NELSON GEOTECHNICAL ASSOCIATES, INC.

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July 27, 2022

2812 Architecture
ATTN: Adam Clark
VIA Email: adam@2812architecture.com

Geotechnical Engineering Evaluation – **REV2**
Kendall Subaru Development
16xxx Smokey Point Boulevard
Marysville, Washington
NGA File No. 1378422

INTRODUCTION

This letter presents the results of our geotechnical engineering investigation and evaluation of the planned Kendall Subaru Development project evaluation for the Kendall Subaru Dealership project located at **16xxx Smokey Point Boulevard in Marysville, Washington,** as shown on the Vicinity Map in Figure 1. The parcel numbers for the affected properties are 31052800300600, -1200, and -0300. We have been requested to revise this document so it does not include the seismic site coefficient F_a, which we understand the project structural engineer will determine without our input.

The purpose of this study is to explore and characterize the site's surface and subsurface conditions and to provide geotechnical recommendations for the planned site development.

The properties consist of three rectangular parcels that are offset to form an irregularly shaped site that covers approximately 15.72 acres. It is currently vacant and undeveloped. Topographically, the site is relatively level. We understand the plans for development include the construction of an auto dealership structure and associated parking lot. We have been informed that the structure will be supported only with isolated foundations, and it will not include any continuous foundations. We have been informed that site stormwater will be directed off-site. We have been requested to prepare this letter to address the City of Marysville code.

For our use in preparing this letter, we were provided with a site plan titled "Kendall Subaru," dated May 26, 2022, and prepared by 2812 Architecture. We also were provided with a geotechnical report titled "Geotechnical Investigation - CamNel Properties," dated December 26, 2016, and prepared by Liu and Associates, Inc.

SCOPE

The purpose of this study is to explore and characterize the site surface and subsurface conditions and provide general recommendations for site development.

Specifically, our scope of services included the following:

1. Review available soil and geologic maps of the area, including previous geotechnical documentation.
2. Visit the site to reconnoiter surficial information and evaluate subsurface soil and groundwater conditions within the site with test pits using a mini excavator.
3. Perform laboratory grain-size sieve analysis on soil samples, as necessary.
4. Determine the presence of Geologically Hazardous Areas in accordance with the City of Marysville Municipal Code, as warranted.
5. Provide recommendations for earthwork and foundation support.
6. Provide recommendations for retaining walls.
7. Provide recommendations for temporary and permanent slopes.
8. Provide recommendations for subsurface utilities and pavement subgrade preparation.
9. Provide general recommendations for site drainage and erosion control.
10. Document the results of our findings, conclusions, and recommendations in an updated written geotechnical letter.

SITE CONDITIONS

Surface Conditions

The site consists of three rectangular parcels that are offset to form an irregularly shaped site that covers 15.72 acres. The site is bordered to the west by Smokey Point Boulevard, to the north by undeveloped, wooded land and by an automotive repair business, and to the south and east by undeveloped, wooded land. The site is currently undeveloped and is generally fairly level. A mound of soil up to about 12 feet tall has been placed in a stockpile near the southwest corner of the site. That stockpile has side slopes with inclination close to 3H:1V, and approximate dimensions of 120 feet by 50 feet. The western two-thirds of the site is sparsely vegetated with brush, with areas of exposed soil. The eastern third of the property is wooded. We did not observe surface water within the site during our site visit on May 20, 2022.

Subsurface Conditions

Geology: The geologic units for this area are shown on the Geologic Map of the Arlington West 7.5 Minute Quadrangle, Snohomish County, Washington, by James P. Minard, et al. (USGS, 1985). The site is mapped as Marysville Sand (Qvrm). The Marysville Sand is described as well-drained, stratified to massive outwash sand with some fine gravel. Our explorations encountered topsoil or disturbed ground underlain by fine to medium sand with varying amounts of silt consistent with the description of Marysville Sand.

Explorations: The subsurface conditions within the site were explored on June 22, 2022 by excavating four test pits to depths of 6.5 feet below the existing ground surface using a mini excavator. The approximate locations of our explorations are shown on the Site Plan in Figure 2. A geologist from NGA was present during the explorations, examined the soils and geologic conditions encountered, obtained samples of the different soil types, and maintained logs of the test pits. The soils were visually classified in general accordance with the Unified Soil Classification System, presented in Figure 3. The logs of our test pits are attached to this report and are presented as Figure 4. We present a brief summary of the subsurface conditions in the following paragraph. For a detailed description of the subsurface conditions, the logs of the test pits should be reviewed. The test pits encountered 0.5 to 1 foot of topsoil or fill/disturbed ground at the ground surface. These surficial soils were generally underlain by medium dense sand with silt and varying amounts of roots, which extended to 1.5 to 2.5 feet below the surface. That sand with silt was underlain by medium dense sand, which extended to the maximum explored depths of 6.5 feet. We interpret the sand to be Marysville Sand. Heavy test pit caving was observed below depths of 2 to 3.5 feet in all of the test pits. The conditions observed in our test pits are generally consistent with the subsurface soil conditions described in the provided 2016 geotechnical report for the site.

