DRAINAGE REPORT

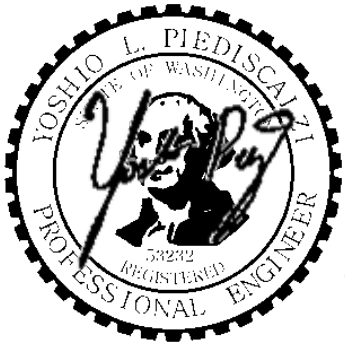
for

WELLMON RESIDENCE

6333 77th Ave SE

Mercer Island, Washington 98040

Parcel No. 4097100010



9-29-23

DRS Project No. 22109
Mercer Island File No. _____

Owner/Applicant

Nick & Lindsey Wellmon
6333 77th Ave SE
Mercer Island WA 98040

Report Prepared by

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Issue Date:

September 28, 2023

TABLE OF CONTENTS

List of Figures

Appendix

MR 1 - STORMWATER SITE PLANNING

PROJECT OVERVIEW

The Site is located at 6333 77th Ave SE in the City of Mercer Island, Washington, also known as Tax Parcel Number 4097100010 (Site). The applicant is proposing to demolish the existing residence and construct a single-family home, sport court, driveway, landscaping and associated utilities. The Site is approximately 19,982 SF (0.458 AC). The Project will meet the requirements of MICC 15.09.050, and the 2014 Washington State Department of Ecology (DOE) Stormwater Management Manual for Western Washington (Manual).

PREDEVELOPED SITE CONDITIONS

The existing Site is currently developed with a single-family residence, detached garage, brick paved driveway and walkways, concrete patio, boat dock and rockeries. The remainder of the Site consists of lawn, trees, and shrubs

The Site is contained within one Threshold Discharge Area (TDA). The topography slopes from east to west at slopes ranging from 10-30%. Surface runoff generated onsite travels westerly across the Site and sheet-flows into Lake Washington. Driveway and roof runoff collected onsite is discharged to Lake Washington via a 4" outlet at the bulkhead.

According to the City of Mercer Island GIS portal sensitive areas maps, the contains erosion, and seismic hazard areas.

The USDA Web Soil Survey describes the soil on Site as Kitsap silt loam (KpB), 2-8% slopes.

DEVELOPED SITE CONDITIONS

The applicant is seeking approval to demolish the existing residence, and construct a new single-family residence. The total Project area is the Site area of 19,882 SF (0.456 AC), plus approximately 173 SF (0.004 AC) of ROW disturbance. The impervious surface estimates are based on the architectural site plan, provided by Lochwood Lozier, dated March 6, 2023. An upstream area of 600 SF (0.014 AC) of road area is included in the flow rate calculations (see section MR 5). This 600 SF includes the 173 SF of ROW disturbance, plus additional area that drains onto the Site from the ROW. The Project is proposing 9,222 SF of new or replaced impervious area. The remainder of the Project area will consist of residential landscaping and other pervious surfaces. See the table below for a breakdown of the contributing surfaces.

Site is proposing to utilize the existing 4" discharge pipe. Because the Project is discharging directly to Lake Washington, which is a designated receiving water, no control facilities are required. See Section IV for a full description of the drainage calculations.

Total new or replaced Pollution Generating Impervious Surface (PGIS) for the project will include a concrete driveway to the single-family residence. Per Section 1.2.8.1 of the Manual, the project is exempt from providing a water quality facility (less than 5,000 SF of new plus replaced PGIS being added and less than ¾ of an acre of new PGPS being added). See the table below for proposed surface area breakdown.

Developed Site Area Breakdown				
Land Cover	Roof	Walkways/Sports Court/Patio	Driveway (PGIS)	Grass/Landscape (PGPS)
S.F.	4,496	2,327	*1,799	11,260
Acres	0.103	0.053	0.041	0.258

*****For flow calculations, an additional 600 SF of road is included (total = 2,399 SF) for the upstream area.

THRESHOLD DETERMINATION

Existing Site hard surface area coverage is approximately 39%. The remainder of the Site is vegetated. Greater than 35% of the existing Site is existing hard surface coverage and therefore the thresholds for redevelopment projects apply.

The Project will create over 5,000 SF (9,222 SF) of new, replaced, or new plus replaced hard surfaces and the value of the proposed improvements exceeds 50% of the assessed value of the existing Site improvements. Per DOE Figure I-2.4.2 *Flow Chart for Determining Requirements for Redevelopment Minimum Requirements,* MR #1 - 9 apply to new and replaced hard surfaces and the land disturbed (see Appendix A). No adverse drainage impacts are anticipated as a result of the proposed Project improvements.

OFFSITE ANALYSIS AND MITIGATION

The Project will discharge all collected runoff directly to Lake Washington. Since Lake Washington is a designated receiving water no flow control facilities are required or proposed. On-site Flow Control BMPs were evaluated and found to be unsuitable for this Site. See Section MR 5 for complete BMP analysis. No adverse drainage impacts are anticipated as a result of the proposed Project improvements.

UPSTREAM ANALYSIS

The upstream area consists of approximately 600 SF (0.014 AC) of area within the 77th Ave SE ROW to the east of the Site. Due to existing asphalt berms, most of the runoff generated on 77th Ave SE is directed south, away from the Site. Runoff generated on parcels to the east is collected by the conveyance system in 77th Ave SE. Existing topography keeps runoff from the developed adjacent parcels to the north and south contained on their own parcels.

See Figure 5 for the limits of the upstream basin area.

DOWNSTREAM ANALYSIS

Site runoff currently is discharged via sheet flow and a 4” pipe outfall to Lake Washington, which is a designated receiving water. The Natural Discharge Location of the Site will remain unchanged. No adverse drainage impacts are anticipated as a result of the proposed Project.

ADJUSTMENTS, DEVIATIONS AND EXEMPTIONS

There are no Adjustments, Deviations or Exemptions that have been requested or apply to this Project.

FIGURE 1
VICINITY MAP

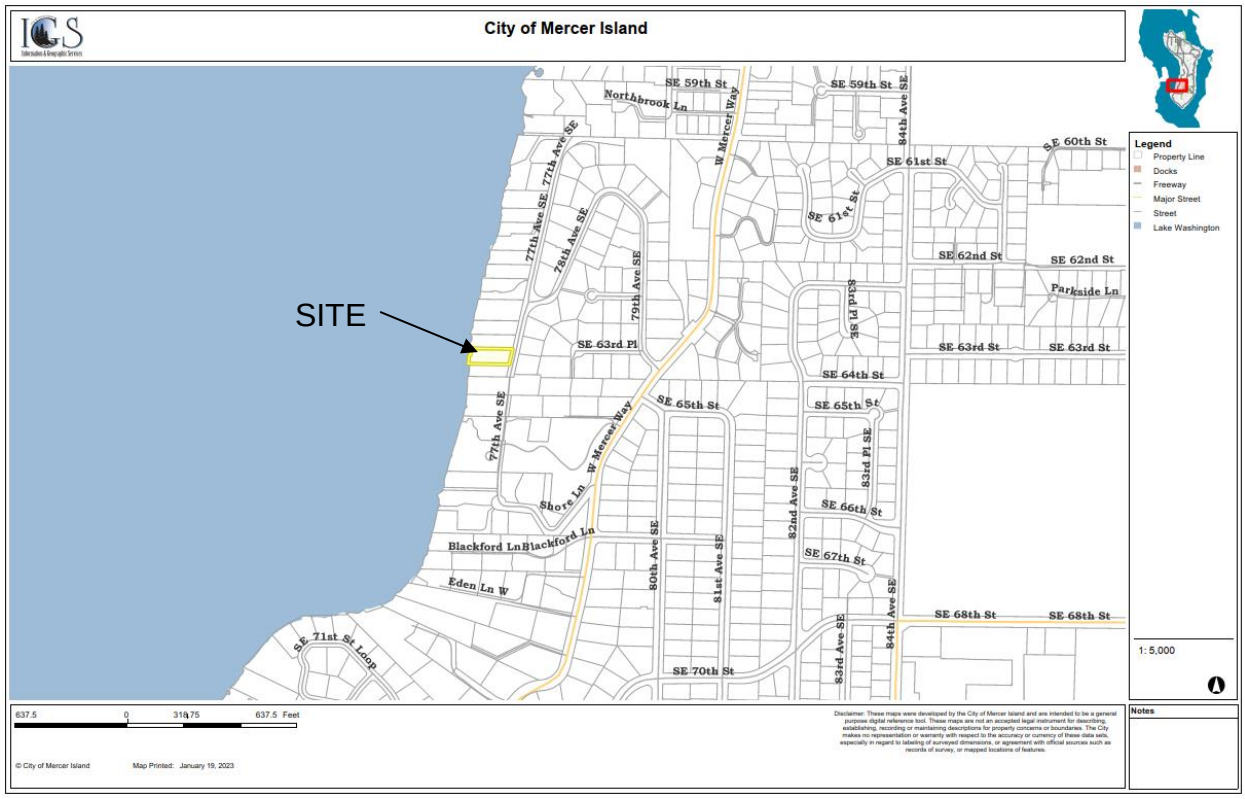
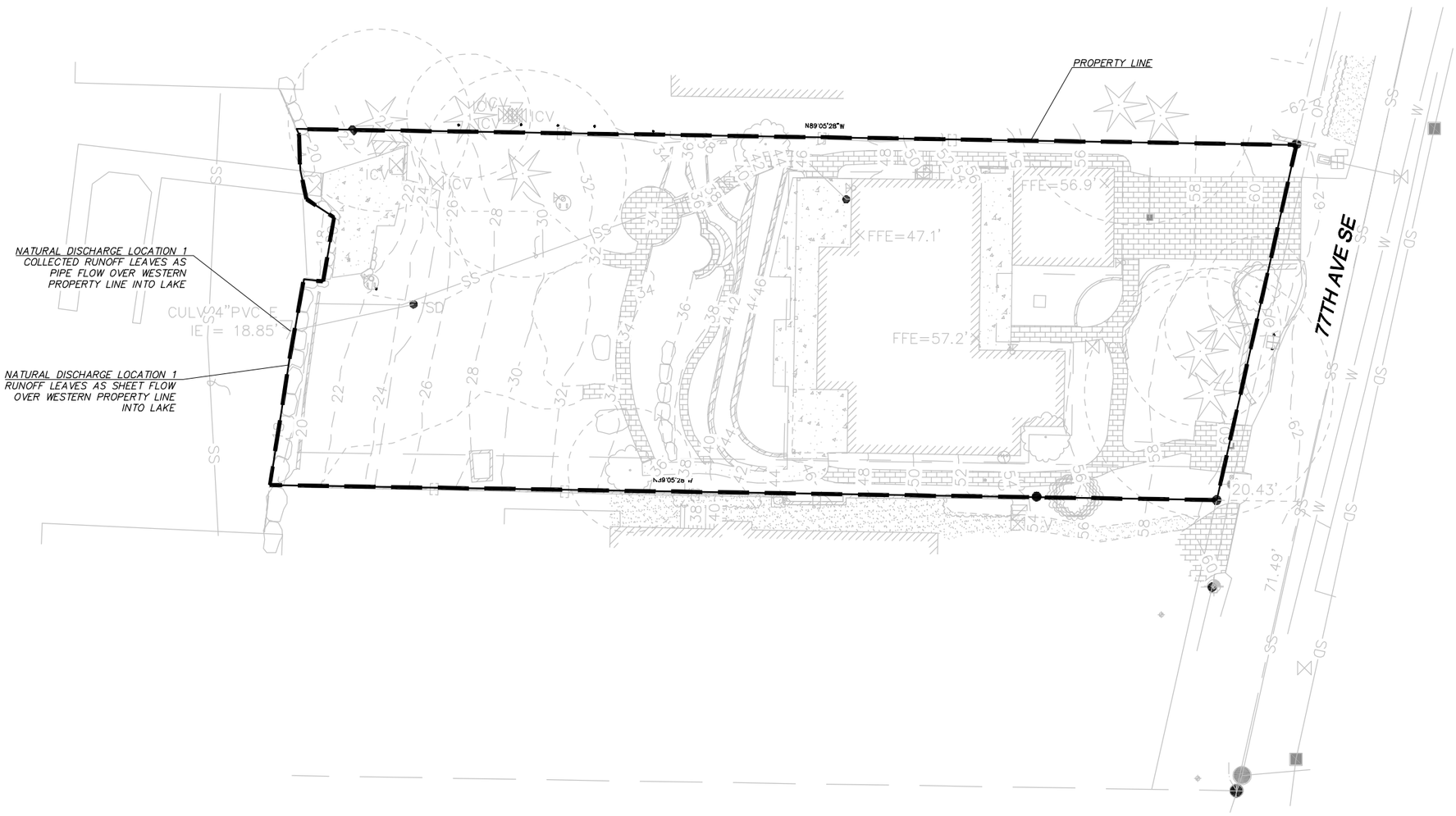


