



TECHNICAL INFORMATION REPORT CITY OF MERCER ISLAND

For

**Adams Mercer Island SFR
3508 96th Ave SE
Mercer Island, WA 98040**

November 30, 2023
Updated May 8, 2025



**Prepared By:
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Prepared For:

**Samuel Adams
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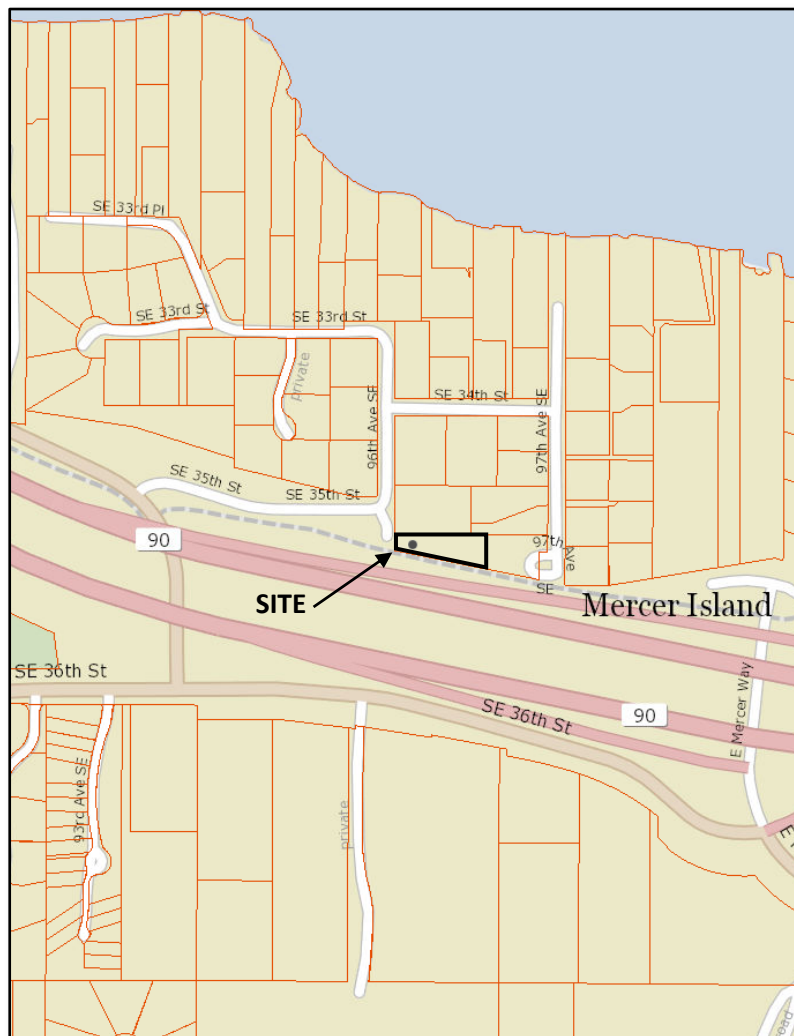
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WWHM Capacity Check Output

I. PROJECT OVERVIEW

Project Name: Adams Mercer Island SFR
Site Address: 3508 96th Ave SE
King County Tax Parcel: 413930-0045
Zoning: RS-9.6
Site Area: 11,900 SF (0.273 AC)
Site Location: The site is located in the City of Mercer Island at 3508 96th Ave SE within the SE ¼ of Section 7, Township 24 North, Range 5 East, W.M.
Ex. Adjacent Development: North – Single-Family Residence
East – Single-Family Residence
South – Interstate 90
West – 96th Ave SE

Figure 1: Vicinity Map



Pre-developed Site Conditions:

The property is presently undeveloped with a demolished single-family residence with access to 96th Avenue SE. Except for the demolished structure, the site is vegetated with shrubs and trees. The site generally slopes down from the west to the east at an average grade of approximately 4%.

Critical Areas:

Per the City of Mercer Island GIS Mapping, the northeastern portion of the site is partially within a seismic hazard. Per FEMA Flood Map Number 53033C0654G the site is located outside of the floodplains. The property is not located within and does not contain any other known critical areas.

Post-developed Site Conditions:

The development proposal incorporates the construction of on-site and off-site infrastructure to support the construction of a new single-family residence. The existing structures will be demolished. The lot will be accessed via a new asphalt driveway extending from 96th Ave SE. The project site is located within the Mercer Island Drainage Basin. The site is defined by a single drainage basin that discharges to the northeast. Developed runoff will be collected in a detention system approved by the City of Mercer Island and will convey to a catch basin along an existing drainage easement.

Soils:

The onsite soils are mapped as Kitsap silt Loam (KpB) by the US Department of Agriculture (USDA), Natural Resources Conservation Service (NCRS) Web Soil Survey information. Further field exploration and testing were performed by Cobalt Geosciences revealed that the site is underlain with Vashon Recessional Lacustrine Deposits which include silt and clay. Refer to Appendix B for the full geotechnical report.

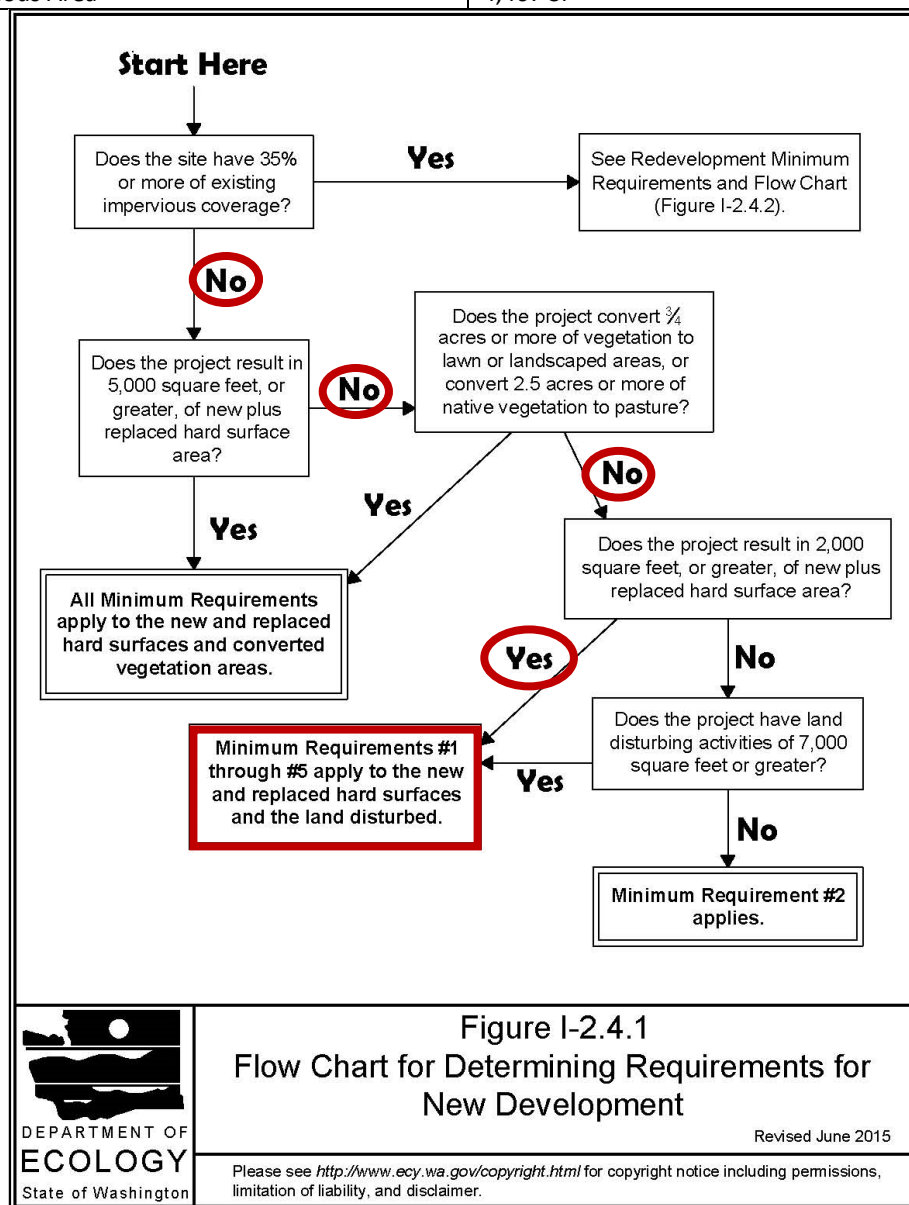
Figure 2: Soils Map and Legend

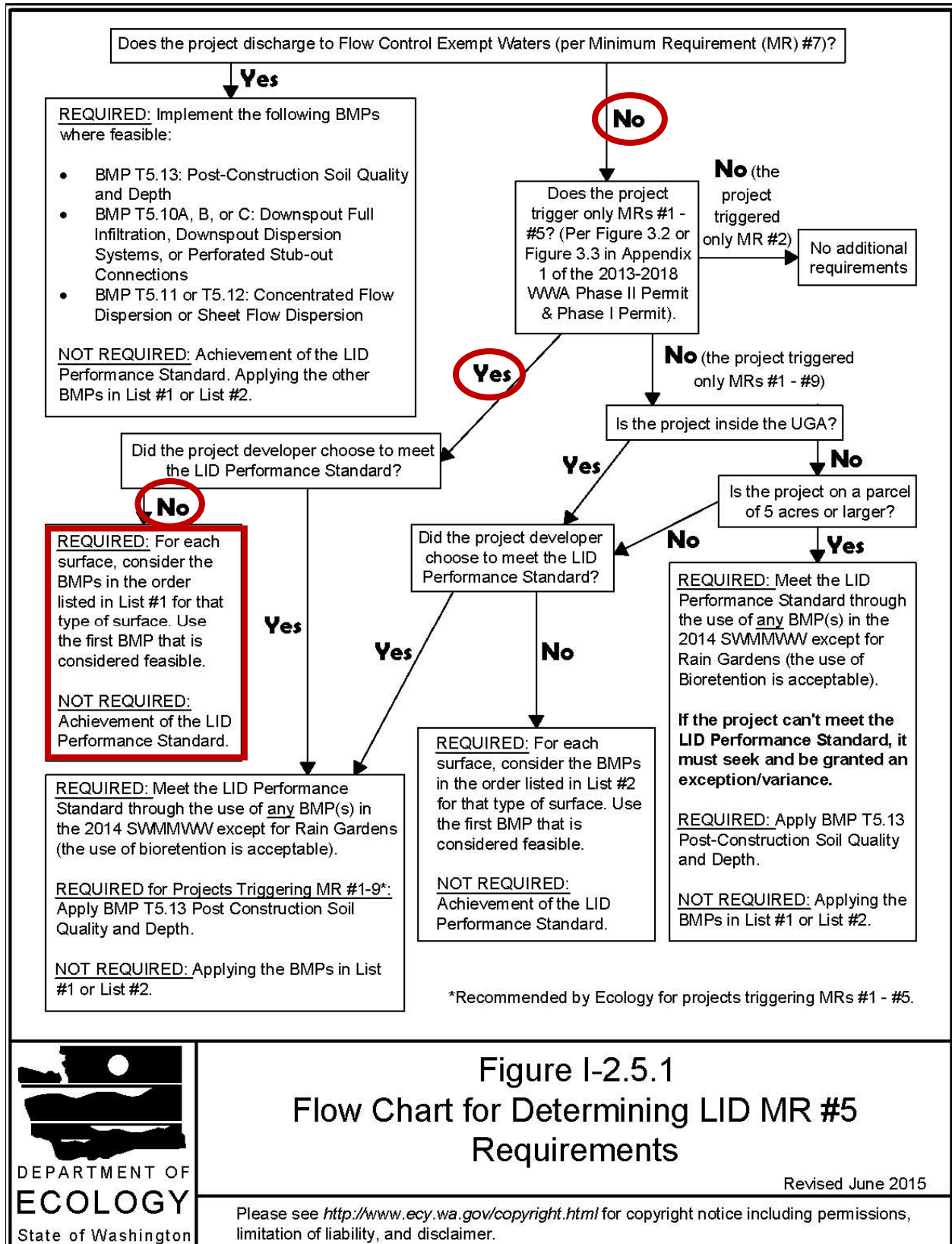


II. CONDITIONS AND REQUIREMENTS SUMMARY

Flow Chart #1: Flow Chart for Determining Requirements for New Development was utilized to determine which requirements apply to the project. The site areas used are provided in the table below. Per Flow Chart #1, Minimum Requirements 1-5 apply to the new and replaced hard surfaces and converted vegetation areas. Please refer to the flow chart below.

Parcel Area	11,900 SF
Roof Area	1,560 SF
Concrete Turnaround	774 SF
Concrete Slab (Patio)	519 SF
Asphalt Driveway (PGHS)	1,554 SF
Total Impervious Area	4,407 SF





Minimum Requirements #1-5:**Minimum Requirement No. 1 – Preparation of Stormwater Site Plans**

A Stormwater Site Plan has been prepared for review by the city.

Minimum Requirement No. 2 – Construction Stormwater Pollution Prevention (SWPPP)

A SWPPP (i.e., TESC) is included in the project submittal.

Minimum Requirement No. 3 – Source Control of Pollution

Source control is not required as the proposed development is residential and is not a high use site.

Minimum Requirement No. 4 – Preservation of Natural Drainage Systems and Outfalls

The natural drainage pattern and discharges from the site will be maintained to the maximum extent practicable. No significant adverse impacts to the downstream system are expected or anticipated.

Minimum Requirement No. 5 – On-site Stormwater Management

Figure I-2.5.1 Flow Chart for Determining LID MR #5 Requirements was utilized to determine the requirements to meet On-site Stormwater Management. Per the Flow Chart List #1 was used to determine the On-site Stormwater Management BMPs feasible for the project. Please refer to Figure I-2.5.1 on page 5.

List #1 Analysis:

Per Table I-3.2 of the SWMMWW, the BMPs must be considered in the order listed in List #1 for each surface. The first BMP considered feasible must be implemented to the maximum extent feasible. Below is the feasibility evaluation of the BMPs in the order listed.

Lawn and Landscaped areas:

1. Post Construction Soil Quality and Depth – This BMP is feasible and will be implemented per BMP T5.13 for all disturbed and converted vegetated areas that are sloped at less than 33%.

Roofs:

1. Full Dispersion or Full Infiltration – Full dispersion is infeasible due to lack of vegetated flow paths. Full infiltration is infeasible due to impermeable soils consisting of silt trace with clay and very fine sand. Refer to the Cobalt Geosciences Limited Geotechnical Evaluation, included as Appendix C.
2. Rain Gardens or Bioretention – Infeasible due to setback requirements and lack of vegetated flow paths.
3. Downspout Dispersion Systems – Dispersion systems are infeasible due to the project site being mapped as a landslide hazard area. King County has secured an easement for extension of the sewer force main across the east portion of the site, making dispersion facilities in this area infeasible and not permissible.
4. Perforated Stub-out Connections – Infeasible due to landslide hazard area as mentioned above.

Other Hard Surfaces:

1. Full Dispersion – Infeasible due to lack of vegetated flow paths.
2. Permeable Pavement or Rain Gardens or Bioretention – Infeasible due to setback requirements and lack of vegetated flow paths.
3. Sheet Flow Dispersion or Concentrated Flow Dispersion – Infeasible due to lack of vegetated flow paths and the site is mapped as a landslide hazard area.

Since all the BMPs from List #1 are considered infeasible, the project proposes a detention system in accordance with City of Mercer Island standards. The project creates between 4,407 sf of new and replaced impervious surface area with Type C soils. Therefore, a 60" diameter detention pipe has been chosen with a length of 31 feet. The detention system will mitigate all runoff from the driveway, roof areas, concrete turnaround, and concrete slabs through conveyance systems that include catch basins, clean outs, area drains, and sediment control structures. Downstream from the detention system, the conveyance system will connect to an existing catch basin, running along a 10' utility and drainage easement.

III. CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

The project SWPPP addresses the thirteen required elements as follows:

Element 1 – Preserve Vegetation/Mark Clearing Limits – Clearing limits will be delineated with silt fence and orange construction fencing.

Element 2 – Establish Construction Access - A quarry spall construction entrance and a wheel wash will be provided if warranted.

Element 3 – Control Flow Rates – The proposed detention tank will be used during construction as a sediment and flow control device. Upon completion of the project, the tank and associated catch basins to be flushed and cleaned of debris.

Element 4 – Install Sediment Controls – Silt fencing will be constructed and is expected to provide construction stormwater sediment control during construction.

Element 5 – Stabilize Soils – Stockpiled or unworked soils will be protected during construction by covering with plastic or temporary or permanent seeding. All exposed soils will be landscaped or seeded and BMP T5.13- Post Construction Soil Amendment will be implemented at the conclusion of the project.

Element 6 – Protect Slopes – Areas of cut slopes to be covered with plastic per BMP C123 until permanently stabilized.

Element 7 – Protect Drain Inlets – The existing and newly constructed conveyance system inlets in the vicinity of the project site will be protected with catch basin filters during construction.

Element 8 – Stabilize Channels and Outlets – There are no existing or proposed surface channels or outfalls. Therefore the use of typical energy dissipation devices and channel lining such as riprap are not anticipated.

Element 9 – Control Pollutants – The small size of this project will limit the opportunity for discharge of pollutants. Waste/demolition debris will not be stockpiled, fueling will be done off-site and concrete trucks will be washed out off-site.

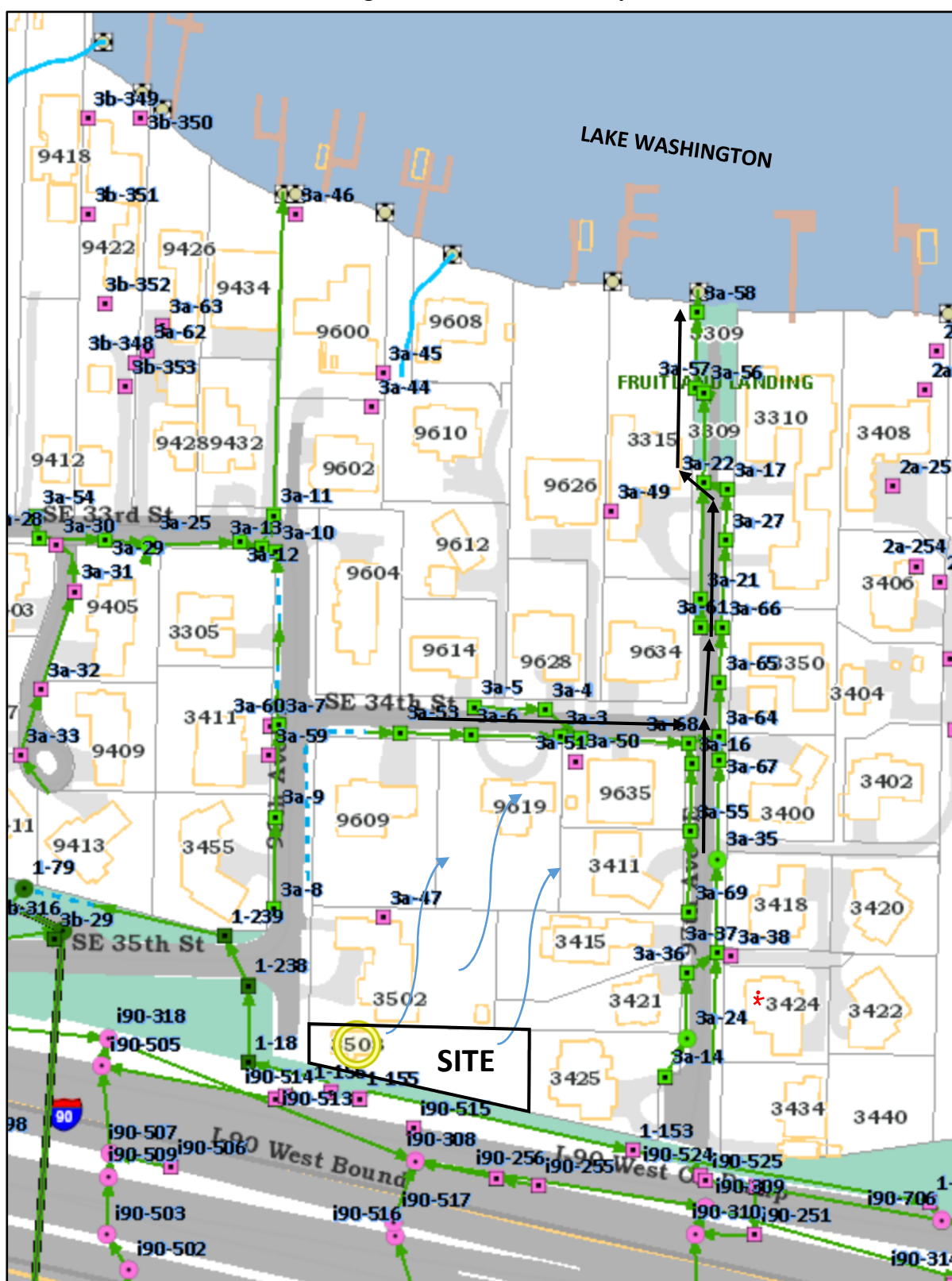
Element 10 – Control De-watering – De-watering is not anticipated.

Element 11 – Maintain BMPs – BMPs will be maintained as necessary to assure continued functioning.

Element 12 – Manage the Project – An inspector (sites less than 1 acre) will be present or on call to ensure BMPs are maintained and assess effectiveness of ESC measures. Rainy season requirements will be implemented if necessary.

Element 13 – Protect LID BMPs – N/A. No LID BMPs are proposed.

Figure 3: Downstream Map



IV. CONVEYANCE ANALYSIS

The post-detention conveyance pipe system (6" PVC) was checked for capacity utilizing Manning's equation and WWHM's 100-year flow capacity. At 2% slope, the pipe is capable of handling a flowrate of 0.9166 cfs. After inputting the proper areas into the WWHM model, the 100-year flowrate was determined to be 0.1338 cfs. Therefore, the pipe is sufficiently sized to handle the post-detention flowrate.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Adams Mercer Island SFR		
Capacity Check		
Results		
Flow depth, y	0.4000	ft
Flow area, a	0.1684	ft ²
Pipe area, a ₀	0.1964	ft ²
Relative area, a/a ₀	0.8576	fraction
Wetted perimeter, P _w	1.1071	ft
Hydraulic radius, R _h	0.1521	ft
Top width, T	0.4000	ft
Velocity, v	5.4433	ft/sec
Velocity head, h _v	0.4605	ft H ₂ O
Froude number, F	1.48	
Average shear stress (tractive force), tau	0.1899	psf
Flow, Q (See notes)	0.9166	cfs
Full flow, Q ₀	0.9377	cfs
Ratio to full flow, Q/Q ₀	0.9775	fraction
Inputs		
Pipe diameter, d ₀	6	in
Manning roughness, n	0.011	
Pressure slope (possibly 2 equal to pipe slope), S ₀	2	% rise/run
Relative flow depth, y/d ₀	.8	fraction

Flow Frequency Return Periods for Predeveloped.

