



**Pacific Lifestyle Homes, Inc.
Geotechnical Engineering Evaluation**

**Monte Verde Subdivision
22205 NE 28th St, Camas WA 98607
Camas, Washington 98607**

**True North Project No. 22-0111-1
July 2022**

July 12, 2022

Pacific Lifestyle Homes, Inc
11815 NE 99th Street, Suite 1200
Vancouver, WA 98682



Attn: Mr. Nick Peets

Subject: Geotechnical Engineering Evaluation
Monte Verde Subdivision
22205 NE 28th St, Camas, WA 98607
Clark County Parcel No. 173184000
True North Project # 22-0111-1

Dear Mr. Peets:

At your request, True North Geotechnical Services (True North) is providing you with this report summarizing our geotechnical services for the proposed new Monte Verde Subdivision residential development to be located at the above-mentioned address in Camas, Washington (site). The purpose of our services was to provide a geotechnical evaluation of the site as it pertains to the proposed new development.

We have endeavored to prepare this report in accordance with generally accepted geotechnical engineering practices at the time we prepared it, for the exclusive use of Pacific Lifestyle Homes, Inc. (PLH), the owner, and their agents, for specific application to this project. Use or reliance upon this report by a third party is at their own risk. True North does not make any representation or warranty, express or implied, to such other parties as to the accuracy or completeness of this report or the suitability of its use by such other parties for any purpose whatever, known or unknown, to True North.

Based on the results of our study, development of the site with the proposed buildings and associated parking and utilities is feasible provided the recommendations in this report are included in the project design and implemented during construction. The chief geotechnical concerns of note associated with the project are ensuring foundations are bearing on dense, competent native soils and designing a stormwater system that meets the needs of the site while taking into account the depth of groundwater within the lower, southern portion of the site.

The attached report includes a summary of our project understanding, geologic site reconnaissance, subsurface explorations, and our conclusions regarding the expected effect that the proposed lot development will have on the site.

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PURPOSE AND SCOPE OF WORK

The purpose of our services was to provide a geotechnical evaluation of the site as it pertains to the proposed new development. This report includes a summary of our project understanding, geologic site reconnaissance, subsurface exploration, our conclusions regarding the effects of the proposed lot development on the site, and recommendations for design and construction.

The following describes our specific scope of work that was completed:

- **Geologic Map and Literature Review:** We reviewed published geologic and geologic hazard mapping for the site.
- **Test Pit Excavations:** We completed eight (8) test pit excavations on the property. The test pit excavations extended to depths ranging from about 6 to 12 feet below the ground surface (bgs).
- **Laboratory Testing:** Samples collected from the borings were returned to our office for further examination including classification in general accordance with the Unified Soil Classification, Visual-Manual Procedure. Select samples were subjected to laboratory testing, including natural moisture content analysis, and fines content analysis.
- **Analysis:** Data collected during the literature research, subsurface explorations, and laboratory testing were used to develop site-specific geotechnical design parameters and construction recommendations.
- **Report Preparation:** This Geotechnical Engineering Evaluation summarizes the results of our explorations and analyses, including information relating to the following:
 - Exploration logs and site plan with exploration locations
 - Laboratory test results
 - Summary of interpreted surface and subsurface conditions
 - Shallow foundation design recommendations
 - Minimum embedment and allowable bearing pressure
 - Estimated settlement
 - Sliding coefficient and passive earth pressure
 - Subsurface drainage requirements
 - Earthwork recommendations
 - Temporary and permanent slope inclinations
 - Structural fill materials and preparation
 - Suitability of native and on-site soils for reuse as structural fill
 - Wet weather/conditions consideration
 - Foundation, slab and pavement subgrade preparation recommendations
 - Flexible and rigid pavement design recommendations
 - Utility trench excavation and backfill recommendations for associated utilities
 - Seismic design criteria and design considerations

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PROJECT UNDERSTANDING

True North understands that you are planning to subdivide an existing City of Camas/Clark County Tax Parcel, No. 173184000, comprising approximately 8.84 acres.

True North's understanding of the proposed development is based on a review of a "Preliminary Plat" for the project, prepared by PLS Engineering, dated October 6, 2021. We understand that the proposed project consists of the subdivision of the existing lot into 34 new lots. The new lots will range in size from approximately 5900 to 8300 square-feet, and will each accommodate one single-family home. An existing Bonneville Power Administration (BPA) transmission line easement bisects the site, where we understand no new lots will be developed, and instead a shared park area will be constructed. We understand that one new private roadway, NW Noble Ave, is planned to provide access to the lots from NE 28th Street, where some frontage improvements to NE 28th Street will be also be completed. In general, we understand that utilities are planned below the new roadways. The site with respect to existing nearby features is shown in the attached Vicinity Map, Figure 1. The location of our explorations with respect to existing site conditions and boundaries is shown on the attached Figure 2, Site and Exploration Plan.