FIGURE 2
DOWNSTREAM MAP



NORTH

GRAPHIC SCALE

0 15 30 60

1 INCH = 30 FT.

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FIGURE 2

DOWNSTREAM MAP

WELLMON RESIDENCE

DRAFTED BY: PHB
DESIGNED BY: NBM
PROJECT ENGINEER: YLP
DATE: 9/28/2023
PROJECT NO.: 22109

FIGURE: 2

MR 2 - SWPPP NARRATIVE

A Construction Stormwater Pollution Prevention Plan has been prepared for this Site and is enclosed. Each of the 13 construction SWPPP elements has been considered and discussed below.

Element 1: Mark clearing limits: Prior to beginning land disturbing activities, including clearing and grading, all clearing limits, sensitive areas and their buffers (if any), and trees that are to be preserved within the construction area shall be clearly marked in the field to prevent damage and offsite impacts.

Element 2: Establish construction access: Construction vehicle access and exit shall be limited to the one route shown on the CSWPPP. Sediment tracked off Site shall be cleaned up at the end of each day.

Element 3: Control flow rates: Not applicable – no detention required.

Element 4: Install sediment controls: Prior to leaving the construction site, stormwater runoff from disturbed areas shall pass through a double silt fence.

Element 5: Stabilize soils: All exposed and unworked soils shall be stabilized by application of straw mulch such that the soil is protected from the erosive forces of raindrop impacts and flowing water, and wind erosion. Soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast. Soil stockpiles must be stabilized from erosion, protected with sediment trapping measures, and when possible, be located away from storm drain inlets, waterways and drainage channels.

Element 6: Protect slopes: Cut and fill slopes will be protected from erosion by covering worked soils with mulching, matting, and compost blankets. If necessary, plastic covering can be used to protect slopes.

Element 7: Protect drain inlets: All storm drain inlets made operable during construction and existing inlets affected by runoff shall be protected so that stormwater runoff shall not enter the public conveyance system without first being filtered or treated to remove sediment. Inlets should be inspected weekly at a minimum and daily during storm events. Inlet protection devices should be cleaned or removed and replaced when sediment has filled one-third of the available storage.

Element 8: Stabilize channels and outlets: The existing outlet is above the ordinary high water mark of Lake Washington and discharge directly to the lake surface.

Element 9: Control pollutants: All pollutants, including waste materials and demolition debris that occur on-site, shall be handled and disposed of in a manner that does not cause contamination of stormwater. Woody debris may be chopped and spread on site. Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see chapter 173-304 WAC for the definition of inert waste). On-site fueling tanks shall include secondary containment.

Element 10: Control de-watering: If dewatering is required a temporary sediment trap may be utilized.

Element 11: Maintain BMPs: All temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to assure continued performance of their intended function. All maintenance and repair shall be conducted in accordance with BMP specifications. All temporary erosion and sediment control BMPs shall be removed within 30 days after final Site stabilization is achieved or after the temporary BMPs are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal of BMPs or vegetation shall be permanently stabilized.

Element 12: Manage the project: All BMPs shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function. The CSWPPP shall be modified whenever there is a significant change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

Element 13: Protect LID BMPs: No LID BMPs are proposed at this time. Due to Site constraints, including high groundwater and steep slopes, no LID BMPs are feasible.

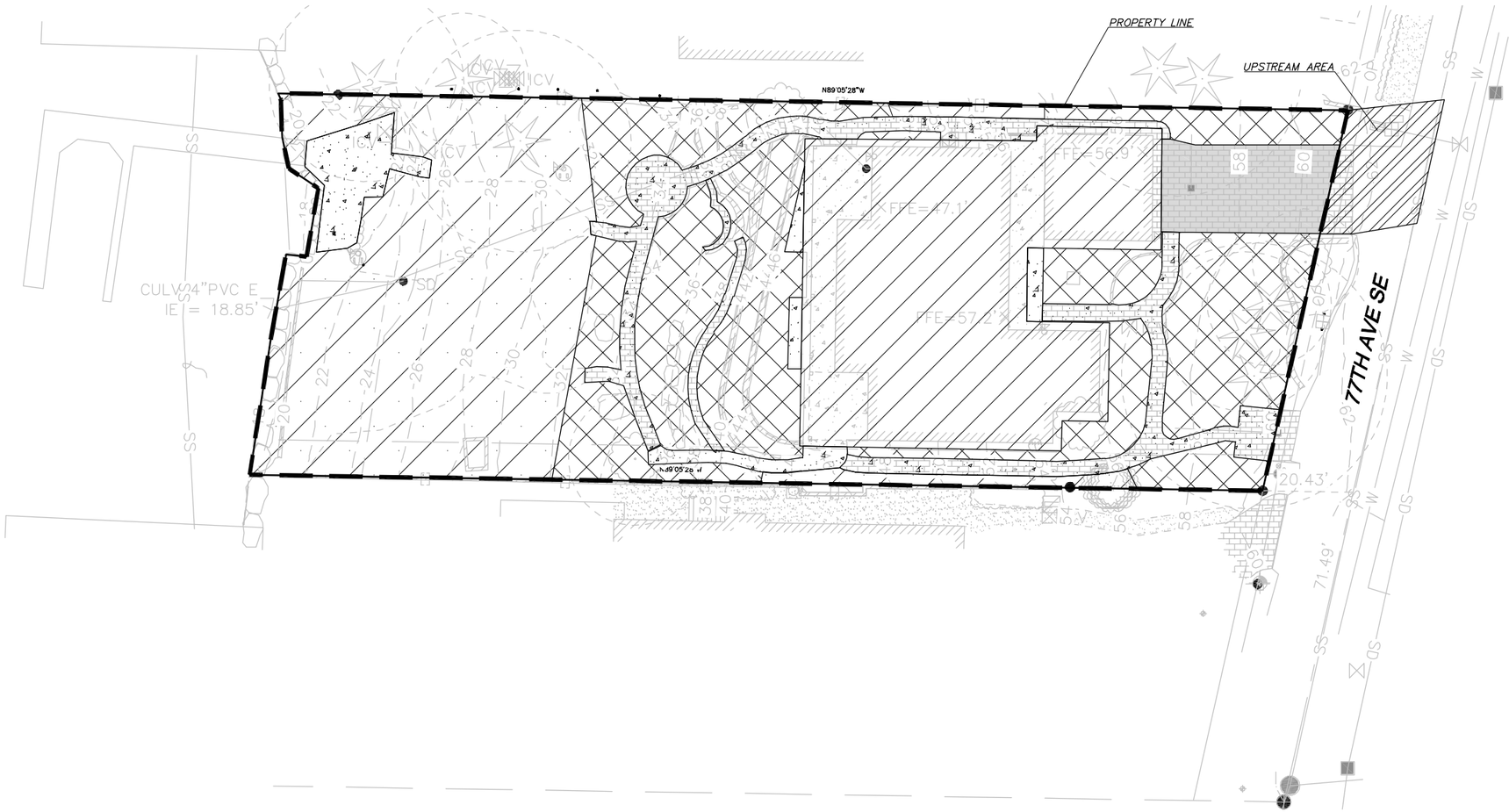
MR 3 - WATER POLLUTION SOURCE CONTROL FOR NEW DEVELOPMENT

Not applicable for this Project. There will be no activities during or after construction that are listed in Volume IV of the Drainage Manual.

MR 4 - PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS, AND PROVISIONS OF OFF-SITE MITIGATION.

Under existing conditions, runoff collected onsite is discharged to Lake Washington via a 4” outlet at the bulkhead. Any runoff generated onsite that is not collected, sheet flows in a westerly direction into Lake Washington. The proposed development will discharge at the natural location along the western property line (Lake Washington). No adverse drainage impacts are anticipated as a result of the proposed Project.

FIGURE 3
EXISTING SITE CONDITIONS MAP



PREDEV. AREA BREAKDOWN

SITE & TDA BOUNDARY

PROJECT BOUNDARY

WWHM INPUTS:

TDA AREA (SITE+UPSTREAM): 20,482 SF (0.470 AC)

MODERATE LAWN/LANDSCAPE AREA
C, LAWN, MOD: 5,487 SF (0.127 AC)

STEEP LAWN/LANDSCAPE AREA
C, LAWN, STEEP: 6,504 SF (0.149 AC)

ROOF AREA
C, ROOF, FLAT: 4,811 SF (0.110 AC)

WALKWAY/PATIO AREA
SIDEWALK, FLAT: 2,320 SF (0.053 AC)

DRIVEWAY AREA
ROAD, MOD: 760 SF (0.017 AC)

UPSTREAM AREA
ROAD, MOD: 600 SF (0.014 AC)

NORTH

GRAPHIC SCALE
0 15 30 60
1 INCH = 30 FT.