Return Period	Flow(cfs)
2 year	0.008026
5 year	0.012606
10 year	0.015201
25 year	0.01795
50 year	0.019652
100 year	0.021099

Flow Frequency Return Periods for Mitigated.

Return Period	Flow(cfs)
2 year	0.050391
5 year	0.069503
10 year	0.083397
25 year	0.102403
50 year	0.117644
100 year	0.133837

Appendix A

MAINTENANCE & OPERATIONS MANUAL

Table V-4.5.2(5) Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks. Frame is sit-

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	ting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into	Mechanism opens with

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Working	frame have less than 1/2 inch of thread.	proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

V-A.5 Maintenance Standards - Tanks and Vaults

Table V-A.4: Maintenance Standards - Tanks and Vaults

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point, or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for one-half the length of the storage vault, or any point depth exceeds 15% of the diameter. (Example: 72-inch diameter storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 the length of the tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into the tank/vault. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 0.5-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound. Cracks wider than 0.5-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	Vault replaced or repaired to design specifications and is structurally sound. No cracks more than 0.25-inch wide at the joint of the inlet/outlet pipe.
Access Opening(s)	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 0.5-inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See V-A.7 Maintenance Standards - Catch Basins		

Appendix B
ARBORIST REPORT
GEOTECHNICAL REPORT

Arborist Report

Tree Inventory and Assessment

3508 96th Ave SE Mercer Island, WA 98040

Prepared for:

Sam Adams

Prepared by:

Alan Haywood

Certified Arborist, PN-0330AM

~~March 23, 2022~~

Revised/Updated: May 22, 2023

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Summary

There were nineteen trees large enough to count towards the City of Mercer Island's tree retention requirements on the lot owned by Mr. Sam Adams at 3508 96th Ave SE. Five of those trees were in poor condition and not suitable for retention. Three of the trees were large enough to be considered Exceptional trees by the City standards. The City requires at least 30 percent of the trees to be retained and prioritizes the retention of the Exceptional trees. Of the fourteen trees that were suitable for retention, the City would require at least four to be saved and would prefer the three Exceptional trees to be among the trees retained.

The North Mercer Interceptor Sewer Improvement Project will require the removal of thirteen trees from the site and nine trees from the adjacent ROW to the west. All three of the Exceptional trees will be removed. Four trees are proposed for retention.

Introduction

Background and History

I was contacted by Sam Adams to provide a tree inventory and assessment for their vacant property at 3508 96th Ave SE Mercer Island, WA 98040. He explained to me that he was proposing to build a house on the property and this report would be part of the permit application process with the City of Mercer Island. It was located at the end of the short dead-end street, 96th Ave SE. The street ends at the paved Mountains To Sound Greenway Trail to the south. Just past the trail is the Interstate 90 Freeway.

According to Mr. Adams, the property was vacant because the previous owner demolished a house that had previously stood there. The western half of the property had been mostly cleared, with just a few smaller trees remaining. The eastern half of the property was vegetated with mostly native trees and smaller plants, as well as a few invasive species, including English ivy (*Hedera helix*) and Himalayan blackberry (*Rubus discolor*).

Mr. Adams provided me with a Topographic Survey/site map dated 9/30/20. In addition to the property lines, it showed the locations of the significant trees onsite. The trees were labeled and their diameter was included.

Assignment

My assignment was to:

- Complete the tree inventory, including counting, measuring, tagging, identifying and assessing all of the significant trees on the site.
- Provide a site map with the trees numbered according to the inventory.
- Provide an arborist report that notes the condition and viability of the trees. Note any trees that are in poor condition now that would be a hazard (high risk) to the proposed development or to neighboring properties. Also identify any that would become hazardous due to damage or exposure that the trees would receive as part of the development.
- *Provide a tree retention and replacement plan.*

Limits of the Assignment

I was not provided a site plan showing the limits of clearing and grading, the location of any new structures or the location of utilities.

I was not asked to provide a Tree Removal and Retention Plan, since there was no conceptual construction plan yet.

I was asked to provide a tree removal and retention plan in 2023, after a conceptual site plan was developed.

Methodology

I examined the trees using the standard visual tree assessment method, as outlined in the *Tree Risk Assessment Manual* published by the International Society of Arboriculture. This is considered a Level 2 Basic Tree Risk Assessment. All of my observations were made from ground level. I did not climb the trees, perform any invasive tests on them or excavate any soil from around them.

The tree risk assessment methodology is based on three factors:

- How likely is the tree (or a tree part) to fail?
- How likely is the tree (or tree part) to hit a target of value when it fails?
- How likely is the tree (or tree part) to damage or injure the target if it hits it?

Tree structure, as well as health, plays a role in the risk determination. The proximity of a target of value is also considered. The presence of people and the duration of that presence (occupancy) is also factored in to the risk level determination.

Tree risk is categorized as Low, Moderate, High or Extreme. A normal healthy tree is generally considered low risk, because it is not likely to fail. It is the presence of defects in the tree that increases the likelihood of failure. If no one would be harmed or nothing of value would be damaged by the tree failure, it is also considered low risk. A tree that is likely to fail, but is unlikely to strike a target, is not a high risk tree.

Most trees are either Low Risk or Moderate Risk and are not considered Hazard Trees. However, a property owner's tolerance for risk may be low and a tree of Moderate Risk may be out of their comfort zone. In such cases, removal of the tree should be sought through other permitted means, not hazard tree removal. The definition of a Hazard Tree varies by jurisdiction.

Tree diameter measurements are taken at 4.5' above ground. This is known as Diameter at Breast Height – DBH. I used a diameter tape for this measurement. I used metal tags and flagging tape for tagging and numbering the trees.

Purpose and Use of this Report

The purpose of this report is to provide the tree information I gathered from my site visit and inspection for the purposes of generating a report to meet the permit requirements of the City of Mercer Island. This report is for the sole use of my client and may not be reproduced, used in any way, or disseminated in any form, without prior consent of the client and Alan Haywood – Arborist & Horticulturist, LLC.

Observations

I visited the site on March 4, 2022. I found the site to mostly level from the street heading east. In the northeast corner of the property, there was a gentle downhill slope. The site was dominated by several bigleaf maples (*Acer macrophyllum*) and one large Douglas fir (*Pseudotsuga menziesii*), with a few other trees present. The understory was a mix of vine maple, beaked hazelnut, small bitter cherries, a small western redcedar, western sword fern, salal, salmonberry and trailing blackberry. There were also a few non-native trees and invasive plant species (ivy and blackberry) present.

I tagged the trees with aluminum tags and numbered them according to the tree numbers shown on the Topographic Survey. Some trees in the western cleared area were already tagged. Trees that I found that were not shown on the plan, I numbered as well. Some trees that were in the numerical tree sequence were not on the Topographic Survey (1, 2, 3, 8, 9 and 10) were no longer present on the site. I came to this conclusion based on the sequence of the numbered trees that were present. I included these missing trees in the report, thinking that there may be a record of them associated with the demolition permit of the house. I also noted six newly planted trees on the site. My assumption was that they were replacement trees that were planted as mitigation for trees that had been removed at the same time as the house was removed.

I counted 19 trees on the property that were large enough to meet the Mercer Island criteria for a tree to be counted – 10” DBH and three that were large enough to be considered Exceptional – 24” DBH. Six of the countable trees were in poor condition and were not viable trees to be retained.

The tree inventory chart is included in Appendix A. There was a total count of 20 trees shown on the Topographic Survey map that were shown to be on the property. Another four were shown to be off site. Three of the off-site trees were in the street ROW and one was shown to be mostly in the neighbor’s yard to the east. According to my count and measurements, six of the trees on the map were too small (under 10” DBH) to be counted. One of those was in poor condition and not viable for retention. I also counted another four trees that were large enough to be counted that weren’t shown on the map (trees # 11, 12, 19 and 31). Based on my inventory and assessment, there were 25 trees on the property:

- 6 were too small to be counted
- 16 were large enough to be counted
- 3 qualified as exceptional

Of the 16 trees that were countable, 5 of them were in poor condition and not suitable for retention. These 5 trees would qualify as high risk trees, if there were a target within striking distance of them. High risk trees are generally considered hazard trees. This left 3 Exceptional trees and 11 countable trees for a total of 14 on the property to consider for retention.

There were also the 6 trees that had been recently planted on the property. They were 2” caliper trees, which were still staked and had a temporary irrigation system set up to water them. I assume that these trees are also required to be retained, but they are of a size that they could easily be transplanted.

There were 11 off-site trees included in the inventory and assessment. Eight of these trees were on the street ROW, with 3 of them being shown on the Topographical Survey. Only 2 were large enough to be counted and 1 of those was dead. The rest of the trees present in the street ROW were too small to be counted, but I inventoried and assessed them, nonetheless. These are

essentially City owned trees and the City and City owned trees would require City permission for removal, or could be required to be removed as part of this project by the City.

The large off site tree shown on the east border, mostly on the neighbor's property, was no longer present. I did use that symbol on the map for another tree on the property that was close to that location.

There were 2 trees on the neighbor's property to the north that overhung the subject property. One was large enough to be counted and the other was exceptional. These trees would require protection from any future development. There was also a row of Leyland Cypress planted as a hedge along the fence in the backyard of the neighbor to the north. None of these trees were large enough to count.

The complete tree inventory and assessment is shown in Appendix A and Appendix B. The trees large enough to be counted for retention and in good enough condition to be viable for retention broke down as follows:

- Douglas fir – 2
- Bigleaf maple -8
- Pacific Madrone – 1
- Black Cottonwood – 1
- European Plum – 1
- Unidentified Deciduous Tree – 1 (To be identified when it leafs out)

Discussion and Recommendations

The City of Mercer Island requires a minimum of 30% of the trees with a diameter of 10" or greater be retained for all development proposals. They also require that the development proposal be designed to minimize the removal of large trees. Trees that are defined in the City Code to be "Exceptional" are prioritized for retention. Trees that are in poor health and declining condition, and trees that have significant defects that make them likely to fail, are not considered viable for retention.

There were three trees onsite that qualified as Exceptional Trees:

- Tree # 22 – 30" Bigleaf Maple
- Tree #23 – 30" Bigleaf Maple (with 13" dead leader)
- Tree #26 – 10" Pacific Madrone

There was also a 10" DBH Pacific Madrone off site, on the street ROW. However, it was dead and therefore, not viable for retention.

The North Mercer Interceptor Sewer Improvement Project will require the removal of fourteen trees from the site, along the south and east border of the project. It will also require the removal of eight trees from the ROW to the west of the site. All three of the Exceptional trees onsite will be removed as part of the sewer project. Eight trees are proposed for removal and are located in the proposed house footprint. One tree is proposed to be removed due to its poor condition and one ROW tree is proposed for removal that is located in the proposed driveway location.

The trees that are proposed for retention are #4, 5, 13, 19 and 20. They are native bigleaf maple trees and one cherry Tree. #4 and 19 are considered too small to be regulated. These five trees, as well as the two Douglas firs (#10 and 11) that are located offsite to the north should have tree protection measures taken.

~~Since my assignment was only to inventory and assess the trees and I wasn't provided with a construction proposal, I can't comment on the retention and removal of specific trees at this time. I can make recommendations for consideration when site design work begins.~~

The current plan shows eleven trees to be removed because they are in the building footprint and four trees to be removed because they are in the King County Utility easement on the east side of the property.

The current industry methodology for tree root protection is the Critical Root Zone (CRZ) formula. A CRZ is developed for an individual tree by measuring its DBH and measuring one foot out from the trunk in all directions for every one inch of trunk diameter. Using this formula, a 10" diameter tree would have a CRZ of 10' extending out from the trunk in all directions.

In some circumstances, it isn't possible to develop the property as proposed and protect this much of the root zone. What has been found successful is to allow encroachment into the CRZ on one side of the tree by up to 50%. This will still preserve over three quarters of the CRZ and most healthy trees can withstand this. This is particularly true when the other side of the tree is not disturbed at all. The same 10" DBH tree could have soil disturbance up to 5' away from its trunk on one side and be expected to survive, if the rest of its CRZ is left undisturbed. ~~Some jurisdictions refer to this 50% measurement of the CRZ~~ *is sometimes referred to* as the "Interior Critical Root Zone (ICRZ)."

To prevent unintended disturbances in the CRZ, a Tree Protection Zone (TPZ) should be established where no significant disturbance will take place. Ideally, this is at or beyond the CRZ. If the TPZ is reduced by up to 50% on one side, that would be the border of the TPZ. If the TPZ can't be set up to preserve at least three quarters of the CRZ, the tree is probably not a good candidate for retention. *This should be done for trees #4, 5, 13, 19 and 20 as well as the two Douglas firs (#10 and 11) that are located offsite to the north.*

Best management practices to reduce impacts to CRZs can include:

-
- Fencing of the TPZ - this is often required by the permitting jurisdiction.
 - Cantilevering over root zones rather than installing a solid foundation wall.
 - Use of pier piling construction methods instead of solid foundation walls.
 - Cutting of large roots (over 2" diameter) that need to be removed, not tearing them out with excavation equipment
 - Keeping Cut roots moist to prevent dehydration and further dieback. Covering them with moist organic mulch, wood chips or moist fabric (burlap, cloth tarp, etc.) until they are covered with soil.
 - Tunneling under roots when possible.
 - Using pneumatic or hydraulic excavation methods to preserve roots, rather than open trenching with excavation equipment.
 - Prohibiting the storage of materials and the use of heavy equipment within the TPZ.
 - *Providing extra irrigation during the summer dry season.*
 - *Providing supplemental organic fertilizer and root bio-stimulant products to promote root growth.*

All of the above practices should be considered and implemented as is deemed appropriate by the City of Mercer Island. Agencies sometimes require an arborist to be onsite to monitor work done within the protected CRZs of trees. If any of the trees can't be saved due to unforeseen circumstances during construction, then the arborist can help make that determination. Tree replacement or other mitigation measures can be required by the permitting agency. Again, the arborist can help advise on what would be appropriate under the existing circumstances. *The proposed utility connection to the house is shown to run through the CRZ of the neighbor's two large Douglas firs. I recommend either tunneling or compressed air excavation through the CRZ of the these two trees.*

Tree #13 is proposed for retention, but its ICRZ will be impacted by the house construction. Appropriate BMPs will be implemented to try to successfully retain the tree. However, it is recognized that that it may not survive or thrive after construction and that removal would be required if that were the case. The City could determine appropriate mitigation at that time. The City might also determine that the risk to the tree is too great and that removal is the better course of action with some sort of mitigation planting added to the plan.

The proposed mitigation planting for this project is located along the south border of the property and on the western portion of the property on the north side of the driveway. Because of the utility easement on the east side of the property, the potential mitigation planting sites are limited. At some point, off-site mitigation planting or fee in lieu of mitigation may have to be considered, if what is proposed isn't acceptable. It is also a possibility that a smaller tree slated for removal could be transplanted and retained elsewhere on the site. Trees #11 and 12 are slated for removal, due to their condition, but they could be retained in their current location.

Tree Replacement

The proposed tree removal will require 11 tree replacement trees. At least Fifty percent of the replacements are required to be native species. The trees proposed as replacements are 1 Douglas fir, 4 shore pines and 3 vine maples for native species and 3 Japanese flowering cherries as non-native ornamental species. The trees will be planted in the dormant season and will be mulched per City specifications and will be given supplemental organic fertilizer with bio-stimulants for enhanced root growth.

Conclusion

The information in this report is based on my site visit and inspection completed on March 4, 2022 and the plans for the project that I have reviewed. I attest that all of the information within this report is accurate, to the best of my knowledge. It does not provide any guarantees or implications that conditions of the trees on the site won't change over time. All trees eventually fail and even sound, healthy trees fail during severe weather events.

Thank you for the opportunity to be of service to you with this project. Please feel free to contact me if you have any questions about this report or if you have any further need for my services.

Sincerely,



Alan Haywood – Arborist & Horticulturist, LLC.

ISA Certified Arborist/Municipal Specialist – PN 0330-AM

ISA Qualified Tree Risk Assessor

ASCA Qualified Tree and Plant Appraiser

WSNLA Certified Professional Horticulturist - 2332

ecoPRO Certified Sustainable Landscape Professional – 6017

WSDA Licensed Pest Control Consultant – 7627

Appendix A: Tree Chart – On Subject Property-*Revised 5/23*

Tree #	Species	DBH "	Cndtn	Excptnl	Comments & Recommendations
1					Not Present
2					Not Present
3					Not Present
4	BL	9	Fair	No	Small. Adjacent to the property line – could be a shared tree. Leans to the west, ivy on trunk, growing next to a Hawthorn tree on adjacent property. Retain.
5	CH	7 & 4	Fair	No	Small. Trunk forks at 1', leans to the south, ivy on trunk, over topped by neighbor's 24" Douglas fir. Retain.
6	EP	8, 5, 5, 5 & 7	Fair	No	One 3" trunk is dead, crown is dense and overgrown due to previous pruning practices, some cherry bark tortrix infestation present. To be removed as part of King County Sewer Improvement Project.
7	EP	3, 4, 5, 6, & 7	Poor	No	Small. Trunks 3, 5 and 7" are dead. Decay and cracks in trunk are present. To be removed as part of King County Sewer Improvement Project.
8					Not Present
9					Not Present
10					Not Present
11	As	2, 3, 3, 3, 4 & 5	Fair	No	Small. Poor structure, To be removed.
12	BS	7	Poor	No	Small. Leans to the west with an uneven crown. Sparse foliage and low vigor due to spruce aphid damage. To be removed.
13	BLM	19	Fair	No	Ivy on trunk. Retain.
14	BLM	18	Fair	No	Ivy on trunk. To be removed – In house footprint.
15	BLM	18	Fair	No	Ivy on trunk. To be removed – In house footprint.
16	BLM	14	Poor	No	Decay in trunk from 10 – 15'. To be removed – In house footprint.
17	BLM	11	Fair	No	Uneven crown due to crowding. To be removed – In house footprint.
18	BLM	15	Poor	No	Main trunk dead at 15'. To be removed – In house footprint
19	BLM	7	Good	No	Small. Retain.
20	BLM	11 & 14	Fair	No	Ivy on trunk, bark inclusion at fork. Retain.
21	BLM	7, 12, 7 & 7	Poor	No	Brittle Cinder fungus (<i>Kretzschmaria deusta</i>) present, dead wood in crown. To be removed – In house footprint.
22	BLM	30	Fair	Yes	Trunk forks at 12', ivy on trunk, dead wood in crown. To be removed– In house footprint.
23	BLM	30 & 13	Fair	Yes	30" trunk forks at 7'. 13" trunk forks at 5' with one dead leader. Recommend removal of dead leader. To be removed as part of King County Sewer Improvement Project.
24	DF	26	Good	No	Ivy on trunk. To be removed – In house footprint.

Tree #	Species	DBH "	Cndtn	Excpnl	Comments & Recommendations
25	BLM	15	Fair	No	Dead wood in crown. To be removed as part of King County Sewer Improvement Project. — In house footprint.
26	PM	10	Fair	Yes	Significant lean over trail. Tree is stable – phototropic lean is characteristic of the species. To be removed as part of King County Sewer Improvement Project. — In house footprint.
27	DF	13	Fair	No	Uneven crown. To be removed as part of King County Sewer Improvement Project. — In house footprint.
28	BCW	12	Fair	No	Trunk has dogleg and leans to the south with low taper. To be removed as part of King County Sewer Improvement Project.
29	BLM	18 & 10	Poor	No	Ivy on trunk, 18" trunk is forks at 18' – one fork broken off. 10" trunk has decay up to 7' with a basal hollow. To be removed as part of King County Sewer Improvement Project.
30	DT	4, 5, 6 & 6	Fair	No	Basal inclusion. To be removed as part of King County Sewer Improvement Project.
31	SS	12	Poor	No	Trunk has significant lean to the north that is self-corrected at 12'. Trunk forks at 6' with bark inclusion. To be removed as part of King County Sewer Improvement Project.
Cs-1	Cs	2	Fair	No	Replacement Tree. To be relocated on site.
Cs-2	Cs	2	Fair	No	Replacement Tree. To be relocated on site.
Cs-3	Cs	2	Fair	No	Replacement Tree. To be relocated on site.
VM-1	VM	2	Fair	No	Replacement Tree, To be removed as part of King County Sewer Improvement Project.
VM-2	VM	2	Fair	No	Replacement Tree, To be removed as part of King County Sewer Improvement Project.
VM-3	VM	2	Fair	No	Replacement Tree, To be removed as part of King County Sewer Improvement Project.

Abbreviations

As = Ash sp. (*Fraxinus* sp.)

DF = Douglas Fir (*Pseudotsuga mensiezii*)

BCW = Black Cottonwood (*Populus trichocarpa*)

BL = Black Locust (*Robinia Pseudoacacia*)

BLM = Bigleaf Maple (*Acer macrophyllum*)

BS = Colorado Blue Spruce (*Picea pungens*)

CH = Common Hawthorn (*Crataegus monogyna*)

Cs = Cascara (*Rhamnus purshiana*)

DT = Deciduous Tree – Unidentified

PM = Pacific Madrone

EP = European Plum (*Prunus x domestica*)

SS = Sitka Spruce (*Picea sitchensis*)

VM = Vine Maple (*Acer circinatum*)

Appendix B: Tree Chart – Off Site *in ROW*

Tree #	Species	DBH "	Cndtn	Excptnl	Comments & Recommendations
1	NS	6	Fair	No	Small, In ROW. To be removed
2	BL	6 & 2	Fair	No	Small, In ROW. To be removed as part of King County Sewer Improvement Project.
3	BL	5&5	Fair	No	Small, In ROW. To be removed as part of King County Sewer Improvement Project.
4	PM	10	Poor	Yes	Dead with Damaged trunk .To be removed as part of King County Sewer Improvement Project.
5	SW	9	Fair	No	Small, In ROW. To be removed as part of King County Sewer Improvement Project.
6	FP	3	Fair	No	Small, In ROW. To be removed as part of King County Sewer Improvement Project.
7	BL	9, 7 & 9	Fair	No	In ROW. To be removed as part of King County Sewer Improvement Project.
8	As	8	Fair	No	Small, In ROW. To be removed as part of King County Sewer Improvement Project.
9	BL	8"	Fair	No	Small, In ROW. To be removed as part of King County Sewer Improvement Project.
10	DF	24"	Fair	No	Neighbor to the north. Retain.
11	DF	20"	Fair	No	Neighbor to the north. Retain.