We anticipate the future homes at all lots will have relatively short driveways to the new private roadway and will be supported by conventional concrete spread footings. We also understand that the stormwater management is planned for the lots at a planned storm facility tract located at the southwest corner of the site. Based on our understanding of proposed development, we anticipate cuts and fills of less than 4 feet across the site. The purpose of our explorations was to evaluate subsurface conditions and provide geotechnical recommendations for design and construction, including site preparation and support of the proposed new development.

SITE CONDITIONS

Geologic Setting

The site is located in the eastern margin of the Portland Basin, a structural basin with basalt bedrock overlain by sediment associated with repeated glacial outburst flooding of the Columbia River and its tributaries. The last of these outburst flooding events, known as the Missoula Floods, occurred about 10,000 years ago. The flood deposits include layers of clay, silt, sand, and gravel. Some layers may include boulders up to 8 feet in diameter.

In the immediate vicinity of the site, the near surface soils are mapped as Pliocene-age gravel facies (Qfg), consisting of unconsolidated bouldery pebble to cobble gravel, underlain at depth by Pleistocene- or Pliocene-age unconsolidated to semi-consolidated pebble to boulder conglomerate (QTc).

Surface Conditions

The site consists of the above-mentioned parcel, which comprises approximately 8.84 acres located on the south side of NE 28th Street. There is a 0.37 acre parcel currently developed with a

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manufactured home at the northeastern extent of the site, which includes a driveway. The parcel to the west of the site is developed with a single family home, detached garage, and two outbuildings, including a driveway. The parcel to the east of the site is undeveloped and owned by Clark County Parks.

The ground surface at the site slopes gently towards the south at a gradient of approximately 0 to 10 percent. The site ranges in elevation from about 286 feet above mean sea level (AMSL) at the northern end of the property to about 238 feet AMSL at the southern extent. The majority of the site is open pasture and the southernmost quarter of the site is lightly wooded, consisting of undergrowth, shrubs, and tall deciduous and evergreen trees.

Subsurface Conditions

On May 6th, 2022, we visited the site to excavate eight test pits and to perform two infiltration tests (see attached Site Plan, Figure 2). The test pit explorations, designated TP-1 through TP-8, were excavated to maximum depths between about 6 and 12 feet bgs. The approximate test pit locations are shown on Figure 2. Descriptions of field and laboratory procedures and the interpreted exploration logs are included in Attachment A. The following is a generalized description of the subsurface units encountered in our explorations:

TOPSOIL: Dark brown silty topsoil with varying amounts of organics and tree roots was observed at the surface in all our test pits, extending to depths ranging from about 6 to 24 inches bgs.

Silty/Clayey SAND: Dark brown to light brown silty/clayey Sand (SM) with gravel was encountered just below the topsoil in all the test pits, extending to depths of about 4 to 9 feet below grade. Samples from TP-7 and TP-8 contained more clay and silt. Generally, the relative density of this layer was medium dense, with the density increasing with depth, and becoming consistently coarser with depth. The moisture content of eight samples tested from this layer ranged from about 27 to 36 percent. The fines content of one sample from this layer in TP-7 was measured to be about 14 percent.

Sandy GRAVEL: Gray-brown to brown Sandy Gravel (GP) with silt and cobbles was encountered below the sand layer in all test pits extending to the termination depth in all, at about 6 to 12 feet bgs. In general, the relative density of this layer was dense to very dense, and soil particles were observed to consistently increase in size with depth. The moisture content of samples tested from this layer ranged from about 18 to 58 percent. The fines content of one sample from this layer in TP-3 was about 4 percent.

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Groundwater

Groundwater was encountered at three of the eight test pit explorations, TP-1, TP-2, and TP-4. At each of these locations, moderate seepage was observed at about 4 feet bgs and heavy seepage was encountered at approximately 5 to 7 feet bgs. These three test pits were all located within the lower, southern portion of the site. Based on a review of nearby well logs as well as Clark County data, the static groundwater level at the property is mapped at about 10 to 20 feet bgs, although zones of isolated restrictive layers may occur, resulting in seasonally higher perched water levels at times.

Infiltration Testing

Infiltration testing was completed in TP-3 and TP-7 at depths of about 5 and 2 feet bgs, respectively. The infiltration tests were conducted within 6-inch outside diameter PVC pipes embedded into the underlying soils using the single-ring falling head method, in general accordance with the 2015 Clark County Stormwater Manual. Water was placed into each pipe to achieve a minimum 6-inch-high column of water (head). After a period of saturation, the height of the water column in each pipe was measured initially and at regular timed intervals to determine the rate of water infiltration into the soil. Results of the field infiltration testing are presented in Table 1.

Table 1. Infiltration Testing Results				
Location	Depth of Test (feet bgs)	Coefficient of Permeability, k (inches/hour)	Fines Content (percent)	Soil Classification ²
TP-3	5	42.2	14.4	Brown Silty GRAVEL with Sand and Cobbles, moist
TP-7	2	4.7	32.3	Brown Silty SAND with Gravel, damp

¹ Average rate after saturation. ² Based on visual-manual classification and limited lab testing

The recommended coefficients of permeability, k, presented in Table 1 have been determined using the guidelines presented in CCSM. It is recommended that the designer also include correction factors to account for the level of maintenance, type of system, vegetation, siltation, etc., as necessary.