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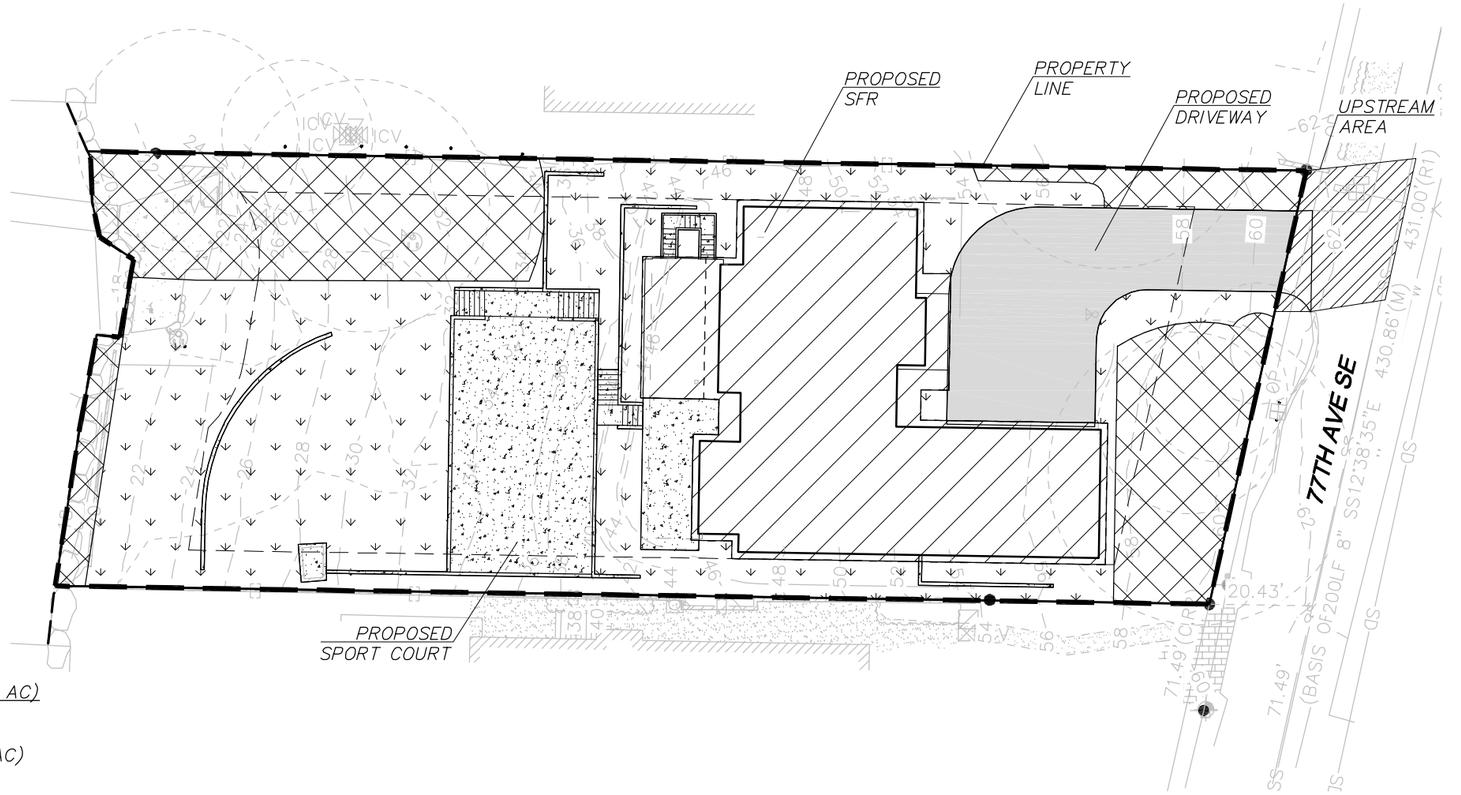
FIGURE 3
PRE-DEVELOPED CONDITIONS
WELLMON RESIDENCE

DRAFTED BY: PHB
DESIGNED BY: NBM
PROJECT ENGINEER: YLP
DATE: 9/28/2023
PROJECT NO.: 22109

FIGURE: 3

FIGURE 4
PROPOSED SITE CONDITIONS MAP



DEVELOPED AREA BREAKDOWN

SITE & TDA BOUNDARY

PROJECT BOUNDARY

WWHM INPUTS:

TDA AREA (SITE+UPSTREAM): 20,482 SF (0.470 AC)

TREE PROTECTION AREA
C, PASTURE, MOD: 4,196 SF (0.096 AC)

LAWN/LANDSCAPE AREA
C, PASTURE, FLAT: 2,979 SF (0.068 AC)
C, PASTURE, STEEP: 4,085 SF (0.094 AC)

ROOF AREA
C, ROOF, FLAT: 4,496 SF (0.103 AC)

WALKWAY/PATIO/DECK AREA
SIDEWALK, FLAT: 2,327 SF (0.053 AC)

DRIVEWAY AREA
ROAD, MOD: 1,799 SF (0.041 AC)

UPSTREAM AREA
ROAD, FLAT: 600 SF (0.014 AC)

NORTH

GRAPHIC SCALE
0 15 30 60
1 INCH = 30 FT.

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FIGURE 4
DEVELOPED CONDITIONS
WELLMON RESIDENCE

DRAFTED BY: NBM
DESIGNED BY: NBM
PROJECT ENGINEER: YLP
DATE: 9/28/2023
PROJECT NO.: 22109

FIGURE: 4

FIGURE 5
USDA SOIL SURVEY MAP

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KpB	Kitsap silt loam, 2 to 8 percent slopes	0.4	100.0%
Totals for Area of Interest		**0.4**	**100.0%**

King County Area, Washington

KpB—Kitsap silt loam, 2 to 8 percent slopes

- **Map Unit Setting**

- *National map unit symbol:* 1hmt9
- *Elevation:* 0 to 590 feet
- *Mean annual precipitation:* 37 inches
- *Mean annual air temperature:* 50 degrees F
- *Frost-free period:* 160 to 200 days
- *Farmland classification:* All areas are prime farmland

- **Map Unit Composition**

- *Kitsap and similar soils:* 85 percent
- *Minor components:* 15 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

- **Description of Kitsap**
- **Setting**

- *Landform:* Terraces
- *Parent material:* Lacustrine deposits with a minor amount of volcanic ash

- **Typical profile**

- *H1 - 0 to 5 inches:* silt loam
- *H2 - 5 to 24 inches:* silt loam
- *H3 - 24 to 60 inches:* stratified silt to silty clay loam

- **Properties and qualities**

- *Slope:* 2 to 8 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Moderately well drained
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
- *Depth to water table:* About 18 to 36 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water supply, 0 to 60 inches:* High (about 11.4 inches)

- **Interpretive groups**

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 3w

- *Hydrologic Soil Group:* C
- *Ecological site:* F002XA004WA – Puget Lowlands Forest
- *Forage suitability group:* Soils with Few Limitations (G002XN502WA)
- *Other vegetative classification:* Soils with Few Limitations (G002XN502WA)
- *Hydric soil rating:* No

- **Minor Components**
- **Alderwood**

- *Percent of map unit:* 10 percent
- *Hydric soil rating:* No

- **Bellingham**

- *Percent of map unit:* 3 percent
- *Landform:* Depressions
- *Other vegetative classification:* Wet Soils (G002XN102WA)
- *Hydric soil rating:* Yes

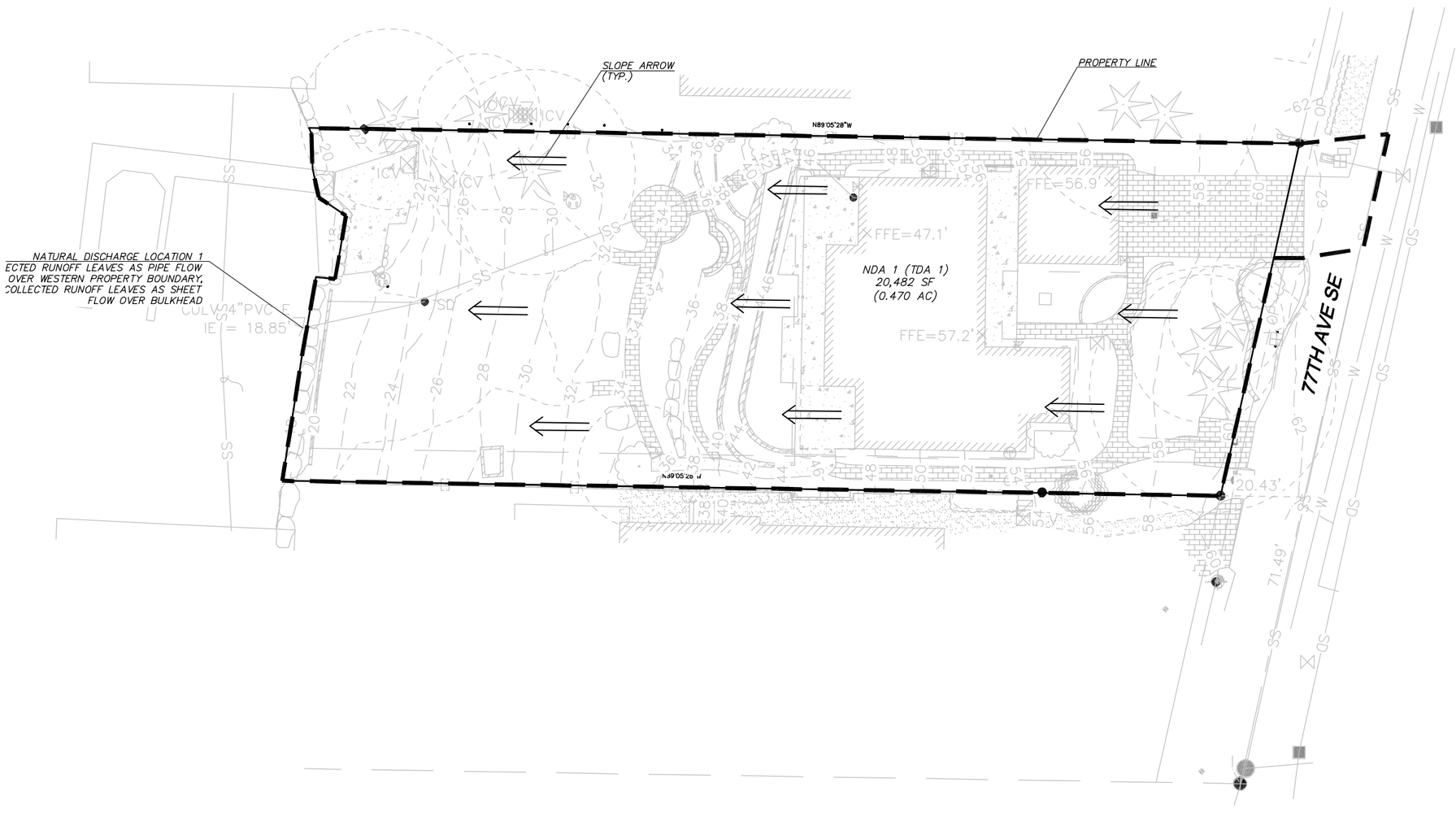
- **Tukwila**

- *Percent of map unit:* 1 percent
- *Landform:* Depressions
- *Other vegetative classification:* Wet Soils (G002XN102WA)
- *Hydric soil rating:* Yes

- **Seattle**

- *Percent of map unit:* 1 percent
- *Landform:* Depressions
- *Other vegetative classifications:* Wet Soils (G002XN102WA)
- *Hydric soil rating:* Yes

FIGURE 6
DRAINAGE SUBBASINS MAP



AREA BREAKDOWN

- SITE BOUNDARY
- PROJECT BOUNDARY
- TDA BOUNDARY

NORTH

GRAPHIC SCALE

0 15 30 60

1 INCH = 30 FT.

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FIGURE 6

DRAINAGE BASINS, SUBBASINS, AND SITE CHARACTERISTICS

WELLMON RESIDENCE

DRAFTED BY: PHB
DESIGNED BY: NBM
PROJECT ENGINEER: YLP
DATE: 9/28/2023
PROJECT NO.: 22109

FIGURE: 6

MR 5 - ON-SITE STORMWATER MANAGEMENT

GENERAL PARAMETERS

- The Project will implement the following BMP's: BMP T5.13 Post-Construction Soil Quality and Depth.
- Infiltration and dispersion Flow Control BMPs are not feasible due to the presence of high ground water, erosion hazard areas, seismic hazard areas, and steep slopes.

