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July 13, 2022

Neil Walter Company
1940 East D Street, Suite 100
Tacoma, Washington 98421

Attn: Kermit Jorgensen
(253) 779-8400
kjorgensen@neilwalter.com

Updated Stormwater Feasibility Soils Report
Proposed Contractor's Yard
1036 – 1106 Valley Avenue NW
Puyallup, Washington
PN: 042016-3042, -3041, & -3040
Doc ID: NWC.ValleyAveNW.SRu

INTRODUCTION

This *Updated Soils Report* addresses the feasibility of the site soils to support the infiltration of stormwater runoff generated by the proposed contractor's yard to be constructed at 1036 – 1106 Valley Ave NW in Puyallup, Washington. The location of the project site is shown on the attached Site Location Map, Figure 1.

Our understanding of the project is based on our conversations with you; our review of the provided *Site Survey* prepared by Contour Engineering; our December 10, 2021 site visit and subsurface explorations; our understanding of the City of Puyallup (the City) development requirements; and our experience in the site area. The site consists of three adjacent tax parcels, each of which is currently developed with an existing single-family residence, driveway, and associated utilities. We understand that you propose to demolish the existing structures and develop the site as a contractor's yard. We were not provided with a site plan prior to the preparation of this document, but a copy of the recent survey prepared by Contour Engineering is attached as Figure 2.

PURPOSE & SCOPE

The purpose of our services was to evaluate the surface and subsurface conditions at the site as a basis for providing our opinion on the feasibility of infiltration of stormwater and monitoring the groundwater levels during the wet season to observe if infiltration is feasible at the site for the proposed development in order to satisfy the City of Puyallup requirements. Specifically, our scope of services for the project included the following:

1. Reviewing the available geologic, hydrogeologic, and geotechnical data for the site area;
2. Exploring the surface and subsurface conditions by reconnoitering the site and monitoring the drilling of two hollow-stem auger borings to depths of 16.5 feet each, completed as groundwater observation wells;
3. Describing surface and subsurface conditions, including soil type, depth to groundwater, if encountered, and an estimate of seasonal high groundwater levels;

4. Providing our opinion about the feasibility of onsite stormwater infiltration in accordance with the 2014 SWMMWW, including a preliminary design infiltration rate based on grain size analysis; and,
5. Preparing this *Soils Report* that satisfies the 2014 SWMMWW requirements and summarizes our site observations and conclusions, our geotechnical recommendations and design criteria, along with the supporting data.

The above scope of work was completed in accordance with our *Proposal for Services* dated November 28, 2021. We received written notice to proceed on December 3, 2021.

SITE CONDITIONS

Surface Conditions

The site consists of three adjacent tax parcels located at 1036 – 1106 Valley Avenue NW in Puyallup, Washington, within an area of existing commercial development. The parcels, when combined, form an irregular shaped site that generally measures about 80 to 315 feet wide (northwest to southeast), by about 80 to 450 feet long (northeast to southwest), and encompass approximately 1.93 acres. The site is bounded by existing warehouse and light industrial development to the north, west, and south, and by Valley Avenue NW to the east.

The site is located in the Puyallup River valley and is generally flat. According to topographic information obtained from the Pierce County Public GIS website and as generally confirmed in the field, the site slopes down from Valley Avenue to the southwest at about 0 to 3 percent to a wide shallow depression located in the central portion of the site. The western portion of the site then slopes back up to the southwest at about 0 to 3 percent. The total topographic relief across the site is on the order of 6 feet. The existing site configuration and topography is shown on the attached Site & Exploration Map, Figure 3.

Vegetation across the site generally consists of pasture grasses with ornamental trees, plants, and shrubs surrounding the residence. No evidence of seeps, springs, or soil erosion was observed at the time of our site visit. However, standing water was observed in the stormwater pond located on the adjacent property near the southwest corner of the site.

Site Soils

The Natural Resources Conservation Survey (NRCS) Web Soil Survey maps the site as Briscot loam (6A) soils. An NRCS soils map for the site area is included as Figure 4.

- *Briscot Loam (6A):* These soils are derived from alluvium and form on slopes of 0 to 2 percent. The Briscot Loam soils have a "slight" erosion hazard when exposed and are included in hydrologic soils group B/D.

Site Geology

The draft *Geologic Map of the Puyallup 7.5-minute Quadrangle, Pierce County, Washington* (Troost et al, in review) maps the site as being underlain by alluvium (Qal). No geologic formations or deposits that could potentially adversely affect the development of the site such as landslides, areas of mass wasting, or alluvial fans are mapped within 300 feet of the site. An excerpt of the above referenced map is included as Figure 5.

- *Alluvium (Qal):* Alluvium generally consists of fluvial sediments deposited during the late Pleistocene to Holocene epochs, and typically consists of loose and stratified, fluvial silt, sand, and gravel, and is typically well rounded and well sorted and locally includes sandy to silty estuarine deposits. Because the alluvium was not overridden by the continental ice mass, it is considered normally consolidated. The infiltration potential of alluvium is highly variable, depending on the grain size distribution of the soil.

Subsurface Explorations

On December 10, 2021, we visited the site and monitored the drilling of two hollow-stem auger borings to depths of about 16½ feet below the existing ground surface, logged the subsurface conditions encountered in each boring, and obtained representative soil samples. The borings were drilled using a small track-mounted drill rig operated by a licensed drilling contractor working for GeoResources. Table 1, below, summarizes the approximate functional locations, surface elevations, and termination depths of our test pits explorations.

TABLE 1:
APPROXIMATE LOCATIONS, ELEVATIONS, AND DEPTHS OF EXPLORATIONS

Boring Number	Functional Location	Surface Elevation (feet)	Termination Depth (feet)	Termination Elevation[1] (feet)
B-1/MW-1	End of driveway at 1106 Valley Ave NW	40.23	16.5	23.7
B-2/MW-2	Field in front of 1106 Valley Ave NW	38.77	16.5	22.3

Notes:
1 = Surface elevation estimated from the *Site Survey* prepared by Contour Engineering (NAVD 88)

The specific locations, and depths of our borings were selected based on the configuration of the proposed development and were adjusted in the field based on considerations for underground utilities, existing site conditions, site access limitations, and encountered stratigraphy. Representative soil samples obtained from the borings were placed in sealed plastic bags and then taken to our laboratory for further examination and testing as deemed necessary. The borings were completed as groundwater monitoring wells per WA State regulations.

