FACET

Formerly DCG/Watershed

Drainage Report – Rev 1

ADDRESS: 6427 E Mercer Way Mercer Island, WA 98040
PARCEL: 302405-9151
DATE: October 2025

OWNER:

Citizen Design
c/o Isaac Greenetz
10 Dravus St
Seattle, WA 98109

FOR SUBMITTAL TO:
CITY OF MERCER ISLAND

CERTIFICATE OF ENGINEER

The technical material and data contained within this report has been prepared by or under the direction of the following registered professional engineer(s), licensed in accordance with the laws of the State of Washington to practice in the State of Washington.

Table of Contents

Tables

Figures

Appendices

Quick Reference Project Information

GENERAL PROJECT INFORMATION

Project Description	The project proposes to construct a new single-family residence. Site improvements include drainage, grading, paving, utilities, and landscaping to support the construction of the proposed development.
Project Address	6427 E Mercer Way Mercer Island, WA 98109
Project Size	Developed Site = 10,201 SF (0.234 Acres)
Owner/Developer	Citizen Design c/o Isaac Greenetz 10 Dravus St Seattle, WA 98109
Consulting Engineer	Ben, Iddins, PE Facet 9706 4th Ave NE, Suite 300 Seattle, WA 98115 Phone: (206) 523-0024 ext. 115

DRAINAGE SUMMARY

Drainage Requirements	2019 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW) & the City of Mercer Island site specific amendments. • Minimum Requirements #1-9	
Tributary Drainage Area & Land Cover Summary	Predeveloped Conditions: Impervious Surface = 2,904 SF PGIS = 0 SF Pervious Surface = 8,107 SF Total = 10,201 SF (0.234 Acres)	Developed Conditions: Total Impervious = 7,893 SF Total PGIS = 3,488 SF Pervious Surface = 2,308 SF Total = 10,201 SF (0.234 Acres)
Soils	A Geotechnical Engineering Report was performed by PanGEO, Inc. and summarized in a report dated March 3, 2025. See Section 1.6 and Appendix A for additional information.	
Stormwater BMPs	Detention Facility	
ESC Measures	TESC plan required per the Stormwater Manual. TESC measures include (but are not limited to) storm drain inlet protection, perimeter protection, construction entrance, construction fencing, straw wattles, and street cleaning.	

1. Project Overview

The project proposes to construct a new single-family residence on the currently vacant lot. The project is located at 6427 E Mercer Way, Mercer Island, WA 98040 (Parcel #302405-9151). Improvements include site grading, drainage, water services, sewer utilities, and power and gas utilities. The project site is bound by single-family residences to the west, a private access roadway to the north, and by E Mercer Way to the east and south.

The project location is shown in Figure 1. The City of Mercer Island has site specific amendments which adopt the 2019 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW), the combination of which is hereafter referred to as "the Manual".

Figure 1. Site Location (via King County iMap)

1.1 Predeveloped Site Conditions

The existing parcel is currently vacant with a driveway to access E Mercer Way. The site slopes from southwest to northeast with an average gradient of approximately 11-12% and a total elevation change of approximately 28 feet. There are steep slopes and seismic hazard environmentally critical areas on the site according to the City of Mercer Island online mapping tool. Table 1 summarizes the existing site conditions and land cover characteristics of the project site's on-site areas.

1.2 Developed Site Conditions

The developed parcel conditions, shown in the Civil Plans (under separate cover), include a new single-family residence with a driveway, walkways, utilities, and landscaping necessary to support the development. The project proposes a detention facility to serve all impervious surfaces onsite (roof and at-grade areas). The outlet from the detention facility will connect to the proposed storm system in the private access roadway fronting the site and then into the existing system in E Mercer Way. Table 1 summarizes the developed site conditions and land cover characteristics of the project site's on-site areas.

1.3 Site Area and Size of Improvements

The total project site contains 10,201 SF (0.234 acres) of improvements, located on E Mercer Way. The drainage basin for this site is the project parcel, the private access roadway improvements, and the downstream drainage system. The site area and size of improvements are shown in the project plans and summarized in Table 1. See Section 8 of this report for the Drainage Plan for the project.

Table 1. On-Site Project Areas and Size of Improvements

Description of On-site Areas	Ex Areas		Dev Areas	
	SF	Acres	SF	Acres
EX Buildings				
EX Driveway				
EX Walkway/Walls				
New Buildings			4,287	0.098
New Driveway			865	0.020
New Walkways/Walls			118	0.003
Total EX Impervious Surface:				
Total New/Replaced Impervious Surface:			5,270	0.121
Total EX Pollution Generating Impervious Surface:				
Total New/Replaced Pollution Generating Impervious Surface:			865	0.020
Total Impervious Surface:			5,270	0.121
EX Onsite Pervious Surface:	8,107	0.186		
New/Replaced Onsite Pervious Surface:			2,308	0.053
Total Pervious Surface:	8,107	0.186	2,308	0.053
Total Onsite Project Site Area	8,107	0.186	7,578	0.174

Table 2. Private Access Roadway Project Areas and Size of Improvements

Description of Private Access Roadway Areas	Ex Areas		Dev Areas	
	SF	Acres	SF	Acres
Roadway, Curb & Gutter	2,094	0.048	2,623	0.060
Sidewalk				
Driveway Approach				
Total EX Impervious Surface	2,094	0.048		
Total New/Replaced Impervious Surface			2,623	0.060
Total EX Pollution Generating Impervious Surface	2,094	0.048		
Total New/Replaced Pollution Generating Impervious Surface			2,623	0.060
Total Impervious Surface	2,094	0.048	2,623	0.060
EX Pervious Surface				
New/Replaced Pervious Surface				
Total Pervious Surface				
Total Private Access Roadway Project Site Area	2,094	0.048	2,623	0.060

Table 3. Total Project Areas (On-site & Private Access Roadway)

Combined On-site & Private Access Roadway Areas	Ex Areas		Dev Areas	
	SF	Acres	SF	Acres
Total EX Impervious Surface	2,094	0.048		
Total New/Replaced Impervious Surface:			7,893	0.181
Total EX Pollution Generating Impervious Surface:	2,094	0.048		
Total New/Replaced Pollution Generating Impervious Surface:			3,488	0.080
Total Pervious Surface:	8,107	0.186	2,308	0.053
Total Project Site Area:	10,201	0.234	10,201	0.234

1.4 Pre-developed Stormwater Runoff Conditions

Runoff from the existing vacant parcel is dispersed onto the surrounding pervious areas and flows northeast across the site. No additional onsite stormwater facilities are known to exist.

1.5 Post-developed Stormwater Runoff Conditions

Roof runoff for the SFR and the at-grade surfaces will be collected via downspouts and routed to a catch basin which conveys stormwater runoff to the proposed detention facility. Runoff from the private access roadway will be collected to the maximum extent feasible via catch basins and routed to the proposed detention facility onsite. The detention facility has been sized to accommodate the surface areas without creating a significant adverse impact to the downstream drainage system and will convey the stormwater to the same point of compliance as in the existing conditions. The outlet from the detention facility will connect to the proposed storm system in the private access roadway fronting the site and then into the existing system in E Mercer Way.

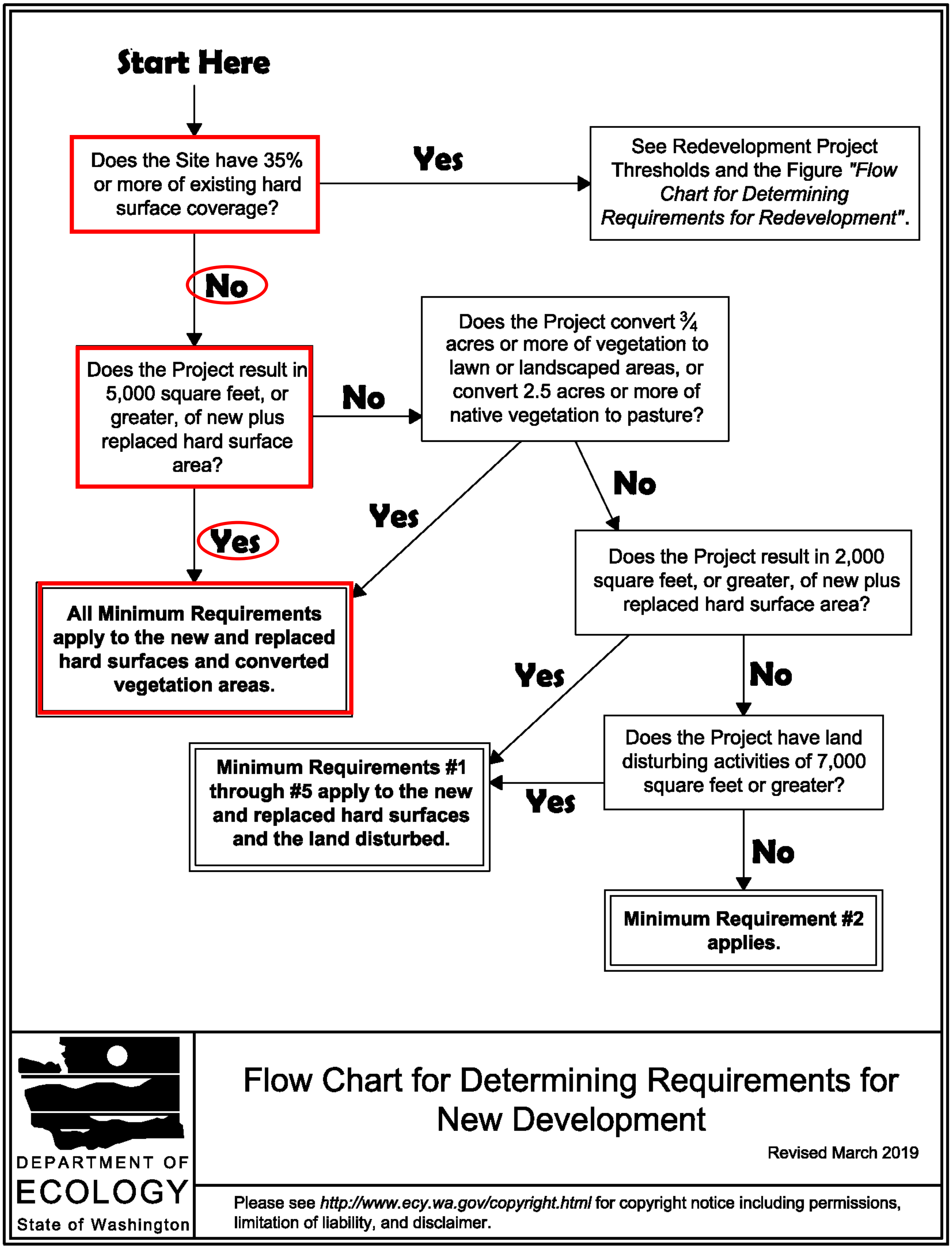
1.6 Soils

A Geotechnical Engineering Report was performed by PanGEO, Inc. and summarized in a report dated March 3, 2025. Test borings were excavated, and the site is underlain by pre-Olympia non-glacial deposits (Qpon), with the basal contact of the Lawton Clay (Qvlc) located upslope of the site. Based on the existing conditions, it was determined that infiltration is infeasible onsite. Please see Appendix A which includes the above-mentioned Geotechnical Engineering Report.

2. Minimum Requirements

The Minimum Requirements applicable to this project were determined using *Figure I-3.1: Flow Chart for Determining Requirements for New Development* from the Stormwater Manual, as shown on the next page.

Figure I-3.1: Flow Chart for Determining Requirements for New Development



As shown in Figure I-3.1, all Minimum Requirements apply to the new and replaced hard surfaces and converted vegetation areas. The project meets the Stormwater Manual's minimum requirements as summarized in the following sections.

2.1 Minimum Requirement #1: Preparation of Stormwater Site Plans

The Stormwater Site Plan was prepared in accordance with Volume 1 Section I-3.4.1 of the Stormwater Manual and includes the minimum requirements applicable to the subject site based on thresholds of new and replaced site impervious coverage.

2.2 Minimum Requirement #2: Construction Stormwater Pollution Prevention Plan

The Construction Stormwater Pollution Prevention Plan (SWPPP) was prepared in accordance with Volume 1 Section I-3.4.2 of the Stormwater Manual, utilizing the Department of Ecology's (DOE) Construction Stormwater General Permit SWPPP template, and is described further in Section 4. The Temporary Erosion and Sediment Control Plan (TESC Plan) can be seen in Section 8 of this report and serves as a guide for the contractor to implement a final TESC Plan. As the site disturbance is less than one acre, a Construction Stormwater General Permit through the DOE is not required.

2.3 Minimum Requirement #3: Source Control of Pollution

The proposed detention facility, storm drains, area drains, and cleanouts serve as source control of pollution for the project site prior to being detained and released from the project site. To control pollutants, proper maintenance and cleaning of debris, sediments, and oil from stormwater collection and conveyance systems is required per the operation and maintenance recommendations found in Volume 5 Appendix A of the Stormwater Manual in addition to the BMPs in Volume IV Section IV-1. See Appendix C for Operation and Maintenance requirements pertaining to the project.

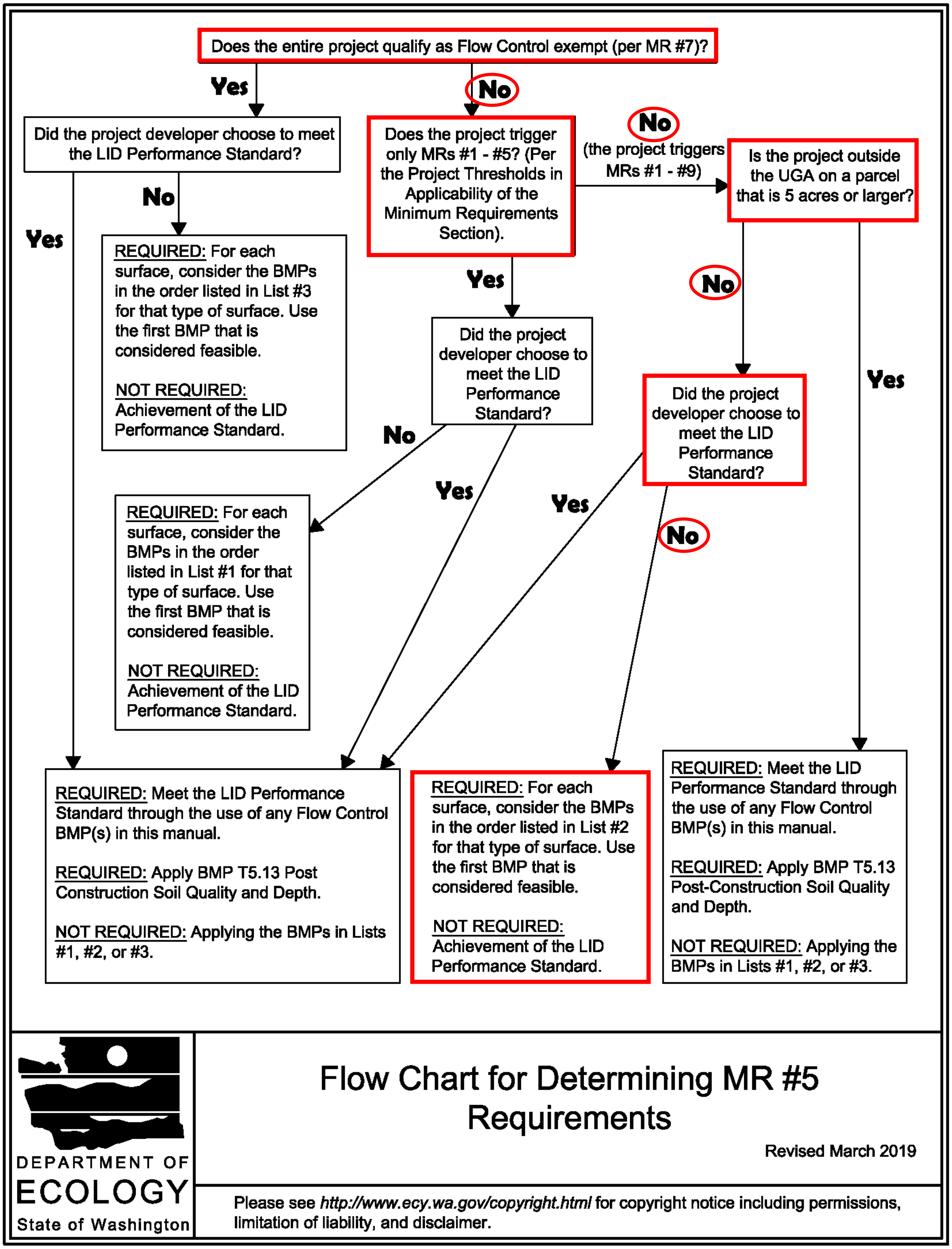
2.4 Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

The proposed drainage system will emulate the natural pre-developed conditions of the site as much as possible as runoff from all new and replaced impervious surfaces will be collected and discharged to the existing public drainage system in E Mercer Way which eventually discharges to Lake Washington, thus maintaining the natural drainage course from the site.

2.5 Minimum Requirement #5: On-Site Stormwater Management

The On-Site Stormwater Management requirements applicable to this project were determined using *Figure I-3.3 – Flow Chart for Determining LID MR #5 Requirements* from the Stormwater Manual, as shown on the next sheet.

Figure I-3.3: Flow Chart for Determining MR #5 Requirements



As shown in Figure I-3.3, List #2 applies to this project. This project complies with List #2 as described below:

Lawn and landscaped areas:
All disturbed pervious surfaces not covered by an impervious surface in the developed condition will be amended in accordance with the Post-Construction Soil Quality and Depth requirements as listed under BMP T5.13 in Chapter 5 of Volume V.

Roof:

- Full Dispersion/Downspout Dispersion Systems are infeasible because the required vegetated flow path is not available onsite.
- Downspout Full Infiltration is infeasible because the geotechnical report indicates that infiltration is not feasible at this project site. See Appendix A of this report for the full geotechnical report.
- Bioretention is infeasible because the geotechnical report indicates that infiltration is not feasible at this project site. See Appendix A of this report for the full geotechnical report.
- Perforated Stub-out Connections are infeasible because the geotechnical report indicates that infiltration is not feasible at this project site, and because the area available for siting a perforated stub-out connection is at the east (low) end of the site, which would then requiring pumping up to the detention facility or significantly lowering the detention facility. See Appendix A of this report for the full geotechnical report.
- On-Site Detention is feasible and will be utilized for all new roof areas onsite.

Other Hard Surfaces:

- Full, Sheet and Concentrated Flow Dispersion are infeasible because the required vegetated flow path is not available onsite.
- Bioretention is infeasible because the geotechnical report indicates that infiltration is not feasible at this project site. See Appendix A of this report for the full geotechnical report.
- Permeable Pavement is infeasible because the geotechnical report indicates that infiltration is not feasible at this project site. See Appendix A of this report for the full geotechnical report.
- On-Site Detention is feasible and will be utilized to the maximum extent feasible for at-grade hard surfaces.

See Section 1.5 and 5.1 of this report for additional information on the proposed storm system.

2.6 Minimum Requirement #6: Runoff Treatment

This project does not trigger Minimum Requirement #6 since the entire project development will add and replace less than 5,000 SF of PGIS (total of 3,488 SF).

2.7 Minimum Requirement #7: Flow Control

The project does not trigger Minimum Requirement #7 because less than 10,000 SF of effective impervious surfaces are proposed, the project will not convert ¾ acres or more of vegetation to lawn or landscape, and the project will not cause a 0.15 cubic foot per second increase in the 100-year flow frequency as estimated using WWHM2012 utilizing 15-minute timesteps. Using 15-minute time steps the predeveloped 100-year flow frequency is 0.018-cfs and the developed site 100-year flow frequency is 0.143-cfs, resulting in a 0.125-cfs increase. The predeveloped site was modeled utilizing a forested land cover. The developed site was modeled using the proposed areas with all roof areas, driveway, and walkways. Please see Appendix B for the full WWHM2012 modeling report.

2.8 Minimum Requirement #8: Wetlands Protection

There are no wetlands on the project site or within the following mile of the downstream drainage path. Therefore, the project does not trigger Minimum Requirement #8: Wetlands Protection.

2.9 Minimum Requirement #9: Operation and Maintenance

An Operations and Maintenance Manual consistent with Volume V of the Stormwater Manual has been provided in Appendix C.

3. Off-Site Analysis Report

The project proposes to discharge stormwater offsite to the City's public stormwater network. Therefore, an offsite analysis is required for this project in accordance with Section I-3.5.3 AMP2 of the Stormwater Manual. The downstream drainage system was followed utilizing the City of Mercer Island's online GIS mapping, Google Maps, and a site visit. Please see the Downstream Drainage Exhibit and the Downstream Analysis Photos Included in Appendix E of this report. The general path of flow for the downstream drainage system is as follows:

The offsite analysis performed begins at the project site. Stormwater discharged from the site flows east into the stormwater main/system in E Mercer Way which flows north and eventually drains into Lake Washington.

There was no visual indication of conveyance system capacity problems, localized flooding, erosion impacts, or violations of surface water quality standards. Additionally, there was no evidence of any damage to the drainage system. See Appendix E of this report for the Downstream Drainage Exhibit and Downstream Analysis Photos.

4. Construction Stormwater Pollution Prevention Plan (SWPPP)

This section summarizes the construction stormwater pollution prevention plan (CSWPPP) analysis and design. The two components of the CSWPPP are the erosion and sediment control (ESC) and the stormwater pollution prevention and spill (SWPPS) plans. Both the ESC Plan and SWPPS serve as guides as the contractor is required to design a working CSWPPP for the site. The analysis and design of these plans are discussed in the following sections.