All runoff from roof and hard surfaces will be collected and directly discharged to Lake Washington.

SOIL MANAGEMENT PLAN

Within the limits of Site disturbance, duff and topsoil will be retained in an undisturbed state and stockpiled for later use to stabilize and amend soils throughout the Site. Post-construction soil amendment will meet the requirements of BMP T5.13 Post-Construction Soil Quality and Depth.

SITE DISCHARGE

The following table represents the Project areas breakdown of existing and post developed conditions used for WWHM modeling. Pasture is used to model the pervious area in the developed conditions because the Project is proposing Amended Soils BMP T5.13 (Manual, Vol. III Appendix C.9). The 600 SF (0.014 AC) of upstream road area is included in both the Predeveloped and Developed conditions.

Predeveloped	**S.F.**	**Acres**
Impervious (Rooftops/Flat)	4,811	0.110
Impervious (Roads/Mod)	1,360	0.031
Impervious (Sidewalks/Flat)	2,320	0.053
Pervious (C, Lawn, Mod)	5,487	0.126
Pervious (C, Lawn, Steep)	6,504	0.149
Basin Total	**20,482**	**0.470**

Developed	**SF**	**Acres**
Impervious (Rooftops/Flat)	4,496	0.103
Impervious (Roads/Flat)	600	0.014
Impervious (Roads/Mod)	1,799	0.041
Impervious (Sidewalks/Flat)	2,327	0.053
Pervious (C, Pasture, Flat.)	2,979	0.069
Pervious (C, Pasture, Mod)	4,196	0.096
Pervious (C, Pasture, Steep)	4,085	0.094
Basin Total	**20,482**	**0.470**

The 100-year, pre-developed runoff flowrate resulting from this WWHM analysis was 0.2670 CFS and the mitigated, developed runoff was 0.1976 CFS, as shown in the results below. Point of Compliance #1 (POC #1) is the existing 4" pipe outfall at the bulkhead.

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.101509
5 year	0.139560
10 year	0.167152
25 year	0.204825
50 year	0.234983
100 year	0.266981

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.089202
5 year	0.115226
10 year	0.133586
25 year	0.158123
50 year	0.177405
100 year	0.197572

The full WWHM report used to model the scenarios has been included as Appendix B.

CONVEYANCE SYSTEM

Conveyance criteria for the Project require that all new pipes be designed to convey and contain (at minimum) the 25-year peak flow. This system has been designed to convey and contain the 100-year peak flow. To simplify calculations and provide a safety factor, each of the pipes is assumed to convey the runoff generated from the entire Project area.

Onsite and upstream runoff from all target surfaces, will be collected by catch basins, surface drains , or roof gutters, and conveyed to the existing 4 IN pipe outfall at the bulkhead. The conveyance system consists of 4 IN diameter PVC pipes, and type-1 catch basins. Manning's Equation for flow in a circlular channel was used to estimate the capacity of the pipes upstream of the detention tank. The WWHM2012 condition, included as Appendix B, was used to estimate the developed 100-year flow entering the tank for the on-site target surfaces.

Per the WWHM model, the developed 100-year flow is 0.1976 CFS. The 4 IN pipe that connects to the existing 4 IN outfall has the flattest slope, at 1.5%. The pipe capacitiy of this 4 IN with 1.5% slope is 0.2761 CFS. Therefore, all pipes meet flow capacity requirements. The complete analysis is shown on the following page.

Pipe P1 Capacity Estimate:

V = (k/n)*[(A/P)^(2/3)]*[S^(1/2)]	**V=**	**3.164872**	**ft/s**
Q = V * A	**Q=**	**0.276132**	**ft^3/s**
k = unit conversion factor			
A = flow area of pipe			
P = wetted perimeter			
S = slope			
V= velocity in pipe			
Q = discharge rate			
n = mannings n =	0.011		
pipe diameter =	0.3333	ft	
P = pipe circumference = 2πr =	1.0470919	ft	
k =	1.49		
A = πr^2 =	0.0872489	ft^2	
slope =	0.015	ft/ft	
bold italicized=	user input		

MR 6 - RUNOFF TREATMENT REQUIREMENTS

Not required for this Project. Total new/ replaced P.G.H.S. is less than 5,000 SF and P.G.P.S. is less than ¾ of an acre. A spill control device will be provided for collected driveway runoff.

MR 7 - FLOW CONTROL

Not required for this Project. The Site directly discharges to Lake Washington, which is a designated receiving water.

MR 8 - DETENTION OR TREATMENT IN WETLAND AND WETLAND BUFFERS

Not required for this Project. No known wetlands exist on or adjacent to the Site.

MR 9 - INSPECTION, OPERATION AND MAINTENANCE REQUIREMENTS

Catch Basins:

Catch basins have a one foot deep sump for sediment accumulation. This sump should be periodically checked and the sediment removed when accumulated to more than 1/3 of the depth from the bottom of the basin to the invert of the lowest pipe into or out of the basin. Grates should be cleaned when trash or debris of more than ½ cubic foot is located immediately in front of the basin opening, or is blocking capacity of the basin by more than 10%. Additional details are provided at the end of this section.

Conveyance Pipes and Channels:

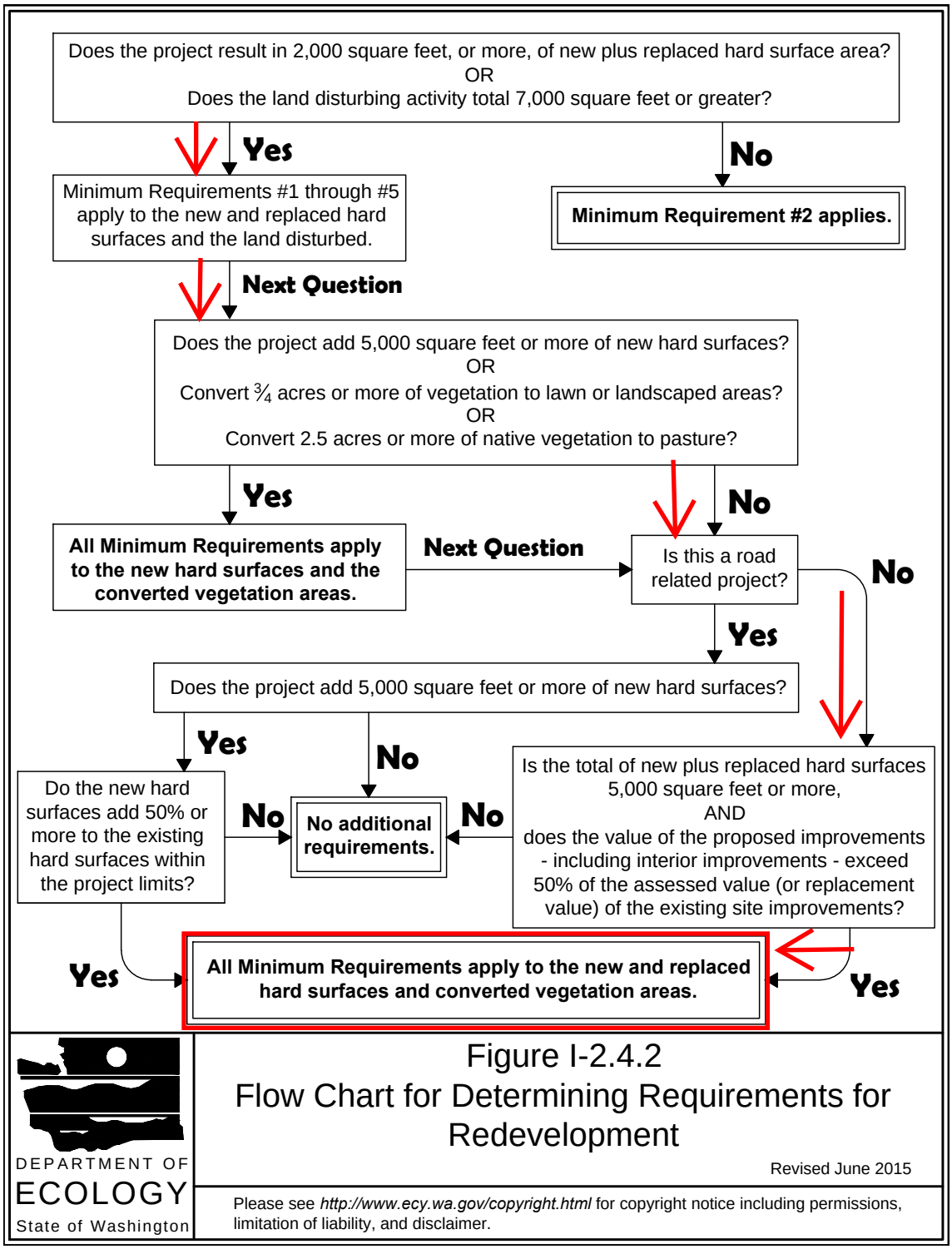
Conveyance pipes and channels should be periodically checked and cleaned when more than 20% of the pipe diameter or channel depth is obstructed by accumulated sediment or debris.

Inspections:

Perform inspections of all components quarterly during the first year of operation, then annually thereafter.

APPENDIX A
DOE FLOW CHART

Figure I-2.4.2 Flow Chart for Determining Requirements for Redevelopment



APPENDIX B
WWHM2012 REPORT

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WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: 22109_WELLMON FLOW CALCS_230928

Site Name:	WELLMON
Site Address:	6333 77TH AVE SE
City:	MERCER ISLAND
Report Date:	9/28/2023
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

PREDEV

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Mod	0.127
C, Lawn, Steep	0.149
Pervious Total	0.276

Impervious Land Use	acre
ROADS MOD	0.031
ROOF TOPS FLAT	0.11
SIDEWALKS FLAT	0.053
Impervious Total	0.194
Basin Total	0.47

Mitigated Land Use

DEVELOPED

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	0.069
C, Pasture, Mod	0.096
C, Pasture, Steep	0.094
Pervious Total	0.259

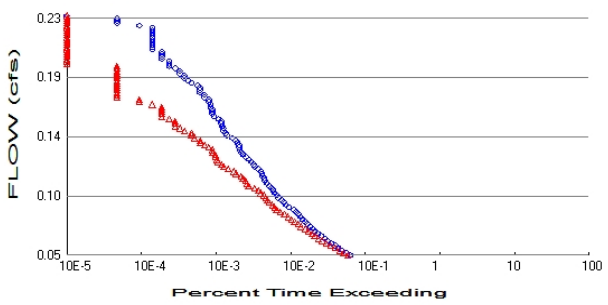
Impervious Land Use	acre
ROADS FLAT	0.014
ROADS MOD	0.041
ROOF TOPS FLAT	0.103
SIDEWALKS FLAT	0.053
Impervious Total	0.211
Basin Total	0.47