Abbreviations

As = Ash sp. (*Fraxinus* sp.)

BL = Black Locust (*Robinia Pseudoacacia*)

FP = Flowering Plum

NS = Norway Spruce

PM = Pacific Madrone

SW = Scouler's Willow

Sam Adams



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DATE	REVISION	DATE

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PROJECT NO. 20-451

DRAWN BY: MTS
CHECKED BY: TNW
DATE: 9/30/2020

SHEET 1 OF 1



Cobalt Geosciences, LLC
P.O. Box 1792
North Bend, WA 98045

August 9, 2023

Sam Adams
samad@microsoft.com

RE: Limited Geotechnical Evaluation
Proposed Residence
3508 96th Avenue SE
Mercer Island, Washington

In accordance with your authorization, Cobalt Geosciences, LLC has prepared this letter to discuss the results of our geotechnical evaluation at the referenced site.

The purpose of our evaluation was to provide recommendations for foundation design, grading, and earthwork as well as discussion of mapped geologic hazards.

Site Description

The site is located at 3508 96th Avenue SE in Mercer Island, Washington. The site consists of one irregularly shaped parcel (No. 4139300045) with a total area of 11,900 square feet.

The site is undeveloped and vegetated with grasses, blackberry vines, understory, and sparse small diameter trees.

The site is nearly level to slightly sloping downward to the south with relief of about 5 feet. There is a graded slope embankment south of the property and paved trail extending downward to the south toward I-90 with magnitudes of about 50 percent and relief of about 15 feet. There are walls on both sides of this graded slope.

The northern margin of the site contains seismic hazard areas per City mapping.

The site is bordered to the north and east by residential properties, to the west by a tract and to the south by a trail and I-90.

The proposed development includes a new residence and driveway in the central portion of the property.

Stormwater will be routed to City infrastructure since the site is within an infiltration infeasibility area. Site grading may include cuts and fills of about 12 feet or less for driveway and basement construction and foundation loads are expected to be light. We should be provided with the final plans to verify that our recommendations remain valid and do not require updating.

We note that we have reviewed provided plans from late 2022 and early 2023 which show shoring locations, grading, and finish floor elevations.

Area Geology

The Geologic Map of Mercer Island, indicates that the site is underlain by Vashon Recessional Lacustrine Deposits.

These materials include silt and clay deposited in lake environments during glacial retreat. These materials are normally consolidated and typically soft to medium stiff near the ground surface, becoming stiff and locally very stiff at depth.

Soil & Groundwater Conditions

As part of our evaluation, we advanced two hand borings where accessible to determine if soils consistent with seismic hazard areas are present at the site.

The soils encountered were logged in the field and are described in accordance with the Unified Soil Classification System (USCS).

The hand borings encountered approximately 6 inches of topsoil and vegetation underlain by about 3 to 5 feet of medium stiff, silt trace to with clay (Weathered Recessional Lacustrine Deposits). These soils were underlain by stiff to very stiff, sandy silt trace gravel (Vashon Recessional Lacustrine Deposits) which continued to the termination depths of the hand borings.

Groundwater was not observed or encountered in the explorations. Light volumes of groundwater could be present on or within the silt and clay deposits at variable depths below grade.

We reviewed nearby boring and test pit logs which encountered variable density silt and clay (low to high plasticity) underlain by stiff or firmer silts and fine grained deposits. It appears that this area is underlain consistently by lacustrine silts and clays and not outwash sands, which often have susceptibility to seismic activity.

Water table elevations often fluctuate over time. The groundwater level will depend on a variety of factors that may include seasonal precipitation, irrigation, land use, climatic conditions and soil permeability. Water levels at the time of the field investigation may be different from those encountered during the construction phase of the project. It would be necessary to install a piezometer to determine groundwater depths over a typical year.

City of Mercer Island GIS Mapped Hazards

The City of Mercer Island GIS maps indicate that the northern edge of the site is within a seismic hazard area. This designation is likely due to the mapped Vashon Recessional Outwash in the area. These deposits can include sands which can have susceptibility to liquefaction.

It is our opinion that the seismic hazard risks are low due to the very fine grained nature of the near surface soils. Mitigation for these hazards is not warranted.

Statement of Risk

Per Section 19.07.160B3 of the Mercer Island City Code, development within geologic hazard areas require that a Geotechnical Engineer licensed within the State of Washington provide a statement of risk with supporting documentation indicating that one of the following conditions can be met:

- a. The geologic hazard area will be modified, or the development has been designed so that the risk to the lot and adjacent property is eliminated or mitigated such that the site is determined to be safe; or
- b. An evaluation of site specific subsurface conditions demonstrates that the proposed development is not located in a geologic hazard area; or

c. Development practices are proposed for the alteration that would render the development as safe as if it were not located in a geologic hazard area; or

d. The alteration is so minor as not to pose a threat to the public health, safety and welfare.

The project meets the criteria of b from above. The site is underlain by very fine grained soils which have a low risk of liquefaction.

This proposed development can be completed without adversely affecting geologic hazards near or within the site.

Seismic Parameters

The overall subsurface profile corresponds to a Site Class *D* as defined by Table 1613.5.2 of the International Building Code (IBC). A Site Class *D* applies to an overall profile consisting of medium dense to very dense soils within the upper 100 feet.

We referenced the U.S. Geological Survey (USGS) Earthquake Hazards Program Website to obtain values for S_s , S_I , F_a , and F_v . The USGS website includes the most updated published data on seismic conditions. The following tables provide seismic parameters from the USGS web site with referenced parameters from ASCE 7-16.

Seismic Design Parameters (ASCE 7-16)

Site Class	Spectral Acceleration at 0.2 sec. (g)	Spectral Acceleration at 1.0 sec. (g)	Site Coefficients		Design Spectral Response Parameters		Design PGA
			F_a	F_v	S_{DS}	S_{D1}	
D	1.395	0.486	1.0	Null	0.93	Null	0.597

Additional seismic considerations include liquefaction potential and amplification of ground motions by soft/loose soil deposits. The liquefaction potential is highest for loose sand with a high groundwater table. The site has a low likelihood of liquefaction. For items listed as "Null" see Section 11.4.8 of the ASCE.

Conclusions and Recommendations

General

The site appears to be underlain by Lacustrine Deposits, consisting of silt with variable amounts of clay and fine sand. There may be areas of fill associated with historic grading in this area.

Foundation elements for the new residence should bear on medium dense/stiff or firmer native soils. Overexcavation of loose soils or fill is required if and where present.

The underlying stiff to very stiff and possibly hard silts have a low risk of liquefaction. Mitigation is not warranted.

Site Preparation

Trees, shrubs and other vegetation should be removed prior to stripping of surficial organic-rich soil and fill. Based on observations from the site investigation program, it is anticipated that the stripping depth will be 6 to 18 inches. Deeper excavations will be necessary in areas of loose soils and fill, where present.

The native soils consist of silt with fine sand and variable amounts of clay. These soils are not suitable for use as structural fill but may be used in landscaping areas if they can achieve 90 percent compaction (ASTM D1557 Test Method).

Imported structural fill should consist of a sand and gravel mixture with a maximum grain size of 3 inches and less than 5 percent fines (material passing the U.S. Standard No. 200 Sieve). Structural fill should be placed in maximum lift thicknesses of 12 inches and should be compacted to a minimum of 95 percent of the modified proctor maximum dry density, as determined by the ASTM D 1557 test method.

Temporary Excavations

Based on our understanding of the project, we anticipate that the grading could include local cuts on the order of approximately 3 feet or less for foundation and most of the utility placement. Any deeper temporary excavations should be sloped no steeper than 1.5H:1V (Horizontal:Vertical) in loose/soft/medium stiff native soils and fill and 1H:1V in medium dense/stiff native soils. If an excavation is subject to heavy vibration or surcharge loads, we recommend that the excavations be sloped no steeper than 2H:1V, where room permits.

Temporary cuts should be in accordance with the Washington Administrative Code (WAC) Part N, Excavation, Trenching, and Shoring. Temporary slopes should be visually inspected daily by a qualified person during construction activities and the inspections should be documented in daily reports. The contractor is responsible for maintaining the stability of the temporary cut slopes and reducing slope erosion during construction.

Temporary cut slopes should be covered with visqueen to help reduce erosion during wet weather, and the slopes should be closely monitored until the permanent retaining systems or slope configurations are complete. Materials should not be stored or equipment operated within 10 feet of the top of any temporary cut slope.

Soil conditions may not be completely known from the geotechnical investigation. In the case of temporary cuts, the existing soil conditions may not be completely revealed until the excavation work exposes the soil. Typically, as excavation work progresses the maximum inclination of temporary slopes will need to be re-evaluated by the geotechnical engineer so that supplemental recommendations can be made. Soil and groundwater conditions can be highly variable. Scheduling for soil work will need to be adjustable, to deal with unanticipated conditions, so that the project can proceed and required deadlines can be met.

If any variations or undesirable conditions are encountered during construction, we should be notified so that supplemental recommendations can be made. If room constraints or groundwater conditions do not permit temporary slopes to be cut to the maximum angles allowed by the WAC, temporary shoring systems may be required. The contractor should be responsible for developing temporary shoring systems, if needed. We recommend that Cobalt Geosciences and the project structural engineer review temporary shoring designs prior to installation, to verify the suitability of the proposed systems.

Foundation Design

The proposed structure may be supported on a shallow spread footing foundation system bearing on undisturbed medium dense/stiff or firmer native soils or on properly compacted structural fill placed on the suitable native soils. Any undocumented fill and/or loose native soils should be removed and replaced with structural fill below foundation elements. Structural fill below footings should consist of clean angular rock 5/8 to 4 inches in size. We should verify soil conditions during foundation excavation work.

For shallow foundation support, we recommend widths of at least 16 and 24 inches, respectively, for continuous wall and isolated column footings supporting the proposed structure. Provided that the footings are supported as recommended above, a net allowable bearing pressure of 1,500 pounds per square foot (psf) may be used for design.

A 1/3 increase in the above value may be used for short duration loads, such as those imposed by wind and seismic events. Structural fill placed on bearing, native subgrade should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Footing excavations should be inspected to verify that the foundations will bear on suitable material.

Exterior footings should have a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Interior footings should have a minimum depth of 12 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower.

If constructed as recommended, the total foundation settlement is not expected to exceed 1 inch. Differential settlement, along a 25-foot exterior wall footing, or between adjoining column footings, should be less than 1/2 inch. This translates to an angular distortion of 0.002. Most settlement is expected to occur during construction, as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. All footing excavations should be observed by a qualified geotechnical consultant.

Resistance to lateral footing displacement can be determined using an allowable friction factor of 0.30 acting between the base of foundations and the supporting subgrades. Lateral resistance for footings can also be developed using an allowable equivalent fluid passive pressure of 250 pounds per cubic foot (pcf) acting against the appropriate vertical footing faces (neglect the upper 12 inches below grade in exterior areas). The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance.

Care should be taken to prevent wetting or drying of the bearing materials during construction. Any extremely wet or dry materials, or any loose or disturbed materials at the bottom of the footing excavations, should be removed prior to placing concrete. The potential for wetting or drying of the bearing materials can be reduced by pouring concrete as soon as possible after completing the footing excavation and evaluating the bearing surface by the geotechnical engineer or his representative.

Concrete Retaining Walls

The following table, titled **Wall Design Criteria**, presents the recommended soil related design parameters for retaining walls with a level backslope. Contact Cobalt if an alternate retaining wall system is used. This has been included for new cast in place walls, if any are proposed.

Wall Design Criteria	
“At-rest” Conditions (Lateral Earth Pressure – EFD ⁺)	60 pcf (Equivalent Fluid Density)
“Active” Conditions (Lateral Earth Pressure – EFD ⁺)	40 pcf (Equivalent Fluid Density)
Seismic Increase for “At-rest” Conditions (Lateral Earth Pressure)	14H* (Uniform Distribution)
Seismic Increase for “Active” Conditions (Lateral Earth Pressure)	7H* (Uniform Distribution)
Passive Earth Pressure on Low Side of Wall (Allowable, includes F.S. = 1.5)	Neglect upper 2 feet, then 250 pcf EFD ⁺
Soil-Footing Coefficient of Sliding Friction (Allowable; includes F.S. = 1.5)	0.30

*H is the height of the wall; Increase based on one in 500 year seismic event (10 percent probability of being exceeded in 50 years),

⁺EFD – Equivalent Fluid Density. Assumes excavation into stiff to hard soils for passive pressures.

The stated lateral earth pressures do not include the effects of hydrostatic pressure generated by water accumulation behind the retaining walls. Uniform horizontal lateral active and at-rest pressures on the retaining walls from vertical surcharges behind the wall may be calculated using active and at-rest lateral earth pressure coefficients of 0.3 and 0.5, respectively. A soil unit weight of 125 pcf may be used to calculate vertical earth surcharges.

To reduce the potential for the buildup of water pressure against the walls, continuous footing drains (with cleanouts) should be provided at the bases of the walls. The footing drains should consist of a minimum 4-inch diameter perforated pipe, sloped to drain, with perforations placed down and enveloped by a minimum 6 inches of pea gravel in all directions.

The backfill adjacent to and extending a lateral distance behind the walls at least 2 feet should consist of free-draining granular material. All free draining backfill should contain less than 3 percent fines (passing the U.S. Standard No. 200 Sieve) based upon the fraction passing the U.S. Standard No. 4 Sieve with at least 30 percent of the material being retained on the U.S. Standard No. 4 Sieve. The primary purpose of the free-draining material is the reduction of hydrostatic pressure. Some potential for the moisture to contact the back face of the wall may exist, even with treatment, which may require that more extensive waterproofing be specified for walls, which require interior moisture sensitive finishes.

We recommend that the backfill be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. In place density tests should be performed to verify adequate compaction. Soil compactors place transient surcharges on the backfill. Consequently, only light hand operated equipment is recommended within 3 feet of walls so that excessive stress is not imposed on the walls.

Stormwater Management Feasibility

All stormwater should be collected and routed via tightline or perforated connection into City infrastructure. The near surface soils consist of silt trace to with clay and very fine sand. These deposits are typically impermeable or near-impermeable. Systems for flow control may be feasible provided there is overflow and possibly collection systems near property margins. We can provide additional input if other systems are under consideration.

Slab-on-Grade

We recommend that the upper 12 inches of the existing native soils within slab areas be re-compacted to at least 95 percent of the modified proctor (ASTM D1557 Test Method).

Often, a vapor barrier is considered below concrete slab areas. However, the usage of a vapor barrier could result in curling of the concrete slab at joints. Floor covers sensitive to moisture typically requires the usage of a vapor barrier. A materials or structural engineer should be consulted regarding the detailing of the vapor barrier below concrete slabs. Exterior slabs typically do not utilize vapor barriers.

The American Concrete Institutes ACI 360R-06 Design of Slabs on Grade and ACI 302.1R-04 Guide for Concrete Floor and Slab Construction are recommended references for vapor barrier selection and floor slab detailing.

Slabs on grade may be designed using a coefficient of subgrade reaction of 150 pounds per cubic inch (pci) assuming the slab-on-grade base course is underlain by structural fill placed and compacted as outlined above. A 4- to 6-inch-thick capillary break layer should be placed over the prepared subgrade. This material should consist of pea gravel or 5/8 inch clean angular rock.

A perimeter drainage system is recommended unless interior slab areas are elevated a minimum of 12 inches above adjacent exterior grades. If installed, a perimeter drainage system should consist of a 4-inch diameter perforated drain pipe surrounded by a minimum 6 inches of drain rock wrapped in a non-woven geosynthetic filter fabric to reduce migration of soil particles into the drainage system. The perimeter drainage system should discharge by gravity flow to a suitable stormwater system.

Exterior grades surrounding buildings should be sloped at a minimum of one percent to facilitate surface water flow away from the building and preferably with a relatively impermeable surface cover immediately adjacent to the building.

Erosion and Sediment Control

Erosion and sediment control (ESC) is used to reduce the transportation of eroded sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be implemented, and these measures should be in general accordance with local regulations. At a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features for the site:

- Schedule the soil, foundation, utility, and other work requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMP's), grading activities can be completed during the wet season (generally October through April).
- All site work should be completed and stabilized as quickly as possible.

- Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.
- Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

Utilities

Utility trenches should be excavated according to accepted engineering practices following OSHA (Occupational Safety and Health Administration) standards, by a contractor experienced in such work. The contractor is responsible for the safety of open trenches. Traffic and vibration adjacent to trench walls should be reduced; cyclic wetting and drying of excavation side slopes should be avoided. Depending upon the location and depth of some utility trenches, groundwater flow into open excavations could be experienced, especially during or shortly following periods of precipitation.

In general, silty and sandy soils were encountered at shallow depths in the explorations at this site. These soils have low cohesion and density and will have a tendency to cave or slough in excavations. Shoring or sloping back trench sidewalls is required within these soils in excavations greater than 4 feet deep.

All utility trench backfill should consist of imported structural fill or suitable on site soils. Utility trench backfill placed in or adjacent to buildings and exterior slabs should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. The upper 5 feet of utility trench backfill placed in pavement areas should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Below 5 feet, utility trench backfill in pavement areas should be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. Pipe bedding should be in accordance with the pipe manufacturer's recommendations.

The contractor is responsible for removing all water-sensitive soils from the trenches regardless of the backfill location and compaction requirements. Depending on the depth and location of the proposed utilities, we anticipate the need to re-compact existing fill soils below the utility structures and pipes. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction procedures.

CONSTRUCTION FIELD REVIEWS

Cobalt Geosciences should be retained to provide part time field review during construction in order to verify that the soil conditions encountered are consistent with our design assumptions and that the intent of our recommendations is being met. This will require field and engineering review to:

- Monitor and test structural fill placement and soil compaction
- Observe bearing capacity at foundation locations
- Observe slab-on-grade preparation
- Monitor foundation drainage placement
- Observe excavation stability

Geotechnical design services should also be anticipated during the subsequent final design phase to support the structural design and address specific issues arising during this phase. Field and engineering review services will also be required during the construction phase in order to provide a Final Letter for the project.

CLOSURE

This report was prepared for the exclusive use of Sam Adams and his appointed consultants. Any use of this report or the material contained herein by third parties, or for other than the intended purpose, should first be approved in writing by Cobalt Geosciences, LLC.

The recommendations contained in this report are based on assumed continuity of soils with those of our test holes and assumed structural loads. Cobalt Geosciences should be provided with final architectural and civil drawings when they become available in order that we may review our design recommendations and advise of any revisions, if necessary.

Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of Sam Adams who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Cobalt Geosciences should any of these not be satisfied.

Sincerely,

Cobalt Geosciences, LLC



8/9/2023
Phil Haberman, PE, LG, LEG
Princip

Statement of General Conditions

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Cobalt Geosciences and the Client. Any use which a third party makes of this report is the responsibility of such third party.

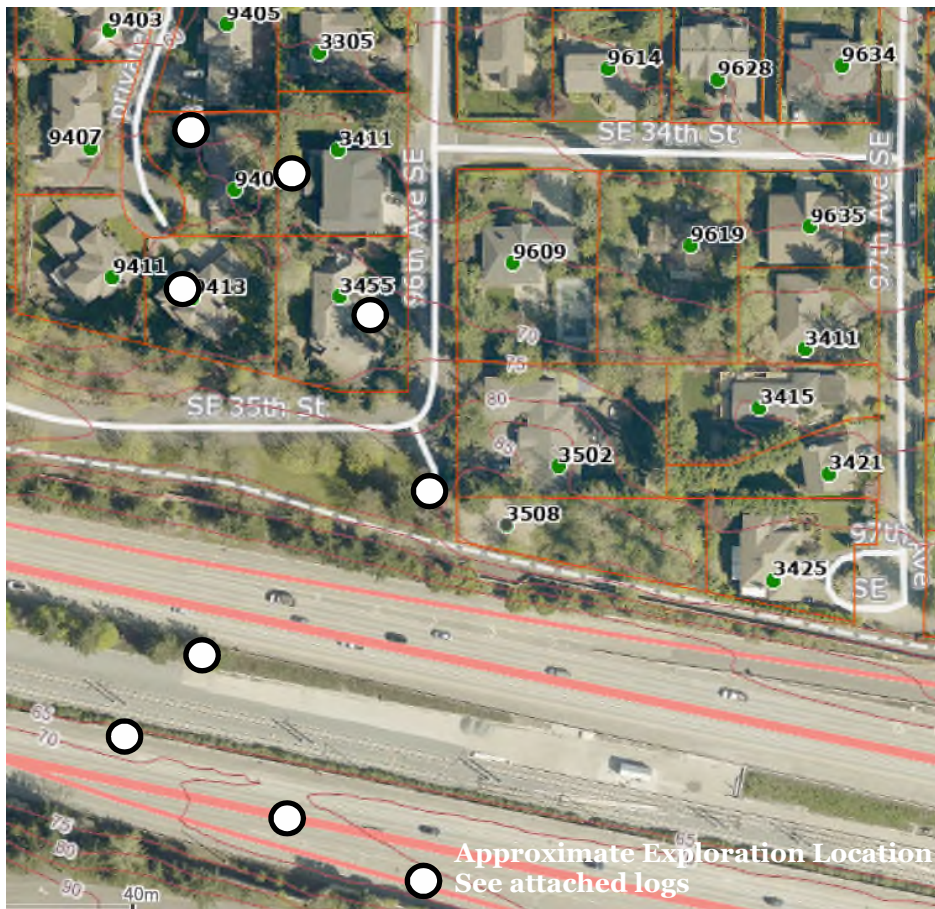
BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Cobalt Geosciences present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Cobalt Geosciences is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Cobalt Geosciences at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Cobalt Geosciences must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Cobalt Geosciences will not be responsible to any party for damages incurred as a result of failing to notify Cobalt Geosciences that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Cobalt Geosciences, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Cobalt Geosciences cannot be responsible for site work carried out without being present.