4.1 ESC Plan Analysis and Design

The ESC design follows the guidelines provided in Appendix D of The Manual and is intended to satisfy Core Requirement #5 Erosion and Sediment Control.

A stabilized construction entrance will be maintained throughout the construction of the site improvements. Perimeter protection such as silt fence, straw wattles, or compost socks will be installed downslope of the improvements. Street cleaning on E Mercer Way will occur daily or as needed to remove any sediment tracked from the site. Site surface drainage will be maintained to prevent any ponding and inlet protection will be provided at all existing and proposed inlets that may receive runoff during construction. All disturbed areas that will not be paved will be stabilized by planting and mulching in accordance with BMP T5.13 of the 2019 Washington State DOE Stormwater Management Manual for Western Washington immediately after construction. The proposed ESC measures are shown on the Temporary Erosion and Sediment Control Plan in Section 8 and summarized in Table 4.

An ESC supervisor will be designated for the project and must be a Certified Professional in Erosion and Sediment Control or a Certified Erosion and Sediment Control Lead, as recognized by King County. The ESC supervisor will be responsible for the performance, maintenance, and review of all ESC measures, as well as the compliance with all permit conditions relating to ESC as described in The Manual.

4.2 SWPPS Plan Design

The SWPPS plan is intended to prevent pollutants from coming into contact with stormwater runoff, surface waters, or groundwater, during construction. Vehicles, construction equipment, materials, chemical storage, and sediment from clearing and grading all have the potential to pollute stormwater during construction. The following BMPs are required during the construction of this project:

- Maintain good housekeeping.
- Designate vehicle, equipment, and chemical storage areas.

- Inspect vehicle, equipment, and petroleum product storage and dispensing areas regularly to detect any leaks or spills.
- Store and contain liquid materials in such a manner that if the tank leaks, the contents will not discharge into the storm drainage system, surface waters, or groundwater.
- Provide maintenance and cleaning of the storm drainage system regularly by removing sediment and debris.
- All spills will be cleaned up immediately and disposed of correctly. Do not hose down spill areas to a storm drainage system.
- All toxic materials will be stored under cover when not in use or during a rain event.
- Use storm drain covers or other similarly effective runoff control measures to prevent sediment and other pollutants from entering catch basins.

All ESC and SWPPS BMPs will be inspected routinely by the ESC supervisor. All ESC measures will be removed, the site stabilized, and the drainage system cleaned once construction is completed.

4.3 Rainy Season Requirements

The construction of this project will be managed to minimize the amount of time that exposed soil is receptive to rainfall. This will help minimize stormwater runoff and erosion. Compost socks, silt fencing, and/or straw wattles will be placed around the site where needed to control the flow rate and disperse stormwater leaving the site. Mulching will be used to help stabilize the soil, especially when rain is anticipated.

4.4 Seasonal Suspension Plan

N/A. Construction is not expected to come to a halt at any time during the year unless specifically directed by the City of Mercer Island construction inspector.

Table 4. Proposed ESC Measures

(All ESC Measures Shall Comply with the Stormwater Manual)

	ESC Measure	Comment
1	Identify Project Limits	Mark by fencing or other means to contain the grubbing and grading activities.
2	Catch Basin Inlet Protection	Install catch basin inlet protection in any drainage structures that may collect any stormwater flowing from the construction site.
3	Phase Grubbing and Grading	Phase clearing so that only those areas that are actively being worked are uncovered. From October 1 through April 30, no soils shall remain exposed for more than 2 days. From May 1 through September 30, no soils shall remain exposed for more than 7 days.
4	Install Straw Wattles	Install straw wattles around disturbed areas where sediment could be transported off-site. Adjust straw wattles as required by site conditions and construction sequencing.
5	Sod/Seed Exposed Areas	Cleared areas will be sod/seeded as soon as possible after grading completed (few weeks).
6	Soil Removal	Remove excess soil from the site as soon as possible after backfilling.
7	Protect Adjacent Properties	Adjacent properties shall be protected from sediment deposition by appropriate use of vegetative buffer strips, sediment barriers or filters, dikes or mulching, or by a combination of these measures and other appropriate BMPs.
8	Street Cleaning	Provide for periodic street cleaning to remove any sediment that may have been tracked out. Sediment should be removed by shoveling or sweeping and carefully removed to a suitable disposal area where it will not be re-eroded.
9	Inspect ESC BMPs	Inspect all erosion and sediment control BMPs installed regularly, especially after any large storm. Maintenance, including removal and proper disposal of sediment should be done as necessary.

5. Permanent Stormwater Control

Total areas and land-cover characteristics for all proposed surfaces are shown in Table 1 for the developed site. Please see the Site Assessment and Summary Exhibit Included in Section 8 of this report for tributary areas to the proposed stormwater network elements. The stormwater requirement thresholds are as follows:

- On-site stormwater management BMPs per Table I-3.2 of the Stormwater Manual. See Section 5.1 of this report for more information.
- Flow Control is not required for the project site (<10,000 SF of effective impervious surface is proposed,).
- Water quality treatment is not required for the site (<5,000 SF of new plus replaced PGIS).

Table 5. Stormwater Facilities Summary

Facilities Summary
(1) Detention Facility
(2) Catch Basins
(5) Area Drains
(2) Cleanouts

5.1 On-Site Stormwater Management (LID BMPs)

The project proposes to utilize a detention facility to meet On-Site Stormwater Management requirements (Minimum Requirement #5). The detention facility was sized using the City of Mercer Island's detention system sizing Chart for projects with less than 9,500 SF of new plus replaced impervious surface.

The detention system was sized based on 7,420 SF of new plus replaced impervious surface (5,270 SF on-site, 2,150 SF private access roadway) and an additional 2,056 SF (512 SF on-site, 1,544 SF private access roadway) due to the driveway sloping of the neighboring site (6423 E Mercer Way). That totals 9,476 SF of contributing area tributary to the detention system.

Utilizing the sizing parameters for sites with Type C soils, a 60" diameter pipe was selected and therefore 58 LF of detention pipe is required. This will be satisfied with the use of two (2) parallel 29.0 LF, 60" diameter, detention pipes. See Appendix G for more detention system sizing information.

5.2 Flow Control

Flow control is not triggered (see Section 2.7).

5.3 Water Quality

Water quality is not triggered (see Section 2.6).

5.4 Conveyance System Analysis and Design

The onsite conveyance system is comprised of 4-to-12-inch storm drainpipes, area drains, catch basins, and a detention facility. Stormwater exiting the detention facility will be routed to the existing storm drain main within E Mercer Way. All proposed storm drains onsite have been sized to handle anticipated site runoff from a storm event greater than a 100-year storm event. See conveyance calculations located in Appendix F for sizing results.

6. Special Reports and Studies

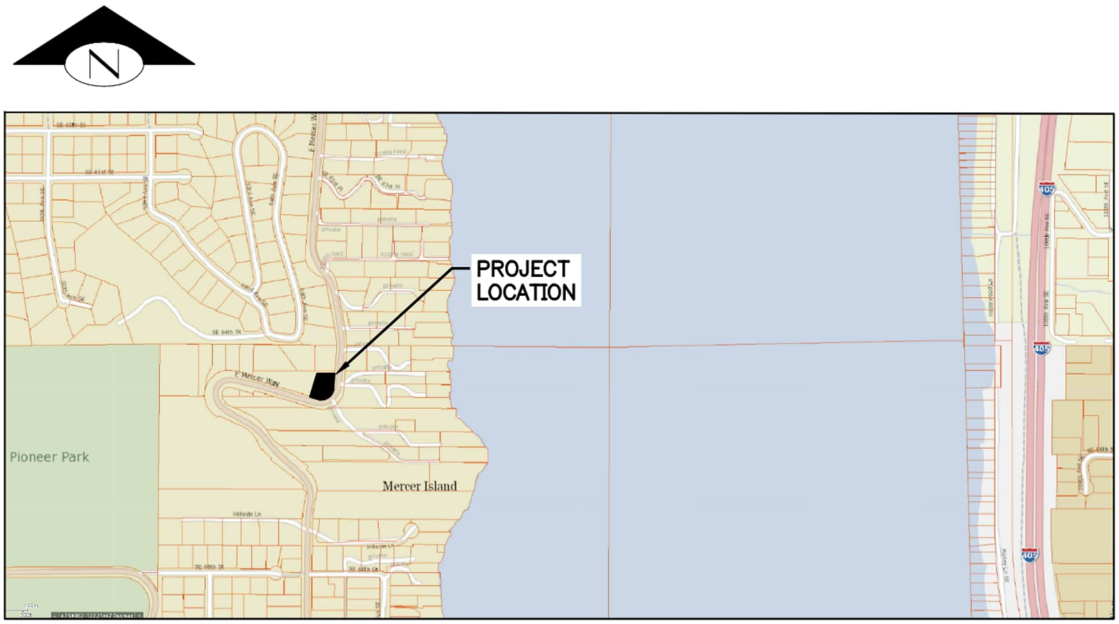
A Geotechnical Engineering Report was performed by PanGEO, Inc. and summarized in a report dated March 3, 2025 (see Section 1.6 and Appendix A for additional information). Additionally, an arborist report was completed by Earth Dance Design and is submitted under separate cover. No other special reports or studies were required or conducted for this project.

7. Other Permits

No other permits or approvals are expected to be required for this project.

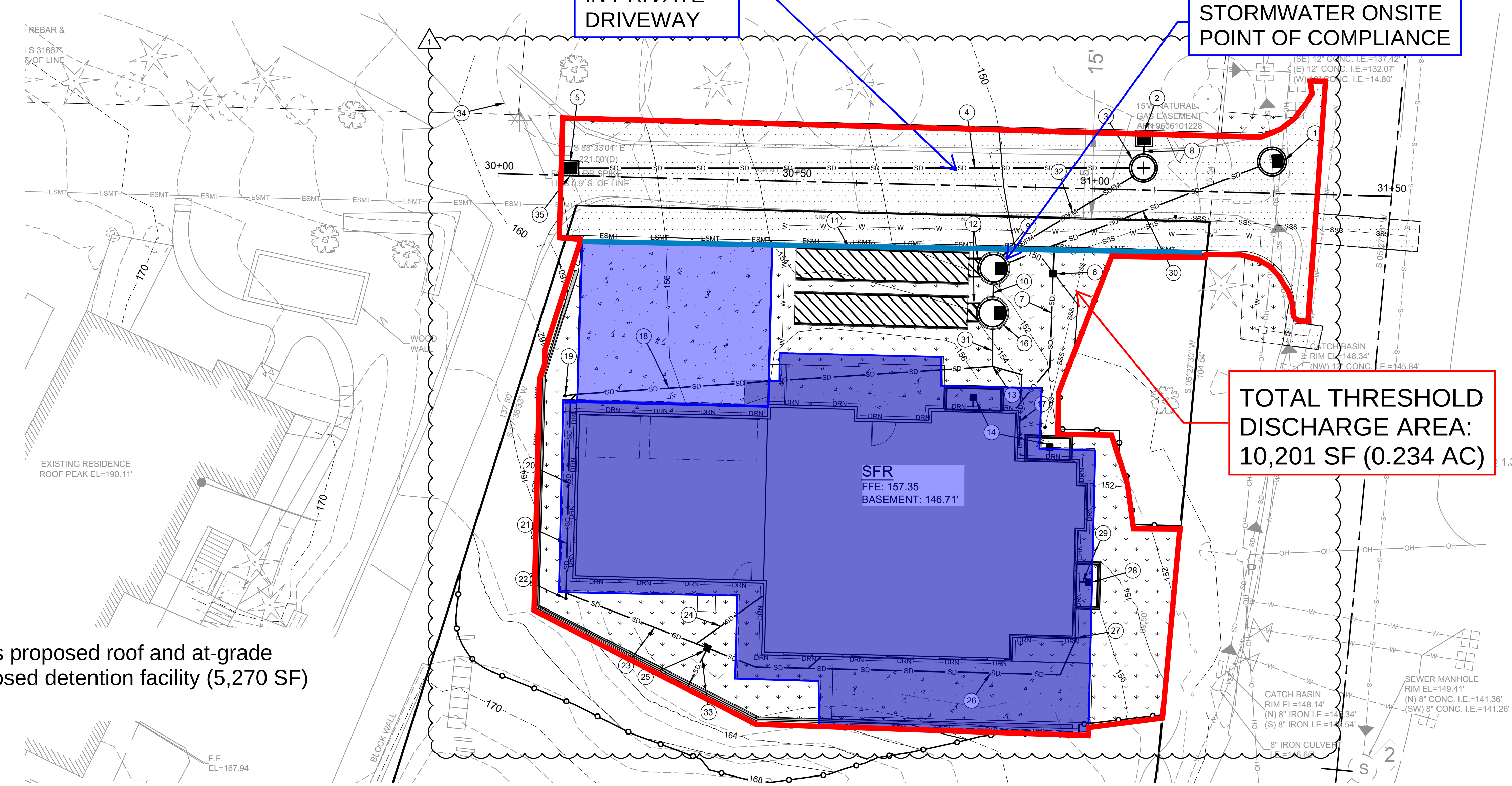
8. Additional Figures

Figure 2. Vicinity Map



VICINITY MAP
SCALE: 1" = 200'

Figure 3. Site Assessment and Summary



DRAINAGE PLAN

SCALE: 1" = 10'

LEGEND:

Hatch denotes proposed roof and at-grade areas to proposed detention facility (5,270 SF)

NO.	DATE	BY	REVISION
1	11/06/2025	BI	REVISIONS PER CITY COMMENTS #1

BASE MAP/TOPOGRAPHY PROVIDED BY OTHERS. FACET CANNOT BE HELD LIABLE FOR ACCURACY. CONTRACTOR SHALL FIELD VERIFY GRADES, UTILITIES, AND ALL OTHER EXISTING FEATURES AND CONDITIONS. IF CONDITIONS ARE NOT AS SHOWN AND/OR PLANS CANNOT BE CONSTRUCTED AS SHOWN, CONTACT FACET PRIOR TO CONSTRUCTION.

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(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

6427 E MERCER WAY

6427 E MERCER WAY
MERCER ISLAND, WA 98040
PROJECT No. 2501.0550.00

PERMIT PLAN

DRAINAGE PLAN

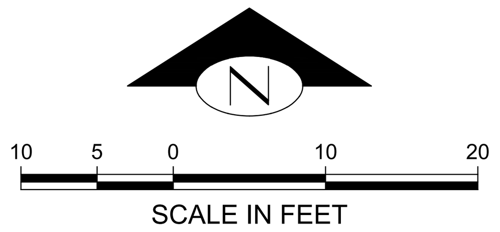
DATE: 11/6/2025

PLAN NUMBER: C06

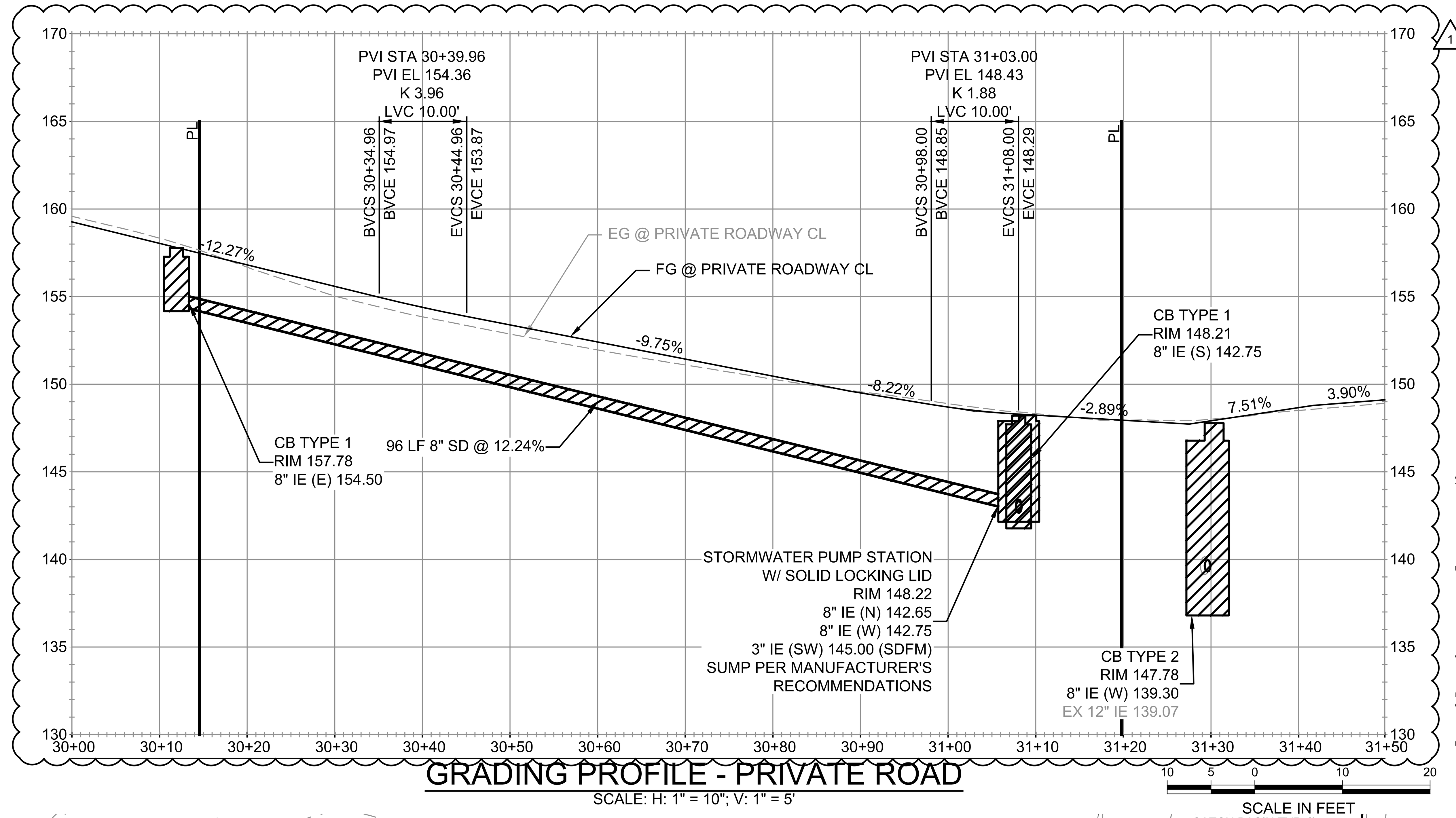
SHEET 6 OF 12

PRINCIPAL: BI PROJECT MANAGER: JR DESIGNED BY: ZP DRAWN BY: GS, CK CHECKED BY: BI

Figure 4. Drainage Plan



KEY NOTES:		
KEY	NOTE	DETAIL/ SHEET
1	TYPE 2 CB (SEE GRADING PROFILE - PRIVATE ROAD, THIS SHEET)	D/C09
2	TYPE 1 CB (SEE GRADING PROFILE - PRIVATE ROAD, THIS SHEET)	D/C09
3	STORMWATER PUMP STATION W/ SOLID LOCKING LID (SEE GRADING PROFILE - PRIVATE ROAD, THIS SHEET)	PS1/C12
4	8" SD @ 2.00% MIN (SEE GRADING PROFILE - PRIVATE ROAD, THIS SHEET)	G/C09
5	TYPE 1 CB (SEE GRADING PROFLIE - PRIVATE ROAD, THIS SHEET)	D/C09
6	AREA DRAIN W/ 2' MIN SUMP RIM 150.03 4" IE (W) 144.60 4" IE (S) 144.60	-
7	4" SOLID WALL PVC FOOTING DRAIN TIGHTLINE @ 2.00% MIN	-
8	5 LF 8" SD @ 2.00% MIN	G/C09
9	TYPE 2 CB (54Ø) W/ FLOW CONTROL STRUCTURE RIM 151.27 3" IE (NE) 148.00 (SDFM) 8" IE (S) 143.50 36" IE (W) 143.50 8" IE (E) 143.50 (OUTLET) OVERFLOW ELEV 148.00	F/C09
10	8" SD @ ELEV 143.50	-
11	DETENTION FACILITY FACILITY DIMENSION: (2) 29.0'L X 5.0'Ø TOP OF FACILITY 148.00 DEAD STORAGE ELEV 143.50 BOTTOM OF FACILITY 143.00	C11
12	36" SD @ ELEV 143.50	-
13	4" WYE IE 151.35	-
14	AREA DRAIN RIM 148.71 4" IE 146.85	-
15	35 LF 8" SD @ 2.00% MIN	G/C09
16	TYPE 2 CB RIM 152.90 4" IE (S) 150.00 36" IE (W) 143.50 8" IE (N) 143.50	E/C09
17	16 LF 4" SD @ 2.00% MIN	G/C09
18	72 LF 4" SD @ 2.00% MIN	G/C09
19	4" SDCO RIM 156.29 4" IE 152.80	H/C10
20	PERIMETER FOOTING DRAIN: 4" PERFORATED PVC PIPE IN 3/4" WASHED ROCK WRAPPED IN FILTER FABRIC (TYP)	-
21	35 LF 4" SD @ 2.00% MIN	G/C09
22	4" SDCO RIM 156.85 4" IE 153.55	H/C10
23	26 LF 4" SD @ 2.00% MIN	G/C09
24	13 LF 4" SD @ 2.00% MIN	G/C09
25	AREA DRAIN RIM 156.50 4" IE (E) 154.15 4" IE (W) 154.15 4" IE (S) 154.50 (WALL DRN)	-
26	67 LF 4" SD @ 2.00% MIN	G/C09
27	4" ROOF DOWNSPOUT TIGHTLINE W/ 1.5' MIN COVER @ 2.00% MIN SLOPE (TYP)	-
28	AREA DRAIN RIM 149.21 4" IE 147.45	-
29	WINDOW WELL AREA DRAINS TO TIGHTLINE INTO FOOTING DRAIN CONVEYANCE SYSTEM (TYP)	-
30	48 LF 8" SD @ 2.00% MIN	G/C09
31	6 LF 4" SD @ 2.00% MIN	G/C09
32	35 LF 3" SDFM	-
33	WALL DRAINAGE PER GEOTECHNICAL RECOMMENDATIONS TO CONNECT TO AREA DRAIN (SEE KEYNOTE 25)	-
34	TREE LIMITS OF DISTURBANCE (TYP)	-
35	ALL UTILITY TRENCHING TO BE OUTSIDE OF TREE LIMITS OF DISTURBANCE. COORDINATION WITH PROJECT ARBORIST IS REQUIRED.	-