During drilling, soil samples were obtained at 2½ and 5 foot depth intervals in accordance with Standard Penetration Test (SPT) as per the test method outlined by ASTM D1586. The SPT method consists of driving a standard 2 inch-diameter split-spoon sampler 18 inches into the soil with a 140-pound hammer. The number of blows required to drive the sampler through each 6-inch interval is counted, and the total number of blows struck during the final 12 inches is recorded as the Standard Penetration Resistance, or "SPT blow count". If a total of 50 blows for any 6-inch interval is reached, refusal is called and the blow counts are recorded as 50 for the actual depth driven. The resulting Standard Penetration Resistance values indicate the relative density of granular soils and the relative consistency of cohesive soils.

The subsurface explorations completed as part of this evaluation indicates the subsurface conditions at specific locations only, as actual subsurface conditions can vary across the site.

Furthermore, the nature and extent of such variation would not become evident until additional explorations are performed or until construction activities have begun.

The approximate locations and numbers of our borings/wells are shown on the attached Site Survey, Figure 2 and the Site & Exploration Map, Figure 3. The indicated locations were determined by taping or pacing from existing site features and reference points; as such, the locations should only be considered as accurate as implied by the measurement method. The soils encountered were visually classified in accordance with the Unified Soil Classification System (USCS) and ASTM D2488. The USCS is included in Appendix A as Figure A-1, while the descriptive logs of our borings are included as Figures A-2 and A-3.

Subsurface Conditions

At the locations of our explorations we encountered relatively uniform subsurface conditions that, in our opinion, generally confirmed the mapped stratigraphy within the site vicinity. Boring B-1 encountered about ½ foot of dark brown topsoil in a loose, moist to wet condition overlying grey-brown silty gravelly sand in a loose to medium dense, moist condition. We interpret these soils to be consistent with undocumented fill soils. Underlying the fill in boring B-1 and at the surface of boring B-2, our explorations encountered mottled grey-brown sand with silt interbeds in a very loose to loose, moist to wet condition. These soils were encountered to the full depth explored in boring B-1. Underlying these soils in boring B-2, our exploration encountered black silty sand in a loose to medium dense, wet condition to the full depth explored. We interpret these soils encountered in our borings to be consistent with alluvium. Table 2 below summarizes the soils encountered in our borings.

TABLE 2:
APPROXIMATE THICKNESS, DEPTHS, AND ELEVATION OF ENCOUNTERESOIL TYPES

Boring Number	Thickness of Topsoil (Feet)	Thickness of Fill (feet)	Thickness of Loose Silt SAND (feet)	Depth to Loose SAND (feet)	Elevation[1] of Loose SAND (feet)
B-1/MW-1	0.5	1.5	8.0	10.0	30.2
B-2/MW-2	0.5	0.0	9.8	10.3	28.5

Notes:
1 = Surface elevation estimated from the *Site Survey* prepared by Contour Engineering (NAVD 88)

Laboratory Testing

Geotechnical laboratory tests were performed on select samples retrieved from the test pits to estimate index engineering properties of the soils encountered. Laboratory testing included visual soil classification per ASTM D2488 and ASTM D2487, moisture content determinations per ASTM D2216, and grain size analyses per ASTM D6913 standard procedures.

We returned to the site on May 27, 2022 to collect shallow subsurface samples adjacent to each boring exploration. Cat-ion exchange capacity (CEC) and organic content testing were performed by an independent laboratory to evaluate the treatment capacity of the shallow onsite soils for LID methods. The results of the laboratory tests are summarized below in Table 3 and graphical outputs are included in Appendix B.

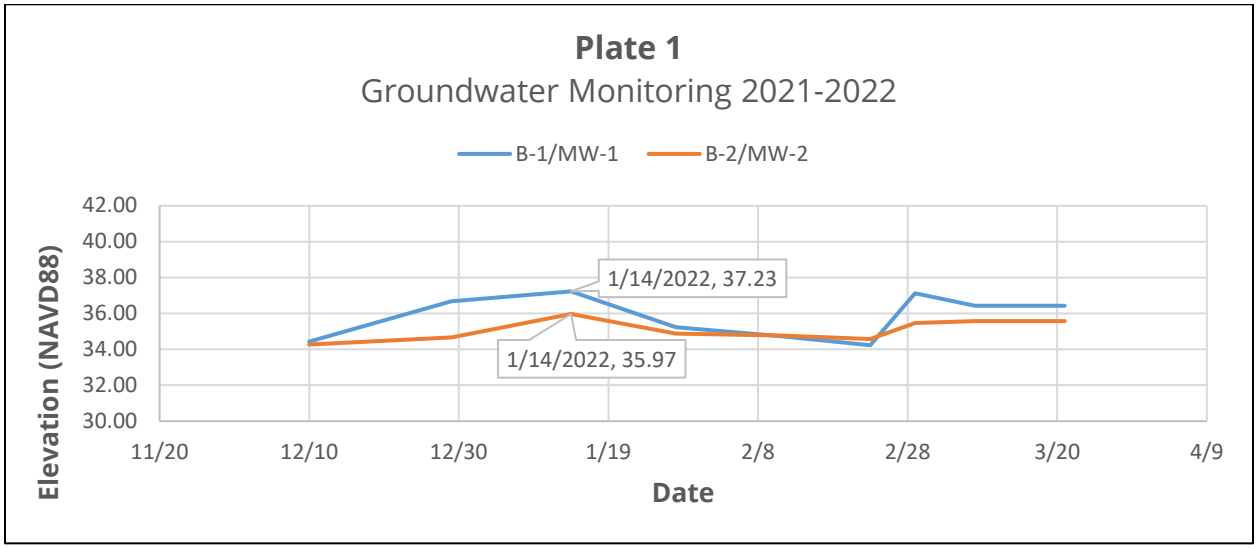
TABLE 3:
LABORATORY TEST RESULTS FOR ON-SITE SOILS

Sample	Soil Type	Lab ID	Gravel Content (percent)	Sand Content (percent)	Silt/Clay Content (percent)	D10 Ratio (mm)
B-1, S-1a, 2½'	SM	102783	0.1	87.8	12.1	>0.075
B-2, S-1, 2'	SM	102784	0.0	52.4	47.6	>0.075

Groundwater Conditions

Groundwater monitoring wells were installed at the site on December 10, 2021. The locations of the observation wells are shown on the Site & Exploration Map, Figure 2. At the time of drilling, groundwater was encountered at about 4.5 to 5.8 feet below the ground surface (Elevation 34.3 to 34.4 feet). Groundwater readings for the observation wells were manually measured on a bi-monthly basis from December 10, 2021 to March 21, 2022.

Based on our wet season monitoring, it appears that seasonal high groundwater occurs at about Elevation 35.97 to 37.23 feet (NAVD 88) at the locations monitored, approximately 2.80 to 3.00 feet below the ground surface. These levels were recorded on January 14, 2022. Plate 1, below, summarizes the groundwater levels recorded as part of our groundwater monitoring program during our monitoring period.