Hydrologic Soil Properties

According to the USDA Web Soil Survey, the near-surface soils at the site are generally identified as Lauren Loam, which generally consists of soils classified as gravelly loamy coarse sand at the approximate test depths and are assigned the hydrologic soil group "B" based on drainage and other properties, indicating the soils have a moderately high to high capacity to transmit water.

For the purposes of the stormwater system design using the Western Washington Hydrologic Model (WWHM), it is our opinion, based on the results of our explorations, infiltration testing, and laboratory testing, that the native near-surface soil conditions observed in our explorations can generally be classified as Soil Group 4 (SG4).

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Geologic Hazards

The following provides a geologic hazard review for the subject site. The geologic hazard review as based on our site reconnaissance and explorations, as well as a review of publicly available published literature and maps.

Slope and Landslide Hazards:

For the most part the site is relatively level, with no slopes exceeding 15 percent within the site boundaries, or at adjacent lots. As a result, slope and landslide hazards are not a concern at the property.

Seismic Hazards:

The following seismic hazards have been considered as part of our geologic hazards review for the project site:

Ground Motion Amplification: Based on a review of Clark County Maps Online, the site is designated as seismic Site Class “C”. Based on the presence of dense cobbly/gravelly soils at shallow depths in our explorations, it is our opinion that Site Class “C” is indeed appropriate for use at the site. The seismic design parameters, in accordance with the 2018 IBC (with Washington State amendments), are summarized in Table 2.

Table 2. 2018 IBC Seismic Design Parameters		
Location	Short Period	1-Second
Maximum Credible Earthquake Spectral Acceleration	$S_s = 0.793 \text{ g}$	$S_1 = 0.350 \text{ g}$
Site Class	C	
Site Coefficient	$F_a = 1.2$	$F_v = 1.5$
Adjusted Spectral Acceleration	$S_{MS} = 0.951 \text{ g}$	$S_{M1} = 0.524 \text{ g}$
Design Spectral Response Acceleration Parameters	$S_{DS} = 0.634 \text{ g}$	$S_{D1} = 0.350 \text{ g}$

g – acceleration due to gravity

Liquefaction: While relatively shallow groundwater was encountered at the site, based on the relative density and grain size of the soils encountered in our explorations, we consider the potential for liquefaction settlement within the site boundaries to be low. Indeed, site is mapped as having a “very low” liquefaction susceptibility based on the Liquefaction Susceptibility Map of Clark County.

CONCLUSIONS AND RECOMMENDATIONS

Geotechnical Design and Construction Considerations

Based on the results of our site reconnaissance, subsurface explorations, and geologic map review, it is our opinion that the planned single-family residential development of the site within the proposed new lots and the associated utilities, access roads and driveways are feasible

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provided the recommendations in this report are included in the project design and implemented during construction. The chief geotechnical concerns of note associated with the project are ensuring foundations are bearing on competent dense native soils and designing a stormwater system that meets the needs of the site while taking into account the depth of groundwater within the lower portion of the site. Our opinion is based on field observations and subsurface explorations completed by True North and review of the following documents and information sources: County soils and groundwater mapping, a published geologic map, and our understanding of the proposed development plans.

Site Preparation

After any surface and near surface water sources have been controlled, the construction areas should be cleared and stripped of organic matter, and other deleterious materials. Silt fences, hay bales, buffer zones of natural growth, sedimentation ponds, and granular haul roads should be used as required to reduce sediment transport during construction to acceptable levels.

Where present, existing topsoil, buried structures, and other disturbed surface materials should be stripped and removed from proposed development locations and for a five-foot-margin around such areas. Based on our explorations, the depth of stripping may range from 6 to up to 24 inches, although greater stripping depths may be required if loose or soft materials are encountered, abandoned utilities or other embedded structures, or where mature trees and their associated roots are removed. Deleterious materials encountered during site preparation should be removed from the subgrade soils and hauled off site for disposal. Stripped material should be transported off site for disposal or stockpiled for use in landscaped areas. If stripping operations occur during wet weather, a generally greater stripping depth might be required in order to remove disturbed moisture sensitive soils; therefore, stripping is best performed during a period of dry weather.

Subgrade Verification

Following site preparation, including removal of all topsoil/till zone and compaction of the exposed subgrade and prior to placing aggregate base for the foundations, building pad, or pavement section, the exposed subgrade should be evaluated. The subgrades should be evaluated by qualified True North personnel using a steel foundation probe, proofroll, or other acceptable method. Unsuitable areas identified during the field evaluation should be re-compacted to or be excavated to firm ground and replaced with structural fill.

Wet/Freezing-Weather/Wet-Soil Conditions

Due to the presence of fine-grained silt and clay in the near-surface materials at the site, construction equipment may have difficulty operating on the near-surface soils when the moisture content of the surface soil is more than a few percentage points above the optimum moisture required for compaction. Soils that have been disturbed during site preparation activities, or unsuitable areas identified during proofrolling or probing, should be removed and replaced with compacted structural fill.

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Site earthwork and subgrade preparation should not be completed during freezing conditions.

