Correction factors	
F-testing	0.5
F-geometry	1
F-plugging	0.8

Correction factors from the 2016 King County Surface Water Design Manual Section 5.2.

Assumed facility width = 10 feet. Assumed depth to groundwater = 5 feet.

Corrected steady state infiltration rate

9.63 inches per hour

Corrected falling head infiltration rate

3.74 , say, 3 inches per hour

Test Number: PIT-2
Project Name: 12844 NE 70th Place
Project Number: T-8533
Test Date: 4/30/2021
Test Procedure: Small-Scale PIT, Reference 6A, 2016 KCSWDM

hole dimensions 3'x5'x3.5'D
 Hole area 15 square feet
 initial meter reading 211 gal

time (minutes)	cum vol (gal)	flow rate (gpm)	Head (feet)	vol reading (gal)
15	84	4.42	1	295
30	145	3.66	1.04	356
45	200	3.70	1.04	411
60	378	3.30	1.04	471

Falling head test

time (minute)	HEAD (feet)
0.00	1.04
15.00	0.78
30.00	0.56
45.00	0.34
60.00	0.13

Use mean flow rate over final 30 minutes of test as steady state infiltration rate

3.50 gpm

0.47 cfm

infiltration rate=steady state flow divided by area of pit

0.03 feet per minute

0.37 inches per minute

measured infiltration rate using steady state data 22.46 inches per hour

measured infiltration rate using falling head data 10.92 inches per hour

Correction factors	
F-testing	0.5
F-geometry	1
F-plugging	0.8

Correction factors from the 2016 King County Surface Water Design Manual Section 5.2.

Assumed facility width = 10 feet. Assumed depth to groundwater = 5 feet.

Corrected steady state infiltration rate

8.98 inches per hour

Corrected falling head infiltration rate

4.37 , say, 4 inches per hour