We anticipate fluctuations in the local groundwater levels will occur in response to precipitation patterns, off site construction activities, and site utilization and will in general be similar to the water surface elevation of the adjacent river. As such, water level observations made at the time of our field investigation may vary from those encountered during the construction phase. Analysis or modeling of anticipated groundwater levels during construction is beyond the scope of this report.

CONCLUSIONS

Based on the results of our site reconnaissance and subsurface explorations, it is our opinion that conventional infiltration using a pond or gallery is likely not feasible given the shallow depth to groundwater, but the use of low-impact development (LID) Best Management Practices (BMPs) per the Puyallup stormwater manual does appear feasible.

Infiltration Recommendations

Based on our subsurface explorations and groundwater monitoring, it is our opinion that stormwater infiltration via a shallow trench or basin type system, and permeable pavement is feasible at the site, provided the bottom of the facility is located above elevation 37 feet (NAVD88). This elevation is based on the results of our winter season groundwater monitoring and topographic information obtained from the Pierce County Public GIS and should be surveyed in the field.

Per Volume III Section 3.1.1 of the 2014 SWMMWW, downspout infiltration is considered feasible if there is at least 1 foot of clearance from the expected bottom elevation of the infiltration facility to the seasonal high ground water table. Infiltration facilities for flow control and treatment, Volume III Section 3.3.7 *Site Suitability Criteria (SSC) 5 Depth to Bedrock, Water Table, or Impermeable Layer*, requires that the base of all infiltration basins or trench system be greater than or equal to 5 feet above the seasonal high water mark, bedrock (or hardpan), or other low permeability layer. The vertical separation may be reduced to 3 feet as recommended by the site professional. For the purposes of this infiltration feasibility evaluation, we have assumed that, at a minimum, the standard infiltration trench section (6 inches of topsoil over a 2 foot deep trench) would be used. Based on the above, there is not sufficient separation from seasonal high groundwater to the bottom of an infiltration trench.

Volume III Section 3.4.2 of the 2014 SWMMWW requires at least 1 foot of separation from the bottoms of rain gardens and permeable pavement to seasonal high groundwater. A 1 foot or 3 foot minimum separation from the bottom of bioretention is required depending upon the drainage area. For the purposes of this evaluation, a standard permeable pavement section (6 inches of pavement over 6 inches of storage course) would be used. Based on the above, shallow infiltration facilities such as rain gardens, bioretention, and permeable pavement appear to be feasible. Deeper trenches and thicker storage courses may be designed by a civil engineer where the vertical separation requirements can be met.

Infiltration Rate

We completed soil gradation analyses on two representative soil samples from the site per the 2014 SWMMWW, Volume III, Section 3.3.6, Method 3 (Massman, 2003) and in accordance with ASTM D6913. Based on our gradation analyses, we recommend a preliminary design infiltration rate of 1 inch per hour be used for the alluvium soils encountered at the site. Appropriate correction factors have been applied to these values in accordance with the 2014 SWMMWW, Volume III, Section 3.3.6, Table 3.3.1, including correction factors for site variability ($F_{variability}$), testing method ($F_{testing}$) and maintenance for situation biofouling ($F_{maintenance}$). Our calculations are included in Appendix C.

All proposed infiltration facilities should be designed and constructed in accordance with the 2014 SWMMWW. All minimum separations, setback requirements, and infeasibility criteria per 2014 SWMMWW should be considered prior to the selection, design and location of any stormwater facility for the proposed development.

Feasibility of the Native Soils for Water Quality Treatment

Volume III, Section 3.3.7 SSC-6 *Soil Physical and Chemical Suitability for Treatment* of the 2014 SWMMWW requires treatment soils to have at least 5mEq/100g of cation exchange capacity (CEC) and 1 percent by weight organic content. Cation exchange capacity and organic content testing was performed by a third party independent laboratory. The organic content of the site soils were determined to be about 1.12 to 11.1 percent per ASTM D2974-13, with a cation exchange capacity of 15.4 to 16.7 milliequivalents per 100 grams as determined by SW-846 Test Method 9081. Based on the results of the soil testing, the soils meet the minimum requirements for water quality treatment via infiltration; therefore, the subgrade soils should provide adequate treatment of stormwater runoff generated by the proposed pollution generating impervious surface.

Construction Considerations

Appropriate design, construction and maintenance measures will be required to ensure the infiltration rate can be effectively maintained over time. Stormwater Best Management Practices (BMPs) in accordance with the 2014 SWMMWW should be included in the project plans and specifications to minimize the potential for fines contamination of Low Impact Development BMPs utilized at the site.

We recommend that a representative from our firm be onsite at the time of excavation of the proposed infiltration facilities to verify that the soils encountered during construction are consistent with the soils observed in our subsurface explorations. In-situ infiltration testing should be performed at the time of construction to verify the recommended infiltration rate and to determine if a different site specific infiltration rate would be more appropriate for the site.

Suspended solids could clog the underlying soil and reduce the infiltration rate of the facilities. To reduce potential clogging of the infiltration systems, the infiltration system should not be connected to the stormwater runoff system until after construction is complete and the site area is landscaped, paved or otherwise protected. Temporary systems may be utilized throughout construction. Periodic sweeping of the paved areas will help extend the life of the infiltration system.

Additional measures may also be taken during construction to minimize the potential of fines contamination of the proposed infiltration system, such as utilizing an alternative storm water management location during construction or leaving the bottom of the permanent systems 1 to 2 feet high, and subsequently excavating to the finished grade once the site soils have been stabilized. All contractors working on the site (builders and subcontractors) should divert sediment laden stormwater away from proposed infiltration facilities during construction and landscaping activities. No concrete trucks should be washed or cleaned, and washout areas should not be within the vicinity of the proposed infiltration facilities. After construction activities have been completed, periodic sweeping of the paved areas will help extend the life of the infiltration system.

LIMITATIONS

We have prepared this report for use by Neil Walter Company and members of the design team, for use in the design of a portion of this project. The data used in preparing this report and this report should be provided to prospective contractors for their bidding or estimating purposes only. Our report, conclusions and interpretations are based on our subsurface explorations, published geologic information, and limited site reconnaissance, and should not be construed as a warranty of the subsurface conditions.

Variations in subsurface conditions are possible between the explorations and may also occur with time. A contingency for unanticipated conditions should be included in the budget and schedule. Sufficient monitoring, testing and consultation should be provided by our firm 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 during the work differ from those anticipated, and to evaluate whether earthwork and foundation installation activities comply with contract plans and specifications.

The scope of our services does not include services related to environmental remediation and construction safety precautions. Our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.