Protection of the subgrade is the responsibility of the contractor. Construction of granular haul roads may help reduce further damage to the pavement and disturbance of site soils. The thickness of the granular material for haul roads and staging areas will depend on the amount and type of construction traffic. The actual thickness of haul roads and staging areas should be based on the contractors' approach to site development, and the amount and type of construction traffic. The imported granular material should be placed in one lift over the prepared, undisturbed subgrade and compacted using a smooth-drum, non-vibratory roller. A geotextile fabric should be used to separate the subgrade from the imported granular material in areas of repeated construction traffic.

Excavations

Where required, temporary soil cuts associated with site excavations or regrading activities should be adequately sloped back to prevent sloughing and collapse, unless a shoring box or other suitable excavation side wall bracing is provided. It is the responsibility of the contractor to ensure that excavations are properly sloped or braced for worker safety protection, in accordance with OSHA safety guidelines.

Structural Fill

Structural fill includes any fill materials placed under footings, pavements, or driveways and backfill over the embedded mat foundation. Typical materials used for structural fill include: clean, well-graded sand and gravel; clean sand; crushed rock; controlled-density fill (CDF); lean-mix concrete; and various soil mixtures of silt, sand, and gravel. Use of the on-site soils as structural fill may be feasible, provided they are properly moisture conditioned prior to placement and compaction.

Imported granular structural fill should consist of angular pit or quarry run rock, crushed rock, or crushed gravel and sand that is fairly well graded between coarse and fine particle sizes. The fill should contain no organic matter or other deleterious materials, have a maximum particle size of one inch, and have less than 5 percent passing the U.S. No. 200 Sieve. In deep excavations, or where subgrade soils require stabilization, the particle size may be increased to four inches. The percentage of fines can be increased to 12 percent of the material passing the U.S. No. 200 Sieve if placed during dry weather and provided the fill material is moisture-conditioned, as necessary, for proper compaction. The material should be placed in lifts with a maximum uncompacted thickness of 12 inches and be compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D 1557. During the wet season or when wet subgrade conditions exist, the initial lift thickness may be increased to 24 inches and should be compacted by rolling with a smooth-drum, nonvibratory roller.

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Foundations

Continuous-wall and isolated-spread footings should be at least 12 and 24 inches wide, respectively. For frost protection, the footings should be founded at least 12 inches below the lowest adjacent grades or deeper if required by local building code. The footings should be founded below an imaginary line project at a 1H:1V slope from the base of any adjacent, parallel utility trenches.

Footings should bear on the near-surface silt or gravelly clay or structural fill placed in accordance with our recommendations. Footings should be sized for an allowable bearing capacity of 1,500 psf. We estimate post construction settlements will be less than one inch for our recommended allowable bearing capacity. We estimate that the differential settlement will be approximately half of the total settlement. Our recommended bearing capacity is based on limiting settlements and includes a minimum factor of safety of 3 against ultimate bearing failure.

Lateral loads acting on the foundations can be resisted by passive earth pressures on the sides of the foundation and by friction along the soil-rock-concrete interface at the base of the foundation. We recommend using an allowable passive earth pressure of 250 pounds per cubic foot (pcf) for foundations confined by the near-surface silty sand or structural fill placed in accordance with our recommendations. We recommend an allowable coefficient of friction of 0.35 for foundations. In order to develop these capacities, concrete must be poured neat in excavations, the adjacent grade must be level, and the static ground water level must remain below the base of the footing throughout the year. The passive pressure within the upper foot of embedment should be neglected. These allowable lateral resistance values include a factor of safety of 1.5.

Slab-on-grade Floors

Satisfactory subgrade support for lightly-loaded building floor slabs can be obtained on the undisturbed native soil or on engineered structural fill. A subgrade modulus of 125 pounds per cubic inch may be used to design floor slabs.

A minimum 6-inch-thick layer of drain rock should be placed and compacted over the prepared subgrade to assist as a capillary break and blanket drain. The drain rock may include a capping layer of clean $\frac{3}{4}$ inch minus crushed rock that contains no more than 5% fines. The drain rock and capping rock should be placed in one lift and compacted until well-keyed, about 90% of the maximum dry density as determined by ASTM D698.

A vapor retarder manufactured for use beneath floor slabs should be installed according to the manufacturer's recommendations. Careful attention should be made during construction to prevent perforating the retarder, and to seal edges and utility penetrations. We recommend following ACI 302.1, Chapter 3 with regard to installing a vapor retarder.

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Pavement Design

The following pavement design recommendations are based on our experience with similar facilities and subgrade conditions.

For automobile parking areas, we recommend a pavement section consisting of 3 inches of asphaltic concrete (AC) over 8 inches of crushed rock base (CRB) or 5 inches of Portland Cement concrete (PCC) over 5 inches of crushed rock base (CRB). For truck traffic areas, the pavement section should consist of 4 inches of AC over 12 inches of CRB or 6 inches of PCC over 8 inches of CRB. These recommended pavement sections are based on the assumption that the subgrade consists of firm structural fill or compacted native subgrade and that the pavement will be constructed during the dry summer months. Proofrolling should be used to evaluate pavement subgrade. Any soft areas disclosed by proofrolling will likely need to be reworked. Some contingency should be provided for the repair of any soft areas. If pavement construction is scheduled for the wet season, it will be necessary to increase the above-recommended base course sections.

