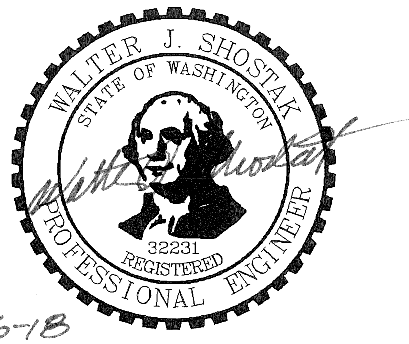
DRAINAGE REPORT

for

6025 77TH AVE SE

Mercer Island, Washington 98040



2-26-18

DRS Project No. 17125
Mercer Island File No. ______________

Owner/Applicant

Tangled Ride LLC,
17 Brook Bay Road
Mercer Island WA 98040

Report Prepared by

DRS

D. R. STRONG Consulting Engineers, Inc.
620 7th Ave.
Kirkland WA 98033
(425) 827-3063

Issue Date:

February 26, 2018

Executive Summary

Drainage Plan Description

The subject parcel is located at 6025 77th Ave SE in the City of Mercer Island (City), King County, also known as Tax Parcel Number 4097100075 (Site). The applicant is proposing to demolish the existing residence and construct one new detached single family residence, driveway, landscaping and associated utilities (Project). The Project Site is approximately 22,620 s.f. (0.519 acres) or 17,989 s.f. (0.41 acres) exclusive of easement for ingress and egress taken to the face of rock bulkhead.

On-site Flow Control BMP's were evaluated and found to be unsuitable for this Site for several reasons. The Site is within a mapped area where infiltrating LID facilities are not permitted. There is insufficient room for dispersion flow paths and the Site is located within an erosion hazard area and potential slide area.

The Project will discharge all collected runoff directly to Lake Washington which is a designated receiving water, and therefore no flow control facilities are required or proposed. The Site has one natural point of discharge located along the western property line (Lake Washington. No adverse drainage impacts are anticipated as a result of the proposed Project improvements.

Upstream Analysis

The upstream area consists of two residential lots to the east of the Site. Topography keeps runoff from the developed adjacent parcels to the north and south mainly contained on their own parcels. The lots upslope and east of the Site (Lots 2 and 3) have existing single family residences and driveways. Hard surfaces on Lot 3 (adjacent to the east of the proposed residence) are collected and piped directly to Lake Washington. Surface runoff from landscaped pervious areas that sheet flow onto the Site will be collected by a v-shaped concrete channel adjacent to the shoring wall on the east side of the new residence and piped to Lake Washington. Subsurface flow from Lot 3 will be collected by a perforated pipe system in a gravel trench below the concrete channel and discharged to the lake.

Lot 2 is also developed and some runoff reaches the existing driveway collection system which is independent of the existing and proposed conveyance systems proposed on the Site. This runoff is piped directly to Lake Washington with an outfall on Lot 1. No changes are proposed to the collection system serving this area as only minor additions to the driveway are proposed.