Hydrogeologic Conditions

We observed groundwater within the test pits at depths of 3 to 4 feet, which we interpret to be associated with the regional groundwater table. We would expect the groundwater elevation to be slightly lower during drier times of the year and slightly higher during wetter periods. The provided 2016 geotechnical report for the site describes 6 test pit explorations that were completed on August 25, 2016. Groundwater was encountered in those test pits at depths of 6 to 7.5 feet. Those explorations were excavated late in the summer, and groundwater was lower than in our recent test pits, excavated early in the summer.

SENSITIVE AREA EVALUATION

General

We reviewed the 2012 City of Marysville Critical Areas map and found that the subject site is not mapped as having critical areas.

Seismic Hazard

We reviewed the 2018 International Building Code (IBC) for seismic site classification for this project. Since competent glacial outwash soils are inferred to underlie the site at depth, the site conditions best fit the IBC description for Site Class D.

Table 1 below provides seismic design parameters for the site that are in conformance with the 2018 IBC, which specifies a design earthquake having a 2% probability of occurrence in 50 years (return interval of 2,475 years), and the 2008 USGS seismic hazard maps.

Table 1 – 2018 IBC Seismic Design Parameters

Site Class	Spectral Acceleration at 0.2 sec. (g) S_s	Spectral Acceleration at 1.0 sec. (g) S_1	Site Coefficients		Design Spectral Response Parameters	
				F_v	S_{DS}	S_{D1}
D	1.072	0.383		null	0.858	null

The spectral response accelerations were obtained from the OSHPD Seismic Design Maps website (ASCE 7-16 data) for the project latitude and longitude.

We reviewed the Liquefaction Susceptibility Map of Snohomish County, Washington by Stephen Palmer et al. (Washington State Department of Natural Resources, 2004). The site and surrounding vicinity are mapped as having low to moderate liquefaction susceptibility.

Hazards associated with seismic activity include liquefaction potential and amplification of ground motion. Liquefaction is caused by a rise in pore pressures in a loose, fine sand deposit beneath the groundwater table. It is our opinion that the medium dense native Marysville Sand deposits interpreted to underlie the site have a low to moderate potential for liquefaction or amplification of ground motion.

Erosion Hazard

The criteria used for determination of the erosion hazard for affected areas include soil type, slope gradient, vegetation cover, and groundwater conditions. The erosion sensitivity is related to vegetative cover and the specific surface soil types, which are related to the underlying geologic soil units. The Soil Survey of Snohomish County Area, Washington by the Natural Resources Conservation Service (NRCS), classifies the site as Custer fine sandy loam and Norma loam. These soils are listed as having slight erosion hazard. Based on our experience in the area and our observations in the field, it is our opinion that the site would have a low erosion hazard for areas where the soils are exposed. It is our opinion that the erosion hazard for site soils should be very low in areas where vegetation is not disturbed.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion from a geotechnical standpoint that the planned development is feasible. Our explorations indicated that the site was underlain by medium dense sand with silt or sand at depths of 0.5 to 1 foot below the ground surface. These native soils should provide adequate support for foundation, slab, and pavement loads. We recommend that the new structure be designed utilizing shallow foundations. Footings should extend through any loose soil and be founded on the underlying medium dense native soil, or structural fill extending to these soils. Footing excavations that extend below groundwater should be filled with compacted crushed rock above the water level. Deeper areas of unsuitable soils and/or undocumented fill could be encountered in the unexplored areas of the site. This condition, if encountered, would require deeper excavations in foundation, slab, and pavement areas to remove the unsuitable soils.

The surficial soils encountered on this site are considered moisture-sensitive and may disturb easily when wet. We recommend that construction take place during the drier summer months, if possible. If construction is to take place during wet weather, the soils may disturb and additional expenses and delays should be expected due to the wet conditions. Additional expenses could include the need for placing a blanket of rock spalls to protect exposed subgrades and construction traffic areas. Some of the native granular on-site soils may be suitable for use as structural fill depending on the moisture content of the soil during construction. NGA should be retained to determine if the on-site soils can be used as structural fill material during construction.