If there are any changes in the loads, grades, locations, configurations or type of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide written modifications or verifications, as appropriate.

◆ ◆ ◆

We have appreciated the opportunity to be of service to you on this project. If you have any questions or comments, please do not hesitate to call at your earliest convenience.

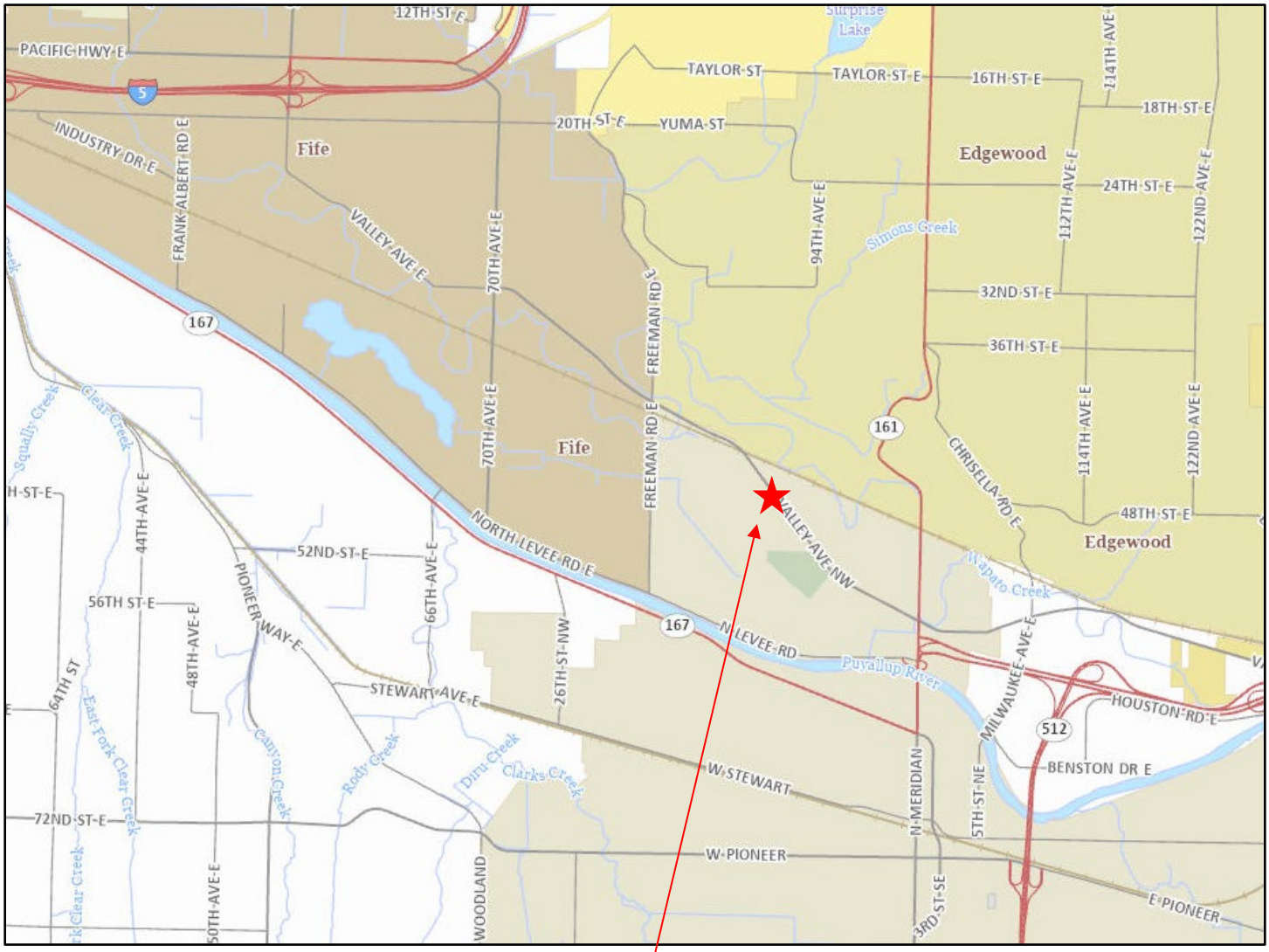
Respectfully submitted,
GeoResources, LLC

Jordan L. Kovash, LG
Project Geologist

Keith S. Schembs, LEG
Principal

Eric W. Heller, PE, LG
Senior Geotechnical Engineer

JLK:KSS:EWH/jlk
Doc ID: NWC.ValleyAveNW.SR
Attachments: Figure 1: Site Location Map
Figure 2: Site Survey
Figure 3: Site & Exploration Map
Figure 4: NRCS Soils Map
Figure 5: Geologic Map
Appendix A – Subsurface Explorations
Appendix B – Laboratory Test Results
Appendix C – Massman Calculations



Approximate Site Location

Map created from Pierce County WA GIS (https://matterhornwab.co.pierce.wa.us/publicgis/)