GRADING PROFILE - PRIVATE ROAD

SCALE: H: 1" = 10'; V: 1" = 5'

DRAINAGE PLAN

SCALE: 1" = 10'

NO.	DATE	BY	REVISION
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FEDERAL WAY | KIRKLAND | MOUNT VERNON | SEATTLE | SPOKANE | WHIDBEY ISLAND

BENJAMIN J. IDDINS — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER
Digitally signed by Ben Iddins Date: 2025.11.06

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2 BUSINESS DAYS BEFORE YOU DIG
(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

6427 E MERCER WAY

6427 E MERCER WAY
MERCER ISLAND, WA 98040
PROJECT No. 2501.0550.00

PERMIT PLAN

DRAINAGE PLAN

DATE: 11/6/2025
PLAN NUMBER:
C06
SHEET 6 OF 12

FILE LOCATION: Z:\SHARED\PROJECTS\ACTIVE\2025\01\2501.0550, CITIZEN DESIGN, 6427 E MERCER WAY MERCER ISLAND\DRAWINGS\CAD-REVIT\ACTIVEFILE\6427 E MERCER WAY_MERCER ISLAND.DWG - ORIGINAL SHEET SIZE: ARCH FULL BLEED D (36.00 X 24.00 INCHES) - LAST MODIFIED BY: ZOE POPOVICH
PRINCIPAL: BI PROJECT MANAGER: JR DESIGNED BY: ZP DRAWN BY: GS, CK CHECKED BY: BI

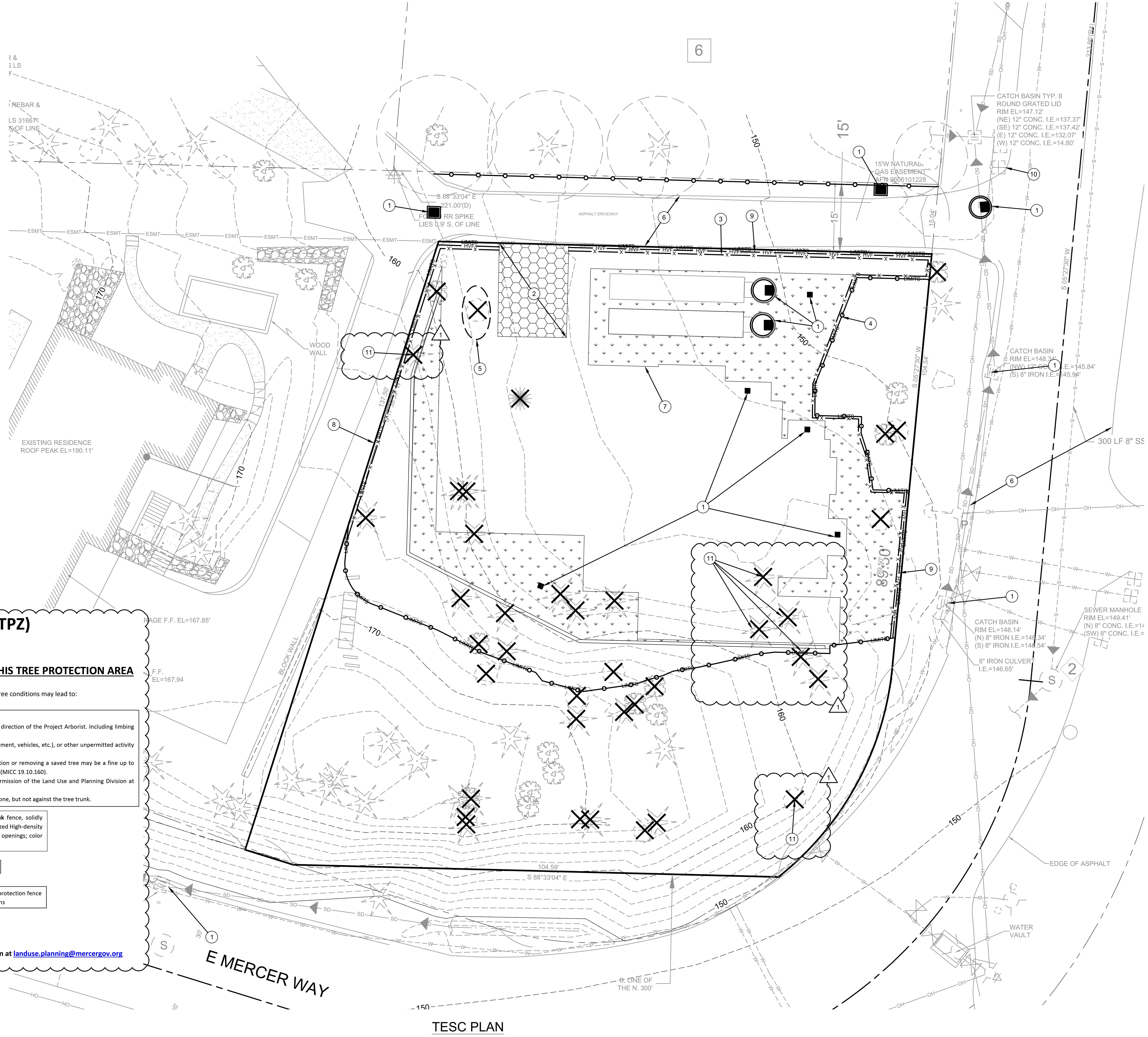
Figure 5. TESC Plan

SCALE IN FEET

KEY NOTES:

KEY	NOTE:	DETAIL/ SHEET
1	INSTALL TEMPORARY STORM DRAIN INLET PROTECTION IN ALL STRUCTURES WITHIN 500' OF THE PROJECT SITE (INCLUDING THOSE THAT BECOME OPERABLE DURING CONSTRUCTION) AND REMOVE AFTER PERMANENT SITE STABILIZATION	A/C08
2	INSTALL TEMPORARY STABILIZED CONSTRUCTION ENTRANCE OFF EDGE OF EX DWY. CONTRACTOR TO DETERMINE FINAL LOCATION IN FIELD BASED ON ACCESS AVAILABILITY	B/C08
3	INSTALL APPROX 278 LF PERIMETER PROTECTION*	C/C08
4	TREE PROTECTION FENCING (TYP)	TP/C04
5	PROPOSED STOCKPILE LOCATION. CONTRACTOR TO DETERMINE FINAL LOCATION IN FIELD	-
6	CONTRACTOR TO SWEEP STREET DAILY OR MORE OFTEN IF NECESSARY TO REMOVE TRACKED SEDIMENT	-
7	AMEND ALL DISTRUBED PERVIOUS AREAS IN ACCORDANCE W/ BMP T5.13 IN VOLUME V OF THE DOE 2019 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON	-
8	APPROXIMATE ON-SITE CLEARING LIMITS	-
9	INSTALL HIGH VISIBILITY FENCE ALONG ROW & PRIVATE DRIVE AISLE	-
10	EX WATER METER AND SERVICE LINE TO REMAIN AND BE PROTECTED FOR NEIGHBORING PARCEL (#302405-9043)	-
11	PREVIOUSLY FALLEN TREE PER ARCHITECTURAL PLANS	-

* INSTALL PERIMETER PROTECTION, SUCH AS SILT FENCING, COMPOST SOCKS, OR STRAW WATTLES IN ACCORDANCE WITH VOL II OF THE 2019 DOE STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON



TREE PROTECTION AREA (TPZ)

KEEP OUT!

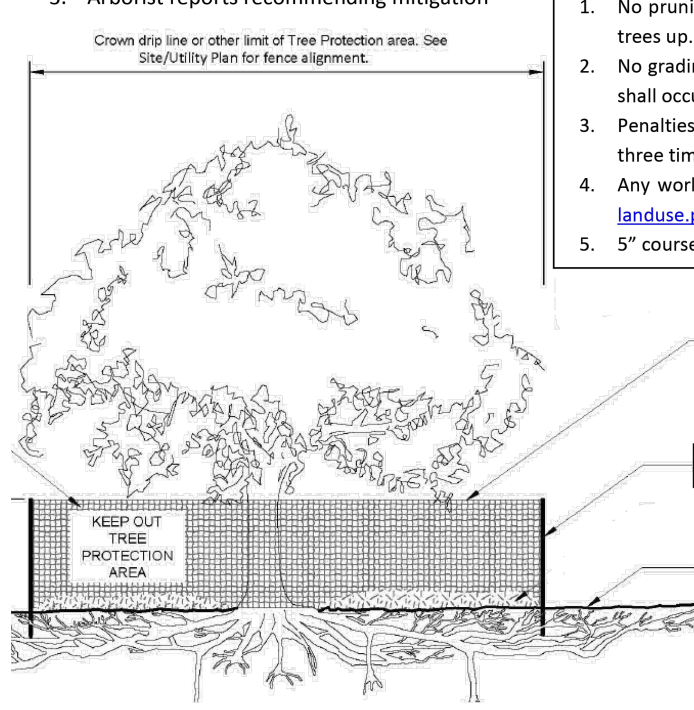
DO NOT REMOVE OR ADJUST THE APPROVED LOCATION OF THIS TREE PROTECTION AREA

Trees enclosed by this fence are protected and are subject to the conditions of the tree permit. Violation of tree conditions may lead to:

1. Correction Notices or Stop Work Orders until compliance is achieved
2. RE Inspection Fees/financial penalties
3. Arborist reports recommending mitigation

Notes

1. No pruning shall be performed unless under the direction of the Project Arborist. Including limbing trees up.
2. No grading, excavation, storage (materials, equipment, vehicles, etc.), or other unpermitted activity shall occur inside the protective fencing.
3. Penalties for damaging by root damage/compaction or removing a saved tree may be a fine up to three times the value of the tree plus restoration (MICC 19.10.160).
4. Any work in approved TPZ must be with the permission of the Land Use and Planning Division at landuse.planning@mercergov.org
5. 5" course woodchips within the tree protection zone, but not against the tree trunk.



Tree protection fence: 4-6" **chain link** fence, solidly anchored into the ground, or if authorized High-density polyethylene fencing with 3.5" x 1.5" openings; color orange. Steel posts installed at 8' o.c.

2" x 6" steel posts or approved equal

Maintain existing grade with the tree protection fence unless otherwise indication on the plans

Any Work in the protected area must be with the permission of the Land Use and Planning Division at landuse.planning@mercergov.org

TREE PROTECTION FENCING TP/C04
NOT TO SCALE

TESC PLAN
SCALE: 1" = 10'

NO.	DATE	BY	REVISION
1	11/06/2025	BI	REVISIONS PER CITY COMMENTS #1

BASE MAP/TOPOGRAPHY PROVIDED BY OTHERS. FACET CANNOT BE HELD LIABLE FOR ACCURACY. CONTRACTOR SHALL FIELD VERIFY GRADES, UTILITIES, AND ALL OTHER EXISTING FEATURES AND CONDITIONS. IF CONDITIONS ARE NOT AS SHOWN AND/OR PLANS CANNOT BE CONSTRUCTED AS SHOWN, CONTACT FACET PRIOR TO CONSTRUCTION.

FACET
P: 206.523.0024
www.facetnw.com
9706 4th Ave NE
Suite 300
Seattle, WA 98115
FEDERAL WAY | KIRKLAND | MOUNT VERNON | SEATTLE | SPOKANE | WHIDBEY ISLAND

Digitally signed by Ben Iddins Date: 2025.11.06 16:12:15 -08'00'

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6427 E MERCER WAY

6427 E MERCER WAY
MERCER ISLAND, WA 98040
PROJECT No. 2501.0550.00

PERMIT PLAN

TESC PLAN

DATE: 11/6/2025
PLAN NUMBER:
C04
SHEET 4 OF 12

PRINCIPAL: BI PROJECT MANAGER: JR DESIGNED BY: ZP DRAWN BY: GS, CK CHECKED BY: BI

APPENDIX A. Geotechnical Report

Geotechnical & Earthquake
Engineering Consultants

March 3, 2025
File No. 25-036.100

Citizen Design
Attn: Mr. Isaac Greenetz
10 Dravus Street,
Seattle, WA 98109

Subject: **Geotechnical Engineering Report (DRAFT)**
Proposed Single-Family Residence
6427 East Mercer Way, Mercer Island, Washington

Dear Isaac,

Please find attached our draft geotechnical engineering report for the proposed single-family residence at the above address in Mercer Island, Washington. This report documents the subsurface conditions at the site and presents our geotechnical engineering recommendations for the proposed project.

PanGEO previously prepared a geotechnical report for three lots, including the subject lot, dated April 16, 2019. We subsequently prepared supplemental addendums to address the previously proposed developments on each specific lot. The attached report is intended to supersede our original report for the three lots, and all previous addendums, and should be used for the current design of the project. We will finalize this draft report after we receive review comments from the project team.

Soil Conditions - In summary, the majority of the site is generally underlain by competent soils consisting of medium dense to dense silty sand. The exception is the northeast portion of the site, where loose, unsuitable soils were encountered, which we interpreted to be undocumented fill. Perched groundwater was encountered in one test boring about thirteen feet below the ground surface.

Foundation Recommendations - Based on the currently proposed design, the majority of the proposed house foundations are expected to bear on competent soils. However, unsuitable soils are expected to be encountered along the north foundation wall, and along the approximately northern half of the east foundation wall. At these locations, the unsuitable soils would need to be over-excavated and replaced with properly compacted structural fill, or lean-mix concrete. We estimate that over-excavation depths may be up to five to six feet below the proposed footings. As an alternative to over-excavation and replacement, to avoid the large amounts of earthwork, the footings underlain by unsuitable soil may be supported by small diameter driven pipe piles, commonly referred to as pin piles.

Critical Area Considerations – Provided that the recommendations presented in this report are incorporated into the project plans and construction of the project, in our opinion the proposed project is feasible from the geotechnical standpoint, and will not adversely affect the mapped critical areas at the site.

We appreciate the opportunity to work on this project. Please call if there are any questions.

Sincerely,

Stephen H. Evans, L.E.G.
Senior Engineering Geologist
sevans@pangeoinc.com

Jon C. Rehkopf, P.E.
Principal Geotechnical Engineer
jrehkopf@pangeoinc.com

Encl.: Geotechnical Engineering Report (DRAFT)

TABLE OF CONTENTS

List of Figures

Appendix

GEOTECHNICAL ENGINEERING REPORT (DRAFT)
PROPOSED SINGLE-FAMILY RESIDENCE
6427 EAST MERCER WAY
MERCER ISLAND, WASHINGTON

1.0 INTRODUCTION

This report presents the results of a geotechnical engineering study that was undertaken to support the design of the proposed single-family residence (SFR) at 6427 East Mercer Way (Parcel 3024059151) on Mercer Island, Washington. This study was performed in general accordance with our mutually agreed scope of services outlined in our proposal for the current study dated January 24, 2025, which was subsequently authorized by you on January 29, 2025. Our scope of services included reviewing readily available geologic and geotechnical data, including our previous studies on this site, compiling our previous engineering analyses and recommendations, performing additional engineering analyses as needed, and preparing this geotechnical engineering report for this specific property. All previous reports and memos provided for this property are superseded by this report.

2.0 SITE AND PROJECT DESCRIPTION

The project site consists of an irregularly shaped, undeveloped parcel located at 6427 East Mercer Way, on the east side of Mercer Island, Washington (see Figure 1, Vicinity Map). The 15,812 sq. ft. parcel is located above a 90-degree bend in E. Mercer Way (see Figures 2). A low ridgeline with moderately steep slopes surrounds the property to the south, west, and east, forming a semi-open, northeast-facing bowl with about 30 feet of total relief (see Plate 1 and Figure 2). The surface within the "bowl" is relatively level, and the near 90-degree angle between the south and west slopes suggest the site has been excavated and backfilled. The ridge area is covered with scattered conifer and deciduous trees, while the bowl area was grassy at the time of our explorations.

The property is mapped by the City of Mercer Island within several geological hazard areas, including an erosion hazard area, a potential landslide hazard area, and seismic hazard area. As such, the development will need to consider these hazards, which are addressed in *Section 5.0* of this report.

Current plans call for developing the house footprint in the bowl portion of the property (see Figure 2). We understand that the finished floor of the house will be around elevation 147 feet, while the finished floor of the garage will be around elevation 157 feet. As such, the lowest floor of the house will consist of a daylight basement open to the northeast. We anticipate excavations for the house foundation will be on the order of 8 feet, or less.

Plate 1 – General conditions of the East Lot bowl area, looking south. (3/1/2019)

Plate 2 –Schematic West Elevation, dated 9/15/20, by Mcleod Home Designs.

The conclusions and recommendations in this report are based on our understanding of the proposed development, which is in turn based on the project information provided. If the above project description is incorrect, or the project information changes, we should be consulted to review the recommendations contained in this study and make modifications, if needed.

3.0 SUBSURFACE EXPLORATIONS

PanGEO completed three (3) test borings (PG-1, PG-2 and PG-3) at the subject site on March 7, 2019. The borings were advanced to between 11½ and 26½ feet below the existing ground surface using an EC-95 track mounted drill or a hand-operated portable Acker drill rig, both owned and operated by Boretec, Inc. The approximate boring locations are shown on the attached Figure 2.

Soil samples were obtained from the borings at 2½-foot and 5-foot depth intervals in general accordance with Standard Penetration Test (SPT) sampling methods (ASTM test method D-1586) in which the samples were obtained using a 2-inch outside diameter split-spoon sampler. The sampler was driven 18-inches into the soil using a 140-pound weight freely falling a distance of 30 inches. The number of blows required for each 6-inch increment of sampler penetration was recorded. The number of blows required to achieve the last 12 inches of sample penetration is defined as the SPT N-value. The N-value provides an empirical measure of the relative density of cohesionless soil, or the relative consistency of fine-grained soils.

A geologist from PanGEO was present on a full-time basis to observe the drilling, assist in sampling, and to describe and document the soil samples obtained from the borings. The soils were logged in general accordance with the system summarized on *Figure A-1, Terms and Symbols for Boring and Test Pit Logs*. Summary boring logs are included as Figures A-2 to A-4 in Appendix A. The stratigraphic contacts indicated on the boring logs represent the approximate depth to the boundaries between soils units. Actual transitions between soil units may be more gradual or occur at different elevations. The descriptions of groundwater conditions and depth are likewise approximate.

4.0 SUBSURFACE CONDITIONS

4.1 SITE GEOLOGY

According to *The Geologic Map of Mercer Island (Troost and Wisher,2006)*, the subject parcel is underlain by pre-Olympia non-glacial deposits (Qpon), with the basal contact of the Lawton Clay (Qvlc) located just upslope of the site. Possible mass-wastage deposits are mapped over the surface of the site.

- **Mass-wastage Deposits (Qmw) –** Mass-wastage deposits consist of surficial deposits transported downslope in mass by gravity (landslides, colluvial soil movement, and other gravitational processes). Mass-wastage deposits typically consist of intermixed, very loose to medium dense, coarse-grained deposits and soft to stiff fine-grained deposits with voiding. This geologic unit typically exhibits moderate to high compressibility and low to moderate strength characteristics due to the highly variable composition and the nature in which this unit was deposited.

- **Vashon Lawton Clay (Qvlc)** – This deposit typically consists of sediment deposited in proglacial lakes, and is laminated to massive, very stiff to hard, silt, clayey silt to silty clay. Lawton Clay deposits typically exhibit low compressibility and high strength characteristics in an undisturbed state.

- **Pre-Olympia Non-Glacial Deposits (Qpon)** – This geologic unit is described by Troost and Wisher as generally consisting of very dense and hard, sand, gravel, silt, clay and organics of non-glacial origin. The unit may contain tephra beds, paleosols, and iron oxidized layers. These pre-Olympia deposits also typically exhibit low compressibility and high strength characteristics in an undisturbed state.

4.2 SOIL CONDITIONS

The test borings advanced at the project site are generally encountered soils consistent with the mapped geologic stratigraphy, though we did not encounter significant mass-wasting deposits. Rather, the disturbed surficial materials we found at the site were either interpreted to be fill, or deposits attributable to alluvial processes. Also, we consider that the fine-grained silt deposits encountered in PG-3 may be pre-Olympia fine-grained deposits. However, for the purposes of this report, the fine-grained silt deposits are referred to as the mapped Lawton Clay.

The interpreted subsurface conditions are depicted in *Figure 3 – Generalized Subsurface Profile A-A'* and brief descriptions of the generalized soil conditions encountered at the locations of the test borings advanced at the site are presented below. Please refer to the summary boring logs in *Appendix A* for more details.

Fill (Hf) – Fill was encountered in the central bowl area of the site in PG-2. The fill encountered generally consisted of loose, brown to red brown, silty fine sand with occasional organics. As the bowl area is near the low section of a shallow drainage that drains areas to the west, the bowl area may contain alluvial material in addition to fill.