Erosion Control

The erosion hazard for the on-site soils is interpreted to be low for exposed soils, but actual erosion potential will be dependent on how the site is graded and how water is allowed to concentrate. Best Management Practices (BMPs) should be used to control erosion. Areas disturbed during construction should be protected from erosion. Erosion control measures may include diverting surface water away from the stripped or disturbed areas. Silt fences and/or straw bales should be erected to prevent muddy water from leaving the site. Disturbed areas should be planted as soon as practical, and the vegetation should be maintained until it is established. The erosion potential of areas not stripped of vegetation should be low.

Site Preparation and Grading

After erosion control measures are implemented, site preparation should consist of removing loose soils, topsoil, and any undocumented fill from foundations, slab, and pavement areas, to expose medium dense native bearing soils. The stripped soil should be removed from the site or stockpiled for later use as a landscaping fill. Based on our observations, we anticipate native, medium dense soil is present at depths of approximately 0.5 to 1 foot at the site. We recommend that if loose soils are encountered at the foundation subgrades, that the subgrade be compacted to a non-yielding condition using a vibratory roller or a heavy plate compactor. Deeper areas of unsuitable soils and/or undocumented fill could be encountered in the unexplored areas of the site. This condition, if encountered, would require deeper excavations in foundation, slab, and pavement areas to remove the unsuitable soils. After site preparation, if the exposed subgrade is deemed loose, it should be compacted to a non-yielding condition and then proof-rolled with a heavy rubber-tired piece of equipment. Areas observed to pump or weave during the proof-roll test should be reworked to structural fill specifications or over-excavated and replaced with properly compacted structural fill or rock spalls. If loose soils are encountered in foundation areas, the loose soils should be removed and replaced with rock spalls. If significant surface water flow is encountered during construction, this flow should be diverted around areas to be developed, and the exposed subgrades should be maintained in a semi-dry condition. If wet conditions are encountered, alternative site grading techniques might be necessary. These techniques could include using large excavators equipped with wide tracks and a smooth bucket to complete site grading and covering exposed subgrade with a layer of crushed rock for protection. If wet conditions are encountered or construction is attempted in wet weather, the subgrade should not be compacted, as this could cause further subgrade disturbance. In wet conditions, it may be necessary to cover the exposed subgrade with a layer of crushed rock as soon as it is exposed to protect the moisture sensitive soils from disturbance by machine or foot traffic during construction. The prepared subgrade should be protected from construction traffic and surface water should be diverted around areas of prepared subgrade.

Temporary and Permanent Slopes

Temporary cut slope stability is a function of many factors, including the type and consistency of soils, depth of the cut, surcharge loads adjacent to the excavation, length of time a cut remains open, and the presence of surface or groundwater. It is exceedingly difficult under these variable conditions to estimate a stable, temporary, cut slope angle. Therefore, it should be the responsibility of the contractor to maintain safe slope configurations at all times as indicated in OSHA guidelines for cut slopes.

The following information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Nelson Geotechnical Associates, Inc. assumes responsibility for job site safety. Job site safety is the sole responsibility of the project contractor.

For planning purposes, we recommend that temporary cuts in the on-site soils be no steeper than 1.5 Horizontal to 1 Vertical (1.5H:1V). If significant groundwater seepage or surface water flow were encountered, flatter inclinations would be necessary. We recommend that cut slopes be protected from erosion. The slope protection measures may include covering cut slopes with plastic sheeting and diverting surface runoff away from the top of cut slopes. We do not recommend vertical slopes for cuts deeper than four feet, if worker access is necessary. We recommend that cut slope heights and inclinations conform to appropriate OSHA/WISHA regulations. Permanent cut and fill slopes should be no steeper than 3H:1V. However, flatter inclinations may be required in areas where loose soils are encountered. Permanent slopes should be vegetated, and the vegetative cover maintained until established.

Foundations

Conventional shallow spread foundations should be placed on medium dense native bearing soils or be supported on structural fill or rock spalls extending to those soils. Medium dense soils should be encountered approximately 0.5 to one foot below ground surface based on our explorations. Where undocumented fill or loose soils are encountered at footing bearing elevation, the subgrade should be over-excavated to expose suitable bearing soil. The over-excavation may be filled with structural fill, or the footing may be extended down to the competent native soils. If footings are supported on structural fill, the fill zone should extend outside the edges of the footing a distance equal to one half of the depth of the over-excavation below the bottom of the footing.