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Not to Scale

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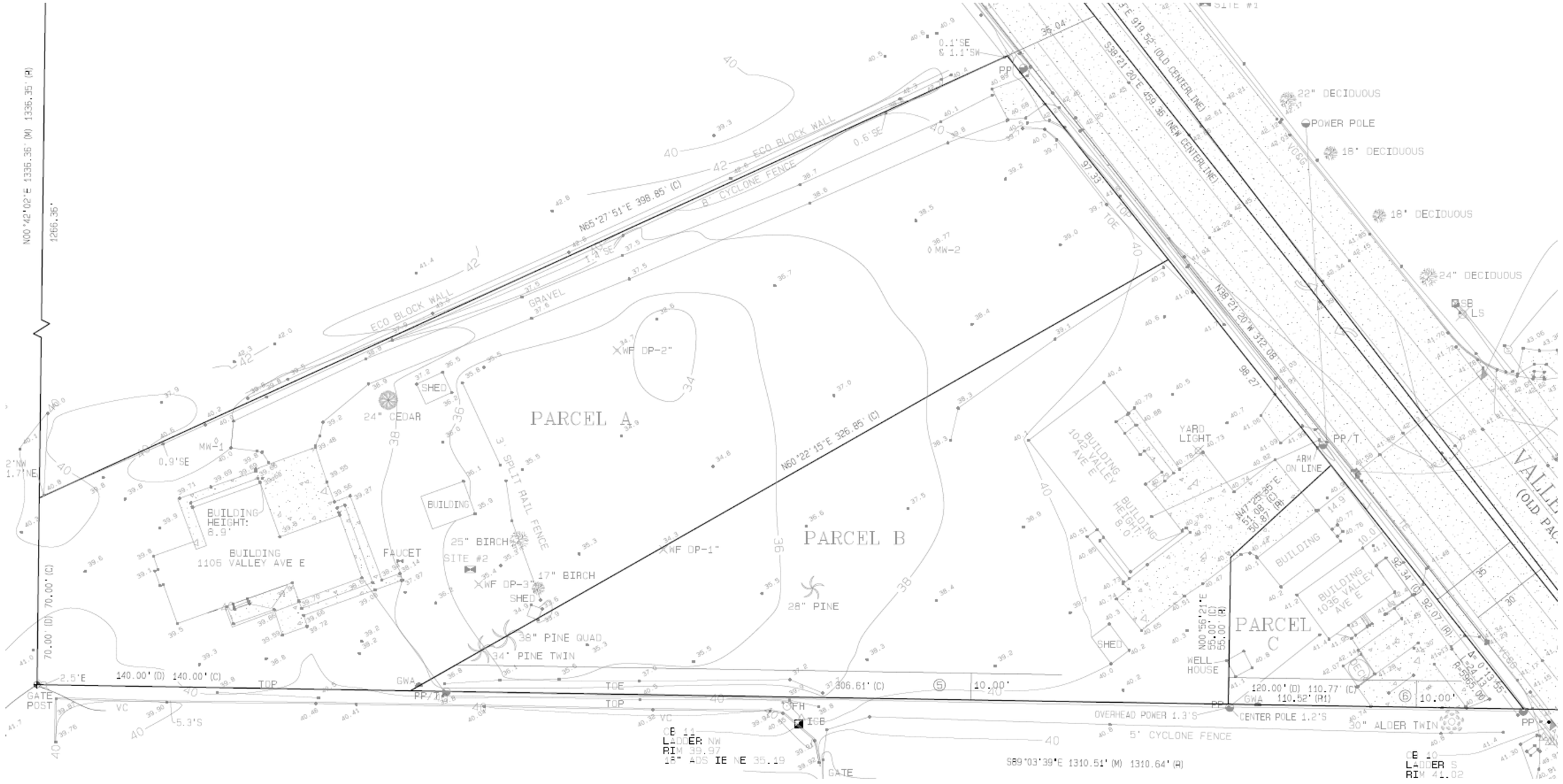
Site Location Map

Proposed Contractor's Yard
1036 – 1106 Valley Avenue NW
Puyallup, Washington
PN: 042016-3040, 3041, 3042

Doc ID: NWC.ValleyAve.Fu	July 2022	Figure 1



Notes:
Site Survey prepared by Contour Engineering
Not to Scale

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Site Survey Map

Proposed Contractor's Yard
1036 – 1106 Valley Avenue NW
Puyallup, Washington
PN: 042016-3040, 3041, 3042

Doc ID: NWC.ValleyAve.F2	July 2022	Figure 2

Approximate Site Location

Map created from Pierce County WA GIS (https://matterhornwab.co.pierce.wa.us/publicgis/)

B/MW Exploration number and approximate location (GeoResources 2021)

Not to Scale

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Site & Exploration Map

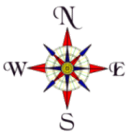
Proposed Contractor's Yard
1036 – 1106 Valley Avenue NW
Puyallup, Washington
PN: 042016-3040, 3041, 3042

Doc ID: NWC.ValleyAve.Fu	July 2022	Figure 3

Approximate Site Location

Map created from Web Soil Survey (http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx)

Soil Type	Soil Name	Parent Material	Slopes	Erosion Hazard	Hydrologic Soils Group
6A	Briscot Loam	Alluvium	0 to 2	Slight	B/D
30A	Puget silty clay loam	Alluvium	0 to 2	None	C/D
31A	Puyallup fine sandy loam	Alluvium	0 to 3	Slight	A
42A	Sultan silt loam	Alluvium	0 to 2	Slight	C/D



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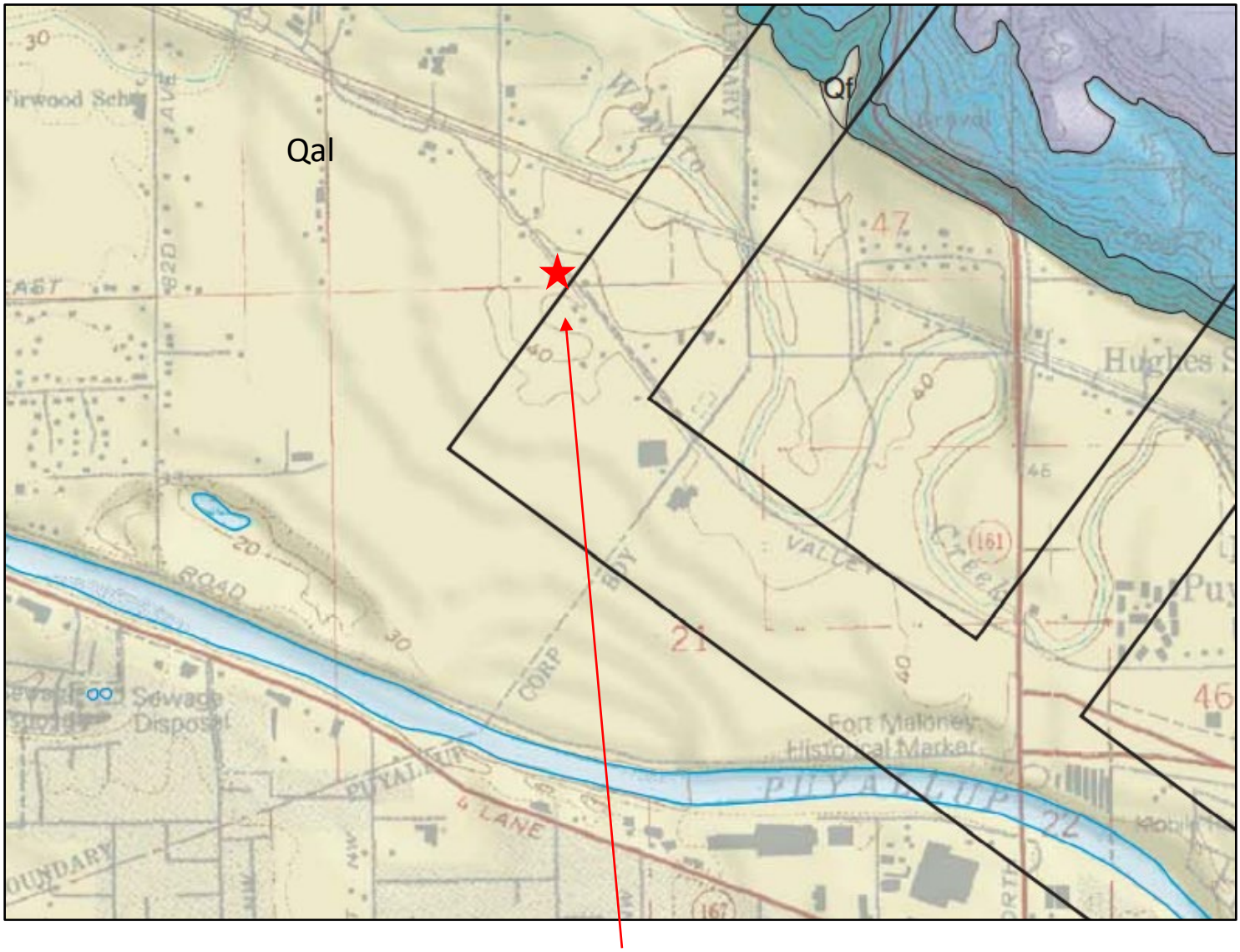
NRCS Soils Map