Downstream analysis

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

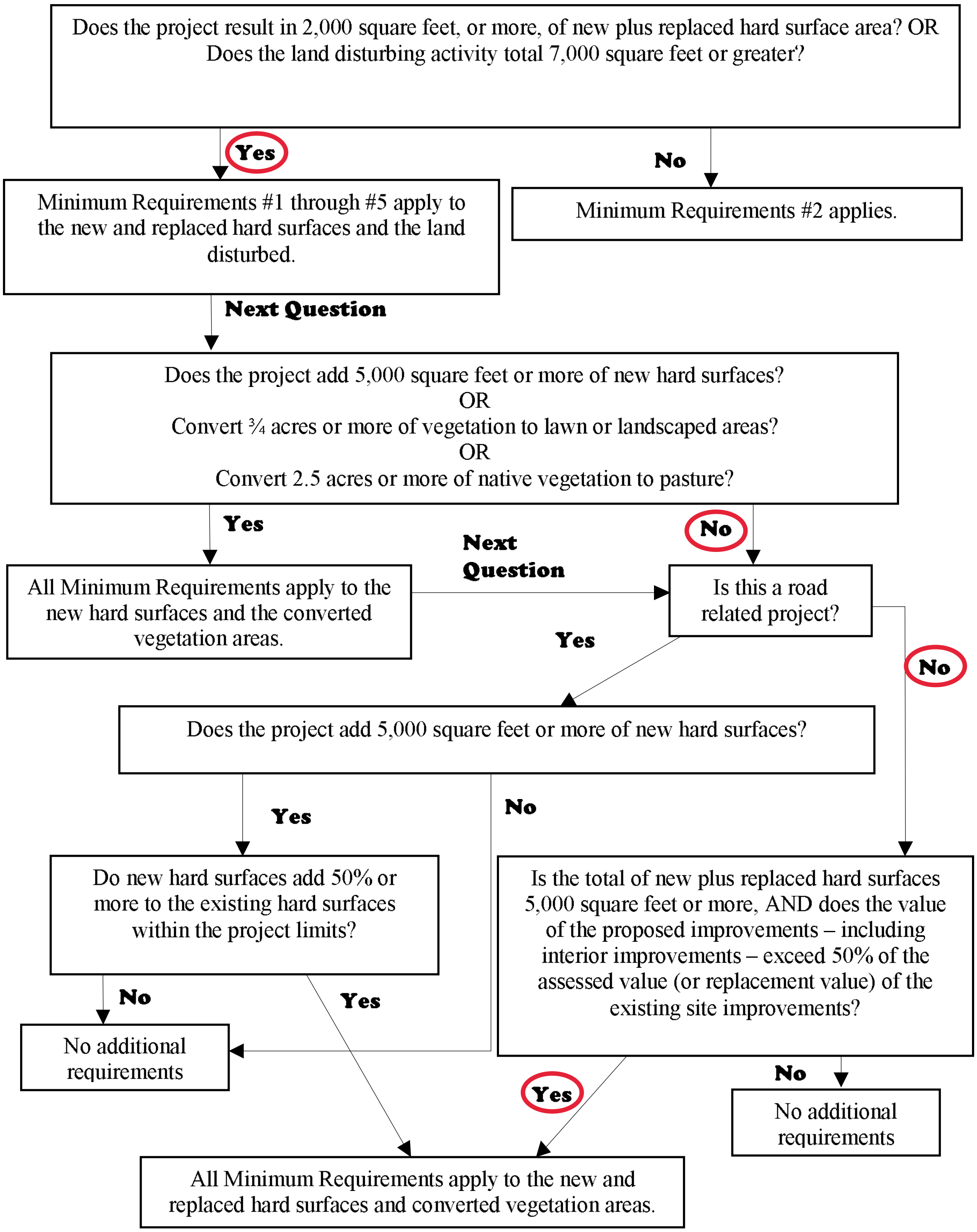


Figure 2.4.2 – Flow Chart for Determining Requirements for Redevelopment

6025 77TH AVE SE

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MR 1 - Stormwater Site Planning

Project Overview

The subject parcel is located at 6025 77th Ave SE in the City of Mercer Island (City), King County, also known as Lot 4 of Mercer Island Lot Line Adjustment MI-88-06-21 (Rec. No. 8808159001), Tax Parcel Number 4097100075 (Site). The applicant is proposing to demolish the existing residence and construct one new detached single family residence, driveway, landscaping and associated utilities (Project). The Project Site is approximately 22,620 s.f. (0.519 acres) or 17,989 s.f. (0.41 acres) exclusive of easement for ingress and egress taken to the face of rock bulkhead.

Existing Conditions Summary

The existing Site is developed with a residence, detached garage, walkways, driveway and rockeries. There are access easements containing a paved driveway and utilities serving residences to the north (Lots 1 and 2 of the short plat).

The area between the house and Lake Washington is covered with lawn/landscaping. The remainder of the Site contains vegetated areas of evergreen and deciduous trees with light underbrush. The Site mainly has slopes ranging from 3-33% down to the western property line with an area of steeper slopes east of the residence and garage. Slopes in the landscaped area west of the existing residence range from 3-15%.

Runoff from roof and driveway areas is collected and piped directly to Lake Washington. Uncollected runoff is dispersed westerly across the Site as sheet flow to the lake.

According to the City of Mercer Island GIS portal sensitive areas maps the entire Site is listed as a potential slide, erosion, and seismic hazard area.

The USDA SCS mapping indicates Kitsap silt loam soils (2-8% slopes) on the Site.

Threshold Determination

Existing Site hard surface area coverage consists of 5,298 s.f. of paved driveway, 2,902 s.f. of buildings, 1,053 s.f. of walks and 586 s.f. of walls for a total of 9,839 s.f. 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 greater than 5,000 square feet 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. Therefore Minimum Requirements (MR) 1 through 9 apply to new and replaced hard surfaces and the land disturbed. 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 BMPċs were evaluated and found to be unsuitable for this Site. Erosion hazard and potential slide areas are present on the Site and it is within a mapped area where infiltrating LID facilities are not permitted. No adverse drainage impacts are anticipated as a result of the proposed Project improvements.

Upstream Analysis

The upstream area consists of two residential lots to the east of the Site. Topography keeps runoff from the developed adjacent parcels to the north and south mainly contained on their own parcels. The lots upslope and east of the Site (Lots 2 and 3) have existing single family residences and driveways. Hard surfaces on Lot 3 (adjacent to the east of the proposed residence) are collected and piped directly to Lake Washington. Surface runoff from landscaped pervious areas that sheet flow onto the Site will be collected by a v-shaped concrete channel adjacent to the shoring wall on the east side of the new residence and piped to Lake Washington. Subsurface flow from Lot 3 will be collected by a perforated pipe system in a gravel trench below the concrete channel and discharged to the lake.

Lot 2 is also developed and some runoff reaches the existing driveway collection system which is independent of the existing and proposed conveyance systems proposed on the Site. This runoff is piped directly to Lake Washington with an outfall on Lot 1. No changes are proposed to the collection system serving this area as only minor additions to the driveway are proposed.