AC and CRB materials should conform to WSDOT specifications. All CRB should be compacted to at least 95 percent of the modified proctor ASTM D-1557 laboratory test standard.

Permanent, properly installed drainage is also an essential aspect of pavement design and construction. All paved areas should have positive drainage to prevent ponding of surface water and saturation of the base course. This is particularly important in cut sections or at low points within the paved areas, such as around stormwater catch basins.

Drainage

The Contractor should be made responsible for temporary drainage of surface water and groundwater as necessary during construction to prevent standing water and/or erosion at the site.

As a matter of good construction practice, we recommend that perimeter drains be installed for all buildings. Perimeter drains should consist of perforated drainpipe embedded in a zone of free draining fill that is wrapped in a non-woven geotextile filter. The pipe should be connected to a tightline drainpipe leading to storm drain facilities. Foundation and crawl space drainage should be sloped to drain to a sump or low point drain outlet. Water should not be allowed to pond within crawl spaces. Roof drains should be connected to a tightline drainpipe leading to storm drain outlet facilities.

Water should not be allowed to “pond” or collect anywhere on the site. The ground surface around structures should be sloped to drain away from building foundations for a distance of at least 5 feet. Surface water should be directed away from all buildings into drainage swales or other

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approved drainage areas. "Trapped" planting areas should not be created next to any buildings without providing means for drainage.

Soil Erosion

Site-specific erosion control measures should be implemented to address the maintenance of slopes or exposed areas. This may include silt fence, bio-filter bags, straw wattles, or other suitable methods. During construction, all exposed areas should be well compacted and protected from erosion. Temporary slopes or expose areas may be covered with straw, crushed aggregate, or rip in localized areas to minimize erosion.

Finished slopes should be vegetated as soon as possible with erosion-resistant native grasses and plants. Once established, slope vegetation should be properly maintained. Concentrated water should be prevented from flowing over slope faces.

CONSTRUCTION OBSERVATIONS

Satisfactory earthwork performance depends on the quality of construction. Sufficient monitoring of the contractor's activities is a key part in ensuring that work is completed in accordance with the construction drawings and specifications. We recommend that True North observe that the subsurface conditions observed during our site investigation are consistent with those encountered during construction, and that foundation subgrades are suitable for placement of structural fill, rebar, or concrete for the new structures.

The City of Camas and/or Clark County may require a final letter of geotechnical compliance before they will finalize a permit. If such a letter is required, a representative from True North MUST observe foundation subgrades PRIOR to concrete being poured for the foundation. If True North does not perform this observation, we cannot provide a final letter of geotechnical compliance, and a permit will not be eligible for final sign-off. It is the owner's responsibility to ensure that True North be notified in a timely manner (i.e., at least 48 hours prior to the required site observation) of the need for our services on site during construction.

LIMITATIONS

We have prepared this report for use by the owner/developer and other members of the design and construction team for the proposed Monte Verde Subdivision. The opinions and recommendations contained within this report are not intended to be construed as a warranty of subsurface conditions, but are forwarded to assist in the planning and design process. The conclusions and recommendations contained in this report are based on our understanding of the currently proposed project, as derived from written and verbal information supplied to us by you.

The conclusions and recommendations contained in this report are based on our understanding of the currently proposed project and potential future development, as derived from written and verbal information supplied to us by you. When the design has been finalized, we recommend

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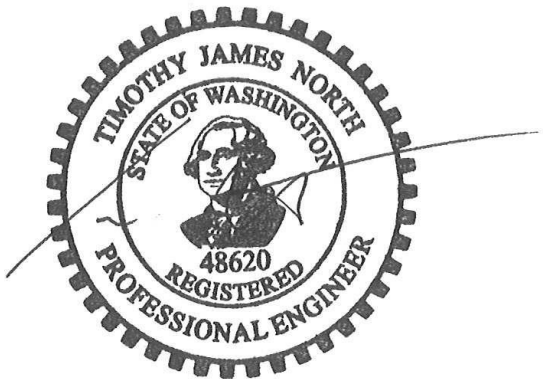
that we review the design and specifications to see that our recommendations have been interpreted and implemented as intended. If design changes are made, we request that we be retained to review our conclusions and recommendations and to provide a written modification or verification.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

CLOSING

We appreciate the opportunity to be of service to you. If you have any questions, or if we can be of further assistance to you, please contact us at (360) 984-6584.