King County Imap



HB-1 Approximate Hand Boring Location



King County Imap

Not to Scale



Proposed Residence
3508 96th Avenue SE
Mercer Island, Washington

SITE MAP
FIGURE 1

Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, WA 98028
(206) 331-1097
www.cobaltgeo.com
cobaltgeo@gmail.com

Log of Hand Boring HB-1

Date: August 2023	Depth: 6'	Initial Groundwater: None
Contractor:	Elevation:	Sample Type: Grab
Method: Hand Auger	Logged By: PH Checked By: SC	Final Groundwater: N/A

Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)	
								Plastic Limit	Liquid Limit
						Vegetation/Topsoil			
1					ML	Medium stiff, silt trace clay, locally mottled yellowish brown to grayish brown, moist. (Possible Fill over Weathered Lacustrine Deposits)			
2									
3									
4					ML	Stiff, silt trace clay, locally mottled olive brown to grayish brown, moist. (Lacustrine Deposits)			
5									
6						End of Hand Boring 6'			
7									
8									
9									
10									



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Proposed Residence
3508 96th Avenue SE
Mercer Island, Washington

Hand
Boring
Log

Log of Hand Boring HB-2

Date: August 2023

Depth: 6'

Initial Groundwater: None

Contractor:

Elevation:

Sample Type: Grab

Method: Hand Auger

Logged By: PH

Checked By: SC

Final Groundwater: N/A

Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)	
								Plastic Limit	Liquid Limit
						Vegetation/Topsoil			
1					ML	Medium stiff to locally stiff, silt trace clay, locally mottled yellowish brown to grayish brown, moist. (Possible Fill over Weathered Lacustrine Deposits)			
2									
3									
4									
5									
6					ML	Stiff to very stiff, silt trace clay, locally mottled olive brown to grayish brown, moist. (Lacustrine Deposits)			
7						End of Hand Boring 6'			
8									
9									
10									

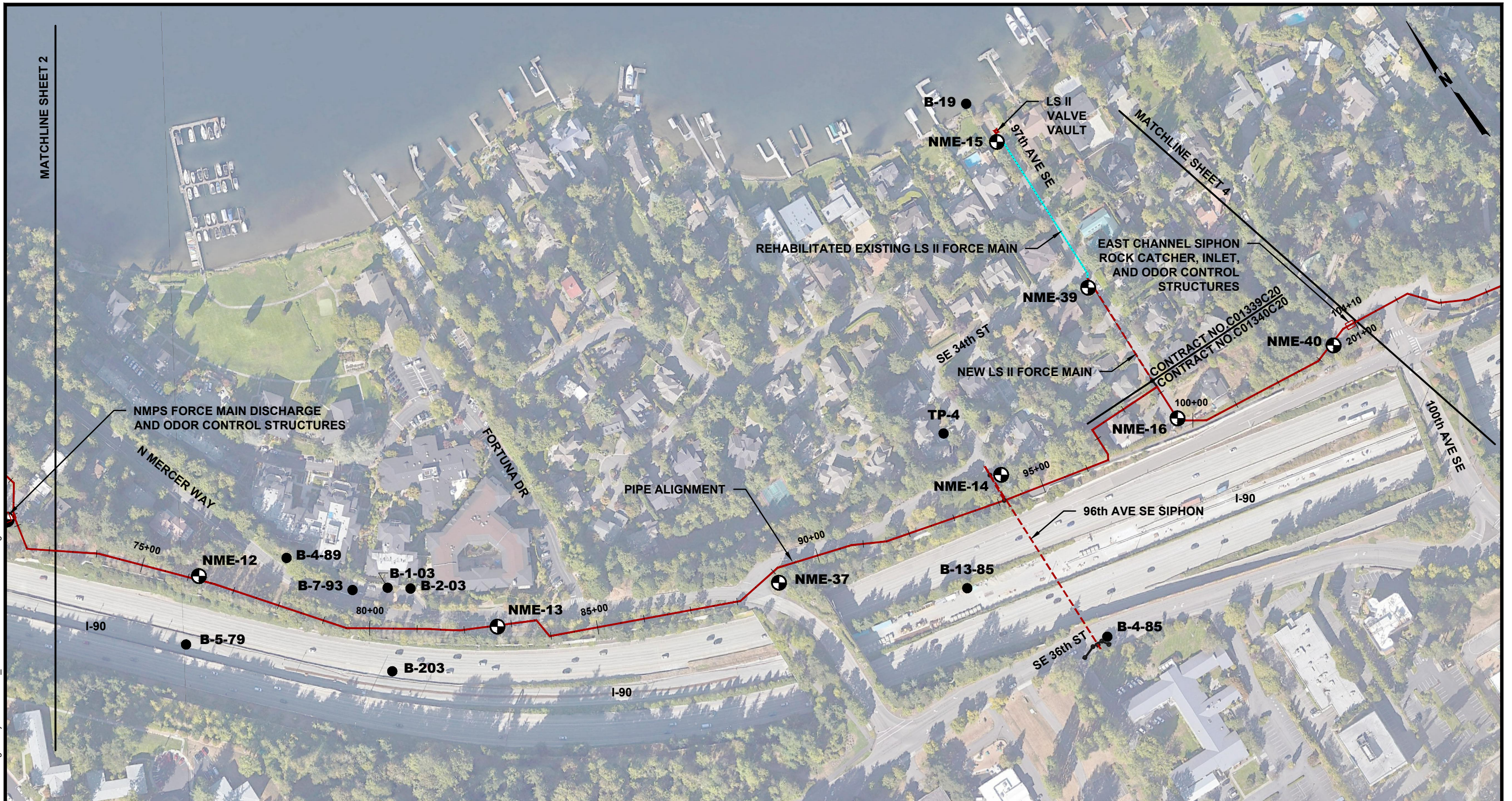


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Proposed Residence
3508 96th Avenue SE
Mercer Island, Washington

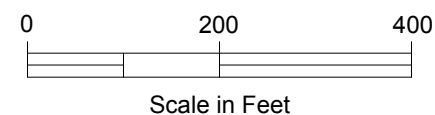
Hand
Boring
Log

Filename: F:\J21\22000\21221-1-22000 Plans.dwg Layout: Sheet 3_GDR Date: 05-06-2020 Login: SAC



LEGEND

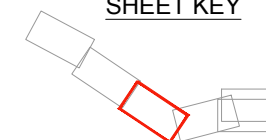
- NME-01**  Current Exploration Designation and Approximate Location (Completed by Shannon & Wilson)
- B-1, TP-1**  Existing Exploration Designation and Approximate Location (Completed by Others)



NOTE

Figure adapted from JACOBS' file *E00306E13-PIPE-ALIGN*, dated 4-10-20 and Tetra Tech's files *E00306E-PIPE-ALIGN-ECS_EAST*, dated 5-1-20, and *E00306E-PIPE-EIR_EAST*, *E00306E-PIPE-EIS_EAST*, and *E00306E-PIPE-SSWR-N_EAST*.dwg dated 4-13-20.

SHEET KEY



North Mercer Island Interceptor and Enatai Interceptor Upgrade Project
King County, Washington

SITE AND EXPLORATION PLAN CONVEYANCE

CONTRACT NO. C01340C20

May 2020

21-1-22000-212

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2
Sheet 3 of 6

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT ²	FINE-GRAINED SOILS (50% or more fines) ¹	COARSE-GRAINED SOILS (less than 50% fines) ¹
Major	Silt, Lean Clay, Elastic Silt,³ or Fat Clay³	Sand or Gravel⁴
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: Sandy or Gravelly⁴	More than 12% fine-grained: Silty or Clayey³
Minor Follows major constituent	15% to 30% coarse-grained: with Sand or with Gravel⁴ 30% or more total coarse-grained and lesser coarse-grained constituent is 15% or more: with Sand or with Gravel⁵	5% to 12% fine-grained: with Silt or with Clay³ 15% or more of a second coarse-grained constituent: with Sand or with Gravel⁵

¹All percentages are by weight of total specimen passing a 3-inch sieve.

²The order of terms is: *Modifying Major with Minor*.

³Determined based on behavior.

⁴Determined based on which constituent comprises a larger percentage.

⁵Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm
	NOTE: If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.
	NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND Fine Medium Coarse	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.) #40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.) #10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL Fine Coarse	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.) 3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS

	Bentonite Cement Grout		Surface Cement Seal
	Bentonite Grout		Asphalt or Cap
	Bentonite Chips		Slough
	Silica Sand		Inclinometer or Non-perforated Casing
	Perforated or Screened Casing		Vibrating Wire Piezometer

PERCENTAGES TERMS^{1,2}

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

¹Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

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North Mercer Island Interceptor and
Enatai Interceptor Upgrade Project
King County, Washington

SOIL DESCRIPTION AND LOG KEY

May 2020

21-1-22000-212

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 1 of 3

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL	TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS (more than 50% retained on No. 200 sieve)	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Gravel (less than 5% fines)	GW	Well-Graded Gravel; Well-Graded Gravel with Sand
			GP	Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel (more than 12% fines)	GM	Silty Gravel; Silty Gravel with Sand
			GC	Clayey Gravel; Clayey Gravel with Sand
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Sand (less than 5% fines)	SW	Well-Graded Sand; Well-Graded Sand with Gravel
			SP	Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand (more than 12% fines)	SM	Silty Sand; Silty Sand with Gravel
			SC	Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS (50% or more passes the No. 200 sieve)	Silts and Clays (liquid limit less than 50)	Inorganic	ML	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays (liquid limit 50 or more)	Inorganic	MH	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat or other highly organic soils (see ASTM D4427)

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

- Dual symbols (symbols separated by a hyphen, i.e., SP-SM, Sand with Silt) are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are a combination of the two graphic symbols (e.g., SP and SM).
- Borderline symbols (symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand) indicate that the soil properties are close to the defining boundary between two groups.

North Mercer Island Interceptor and
Enatai Interceptor Upgrade Project
King County, Washington

**SOIL DESCRIPTION
AND LOG KEY**

May 2020

21-1-22000-212

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Geotechnical and Environmental Consultants

FIG. A-1
Sheet 2 of 3

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS¹

Weak	Crumbles or breaks with handling or slight finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

PLASTICITY²

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASTICITY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20
High	It takes considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS¹

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q _u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS¹

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

North Mercer Island Interceptor and
Enatai Interceptor Upgrade Project
King County, Washington

SOIL DESCRIPTION AND LOG KEY

May 2020

21-1-22000-212

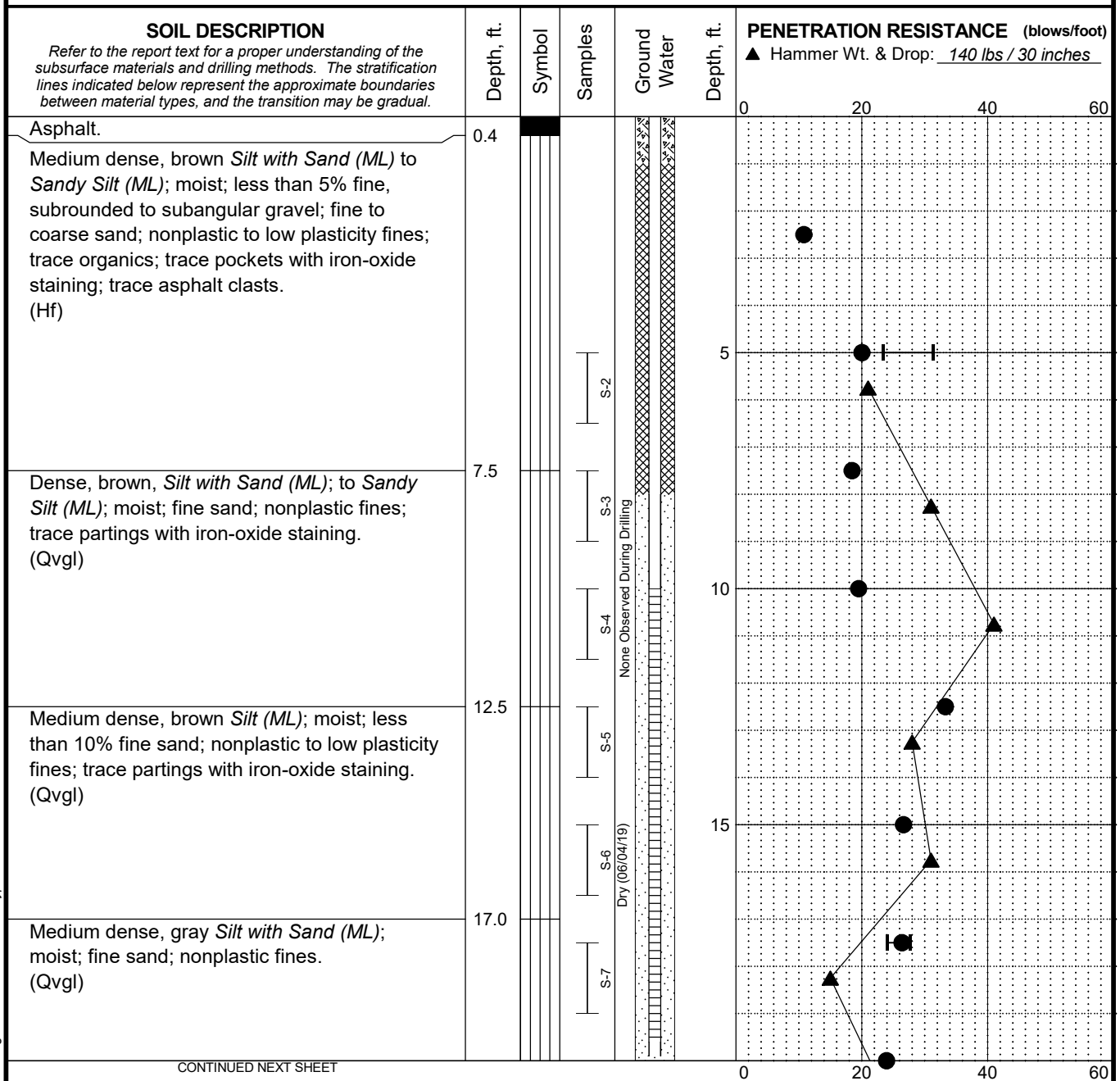
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 3 of 3

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Total Depth:	<u>21.5 ft.</u>	Northing:	<u>~ 214,309 ft.</u>	Drilling Method:	<u>Hollow Stem Auger</u>	Hole Diam.:	<u>8 in.</u>
Top Elevation:	<u>~ 179 ft.</u>	Easting:	<u>~ 1,300,464 ft.</u>	Drilling Company:	<u>Holt</u>	Rod Diam.:	<u>NWJ</u>
Vert. Datum:	<u>KC Metro</u>	Station:	<u>~</u>	Drill Rig Equipment:	<u>Mobile Drill B57 Track Rig</u>	Hammer Type:	<u>Automatic</u>
Horiz. Datum:	<u>NAD83</u>	Offset:	<u>~</u>	Other Comments:	<u>~</u>		



CONTINUED NEXT SHEET

LEGEND

- I Sample Recovery
 - * Sample Not Recovered
 -  Sonic Core Sample
 -  2.0" O.D. Split Spoon Sample

- ▼ Ground Water Level in Well

- ◇ % Fines (<0.075mm)
 ● % Water Content
 Plastic Limit ——— Liquid Limit
 Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

North Mercer Island Interceptor and
Enatai Interceptor Upgrade Project
King County, Washington

LOG OF BORING NME-14

May 2020

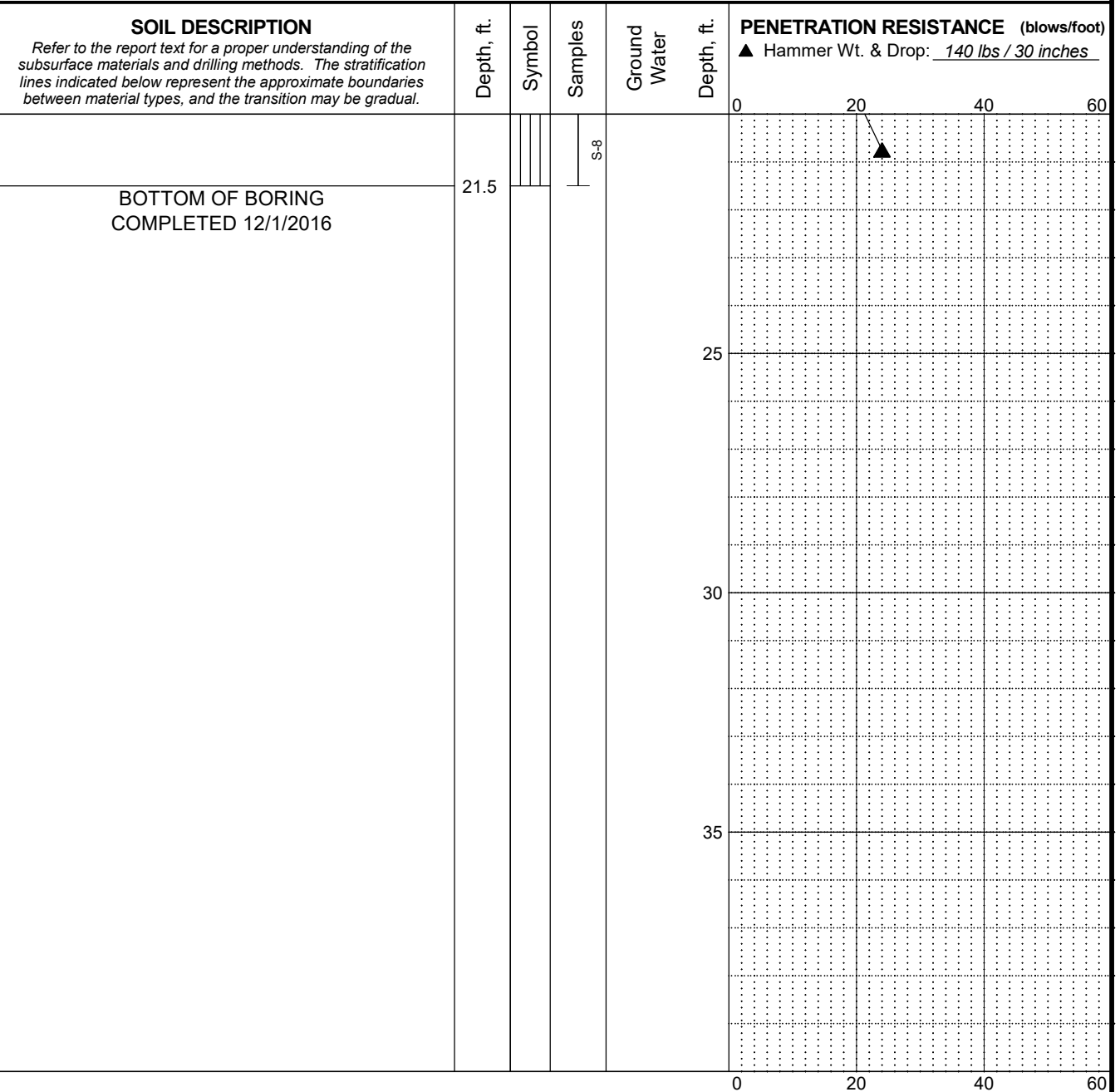
21-1-22000-212

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FIG. A-13
Sheet 1 of 2

MASTER LOG BFW 21-22000.GPJ SHAN WIL.GDT 4/29/20 Log: JAA Rev: EAS Typ: LKN

Total Depth:	<u>21.5 ft.</u>	Northing:	<u>~ 214,309 ft.</u>	Drilling Method:	<u>Hollow Stem Auger</u>	Hole Diam.:	<u>8 in.</u>
Top Elevation:	<u>~ 179 ft.</u>	Easting:	<u>~ 1,300,464 ft.</u>	Drilling Company:	<u>Holt</u>	Rod Diam.:	<u>NWJ</u>
Vert. Datum:	<u>KC Metro</u>	Station:	<u>~</u>	Drill Rig Equipment:	<u>Mobile Drill B57 Track Rig</u>	Hammer Type:	<u>Automatic</u>
Horiz. Datum:	<u>NAD83</u>	Offset:	<u>~</u>	Other Comments:	<u>~</u>		



LEGEND

I Sample Recovery	▼ Ground Water Level in Well	◇ % Fines (<0.075mm)
* Sample Not Recovered		● % Water Content
□ Sonic Core Sample		Plastic Limit —●— Liquid Limit
└ 2.0" O.D. Split Spoon Sample		Natural Water Content

- NOTES**
1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
 2. Groundwater level, if indicated above, is for the date specified and may vary.
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 4. The hole location was measured from existing site features and should be considered approximate.