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

Downstream analysis

Site runoff currently is discharged via sheet flow or from a pipe outfall to Lake Washington, a designated receiving water. The Natural Discharge Location of the Site will remain unchanged. Two new pipe outfalls to Lake Washington are proposed. 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

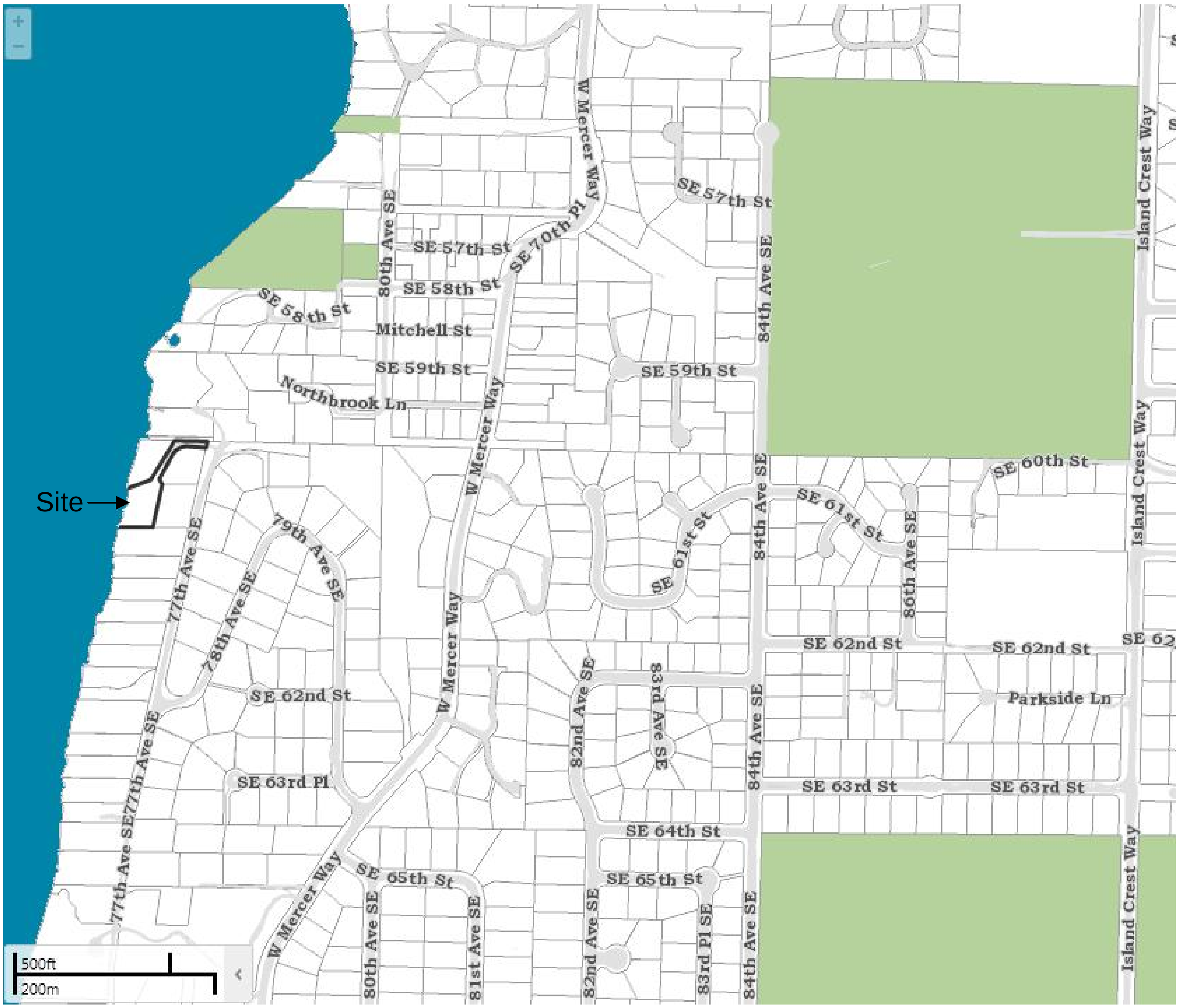
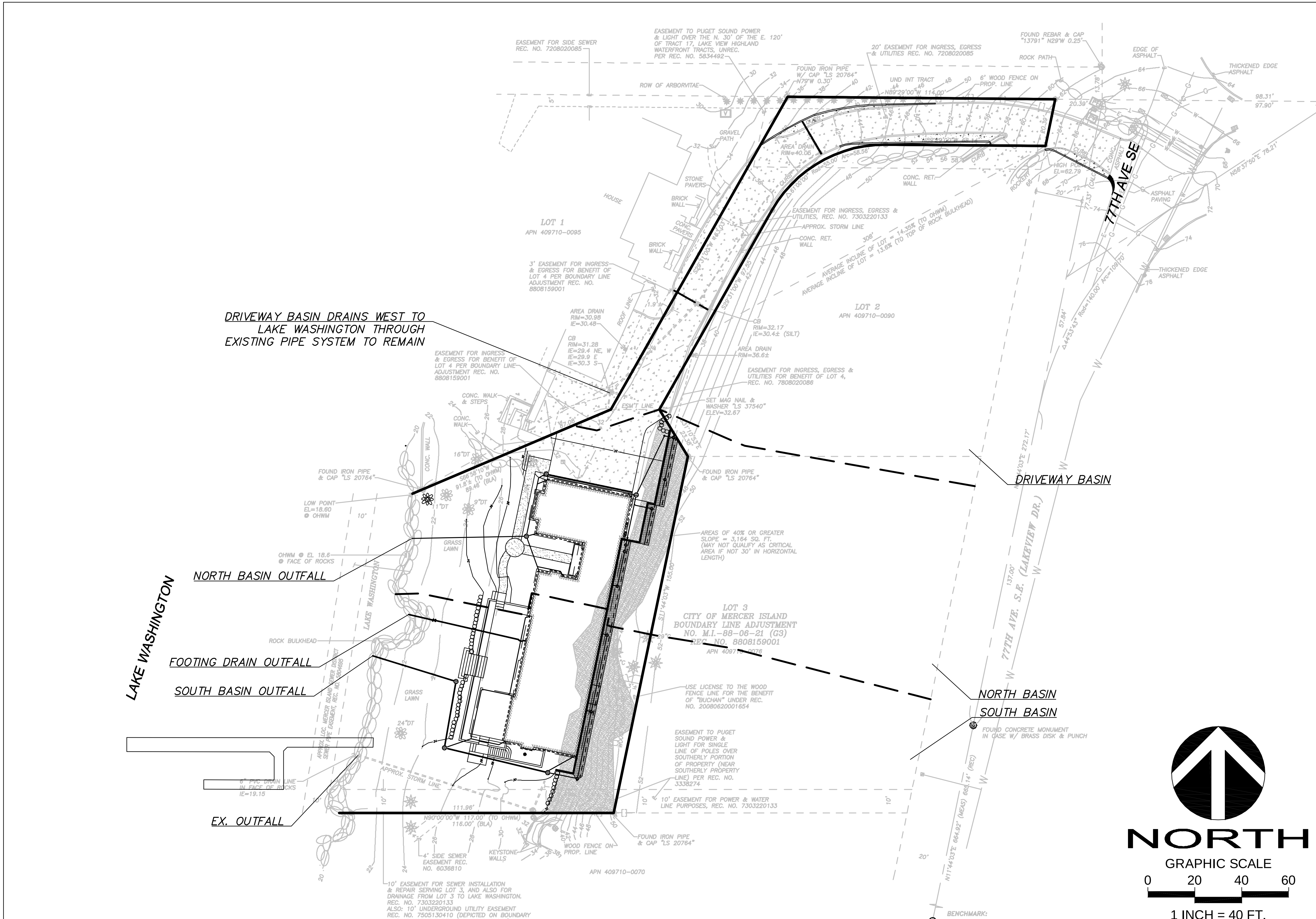