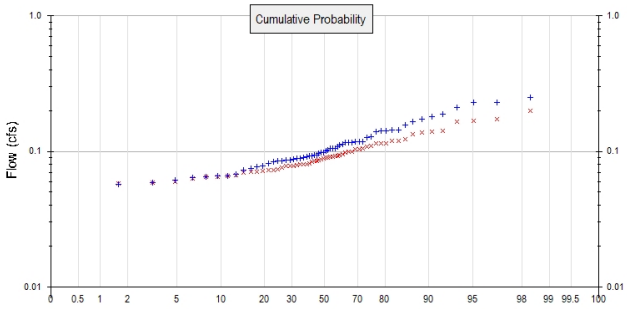
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.276
Total Impervious Area: 0.194

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.259
Total Impervious Area: 0.211

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.101509
5 year	0.13956
10 year	0.167152
25 year	0.204825
50 year	0.234983
100 year	0.266981

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.089202
5 year	0.115226
10 year	0.133586
25 year	0.158123
50 year	0.177405
100 year	0.197572

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.157	0.124
1950	0.142	0.115
1951	0.092	0.079
1952	0.062	0.059
1953	0.065	0.065
1954	0.084	0.074
1955	0.090	0.080
1956	0.085	0.078
1957	0.113	0.095
1958	0.077	0.073

1959	0.066	0.071
1960	0.098	0.087
1961	0.088	0.078
1962	0.066	0.065
1963	0.093	0.078
1964	0.078	0.070
1965	0.118	0.095
1966	0.068	0.064
1967	0.141	0.110
1968	0.143	0.119
1969	0.109	0.085
1970	0.097	0.085
1971	0.115	0.099
1972	0.140	0.105
1973	0.058	0.058
1974	0.112	0.091
1975	0.117	0.097
1976	0.086	0.076
1977	0.081	0.070
1978	0.098	0.090
1979	0.119	0.119
1980	0.173	0.138
1981	0.102	0.092
1982	0.165	0.133
1983	0.106	0.099
1984	0.073	0.066
1985	0.101	0.086
1986	0.094	0.084
1987	0.118	0.114
1988	0.064	0.069
1989	0.085	0.093
1990	0.251	0.199
1991	0.188	0.142
1992	0.075	0.067
1993	0.057	0.058
1994	0.054	0.060
1995	0.087	0.081
1996	0.128	0.104
1997	0.105	0.090
1998	0.089	0.082
1999	0.230	0.168
2000	0.105	0.088
2001	0.094	0.091
2002	0.144	0.114
2003	0.127	0.104
2004	0.210	0.167
2005	0.092	0.081
2006	0.086	0.073
2007	0.228	0.173
2008	0.181	0.140
2009	0.116	0.108

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.2512	0.1986
2	0.2297	0.1732
3	0.2284	0.1681

4	0.2102	0.1667
5	0.1880	0.1422
6	0.1814	0.1402
7	0.1731	0.1375
8	0.1650	0.1332
9	0.1573	0.1235
10	0.1440	0.1192
11	0.1433	0.1192
12	0.1418	0.1148
13	0.1414	0.1140
14	0.1405	0.1139
15	0.1280	0.1098
16	0.1267	0.1079
17	0.1186	0.1055
18	0.1180	0.1039
19	0.1178	0.1038
20	0.1166	0.0991
21	0.1157	0.0990
22	0.1154	0.0975
23	0.1128	0.0950
24	0.1117	0.0945
25	0.1086	0.0932
26	0.1056	0.0920
27	0.1050	0.0915
28	0.1048	0.0912
29	0.1020	0.0898
30	0.1007	0.0898
31	0.0981	0.0883
32	0.0980	0.0868
33	0.0972	0.0861
34	0.0938	0.0852
35	0.0936	0.0847
36	0.0932	0.0841
37	0.0920	0.0817
38	0.0919	0.0806
39	0.0896	0.0806
40	0.0889	0.0803
41	0.0883	0.0794
42	0.0871	0.0785
43	0.0863	0.0784
44	0.0862	0.0782
45	0.0852	0.0758
46	0.0848	0.0741
47	0.0842	0.0729
48	0.0814	0.0728
49	0.0781	0.0714
50	0.0768	0.0703
51	0.0747	0.0703
52	0.0728	0.0693
53	0.0678	0.0666
54	0.0662	0.0657
55	0.0658	0.0647
56	0.0647	0.0646
57	0.0636	0.0635
58	0.0615	0.0596
59	0.0584	0.0591
60	0.0567	0.0583
61	0.0544	0.0578

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0508	1349	1240	91	Pass
0.0526	1196	1096	91	Pass
0.0545	1042	970	93	Pass
0.0563	928	838	90	Pass
0.0582	838	736	87	Pass
0.0601	748	640	85	Pass
0.0619	670	572	85	Pass
0.0638	608	499	82	Pass
0.0656	549	449	81	Pass
0.0675	494	410	82	Pass
0.0694	448	368	82	Pass
0.0712	424	334	78	Pass
0.0731	389	292	75	Pass
0.0749	356	268	75	Pass
0.0768	332	240	72	Pass
0.0787	305	218	71	Pass
0.0805	289	198	68	Pass
0.0824	270	176	65	Pass
0.0843	254	155	61	Pass
0.0861	234	138	58	Pass
0.0880	203	130	64	Pass
0.0898	187	121	64	Pass
0.0917	174	110	63	Pass
0.0936	160	104	65	Pass
0.0954	147	99	67	Pass
0.0973	140	93	66	Pass
0.0991	131	84	64	Pass
0.1010	124	79	63	Pass
0.1029	119	70	58	Pass
0.1047	110	58	52	Pass
0.1066	102	55	53	Pass
0.1084	97	53	54	Pass
0.1103	94	49	52	Pass
0.1122	90	46	51	Pass
0.1140	88	40	45	Pass
0.1159	85	37	43	Pass
0.1177	79	31	39	Pass
0.1196	71	27	38	Pass
0.1215	68	25	36	Pass
0.1233	64	23	35	Pass
0.1252	59	22	37	Pass
0.1271	54	21	38	Pass
0.1289	49	21	42	Pass
0.1308	46	19	41	Pass
0.1326	44	19	43	Pass
0.1345	43	17	39	Pass
0.1364	43	15	34	Pass
0.1382	41	13	31	Pass
0.1401	39	13	33	Pass
0.1419	35	11	31	Pass
0.1438	30	10	33	Pass
0.1457	29	10	34	Pass
0.1475	27	8	29	Pass

0.1494	27	7	25	Pass
0.1512	26	6	23	Pass
0.1531	25	6	24	Pass
0.1550	25	6	24	Pass
0.1568	23	5	21	Pass
0.1587	20	4	20	Pass
0.1605	19	4	21	Pass
0.1624	19	4	21	Pass
0.1643	19	4	21	Pass
0.1661	18	4	22	Pass
0.1680	18	3	16	Pass
0.1699	17	2	11	Pass
0.1717	17	2	11	Pass
0.1736	15	1	6	Pass
0.1754	15	1	6	Pass
0.1773	13	1	7	Pass
0.1792	13	1	7	Pass
0.1810	13	1	7	Pass
0.1829	12	1	8	Pass
0.1847	10	1	10	Pass
0.1866	9	1	11	Pass
0.1885	8	1	12	Pass
0.1903	8	1	12	Pass
0.1922	7	1	14	Pass
0.1940	7	1	14	Pass
0.1959	6	1	16	Pass
0.1978	5	1	20	Pass
0.1996	5	0	0	Pass
0.2015	5	0	0	Pass
0.2033	4	0	0	Pass
0.2052	4	0	0	Pass
0.2071	4	0	0	Pass
0.2089	4	0	0	Pass
0.2108	3	0	0	Pass
0.2127	3	0	0	Pass
0.2145	3	0	0	Pass
0.2164	3	0	0	Pass
0.2182	3	0	0	Pass
0.2201	3	0	0	Pass
0.2220	3	0	0	Pass
0.2238	3	0	0	Pass
0.2257	3	0	0	Pass
0.2275	3	0	0	Pass
0.2294	2	0	0	Pass
0.2313	1	0	0	Pass
0.2331	1	0	0	Pass
0.2350	1	0	0	Pass

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 = Passed

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   22109_WELLMON FLOW CALCS_230928.wdm
MESSU       25   Pre22109_WELLMON FLOW CALCS_230928.MES
            27   Pre22109_WELLMON FLOW CALCS_230928.L61
            28   Pre22109_WELLMON FLOW CALCS_230928.L62
            30   POC22109_WELLMON FLOW CALCS_2309281.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      17
      PERLND      18
      IMPLND       2
      IMPLND       4
      IMPLND       8
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        PREDEV                     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           ***
   17     C, Lawn, Mod             1    1    1    1   27    0
   18     C, Lawn, Steep           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 ***
   17         0    0    1    0    0    0    0    0    0    0    0    0
   18         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  *********
   17         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   18         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 ***
   17         0    0    0    0    0    0    0    0    0    0    0
   18         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
   17              0       4.5      0.03       400       0.1       0.5     0.996
   18              0       4.5      0.03       400      0.15       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   17              0         0         2         2         0         0         0
   18              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   17            0.1      0.25      0.25         6       0.5      0.25
   18            0.1      0.15      0.25         6       0.3      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   17              0         0         0         0       2.5         1         0
   18              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           ***
    2      ROADS/MOD              1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    2         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    2         0    0    4    0    0    4    1    9
    4         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO
```

```
  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    2         0    0    0    0    0
    4         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    2            400      0.05       0.1      0.08
    4            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    2              0         0
    4              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    2              0         0
    4              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
PREDEV***
PERLND  17                      0.127     COPY   501     12
PERLND  17                      0.127     COPY   501     13
PERLND  18                      0.149     COPY   501     12
PERLND  18                      0.149     COPY   501     13
IMPLND   2                      0.031     COPY   501     15
IMPLND   4                       0.11     COPY   501     15
IMPLND   8                      0.053     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   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

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


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   22109_WELLMON FLOW CALCS_230928.wdm
MESSU       25   Mit22109_WELLMON FLOW CALCS_230928.MES
            27   Mit22109_WELLMON FLOW CALCS_230928.L61
            28   Mit22109_WELLMON FLOW CALCS_230928.L62
            30   POC22109_WELLMON FLOW CALCS_2309281.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      13
      PERLND      14
      PERLND      15
      IMPLND       1
      IMPLND       2
      IMPLND       4
      IMPLND       8
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        DEVELOPED                  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
   14     C, Pasture, Mod         1    1    1    1   27    0
   15     C, Pasture, Steep       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
```

```
   14         0    0    1    0    0    0    0    0    0    0    0    0
   15         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
   14         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   15         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
   14         0    0    0    0    0    0    0    0    0    0    0
   15         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
   14              0       4.5      0.06       400       0.1       0.5     0.996
   15              0       4.5      0.06       400      0.15       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
   14              0         0         2         2         0         0         0
   15              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
   14           0.15       0.4       0.3         6       0.5       0.4
   15           0.15      0.25       0.3         6       0.3       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
   14              0         0         0         0       2.5          1         0
   15              0         0         0         0       2.5          1         0
  END PWAT-STATE1