Lawton Clay (Qvlc) – Test boring PG-3 encountered medium dense, brown-gray, non-plastic SILT with some fine sand, which is laminated. The unit is roughly 8 to 8½ feet thick, and is the uppermost soil layer in PG-3. We anticipate this unit will exhibit high strength characteristics in its undisturbed state.

Pre-Olympia Non-Glacial Deposits (Qpon) – The soil unit encountered at depth in all three borings was a medium dense to very dense, brown to brown-gray, fine to medium SAND unit, which we interpret as pre-Olympia non-glacial strata. The unit was laminated to bedded, with finer and coarser beds, homogeneous, slightly silty to silty, with high strength.

Our subsurface descriptions are based on the conditions encountered and observed at the time of our exploration. Soil conditions between exploration locations may vary from those encountered. The nature and extent of variations between our exploratory locations may not become evident until construction. If variations do appear, PanGEO should be requested to reevaluate the recommendations in this report and to modify or verify them in writing prior to proceeding with earthwork and construction.

<u>Selected Sample Photos:</u> *Plates 3 through 5* below depict select soil samples obtained from our recent test borings. For reference purposes, the split-soon samplers pictured below have an outside diameter of 2 inches.

Plate 3 –Hf | Loose, silty sand | PG-2, S-1 @ 2½ – 4 feet.

Plate 4 –Qvlc | Medium dense SILT | PG-3, S-1 @ 5-6½ feet.

Plate 5 – Nonglacial Deposits Qpon | Medium Dense to Very dense, SAND, trace silt | PG-1, S-2 @ 5 – 6½ feet.

4.3 Groundwater Conditions

Groundwater was encountered in PG-2 during drilling at a depth of roughly 13½ feet below the existing ground surface. We interpreted this as a perched lens above a thin silt bed within the overall sand deposit, as reflected in the log. Please note that there will be fluctuations in seepage and groundwater levels, depending on the season, amount of rainfall, surface water runoff, local subsurface conditions and other factors. Generally, the groundwater levels are higher and seepage rates are greater in the wetter winter months (typically October through May).

5.0 GEOLOGIC HAZARDS EVALUATION

As part of our study, we conducted an assessment of potential geologic hazards within the subject site as defined in Mercer Island City Code Chapter 19.07.160, Geologically Hazardous Areas. Mercer Island City Code identifies three different types of Geologic Hazards: Erosion Hazards, Potential Landslide Hazards, and Seismic Hazards. The City's criteria for the various hazard areas and our assessment of the hazard areas with respect to the planned improvements are provided in the following sections of this report.

5.1 EROSION HAZARDS

The site is mapped as a potential erosion hazard area in accordance with the City of Mercer Island's Geologic Hazards Map. Based on the Web Soil Survey data, the mapped site soils (Kitsap Silt Loam KpD) have an Erosion Factor K of 0.37 to sheet and rill erosion. Factor K values range between 0.02 and 0.69, with the higher number indicating higher vulnerability. As such, we interpret the site soils to have a moderate susceptibility to erosion.

Conclusions: In our opinion, the erosion hazards at the site can be effectively mitigated with best management practices during construction and with properly designed and implemented landscaping for permanent erosion control. During construction, the temporary erosion hazard can be effectively managed with an appropriate erosion and sediment control plan, including, but not limited to, installing a silt fence at the construction perimeter, placing quarry spalls or hay bales at the disturbed and high traffic areas, covering stockpiled soil or cut slopes with plastic sheets, constructing a temporary drainage pond, if needed, to control surface runoff and trap sediment, and by maintaining a stabilized construction entrance.

Permanent erosion control measures should be applied to the disturbed areas of the site as soon as feasible. These measures may include, but not limited to, planting and mulching. The use of permanent erosion control mats may also be considered in conjunction with planting/mulching to protect the soils from erosion.

5.2 POTENTIAL LANDSLIDE HAZARDS

The subject site is mapped within a potential landslide hazard area according to the City of Mercer Island's Geologic Hazards Map. The map indicates that steep slopes are not present at the site.

The City of Mercer Island GIS mapping identifies a few landslide indicators within 500 feet of the subject site. One is on East Mercer Way, north of the subject site, and one is below East Mercer

Way, south of the site, above the deeply incised stream channel at that location. The indicator on East Mercer Way is likely in response to pavement settlement issues. The map also shows a landslide scarp along the north side of a drainage swale that passes along the north side of the subject property, and is more fully described in the next section. This scarp is above the project site, but is not associated with any mapped known slide.

Site Reconnaissance and Observations: We conducted a reconnaissance visit to review the condition of the sloping areas of the site, and areas adjacent to the site, and identify indications of potential historical slope instability.

The site morphology consists of a narrow descending ridge running along the south and east sides of a level bowl area, as shown in Plate 1 and Figure 2. The west side of the site rises onto a broad-backed ridge that continues ascending to the west. On the north, the bowl opens onto a west to east trending drainage swale, the axis of which is located roughly 20 to 30 feet north of the property line, per Mercer Island GIS. The drainage continues under East Mercer Way, down to discharge into Lake Washington.

The ridge line is vegetated with scattered conifer and deciduous trees, and the bowl area was generally grassy at the time of our reconnaissance, as shown in Plate 1. Overall, the site gives the appearance of having been excavated, possibly to provide sandy aggregate for construction purposes, and then backfilled. It is also possible that the area was part of the general stream drainage system, and the drainage was backfilled to provide building sites and road access.

During our site visits, we did not observe evidence of recent slope instability such as slide scarps or tension cracks within the subject property. In addition, no recent or historical slides have been mapped on or directly adjacent to the subject property. Review of the recent Lidar image of the area shows the steep road cut of East Mercer Way on the south side of the south ridge line, described above, and the bowl area, but shows no other features that may suggest slope instability in the subject area.

Conclusions: Based on our reconnaissance, review of existing data, and our understanding of subsurface conditions at the site, in our opinion neither shallow nor large, deep-seated-type slope failures are likely to adversely affect the proposed development. In addition, in our opinion the proposed development, located in the mostly gently sloping portion of the site, will not adversely affect the stability of the site, or the stability of adjacent sites.

5.3 Seismic Hazards

Based on our review of the City of Mercer Island's Geologic Hazards Maps, the project site is mapped in a seismic hazard area. The City of Mercer Island Code defines seismic hazard areas as those areas subject to risk of damage as a result of earthquake-induced ground shaking, slope failure, soil liquefaction or surface faulting.

Based on our subsurface explorations, the site is underlain by primarily dense silty sand, and a static groundwater level was not encountered in the test borings. Based on these conditions, in our opinion the liquefaction potential of the soils underlying the site is low, and design considerations related to soil liquefaction are not necessary for this project.

It is also our opinion that the potential for significant deep-seated seismic-induced land sliding is low at the site due to the underlying dense sand. Provided the proposed project is designed and constructed in accordance with the recommendations in the report, the developed portion of the site should not be adversely affected during the code-level seismic event.

6.0 GEOTECHNICAL RECOMMENDATIONS

6.1 Seismic Design Considerations

6.1.1 Site Class

We understand that the project will be designed in accordance with the 2021 editions of the International Building Code (IBC), and ASCE 7-16, which specifies a design earthquake having a 2% probability of occurrence in 50 years (return interval of 2,475 years). For design purposes, Site Class D (Stiff Soil) is considered appropriate for the seismic design for the project site.

6.1.2 Liquefaction

Liquefaction is a process that can occur when soil loses its shear strength for short periods of time during a seismic event. Ground shaking of sufficient strength and duration results in the loss of grain-to-grain contact and an increase in pore water pressure, causing the soil to behave as a fluid. Soils with a potential for liquefaction are typically cohesionless, predominately silt and sand sized, must be loose to medium dense, and be below the groundwater table.

Based on our subsurface explorations, the site is underlain by primarily dense silty sand, and a static groundwater level was not encountered in the test borings. Based on these conditions, in our opinion the liquefaction potential of the soils underlying the site is low, and design considerations related to soil liquefaction are not necessary for this project.

6.2 Foundation Recommendations

Based on the results of our test borings and our understanding of the project design, we anticipate that the majority of the building footings will bear on competent native soils, and the remainer of the foundation will bear on loose, undocumented fill. Foundations bearing on the loose, undocumented fill are expected to experience undesirable settlements, and are therefore spread footings are not recommended when the loose soils are present at the footing elevation.

Based on our current understanding of the proposed design, the house foundations under the west, south and the southern half of the east wall will likely bear on competent bearing soils. The garage footings will also likely bear on or near competent soils. However, we anticipate the north perimeter footing, the entry way footings to the north of the house, and the northern half of the east wall footing will bear on unsuitable soils. When unsuitable soils are present, the soils will need to be over-excavated down to the competent soils, or, driven pin piles may be used to support the footings in these areas to reduce the amount of earthwork associated with over-excavations and backfill.

The following sections present our design recommendations for conventional footings and driven pin piles.

6.2.1 Conventional Footings

Footings should bear on the undisturbed native medium dense to dense soils, or on properly compacted structural fill placed on the undisturbed medium dense to dense native soils. For planning purposes, we recommend assuming that most of the perimeter footings, as well as the interior footings will bear on suitable bearing soil. Footing locations along the north wall, and the northern half of the east wall, will most likely require over-excavation of the unsuitable soil and replacement with lean-mix concrete or structural fill, as described below. Alternatively, where over-excavation becomes too deep, pin piles, as described below, may be used in lieu of over-excavation.

6.2.1.1 Over-excavation & Replacement

The over-excavation should be backfilled with lean-mix concrete (1½ sack of cement per cubic yard, minimum) or properly compacted structural fill, such as 1¼-inch minus crushed rock, or approved equivalent. If lean-mix is used, the over-excavation should extend horizontally at least one foot beyond the edge of the footings. If structural fill is utilized, the fill should extend horizontally out from the edge of the footing a distance equal to one-half of the over-excavation depth. As such, to limit the amount of earthwork, if over-excavations more than about 3 feet are required, we recommend lean-mix be used as backfill.

6.2.1.2 Allowable Bearing Pressure

A maximum allowable soil bearing pressure of 3,000 pounds per square foot may be used to size footings bearing on the undisturbed medium dense to dense native soils, or structural fill placed over the native soils. For allowable stress design, the recommended allowable bearing pressure may be increased by one-third for transient loading conditions such as those due to wind and seismic forces. For frost protection considerations, footings should be placed at least 18 inches below adjacent finished grade.

6.2.1.3 Lateral Resistance

Lateral loads acting on footings may be resisted by passive earth pressure developed against the embedded portion of the footings and by frictional resistance developed at the base of the footings.

- An allowable frictional coefficient of 0.4 may be used to evaluate sliding resistance.
- An allowable passive soil resistance may be calculated using an equivalent fluid pressure of 300 pcf, assuming the footings are backfilled with structural fill and level ground surface. Unless covered by pavements or slabs, the passive resistance in the upper 12 inches of soil should be neglected.

The above values include a geotechnical factor of safety of 1.5.

6.2.1.4 Footing Drains

Footing drains should be installed around the perimeter of the building, at or just below the bottom of the footings. Under no circumstances should roof downspout drain lines be connected to the footing drain systems. Roof downspouts must be separately tightlined to appropriate discharge locations. Cleanouts should be installed at strategic locations to allow for periodic maintenance of the footing drain and downspout tightline systems.

6.2.1.5 Footing Subgrade Preparation

Footing subgrades should be carefully prepared and should not contain loose, soft, or disturbed soils. The adequacy of footing subgrades should be verified by a representative of PanGEO prior to placing forms or rebar. The footing subgrades should be in a dense and unyielding condition prior to pouring concrete.

Please note that the site soils are moderately to highly moisture sensitive and can become disturbed and softened when exposed to moisture and construction traffic. Sandy soils with low fines content are also vulnerable to disturbance by general foot traffic. Protection of the foundation bearing soils should be the responsibility of the contractor.

6.2.1.6 Foundation Performance

Total and differential settlements are anticipated to be within tolerable limits for footings designed and constructed as discussed above. Footing settlement under static loading conditions is estimated to be about ¾-inch, and differential settlement across the structure should be about ½ inch or less. If driven pin piles are utilized, we estimate settlement of the pile-supported foundation to be on the order of ¼-inch. As such, differential settlements between spread footings and the pin pile supported foundation should be on the order of ½ inch or less. Most settlement will be realized during construction as the dead loads are applied.

6.2.2 Driven Pin Piles

Our test boring PG-2 encountered a layer of loose, disturbed material that extended a maximum of about four feet below the planned finished floor elevation of the basement along the north side of the house. However, based on the site topography, we anticipate that up to about 5 or 6 feet of unsuitable soils may be present near the northeast corner of the house, as projected in the attached Figure 3. As such, in lieu of over-excavation and replacement, we anticipate that utilizing a driven pin pile foundation may be more cost effective along the north wall, and northern half of the east wall. However, if competent soils are encountered at sufficiently shallow depth for over-excavation and replacement to be feasible during construction, PanGEO will work with the structural engineer, as desired, to reduce the required number of pin piles and revise the foundations to spread footings.

Small diameter pin piles are utilized to transfer the structure loads through the weak and marginal soils to the underlying competent bearing layer. Pin piles of 3- to 4- inches in diameter are typically utilized for projects such as the subject residence. However, 6-inch diameter piles may also be used, which have a higher vertical capacity. Three- to six-inch pin piles are typically installed using small to large hammers (600 to 4,700 lbs) mounted on small to medium-sized excavators.

6.2.2.1 Pin Pile Sizes

We have provided recommendations for 3-, 4-, and 6-inch diameter pipe piles. The structural engineer should evaluate the pile sizing and spacing based on the design loads and pile capacities.

6.2.2.2 Pin Pile Capacity

The following allowable axial compression capacities can be used per pile assuming a factor of safety of at least 2.0:

- 6 tons (12 kips) per 3-inch diameter pile
- 10 tons (20 kips) per 4-inch diameter pile
- 15 tons (30 kips) per 6-inch diameter pile

Penetration resistance required to achieve the capacities will be determined based on the hammer used to install the pile. The tensile capacity of pin piles should be ignored in design calculations.

6.2.2.3 Pin Pile Specifications

We recommend that the following specifications be included on the foundation plan:

1. 3-inch, 4-inch, and 6-inch diameter piles should consist of Schedule-40, ASTM A-53 Grade “A” pipe.

2. 3-inch piles shall be driven to refusal with a minimum 600-lb hydraulic hammer. We recommend the following refusal criteria based on the size of hammer utilized:

Hammer Size	Blow per Minute	Refusal Criteria (3-inch pile)
600 lbs	1000	12 seconds per inch
850 lbs	900	10 seconds per inch
1100 lbs	900	6 seconds per inch

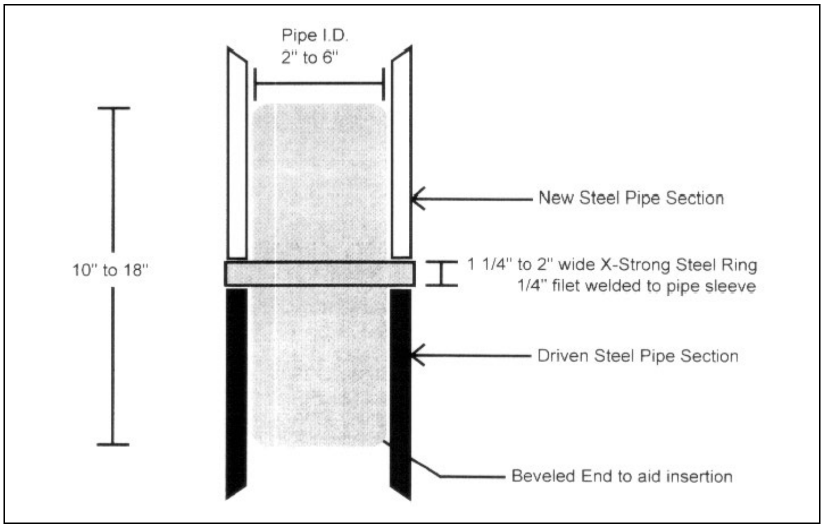
3. 4-inch piles shall be driven to refusal with a minimum 850-lb hydraulic hammer. We recommend the following refusal criteria based on the size of hammer utilized:

Hammer Size	Blow per Minute	Refusal Criteria (4-inch pile)
850 lbs	900	16 seconds per inch
1100 lbs	900	10 seconds per inch
2000 lbs	600	4 seconds per inch

4. 6-inch piles shall be driven to refusal with a minimum 2000-lb hydraulic hammer. We recommend the following refusal criteria based on the size of hammer utilized:

Hammer Size	Blow per Minute	Refusal Criteria (6-inch pile)
2000 lbs	600	10 seconds per inch
3000 lbs	500	6 seconds per inch
4700 lbs	500	4 seconds per inch

5. Piles shall be driven in nominal sections and connected with compression fitted sleeve couplers (see following detail – Courtesy of McDowell Pile King, Kent, WA). We discourage welding of pipe joints, particularly when galvanized pipe is used, as we have observed welds break during driving.



6. At least 3% (but no more than 5) of the 3-inch, 4-inch, and 6-inch pin piles should be load tested to verify the driving criteria listed above. The load tests should be performed prior to installed production piles. If more than one size of pipe pile is used, each pipe size should be subject to separate testing. Contractors may elect to use a different hammer system and driving criteria, provided that the driving criteria for the selected hammer can be verified with the load test program.

7. All load tests shall be performed in accordance with the procedure outlined in ASTM D1143 - *Standard Test Methods for Deep Foundations Under Static Axial Compressive Load*. The maximum test load shall be 2 times the design load. The objective of the testing program is to verify the adequacy of the driving criteria, and the efficiency of the hammer used for the project.

8. The geotechnical engineer of record or his/her representative shall provide full time observation of pile installation and testing.

6.2.2.4 Installation Monitoring

As it is not possible to observe the completed pile below the ground, judgment and experience must be used as the basis for determining the acceptability of a pile. Therefore, all piles should be installed under the full-time observation of a representative of PanGEO. This will allow us to fully evaluate the contractor's operation, collect and interpret the installation data, and verify bearing stratum elevations.

The quality of a pin pile foundation is dependent, in part, on the experience and professionalism of the installation company. We recommend that a company with experienced personnel be selected to install the piles. Furthermore, we will also understand the implications of variations from normal procedures with respect to the design criteria. The contractor's equipment and procedures should be reviewed by PanGEO before the start of construction.

6.2.2.5 Lateral Resistance

The lateral capacity of pin pipes is very limited and should not be used in design. Therefore, lateral forces from wind or seismic loading should be resisted by the passive earth pressures acting against the pile caps and below-grade walls or from battered piles [batter no steeper than 3(H):12(V)]. Friction at the base of pile-supported footings and grade beam should be ignored in the design calculations.

Passive resistance values may be determined using an equivalent fluid weight of 300 pounds per cubic foot (pcf), assuming level ground surface in front of the footings. This value includes a safety factor of about 1.5 assuming that properly compacted granular fill will be placed adjacent to the pile caps and grade beams, and level ground surface.

6.2.2.6 Estimated Pile Length

The required pile length in order to develop the recommended pile capacity is expected to vary across the footprint of the structure, depending on the actual driving conditions encountered. Based on the soil conditions encountered in our test borings, we anticipate penetrations of about 15 to 20 feet may be needed below the pile caps. A minimum pile length of 8 feet (below final basement level) should also be specified in the plans.

6.2.2.7 Pin Pile Performance

It is our experience that the driven pipe pile foundations should provide adequate support with total settlements on the order of ¼- to ½-inch.

6.2.2.8 Obstructions

Obstructions may be encountered during pile installation. Where possible, the obstructions should be removed to facilitate pile driving. If obstructions cannot be removed, the structural engineer of record should be notified to revise the pile layout to accommodate moving the piles as needed.

6.3 FLOOR SLABS

6.3.1 Concrete Slab-on-grade

A slab-on-grade may be used for the basement floor of the proposed building. However, loose/soft soils may be present below the slab elevation in some areas of the house footprint. In these areas there is a potential for some slab settlement to occur over the design life of the structure, which can result in cracks and uneven floor surfaces.

To reduce the potential of slab settlement and distress in these areas, we recommend that the floor slab subgrade (below the base of the capillary break material, as outlined below) be over-excavated by at least 12 inches, and existing fill or native subgrade soil recompacted to a firm and unyielding condition. Any soft/loose and pumping native subgrade soil observed during compaction should be removed and replaced with granular structural fill. If more than two feet of unsuitable soils are present, to improve subgrade, we recommend that a layer of geogrid reinforcement be placed over the native subgrade prior to placement and compaction of structural fill. The geogrid should be overlapped a minimum of 12-inches. We also recommend that construction joints be incorporated into the floor slab to control cracking.

6.3.2 Structural Slab

If a higher level of slab performance is desired than described above for slab-on-grades, a structural slab can be designed to span between foundations. If a structural slab is utilized, the existing loose/soft soils below the slab may be left in place without re-compaction or replacement. A capillary break and vapor barrier should be placed below the slab, as described below. We recommend a structural slab when the floor surface will receive settlement sensitive floor coverings, such as tile, or if the exposed floor will be polished concrete.

6.3.3 Capillary Break

The capillary break material should consist of at least 4 inches of free-draining, clean (less than 3 percent fines) crushed rock compacted to a firm and unyielding condition. The capillary break material should have no more than 10 percent and 5 percent by weight of material passing the U.S. Standard No. 4 and No. 100 sieves, respectively. We also recommend that a 10-mil polyethylene vapor barrier be placed below the slab.