North Mercer Island Interceptor and
Enatai Interceptor Upgrade Project
King County, Washington

LOG OF BORING NME-14

May 2020

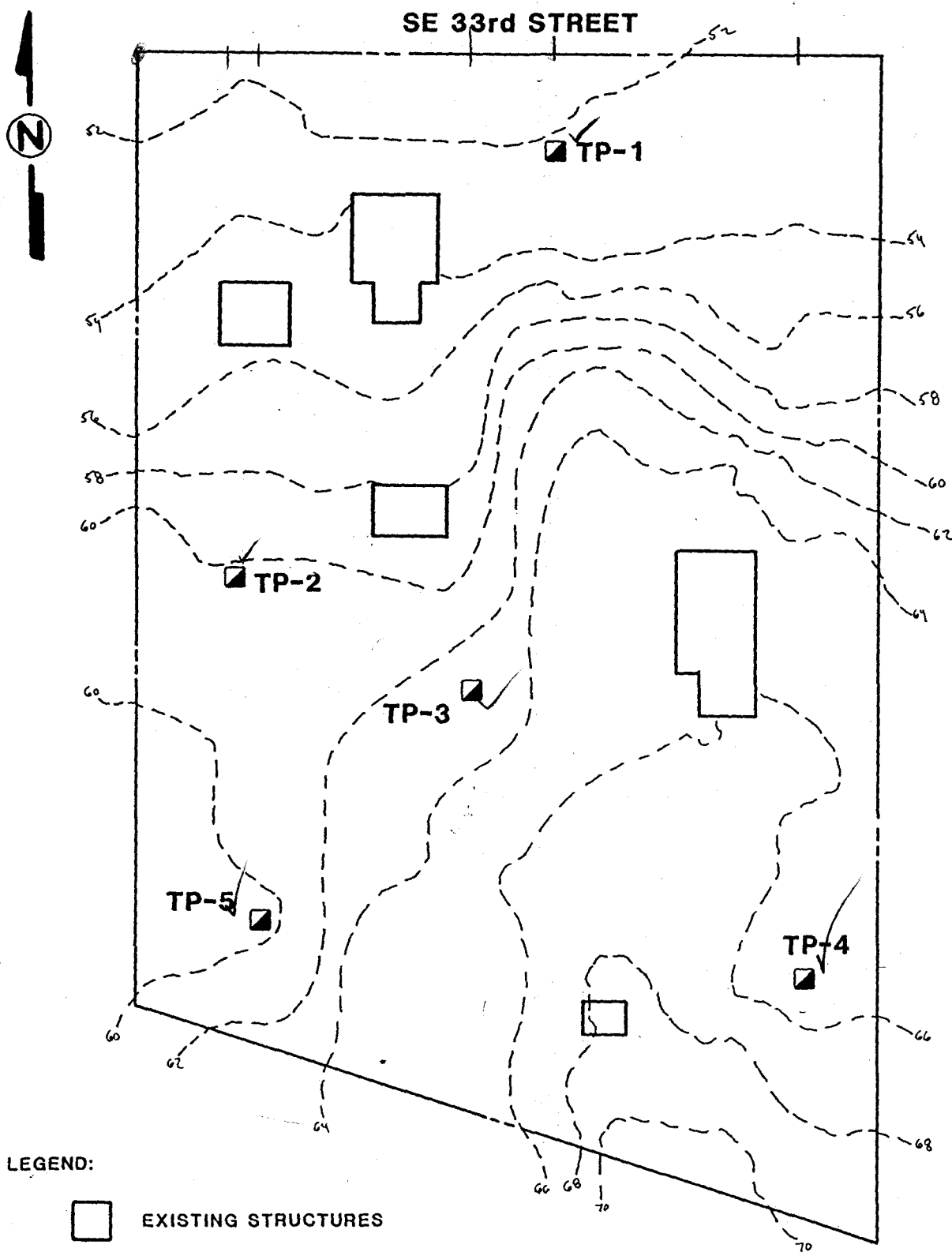
21-1-22000-212

SHANNON & WILSON, INC.
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FIG. A-13
Sheet 2 of 2

REV 3 - Approved for Submittal

MASTER LOG BFW 21-22000.GPJ SHAN WIL GDT 4/29/20 Log: JAA Rev: EAS Typ: LKN



LEGEND:



EXISTING STRUCTURES



APPROXIMATE TEST PIT LOCATIONS



**GEOTECH
CONSULTANTS**

SITE EXPLORATION PLAN

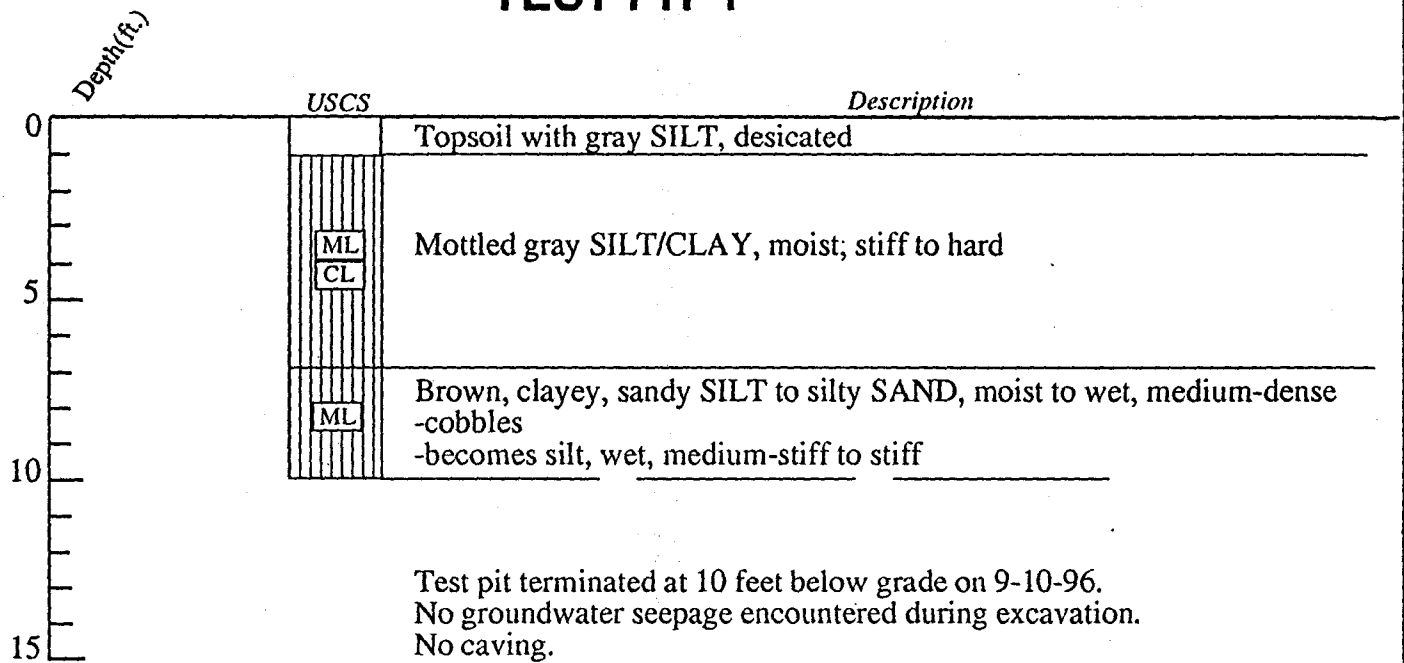
**SE 33rd STREET
MERCER ISLAND, WA**

Job No.:
96316

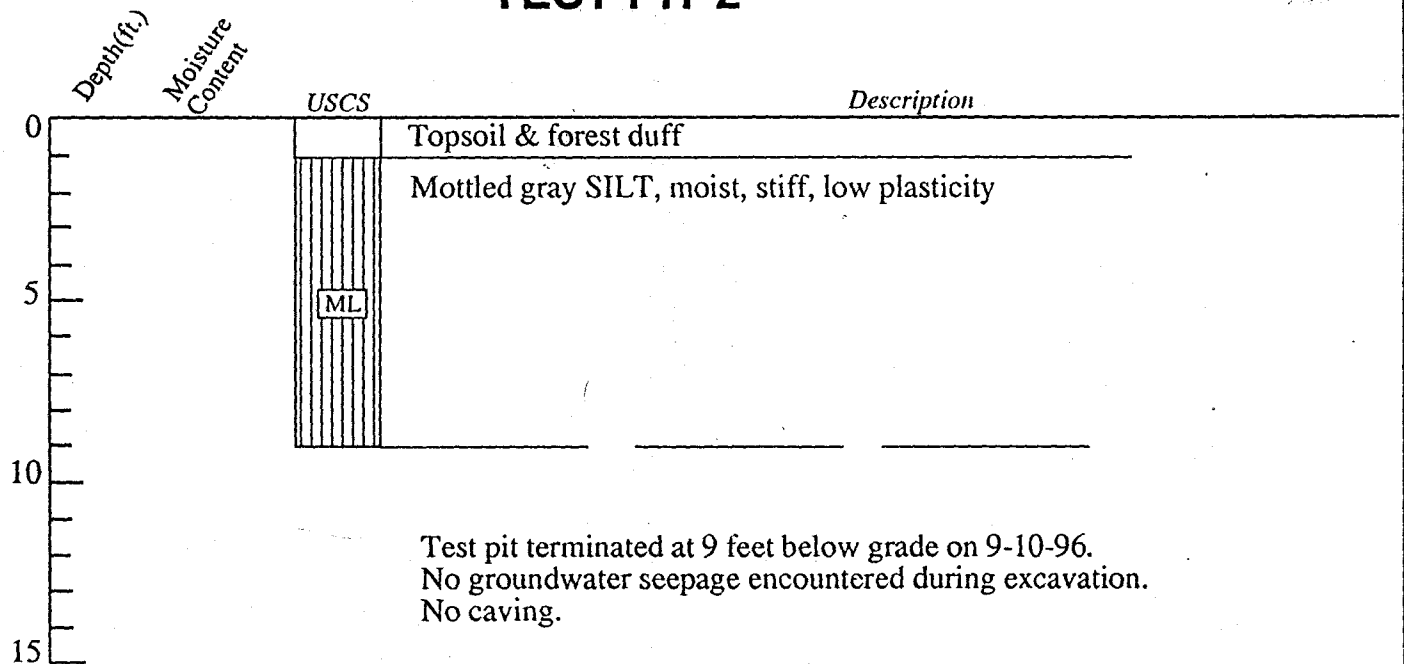
Date:
SEP 1996

Plate:
2

TEST PIT 1



TEST PIT 2

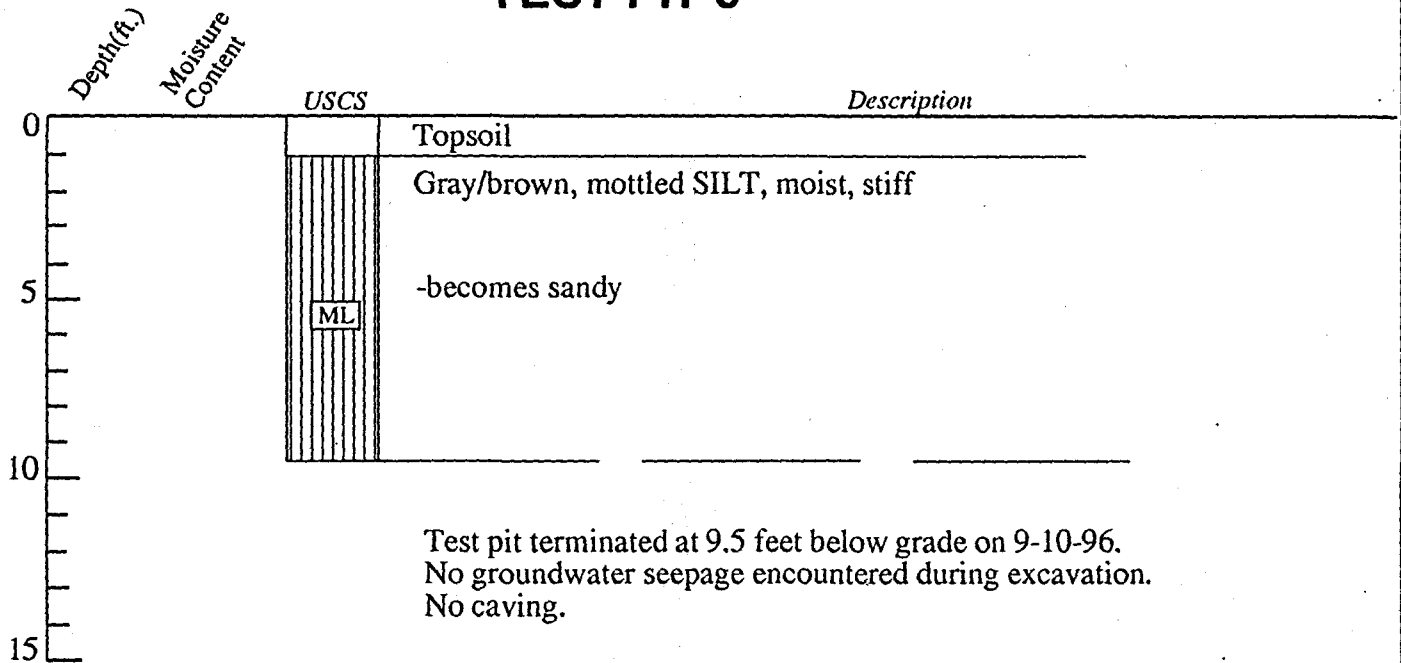


GEOTECH
CONSULTANTS, INC.

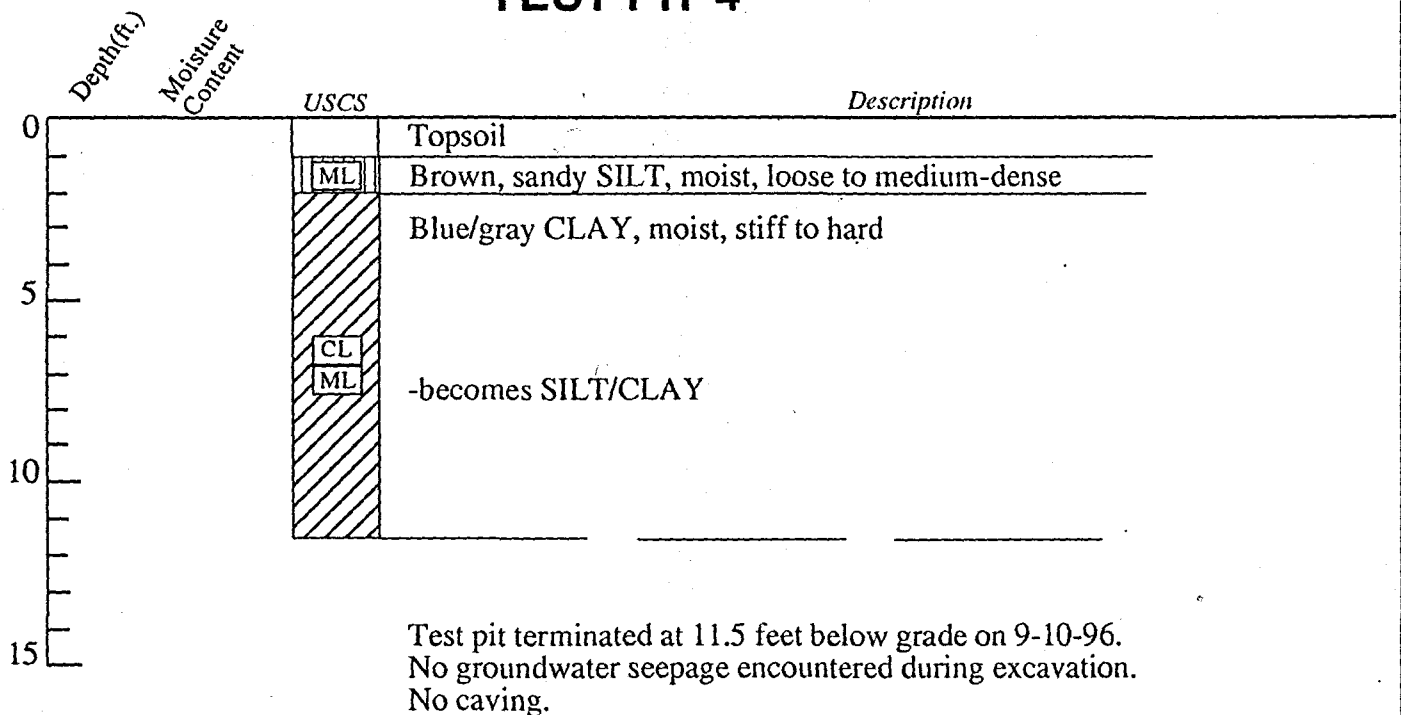
TEST PIT LOGS
SE 33rd STREET
MERCER ISLAND, WA

Job No: 96316	Date: SEP 1996	Logged by: DBG	Plate: 3
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TEST PIT 3



TEST PIT 4



GEOTECH
CONSULTANTS, INC.

TEST PIT LOGS

SE 33rd STREET
MERCER ISLAND, WA

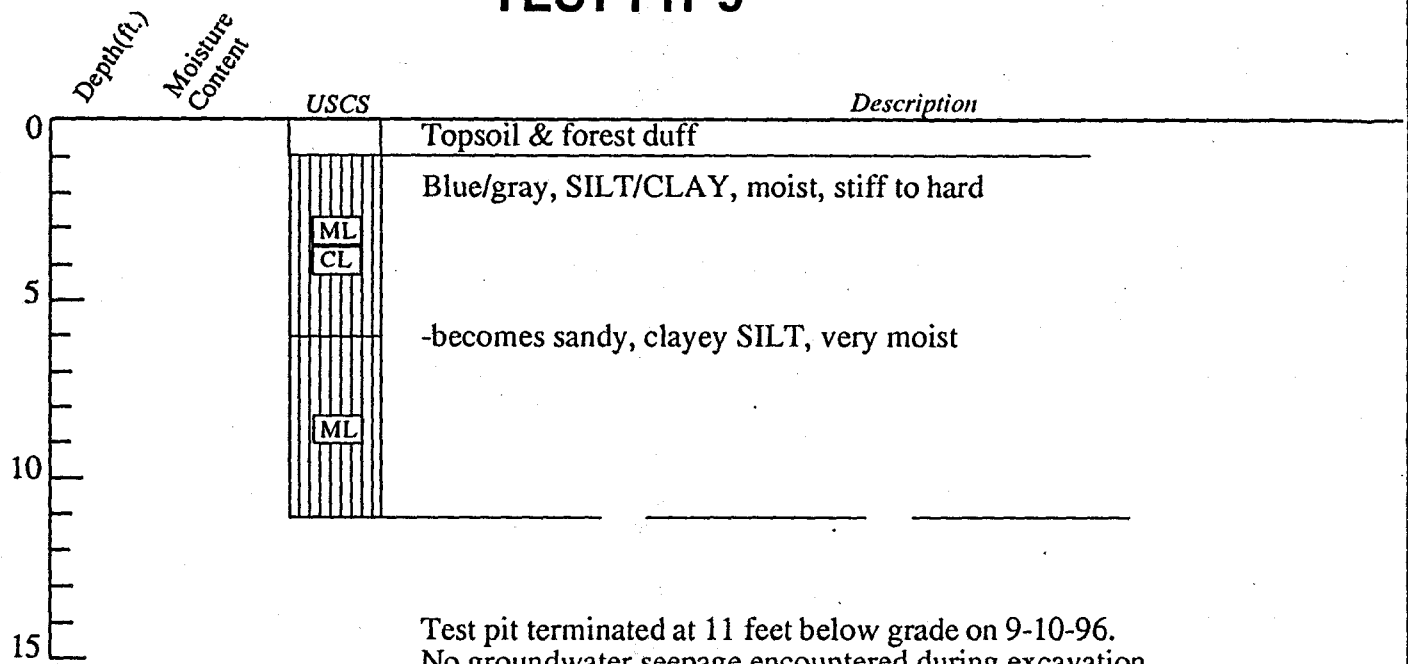
Job No:
96316

Date:
SEP 1996

Logged by:
DBG

Plate:
4

TEST PIT 5



Test pit terminated at 11 feet below grade on 9-10-96.
No groundwater seepage encountered during excavation.
No caving.



GEOTECH
CONSULTANTS, INC.

TEST PIT LOGS

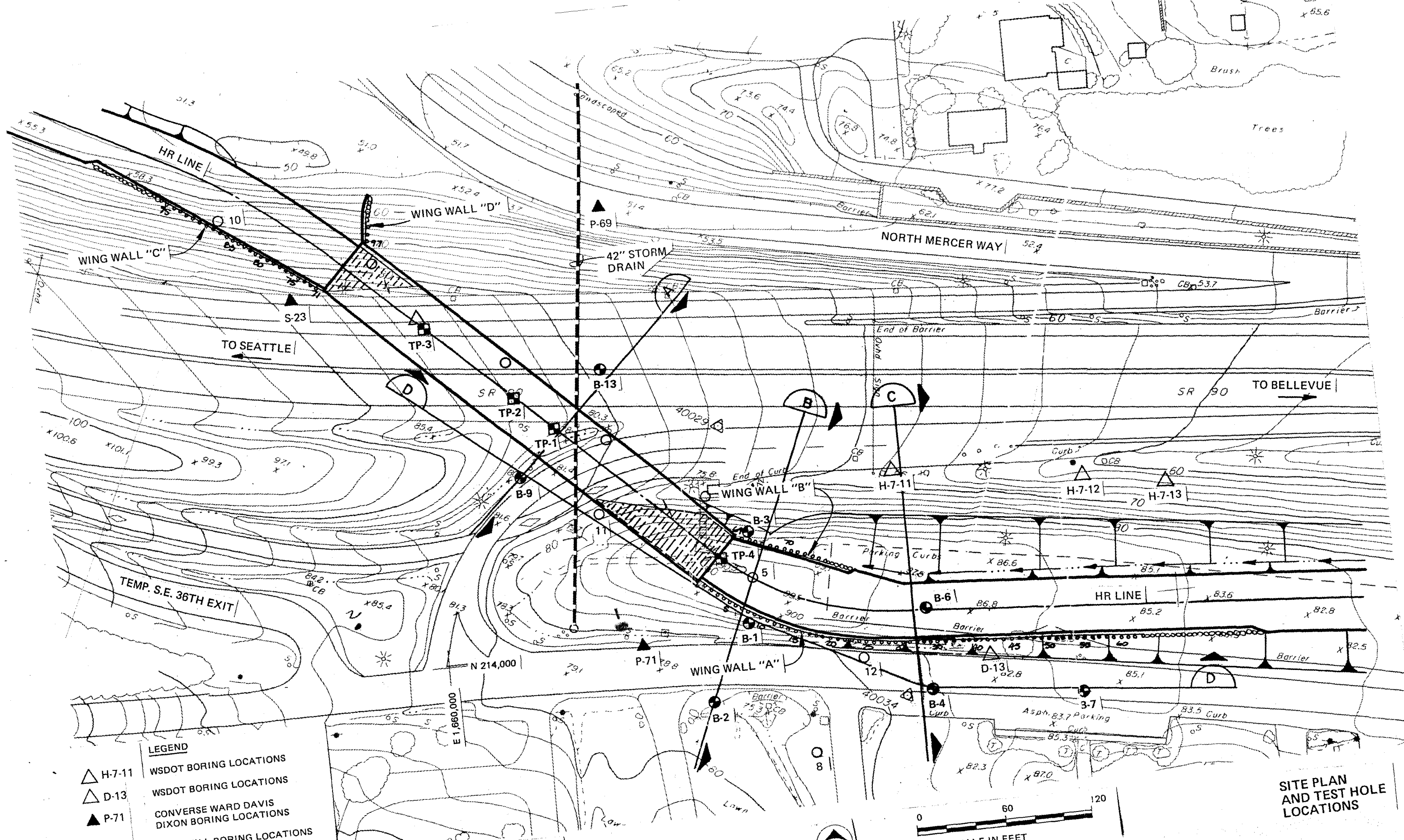
SE 33rd STREET
MERCER ISLAND, WA

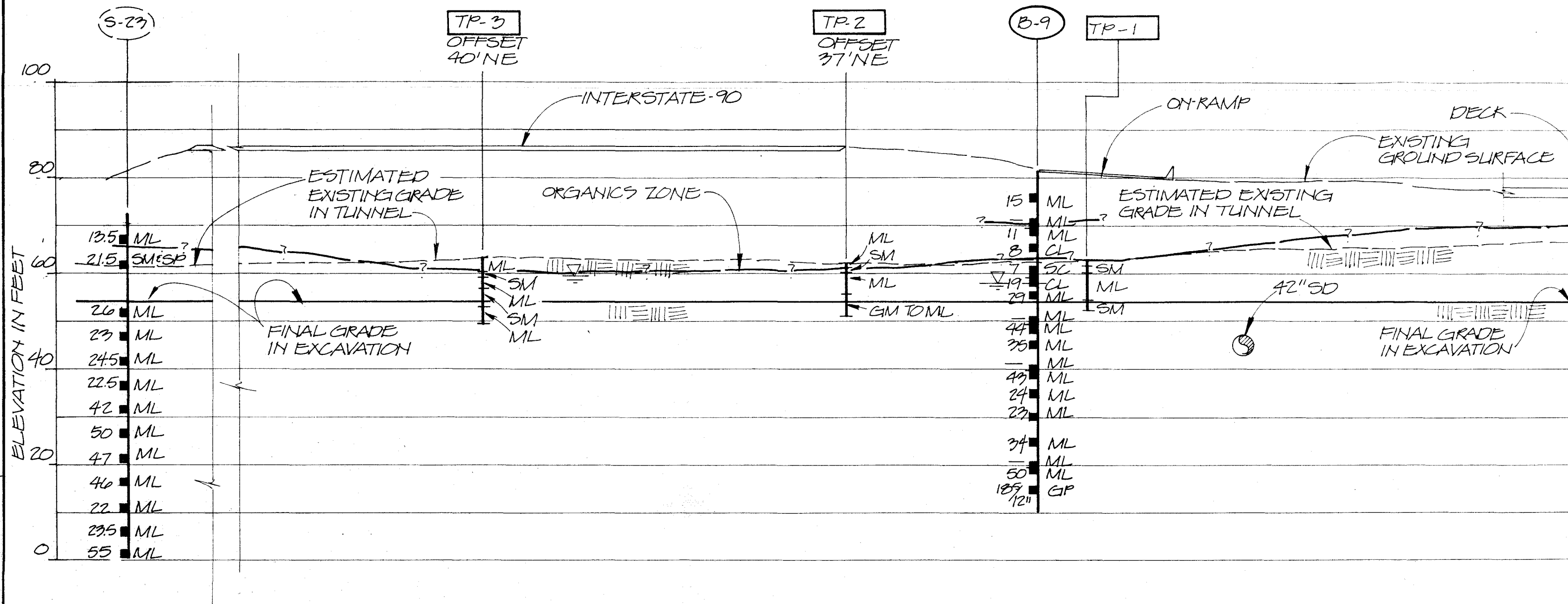
Job No:
96316

Date:
SEP 1996

Logged by:
DBG

Plate:
5





SECTION 1

PRELIMINARY

(P-71) TP-4
OFFSET 50'S
OFFSET 25'NE

B-1

B-4

(D-13)
OFFSET 18'N

B-7

SE. 36TH STREET

ESTIMATED EXISTING
GRADE IN TUNNEL

ORGANICS
ZONE

WING
WALL

? 4
8.5 SM
16 SM
18.5 SM
17.5 SM
2.5 SM
SM
SM
SM
SM

ML
SM
ML

14 ML
16 ML
21 ML
20 SM TO ML
8 CL
24 CL
SP
ML
33 ML
34 ML
SM
12 SM
15 ML
179 GP
108 SP

CLORCH

SM TO ML

CL

CL

SP

ML

ML

ML

ML

SM

SM

ML

GP

SP

9 SP-GP
5 SC
16 SM
8 ML
25 GM
29 ML
32 ML
15 SM
98 ML
62 ML
37 ML

7 CL-ML
5 CL-ML
11 CL-ML
13 SP
9 SP
37 SP
47 SP
18
20
71
89/10

4 ML
29 ML
226 ML
41 ML
37 ML
31 ML
30 ML
51 SP
73 SW
89/10 SM
89/10 SW

ELEVATION IN FEET



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-1

PROJECT: I-90 HAUL ROAD
BORING LOCATION: SEE MAP
DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER
CONTRACTOR: WSDOT
DEPTH TO WATER SURFACE AND DATE: 21' 6/28/85