Footings should extend at least 18-inches below the lowest adjacent finished ground surface for frost protection and bearing capacity considerations. Foundations should be designed in accordance with the 2018 IBC. Footing widths should be based on the anticipated loads and allowable soil bearing pressure. Water should not be allowed to accumulate in footing trenches. All loose or disturbed soil should be removed from the foundation excavation prior to placing concrete.

For foundations constructed as outlined above, we recommend an allowable bearing pressure of not more than 2,000 pounds per square foot (psf) be used for the design of isolated footings with a minimum dimension of at least 4 feet founded on the medium dense or denser native bearing soils or structural fill extending to the competent native bearing material. The foundation bearing soil should be evaluated by a representative of NGA. We should be consulted if higher bearing pressures are needed. Current IBC guidelines should be used when considering increased allowable bearing pressure for short-term transitory wind or seismic loads. Potential foundation settlement using the recommended allowable bearing pressure is estimated to be less than 1-inch total and ½-inch differential between adjacent footings or across a distance of about 20 feet, based on our experience with similar projects.

Lateral loads may be resisted by friction on the base of the footing and passive resistance against the subsurface portions of the foundation. A coefficient of friction of 0.35 may be used to calculate the base friction and should be applied to the vertical dead load only. Passive resistance may be calculated as a triangular equivalent fluid pressure distribution. An equivalent fluid density of 200 pounds per cubic foot (pcf) should be used for passive resistance design for a level ground surface adjacent to the footing. This level surface should extend a distance equal to at least three times the footing depth. These recommended values incorporate safety factors of 1.5 and 2.0 applied to the estimated ultimate values for frictional and passive resistance, respectively. To achieve this value of passive resistance, the foundations should be poured "neat" against the native medium dense soils or compacted fill should be used as backfill against the front of the footing. We recommend that the upper one foot of soil be neglected when calculating the passive resistance.

Retaining Walls

Should retaining walls be utilized, they should be designed and constructed as outlined hereon. The lateral pressure acting on subsurface retaining walls is dependent on the nature and density of the soil behind the wall, the amount of lateral wall movement which can occur as backfill is placed, wall drainage conditions, and the inclination of the backfill. For walls that are free to yield at the top at least one thousandth of the height of the wall (active condition), soil pressures will be less than if movement is limited by such factors as wall stiffness or bracing (at-rest condition). We recommend that walls supporting horizontal backfill and not subjected to hydrostatic forces, be designed using a triangular earth pressure distribution equivalent to that exerted by a fluid with a density of 35 pcf for yielding (active condition) walls, and 55 pcf for non-yielding (at-rest condition) walls. A seismic design loading of 8H should also be included in the wall design, where "H" represents the total height of the wall.

These recommended lateral earth pressures are for a drained granular backfill and assume of a horizontal ground surface behind the wall for a distance of at least the subsurface height of the wall, and do not account for surcharge loads. Additional lateral earth pressures should be considered for surcharge loads acting adjacent to subsurface walls and within a distance equal to the subsurface height of the wall. This would include the effects of surcharges such as traffic loads, floor slab loads, slopes, or other surface loads. We could consult with the structural engineer regarding additional loads on retaining walls during final design, if needed.

The lateral pressures on walls may be resisted by friction between the foundation and subgrade soil, and by passive resistance acting on the below-grade portion of the foundation. Recommendations for frictional and passive resistance to lateral loads are presented in the **Foundations** subsection of this report.

All wall backfill should be well compacted as outlined in the **Structural Fill** subsection of this report. Care should be taken to prevent the buildup of excess lateral soil pressures due to over-compaction of the wall backfill. This can be accomplished by placing wall backfill in 8-inch loose lifts and compacting the backfill with small, hand-operated compactors within a distance behind the wall equal to at least one-half the height of the wall. The thickness of the loose lifts should be reduced to accommodate the lower compactive energy of the hand-operated equipment. The recommended level of compaction should still be maintained. Permanent drainage systems should be installed for retaining walls. Recommendations for these systems are found in the **Subsurface Drainage** subsection of this report. We recommend that we be retained to evaluate the proposed wall drain backfill material and observe installation of the drainage systems.

Structural Fill

General: Fill placed beneath foundations, pavement, or other settlement-sensitive structures should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician. Field monitoring procedures would include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction. The area to receive the fill should be suitably prepared as described in the **Site Preparation and Grading** subsection prior to beginning fill placement. Sloping areas to receive fill should be benched using a minimum 8-foot-wide horizontal benches into competent soils.