END PERLND

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

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

```
    2         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    4    1    9
    2         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    2         0    0    0    0    0
    4         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    2            400      0.05       0.1      0.08
    4            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    2              0         0
    4              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    2              0         0
    4              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
DEVELOPED***
PERLND  13                      0.069     COPY   501     12
PERLND  13                      0.069     COPY   501     13
PERLND  14                      0.096     COPY   501     12
PERLND  14                      0.096     COPY   501     13
PERLND  15                      0.094     COPY   501     12
PERLND  15                      0.094     COPY   501     13
IMPLND   1                      0.014     COPY   501     15
IMPLND   2                      0.041     COPY   501     15
IMPLND   4                      0.103     COPY   501     15
IMPLND   8                      0.053     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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APPENDIX C
GEOTECH REPORT

Geotechnical Report provided by Cobalt Geosciences, dated December 16, 2022.

Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, Washington 98028

December 16, 2022

Nick and Lindsey Wellmon
C/O Matt Mamiya
Lochwood Lozier

RE: Geotechnical Evaluation
Proposed Residence
6333 77th Avenue SE
Mercer Island, Washington

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

The purpose of our evaluation was to provide recommendations for foundation design, grading, and earthwork.

Site Description

The site is located at 6333 77th Avenue SE in Mercer Island, Washington. The site consists of one nearly rectangular parcel (No. 4097100010) with an area of about 21,100 square feet.

The east-central portion of the site is developed with a residence with daylight basement areas and driveway. There are local rockery walls along and near the north and west property lines. These walls are about 2 to 8 feet in height and are locally terraced on the north side of the property to the west. The north wall faces south and the west walls face west.

The site is vegetated with grasses, bushes, and variable diameter evergreen and deciduous trees. The site slopes downward from east to west at magnitudes of 10 to 30 percent and relief of about 42 feet. There are numerous block and cobble/rockery walls west of the residence. These walls are mostly 1 to 3 feet in height and are located at grade breaks. There is a 2 to 3 feet tall cobble with mortar wall at the shoreline.

The site is bordered to the north and south by residential properties, to the west by Lake Washington, and to the east by 77th Avenue SE.

The proposed development includes a new residence and driveway. Stormwater will include infiltration or other systems depending on feasibility.

Site grading may include cuts and fills of 10 feet or less for basement placement and foundation loads are expected to be light. We should be provided with the final plans to verify that our recommendations remain valid and do not require updating.

Area Geology

The Geologic Map of Mercer Island, indicates that the site is near the contacts between Pre-Olympia Glacial Drift and Lake Deposits.

The drift typically includes silty-sands with minor gravel. These deposits generally become denser with depth below a weathered zone. Lake deposits include loose or soft silts near margins of larger bodies of water, where erosion and deposition often occur.

Soil & Groundwater Conditions

As part of our evaluation, we excavated two hand borings within the property, where accessible.

The explorations encountered approximately 6 inches of grass and topsoil underlain by approximately 3.5 to 4.5 feet of loose to medium dense, silty-fine to medium grained sand trace gravel (Weathered Pre-Olympia Glacial Drift). These materials were underlain by medium dense to dense, silty-fine to medium grained sand trace gravel (Pre-Olympia Glacial Drift) which continued to the termination depths of the explorations.

Groundwater was observed approximately 4 feet below grade in HB-2. Groundwater was not encountered in HB-1. We anticipate that groundwater would be present at or just above lake elevations.

We reviewed numerous explorations from the property to the north. These explorations encountered fill, weathered drift/till, and unweathered drift/till approximately 5 to 8 feet below grade. Groundwater was noted at shallow depths in their explorations closer to the lake.

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

City of Mercer Island GIS Mapped Hazards

The City of Mercer Island GIS maps indicate that the site contains erosion hazard areas. There are local seismic hazard areas mapped in the western quarter of the property.

The erosion hazard designation is likely due to the presence of slopes with magnitudes over 15 percent. The liquefaction/seismic hazard designation is likely due to the possible presence of lake deposits near the shoreline. We did not observe evidence of lake deposits except for at the shoreline, where development is not proposed.

Overall, the site areas appear stable at this time with no evidence of recent or ongoing erosion or landslide activity. It is our opinion that the proposed development can be completed without adversely affecting erosion or seismic hazards on the property or adjacent areas.

Statement of Risk

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

a. The geologic hazard area will be modified, or the development has been designed so that the risk to the lot and adjacent property is eliminated or mitigated such that the site is determined to be safe; or

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

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

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

The project meets the criteria of b and c from above.

The site soil and topographic conditions are not consistent with the mapped geologic hazards. The risk of erosion is very low at this site and will remain low with installation of proper temporary erosion control systems followed by permanent landscaping.

Erosion Hazard

The Natural Resources Conservation Services (NRCS) maps for King County indicate that the site is underlain by Kitsap silt loam (2 to 8 percent slopes). These soils would have a slight to moderate erosion potential in a disturbed state depending on the slope magnitude.

It is our opinion that soil erosion potential at this project site can be reduced through landscaping and surface water runoff control. Typically, erosion of exposed soils will be most noticeable during periods of rainfall and may be controlled by the use of normal temporary erosion control measures, such as silt fences, hay bales, mulching, control ditches and diversion trenches. The typical wet weather season, with regard to site grading, is from October 31st to April 1st. Erosion control measures should be in place before the onset of wet weather.

Seismic Hazard

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

We referenced the U.S. Geological Survey (USGS) Earthquake Hazards Program Website to obtain values for S_S, S_1, F_a, and F_v. The USGS website includes the most updated published data on seismic conditions. The following tables provide seismic parameters from the USGS web site with referenced parameters from ASCE 7-16.