FIGURE 2
DOWNSTREAM MAP



R:\2017\1\17125\3\Drawings\Plots\Engineering\Figs\Fig 2 DS Map 17125.dwg 2/22/2018 1:41:41 PM

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FIGURE 2

DOWNSTREAM MAP
6025 77TH AVE SE

DRAFTED BY: DLR
DESIGNED BY:
PROJECT ENGINEER: WJS
DATE: 1.25.18
PROJECT NO.: 17125

FIGURE: 2

MR 2 - SWPPP Narrative

A Construction Stormwater Pollution Prevention Plan has been prepared for this Site and is enclosed. Each of the 12 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 ï 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: New and existing outlets are 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.

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

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

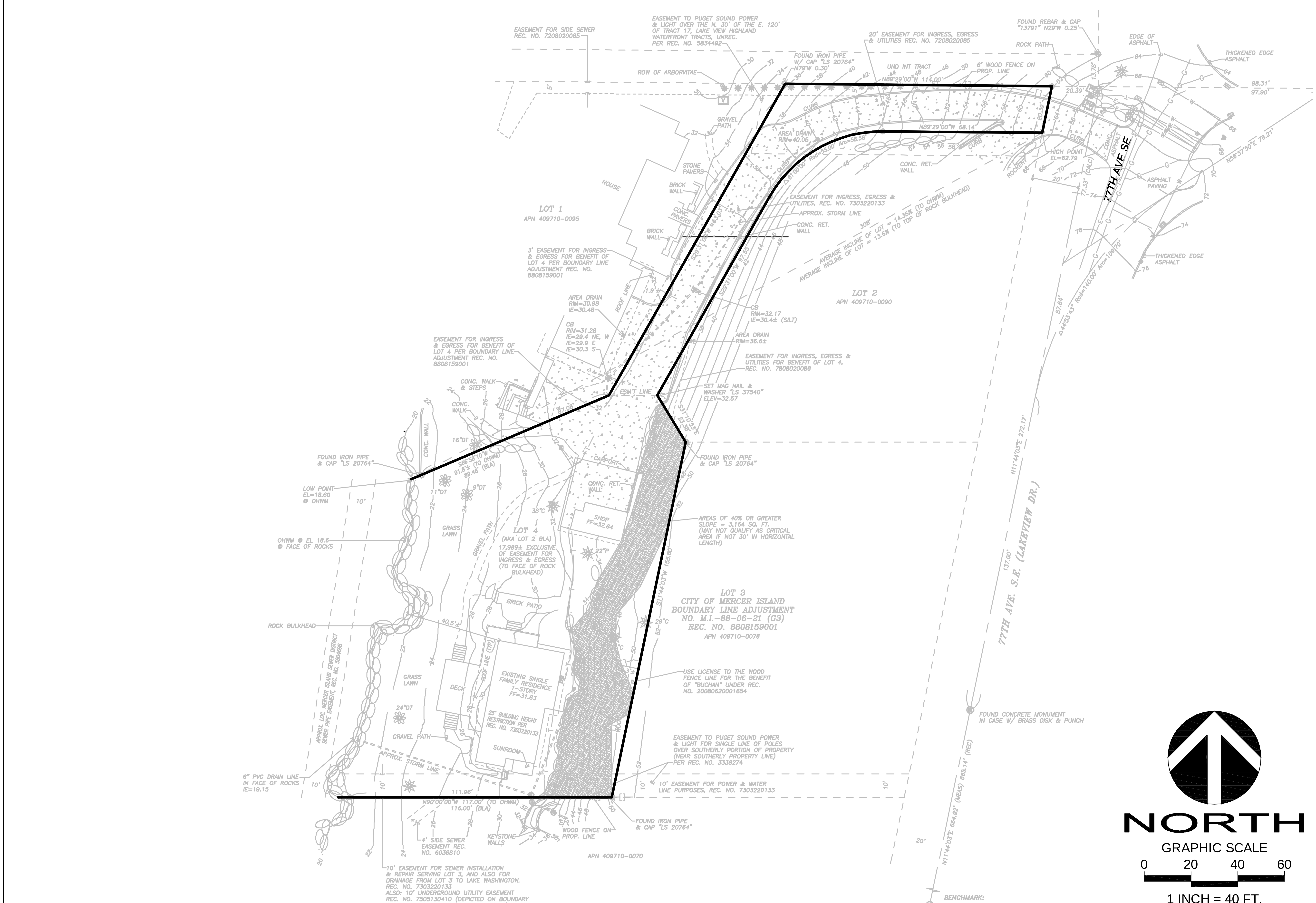

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FIGURE 3

EX. SITE CONDITIONS
6025 77TH AVE SE

DRAFTED BY: DLR