Materials: Structural fill should consist of a good quality, granular soil, free of organics and other deleterious material, and be well graded to a maximum size of about three inches. All-weather fill should contain no more than five-percent fines (soil finer than U.S. No. 200 sieve, based on that fraction passing the U.S. 3/4-inch sieve). Some of the more granular on-site soils may be suitable for use as structural fill depending on the moisture content of the soil during construction. We should be retained to evaluate all proposed structural fill material prior to placement.

Fill Placement: Following subgrade preparation, placement of structural fill may proceed. All filling should be accomplished in uniform lifts up to eight inches thick. Each lift should be spread evenly and be thoroughly compacted prior to placement of subsequent lifts. All structural fill underlying building areas and pavement subgrade should be compacted to a minimum of 95 percent of its maximum dry density. Maximum dry density, in this report, refers to that density as determined by the ASTM D-1557 Compaction Test procedure. The moisture content of the soils to be compacted should be within about two percent of optimum so that a readily compactable condition exists. It may be necessary to over-excavate and remove wet soils in cases where drying to a compactable condition is not feasible. All compaction should be accomplished by equipment of a type and size sufficient to attain the desired degree of compaction and should be tested.

Slab-on-Grade

Slabs-on-grade should be supported on subgrade soils prepared as described in the **Site Preparation and Grading** subsection of this report. We recommend that all floor slabs be underlain by at least six inches of free-draining gravel with less than three percent by weight of the material passing Sieve #200 for use as a capillary break. A suitable vapor barrier, such as heavy plastic sheeting (6-mil minimum), should be placed over the capillary break material. An additional 2-inch-thick moist sand layer may be used to cover the vapor barrier. This sand layer is optional and is intended to be used to protect the vapor barrier membrane and to aid in curing the concrete.

Pavements

Pavement subgrade preparation and structural filling where required, should be completed as recommended in the **Site Preparation and Grading** and **Structural Fill** subsections of this report. The pavement subgrade should be proof-rolled with a heavy, rubber-tired piece of equipment, to identify soft or yielding areas that require repair. The pavement section should be underlain by a minimum of six inches of clean granular pit run or crushed rock. We should be retained to observe the proof-rolling and recommend subgrade repairs prior to placement of the asphalt or hard surfaces.

Utilities

We recommend that underground utilities be bedded with a minimum six inches of pea gravel prior to backfilling the trench with on-site or imported material. Trenches within settlement sensitive areas should be compacted to 95% of the modified proctor as described in the **Structural Fill** subsection of this report. Trenches located in non-structural areas should be compacted to a minimum 90% of the maximum dry density. Trench backfill compaction should be tested.

Site Drainage

Surface Drainage: The finished ground surface should be graded such that stormwater is directed to an appropriate stormwater collection system. Water should not be allowed to stand in any areas where footings, slabs, or pavements are to be constructed. Final site grades should allow for drainage away from the proposed structures. We suggest that the finished ground be sloped at a minimum downward gradient of three percent, for a distance of at least 10 feet away from the proposed structures. Surface water should be collected by permanent catch basins and drain lines and be discharged into an approved discharge system.

Subsurface Drainage: If groundwater is encountered during construction, we recommend that the contractor slope the bottom of the excavation and collect the water into ditches and small sump pits where the water can be pumped out and routed into a permanent storm drain. We recommend the use of footing drains around the structures. Footing drains should be installed at least one foot below planned finished floor elevation. The drains should consist of a minimum 4-inch-diameter, rigid, slotted or perforated, PVC pipe surrounded by free-draining material wrapped in a filter fabric. We recommend that the free-draining material consist of an 18-inch-wide zone of clean (less than three-percent fines), granular material placed along the back of walls. Pea gravel is an acceptable drain material. The free-draining material should extend up the wall to one foot below the finished surface. The top foot of backfill should consist of impermeable soil placed over plastic sheeting or building paper to minimize surface water or fines migration into the footing drain. Footing drains should discharge into tightlines leading to an approved collection and discharge point with convenient cleanouts to prolong the useful life of the drains. Roof drains should not be connected to wall or footing drains.

CONSTRUCTION MONITORING

We should be retained to provide construction monitoring services during the earthwork phase of the project to evaluate subgrade conditions, temporary cut conditions, fill compaction, and drainage system installation.