Seismic Design Parameters (ASCE 7-16)

Site Class	Spectral Acceleration at 0.2 sec. (g)	Spectral Acceleration at 1.0 sec. (g)	Site Coefficients		Design Spectral Response Parameters		Design PGA
			F_a	F_v	S_{DS}	S_{D1}	
D	1.47	0.509	1.0	Null	0.98	Null	0.63

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

Conclusions and Recommendations

General

The site is underlain by soils consistent with Pre-Olympia Glacial Drift. These soils become relatively dense below a thin weathered zone. The proposed residential structure may be supported on a shallow foundation system bearing on medium dense or firmer native soils or on structural fill placed on the native soils. Local overexcavation or recompaction of loose weathered native soils may be necessary depending on the proposed elevations and locations of the new footings.

Infiltration is not feasible due to the presence of dense, fine grained soils at shallow depths and shallow groundwater, particularly in the lower elevation portions of the site. In general, dispersion systems and permeable pavements are feasible in the upper, weathered drift above the groundwater. In general, we recommend direct or perforated connection of runoff devices to City infrastructure.

Site Preparation

Trees, shrubs and other vegetation should be removed prior to stripping of surficial organic-rich soil and fill. Based on observations from the site investigation program, it is anticipated that the stripping depth will be 6 to 12 inches. Deeper excavations will be necessary below larger trees and in any areas where fill is present.

The native soils consist of silty-sand with gravel. Most of the native soils may be used as structural fill provided they achieve compaction requirements and are within 3 percent of the optimum moisture. Some of these soils may only be suitable for use as fill during the summer months, as they will be above the optimum moisture levels in their current state. These soils are variably moisture sensitive and may degrade during periods of wet weather and under equipment traffic.

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

Temporary Excavations

Based on our understanding of the project, we anticipate that the grading could include local cuts on the order of approximately 10 feet or less for foundation and utility placement. Temporary excavations should be sloped no steeper than 1.5H:1V (Horizontal:Vertical) in loose native soils and fill, 1H:1V in medium dense native soils and 3/4H:1V in dense to very dense native soils (if encountered at greater depths). If an excavation is subject to heavy vibration or surcharge loads, we recommend that the excavations be sloped no steeper than 2H:1V, where room permits.

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

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

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

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

Foundation Design

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

For shallow foundation support, we recommend widths of at least 16 and 24 inches, respectively, for continuous wall and isolated column footings supporting the proposed structure. Provided that the footings are supported as recommended above, a net allowable bearing pressure of 2,500 pounds per square foot (psf) may be used for design.

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

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

If constructed as recommended, the total foundation settlement is not expected to exceed 1 inch. Differential settlement, along a 25-foot exterior wall footing, or between adjoining column footings, should be less than ½ inch. This translates to an angular distortion of 0.002. Most settlement is expected to occur during construction, as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. All footing excavations should be observed by a qualified geotechnical consultant.

Resistance to lateral footing displacement can be determined using an allowable friction factor of 0.40 acting between the base of foundations and the supporting subgrades. Lateral resistance for footings can also be developed using an allowable equivalent fluid passive pressure of 250 pounds per cubic foot (pcf) acting against the appropriate vertical footing faces (neglect the upper 12 inches below grade in exterior areas). The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance.

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

Concrete Retaining Walls

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

Wall Design Criteria	
"At-rest" Conditions (Lateral Earth Pressure – EFD[+])	55 pcf (Equivalent Fluid Density)
"Active" Conditions (Lateral Earth Pressure – EFD[+])	35 pcf (Equivalent Fluid Density)
Seismic Increase for "At-rest" Conditions (Lateral Earth Pressure)	21H* (Uniform Distribution) 1 in 2,500 year event
Seismic Increase for "At-rest" Conditions (Lateral Earth Pressure)	14H* (Uniform Distribution) 1 in 500 year event
Seismic Increase for "Active" Conditions (Lateral Earth Pressure)	7H* (Uniform Distribution)
Passive Earth Pressure on Low Side of Wall (Allowable, includes F.S. = 1.5)	Neglect upper 2 feet, then 275 pcf EFD[+]
Soil-Footing Coefficient of Sliding Friction (Allowable; includes F.S. = 1.5)	0.40

[*]H is the height of the wall; Increase based on one in 500 year seismic event (10 percent probability of being exceeded in 50 years),
[+]EFD – Equivalent Fluid Density

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

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

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

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

Stormwater Management Feasibility

The site is underlain by weathered to unweathered glacial drift or till which becomes denser with depth. These soils were mottled and we observed groundwater at shallow depths near Lake Washington. Infiltration is not feasible or recommended in these areas. There is inadequate clearance above the groundwater table. Based on nearby explorations by others, groundwater could be within 2 feet of the ground surface in lower elevation areas.

Dispersion trenches and permeable pavements are generally feasible depending on their locations and elevations. In general, we recommend direct or perforated connection of runoff collection devices to City infrastructure. If allowed, it may be possible to disperse or overflow into Lake Washington.

We should be provided with final plans for review to determine if the intent of our recommendations has been incorporated or if additional modifications are needed.

Slab-on-Grade

We recommend that the upper 18 inches of the existing native soils within slab areas be re-compacted to at least 95 percent of the modified proctor (ASTM D1557 Test Method).

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

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

Slabs on grade may be designed using a coefficient of subgrade reaction of 210 pounds per cubic inch (pci) assuming the slab-on-grade base course is underlain by structural fill placed and compacted as outlined above. A 4- to 6-inch-thick capillary break layer should be placed over the prepared subgrade. This material should consist of pea gravel or 5/8 inch clean angular rock.

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

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

Erosion and Sediment Control

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