Proposed Contractor's Yard
1036 – 1106 Valley Avenue NW
Puyallup, Washington
PN: 042016-3040, 3041, 3042

Doc ID: NWC.ValleyAve.Fu	July 2022	Figure 4



Approximate Site Location

An excerpt from the draft *Geologic Map of the Puyallup 7.5-minute Quadrangle, Pierce County, Washington* by Troost et. al.

Qal	Alluvium

Not to Scale

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Geologic Map

Proposed Industrial Development
25491 WA -3
Mason County, Washington
PN: 12321-1400040, 14-00041, 75-00030

Doc ID: NWC.ValleyAve.Fu	July 2022	Figure 5

Appendix A

Subsurface Explorations

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 GRAVEL, 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 D2488-90.
2. Soil classification using laboratory tests is based on ASTM D2487-90.
3. Description of soil density or consistency are based on interpretation of blow count data, visual appearance of soils, and or test data.

SOIL MOISTURE MODIFIERS:

Dry- Absence of moisture, dry to the touch

Moist- Damp, but no visible water

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

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Unified Soils Classification System

Proposed Contractor's Yard
1036 – 1106 Valley Avenue NW
Puyallup, Washington
PN: 042016-3040, 3041, 3042

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LOG OF BORING B-1/MW-1

Proposed Contractor's Yard
1106 - 1036 Valley Ave NW
Puyallup, Washington

1. Refer to log key for definition of symbols, abbreviations, and codes
2. USCS disination is based on visual manual classification and selected lab testing
3. Groundwater level, if indicated, is for the date shown and may vary
4. NE = Not Encountered
5. ATD = At Time of Drilling
6. HWM = Highest Groundwater Level

Drilling Company:	Boretec 1, Inc.	**Logged By:**	JLK
Drilling Method:	HSA	**Drilling Date:**	12/10/2021
Drilling Rig:	EC 95 Track Drill	**Datum:**	NAVD88
Sampler Type:	split spoon	**Elevation:**	40
Hammer Type:	cat head	**Termination Depth:**	16.5
Hammer Weight:	140 lbs	**Latitude:**	
		Longitude:	

Notes: End of driveway, just north of house at 1106 Valley Ave NW

Depth (feet)	Elevation (feet)	Soil description	STP Blowcounts
0	40	Dark brown silty SAND (loose to medium dense, moist) (Topsoil) (SM)	
		Grey-brown silty SAND with gravel (loose to medium dense, moist) (Fill) (SM)	
2.5	37.5	Mottled grey-brown sandy SILT (medium stiff, moist) (Alluvium) (ML)	3
		Grey-brown silty SAND (loose, moist) (SM)	3
		Brown silty SAND (loose, moist) (SM)	4
5	35	(very loose, wet)	1
			2
		Mottled grey-brown silty SAND, small rootlets/organics (very loose, moist to wet) (SM)	2
7.5	32.5		
10	30	Grey-brown silty SAND with silt interbeds (loose, wet) (Alluvium) (SM)	2
			4
			5
12.5	27.5		
15	25		2
			4
			6

Test Results: Plastic Limit — Liquid Limit; % Fines (<0.075mm) ◇; % Water Content ●; Penetration - ▲ (blows per foot) 10 20 30 40 50

Groundwater: ATD

Description not given for: "OT" | Silty sand | Silt

JOB: NeilWalterCompany.ValleyAveNW

FIG. A-2

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LOG OF BORING B-1/MW-1

Proposed Contractor's Yard
1106 - 1036 Valley Ave NW
Puyallup, Washington

1. Refer to log key for definition of symbols, abbreviations, and codes
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Drilling Company:	Boretec 1, Inc.	**Logged By:**	JLK
Drilling Method:	HSA	**Drilling Date:**	12/10/2021
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Sampler Type:	split spoon	**Elevation:**	40
Hammer Type:	cat head	**Termination Depth:**	16.5
Hammer Weight:	140 lbs	**Latitude:**	
		Longitude:	

Notes: End of driveway, just north of house at 1106 Valley Ave NW

Depth (feet)	Elevation (feet)	Exploration notes	Soil description	STP Blowcounts	Sampler	Symbol	Test Results	Groundwater
							Plastic Limit — Liquid Limit; % Fines (<0.075mm) ◇; % Water Content ●	
							Penetration - ▲ (blows per foot) 10 20 30 40 50	
			(Termination Depth - 12/10/2021)					
17.5	22.5							
20	20							
22.5	17.5							
25	15							
27.5	12.5							
30	10							

Description not given for: "0T" | Silty sand | Silt

JOB: NeilWalterCompany.ValleyAveNW

FIG. A-2

GEORESOURCES
earth science & geotechnical engineering

LOG OF BORING B-2/MW-2

Proposed Contractor's Yard
1106 - 1036 Valley Ave NW
Puyallup, Washington

1. Refer to log key for definition of symbols, abbreviations, and codes
2. USCS disination is based on visual manual classification and selected lab testing
3. Groundwater level, if indicated, is for the date shown and may vary
4. NE = Not Encountered
5. ATD = At Time of Drilling
6. HWM = Highest Groundwater Level

Drilling Company:	Boretec 1, Inc.	**Logged By:**	JLK
Drilling Method:	HSA	**Drilling Date:**	12/10/2021
Drilling Rig:	EC 95 Track Drill	**Datum:**	NAVD88
Sampler Type:	split spoon	**Elevation:**	39
Hammer Type:	cat head	**Termination Depth:**	16.5
Hammer Weight:	140 lbs	**Latitude:**	
		Longitude:	

Notes: Field in front of 1106 Valley Ave NW

Depth (feet)	Elevation (feet)	Soil description	STP Blowcounts
0	37.5	Mottled grey-brown silty SAND (loose, moist) (Alluvium) (SM)	1 3 5
5	32.5	(very loose, wet)	1 1 1
10	27.5	Black SAND (loose, wet) (Alluvium) (SP)	4 4 4
15	25	(medium dense, wet)	2 5 6