6.4 Retaining and Below-Grade Walls

Free standing retaining walls and below-grade foundation walls should be properly designed to resist the lateral earth pressures exerted by the soils behind the walls. The current design includes basement walls and low concrete cantilever walls along the north and west sides of the property. The upslope walls to the west and south will not have final exposed faces of about 3 to 5 feet high. Basement walls may be up to 9 feet high on the west side of the house.

Proper drainage provisions should be provided behind the walls to intercept and remove groundwater that may be present behind the wall. Our geotechnical recommendations for the design and construction of the retaining and below-grade walls are presented in the sections below.

6.4.1 Concrete Wall Foundation Support

The footing recommendations outlined in Section 6.2 of this report are also applicable for the walls. For walls with fore-slopes, with a maximum height of 5 feet, we recommend that the footing be embedded a minimum of 2 feet below the finished grade in front of the wall.

6.4.2 Lateral Earth Pressures

Concrete cantilever walls should be designed for an equivalent fluid pressure of 35 pcf for level backfills behind the walls, assuming the walls are free to rotate. If walls are to be restrained at the top from free movement, such as basement walls, equivalent fluid pressures of 50 pcf should be used for level backfills behind the walls. Walls with a maximum 2H:1V backslope should be designed for an active and at rest earth pressure of 50 and 65 pcf, respectively. The recommended lateral pressures assume that the backfill behind the wall consists of free draining and properly compacted fill with adequate drainage provisions to prevent the development of hydrostatic pressure.

Permanent walls should be designed for an additional uniform lateral pressure of 9H psf for seismic loading, where H corresponds to the buried depth of the wall in feet. The recommended lateral pressures assume that the backfill behind the wall consists of a free draining and properly compacted fill with adequate drainage provisions.

6.4.3 Wall Surcharge

The retaining and basement walls should be designed to resist surcharge pressures, if present, within the height dimension of the wall. As a minimum, for anticipated cars and delivery vans, the traffic surcharge may be considered as 90 psf of horizontal uniform pressure. Similarly, surcharge loads from construction equipment or soil/material stockpiles should be considered in the retaining and basement wall design during construction. We recommend that Figure 4 be used to calculate the lateral pressure on the face of the wall face resulting from surcharge loading.

6.4.4 Lateral Resistance

Lateral forces from wind or seismic loading and unbalanced lateral earth pressures may be resisted by a combination of passive earth pressures acting against the embedded portions of the foundation, and by friction acting on the base of the footings. For pile supported walls, friction should not be accounted for at the base of the grade beam. Passive resistance values may be determined using an equivalent fluid weight of 300 pounds per cubic foot (pcf). This value includes a safety factor of about 1.5 assuming that properly compacted granular fill will be placed adjacent to the footings and level ground surface. If there is a slope descending below the wall, the passive pressure will be significantly reduced, and PanGEO can provide an acceptable value based on the specific geometry and soil conditions at the wall location. An allowable frictional coefficient of 0.4 may be used to evaluate sliding resistance at the base of a footing. This value includes a geotechnical factor of safety of 1.5.

6.4.5 Wall Drainage

Provisions for permanent control of subsurface water should be incorporated into the design and construction of the below-grade walls. As a minimum, 4-inch diameter perforated drainpipes should be installed behind and at the base of the wall footings, embedded in 12 to 18 inches of crushed rock or washed gravel. The gravel should be wrapped in a geotextile filter fabric to prevent the migration of fines into the drain system. The drainpipe should be graded to direct water to a suitable outlet.

Under no circumstances should roof downspout drain lines be connected to the perforated footing/wall drain systems for basement walls. Roof downspouts must be separately tightlined to appropriate discharge locations. Cleanouts should be installed at strategic locations to allow for periodic maintenance of the footing drain and downspout tightline systems.

6.4.6 Wall Backfill

In our opinion, the on-site excavated soils are not suitable for use as wall backfill. We recommended that wall backfill should consist of free draining granular structural fill as defined in Section 7.3 of this report.

Wall backfill should be moisture conditioned to within about 3 percent of optimum moisture content, placed in loose, horizontal lifts less than 8 inches in thickness, and systematically compacted to a dense and relatively unyielding condition and to at least 95 percent of the maximum dry density, as determined using test method ASTM D-1557 (Modified Proctor). Within 5 feet of the wall, the backfill should be compacted with hand-operated equipment to at least 90 percent of the maximum dry density.

6.4.7 Damp-proofing/Waterproofing

We recommend the designers consider utilizing a waterproofing material, such as prefabricated clay mats, or other measures, on the exterior of all below grade foundation walls to reduce the potential for moisture intrusion into the below-grade portion of the homes. We recommend that a waterproofing or building envelope specialty consultant be retained to provide details regarding waterproofing measures, as waterproofing is beyond the scope of our work.

6.5 Permanent Cut and Fill Slopes

Based on the anticipated soil that will be exposed at the site, we recommend permanent cut and fill slopes be constructed no steeper than 2H:1V (Horizontal:Vertical). Any proposed permanent slopes with a relief of more than 8 feet should be evaluated by PanGEO on a case-by-case basis.

Cut slopes should be observed by PanGEO during excavation to verify that conditions are as anticipated. Supplementary recommendations can then be developed, if needed, to improve stability. Fill slopes must consist of properly placed and compacted structural fill, with careful compaction out to the slope face. Proper compaction may require the need to over-build the slope and then cut it back to the desired final condition. All fill must be placed on horizontal benches, and adequately keyed into the native soil. If fill slopes are proposed, PanGEO will need to assist the design team by providing specific recommendations for the fill slope proposed.

Permanently exposed slopes should be treated with permanent erosion control measures as soon as possible to improve stability of the surficial layer of soil.

6.6 Permanent Drainage

Based on currently available plans, we understand that stormwater from paved areas and roof drains will generally be collected and channeled into a stormwater detention vault located on the north side of the house. Based on our understanding of the plans, excavation of the vault area will be up to 10 feet deep, will be in the loose fill and alluvium, and will likely require shoring (see Section 7.4.2).

Permanent control of surface water and roof runoff should be incorporated in the final grading design. In addition to these sources, irrigation and rainwater infiltrating into landscape and planter areas adjacent to paved areas or building walls should also be controlled. All collected runoff should be directed into conduits that carry the water away from the pavement, structure, and steep slope; and into appropriate outlets. Adequate surface gradients should be incorporated into the grading design such that surface runoff is directed away from structures and steep slope.

Under no circumstances should collected surface water or downspout drains be allowed to discharge onto open slopes or behind walls. Furthermore, it is important to note that roof downspouts should be tightlined to a suitable outlet, and not discharged into the wall or perimeter footing drain system.

6.7 Permanent Erosion Control Considerations

Permanent erosion control measures such as covering exposed ground surfaces with topsoil or mulch, and installing landscaping, should be performed as soon as possible after construction to limit the time the exposed surfaces are susceptible to erosion.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Site Preparation

Site preparation for the proposed project includes clearing, grubbing, and excavations to the design subgrade. All stripped surface materials should be properly disposed of off-site.

Following site excavations, the adequacy of the subgrade where structural fill, foundations, slabs, or pavements are to be placed should be verified by a representative of PanGEO. The subgrade soil in the improvement areas, if recompacted and still yielding, should be over-excavated and replaced with compacted structural fill.

7.2 Material Reuse

The soils at the site are moisture sensitive and will become disturbed / soft when exposed to inclement weather conditions. In our opinion, the on-site soils are not suitable to be reused as structural fill. In the context of this report, structural fill is defined as compacted fill placed under footings, pavements, concrete stairs, landings, and slabs, or other load-bearing areas. Material for use as structural fill is described in the following section.

The on-site soil may potentially be used as general fill in the non-structural and landscaping areas. If use of the on-site soil is planned, the excavated soil should be stockpiled and protected with plastic sheeting to prevent softening from rainfall in the wet season.

7.3 Structural Fill Placement and Compaction

For planning purposes, structural fill should consist of imported, well-graded, granular material such as Seattle Type 17 Mineral Aggregate (*COS Standards and Specifications, 2023, Section 9-03.14*), WSDOT Gravel Borrow (*WSDOT Standards and Specifications, 2025, Section 9-03.14(1)*), or an approved equivalent.

Structural fill should be moisture conditioned near its optimum moisture content, placed in loose, horizontal lifts less than 8 inches in thickness, and systematically compacted to a dense and relatively unyielding condition. The adequacy of the compaction should be verified by PanGEO. If density tests are performed, the test results should indicate at least 95 percent of the maximum dry density, as determined using test method ASTM D1557 (modified proctor). For utility backfill or backfill within 5 feet of retaining walls, the backfill should be compacted to at least 90 percent of the maximum dry density.

The procedure to achieve proper density of a compacted fill depends on the size and type of compacting equipment, the number of passes, thickness of the lifts being compacted, and certain soil properties. We recommend that structural fill supporting foundations be compacted with jumping jack compactors at a minimum. If the excavation to be backfilled is constricted and limits the use of heavy equipment, smaller equipment can be used, but the lift thickness will need to be reduced to achieve the required relative compaction. PanGEO can provide additional recommendations regarding structural fill and compaction during construction.

Generally, loosely compacted soils are a result of poor construction technique or improper moisture content. Soils with high fines contents are particularly susceptible to becoming too wet and coarse-grained materials easily become too dry, for proper compaction. Silty or clayey soils with a moisture content too high for adequate compaction should be dried as necessary, or moisture conditioned by mixing with drier materials, or other methods.

7.4 Temporary Excavations

7.4.1 Temporary Open Cuts

All temporary excavations should be performed in accordance with Part N of WAC (Washington Administrative Code) 296-155. The contractor is responsible for maintaining safe excavation slopes and/or shoring. All temporary excavations deeper than a total of 4 feet should be sloped or shored. Temporary excavations less than 4 feet along the property lines should also be sloped or shored.

For planning purposes, we recommend that temporary excavations be sloped no steeper than 1H:1V (Horizontal:Vertical). If temporary excavations are not in the fill, but in the dense native soil, steeper excavations may be feasible, based on PanGEO's field observations and the configuration of the excavations.

The temporary excavations and cut slopes should be re-evaluated in the field during construction based on actual observed soil conditions. If groundwater seepage is encountered the temporary slope will likely need to be cut to shallower angles to maintain stability, or require shoring. During wet weather, runoff water should be prevented from entering excavations and the exposed slopes should be covered with plastic sheets.

7.4.2 Temporary Shoring

As described above, the excavation for the stormwater detention system is located at the northeast corner of the subject site, close to the north property line. The planned excavation for the control structure is up to 10 feet deep, with the vault excavation possibly being nearly as deep in places. As such, shoring will most likely be required for the installation of these structures. We anticipate that trench boxes or similar conventional temporary shoring systems should provide adequate protection for the installation of these facilities.

7.4.3 Groundwater Impacts

As described above, based on the results of PG-2, we anticipate perched groundwater may be present about 13½ feet below the ground surface. However, the field exploration was conducted in March, when groundwater levels are not expected to be at their maximum. Excavation contractors should be prepared to deal with groundwater impacts, particularly during wet times of the year. We anticipate such impacts should be relatively minimal, and groundwater seepage from building excavations can likely be controlled with sumps and pumps.

7.4.4 Surcharge Avoidance

We also recommend that heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed within a distance equal to 1/3 the slope height from the top of any excavation.

7.5 TEMPORARY EROSION AND DRAINAGE CONSIDERATIONS

We recommend that the exposed temporary slopes be covered with plastic sheeting.

Surface runoff can be controlled during construction by careful grading practices. Typically, this includes the construction of shallow, upgrade perimeter ditches or low earthen berms in conjunction with silt fences to prevent water from entering excavations or to prevent turbid runoff from leaving the work site.

Temporary erosion control may require the use of hay bales on the downhill side of the project to prevent water from leaving the site and potential storm water detention to trap sand and silt before the water is discharged to a suitable outlet. All collected water should be directed under control to an appropriate / approve discharge point or outlet.

We recommend that the contractor should be prepared to provide temporary groundwater control methods, especially if excavation is conducted in the wet season. If present, we anticipate that the groundwater can likely be controlled with sumps and pumps.

7.6 WET EARTHWORK RECOMMENDATIONS

General recommendations relating to earthwork performed in wet weather or in wet conditions are presented below:

- All surfaces of the foundation subgrade should be protected against inclement weather. It is the contractor's responsibility to protect the footing subgrade from disturbance. One option is to place a 2- to 3-inch-thick layer of lean-mix concrete or 3 to 4 inches of clean crushed rock on the footing subgrade as soon as the subgrade is exposed.

- Earthwork should be performed in small areas to minimize subgrade exposure to wet weather. Excavation or the removal of unsuitable soil should be followed promptly by the placement and compaction of clean structural fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance.

- During wet weather, the allowable fines content of the structural fill should be reduced to no more than 5 percent by weight based on the portion passing ¾-inch sieve. The fines should be non-plastic.

- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water.

- Geotextile silt fences should be strategically located to control erosion and the movement of soil. Erosion control measures should be installed along all the property boundaries.

- Excavation slopes and soils stockpiled on site should also be covered with plastic sheets.

8.0 ADDITIONAL SERVICES

We anticipate the City of Mercer Island will require a plan review and geotechnical special inspections to confirm that our recommendations are properly incorporated into the design and construction of the proposed development. Specifically, we anticipate that the following construction support services may be needed:

- Review final project plans and specifications;
- Verify implementation of erosion control measures;
- Observe the stability of open cut slopes;
- Monitor pin pile installation and testing;

- Confirm the adequacy of the compaction of structural backfill;
- Observe installation of subsurface drainage provisions, and;
- Other consultation as may be required during construction.

Modifications to our recommendations presented in this report may be necessary, based on the actual conditions encountered during construction.

9.0 STATEMENT OF RISK

Per the Mercer Island City Code, development within geologic hazard areas requires a statement of risk. The statement of risk shall meet one of the following criteria:

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;

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

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

d. An evaluation of site-specific subsurface conditions demonstrates that the proposed development is not located in a geologic hazard area.

Based on our understanding of the proposed project, it is our opinion that criterion (a) above, is applicable. PanGEO will be available to review the final design plans to confirm our statement of risk prior to construction.

10.0 LIMITATIONS

We have prepared this report for use by Citizen Design and the project design team. Recommendations contained in this report are based on a site reconnaissance, review of pertinent subsurface information, and our understanding of the project. The study was performed using a mutually agreed-upon scope of work.

Variations in soil conditions may exist between the explorations and the actual conditions underlying the site. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at the site that are different from those described in this report, we should be notified immediately to review the applicability of our recommendations. Additionally, we should also be notified to review the applicability of our recommendations if there are any changes in the project scope.

The scope of our work does not include services related to construction safety precautions. Our recommendations are not intended to direct the contractors' methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design. Additionally, the scope of our work specifically excludes the assessment of environmental characteristics, particularly those involving hazardous substances. We are not mold consultants nor are our recommendations to be interpreted as being preventative of mold development. A mold specialist should be consulted for all mold-related issues.

This report may be used only by the client and for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both off and on-site), or other factors including advances in our understanding of applied science, may change over time and could materially affect our findings. Therefore, this report should not be relied upon after 24 months from its issuance. PanGEO should be notified if the project is delayed by more than 24 months from the date of this report so that we may review the applicability of our conclusions considering the time lapse.

It is the client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk. Any party other than the client who wishes to use this report shall notify PanGEO of such intended use and for permission to copy this report. Based on the intended use of the report, PanGEO may require that additional work be performed and that an updated report be reissued. Noncompliance with any of these requirements will release PanGEO from any liability resulting from the use this report.

Within the limitation of scope, schedule and budget, PanGEO engages in the practice of geotechnical engineering and endeavors to perform its services in accordance with generally accepted professional principles and practices at the time the Report or its contents were prepared. No warranty, express or implied, is made.

We appreciate the opportunity to be of service to you on this project. Please feel free to contact our office with any questions you have regarding our study, this report, or any geotechnical engineering related project issues.

Sincerely,

PanGEO, Inc.

DRAFT *DRAFT*

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11.0 REFERENCES

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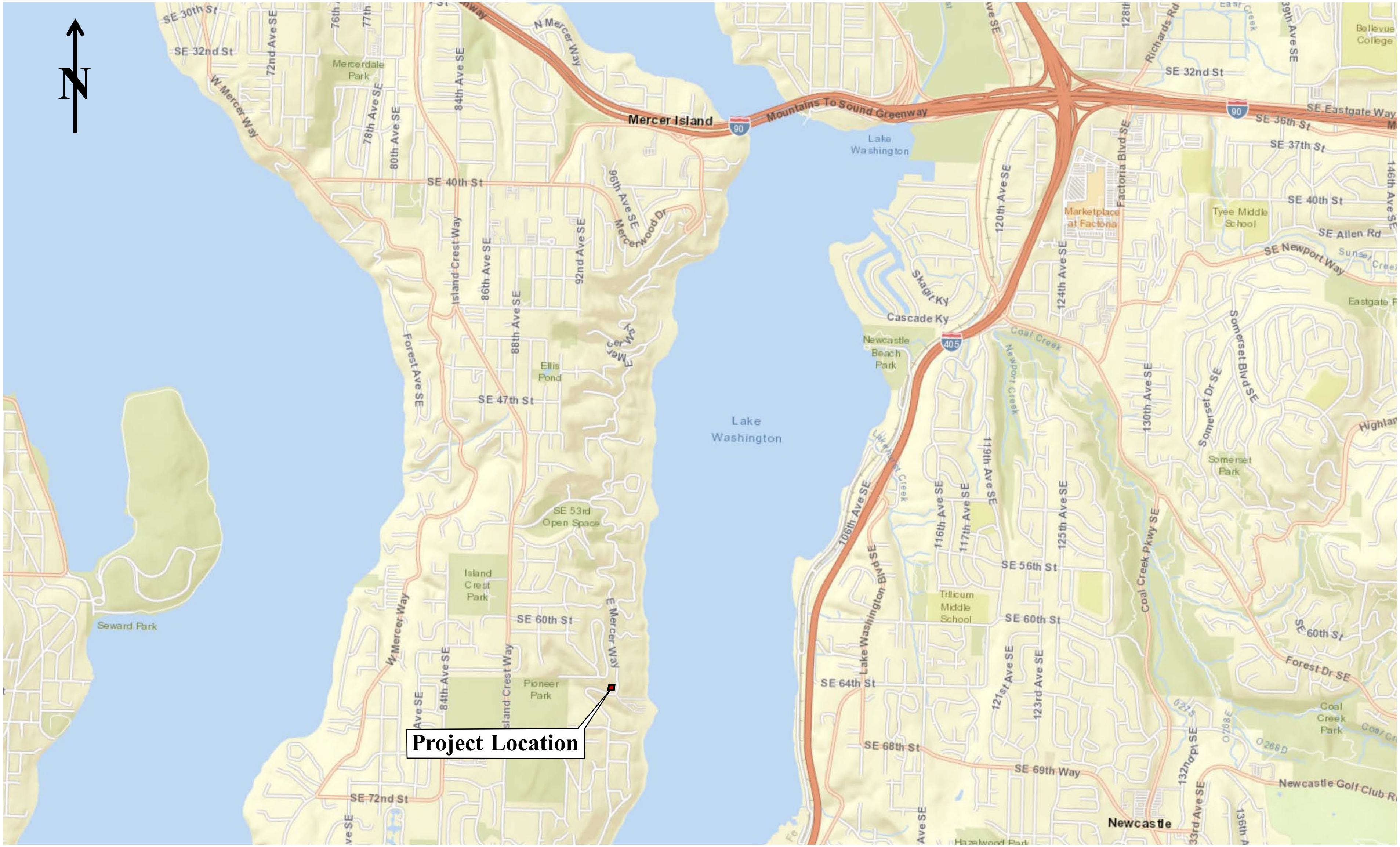
25-036 Vicinity Fig 1.ppt 3/3/2025(12:51 PM) SHE