USE OF THIS LETTER

NGA has prepared this letter for **Adam Clark with 2812 Architecture,** and associated agents, for use in the planning and design of the development on this site only. The scope of our work does not include services related to construction safety precautions and our recommendations are not intended to direct the contractors' methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. There are possible variations in subsurface conditions between the explorations and also with time. Our report, conclusions, and interpretations should not be construed as a warranty of subsurface conditions. A contingency for unanticipated conditions should be included in the budget and schedule.

We recommend that NGA be retained to provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications. We should be contacted a minimum of one week prior to construction activities and could attend pre-construction meetings if requested.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this report was prepared. No other warranty, expressed or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

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It has been a pleasure to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Thor Christensen, PE
Project Engineer

KHALED M. SHAWISH
STATE OF WASHINGTON
35215
REGISTERED
PROFESSIONAL ENGINEER
7.27.2022

Khaled M. Shawish, PE
Principal Engineer

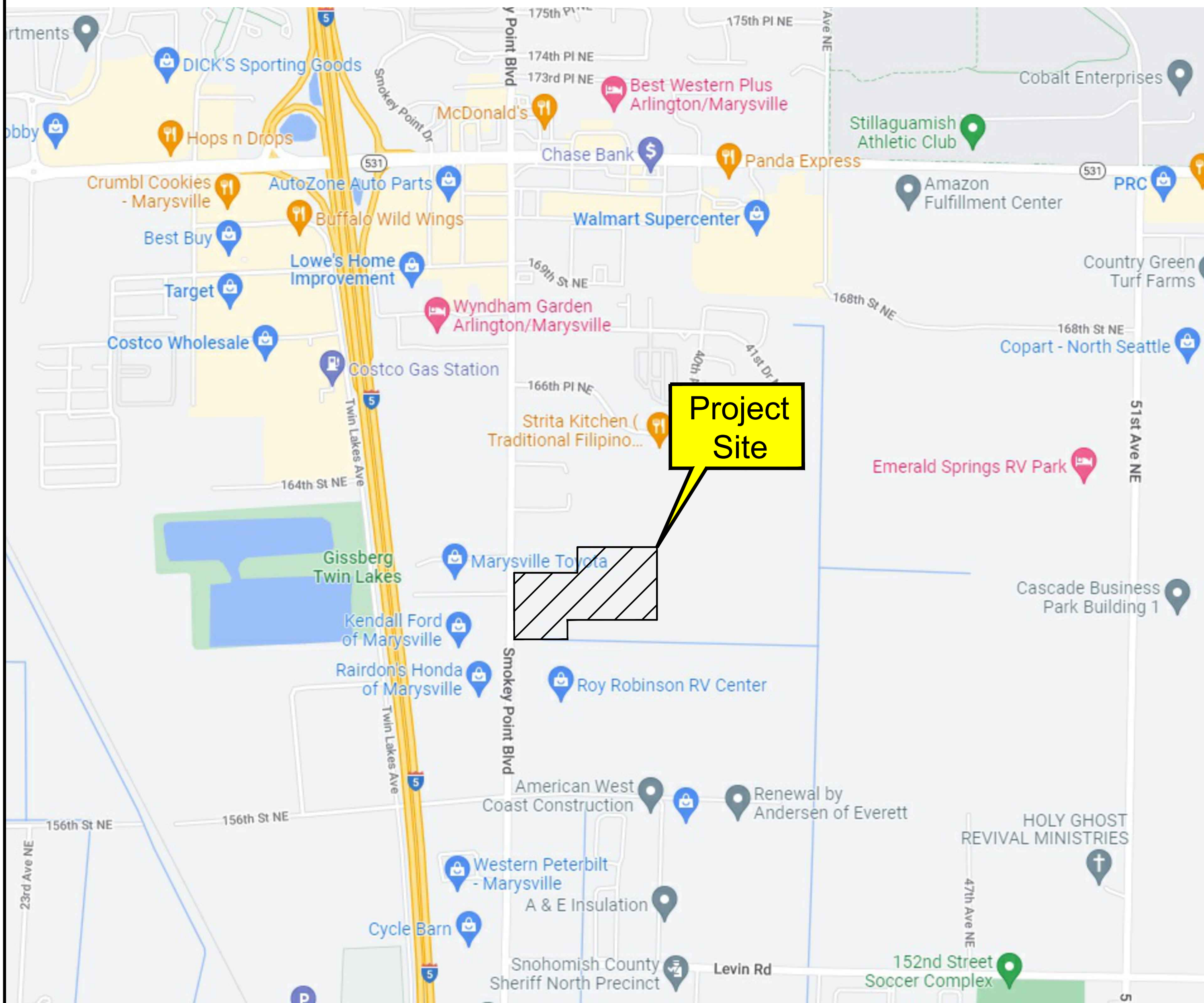
TRC:KMS:dy

Four Figures Attached

VICINITY MAP

Not to Scale

N



Marysville, WA

Project Number	Kendall Subaru Marysville Vicinity Map	NELSON GEOTECHNICAL ASSOCIATES, INC
1378422		
Figure 1		