Exploration notes

Sampler

Symbol

Test Results
Plastic Limit — Liquid Limit
% Fines (<0.075mm) ◇
% Water Content ●
Penetration - ▲ (blows per foot)
10 20 30 40 50

Groundwater
ATD

Description not given for: "OT" | Silty sand | Silt | Poorly graded sand

JOB: NeilWalterCompany.ValleyAveNW

FIG. A-3

GEORESOURCES
earth science & geotechnical engineering

LOG OF BORING B-2/MW-2

Proposed Contractor's Yard
1106 - 1036 Valley Ave NW
Puyallup, Washington

1. Refer to log key for definition of symbols, abbreviations, and codes
2. USCS disination is based on visual manual classification and selected lab testing
3. Groundwater level, if indicated, is for the date shown and may vary
4. NE = Not Encountered
5. ATD = At Time of Drilling
6. HWM = Highest Groundwater Level

Drilling Company:	Boretec 1, Inc.	**Logged By:**	JLK
Drilling Method:	HSA	**Drilling Date:**	12/10/2021
Drilling Rig:	EC 95 Track Drill	**Datum:**	NAVD88
Sampler Type:	split spoon	**Elevation:**	39
Hammer Type:	cat head	**Termination Depth:**	16.5
Hammer Weight:	140 lbs	**Latitude:**	
		Longitude:	

Notes: Field in front of 1106 Valley Ave NW

Depth (feet)	Elevation (feet)	Exploration notes	Soil description	STP Blowcounts	Sampler	Symbol	Test Results	Groundwater
	22.5						Plastic Limit — Liquid Limit; % Fines (<0.075mm) ◇; % Water Content ●	
			(Termination Depth - 12/10/2021)				Penetration - ▲ (blows per foot) 10 20 30 40 50	
17.5	20							
20	17.5							
22.5	15							
25	12.5							
27.5	10							
30	7.5							

Description not given for: "0T" | Silty sand | Silt | Poorly graded sand

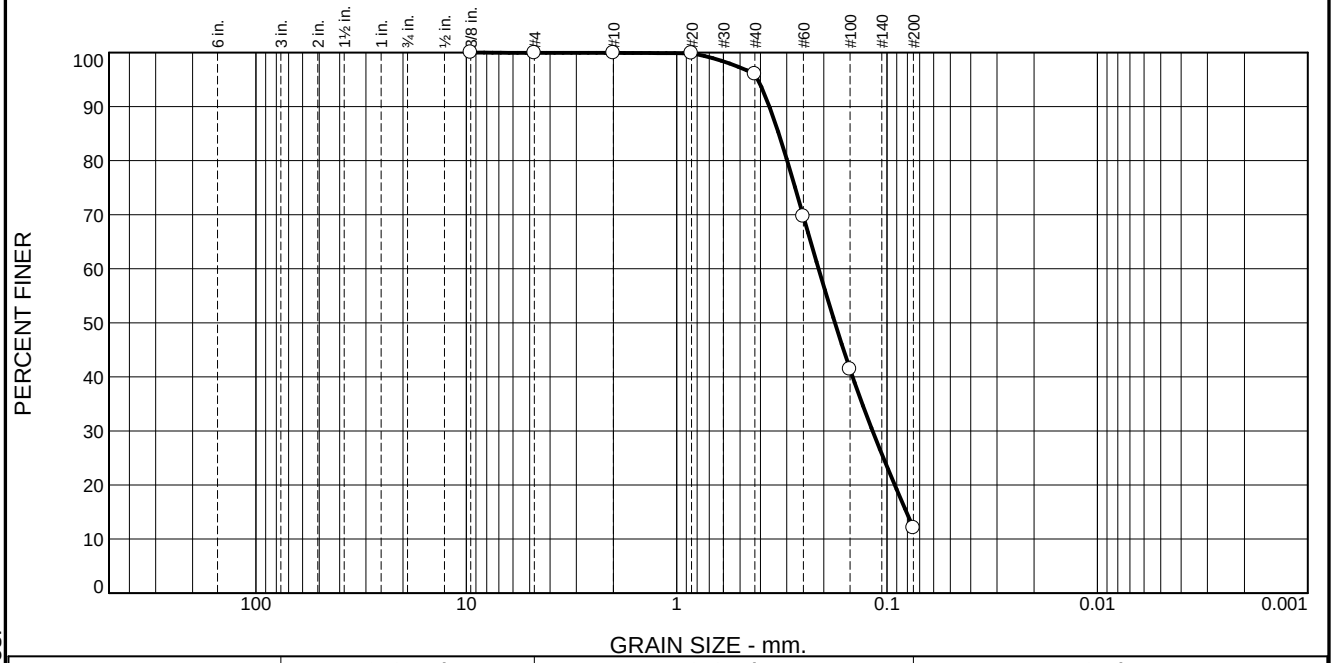
JOB: NeilWalterCompany.ValleyAveNW

FIG. A-3

Appendix B

Laboratory Test Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.0	3.9	83.9	12.1	

Test Results (ASTM D 6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375	100.0		
#4	99.9		
#10	99.9		
#20	99.9		
#40	96.0		
#60	69.7		
#100	41.4		
#200	12.1		

* (no specification provided)

Material Description

Silty SAND (SM)

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.3626 D_{85}= 0.3273 D_{60}= 0.2116
D_{50}= 0.1770 D_{30}= 0.1172 D_{15}= 0.0809
D_{10}= C_u= C_c=