- Schedule the soil, foundation, utility, and other work requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMP's), grading activities can be completed during the wet season (generally October through April).
- All site work should be completed and stabilized as quickly as possible.
- Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.
- Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

Utilities

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

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

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

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

CONSTRUCTION FIELD REVIEWS

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

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

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

CLOSURE

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

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

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

Sincerely,

Cobalt Geosciences, LLC

12/16/2022
Phil Haberman, PE, LG, LEG
Principal

Statement of General Conditions

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

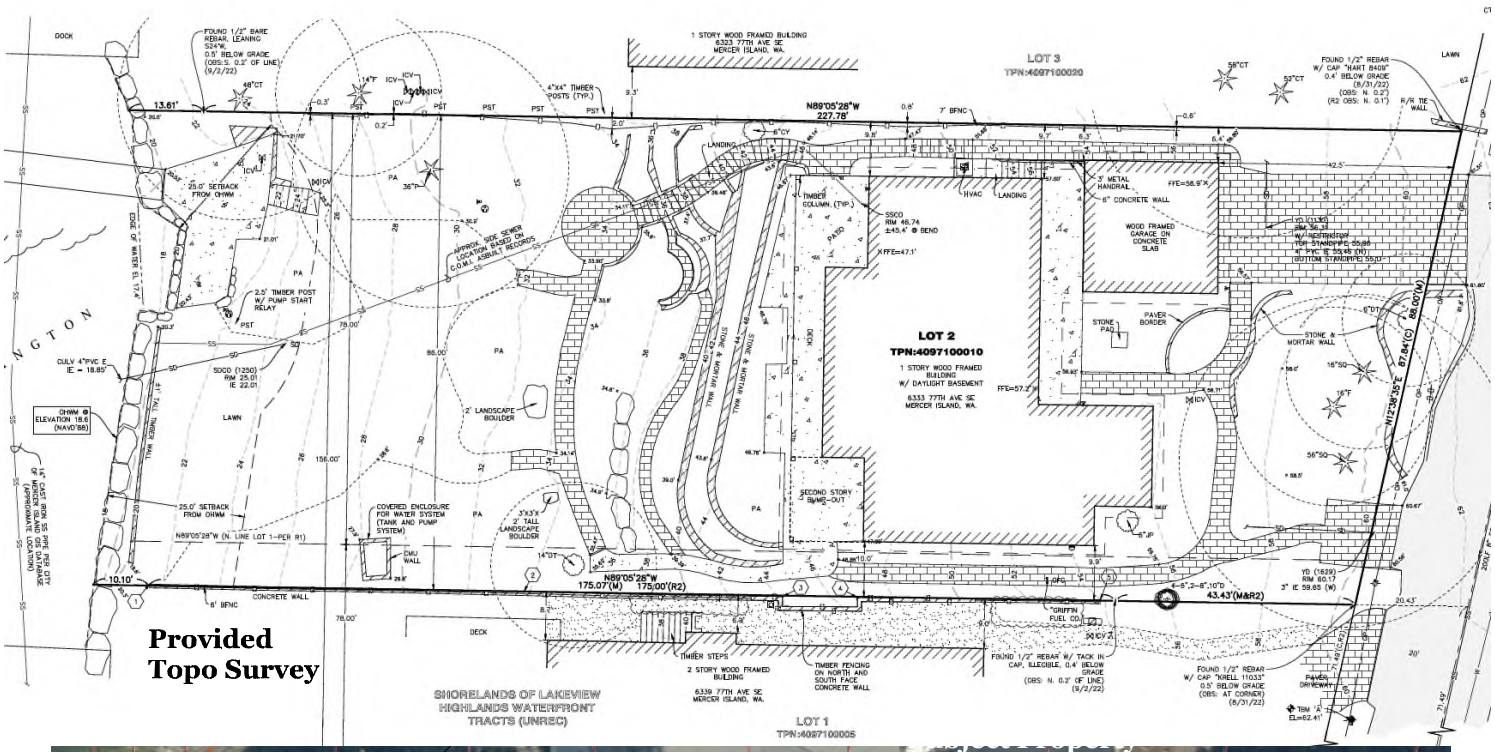
BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Cobalt Geosciences present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of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

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

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

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

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



Provided Topo Survey

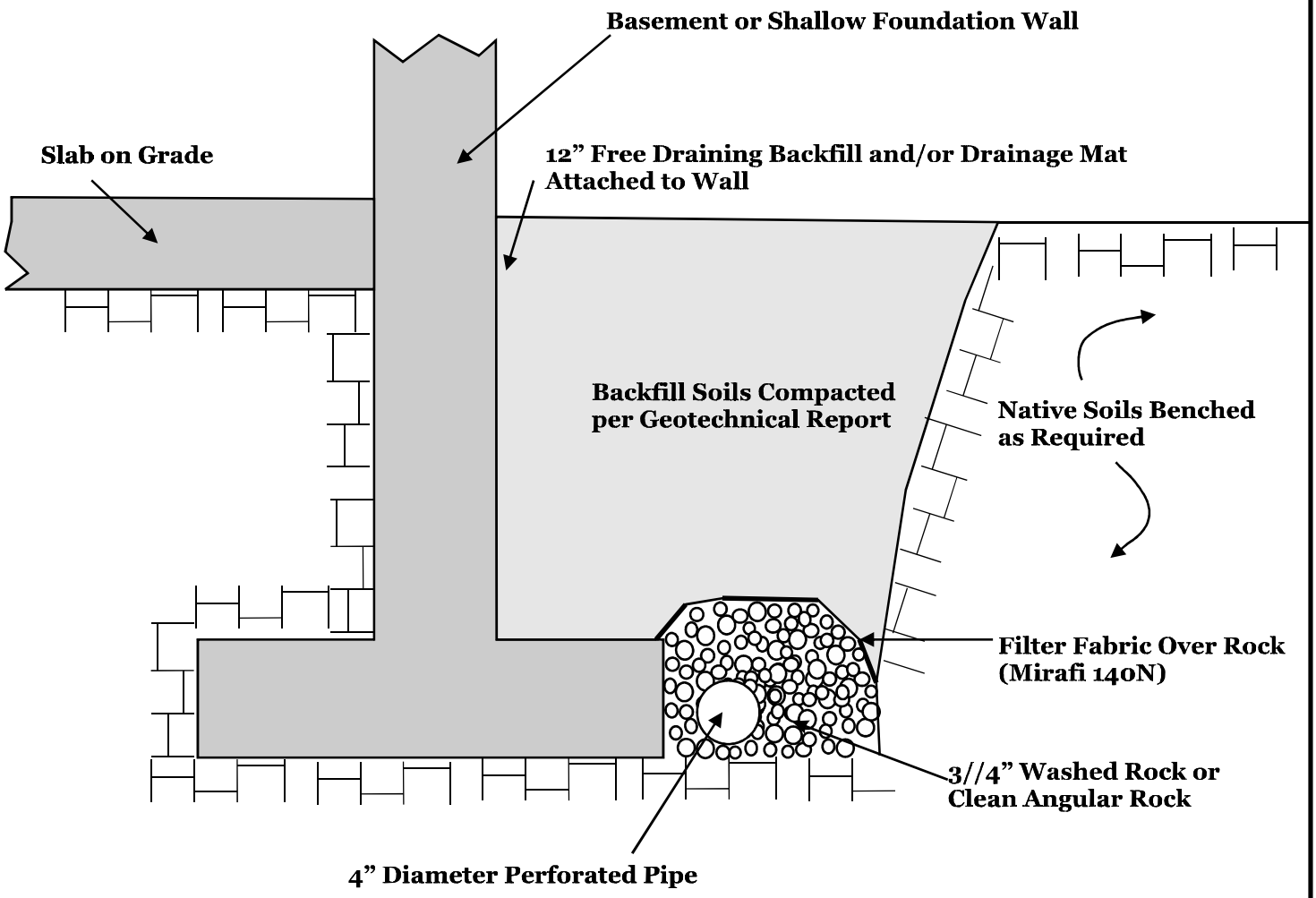
HB-1 **Approximate Hand Boring Location**

N

King County Imap

Not to Scale

COBALT GEOSCIENCES	Proposed Residence 6333 77th Avenue SE Mercer Island, Washington	**SITE MAPS** **FIGURE 1**	Cobalt Geosciences, LLC P.O. Box 82243 Kenmore, WA 98028 (206) 331-1097 www.cobaltgeo.com cobaltgeo@gmail.com



Not to Scale

COBALT GEOSCIENCES	**Typical Foundation Drain Detail**	**Attachment**	Cobalt Geosciences, LLC PO Box 1792 North Bend, WA 98045 (206) 331-1097 www.cobaltgeo.com phil@cobaltgeo.com

Unified Soil Classification System (USCS)

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS (more than 50% retained on No. 200 sieve)	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines (more than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Clean Sands (less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly graded sand, gravelly sands, little or no fines
		Sands with Fines (more than 12% fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (50% or more passes the No. 200 sieve)	Silts and Clays (liquid limit less than 50)	Inorganic	ML	Inorganic silts of low to medium plasticity, sandy silts, gravelly silts, or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays
		Organic	OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (liquid limit 50 or more)	Inorganic	MH	Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silt
			CH	Inorganic clays of medium to high plasticity, sandy fat clay, or gravelly fat clay
		Organic	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat, humus, swamp soils with high organic content (ASTM D4427)

Classification of Soil Constituents

MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (i.e., SAND).

Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).

Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace gravel).

Grain Size Definitions

Description	Sieve Number and/or Size
Fines	<#200 (0.08 mm)
Sand	
-Fine	#200 to #40 (0.08 to 0.4 mm)
-Medium	#40 to #10 (0.4 to 2 mm)
-Coarse	#10 to #4 (2 to 5 mm)
Gravel	
-Fine	#4 to 3/4 inch (5 to 19 mm)
-Coarse	3/4 to 3 inches (19 to 76 mm)
Cobbles	3 to 12 inches (75 to 305 mm)
Boulders	>12 inches (305 mm)

Relative Density (Coarse Grained Soils)

N, SPT, Blows/FT	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium dense
30 - 50	Dense
Over 50	Very dense

Consistency (Fine Grained Soils)

N, SPT, Blows/FT	Relative Consistency
Under 2	Very soft
2 - 4	Soft
4 - 8	Medium stiff
8 - 15	Stiff
15 - 30	Very stiff
Over 30	Hard

Moisture Content Definitions

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

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Soil Classification Chart

Figure C1

Hand Boring HB-1

Date: December 2022	Depth: 6'	Groundwater: None
Contractor:	Elevation:	Logged By: PH Checked By: SC

Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description
				Topsoil/Grass
1			SM	Loose to medium dense, silty-fine to medium grained sand with gravel, dark yellowish brown, moist. (Weathered Glacial Drift)
2				Locally mottled
3	■			
4			SM	Dense to very dense, silty-fine to medium grained sand with gravel, mottled yellowish brown to grayish brown, moist. (Glacial Drift)
5				
6	■			
7				End of Hand Boring 6'
8				
9				
10				

Groundwater

Moisture Content (%)
Plastic Limit — Liquid Limit

DCP Equivalent N-Value
0 10 20 30 40 50

Hand Boring HB-2

Date: December 2022	Depth: 6'	Groundwater: 3'
Contractor:	Elevation:	Logged By: PH Checked By: SC

Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description
				Topsoil/Grass
1			SM	Loose to medium dense, silty-fine to medium grained sand with gravel, dark yellowish brown, moist. (Weathered Glacial Drift)
2	■			Mottled below 20"
3				
4				
5			SM	Dense to very dense, silty-fine to medium grained sand with gravel, mottled yellowish brown to grayish brown, moist. (Glacial Drift)
6	■			
7				End of Hand Boring 6'
8				
9				
10				

Groundwater ▼

Moisture Content (%)
Plastic Limit — Liquid Limit

DCP Equivalent N-Value
0 10 20 30 40 50

COBALT GEOSCIENCES

Proposed Residence
6333 77th Avenue SE
Mercer Island, Washington

Hand Boring Logs

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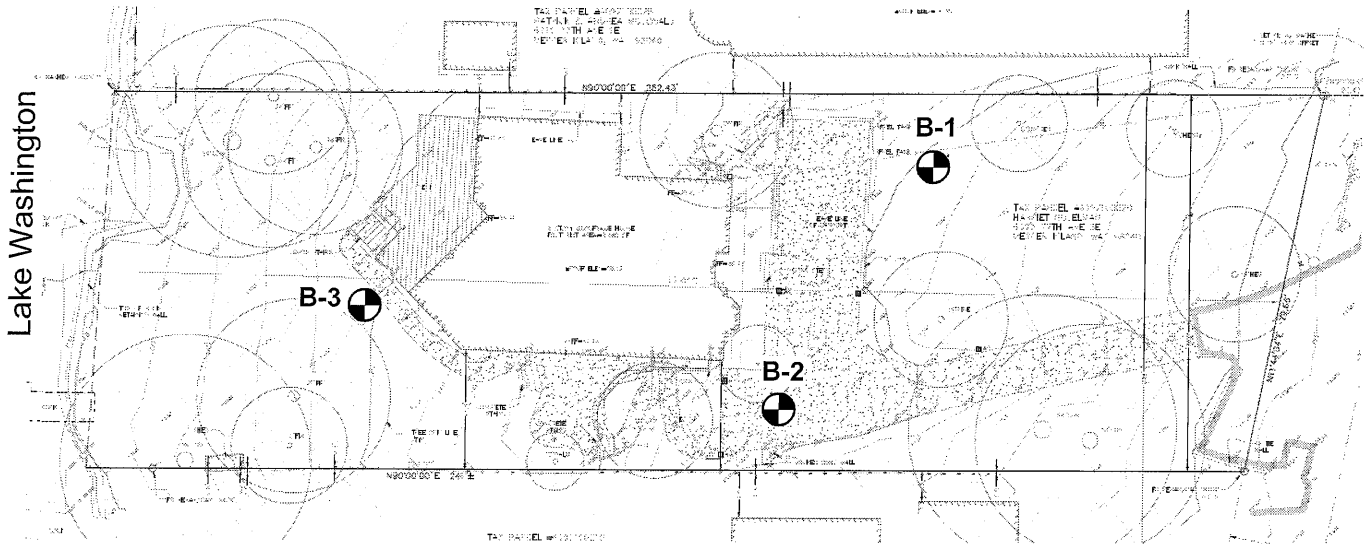
NORTH



Legend:

Test Boring Location

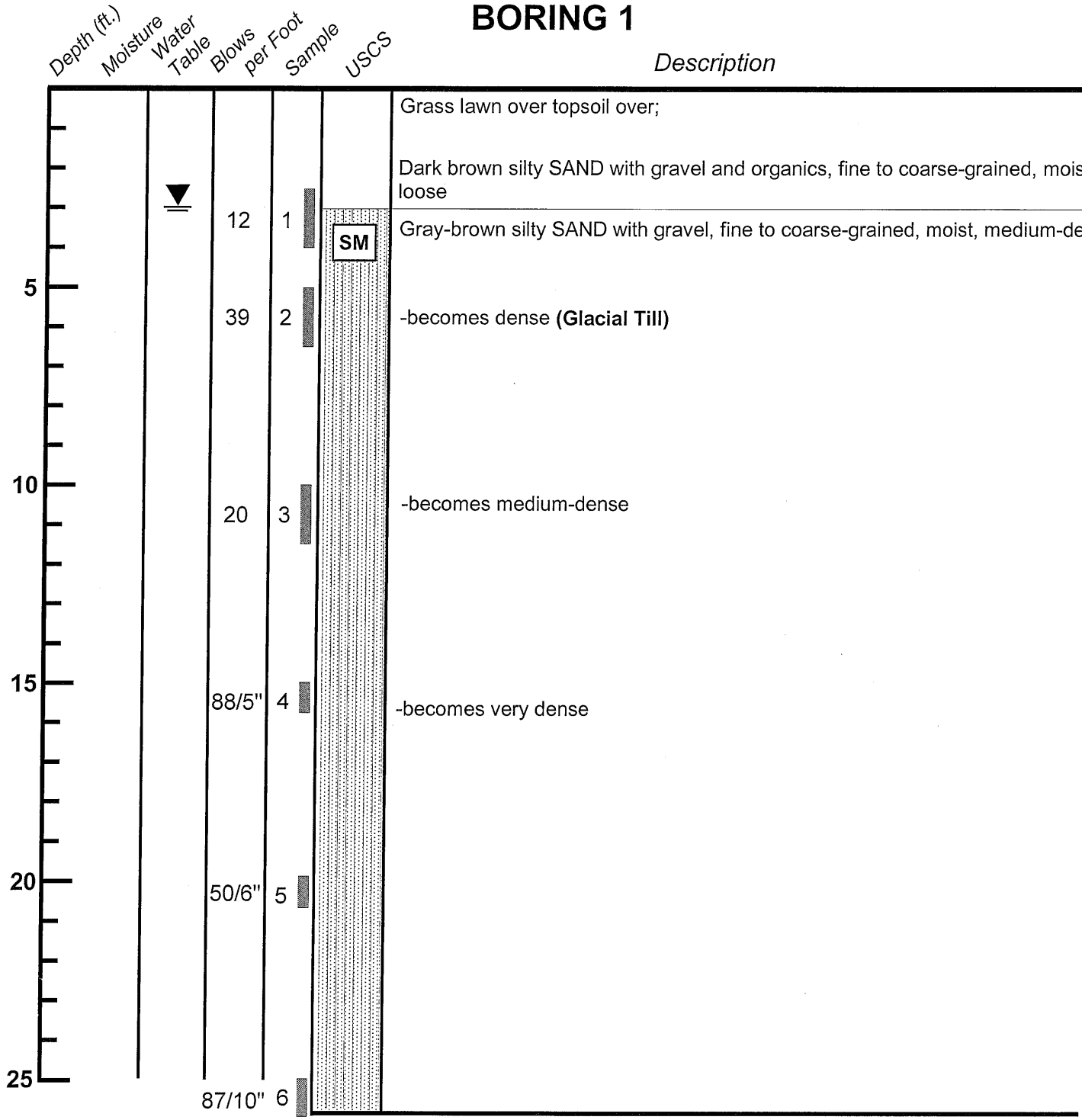
GEOTECH
CONSULTANTS, INC.

SITE EXPLORATION PLAN

6323 - 77th Avenue Southeast
Mercer Island, Washington

Job No:	Date:		Plate:
15031	Feb. 2015	No Scale	2

BORING 1



* **Test boring was terminated on February 9, 2015 at 25.9 feet.**
* **Perched groundwater seepage was observed at 3 feet during drilling.**

GEOTECH
CONSULTANTS, INC.

TEST BORING LOG

6323 - 77th Avenue Southeast
Mercer Island, Washington

Job	Date:	Logged by:	Plate:
15031	Feb. 2015	TRC	3

BORING 2

Depth (ft.)	Moisture	Water Table	Blows per Foot	Sample	USCS	Description
					SM	3 inches of concrete over crushed rock over; Brown silty SAND with gravel, fine to coarse-grained, moist, loose
			14	1		Rust-brown mottled gray-brown silty SAND with gravel, fine to coarse-grained, moist, medium-dense
5			22	2		
			75	3		-becomes very dense and gray-brown **(Glacial Till)**
10			44	4		
15			85/ 11"	5		
20			88/ 11"	6		
25						

* **Test boring was terminated on February 9, 2015 at 20.9 feet.**
* **Groundwater seepage was not observed during drilling.**

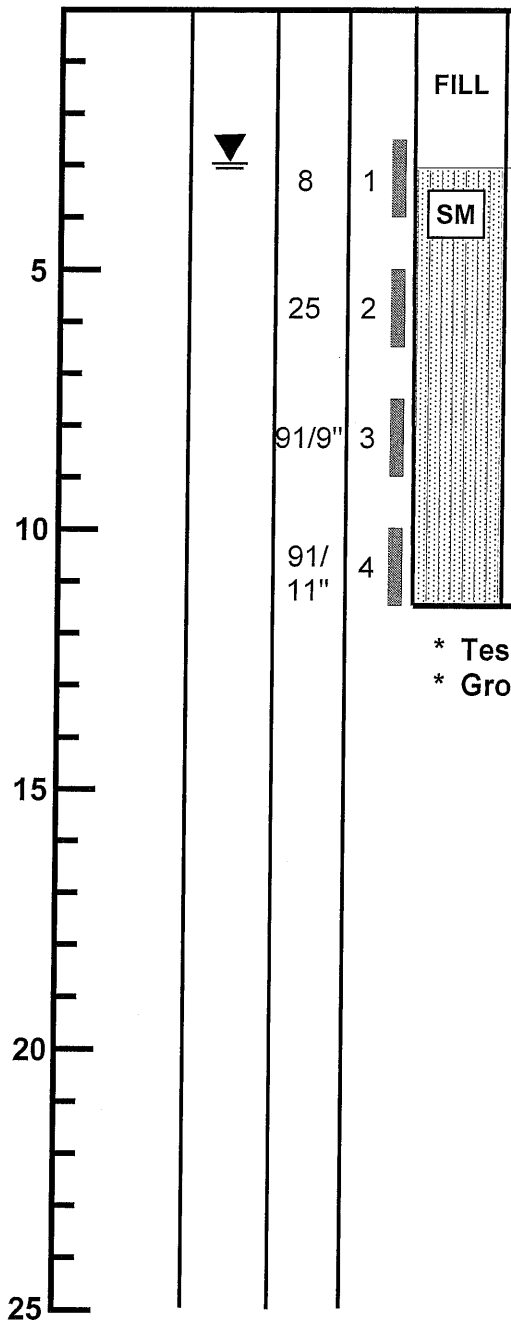
GEOTECH
CONSULTANTS, INC.

TEST BORING LOG

6323 - 77th Avenue Southeast
Mercer Island, Washington

Job	Date:	Logged by:	Plate:
15031	Feb. 2015	TRC	4

BORING 3



USCS	Description
FILL	Grass lawn over; Brown SAND with gravel, fine to coarse-grained, wet, loose **(FILL)**
SM	Rust-brown mottled gray-brown silty SAND with gravel, fine to coarse-grained, moist, loose
	-becomes medium-dense and gray-brown
	-becomes very dense **(Glacial Till)**

* **Test boring was terminated on February 9, 2015 at 11.5 feet.**
* **Groundwater seepage was observed at 3 feet during drilling.**

GEOTECH
CONSULTANTS, INC.

TEST BORING LOG

6323 - 77th Avenue Southeast
Mercer Island, Washington

Job	Date:	Logged by:	Plate:
15031	Feb. 2015	TRC	5