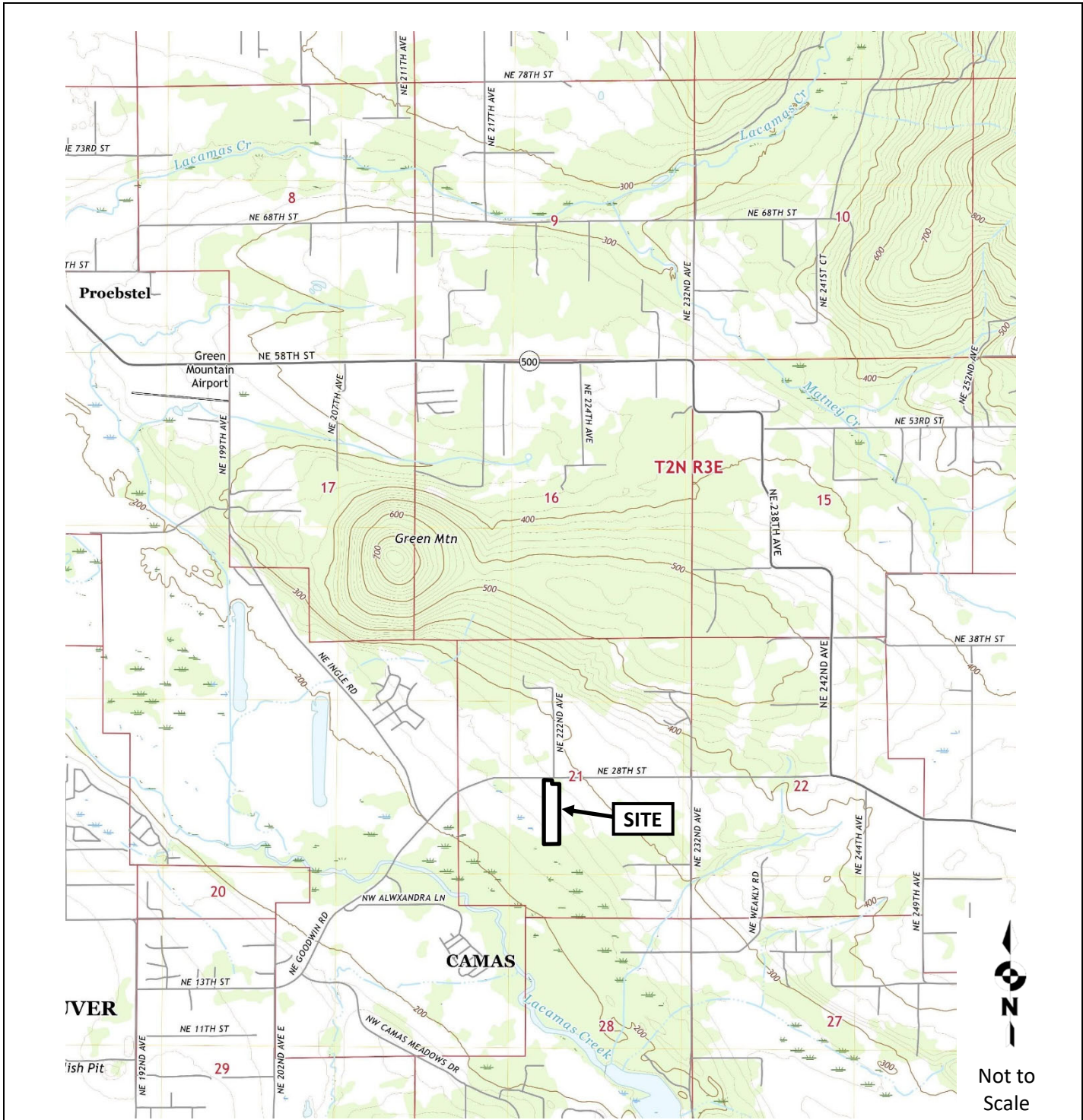
Respectfully Submitted,



Timothy J. North, P.E.
Geotechnical Engineer

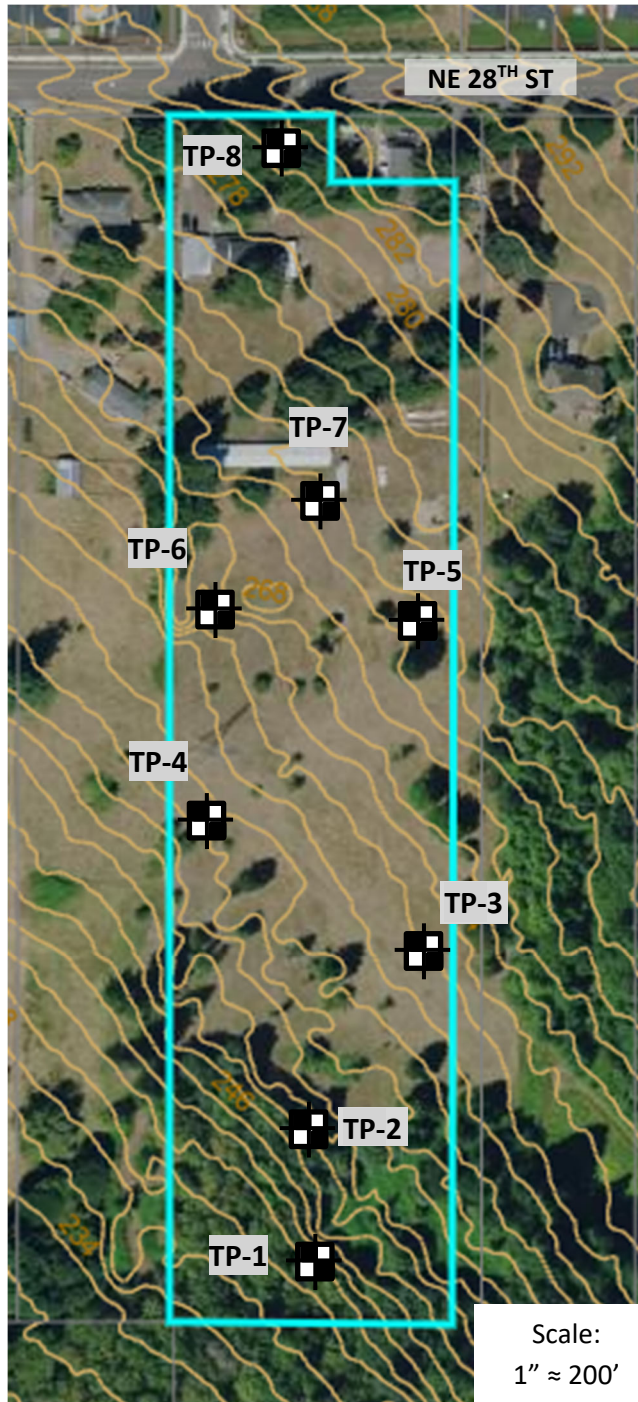
Attachment: Figure 1 – Vicinity Map
Figure 2 – Site Plan
Figure 3 – Site Photographs
Appendix A – Field and Laboratory Procedures
Test Pit Logs TP-1 through TP-8

FIGURES



Source: "Topographic Map of the Lacamas Creek Quadrangle, 7.5 minute series" 2020, United States Geological Survey (USGS).

<p>TRUE NORTH ◆ GEOTECHNICAL ◆</p>	<p>Pacific Lifestyle Homes Monte Verde Subdivision Camas, WA</p>	<p>Project # 22-0111-1</p>
<p>202 E Evergreen St, Suite B Vancouver, WA 98660 360-984-6584</p>	<p>July 2022</p>	<p>Figure 1 – Vicinity Map</p>



TP-1

Approximate Exploratory Test Pit Locations, May 6, 2022.

Source: Aerial & Topo – Clark County MapsOnline, accessed July 05, 2022.



Scale:
1" ≈ 200'

<p>TRUE NORTH ◆ GEOTECHNICAL ◆</p>	<p>Pacific Lifestyle Homes Monte Verde Subdivision Camas WA</p>	<p>Project # 22-0111-1</p>
<p>202 E. Evergreen Blvd Suite B Vancouver, WA 98660 360-984-6584</p>	<p>July 2022</p>	<p>Figure 2 –Site Plan</p>



Photo 1. Seepage observed at TP-1.



Photo 2. Seepage ponding at TP-2 during backfill operations.

<p>TRUE NORTH ◆ GEOTECHNICAL ◆</p>	<p>Pacific Lifestyle Homes Monte Verde Subdivision Camas, WA</p>	<p>Project # 22-0111-1</p>
<p>202 E Evergreen Blvd, Suite B Vancouver, WA 98660 360-984-6584</p>	<p>July 2022</p>	<p>Figure 3A – Site Photographs (1 of 2)</p>



Photo 3. Cobbles and gravel evident at TP-3.



Photo 4. Infiltration testing at TP-7.