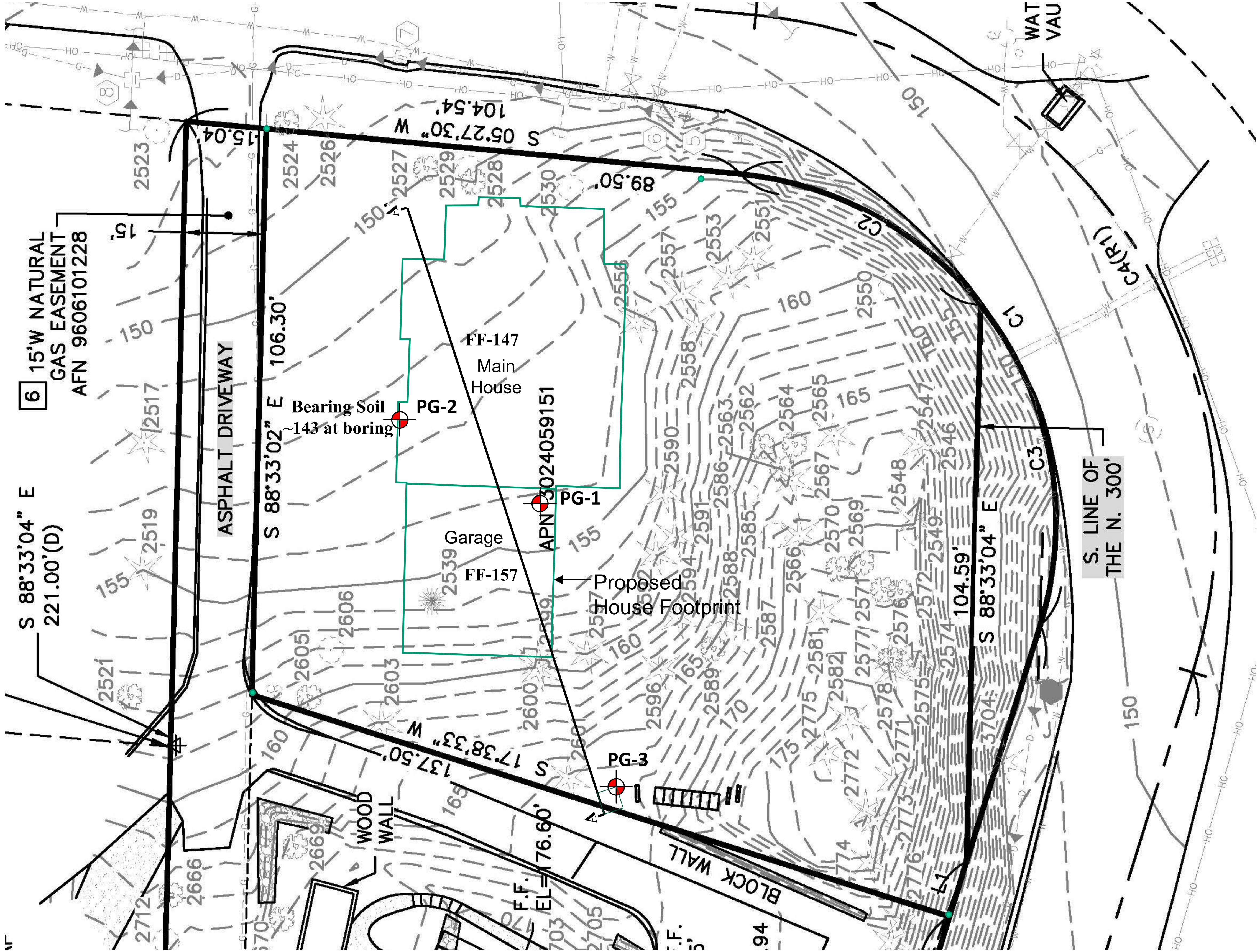
Map not to Scale
Base Map from
Dept of Natural
Resources Geological
Information Portal

PanGEO INCORPORATED

Proposed Single Family Residence
6427 East Mercer Way
Mercer Island, Washington

VICINITY MAP

Project No.	Figure No.
25-036.100	1



Approximate Scale
1"=20'

LEGEND:

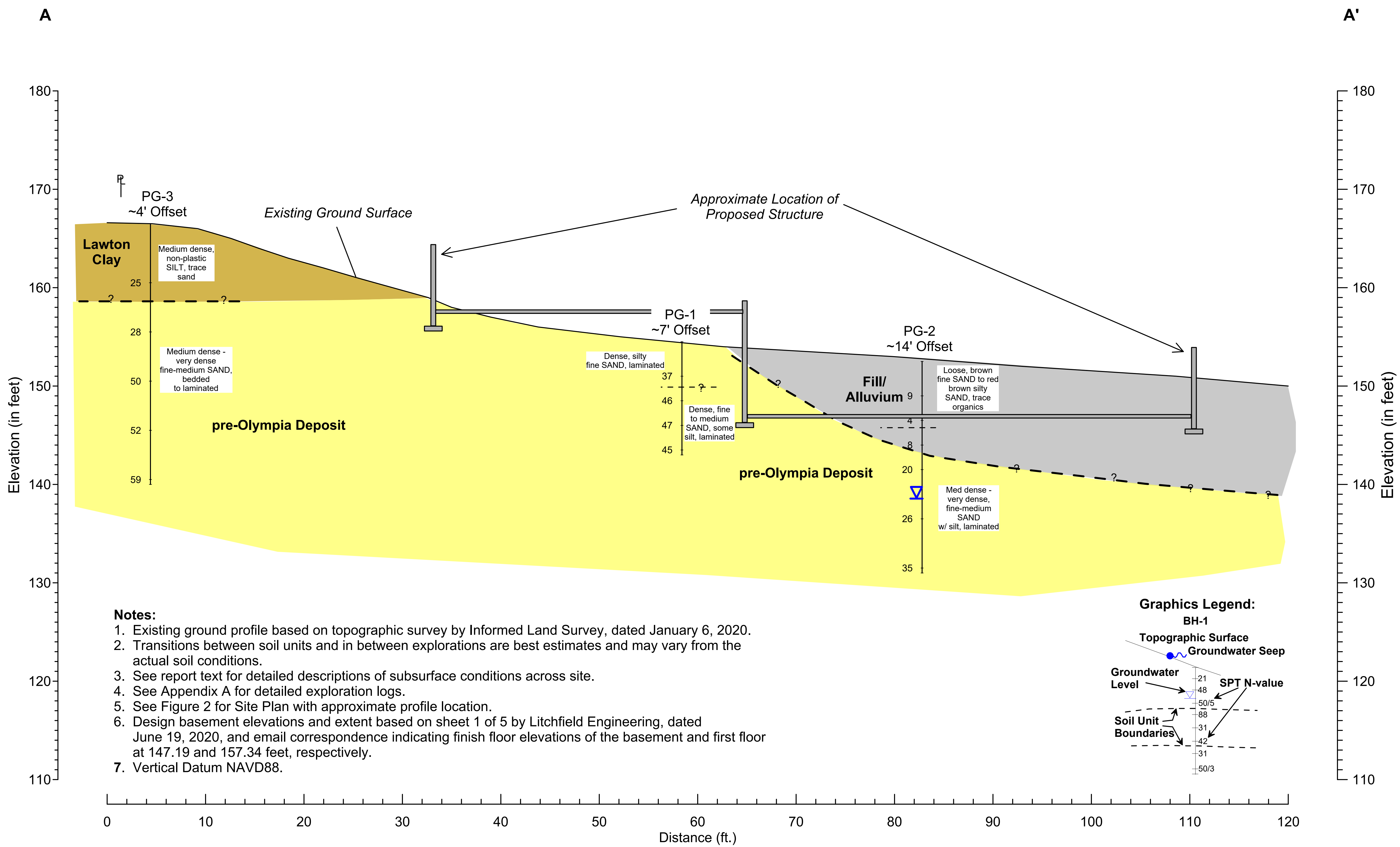
- Approximate Boring Location, PanGEO, Inc., March, 2019
- Subsurface Profile (see Fig 3)

Notes:

1. Topographic Survey by Informed Land Survey, dated January 6, 2020.
2. Vertical Datum NAVD 88

PanGEO INCORPORATED	Proposed Single Family Residence 6427 East Mercer Way Mercer Island, Washington	SITE AND EXPLORATION PLAN	
		Project No. 25-036.100	Figure No. 2

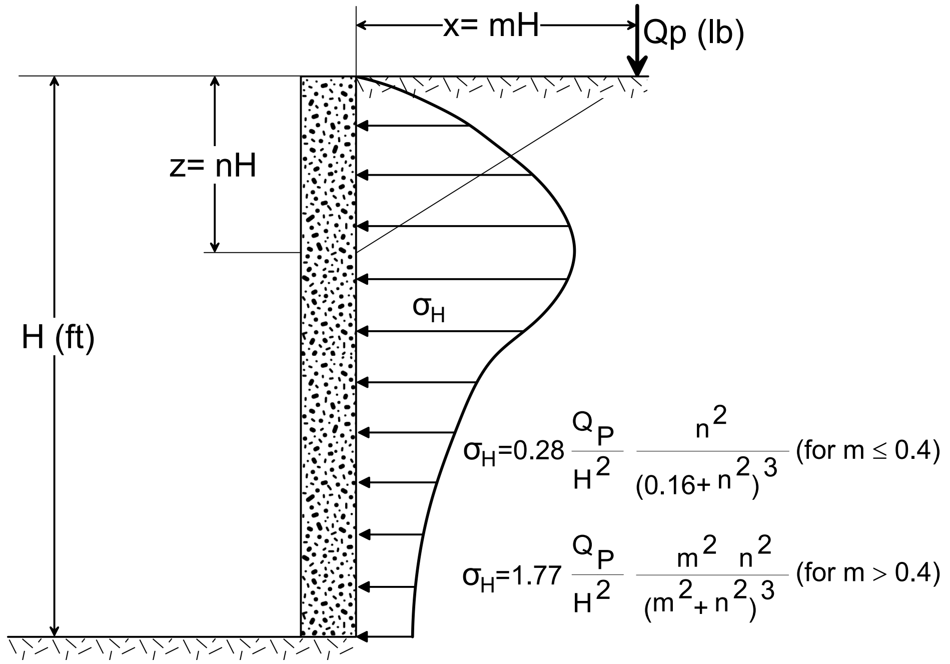
25-036 Site Exploration.ppt 3/3/2025(10:12 AM) SHE



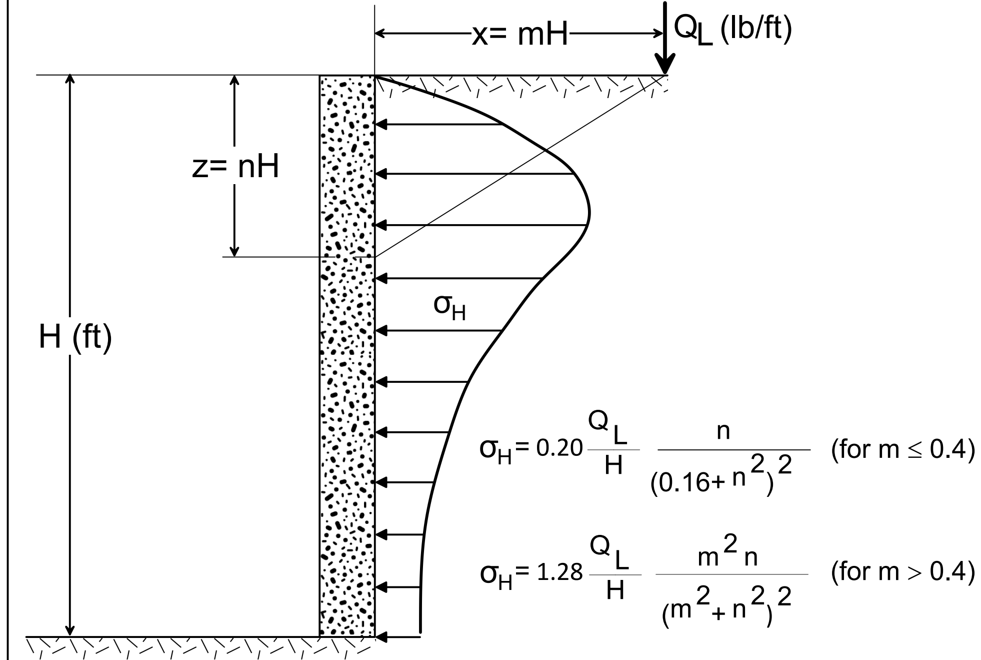
Notes:

1. Existing ground profile based on topographic survey by Informed Land Survey, dated January 6, 2020.
2. Transitions between soil units and in between explorations are best estimates and may vary from the actual soil conditions.
3. See report text for detailed descriptions of subsurface conditions across site.
4. See Appendix A for detailed exploration logs.
5. See Figure 2 for Site Plan with approximate profile location.
6. Design basement elevations and extent based on sheet 1 of 5 by Litchfield Engineering, dated June 19, 2020, and email correspondence indicating finish floor elevations of the basement and first floor at 147.19 and 157.34 feet, respectively.
7. Vertical Datum NAVD88.

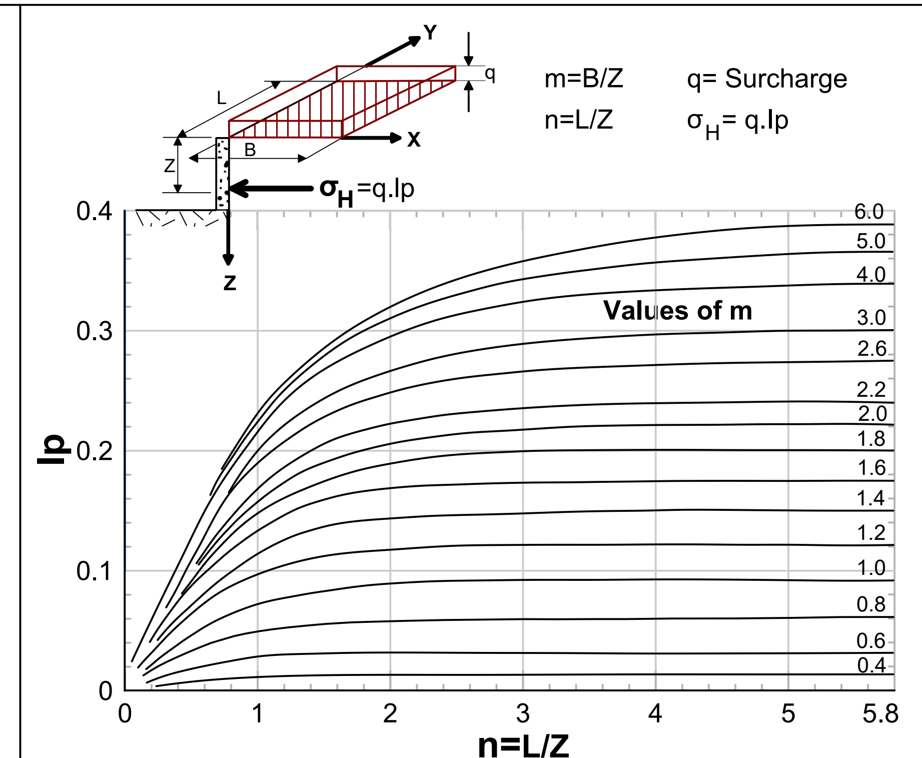
PanGEO INCORPORATED	Proposed Single Family Residence 6427 East Mercer Way Mercer Island, Washington	GENERALIZED SUBSURFACE PROFILE SECTION A-A'
	Project No. 25-036.100	Figure No. 3



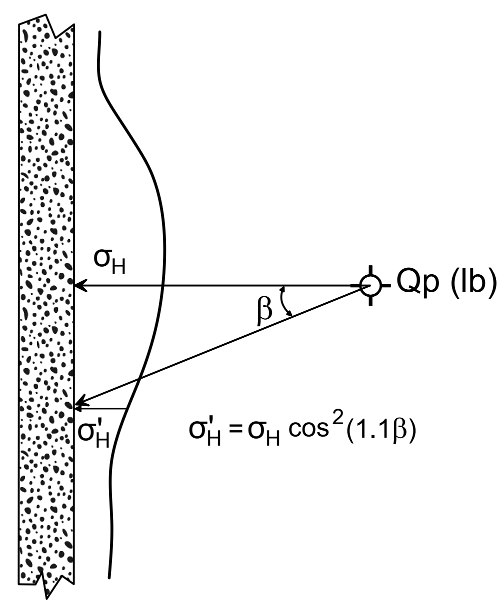
A-1) Lateral Pressure Due to Point Load- Elevation View



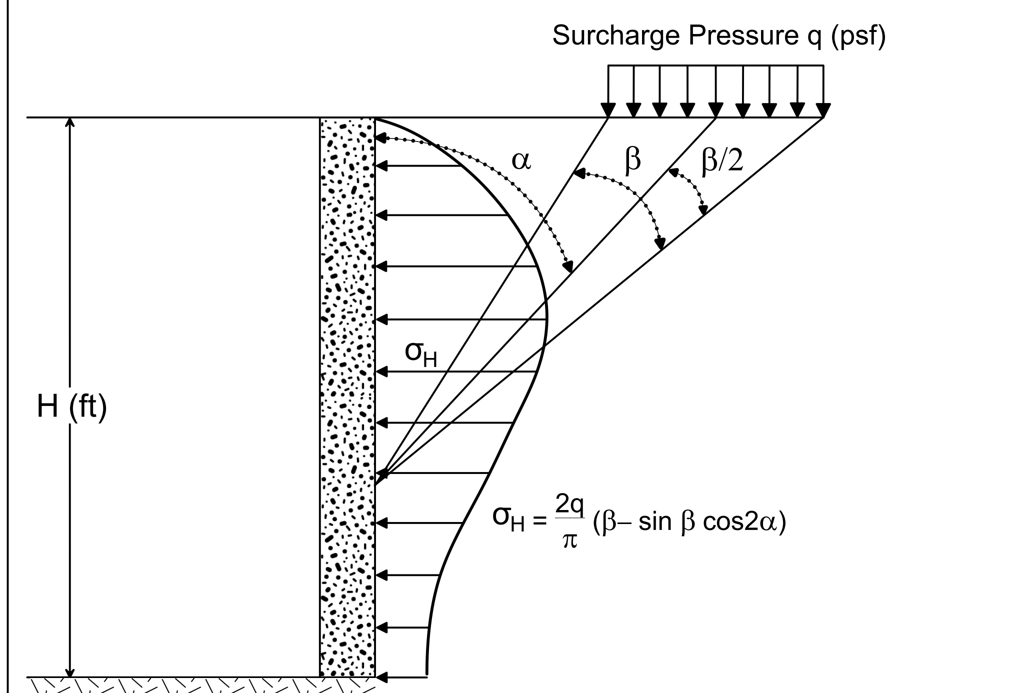
B) Lateral Pressure Due to Line Load-Parallel to the Wall



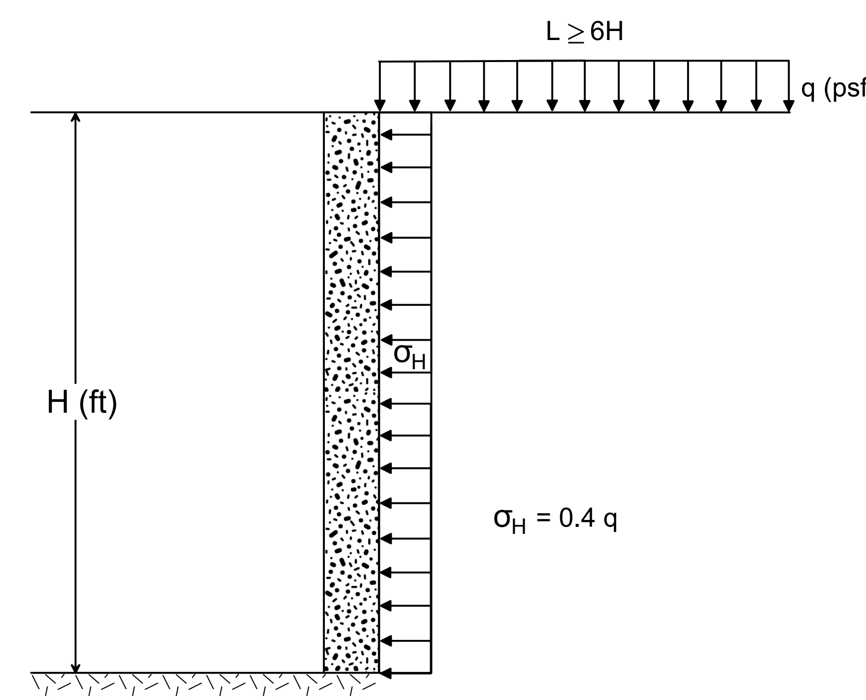
D) Lateral Pressure Due to Adjacent Footing



A-2) Lateral Pressure Due to Point Load- Plan View



C) Lateral Pressure Due to Strip Load-Perpendicular to the Wall



E) Lateral Pressure Due to Uniform Surcharge.
(For L ≤ 6H Use Chart D Above)

* σ_H in psf.

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Proposed Single-Family Residence
6427 East Mercer Way
Mercer Island, Washington

SURCHARGE LOADING ON WALLS

Project No.	Figure No.
25-036.100	4

25-036.100 Surcharge Loading for Walls 2/27/25 (6:16:48)

APPENDIX A

CURRENT SUBSURFACE INVESTIGATION

6427 East Mercer Way, Mercer Island, WA | PanGEO, Inc.

RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)	GW	Well-graded GRAVEL
		GP	Poorly-graded GRAVEL
	GRAVEL (>12% fines)	GM	Silty GRAVEL
		GC	Clayey GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)	SW	Well-graded SAND
		SP	Poorly-graded SAND
	SAND (>12% fines)	SM	Silty SAND
		SC	Clayey SAND
Silt and Clay 50%or more passing #200 sieve	Liquid Limit < 50	ML	SILT
		CL	Lean CLAY
		OL	Organic SILT or CLAY
	Liquid Limit > 50	MH	Elastic SILT
		CH	Fat CLAY
		OH	Organic SILT or CLAY
Highly Organic Soils		PT	PEAT

Notes: 1. Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.

2. The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

DESCRIPTIONS OF SOIL STRUCTURES

Layered: Units of material distinguished by color and/or composition from material units above and below

Laminated: Layers of soil typically 0.05 to 1mm thick, max. 1 cm

Lens: Layer of soil that pinches out laterally

Interlayered: Alternating layers of differing soil material

Pocket: Erratic, discontinuous deposit of limited extent

Homogeneous: Soil with uniform color and composition throughout

Fissured: Breaks along defined planes

Slickensided: Fracture planes that are polished or glossy

Blocky: Angular soil lumps that resist breakdown

Disrupted: Soil that is broken and mixed

Scattered: Less than one per foot

Numerous: More than one per foot

BCN: Angle between bedding plane and a plane normal to core axis

COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel		Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
Coarse Gravel:	3 to 3/4 inches	Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Fine Gravel:	3/4 inches to #4 sieve	Silt	0.074 to 0.002 mm
		Clay	<0.002 mm

TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.