Remarks

Natural Moisture: 21.8%

Date Received: 12/10/21 **Date Tested:** 12/21/21

Tested By: MAW

Checked By: KSS

Title: PM

Source of Sample: B-1/MW-1 **Depth:** 2.5

Sample Number: 1a

Date Sampled: 12/10/21

GeoResources, LLC

Fife, WA

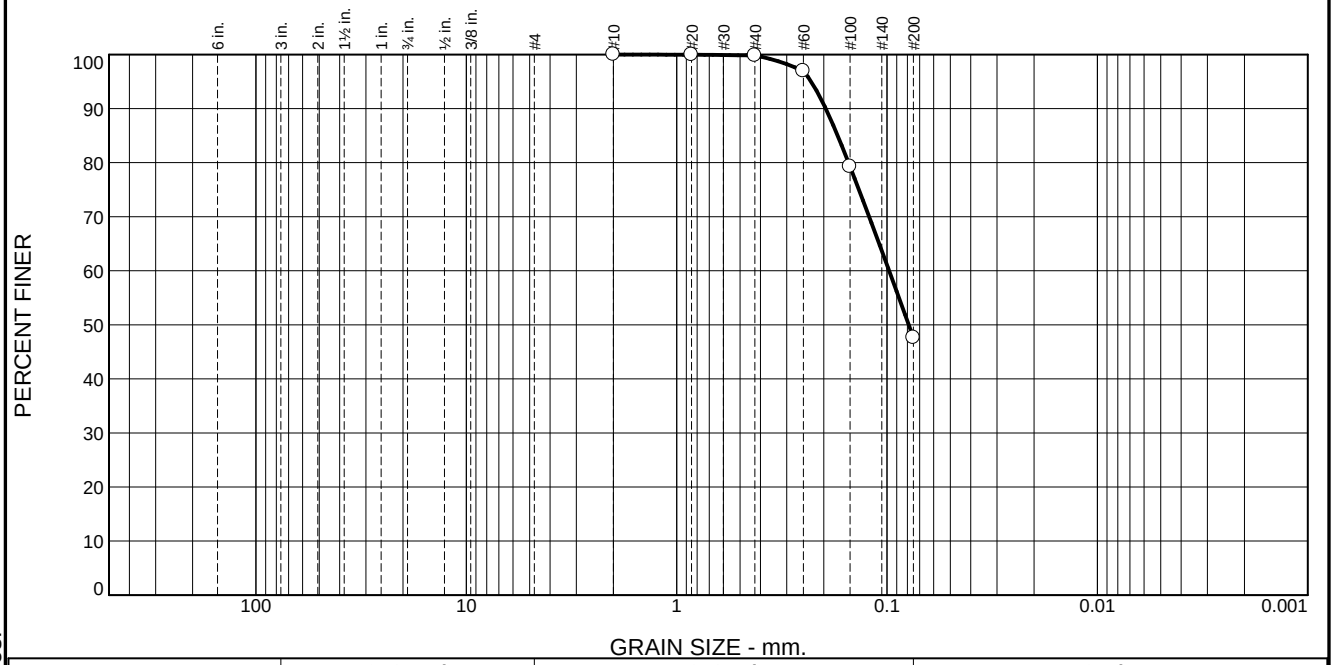
Client: Neil Walter Company

Project: Proposed Contractor's Yard

Project No: NeilWalterCompany.ValleyAveNW **Figure** B-1

Tested By: _____ **Checked By:** _____

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	52.2	47.6	

Test Results (ASTM D 6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#20	100.0		
#40	99.8		
#60	97.0		
#100	79.3		
#200	47.6		

* (no specification provided)

Material Description

Silty SAND (SM)

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 0.1956 D_{85}= 0.1718 D_{60}= 0.0978
D_{50}= 0.0789 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Natural Moisture: 27.6%

Date Received: 12/10/21 **Date Tested:** 12/21/21

Tested By: MAW

Checked By: KSS

Title: PM

Source of Sample: B-2/MW-2 **Depth:** 2.5
Sample Number: 1

Date Sampled: 12/10/21

GeoResources, LLC

Fife, WA

Client: Neil Walter Company
Project: Proposed Contractor's Yard

Project No: NeilWalterCompany.ValleyAveNW **Figure** B-2

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

Tested By: _____ **Checked By:** _____

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Analytical Report

Geo Resources, LLC
4809 Pacific Hwy E
Fife, WA 98424

Project NWC.Valley Ave
PO Number
Date Received 05/27/2022

Client ID: 103272 (HA-1, S-1) **Lab No: 302271-01** **Sample Date: 05/27/22 12:30**

Analyte	Method	Result	Units	PQL	Qualifiers	Analysis Date	Analyst
Cation Echange Capcity	SW 9081	16.7	Na, mEq/100g	---	---	6/29/2022	KLH
Organic Matter	ASTM D-2974-13	1.12	wt. % Dry	0.005	---	6/23/2022	KLH

Client ID: 103273 (HA-2, S-2) **Lab No: 302271-02** **Sample Date: 05/27/22 12:45**

Analyte	Method	Result	Units	PQL	Qualifiers	Analysis Date	Analyst
Organic Matter	ASTM D-2974-13	11.1	wt. % Dry	0.005	---	6/23/2022	KLH
Cation Echange Capcity	SW 9081	15.4	Na, mEq/100g	---	---	6/29/2022	KLH

Lab Qualifiers Comments:

Appendix C

Massman Calculations

City of Puyallup - 2014 SWMMWW

NeilWalterCompany.ValleyAveNW

Puyallup, Washington

Massman Calculation Sheet

Soil Grain Size Analysis Method

Procudure based on 2014 SWMMWW, Volume III

$K_{sat} = 10^{(-1.57 + 1.90D_{10} + 0.015D_{60} - 0.013D_{90} - 2.08F_{fines})}$ (provides Ksat in cm/s)

$K_{sat} = [10^{(-1.57 + 1.90D_{10} + 0.015D_{60} - 0.013D_{90} - 2.08F_{fines})}]*1417$ (provides Ksat in in/hr)

Sample Information				Sieve Data				Unfactored Rate	
I.D.	Test Pit	Depth (ft)	Layer Thickness (ft)	D_{10}	D_{60}	D_{90}	F_{fines}	Individual K_{sat} (cm/s)	Equivalent K_{sat} (in/hr)
102783	B-1	2.5'	15'+	0.07	0.2116	0.3626	0.121	0.020	28.917
102784	B-2	2.5'	15'+	0.030	0.0978	0.1956	0.476	0.003	4.438

Effective Average Hydraulic Conductivity, K_{equiv}

Based on either:

1) Average K_{sat} determined using harmonic mean
2) Lowest conductive layer, if within 5ft of bottom of pond

k_{equiv}=	16.678	Average
	4.438	Lowest
	4.438	To Use

Site Variability & number of location tested (CF_v)

	0.33 to 1.0

Factor to use for calculations: 0.75

Test Method (CF_t)

	0.4 to 0.75
Large-scale PIT	0.75
Small-scale PIT	0.5
Other small-scale (e.g. Double ring, falling head)	0.4
Grain Size Method	0.4

Factor to use for calculations: 0.4

Degree of influent control to prevent siltation and bio-buildup (CF_m)

	0.90

Factor to use for calculations: 0.9

$I_{design} = I_{measured} * F_{testing} * F_{geometry} * F_{plugging}$: **1.20** in/hr

Design Value: 1.00 in/hr

GEORESOURCES
earth science & geotechnical engineering
4809 Pacific Hwy. E. | Fife, WA 98424 | 253.896.1011 | www. georesources.rocks

Infiltration Analysis

Proposed Contractor's Yard
1036-1106 Valley Avenue NW
Puyallup, Washington
PN: 042016-3042, -3041, & -3040