NGA

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No.	Date	Revision	By	CK
1	6/27/22	Original	DPN	DJO

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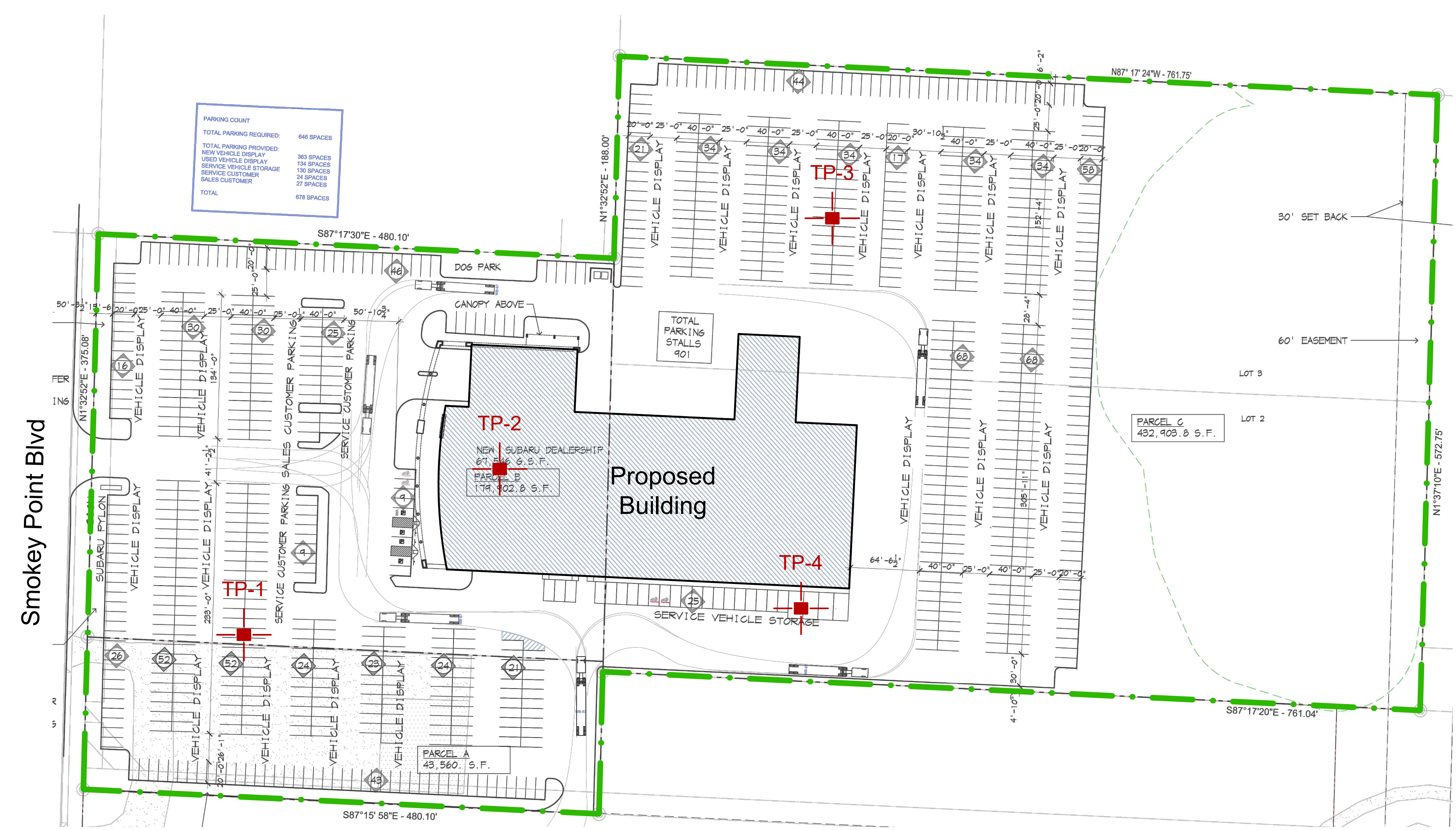
Site Plan



LEGEND

Property line

TP-1

Number and approximate location of test pit

0 150 300

Scale: 1 inch = 150 feet

Reference: Site plan based on a plan dated May 26, 2022 titled "New Auto Dealership for: Kendall Subaru," prepared by 2012 Architecture.