ELEVATION: 79.6'
DATE: JUNE 28, 1985
START TIME: 1130 6/28/85
COMPLETION: 1300 6/28/85
LOGGER: K.D. SHARP
PAGE: 1 OF 3

DEPTH	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
ELEVATION FT. BELOW SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY	6"-6"-6" (N)			
0					PRELIMINARY CLAYEY SILT, medium plastic, 5-10% fine sand, gray, slightly moist, medium (ML) SILT, gray to blue with mottled brown, 1/2" to 1" layers of fine SANDY SILT, moist, soft (ML) SANDY SILT, gray at end of tube (ML) CLAY, medium to highly plastic, with silty sand layers, 1-2" layer fine gravel in matrix, gray, some mottled brown layers, moist, very stiff (CL or CH) ORGANIC CLAY, black and brown mottles, moist, very stiff (DL or OH) with SILTY SAND or SANDY SILT layers, fine sand, wet (SM to ML) CLAY, medium plastic, gray, moist, medium stiff (CL) CLAY, medium plastic, gray, moist, medium stiff, 1" saturated sand on top, some gravel in matrix, (CL)		
5		S-1 JAR	1'	5-7-7 (14)			
		S-2 JAR	7'	2-2-4 (6)			
10		S-3 TUBE	6'				100 psi to push tube
		S-4 JAR	13'	2-8-13 (21)			
15		S-5 JAR	12'	2-6-14 (20)			
		S-6 TUBE	24'				100 psi to push tube
20		S-7 JAR	11'	2-3-5 (8)			gravel in drilling
25							

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-1

PROJECT: I-90 HAUL ROAD
BORING LOCATION: SEE MAP
DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER
CONTRACTOR: WSDOT
DEPTH TO WATER SURFACE AND DATE: -21' 6/28/85

ELEVATION: 79.6'
DATE: JUNE 28, 1985
START TIME: 1130 6/28/85
COMPLETION: 1300 6/28/85
LOGGER: K.D. SHARP
PAGE: 2 OF 3

DEPTH	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6'-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
ELEVATION FT BELOW SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY				
25		S-8 JAR	10'	4-12-12 (24)	SAND, poorly graded, medium to fine, gray, saturated, medium dense, clay and silt in matrix (SP)		
30		S-9 TUBE	15'		SILT, plastic, 5% very fine sand, gray, moist, very stiff to hard, (ML)		Tube crimped 300-500 psi to push tube
		S-10 JAR	18'	4-9-24 (33)	SILT, low plasticity, lenses of fine sand, (ML)		
35		S-11 JAR	18'	7-13-21 (34)	SILT, same as S-9 (ML)		
40		S-12 TUBE	24'		SILT, same as S-9, very stiff to hard, gravel in matrix (ML)		550 psi to push tube
		S-13 JAR	18'	23-40-80 (120)	SILTY SAND, fine to medium, hard, fine rounded gravel in matrix (SM)		
45		S-14 JAR	18'	37-57-100 (157)	SANDY SILT, with lenses of fine sand, fractured, hard, gravel size increasing (ML)		
50							

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: **B-1**

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: ~21' 6/28/85

ELEVATION: 79.6'

DATE: JUNE 28, 1985

START TIME: 1130 6/28/85

COMPLETION: 1300 6/28/85

LOGGER: K.D. SHARP

PAGE: 3 OF 3

ELEVATION FT BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6'-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY				
50		S-15 JAR	18'	41-75-104 (179)	SANDY GRAVEL, some fines, gray, saturated, very dense (GP)		Difficult augering, very hard
55							
60		S-16 JAR	15'	55-48-60 (108)	SAND, poorly graded, fine, gray, wet, very dense, 5-10% silt (SP)		Inclinometer installed at 61' with much difficulty, heave 10'; jetted out hole to reinstall, pipe pushed up 10' then went down 3' below g.s., grouted with weak grout, will take one week to get first reading.
65					End of Boring = 61.5 feet		



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.:

B-2

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: 3' 6/30/85

ELEVATION: 77.0'

DATE: JUNE 30, 1985

START TIME: 3:00 6/29/85

COMPLETION: 9:00 6/30/85

LOGGER: K.D. SHARP

PAGE: 1 OF 3

DEPTH	ELEVATION	FT BELOW SURFACE	INTERVAL	SAMPLE TYPE AND NUMBER	RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
71	0								
75							PRELIMINARY		Water at 3'
	5			S-1 JAR	1'	3-3-3 (6)	SANDY GRAVEL, poorly graded, brown, moist, (GP)		
70				S-2 JAR	3'	2-3-4 (7)	CLAY, medium plastic, brown, moist (CL)		
	10			S-3 JAR	2'	1-1-2 (3)	CLAY, highly plastic, 10% fine sand, brown to gray, moist, soft, (CH)		
65									
	15			S-4 TUBE	24"		SANDY SILT, non-plastic, fine sand, gray, moist, stiff, (ML)		75 psi to 125 psi to push tube
				S-5 JAR		4-8-9 (17)	SANDY CLAY, fine sand, gray, moist to wet, medium dense, layers of medium sand, 1/2 - 1" layer of plastic silt, (SC)		6" heave
60									
	20			S-6 JAR	18"	3-5-7 (12)	SILT, medium plastic, gray, moist, stiff, 5% very fine sand and pebbles (ML)		
55									
	25								

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-2

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: 3', 6/30/85

ELEVATION: 77.0'

DATE: JUNE 30, 1985

START TIME: 3:00 6/29/85

COMPLETION: 9:00 6/30/85

LOGGER: K.D. SHARP

PAGE: 2 OF: 3

DEPTH	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
ELEVATION FT BELOW SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY				
25		S-7 TUBE	2'		CLAY, medium plastic, gray, moist, stiff, 5% sand (CL)		75 psi to push tube
30		S-8 JAR	7'	12-29-53 (82)	SILT, medium plastic, gray, moist to wet, stiff, some fine angular gravel (ML)		hard at 27.5
35		S-9 JAR	16'	9-16-21 (37)	SILT, low plasticity, gray, moist, very stiff, massive (ML)		
40		S-10 JAR	18'	13-16-29 (45)	SILT, low plasticity, gray, wet, stiff, some rounded gravel and fine sand (ML)		Attempted shelly, could not push
45		S-11 JAR	15'	27-34-50/4" (84)	SILTY SAND, fine to medium, 5% gravel, gray, saturated, dense to very dense, 1" layers of medium gravel and sand (SM)		gravels at 37'
50		S-12 JAR	15'	37-41-50/4" (91)	SILTY SAND, fine sand and 3/4" gravel, gray, wet, very dense, with 2" layer of sandy silt (SM)		Hard drilling

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.:

B-2

PROJECT: I-90 HAUL ROAD
BORING LOCATION: SEE MAP
DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER
CONTRACTOR: WSDOT
DEPTH TO WATER SURFACE AND DATE: 3' 6/30/85

ELEVATION: 77.0'
DATE: JUNE 30, 1985
START TIME: 3:00 6/29/85
COMPLETION: 9:00 6/30/85
LOGGER: K.D. SHARP
PAGE: 3 OF 3

ELEVATION FT BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY				
50		S-13 JAR	8'	50-50/3' (100)	SANDY SILT, non-plastic, 40% very fine sand, 5% gravel, gray, moist, very dense, hard (ML)		Drilling softer
55		S-14 JAR	10'	30-50/4' (80)	SILT, low plasticity, 10% fine sand, gray, moist, very stiff to hard, top 2' includes sand and gravel (ML) End of boring at 56.0 feet		Drilling hard gravel
60							

PRELIMINARY

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.:

B-3

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: 20' 6/30/85

ELEVATION: 81.4'

DATE: JUNE 30, 1985

START TIME: 11:00 6/30/85

COMPLETION: 1700 6/30/85

LOGGER: K.D. SHARP

PAGE: 1 OF 3

DEPTH	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
ELEVATION FT BELOW SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY	6"-6"-6" (N)			
0					PRELIMINARY		
5		S-1 JAR	13'	9-8-9 (17)			
10		S-2 TUBE	20'				250 psi to push tube
		S-3 JAR	16'	3-3-3 (6)			
15		S-4 JAR	16'	3-6-8 (14)			
20		S-5 TUBE	24'				300 psi to push tube
		S-6 JAR	15'	5-4-4 (8)			Easy drilling
25							

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-3

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: 20' 6/30/85

ELEVATION: 81.4'

DATE: JUNE 30, 1985

START TIME: 11:00 6/30/85

COMPLETION: 1700 6/30/85

LOGGER: K.D. SHARP

PAGE: 2 OF 3

DEPTH	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
ELEVATION FT BELOW SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY	6"-6"-6" (N)			
53 25		S-7 JAR	18"	1-2-2 (4)	SANDY SILT, low plasticity, fine sand, gray, very moist, loose/soft (ML)		Easy drilling
30		S-8 TUBE	24"		Top: SILTY SAND, fine sand, nonplastic, gray, wet, loose (SM) Bottom: SILT, low plasticity, fine sand, gray, moist, very stiff, (ML)		500 psi to push tube Hard drilling
		S-9 JAR	18"	14-18-32 (50)	SILT, low plasticity, 10% fine sand, gray, moist, very stiff (ML) 2" layer of medium to fine sand, grades to silt.		
35		S-10A JAR S-10B JAR	18"	9-11-18 (29)	SILT, same as S-9, softer, more moist, lenses of clayey silt, (ML) SAND, poorly graded, medium to fine, 10% silt, gray, wet, medium dense, distinct layering, (SP)		Layers of hard/soft/ hard
40		S-11 TUBE	12"		SILT, low plasticity, 5% very fine sand, gray, moist (ML)		400 psi to push 1' hard pushing
		S-12 JAR	18"	12-16-21 (37)	SILT, same as S-10A, very moist, (ML) SAND, same as S-10B, saturated, (SP)		
45		S-13 JAR	16"	12-35-22 (57)	SILT, same as S-10A, very moist 9", (ML) SAND, same as S-10B, saturated 9", (SP)		
50							

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-3

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD:

AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: 20' 6/30/85

ELEVATION: 81.4'

DATE: JUNE 30, 1985

START TIME: 11:00 6/30/85

COMPLETION: 1100 6/30/85

LOGGER: K.D. SHARP

PAGE: 3 OF 3

DEPTH	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
ELEVATION FT BELOW SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY	6'-6'-6' (N)			
50		S-14 JAR	16'	9-20-26 (46)	<u>SILT</u> , low plasticity, 10% sand, 5% gravel, gray, very moist, stiff, (ML) over: <u>SAND</u> , medium to fine, gray, saturated, loose to medium dense (SM) distinct layering silt to sand		Hard drilling
55		S-15 JAR	18'	14-28-50 (78)			
					9' <u>SAND</u> , poorly graded, medium to fine, clean, gray, saturated, very dense (SP) over 9' <u>SILTY SAND</u> , coarse (SM) gravel at interface		
60		No Sample Saved	12'	45-50/5' (95)			
					SAND grades to <u>SILTY SAND</u> , with gravel, wet, very dense (SP-SM)		
					End of boring at 61 feet		

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-4

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: 29'-5" 7/3/85 0700

ELEVATION: 81.4'

DATE: 7/3/85

START TIME: 1530 7/2/85

COMPLETION: 0820 7/3/85

LOGGER: A.E. ERICKSON

PAGE: 1 OF: 3

DEPTH	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6'-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
ELEVATION FT. BELOW SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY				
81					1 1/2' Cold mix asphalt		
75					PRELIMINARY		Auger cuttings: well graded sandy gravel, 2 to 3' minus
5		S-1 JAR	6"	3-5-4 (9)	<u>SANDY GRAVEL</u> , poorly graded 1" minus pea gravel, 5% fines, brown, slightly moist, loose (GP)		
10		S-2 JAR	6"	1-2-3 (5)	<u>CLAYEY SAND</u> , 10-15% gravel, medium to fine sand, orange gray vertical bands, moist, medium (SC) with 1" <u>SAND</u> , coarse, in bottom (SP)		Noisy drilling
		S-3 TUBE	20"		<u>SILTY SAND</u> , poorly graded, brown, moist, loose, (SM)		150 psi push
15		S-4 JAR	8"	5-9-7 (16)	<u>SILTY SAND</u> , poorly graded, fine sand, silty lenses, tan and brown, wet, medium (SM)		
20		S-5 TUBE	24"		<u>SANDY SILT</u> , (ML)		50 to 100 psi push
		S-6 JAR	18"	3-4-4 (8)	<u>SILT</u> , low plasticity, 5-10% fine sand, occasional 1" minus gravel, gray, wet, medium (ML)		Water in hole, wet 2' above sampler
25							

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-4

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD
AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: 29' 5" 7/3/85 0700

ELEVATION: 81.4'

DATE: 7/3/85

START TIME: 1530 7/2/85

COMPLETION: 0820 7/3/85

LOGGER: A. E. ERICKSON

PAGE: 2 OF 3

ELEVATION FT. BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY				
25		S-7 JAR	12'	10-17-8 (25)	Top 3" <u>SANDY SILT</u> , low PI, fine sand, brown, soft, moist, stiff (ML) Bottom 9" <u>SANDY GRAVEL</u> , well graded fractured gravel 1 1/2" minus, 5 to 15% fines, brown, wet, loose (GW)		Sampler wet Hitting cobbles at 26'
30		S-8 TUBE	21'		<u>SILT</u> , nonplastic (ML)		600 psi push Gravel in top of tube, harder @ 31'
		S-9	16'	15-12-17 (29)	<u>SILT</u> , low plasticity, 5% fine sand w/medium sand, 1/2" lenses in lower 10", coarse sand upper 6", gray, moist, stiff (ML)		
35		S-10 JAR	14'	4-9-23 (32)	<u>SANDY SILT</u> , low PI, 20-40% fine sand, occasional gravel, gray, slightly moist, hard, (ML)		3 1/2' of water
40		TUBE S-11	5'				5" push @ 650 psi Rods wet 10' water in sampler
		S-12 JAR	14'	13-21-24 (45)	<u>SILTY SAND</u> , fine, with 1/4" to 1/2" medium sand lenses, hard (SM)		Gravel @ 43'
45		S-13 JAR	18'	19-50-43 (98)	<u>SANDY SILT</u> , same as S-12 with coarser gravel, thinly laminated, sand and silt layers, (ML)		Rods wet 8' (Very hard drilling)
50							

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-4

PROJECT: I-90 HAUL ROAD
BORING LOCATION: SEE MAP
DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER
CONTRACTOR: WSDOT
DEPTH TO WATER SURFACE AND DATE: 29'-5" 7/3/85

ELEVATION: 81.4'
DATE: 7/3/85
START TIME: 1530 7/2/85
COMPLETION: 0820 7/3/85
LOGGER: A.E. ERICKSON
PAGE: 3 OF: 3

ELEVATION FT. BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY				
50		S-14 JAR	18"	13-28-34 (62)	SANDY SILT, nonplastic to low plasticity 15-30% fine sand, lenses of fine sand, gray, slightly moist, very hard (ML)		
55		S-15 JAR	20"	6-12-25 (37)			
					Top 14" SAND, well graded, gray, wet, loose, (SW) Bottom 6" SANDY SILT, same as S-14 (ML) End of boring at 56.5 feet		

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO. B-6

PROJECT: I-90 HAUL ROAD
BORING LOCATION: SEE MAP
DRILLING METHOD: MOBILE B-61 HOLLOW STEM AUGER
AND EQUIPMENT:
CONTRACTOR: WSDOT
DEPTH TO WATER SURFACE AND DATE: 16' @ 1200 7/5/85

ELEVATION: 65.3'
DATE: 7/5/85
START TIME: 0800
COMPLETION: 1130
LOGGER: A.E. ERICKSON
PAGE: 1 OF 2

ELEVATION FT BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY				
65					GRAVEL, poorly graded, 2", brown dry, medium, (GP)		Boring in bottom of Haul Rd. excavation Auger cuttings wet
5		S-1 JAR	16"	1-3-6 (9)	SILT, low to medium plastic, 5-15% fine sand, gray, very moist, stiff (ML)		
		S-2 TUBE	22"		SANDY SILT, (ML)		50 psi push 2' of water in hole
10		S-3 TUBE	22"		SANDY SILT, low plasticity, 20-40% fine sand, gray (ML)		
		S-4 JAR	16"	3-4-4 (8)	SILTY SAND, poorly graded, medium to fine, w/5 to 15% #4 sand, 10 to 25% fines, gray, wet, loose, (SM)		Cuttings very wet and soupy
15		S-5 JAR	16"	8-11-12 (23)	Top 8" SILTY SAND, same as S-4 Bottom 8" SILT, med. plastic, 5% very fine sand, gray, slightly moist, v. stiff, slightly laminated, (ML)		Rough drilling, possible cobble layer
		S-6 TUBE	10"				Hard drilling
20		S-7 JAR	18"	15-28-30 (58)	SANDY SILT in tip with 1" medium silty sand zones, gray, moist to slightly moist, stiff, (ML) SILTY SAND with GRAVEL, well graded 1" minus with 2" silt layer 10" above tip, gray, moist (silt is slightly moist) v. dense, (SM)		550 psi for 9" push Tip of tube deformed on obstruction
25							

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-6

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD:

AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: 16' @ 1200 7/5/85

ELEVATION: 65.3'

DATE: 7/5/85

START TIME: 0800

COMPLETION: 1130

LOGGER: A.E. ERICKSON

PAGE: 2 OF: 2

ELEVATION FT BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6'-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY				
25		S-8 JAR	18"	13-15-21 (36)	SANDY SILT, medium plastic, 5-15% fine sand with sloping 1/4" thick medium sand layers, gray, slightly moist, hard, horizontal bedding, (ML)		Auger hits cobbles
30		S-9 JAR	16"	6-15-24 (39)	SAND and SANDY SILT layers, poorly graded, 1/8" layers of sandy silt with 3/4" minus gravel, and sand with 10-25% fines, gray, slightly moist, dense, (SM) and (ML)		
35		S-10 JAR	18"	12-18-14 (32)	SANDY SILT, with silty sand layers and occasional gravel, low to no PI, 1/8" sand layer dips @ 20 degrees 5' above tip, 1/2" minus gravel and coarse sand, gray, slightly moist silt, wet sand, stiff, (ML)		Harder drilling
40		S-11	16"	15-25-38 (63)	GRAVELLY SAND, poorly graded, layers of fine gravel and coarse to medium sand, dark gray, wet, very dense, (SP)		
45					End of boring at 41.5 feet		

NOTE: Soil descriptions on this log are a summary of field logs visual classifications and laboratory tests if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-7

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD:

AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: 17' 7/3/85

ELEVATION: 84.7'

DATE: JULY 3, 1985

START TIME: 0900 7/3/85

COMPLETION: 1530 7/3/85

LOGGER: A.E. ERICKSON

PAGE: 1 OF 3

DEPTH	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
ELEVATION FT. BELOW SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY				
0					10" Asphalt Concrete <u>SANDY GRAVEL</u> with <u>SILT</u> , well graded, cobbles 6" minus (GW-GM)		Pavement Auger cuttings sandy gravel with cobbles. (Fill)
5		S-1 JAR	1"	6-1-3 (4)	<u>SANDY SILT</u> with <u>GRAVEL</u> , (material caked around rock in tip), low PI, fine sand, 50-70% fines, brown, moist, soft, (ML)		Sampler tip blocked by rock
10		S-2 TUBE	10"		<u>SANDY SILT</u> , (ML)		550 psi push Rock bent tip of tube
		S-3 JAR	16"	9-13-16 (29)	<u>SANDY SILT</u> , low to no PI, 5-20% fine sand, brown with gray mottles, slightly moist, very stiff, (ML)		
15		S-4 JAR	18"	6-9-17 (26)	<u>SANDY SILT</u> , med. plastic, 5-15% fine sand, gray, slightly moist, very stiff, laminated fine sand and silt (ML)		
					(Laminated fine sand and silt)		
20		S-5 TUBE	21"		<u>SANDY SILT</u> , in tip, same as S-4, (ML)		Push 350 psi
		S-6 JAR	18"	7-16-25 (41)	<u>SANDY SILT</u> , low PI, same as S-4, (ML)		
25							

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-7

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD:

AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: 17' 7/3/85

ELEVATION: 84.7'

DATE: JULY 3, 1985

START TIME: 0900 7/3/85

COMPLETION: 1530 7/3/85

LOGGER: A.E. ERICKSON

PAGE: 2 OF: 3

ELEVATION FT BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY				
25		S-7	18'	8-16-21 (37)	SANDY SILT, same as S-6, (ML)		
30		S-8 JAR	18'	10-13-18 (31)	SANDY SILT, same as S-7, (ML)		
35		S-9 JAR	18'	10-14-16 (30)	SANDY SILT, same as S-7, with lenses of fine sand (ML)		
40		S-10 JAR	18'	12-22-29 (51)	SILTY SAND, poorly graded, medium to fine sand, 5-15% fines, gray/black, wet, very dense, (SP-SM)		18' of water on rods
45		S-11 JAR	18'	24-33-40 (73)	SILTY SAND, poorly graded, medium to fine and coarse to medium layers, dark gray, wet, very dense (SP-SM)		
50							

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.



SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-7

PROJECT: I-90 HAUL ROAD
BORING LOCATION: SEE MAP
DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER
CONTRACTOR: WSDOT
DEPTH TO WATER SURFACE AND DATE: 17' 7/3/85

ELEVATION: 84.7'
DATE: JULY 3, 1985
START TIME: 0900 7/3/85
COMPLETION: 1530 7/3/85
LOGGER: A.E. ERICKSON
PAGE: 3 OF 3

ELEVATION FT BELOW SURFACE	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY				
50		S-12 JAR	18"	7-30-50/4 80/10"	SILTY SAND, poorly graded 5'-3' layers of medium to fine and coarse sand with silt, dark gray, wet, very dense, (SP-SM)		17 1/2' of water on rods
55		S-13 JAR	10"	35-50/4 85/10"	SILTY SAND, poorly graded, layers of medium to fine sand, coarser sand with 1/2" minus gravel in lower 3', dark gray, wet, very dense, (SP-SM)		3' of heave removed More gravelly drilling 4' heave
60					End of boring at 60 feet No sample attempted at 60' due to 4' heave. (Gravelly drilling below 57')		Depth to water level measured in augers 12 hours after finish

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.

SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-9

PROJECT: I-90 HAUL ROAD
 BORING LOCATION: SEE MAP
 DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER
 CONTRACTOR: WSDOT
 DEPTH TO WATER SURFACE AND DATE: 22'-8" 7/5/85

ELEVATION: 81.2'
 DATE: 7/1/85
 START TIME: 1200 7/1/85
 COMPLETION: 1520 7/2/85
 LOGGER: A.E. ERICKSON
 PAGE: 1 OF 3

DEPTH ELEVATION FT BELOW SURFACE	INTERVAL	SAMPLE TYPE AND NUMBER	RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
0							
5		S-1 JAR	12"	2-5-8 (13)	SILT, medium plastic, 5 to 20% fine sand, brown & gray mottle, slightly moist, stiff, (ML)		
10		S-2 TUBE	23"		SANDY SILT, medium plastic, 27% fine sand, mottled gray and brown, moist, stiff, (ML)		Push 300 psi
		S-3	10"	3-6-5 (11)	SILT, med. plastic, 20-25% medium to fine sand, top 2" silty sand, gray with brown spots, occasional #4 sand, moist, stiff, (ML)		
15		S-4 JAR	18"	3-4-4 (8)	SANDY CLAY, 5% small gravel, fine sand, gray with brown, moist, loose (CL)		Piece of wood in top 1' of sample
20		S-5 TUBE	23"		CLAYEY SAND, (SC)		100 psi push
		S-6 JAR	15"	3-6-13 (19)	SANDY CLAY, medium to fine sand, 1/4" to 3/4" bands of silt, brown with orange brown, moist, medium (CL)		Soft drilling with rocks similar to 19'
25							

PRELIMINARY

SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-9

PROJECT: I-90 HAUL ROAD
 BORING LOCATION: SEE MAP
 DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER
 CONTRACTOR: WSDOT
 DEPTH TO WATER SURFACE AND DATE: 22' 8" 7/5/85

ELEVATION: 81.2'
 DATE: 7/1/85
 START TIME: 1200 7/1/85
 COMPLETION: 1520 7/2/85
 LOGGER: A.E. ERICKSON
 PAGE: 2 OF: 3

DEPTH	SAMPLE			STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
ELEVATION FT BELOW SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY				
25		S-7 JAR	16'	8-13-16 (29)	<u>SILT</u> , low plasticity, 5-10% very fine sand, brown, and gray brown zones, slightly moist, medium (ML)		
30		S-8 TUBE	12'		Top 10" <u>SILT</u> , medium plastic, lenses of fine sand (ML) Bottom 2" <u>SANDY SILT</u> , nonplastic, fine sand (ML)		700 psi push
		S-9 JAR	16'	14-20-24 (44)	<u>SANDY SILT</u> , nonplastic to low plasticity, very fine sand, gray, slightly moist with wet sand lenses (horizontal bed), hard (ML)		Tube S-8 came off of rod upon pulling. Drove spoon into tube and drilled around tube to remove tube from hole. 12" of sample remained in tube.
35		S-10 JAR	16'	12-14-21 (35)	<u>SILT</u> , same as S-9		Sampler wet
40		S-11 TUBE	12'		<u>SILT</u> , moist, gray, same as S-9, (ML)		400 psi push
		S-12 JAR	16'	12-17-26 (43)	<u>SILT</u> , nonplastic to low plasticity, 5-10% very fine sand, 1/4" sand lense in center of sample, gray, slightly moist, dense (ML)		Hit gravels
45		S-13 JAR	16'	7-10-14 (24)	<u>SILT</u> , low plasticity, 5-10% very fine sand, occasional gravel and #4 sand, gray, moist, very stiff (ML)		Wet sampler but no water on rods Attempt to push shelly tube at 47'-no penetration with 450 psi push.
50							

SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-9

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: 22'-8" 7/5/85

ELEVATION: 81.2'

DATE: JULY 7, 1985

START TIME: 1200 7/1/85

COMPLETION: 1520 7/2/85

LOGGER: A.E. ERICKSON

PAGE: 3 OF 3

DEPTH ELEVATION FT BELOW SURFACE	INTERVAL	SAMPLE TYPE AND NUMBER	RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
50		S-14 JAR	16'	7-10-13 (23)	SILT, same as S-13, very uniform homogeneous material, (ML)		
55		S-15 JAR	18'	8-14-20 (34)	SILT, same as S-13, (ML)		
60		S-16 TUBE	9'		SILT, same as S-13, (ML)		600 psi push Water on top of sample
		S-17 JAR	18'	10-14-36 (50)	SILT, same as S-13, (ML)		
							Gravel at 63'
65		S-18 JAR	6'	100-85/6" (185)/12"	SANDY GRAVEL, well graded 2" minus, gray, wet, very dense, (GW)		-2' heave at 65'
							Drilling through variable densities of gravel material
70							
					End of boring 71 feet		Very hard drilling. Auger refusal at 71' - not sampled
75							

SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-13

PROJECT: I-90 HAUL ROAD
 BORING LOCATION: SEE MAP
 DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER
 CONTRACTOR: WSDOT
 DEPTH TO WATER SURFACE AND DATE: NOT MEASURABLE

ELEVATION: 78.7' ± 1/2'
 DATE: 7/6/85
 START TIME: 1000
 COMPLETION: 1445
 LOGGER: A.E. ERICKSON
 PAGE: 1 OF 3

ELEVATION	DEPTH	INTERVAL	SAMPLE TYPE AND NUMBER	RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
79						7 1/2" Asphalt Concrete		
						<u>SANDY GRAVEL with COBBLES, 5' minus cobbles, dense, (GP)</u>		Very hard drilling on cobbles and gravel to 4.5'
75	5		S-1 JAR	12"	22-7-8 (15)	CLAY, medium plastic ~~SANDY SILT, low PI, 10 to 25% fine sand, brown & gray mottled, slightly moist, stiff, (ML)~~ (CL)		Fractured gravel in top 6" of sampler
	10		S-2 TUBE	24"		~~SANDY SILT--SILTY SAND, low to no PI, 42% medium to fine sand lenses, gray & brown mottle, moist, soft, (ML-SM)~~		Push 100 psi
			S-3 JAR	16"	5-7-12 (19)	~~SANDY SILT--SILTY SAND, same as S-2, (ML-SM)~~ SILT, med. plastic 5-10% fine sand (ML)		
65	15		S-4 JAR	14"	5-5-6 (11)	SILTY SAND, poorly graded, medium to fine sand, 15 to 30% fines, w/1/8" thick plant roots, gray, moist, medium, (SM)		
60	20		S-5 TUBE	24"		~~SANDY SILT, low to no PI, 5 to 15% very fine sand, brown w/gray mottle, moist, medium, (ML)~~		Push 100 psi
			S-6 JAR	18"	2-2-3 (5)	~~SANDY SILT, same as S-5, brown w/red mottles, horizontal bedding to 6' above tip, gray sandier silt in tip, (ML)~~ non plastic		
55	25							

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.

SOIL BORING LOG

PROJECT NO.: S19746.A1

BORING NO.: B-13

PROJECT: I-90 HAUL ROAD
 BORING LOCATION: SEE MAP
 DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOW STEM AUGER
 CONTRACTOR: WSDOT
 DEPTH TO WATER SURFACE AND DATE: NOT MEASURABLE

ELEVATION: 78.7' ± 1/2'
 DATE: 7/6/85
 START TIME: 1000
 COMPLETION: 1445
 LOGGER: A.E. ERICKSON
 PAGE: 2 OF 3

DEPTH	ELEVATION	FT BELOW SURFACE	INTERVAL	SAMPLE TYPE AND NUMBER	RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
25				S-7 TUBE	24'		2" SANDY SILT (ML) over SILTY SAND, poorly graded, medium to fine sand, gray, wet, loose (SM)		Push 50 psi
				S-8 JAR	18'	2-1-2 (3)	to highly plastic CLAYEY SILT, low to medium PI, 1/8" medium sand layer, gray, moist, soft (ML-CL) (MH)		
30				S-9 TUBE	24'		SANDY SILT, in tip, (ML)		0 psi push 200 psi push
				S-10 JAR	18'	7-10-12 (22)	SANDY SILT, low PI, 5 to 15% fine sand with horizontal bed of medium to fine silty sand and sand layers, gray, moist, stiff (ML)		No auger cutting return Gravelly zone
35				S-11 JAR		4-10-10 (20)	SANDY SILT, with SAND, low PI, layers (2 to 4") of silty sand and sandy silt, gray, moist, layers vary from soft to stiff (ML)		8' of water on rods Limited auger cuttings at top of hole Harder drilling
40				S-12 TUBE	6'		SILTY SAND with GRAVEL in tip, gray, moist, dense, (SM)		Tip of tube bent 600 psi for 6" push
				S-13 JAR	18'	10-18-22 (40)	SANDY SILT SILTY SAND with GRAVEL, poorly graded, 5 to 20% 1" minus gravel, in lenses w/bands of red sand, medium to fine sand with 15 to 30% fines, gray, moist, dense, (SM) (ML)		
45				S-14 JAR	18'	6-5-5 (10)	SANDY SILT, low PI, occasional gravel, 1/2" minus, 5 to 20% fine sand w/1/8" medium sand layers, gray, moist, medium, dense w/soft spots, (ML)		Limited auger cuttings return
50									

NOTE: Soil descriptions on this log are a summary of field log visual classifications and laboratory tests, if any.

SOIL BORING LOG

PROJECT NO. S19746.A1

BORING NO. B-13

PROJECT: I-90 HAUL ROAD

BORING LOCATION: SEE MAP

DRILLING METHOD AND EQUIPMENT: MOBILE B-61 HOLLOWSTEM AUGER

CONTRACTOR: WSDOT

DEPTH TO WATER SURFACE AND DATE: NOT MEASURABLE

ELEVATION: 78.7' $\pm$ 1/2'

DATE: 7/6/85

START TIME: 1200

COMPLETION: 1445

LOGGER: A.E. ERICKSON

PAGE: 3 OF 3

DEPTH	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
ELEVATION FT. BELOW SURFACE	INTERVAL	TYPE AND NUMBER	RECOVERY	6"-6"-6" (N)			
50		S-15 JAR	18"	11-21-30 (51)	SANDY SILT, low PI, 5 to 15% very fine sand, 1" coarse to fine silty sand layer, laminated silt beds, gray, slightly moist, hard, (ML)		Smooth drilling
55		S-16 JAR	18"	14-14-18 (32)	SANDY SILT, same as S-15; 1" layer of hard cube fractured clayey silt, (ML)		
60		S-17 JAR	18"	6-13-45 (58)	SANDY SILT, same as S-15 except moist. Top of sample contains 6 inches of well graded sand, (ML)		Insufficient time available for water to stabilize in boring prior to auger removal. Therefore, the depth to water surface is considered unmeasurable.
					End of Boring = 62 feet		

NOTE: Soil descriptions on this log are a summary of field logs, visual classifications, and laboratory tests, if any.

Appendix C

WWHM CAPACITY CHECK OUTPUT

WWHM2012
PROJECT REPORT

General Model Information

WWHM2012 Project Name: Adams's WWHM

Site Name:

Site Address:

City:

Report Date: 5/9/2025

Gage: Seatac

Data Start: 1948/10/01

Data End: 2009/09/30

Timestep: 15 Minute

Precip Scale: 1.000

Version Date: 2023/01/27

Version: 4.2.19

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use C, Forest, Flat	acre 0.273
Pervious Total	0.273
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.273

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.172
Pervious Total	0.172
Impervious Land Use	acre
ROADS FLAT	0.036
ROOF TOPS FLAT	0.036
DRIVEWAYS FLAT	0.018
SIDEWALKS FLAT	0.011
Impervious Total	0.101
Basin Total	0.273

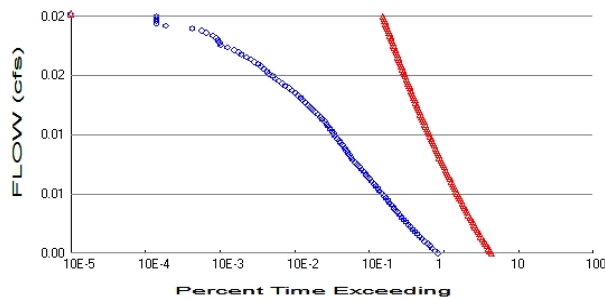
Routing Elements

Predeveloped Routing

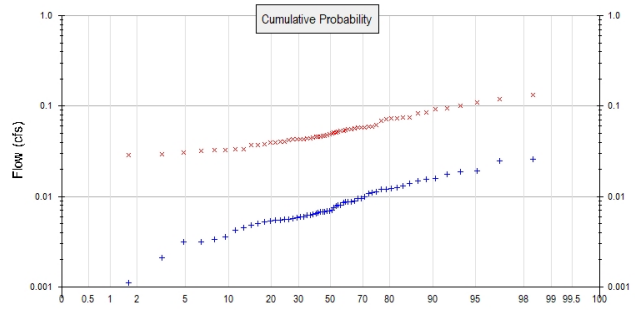
Mitigated Routing

Analysis Results

POC 1



+ Predeveloped x Mitigated



Predeveloped Landuse Totals for POC #1

Total Pervious Area: 0.273
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1

Total Pervious Area: 0.172
Total Impervious Area: 0.101

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped.

Return Period	Flow(cfs)
2 year	0.008026
5 year	0.012606
10 year	0.015201
25 year	0.01795
50 year	0.019652
100 year	0.021099

Flow Frequency Return Periods for Mitigated.

Return Period	Flow(cfs)
2 year	0.050391
5 year	0.069503
10 year	0.083397
25 year	0.102403
50 year	0.117644
100 year	0.133837

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.008	0.075
1950	0.010	0.073
1951	0.018	0.046
1952	0.006	0.031
1953	0.005	0.032
1954	0.007	0.041
1955	0.011	0.043
1956	0.009	0.043
1957	0.007	0.056
1958	0.008	0.038

1959	0.007	0.033
1960	0.012	0.049
1961	0.007	0.046
1962	0.004	0.033
1963	0.006	0.044
1964	0.008	0.040
1965	0.005	0.060
1966	0.005	0.033
1967	0.011	0.074
1968	0.007	0.068
1969	0.007	0.054
1970	0.005	0.047
1971	0.006	0.056
1972	0.013	0.072
1973	0.006	0.029
1974	0.006	0.054
1975	0.009	0.057
1976	0.006	0.042
1977	0.001	0.039
1978	0.006	0.048
1979	0.003	0.058
1980	0.012	0.084
1981	0.005	0.050
1982	0.010	0.084
1983	0.009	0.052
1984	0.005	0.037
1985	0.003	0.051
1986	0.014	0.046
1987	0.012	0.059
1988	0.005	0.033
1989	0.003	0.041
1990	0.026	0.133
1991	0.015	0.095
1992	0.006	0.037
1993	0.006	0.029
1994	0.002	0.027
1995	0.009	0.043
1996	0.019	0.061
1997	0.016	0.054
1998	0.004	0.043
1999	0.015	0.111
2000	0.006	0.051
2001	0.001	0.045
2002	0.007	0.075
2003	0.009	0.058
2004	0.011	0.101
2005	0.008	0.047
2006	0.010	0.044
2007	0.019	0.121
2008	0.025	0.093
2009	0.012	0.057

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0257	0.1333
2	0.0246	0.1208
3	0.0191	0.1107

4	0.0188	0.1010
5	0.0177	0.0952
6	0.0157	0.0933
7	0.0155	0.0844
8	0.0147	0.0836
9	0.0139	0.0748
10	0.0132	0.0747
11	0.0125	0.0738
12	0.0123	0.0731
13	0.0121	0.0717
14	0.0120	0.0684
15	0.0112	0.0613
16	0.0110	0.0595
17	0.0109	0.0592
18	0.0098	0.0581
19	0.0096	0.0580
20	0.0095	0.0575
21	0.0089	0.0573
22	0.0088	0.0561
23	0.0088	0.0557
24	0.0087	0.0544
25	0.0086	0.0538
26	0.0081	0.0536
27	0.0080	0.0524
28	0.0079	0.0509
29	0.0076	0.0506
30	0.0071	0.0502
31	0.0069	0.0487
32	0.0068	0.0479
33	0.0068	0.0468
34	0.0068	0.0466
35	0.0067	0.0462
36	0.0067	0.0462
37	0.0065	0.0459
38	0.0064	0.0451
39	0.0062	0.0444
40	0.0062	0.0437
41	0.0060	0.0435
42	0.0060	0.0434
43	0.0059	0.0434
44	0.0058	0.0430
45	0.0056	0.0419
46	0.0056	0.0408
47	0.0055	0.0406
48	0.0054	0.0399
49	0.0053	0.0392
50	0.0052	0.0381
51	0.0050	0.0372
52	0.0049	0.0369
53	0.0045	0.0334
54	0.0042	0.0332
55	0.0036	0.0327
56	0.0034	0.0326
57	0.0032	0.0321
58	0.0031	0.0305
59	0.0021	0.0292
60	0.0011	0.0287
61	0.0008	0.0272

Duration Flows

The Duration Matching **Failed**

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0040	17550	92122	524	Fail
0.0042	16168	87780	542	Fail
0.0043	14970	83759	559	Fail
0.0045	13856	79973	577	Fail
0.0046	12816	76401	596	Fail
0.0048	11813	73043	618	Fail
0.0050	10900	69941	641	Fail
0.0051	10121	66904	661	Fail
0.0053	9385	63995	681	Fail
0.0054	8733	61322	702	Fail
0.0056	8147	58691	720	Fail
0.0058	7593	56210	740	Fail
0.0059	7060	53836	762	Fail
0.0061	6590	51633	783	Fail
0.0062	6147	49643	807	Fail
0.0064	5777	47611	824	Fail
0.0065	5431	45751	842	Fail
0.0067	5097	43868	860	Fail
0.0069	4808	42136	876	Fail
0.0070	4524	40510	895	Fail
0.0072	4252	39035	918	Fail
0.0073	4017	37580	935	Fail
0.0075	3782	36211	957	Fail
0.0076	3546	34864	983	Fail
0.0078	3337	33559	1005	Fail
0.0080	3138	32276	1028	Fail
0.0081	2950	31057	1052	Fail
0.0083	2785	29944	1075	Fail
0.0084	2597	28811	1109	Fail
0.0086	2447	27763	1134	Fail
0.0088	2304	26800	1163	Fail
0.0089	2160	25838	1196	Fail
0.0091	2024	24897	1230	Fail
0.0092	1898	23998	1264	Fail
0.0094	1790	23121	1291	Fail
0.0095	1688	22351	1324	Fail
0.0097	1586	21560	1359	Fail
0.0099	1483	20822	1404	Fail
0.0100	1383	20105	1453	Fail
0.0102	1293	19410	1501	Fail
0.0103	1220	18728	1535	Fail
0.0105	1159	18151	1566	Fail
0.0106	1098	17558	1599	Fail
0.0108	1049	16970	1617	Fail
0.0110	997	16401	1645	Fail
0.0111	930	15832	1702	Fail
0.0113	884	15351	1736	Fail
0.0114	839	14844	1769	Fail
0.0116	790	14388	1821	Fail
0.0118	743	13905	1871	Fail
0.0119	713	13436	1884	Fail
0.0121	673	13007	1932	Fail
0.0122	633	12611	1992	Fail
0.0124	596	12237	2053	Fail

0.0125	566	11869	2096	Fail
0.0127	539	11484	2130	Fail
0.0129	498	11135	2235	Fail
0.0130	473	10769	2276	Fail
0.0132	436	10384	2381	Fail
0.0133	400	10078	2519	Fail
0.0135	366	9788	2674	Fail
0.0136	348	9486	2725	Fail
0.0138	323	9223	2855	Fail
0.0140	296	8947	3022	Fail
0.0141	272	8699	3198	Fail
0.0143	256	8455	3302	Fail
0.0144	235	8213	3494	Fail
0.0146	217	7987	3680	Fail
0.0148	198	7775	3926	Fail
0.0149	180	7537	4187	Fail
0.0151	158	7315	4629	Fail
0.0152	145	7097	4894	Fail
0.0154	130	6885	5296	Fail
0.0155	119	6684	5616	Fail
0.0157	109	6483	5947	Fail
0.0159	97	6293	6487	Fail
0.0160	91	6111	6715	Fail
0.0162	82	5929	7230	Fail
0.0163	76	5758	7576	Fail
0.0165	69	5615	8137	Fail
0.0167	61	5452	8937	Fail
0.0168	55	5328	9687	Fail
0.0170	48	5197	10827	Fail
0.0171	41	5050	12317	Fail
0.0173	38	4898	12889	Fail
0.0174	33	4776	14472	Fail
0.0176	27	4652	17229	Fail
0.0178	22	4537	20622	Fail
0.0179	21	4404	20971	Fail
0.0181	20	4286	21430	Fail
0.0182	19	4164	21915	Fail
0.0184	17	4055	23852	Fail
0.0185	14	3931	28078	Fail
0.0187	12	3831	31925	Fail
0.0189	9	3732	41466	Fail
0.0190	4	3628	90700	Fail
0.0192	3	3527	117566	Fail
0.0193	3	3444	114800	Fail
0.0195	3	3343	111433	Fail
0.0197	3	3247	108233	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.