DESIGNED BY:
PROJECT ENGINEER: WJS
DATE: 1.25.18
PROJECT NO.: 17125

FIGURE: 3

FIGURE 4
PROPOSED SITE CONDITIONS MAP

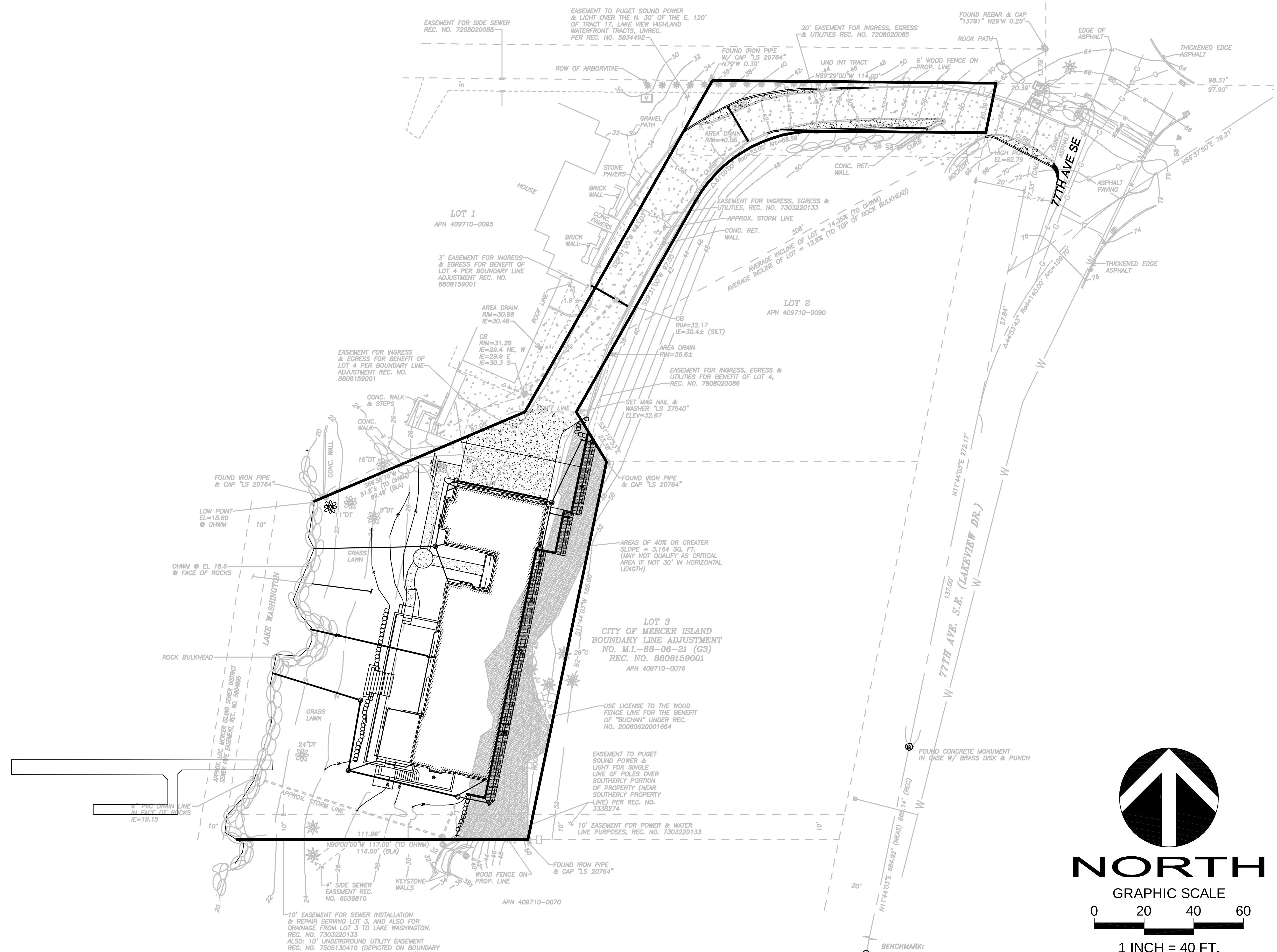

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FIGURE 4

PROPOSED SITE CONDITIONS
6025 77TH AVE SE

DRAFTED BY: DLR
DESIGNED BY:
PROJECT ENGINEER: WJS
DATE: 1.25.18
PROJECT NO.: 17125

FIGURE: 4

FIGURE 5
NRCS SOIL SURVEY MAP

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 storage in profile:* High (about 11.4 inches)

- **Interpretive groups**

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 3w
- *Hydrologic Soil Group:* C
- *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
- *Hydric soil rating:* Yes

- **Tukwila**

- *Percent of map unit:* 1 percent
- *Landform:* Depressions
- *Hydric soil rating:* Yes

- **Seattle**

- *Percent of map unit:* 1 percent
- *Landform:* Depressions
- *Hydric soil rating:* Yes