<p>TRUE NORTH ◆ GEOTECHNICAL ◆</p>	<p>Pacific Lifestyle Homes Monte Verde Subdivision Camas, WA</p>	<p>Project # 22-0111-1</p>
<p>202 E Evergreen Blvd, Suite B Vancouver, WA 98660 360-984-6584</p>	<p>July 2022</p>	<p>Figure 3B – Site Photographs (2 of 2)</p>

APPENDIX A

**Field Exploration Procedures
Laboratory Testing Procedures
Exploration Test Pit Logs**

FIELD EXPLORATION PROCEDURES

General

We explored subsurface conditions at the site by excavating eight test pits, designated TP-1 through TP-8, to depths ranging from about 6.0 to 12.0 feet bgs. The test pit explorations were excavated on May 6, 2022 with Deere 75G tracked excavator, owned and operated by Dan Tapani Excavating of Battle Ground, Washington. Upon completion, the test pits were backfilled with excavated soils tamped into place as best possible.

Soil Sampling

A True North representative observed subsurface explorations to record the soil, rock, and groundwater conditions encountered, and to obtain soil samples. Disturbed soil samples were obtained from the sidewalls of the excavation and the excavator bucket at selected depths throughout the explorations. Soil samples were sealed to retain moisture and returned to our laboratory for additional examination and testing.

Field Classification

The observed soils were classified initially on site in general accordance with ASTM D 2488 Description and Identification of Soils (Visual-Manual Procedure). Consistency, color, relative moisture, degree of plasticity, peculiar odors, and other distinguishing characteristics of the soil samples were noted. The terminology used is described in the key and glossary that follow.