ATT	Atterberg Limit Test
Comp	Compaction Tests
Con	Consolidation
DD	Dry Density
DS	Direct Shear
%F	Fines Content
GS	Grain Size
Perm	Permeability
PP	Pocket Penetrometer
R	R-value
SG	Specific Gravity
TV	Torvane
TXC	Triaxial Compression
UCC	Unconfined Compression

SYMBOLS

Sample/In Situ test types and intervals

- 2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)
- 3.25-inch OD Spilt Spoon (300-lb hammer, 30" drop)
- Non-standard penetration test (see boring log for details)
- Thin wall (Shelby) tube
- Grab
- Rock core
- Vane Shear

MONITORING WELL

- Groundwater Level at time of drilling (ATD)
- Static Groundwater Level
- Cement / Concrete Seal
- Bentonite grout / seal
- Silica sand backfill
- Slotted tip
- Slough
- Bottom of Boring

MOISTURE CONTENT

Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

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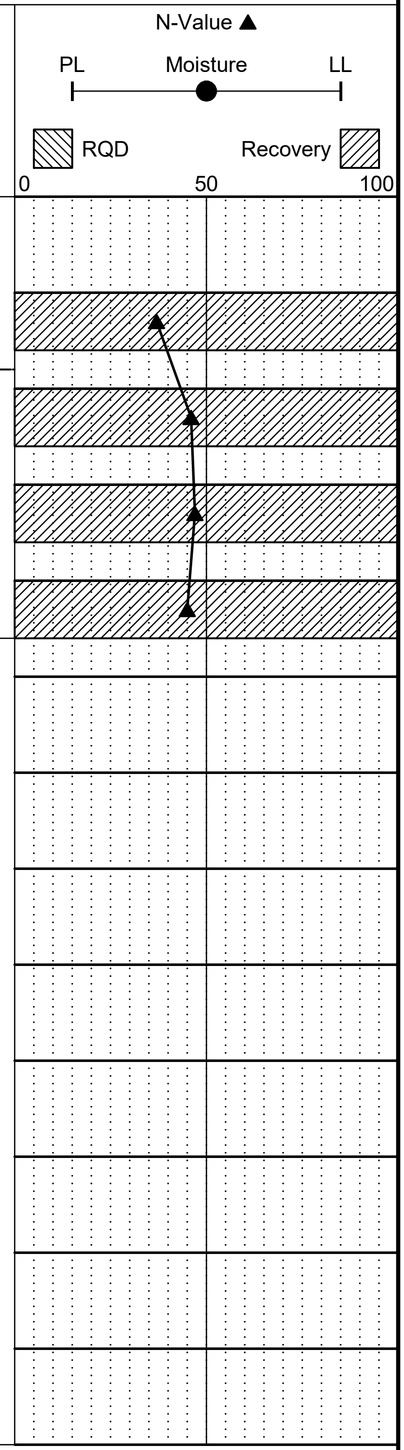
Terms and Symbols for Boring and Test Pit Logs

Figure A-1

Project:	Proposed SFR	Surface Elevation:	154.5ft
Job Number:	25-036	Top of Casing Elev.:	
Location:	6427 East Mercer Way, Mercer Island, WA	Drilling Method:	HSA
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0.0						Dense, brown, silty, fine SAND: slightly moist, non-plastic fines, homogeneous, laminated with slightly rusty laminae. (pre-Olympia Sand Deposit - Qpon).
2.5	S-1	SPT	11 17 20			
5.0	S-2	SPT	13 20 26			Dense, brown to brown gray, fine to medium SAND: slightly moist, some silt, homogeneous, laminated. (pre-Olympia Sand Deposit - Qpon).
7.5	S-3	SPT	16 22 25			
10.0	S-4	SPT	12 23 22			
12.5						Bottom of Boring.
15.0						
17.5						
20.0						
22.5						
25.0						
27.5						
30.0						
32.5						



Completion Depth:	11.5ft
Date Borehole Started:	3/7/19
Date Borehole Completed:	3/7/19
Logged By:	S. Evans
Drilling Company:	Boretec, Inc

Remarks: Boring drilled as part of previous project 19-062. No groundwater encountered during drilling. Vertical Datum NAVD 88.

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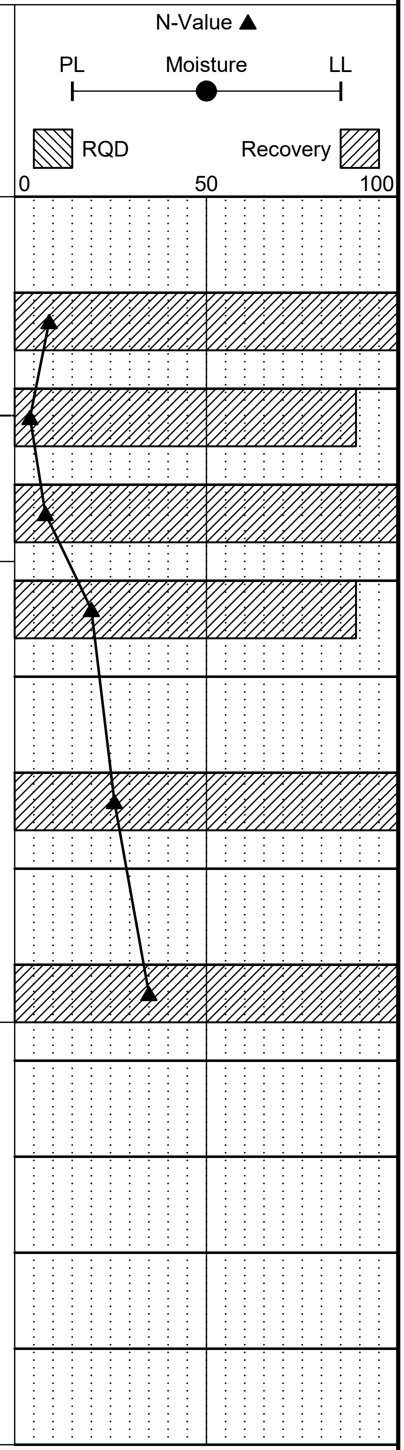
LOG OF TEST BORING PG-1

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed SFR	Surface Elevation:	152.5ft
Job Number:	25-036	Top of Casing Elev.:	
Location:	6427 East Mercer Way, Mercer Island, WA	Drilling Method:	HSA
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0.0						Loose, brown, silty, fine SAND: moist, non-plastic fines, occasional organic bits, slightly mixed texture. (Fill - af).
2.5	S-1	X	5 4 5			
5.0	S-2	X	3 1 3			Loose, red brown, silty, fine SAND with silt: moist to very moist, non-plastic fines, homogeneous, massive. (Fill/Alluvium - af/Qal).
7.5	S-3	X	4 4 4			Laminated, grading brown with reddish laminae.
10.0	S-4	X	5 8 12			Medium dense to dense, brown to brown gray, fine to medium SAND with silt: very moist to wet, non-plastic fines, homogeneous, laminated with slightly rusty laminae at top. (pre-Olympia Sand Deposit - Qpon).
12.5					▽	
15.0	S-5	X	9 12 14			Wet, non-plastic fines, rapid dilatancy, laminated with many yellowish laminae.
17.5						
20.0	S-6	X	13 16 19			Massive.
						Bottom of Boring.
22.5						
25.0						
27.5						
30.0						
32.5						



Completion Depth: 21.5ft
Date Borehole Started: 3/7/19
Date Borehole Completed: 3/7/19
Logged By: S. Evans
Drilling Company: Boretec, Inc

Remarks: Boring drilled as part of previous project 19-062. Groundwater level estimated based on wetness of soil sample and water on the sampling rods. Vertical Datum NAVD 88.

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LOG OF TEST BORING PG-2

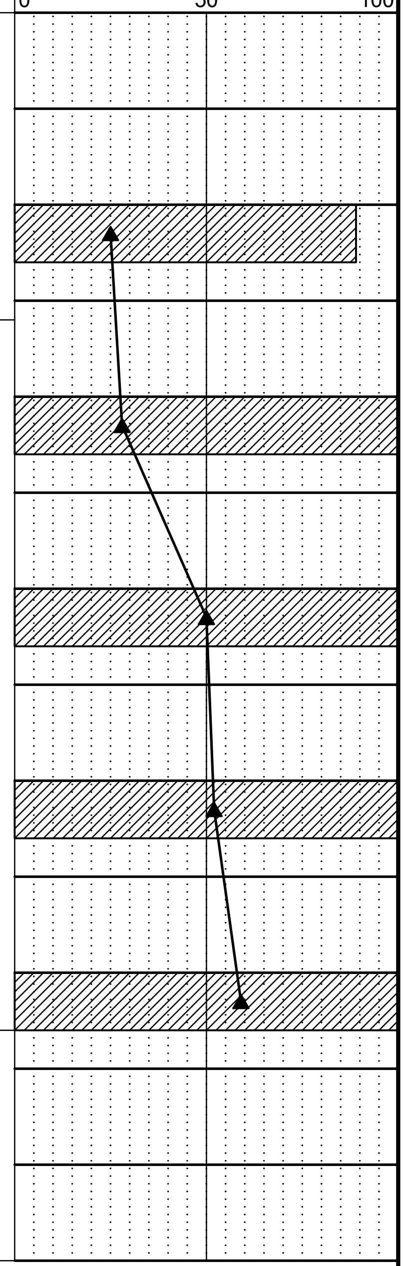
Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed SFR	Surface Elevation:	166.5ft
Job Number:	25-036	Top of Casing Elev.:	
Location:	6427 East Mercer Way, Mercer Island, WA	Drilling Method:	HSA
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0.0						Medium dense, brown gray SILT: very moist, non-plastic, trace to some fine sand, homogenous, laminated. (Lawton Clay - Qvlc).
5.0	S-1	SPT	6 10 15			Grading to silty, fine SAND.
7.5						Medium dense to very dense, brown to brown gray, fine to medium SAND: moist, non-plastic fines, fine bedded with finer / coarse beds, sharp and moderately gradational contacts, indistinctly laminated. (pre-Olympia Sand Deposit - Qpon).
10.0	S-2	SPT	8 12 16			
15.0	S-3	SPT	14 25 25			Grading massive, very dense, some non-plastic silt.
20.0	S-4	SPT	15 24 28			Homogeneous, massive, fine to medium SAND.
25.0	S-5	SPT	18 29 30			Moist, trace to some silt.
26.5						Bottom of Boring.

N-Value ▲ — PL — Moisture — LL; RQD; Recovery (0 – 50 – 100)



Completion Depth:	26.5ft
Date Borehole Started:	3/7/19
Date Borehole Completed:	3/7/19
Logged By:	S. Evans
Drilling Company:	Boretec, Inc

Remarks: Boring drilled as part of previous project 19-062. No groundwater encountered during drilling. Vertical Datum NAVD 88.

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LOG OF TEST BORING PG-3

Figure A-4

The stratification lines represent approximate boundaries. The transition may be gradual.

APPENDIX B. WWHM Documentation

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: 6427 E Mercer Way

Site Name:	6427 E Mercer Way
Site Address:	6427 E Mercer Way
City:	Mercer Island
Report Date:	5/19/2025
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

Predeveloped Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.234
Pervious Total	0.234
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.234

Mitigated Land Use

On-Site Areas

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	0.053
Pervious Total	0.053
Impervious Land Use	acre
ROOF TOPS FLAT	0.121
Impervious Total	0.121
Basin Total	0.174

ROW Areas

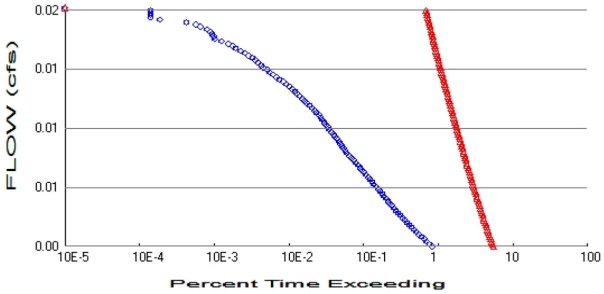
Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.06
Impervious Total	0.06
Basin Total	0.06

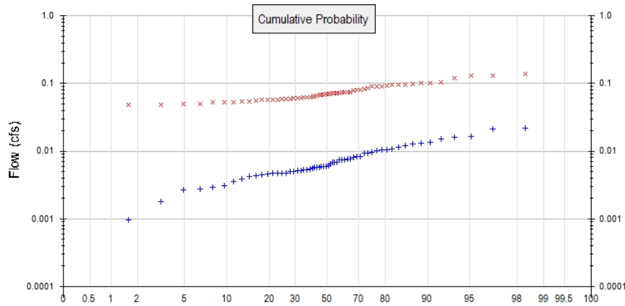
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.234
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.053
Total Impervious Area: 0.181

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.00688
5 year	0.010805
10 year	0.013029
25 year	0.015386
50 year	0.016844
100 year	0.018085

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.070039
5 year	0.088599
10 year	0.101223
25 year	0.117612
50 year	0.130167
100 year	0.143033

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.007	0.092
1950	0.008	0.097
1951	0.015	0.058
1952	0.005	0.050
1953	0.004	0.054
1954	0.006	0.057
1955	0.009	0.064
1956	0.008	0.063
1957	0.006	0.073
1958	0.007	0.058

1959	0.006	0.058
1960	0.010	0.060
1961	0.006	0.062
1962	0.004	0.053
1963	0.005	0.060
1964	0.006	0.058
1965	0.005	0.075
1966	0.004	0.050
1967	0.009	0.085
1968	0.006	0.096
1969	0.006	0.067
1970	0.005	0.066
1971	0.005	0.078
1972	0.011	0.081
1973	0.005	0.048
1974	0.006	0.071
1975	0.008	0.081
1976	0.005	0.056
1977	0.001	0.059
1978	0.005	0.072
1979	0.003	0.098
1980	0.011	0.091
1981	0.004	0.073
1982	0.008	0.103
1983	0.007	0.083
1984	0.005	0.053
1985	0.003	0.072
1986	0.012	0.063
1987	0.011	0.096
1988	0.004	0.058
1989	0.003	0.073
1990	0.022	0.132
1991	0.013	0.102
1992	0.005	0.053
1993	0.005	0.045
1994	0.002	0.049
1995	0.008	0.065
1996	0.016	0.071
1997	0.013	0.068
1998	0.003	0.067
1999	0.013	0.137
2000	0.005	0.069
2001	0.001	0.075
2002	0.006	0.089
2003	0.007	0.071
2004	0.010	0.130
2005	0.007	0.061
2006	0.008	0.054
2007	0.016	0.121
2008	0.021	0.100
2009	0.010	0.089

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0221	0.1372
2	0.0211	0.1323
3	0.0164	0.1296

4	0.0161	0.1213
5	0.0151	0.1030
6	0.0135	0.1020
7	0.0133	0.1003
8	0.0126	0.0983
9	0.0119	0.0966
10	0.0113	0.0962
11	0.0107	0.0959
12	0.0105	0.0919
13	0.0104	0.0909
14	0.0102	0.0893
15	0.0096	0.0892
16	0.0095	0.0847
17	0.0094	0.0828
18	0.0084	0.0813
19	0.0082	0.0806
20	0.0081	0.0777
21	0.0076	0.0750
22	0.0075	0.0745
23	0.0075	0.0731
24	0.0074	0.0730
25	0.0074	0.0728
26	0.0069	0.0721
27	0.0068	0.0718
28	0.0068	0.0710
29	0.0065	0.0709
30	0.0061	0.0708
31	0.0059	0.0693
32	0.0059	0.0683
33	0.0058	0.0675
34	0.0058	0.0672
35	0.0058	0.0656
36	0.0057	0.0647
37	0.0056	0.0643
38	0.0054	0.0633
39	0.0053	0.0625
40	0.0053	0.0620
41	0.0051	0.0605
42	0.0051	0.0604
43	0.0050	0.0599
44	0.0049	0.0587
45	0.0048	0.0585
46	0.0048	0.0584
47	0.0047	0.0581
48	0.0047	0.0580
49	0.0045	0.0576
50	0.0045	0.0572
51	0.0043	0.0558
52	0.0042	0.0537
53	0.0039	0.0536
54	0.0036	0.0531
55	0.0030	0.0529
56	0.0029	0.0525
57	0.0027	0.0499
58	0.0027	0.0497
59	0.0018	0.0487
60	0.0010	0.0479
61	0.0006	0.0450

Duration Flows

The Duration Matching Failed

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0034	17545	117146	667	Fail
0.0036	16164	114002	705	Fail
0.0037	14968	110922	741	Fail
0.0038	13849	108056	780	Fail
0.0040	12814	105276	821	Fail
0.0041	11813	102623	868	Fail
0.0043	10900	100100	918	Fail
0.0044	10121	97640	964	Fail
0.0045	9383	95244	1015	Fail
0.0047	8731	92956	1064	Fail
0.0048	8147	90731	1113	Fail
0.0049	7593	88507	1165	Fail
0.0051	7060	86432	1224	Fail
0.0052	6588	84422	1281	Fail
0.0053	6147	82390	1340	Fail
0.0055	5779	80443	1391	Fail
0.0056	5431	78497	1445	Fail
0.0057	5097	76722	1505	Fail
0.0059	4808	74946	1558	Fail
0.0060	4524	73278	1619	Fail
0.0061	4254	71610	1683	Fail
0.0063	4017	69963	1741	Fail
0.0064	3784	68423	1808	Fail
0.0066	3546	66904	1886	Fail
0.0067	3337	65428	1960	Fail
0.0068	3138	63953	2038	Fail
0.0070	2950	62541	2120	Fail
0.0071	2785	61172	2196	Fail
0.0072	2597	59867	2305	Fail
0.0074	2447	58584	2394	Fail
0.0075	2304	57301	2487	Fail
0.0076	2160	56060	2595	Fail
0.0078	2026	54819	2705	Fail
0.0079	1898	53622	2825	Fail
0.0080	1790	52488	2932	Fail
0.0082	1688	51376	3043	Fail
0.0083	1584	50264	3173	Fail
0.0084	1483	49258	3321	Fail
0.0086	1380	48232	3495	Fail
0.0087	1292	47205	3653	Fail
0.0089	1219	46264	3795	Fail
0.0090	1154	45301	3925	Fail
0.0091	1098	44339	4038	Fail
0.0093	1048	43441	4145	Fail
0.0094	997	42564	4269	Fail
0.0095	930	41687	4482	Fail
0.0097	883	40853	4626	Fail
0.0098	837	39976	4776	Fail
0.0099	789	39120	4958	Fail
0.0101	743	38329	5158	Fail
0.0102	718	37559	5231	Fail
0.0103	671	36767	5479	Fail
0.0105	630	36040	5720	Fail
0.0106	596	35313	5925	Fail

0.0108	566	34522	6099	Fail
0.0109	540	33880	6274	Fail
0.0110	497	33217	6683	Fail
0.0112	474	32575	6872	Fail
0.0113	435	31891	7331	Fail
0.0114	402	31335	7794	Fail
0.0116	369	30693	8317	Fail
0.0117	348	30094	8647	Fail
0.0118	323	29517	9138	Fail
0.0120	298	28982	9725	Fail
0.0121	273	28404	10404	Fail
0.0122	256	27805	10861	Fail
0.0124	235	27313	11622	Fail
0.0125	217	26736	12320	Fail
0.0126	198	26265	13265	Fail
0.0128	180	25731	14295	Fail
0.0129	158	25260	15987	Fail
0.0131	145	24725	17051	Fail
0.0132	130	24276	18673	Fail
0.0133	119	23763	19968	Fail
0.0135	110	23314	21194	Fail
0.0136	97	22865	23572	Fail
0.0137	91	22458	24679	Fail
0.0139	82	21988	26814	Fail
0.0140	76	21581	28396	Fail
0.0141	69	21186	30704	Fail
0.0143	61	20734	33990	Fail
0.0144	55	20358	37014	Fail
0.0145	48	19945	41552	Fail
0.0147	41	19607	47821	Fail
0.0148	38	19244	50642	Fail
0.0149	33	18933	57372	Fail
0.0151	27	18615	68944	Fail
0.0152	22	18298	83172	Fail
0.0154	21	17956	85504	Fail
0.0155	20	17622	88110	Fail
0.0156	19	17295	91026	Fail
0.0158	17	16993	99958	Fail
0.0159	14	16673	119092	Fail
0.0160	12	16324	136033	Fail
0.0162	9	16059	178433	Fail
0.0163	4	15772	394300	Fail
0.0164	3	15477	515900	Fail
0.0166	3	15192	506400	Fail
0.0167	3	14923	497433	Fail
0.0168	3	14671	489033	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.