FIGURE 6
DRAINAGE SUBBASINS MAP

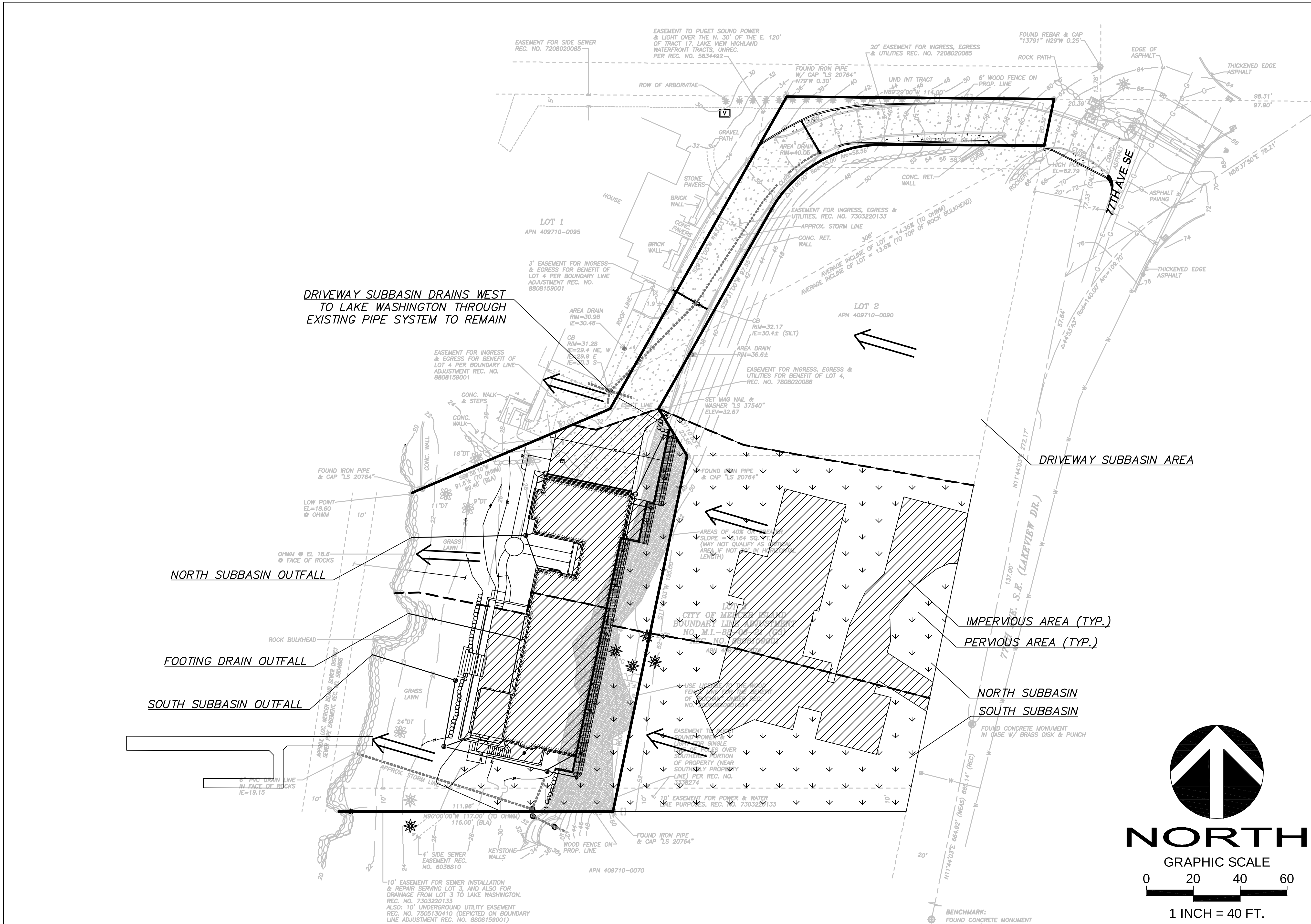

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FIGURE 6

DRAINAGE SUBBASINS MAP
6025 77TH AVE SE

DRAFTED BY: DLR
DESIGNED BY:
PROJECT ENGINEER: WJS
DATE: 1.25.18
PROJECT NO.: 17125

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 BMP's are not feasible due to the presence of erosion hazard areas and potential slide areas.

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.

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.

The proposed drainage system is divided into two subbasins (North and South) by a high point on the slope east of the residence. A shallow v-shaped concrete trench will collect surface runoff from the slope and upstream areas. A gravel trench with a perforated pipe will collect subsurface flow from the slope and upstream area prior to reaching the shoring wall. Upstream runoff will be combined with runoff collected from onsite roof downspout and area drains and directed to one of two new outfalls to Lake Washington.

For simplicity and as a conservative measure, the Rational Method was used to analyze the 100-year storm flows from the combined pervious and hard surface areas for the North and South subbasins. The Flowmaster I v.3.43 software was used to evaluate the capacity of the conveyance system. Results of the analysis are included below.

Surface runoff from each subbasin will be collected by a concrete channel and directed to a new piped conveyance system and will outfall to Lake Washington. Area drains will be located along the channel and will direct channel flow into a separate piped conveyance system below the channel. Roof downspouts will be connected to the area drains and the piped conveyance system. A separate perforated pipe within a gravel trench beneath the concrete channel will collect subsurface runoff and direct it to the tightline system at a point at least one foot below the lowest elevation of the perforated pipe.

Catchment areas for each area drain are actually less than estimated below since each area drain will collect a portion of channel flow at intervals along the channel length. As demonstrated below, the channel system and piped conveyance system to the lake for the North and South subasins will have sufficient capacity for the combined runoff from each subbasin.

Site Discharge

The North subbasin consists of all of the pervious and impervious areas on Lot 3 along with all of the collected pervious and impervious areas on the Site. The peak flow rate calculated for the North subbasin is 0.62 cfs for the 100-year storm event. Per the following calculations, the most shallow-sloped pipe proposed (8òPVC at 2.00%) in the conveyance system is capable of conveying 0.66 cfs.

The South subbasin consists of all of the pervious and impervious areas on Lot 3 along with all of the collected pervious and impervious areas on the Site. The peak flow rate calculated for the South subasin is 0.52 cfs for the 100-year storm event. Per the following calculations, the most shallow-sloped pipe proposed (8òPVC at 2.00%) in the conveyance system is capable of conveying 0.66 cfs.

Haestad Methods FlowMaster I version 3.43

Triangular

Comment: V-shape channel conveyance

Solve For......Depth

Lt Side Slope..	3.00:1 (H:V)	Velocity........	3.06 fps
Rt Side Slope..	3.00:1 (H:V)	Flow Area.......	0.20 sf
Manning's n....	0.017	Flow Top Width..	1.56 ft
Channel Slope..	0.0200 ft/ft	Wetted Perimeter	1.64 ft
Depth..........	0.26 ft	Critical Depth..	0.31 ft
Discharge......	0.62 cfs	Critical Slope..	0.0085 ft/ft
		Froude Number...	1.50