Summary Exploration Logs

Results from the test pits are shown in the summary exploration logs. The left-hand portion of a log provides our interpretation of the soil encountered, sample depths, and groundwater information. The right-hand portion of a log shows the results of field and laboratory testing. Soil descriptions and interfaces between soil types shown in summary logs are interpretive, and actual transitions may be gradual.

LABORATORY TESTING PROCEDURES

Soil samples obtained during field explorations are examined in a laboratory, and representative samples may be selected for further testing. The testing program included visual-manual classification and natural moisture content testing.

Visual Manual Classification

Soil samples are classified in general accordance with guidelines presented in ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). The physical characteristics of the samples are noted and the field classifications are modified, where necessary, in accordance with ASTM terminology, though certain terminology that incorporates current local engineering practice may be used. The term which best described the major portion of the sample is used to describe the soil type.

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Natural Moisture Content

Natural moisture content is determined in general accordance with guidelines presented in ASTM D2216, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. The natural moisture content is the ratio, expressed as a percentage, of the weight of water in a given amount of soil to the weight of solid particles.

Fines Content

Fines content testing is performed in general accordance with guidelines presented in ASTM D1140, *Standard Test Methods for Determining the Amount of Material Finer than 75- μ m (No.200) Sieve in Soils by Washing*. The fines content is the fraction of soil that passes the U.S. Standard Number 200 Sieve. This sieve differentiates fines (silt and clay) from sand and gravel. Soil material that remains on the Number 200 sieve is sand and gravel. Material that passes the sieve is fines. The test is used to refine soil type.



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TABLE A1

Key to Test Pit and Boring Terminology and Symbols


MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTION
			GRAPH	LETTER	
Coarse Grained Soils More Than 50% Material Retained on No. 200 Sieve	Gravel and Gravelly Soils More Than 50% Coarse Fraction Retained on No. 4 Sieve	Clean Gravels (Little or No Fines)		GW	Well-graded Gravels, Gravel-Sand Mixtures, Little or No Fines
		Gravels with Fines (Significant Percentage of Fines)		GP	Poorly-graded Gravels, Gravel-Sand Mixtures, Little or No Fines
				GM	Silty Gravels, Gravel-Sand-Silt Mixtures
			GC	Clayey Gravels, Gravel-Sand-Clay Mixtures	
	Sand and Sandy Soils More Than 50% Coarse Fraction Passing No. 4 Sieve	Clean Sands (Little or No Fines)		SW	Well-graded Sands, Gravelly Sands, Little or No Fines
		Sands with Fines (Significant Percentage of Fines)		SP	Poorly-graded Sands, Gravelly Sands, Little or No Fines
				SM	Silty Sands, Sand-Silt Mixtures
				SC	Clayey Sands, Sand-Clay Mixtures
Fine Grained Soils More Than 50% Material Passing No. 200 Sieve	Silts and Clays Liquid Limit Less than 50 percent		ML	Inorganic Silts and Very Fine Sands, Rock Flour, Silty-Clayey Fine Sands, Clayey Silts	
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays	
			OL	Organic Silts and Organic Silty Clays of Low Plasticity	
	Silts and Clays Liquid Limit Greater than 50 percent		MH	Inorganic Silts Micaceous or Diatomaceous Fine Sand or Silty Soils	
			CH	Inorganic Clays of High Plasticity, Fat Clays	
			OH	Organic Clays of Medium to High Plasticity, Organic Silts	
			PT	Peat, Humus, Swamp Soils	
Topsoil					Humus and Duff Layer
Fill					Highly Variable Constituents





Relative Density	N - Blows per Foot
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	50+

Relative Density	N - Blows per Foot
Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	30 - 50
Very Hard	50+

Key to Sampler Type Symbols

- Grab
- SPT
- Shelby Tube
- Dames & Moore
- Rock Core

 <p>202 E Evergreen Blvd Suite B, Vancouver, WA 360-558-0005 - tim@tnorthgeo.com</p>	Project Name PLH - Monte Verde Subdivision		TEST PIT LOG TP-3	
	Project Location 22205 NE 28th St, Camas, WA 98607		Project No. 22-0111-1	
	Operator Dan Tapani Excavating	Equipment Deere 75G with 2 ft bucket	Date Started 05/6/22	
	Logged By LS	Checked By TJN	Date Completed 05/6/22	

Depth (feet)	Sample Type	Sample No.	Graphic Log	USCS Symbol	Soil Description	Water Content, %	Field Testing	Notes and Lab Data
1	G	S-1			Soft to medium stiff, dark brown silty TOPSOIL with organics; moist.	22	PP = 0.5	Fines content = 4%
2				SC	Medium dense, light brown Clayey SAND with gravel; moist.	27	PP = 0.5	
3					increasing gravel and cobble content with depth			
4	G	S-2						
5	G	S-3			Dense, gray-brown Sandy GRAVEL with cobbles; moist.	18		
6				GP				
7	G	S-4					increasing cobble size with depth	
8								
9								
10								
11					Excavation terminated at 11 feet bgs. Groundwater not encountered. Backfilled with excavated soils.			
12								
13								
14								
15								