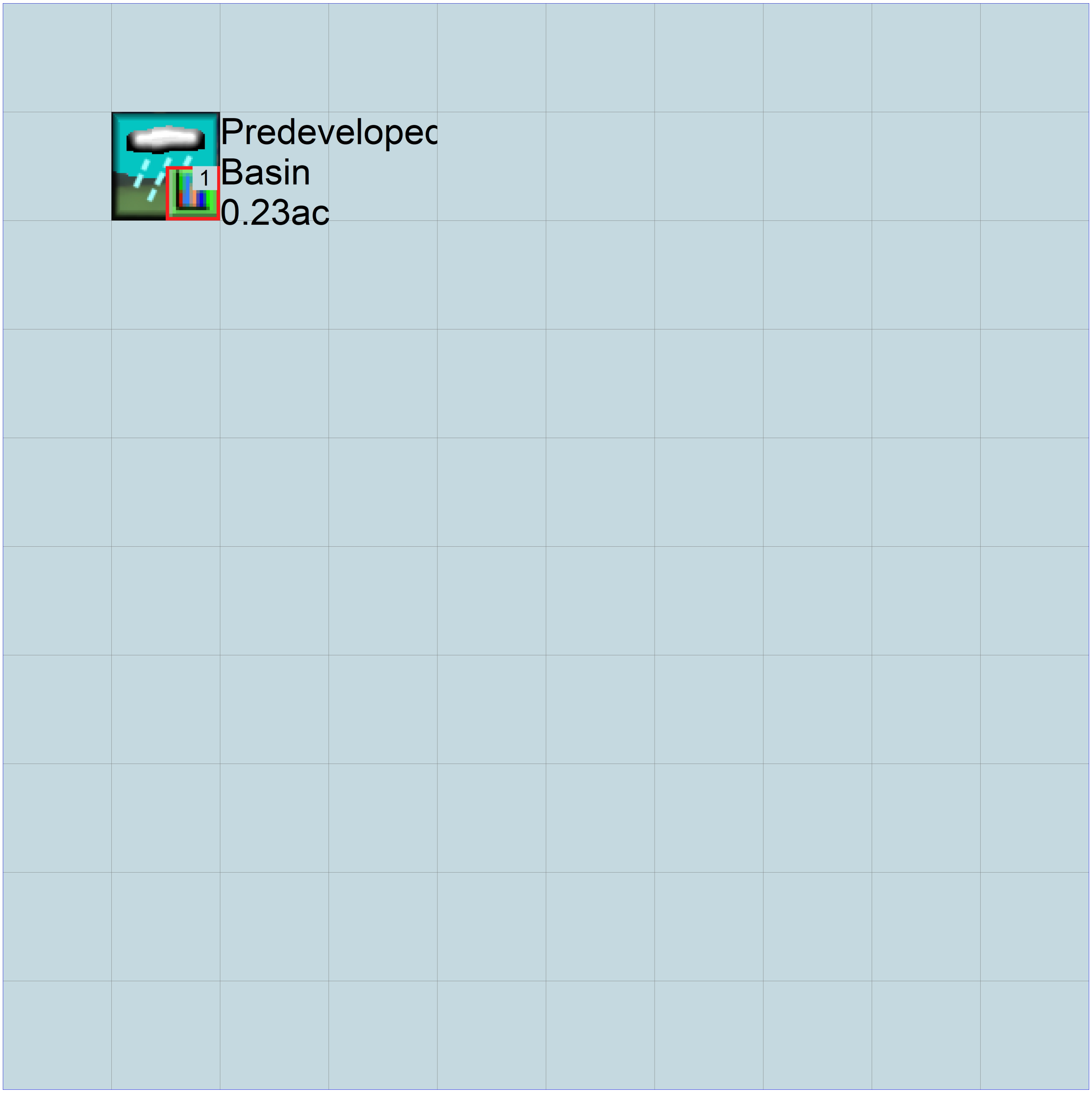
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 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   6427 E Mercer Way.wdm
MESSU      25   Pre6427 E Mercer Way.MES
           27   Pre6427 E Mercer Way.L61
           28   Pre6427 E Mercer Way.L62
           30   POC6427 E Mercer Way1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Predeveloped Basin          MAX                      1    2   30    9
  END DISPLY-INFO1
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 ***
                                             in  out           ***
   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
  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     KVARY     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#   ***
Predeveloped Basin***
PERLND  10                        0.234     COPY   501     12
PERLND  10                        0.234     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                                      ***
    # -  #  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   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>                <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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 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   6427 E Mercer Way.wdm
MESSU      25   Mit6427 E Mercer Way.MES
           27   Mit6427 E Mercer Way.L61
           28   Mit6427 E Mercer Way.L62
           30   POC6427 E Mercer Way1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      13
      IMPLND       4
      IMPLND       1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        On-Site Areas               MAX                     1    2   30    9
  END DISPLY-INFO1
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 ***
                                             in  out           ***
   13     C, Pasture, 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 ***
   13         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  *********
   13         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 ***
   13         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
   13             0       4.5      0.06       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
   13             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   13           0.15       0.4       0.3         6       0.5       0.4
  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
   13             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           ***
    4      ROOF TOPS/FLAT         1    1    1   27    0
    1      ROADS/FLAT             1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

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

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    4    1    9
    1         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     ***
    4         0    0    0    0    0
    1         0    0    0    0    0
  END IWAT-PARM1

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

```
  END IWAT-PARM2

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

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
On-Site Areas ***
PERLND  13                       0.053     COPY   501     12
PERLND  13                       0.053     COPY   501     13
IMPLND   4                       0.121     COPY   501     15
ROW Areas***
IMPLND   1                        0.06     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

Mitigated HSPF Message File

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Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

APPENDIX C. Maintenance Plan

6427 E Mercer Way
Operation and Maintenance Manual

Person or Organization Responsible for Maintenance of the On-Site Storm System:

Citizen Design c/o Isaac Greenetz
10 Dravus St
Seattle, WA 98109

The Location Where the Operation and Maintenance Manual is to be Kept:

6427 E Mercer Way
Mercer Island, WA 98040

*Note: The manual and maintenance activity log must be made available to the City of Mercer Island for inspection purposes.

Description of On-Site Storm System

The on-site storm system for the 6427 E Mercer Way project consists of 4” to 12” conveyance pipes, cleanouts, catch basins, area drains, and a detention facility.

Stormwater runoff from onsite will be captured in a detention facility and then routed to the existing storm drain conveyance system in E Mercer Way.

Property owner(s) shall be responsible for any and all claims, injuries, and damage due to operation and/or failure of the pump system.

The proposed detention facility, storm drains, area drains, and cleanouts serve as source control of pollution for the project site prior to being detained and released from the project site. To control pollutants, proper maintenance and cleaning of debris, sediments and oil from stormwater collection and conveyance system is required per the operations and maintenance recommendations found in Volume 5 Appendix V-A of the Stormwater Manual in addition to the BMPs in Volume IV Section 2.2. See the attached sheets for operation and maintenance requirements pertaining to the project.

Contact Information for Stormwater Facility Manufacturers and Installers:
Contractor (Installer of On-Site Stormwater Facilities)
TBD

Civil Engineer (Designer of On-Site Stormwater Facilities)
Ben Iddins, P.E.
Facet
9706 4th Ave NE, Suite 300
Seattle, WA 98115
Phone – 206.523.0024 Ext. 115
biddins@facetnw.com

Attachments

- Operation and Maintenance Manual for Closed Detention Systems (Tanks/Vaults) (2019 DOE Manual)
- Operation and Maintenance Manual for Control Structure/Flow Restrictor (2019 DOE Manual)
- Operation and Maintenance Manual for Catch Basins (2019 DOE Manual) Catch Basins

Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/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 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (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 1/2-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 1/2-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 1/4-inch wide at the joint of the inlet/outlet pipe.

Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Manhole	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 1/2 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 Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

Table V-A.4: Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe are not watertight and show signs of rust. Any holes - other than designed holes - in the structure.	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as designed. Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)
Catch Basin	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

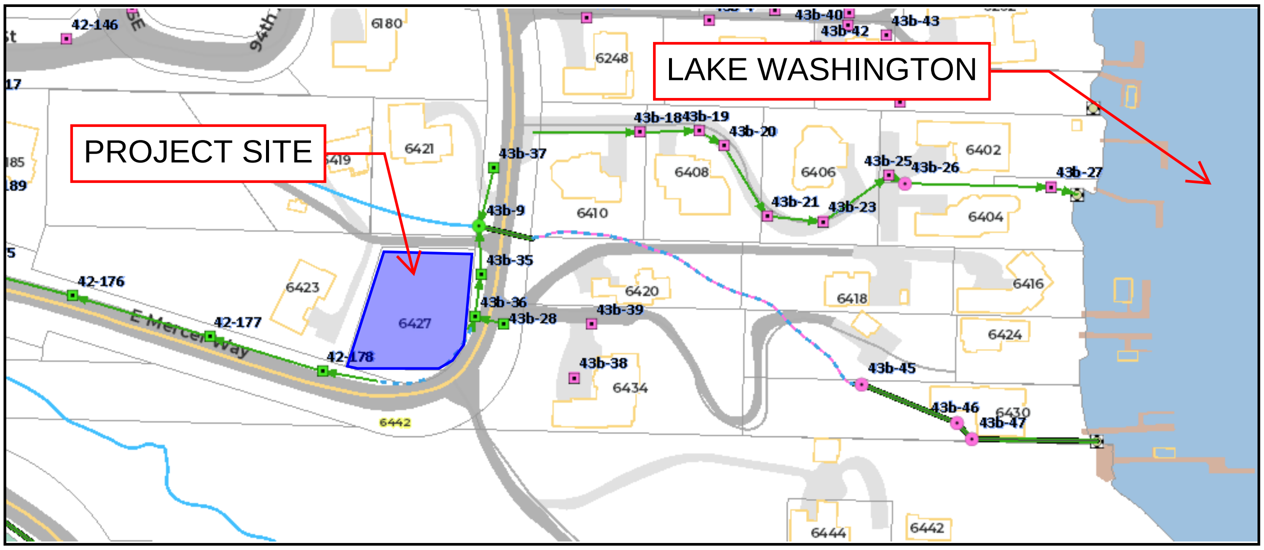
Table V-A.5: Maintenance Standards - Catch Basins

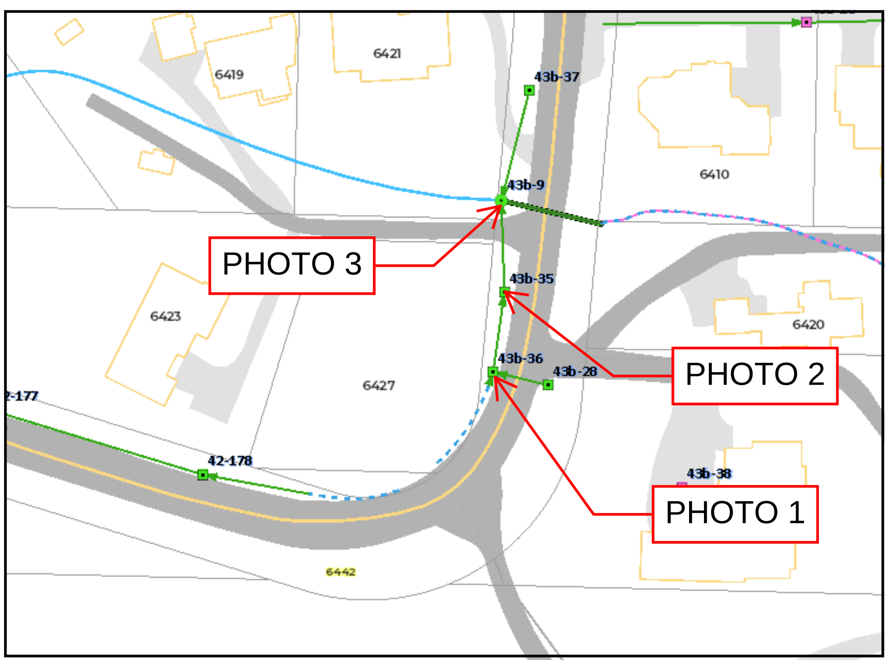
Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in 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). 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	Top slab is free of holes and cracks. Frame is sitting 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 regrouted and secure at basin wall.
	Settlement/ Mis-alignment	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 Table V-A.1: Maintenance Standards - Detention Ponds	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with 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, meets the design standards, and is installed and aligned with the flow path.

APPENDIX D. Covenants, Dedications, Easements (To be Provided at Final Engineering)

APPENDIX E. Downstream Analysis Exhibit & Photos

DOWNSTREAM DRAINAGE ANALYSIS





DOWNSTREAM ANAYLSIS PHOTOS

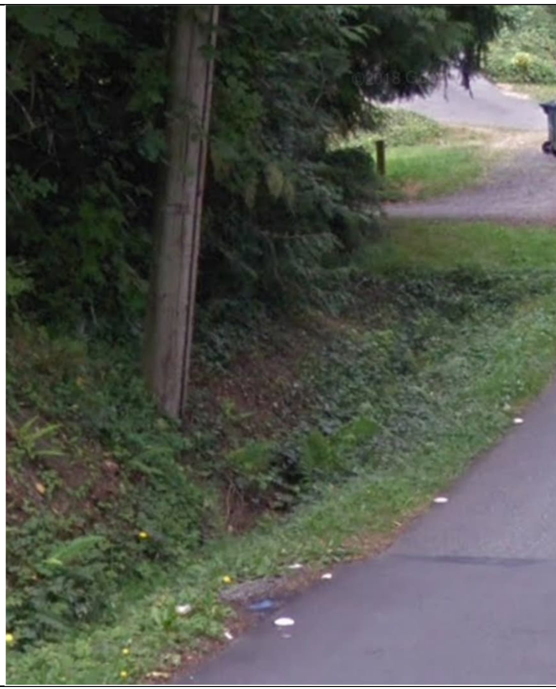


Photo 1 (looking north): culvert flowing north into type 1 catch basin. 8” corrugated polyethylene pipe flowing north.	Photo 2 (looking west): type 1 catch basin. 12” concrete pipe flowing north.

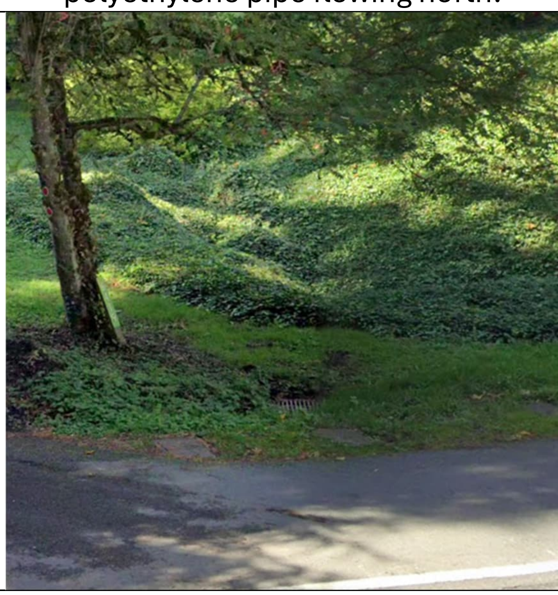



Photo 3 (looking northwest): type 2 catch basin. 12” concrete pipe flowing east.	

APPENDIX F. Conveyance Calculations

RATIONAL METHOD
for Conveyance Facility Sizing

Project: 6427 E Mercer Way Mercer Island
Description: Rational Method for pipe dowstream of the proposed detention facility

Design Storm: 100 yr

Q=CIA
Where: Q = peak flow (cfs) — I = peak rainfall intensity (inches/hour)
C = estimated composite runoff coefficient — A = drainage subbasin area (acres)

Composite Runoff Coefficient

Cc = (C1*A1+C2*A2…)/At
Where: Cc = composite runoff coefficient — A# = area of land cover (acres)
C# = runoff coefficient for Area # — At = total area (acres)

C #		Description	Area (sf)	Area (acres)	C	A*C
1	Onsite/New	Impervious Surface	7,578	0.174	0.90	0.157
			Totals:	**0.174**		**0.157**

Cc = 0.90 (total C#*A#)/(total area)

Time of Concentration

Seg. #	Description of Flow Path Segment	Length (ft)	kr	Upper Elev	Lower Elev	Slope (ft/ft)	Travel Time (minutes)
1	Paved Area (sheet flow) and shallow gutter flow	285	20	483	481	0.007	2.84
	Totals:	**285**					**2.8**

Unity Peak Intensity Factor
ir = ar*Tc^-br
where: Tc = time of concentration (minutes)
ar and br = coefficients from Table 3.2.1.B

Tc = 6.30 minutes (from table above or 6.3 minimum or 100 max)
ar = 2.61 (from Table 3.2.1.B)
br = 0.63 (from Table 3.2.1.B)

ir = 0.82

Peak Rainfall Intensity

Ir = Pr*ir
where: Ir = peak rainfall intensity (inches/hour)
Pr = total 24-hour precipitation for design return period (inches/24 hours)
ir = unit peak rainfall intensity factor

Pr = 3.15 precipitation (inches)
ir = 0.82 unit peak intensity factor (from above)

Ir = 2.58 inches/hour

Peak Runoff Rate
Q = C*Ir*A

C = 0.90 Cc (unitless) from above
Ir = 2.58 Ir (inches/hour) from above
A = 0.17 total area (acres) from above

Q = 0.404 cfs

Pipe Capacity Calculations (Manning's Equation)
Full Flow (d/D = 0.90)

Description	ID (inches)	Area (sf)	Wetted Per. (ft)	Hyd. Radius (ft)	Manning's n	Slope (ft/ft)	Velocity (ft/s)	Pipe Capacity (cfs)	Req'd Flow (cfs)	
6" for all surfaces onsite	6	0.1963495	1.570796327	0.125	0.012	0.02	4.39	0.862	**0.404**	**Capacity OK**

APPENDIX G. Detention Facility Sizing

Table 1

ON-SITE DETENTION DESIGN FOR PROJECTS BETWEEN 500 SF AND 9,500 SF NEW PLUS REPLACED IMPERVIOUS SURFACE AREA

New and Replaced Impervious Surface Area (sf)	Detention Pipe Diameter (in)	Detention Pipe Length (ft)		Lowest Orifice Diameter (in)[3]		Distance from Outlet Invert to Second Orifice (ft)		Second Orifice Diameter (in)	
		B soils	C soils	B soils	C soils	B soils	C soils	B soils	C soils
500 to 1,000 sf	36"	30	22	0.5	0.5	2.2	2.0	0.5	0.8
	48"	18	11	0.5	0.5	3.3	3.2	0.9	0.8
	60"	11	7	0.5	0.5	4.2	3.4	0.5	0.6
1,001 to 2,000 sf	36"	66	43	0.5	0.5	2.2	2.3	0.9	1.4
	48"	34	23	0.5	0.5	3.2	3.3	0.9	1.2
	60"	22	14	0.5	0.5	4.3	3.6	0.9	0.9
2,001 to 3,000 sf	36"	90	66	0.5	0.5	2.2	2.4	0.9	1.9
	48"	48	36	0.5	0.5	3.1	2.8	0.9	1.5
	60"	30	20	0.5	0.5	4.2	3.7	0.9	1.1
3,001 to 4,000 sf	36"	120	78	0.5	0.5	2.4	2.2	1.4	1.6
	48"	62	42	0.5	0.5	2.8	2.9	0.8	1.3
	60"	42	26	0.5	0.5	3.8	3.9	0.9	1.3
4,001 to 5,000 sf	36"	134	91	0.5	0.5	2.8	2.2	1.7	1.5
	48"	73	49	0.5	0.5	3.6	2.9	1.6	1.5
	60"	46	31	0.5	0.5	4.6	3.5	1.6	1.3
5,001 to 6,000 sf	36"	162	109	0.5	0.5	2.7	2.2	1.8	1.6
	48"	90	59	0.5	0.5	3.5	2.9	1.7	1.5
	60"	54	37	0.5	0.5	4.6	3.6	1.6	1.4
6,001 to 7,000 sf	36"	192	128	0.5	0.5	2.7	2.2	1.9	1.8
	48"	102	68	0.5	0.5	3.7	2.9	1.9	1.6
	60"	64	43	0.5	0.5	4.6	3.6	1.8	1.5
7,001 to 8,000 sf	36"	216	146	0.5	0.5	2.8	2.2	2.0	1.9
	48"	119	79	0.5	0.5	3.8	2.9	2.2	1.7
	60"	73	49	0.5	0.5	4.5	3.6	2.0	1.6
8,001 to 8,500 sf[1]	36"	228	155	0.5	0.5	2.8	2.2	2.1	1.9
	48"	124	84	0.5	0.5	3.7	2.9	1.9	1.8
	60"	77	53	0.5	0.5	4.6	3.6	2.0	1.6
8,501 to 9,000 sf	36"	NA [1]	164	0.5	0.5	NA [1]	2.2	NA [1]	1.9
	48"	NA [1]	89	0.5	0.5	NA [1]	2.9	NA [1]	1.9
	60"	NA [1]	55	0.5	0.5	NA [1]	3.6	NA [1]	1.7
9,001 to 9,500 sf[2]	36"	NA [1]	174	0.5	0.5	NA [1]	2.2	NA [1]	2.1
	48"	NA [1]	94	0.5	0.5	NA [1]	2.9	NA [1]	2.0
	60"	NA [1]	58	0.5	0.5	NA [1]	3.7	NA [1]	1.7

Notes:

- Minimum Requirement #7 (Flow Control) is required when the 100-year flow frequency causes a 0.15 cubic feet per second increase (when modeled in WWHM with a 15-minute timestep). Breakpoints shown in this table are based on a flat slope (0-5%). The 100-year flow frequency will need to be evaluated on a site-specific basis for projects on moderate (5-15%) or steep (> 15%) slopes.
- Soil type to be determined by geotechnical analysis or soil map.
- Sizing includes a Volume Correction Factor of 120%.
- Upper bound contributing area used for sizing.

[1] On Type B soils, new plus replaced impervious surface areas exceeding 8,500 sf trigger Minimum Requirement #7 (Flow Control)

[2] On Type C soils, new plus replaced impervious surface areas exceeding 9,500 sf trigger Minimum Requirement #7 (Flow Control)

[3] Minimum orifice diameter = 0.5 inches

in = inch

ft = feet

sf = square feet

Basis of Sizing Assumptions:

Sized per MR#5 in the Stormwater Management Manual for Puget Sound Basin (1992 Ecology Manual)

SBUH, Type 1A, 24-hour hydrograph

2-year, 24-hour storm = 2 in; 10-year, 24-hour storm = 3 in; 100-year, 24-hour storm = 4 in

Predeveloped = second growth forest (CN = 72 for Type B soils, CN = 81 for Type C soils)

Developed = impervious (CN = 98)

0.5 foot of sediment storage in detention pipe

Overland slope = 5%