The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume: 0 acre-feet

On-line facility target flow: 0 cfs.

Adjusted for 15 min: 0 cfs.

Off-line facility target flow: 0 cfs.

Adjusted for 15 min: 0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

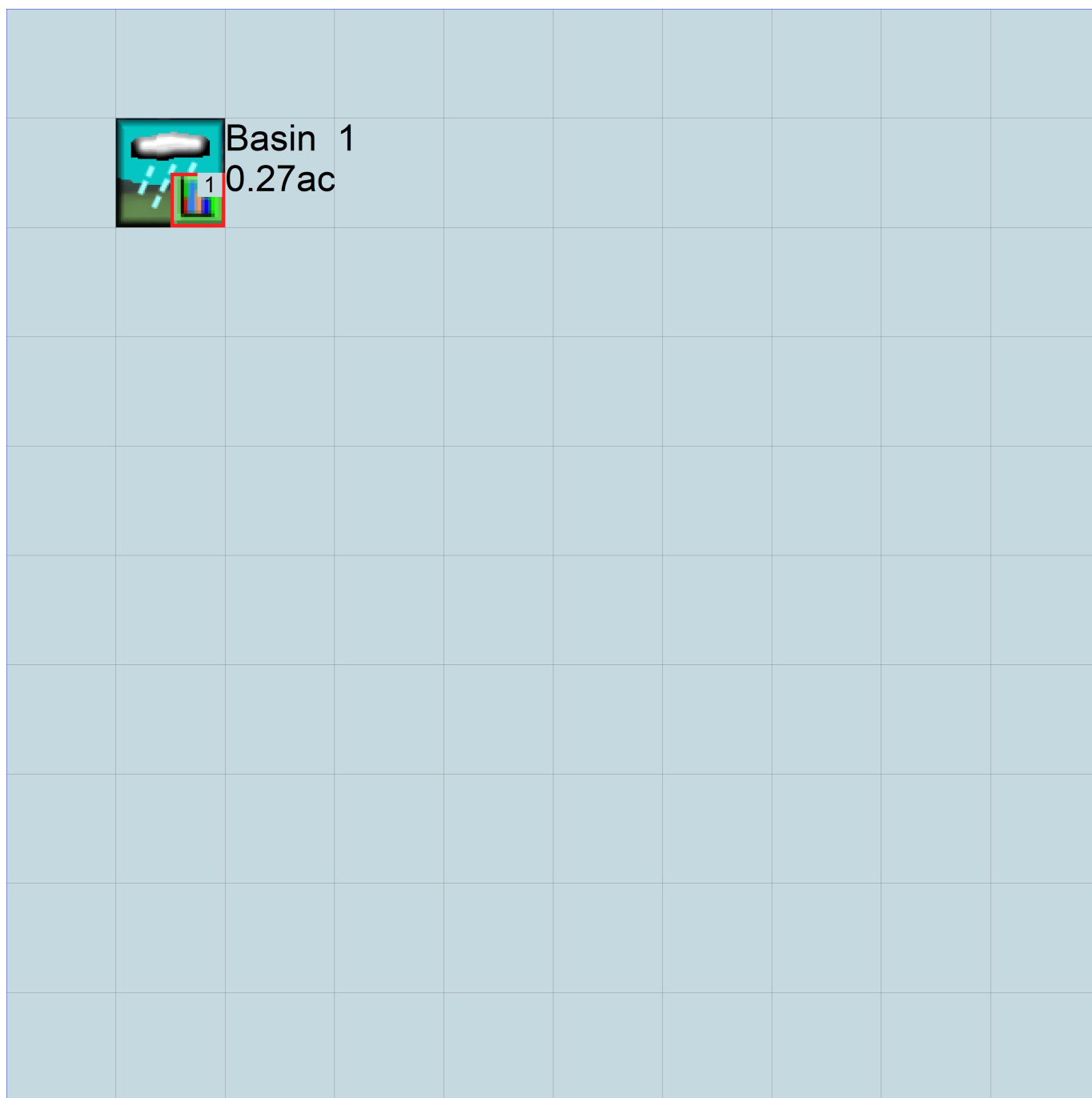
Appendix

Predeveloped Schematic



Basin 1
0.27ac

Mitigated Schematic



Predeveloped UCI File

RUN

GLOBAL

```
WWM4 model simulation
START      1948 10 01      END      2009 09 30
RUN INTERP OUTPUT LEVEL    3      0
RESUME     0 RUN      1
UNIT SYSTEM      1
END GLOBAL
```

FILES

```
<File>  <Un#>  <-----File Name----->***
<-ID->                                     ***
WDM      26     Adams's WWM.wdm
MESSU    25     PreAdams's WWM.MES
          27     PreAdams's WWM.L61
          28     PreAdams's WWM.L62
          30     POCAAdams's WWM1.dat
```

END FILES

OPN SEQUENCE

```
INGRP              INDELT 00:15
  PERLND           10
  COPY             501
  DISPLY           1
```

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

```
# - #<-----Title----->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
1   Basin 1              MAX              1   2   30   9
```

END DISPLY-INF01

END DISPLY

COPY

TIMESERIES

```
# - # NPT NMN ***
1   1   1
501 1   1
```

END TIMESERIES

END COPY

GENER

OPCODE

```
# # OPCD ***
```

END OPCODE

PARM

```
# # K ***
```

END PARM

END GENER

PERLND

GEN-INFO

```
<PLS ><-----Name----->NBLKS Unit-systems Printer ***
# - # User t-series Engl Metr ***
```

```
10 C, Forest, Flat 1 1 1 1 27 0
```

END GEN-INFO

*** Section PWATER***

ACTIVITY

```
<PLS > ***** Active Sections *****
# - # ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC ***
10 0 0 1 0 0 0 0 0 0 0 0 0 0
```

END ACTIVITY

PRINT-INFO

```
<PLS > ***** Print-flags ***** PIVL PYR
# - # ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC *****
10 0 0 4 0 0 0 0 0 0 0 0 0 1 9
```

END PRINT-INFO

```

PWAT-PARM1
<PLS > PWATER variable monthly parameter value flags ***
# - # CSNO RTOP UZFG VCS VUZ VNN VIFW VIRC VLE INFC HWT ***
10 0 0 0 0 0 0 0 0 0 0 0
END PWAT-PARM1

PWAT-PARM2
<PLS > PWATER input info: Part 2 ***
# - # ***FOREST LZSN INFILT LSUR SLSUR KVARV AGWRC
10 0 4.5 0.08 400 0.05 0.5 0.996
END PWAT-PARM2

PWAT-PARM3
<PLS > PWATER input info: Part 3 ***
# - # ***PETMAX PETMIN INFEXP INFILD DEEPFR BASETP AGWETP
10 0 0 2 2 0 0 0
END PWAT-PARM3

PWAT-PARM4
<PLS > PWATER input info: Part 4 ***
# - # CEPSC UZSN NSUR INTFW IRC LZETP ***
10 0.2 0.5 0.35 6 0.5 0.7
END PWAT-PARM4

PWAT-STATE1
<PLS > *** Initial conditions at start of simulation
ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
# - # *** CEPS SURS UZS IFWS LZS AGWS GWVS
10 0 0 0 0 2.5 1 0
END PWAT-STATE1

END PERLND

IMPLND
GEN-INFO
<PLS ><-----Name-----> Unit-systems Printer ***
# - # User t-series Engl Metr ***
in out
END GEN-INFO
*** Section IWATER***

ACTIVITY
<PLS > ***** Active Sections *****
# - # ATMP SNOW IWAT SLD IWG IQAL ***
END ACTIVITY

PRINT-INFO
<ILS > ***** Print-flags ***** PIVL PYR
# - # ATMP SNOW IWAT SLD IWG IQAL *****
END PRINT-INFO

IWAT-PARM1
<PLS > IWATER variable monthly parameter value flags ***
# - # CSNO RTOP VRS VNN RTLI ***
END IWAT-PARM1

IWAT-PARM2
<PLS > IWATER input info: Part 2 ***
# - # *** LSUR SLSUR NSUR RETSC
END IWAT-PARM2

IWAT-PARM3
<PLS > IWATER input info: Part 3 ***
# - # ***PETMAX PETMIN
END IWAT-PARM3

IWAT-STATE1
<PLS > *** Initial conditions at start of simulation
# - # *** RETS SURS
END IWAT-STATE1

```

END IMPLND

SCHEMATIC

<-Source->		<--Area-->		<-Target->	MBLK	***
<Name>	#	<-factor->		<Name>	#	Tbl#
Basin	1***					
PERLND	10	0.273		COPY	501	12
PERLND	10	0.273		COPY	501	13

*****Routing*****

END SCHEMATIC

NETWORK

<-Volume->	<-Grp>	<-Member->	<--Mult-->	Tran	<-Target	vols>	<-Grp>	<-Member->	***
<Name>	#	<Name>	#	<-factor->	strg	<Name>	#	<Name>	#
COPY	501	OUTPUT	MEAN	1 1	48.4	DISPLY	1	INPUT	TIMSER 1

<-Volume->	<-Grp>	<-Member->	<--Mult-->	Tran	<-Target	vols>	<-Grp>	<-Member->	***
<Name>	#	<Name>	#	<-factor->	strg	<Name>	#	<Name>	#

END NETWORK

RCHRES

GEN-INFO

RCHRES	Name	Nexits	Unit	Systems	Printer	***
# - #	<----->	<---->	User	T-series	Engl Metr LKFG	***
			in	out		***

END GEN-INFO

*** Section RCHRES***

ACTIVITY

<PLS > ***** Active Sections *****

# - #	HYFG	ADFG	CNFG	HTFG	SDFG	GQFG	OXFG	NUFG	PKFG	PHFG	***
-------	------	------	------	------	------	------	------	------	------	------	-----

END ACTIVITY

PRINT-INFO

<PLS > ***** Print-flags ***** PIVL PYR

# - #	HYDR	ADCA	CONS	HEAT	SED	GQL	OXRX	NUTR	PLNK	PHCB	PIVL	PYR	*****
-------	------	------	------	------	-----	-----	------	------	------	------	------	-----	-------

END PRINT-INFO

HYDR-PARM1

RCHRES	Flags for each HYDR Section	***	ODGTFG for each	***	FUNCT for each	***
# - #	VC A1 A2 A3	ODFVFG for each	***	ODGTFG for each	FUNCT for each	***
	FG FG FG FG	possible exit	***	possible exit	possible exit	***
	* * * *	* * * *		* * * *		

END HYDR-PARM1

HYDR-PARM2

# - #	FTABNO	LEN	DELTH	STCOR	KS	DB50	***
<----->	<----->	<----->	<----->	<----->	<----->	<----->	***

END HYDR-PARM2

HYDR-INIT

RCHRES	Initial conditions for each HYDR section	***
# - #	*** VOL Initial value of COLIND Initial value of OUTDGT	
	*** ac-ft for each possible exit for each possible exit	
<----->	<----->	*** <----->

END HYDR-INIT

END RCHRES

SPEC-ACTIONS

END SPEC-ACTIONS

FTABLES

END FTABLES

EXT SOURCES

<-Volume->	<Member>	SsysSgap	<--Mult-->	Tran	<-Target	vols>	<-Grp>	<-Member->	***	
<Name>	#	<Name>	#	tem strg	<-factor->	strg	<Name>	#	<Name>	#
WDM	2	PREC	ENGL	1	PERLND	1 999	EXTNL	PREC		
WDM	2	PREC	ENGL	1	IMPLND	1 999	EXTNL	PREC		

WDM	1	EVAP	ENGL	0.76	PERLND	1	999	EXTNL	PETINP
WDM	1	EVAP	ENGL	0.76	IMPLND	1	999	EXTNL	PETINP

END EXT SOURCES

EXT TARGETS

<-Volume->	<-Grp>	<-Member->	<--Mult-->	Tran	<-Volume->	<Member>	Tsys	Tgap	Amd	***
<Name>	#	<Name>	#	#<-factor->	strg	<Name>	#	<Name>	tem	strg
COPY	501	OUTPUT	MEAN	1	1	48.4	WDM	501	FLOW	ENGL
										REPL

END EXT TARGETS

MASS-LINK

<Volume>	<-Grp>	<-Member->	<--Mult-->	<Target>	<-Grp>	<-Member->	***
<Name>		<Name>	#	#<-factor->	<Name>		#
MASS-LINK		12					
PERLND	PWATER	SURO		0.083333	COPY	INPUT	MEAN
END MASS-LINK		12					

MASS-LINK		13					
PERLND	PWATER	IFW0		0.083333	COPY	INPUT	MEAN
END MASS-LINK		13					

END MASS-LINK

END RUN

Mitigated UCI File

RUN

GLOBAL

```
WWM4 model simulation
START      1948 10 01      END      2009 09 30
RUN INTERP OUTPUT LEVEL    3      0
RESUME     0 RUN      1
UNIT SYSTEM      1
END GLOBAL
```

FILES

```
<File>  <Un#>  <-----File Name----->***
<-ID->                                     ***
WDM      26     Adams's WWM.wdm
MESSU    25     MitAdams's WWM.MES
          27     MitAdams's WWM.L61
          28     MitAdams's WWM.L62
          30     POCAAdams's WWM1.dat
```

END FILES

OPN SEQUENCE

INGRP INDELT 00:15

```
PERLND    16
IMPLND     1
IMPLND     4
IMPLND     5
IMPLND     8
COPY      501
DISPLY     1
```

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

```
# - #<-----Title----->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
1   -   Basin 1      MAX      1   2   30   9
```

END DISPLY-INF01

END DISPLY

COPY

TIMESERIES

```
# - # NPT NMN ***
1   -   1   1
501   1   1
```

END TIMESERIES

END COPY

GENER

OPCODE

```
# - # OPCODE ***
```

END OPCODE

PARM

```
# - # K ***
```

END PARM

END GENER

PERLND

GEN-INFO

```
<PLS ><-----Name----->NBLKS  Unit-systems  Printer ***
# - #      User  t-series  Engl Metr ***
              in  out
16   C, Lawn, Flat      1   1   1   1   27   0
```

END GEN-INFO

*** Section PWATER***

ACTIVITY

```
<PLS > ***** Active Sections *****
# - # ATMP SNOW PWAT  SED  PST  PWG  PQAL MSTL PEST  NITR PHOS TRAC ***
16   0   0   1   0   0   0   0   0   0   0   0   0
```

END ACTIVITY

PRINT-INFO

```
<PLS > ***** Print-flags ***** PIVL  PYR
```

```

# - # ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC *****
16      0      0      4      0      0      0      0      0      0      0      0      0      1      9
END PRINT-INFO

PWAT-PARM1
<PLS > PWATER variable monthly parameter value flags ***
# - # CSNO RTOP UZFG VCS VUZ VNN VIFW VIRC VLE INFC HWT ***
16      0      0      0      0      0      0      0      0      0      0      0
END PWAT-PARM1

PWAT-PARM2
<PLS > PWATER input info: Part 2 ***
# - # ***FOREST LZSN INFILT LSUR SLSUR KVARY AGWRC
16      0      4.5      0.03      400      0.05      0.5      0.996
END PWAT-PARM2

PWAT-PARM3
<PLS > PWATER input info: Part 3 ***
# - # ***PETMAX PETMIN INFEXP INFILD DEEPFR BASETP AGWETP
16      0      0      2      2      0      0      0
END PWAT-PARM3
PWAT-PARM4
<PLS > PWATER input info: Part 4 ***
# - # CEPSC UZSN NSUR INTFW IRC LZETP ***
16      0.1      0.25      0.25      6      0.5      0.25
END PWAT-PARM4

PWAT-STATE1
<PLS > *** Initial conditions at start of simulation
ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
# - # *** CEPS SURS UZS IFWS LZS AGWS GWVS
16      0      0      0      0      2.5      1      0
END PWAT-STATE1

END PERLND

IMPLND
GEN-INFO
<PLS ><-----Name-----> Unit-systems Printer ***
# - # User t-series Engl Metr ***
# - # in out ***
1      ROADS/FLAT      1      1      1      27      0
4      ROOF TOPS/FLAT      1      1      1      27      0
5      DRIVEWAYS/FLAT      1      1      1      27      0
8      SIDEWALKS/FLAT      1      1      1      27      0
END GEN-INFO
*** Section IWATER***

ACTIVITY
<PLS > ***** Active Sections *****
# - # ATMP SNOW IWAT SLD IWG IQAL ***
1      0      0      1      0      0      0
4      0      0      1      0      0      0
5      0      0      1      0      0      0
8      0      0      1      0      0      0
END ACTIVITY

PRINT-INFO
<ILS > ***** Print-flags ***** PIVL PYR
# - # ATMP SNOW IWAT SLD IWG IQAL *****
1      0      0      4      0      0      4      1      9
4      0      0      4      0      0      0      1      9
5      0      0      4      0      0      0      1      9
8      0      0      4      0      0      0      1      9
END PRINT-INFO

IWAT-PARM1
<PLS > IWATER variable monthly parameter value flags ***
# - # CSNO RTOP VRS VNN RTLI ***
1      0      0      0      0      0

```

```

4      0      0      0      0      0
5      0      0      0      0      0
8      0      0      0      0      0
END IWAT-PARM1

```

```

IWAT-PARM2
<PLS >      IWATER input info: Part 2      ***
# - # ***  LSUR      SLSUR      NSUR      RETSC
1      400      0.01      0.1      0.1
4      400      0.01      0.1      0.1
5      400      0.01      0.1      0.1
8      400      0.01      0.1      0.1
END IWAT-PARM2

```

```

IWAT-PARM3
<PLS >      IWATER input info: Part 3      ***
# - # ***PETMAX      PETMIN
1      0      0
4      0      0
5      0      0
8      0      0
END IWAT-PARM3

```

```

IWAT-STATE1
<PLS > *** Initial conditions at start of simulation
# - # ***  RETS      SURS
1      0      0
4      0      0
5      0      0
8      0      0
END IWAT-STATE1

```

END IMPLND

```

SCHEMATIC
<-Source->      <--Area-->      <-Target->      MBLK      ***
<Name>      #      <-factor->      <Name>      #      Tbl#      ***
Basin 1****
PERLND 16      0.172      COPY      501      12
PERLND 16      0.172      COPY      501      13
IMPLND 1      0.036      COPY      501      15
IMPLND 4      0.036      COPY      501      15
IMPLND 5      0.018      COPY      501      15
IMPLND 8      0.011      COPY      501      15

```

```

*****Routing*****
END SCHEMATIC

```

```

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name>      #      <Name>      # <-factor->strg <Name>      #      #      <Name>      #      #      ***
COPY      501 OUTPUT MEAN      1 1 48.4      DISPLY      1      INPUT TIMSER 1

```

```

<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name>      #      <Name>      # <-factor->strg <Name>      #      #      <Name>      #      #      ***
END NETWORK

```

```

RCHRES
GEN-INFO
RCHRES      Name      Nexits      Unit Systems      Printer      ***
# - #<-----><----> User T-series Engl Metr LKFG      ***
in out      ***
END GEN-INFO
*** Section RCHRES***

```

```

ACTIVITY
<PLS > ***** Active Sections *****
# - # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***

```

```

END ACTIVITY

PRINT-INFO
<PLS > ***** Print-flags ***** PIVL  PYR
# - # HYDR ADCA CONS HEAT SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR *****
END PRINT-INFO

HYDR-PARM1
RCHRES  Flags for each HYDR Section ***
# - # VC A1 A2 A3 ODFVFG for each *** ODGTFG for each  FUNCT for each
      FG FG FG FG possible exit *** possible exit  possible exit
      * * * * * * * * * * * * * * * * * * * * * *
END HYDR-PARM1

HYDR-PARM2
# - # FTABNO LEN DELTH STCOR KS DB50 ***
<-----><-----><-----><-----><-----><-----><-----> ***
END HYDR-PARM2
HYDR-INIT
RCHRES  Initial conditions for each HYDR section ***
# - # *** VOL Initial value of COLIND Initial value of OUTDGT
      *** ac-ft for each possible exit for each possible exit
<-----><-----><-----><-----><-----><-----><-----><----->
END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name> # <Name> # tem strg<-factor->strg <Name> # # <Name> # # ***
WDM 2 PREC ENGL 1 PERLND 1 999 EXTNL PREC
WDM 2 PREC ENGL 1 IMPLND 1 999 EXTNL PREC
WDM 1 EVAP ENGL 0.76 PERLND 1 999 EXTNL PETINP
WDM 1 EVAP ENGL 0.76 IMPLND 1 999 EXTNL PETINP
END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name> # <Name> # #<-factor->strg <Name> # <Name> tem strg strg***
COPY 1 OUTPUT MEAN 1 1 48.4 WDM 701 FLOW ENGL REPL
COPY 501 OUTPUT MEAN 1 1 48.4 WDM 801 FLOW ENGL REPL
END EXT TARGETS

MASS-LINK
<Volume> <-Grp> <-Member-><--Mult--> <Target> <-Grp> <-Member->***
<Name> <Name> # #<-factor-> <Name> <Name> # #***
MASS-LINK 12
PERLND PWATER SURO 0.083333 COPY INPUT MEAN
END MASS-LINK 12

MASS-LINK 13
PERLND PWATER IFWO 0.083333 COPY INPUT MEAN
END MASS-LINK 13

MASS-LINK 15
IMPLND IWATER SURO 0.083333 COPY INPUT MEAN
END MASS-LINK 15

END MASS-LINK

END RUN

```

Predeveloped HSPF Message File

Disclaimer

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