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Project Number 13784-22

Figure 2

Kendall Subaru Marysville Site Plan

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UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE - GRAINED SOILS MORE THAN 50 % RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50 % OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE - GRAINED SOILS MORE THAN 50 % PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50 %	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 % OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.

2) Soil classification using laboratory tests is based on ASTM D 2488-93.

3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water.

Wet - Visible free water or saturated, usually soil is obtained from below water table

Project Number 1378422	Kendall Subaru Marysville Soil Classification Chart	NELSON GEOTECHNICAL ASSOCIATES, INC	No.	Date	Revision	By	CK
Figure 3			1	6/27/22	Original	DPN	DJO

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LOG OF EXPLORATION

DEPTH (FEET)	USCS	SOIL DESCRIPTION
TEST PIT ONE		
0.0 – 0.5		**TOPSOIL**
0.5 – 1.5	SP	ORANGE-BROWN TO ORANGE-GRAY, FINE TO MEDIUM SAND WITH IRON-OXIDE WEATHERING AND TRACE ROOTS (MEDIUM DENSE, MOIST)
1.5 – 6.5	SP	GRAY, FINE TO MEDIUM SAND (MEDIUM DENSE, MOIST TO WET)
		SAMPLES WERE NOT COLLECTED MINOR GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 3.0 FEET HEAVY GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 3.75 FEET MODERATE TEST PIT CAVING WAS ENCOUNTERED FROM 2.0 TO 6.5 FEET TEST PIT WAS COMPLETED AT 6.5 FEET ON 06/22/2022
TEST PIT TWO		
0.0 – 0.5		**TOPSOIL** / WOOD CHIPS
0.5 – 1.5	SP-SM	ORANGE-BROWN TO ORANGE-GRAY, FINE TO MEDIUM SAND WITH SILT, IRON-OXIDE WEATHERING, AND TRACE ROOTS (MEDIUM DENSE, MOIST)
1.5 – 6.5	SP	GRAY, FINE TO MEDIUM SAND (MEDIUM DENSE, MOIST TO WET)
		SAMPLES WERE NOT COLLECTED HEAVY GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 3.5 FEET MODERATE TEST PIT CAVING WAS ENCOUNTERED FROM 3.0 TO 6.5 FEET TEST PIT WAS COMPLETED AT 6.5 FEET ON 06/22/2022
TEST PIT THREE		
0.0 – 0.75		ORANGE-BROWN, SILTY FINE TO MEDIUM SAND WITH ROOTS AND ORGANICS (LOOSE TO MEDIUM DENSE, MOIST) (**FILL/DISTURBED GROUND**)
0.75 – 2.0	SP-SM	ORANGE-BROWN TO ORANGE-GRAY, FINE TO MEDIUM SAND WITH SILT, IRON-OXIDE WEATHERING, AND TRACE ROOTS (MEDIUM DENSE, MOIST)
2.0 – 6.5	SW	GRAY, FINE TO COARSE SAND WITH TRACE GRAVEL (MEDIUM DENSE, MOIST TO WET)
		SAMPLES WERE NOT COLLECTED HEAVY GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 4.0 FEET MODERATE TEST PIT CAVING WAS ENCOUNTERED FROM 3.5 TO 6.5 FEET TEST PIT WAS COMPLETED AT 6.5 FEET ON 06/22/2022
TEST PIT FOUR		
0.0 – 1.0		ORANGE-BROWN TO DARK BROWN, SILTY FINE TO MEDIUM SAND WITH ROOTS AND ORGANICS (LOOSE TO MEDIUM DENSE, MOIST) (**FILL/DISTURBED GROUND**)
1.0 – 2.5	SP-SM	ORANGE-BROWN TO ORANGE-GRAY, FINE TO MEDIUM SAND WITH SILT AND IRON-OXIDE WEATHERING (MEDIUM DENSE, MOIST)
2.5 – 6.5	SW	GRAY, FINE TO COARSE SAND WITH TRACE GRAVEL (MEDIUM DENSE, MOIST TO WET)
		SAMPLES WERE NOT COLLECTED HEAVY GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 4.0 FEET MODERATE TEST PIT CAVING WAS ENCOUNTERED FROM 3.5 TO 6.5 FEET TEST PIT WAS COMPLETED AT 6.5 FEET ON 06/22/2022