North Subbasin

PEAK RUNOFF CALCULATIONS - 100 YEAR STORM				
	RATIONAL METHOD			
JOB NUMBER:	*17125*			
CALCULATED BY:	*DLR*		***DATE:***	*January 18, 2018*
CHECKED BY:	*WJS*			
PROJECT:	*6025 77th Ave SE*			
FILE:				
R:\2017\0\17125\3\Documents\Analysis\Spreadsheets\Rational-small site 17132 north + upstream.xls				
	HYDROLOGIC CALCULATIONS, (RUNOFF)			
	North Basin			
	Post-Developed Conditions:			
Area (A)				
		(PAVEMENT)	*0.157*	*acre*
		(GRASS & SHRUBS)	*0.194*	*acre*
		TOTAL	***0.351***	***acres***
RUNOFF COEFFICIENT (C)				***k_r Factor***
(from 2009 KCSWDM Table 3.2.1.A)		*(PAVEMENT)*	*0.9*	*20*
		(GRASS & SHRUBS)	*0.25*	*7*
		(ROOF)	*0.9*	*20*
		C (WEIGHTED)	***0.54***	***Postdeveloped***
		(C1 A1+ C2 A2+ C3A3)/A1 + A2 + A3		
TIME OF CONCENTRATION (Tc)				
(Tc = Tci + L/60V)				
T1 - SHEET FLOW, GRASS		*LENGTH (L1) =*	*108*	*ft.*
		SLOPE =	*0.222*	*ft/ft*
		VELOCITY (V)=	*3.30*	*fps*
		T1=	*0.55*	*minutes*
T2 - SHEET FLOW, GRASS		*LENGTH (L2) =*	*29*	*ft.*
		SLOPE =	*0.79*	*ft/ft*
		VELOCITY (V)=	*6.22*	*fps*
		T2=	*0.08*	*minutes*
T3 - SHEET FLOW, PAVEMENT		*LENGTH (L3) =*	*49*	*ft.*
		SLOPE =	*0.03*	*ft/ft*
		VELOCITY (V)=	*3.46*	*fps*
		T3=	*0.24*	*minutes*
		Tc=	*0.9*	*minutes*
			(If <6.3 minutes, use 6.3 minutes	
		Tc=	***6.3***	***minutes***

CALCULATE I_{100}				
COEFFICIENTS FOR THE RATIONAL "I_R" EQUATION		a_R=	*2.61*	*(2009 KCSWDM Table 3.2.1.B)*
		b_R=	*0.63*	*(2009 KCSWDM Table 3.2.1.B)*
		i_R=	*0.82*	
***RAINFALL INTENSITY* (P_{100})**		*P_{100}* =	*4*	*in/hr*
(100 -YEAR STORM - from 2016 KCSWDM Figure 3.2.1.D)				
CALCULATE I_{100}		**I_{100}=**	***3.27***	***in/hr***
RUNOFF (Q)		***Q=***	***0.62***	***cfs***
($Q=C_cI_RA$)				

South Subbasin

PEAK RUNOFF CALCULATIONS - 100 YEAR STORM				
	RATIONAL METHOD			
JOB NUMBER:	*17125*			
CALCULATED BY:	*DLR*		***DATE:***	*January 18, 2018*
CHECKED BY:	*WJS*			
PROJECT:	*6025 77th Ave SE*			
FILE:				
R:\2017\0\17125\3\Documents\Analysis\Spreadsheets\Rational-small site 17132 south + upstream.xls				
	HYDROLOGIC CALCULATIONS, (RUNOFF)			
	South Basin			
	Post-Developed Conditions:			
Area (A)				
		(PAVEMENT)	*0.122*	*acre*
		(GRASS & SHRUBS)	*0.195*	*acre*
		TOTAL	***0.317***	***acres***
RUNOFF COEFFICIENT (C)				**k_r *Factor***
(from 2009 KCSWDM Table 3.2.1.A)		*(PAVEMENT)*	*0.9*	*20*
		(GRASS & SHRUBS)	*0.25*	*7*
		(ROOF)	*0.9*	*20*
		C (WEIGHTED)	***0.50***	***Postdeveloped***
		(C1 A1+ C2 A2+ C3A3)/A1 + A2 + A3		
TIME OF CONCENTRATION (Tc)				
(Tc = Tci + L/60V)				
T1 - SHEET FLOW, GRASS		*LENGTH (L1) =*	*129*	*ft.*
		SLOPE =	*0.248*	*ft/ft*
		VELOCITY (V)=	*3.49*	*fps*
		T1=	*0.62*	*minutes*
T2 - SHEET FLOW, GRASS		*LENGTH (L2) =*	*27*	*ft.*
		SLOPE =	*0.63*	*ft/ft*
		VELOCITY (V)=	*5.56*	*fps*
		T2=	*0.08*	*minutes*
T3 - SHEET FLOW, GRASS		*LENGTH (L3) =*	*43*	*ft.*
		SLOPE =	*0.13*	*ft/ft*
		VELOCITY (V)=	*2.52*	*fps*
		T3=	*0.28*	*minutes*
		Tc=	*1.0*	*minutes*
			(If <6.3 minutes, use 6.3 minutes	
		Tc=	***6.3***	***minutes***

CALCULATE I_{100}				
COEFFICIENTS FOR THE RATIONAL "I_R" EQUATION		a_R=	*2.61*	*(2009 KCSWDM Table 3.2.1.B)*
		b_R=	*0.63*	*(2009 KCSWDM Table 3.2.1.B)*
		i_R=	*0.82*	
RAINFALL INTENSITY (P_{100})		*P_{100} =*	*4*	*in/hr*
(100 -YEAR STORM - from 2016 KCSWDM Figure 3.2.1.D)				
CALCULATE I_{100}		**I_{100}=**	***3.27***	***in/hr***
RUNOFF (Q)		***Q=***	***0.52***	***cfs***
($Q=C_cI_RA$)				

MR 6 - Run-off Treatment Requirements

Not required for this Project. Total new/ replaced P.G.H.S. is less than 5,000 s.f. 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
GEOTECH REPORT

Geotechnical Report by The Galli Group dated July 6, 2017

Geotechnical Report
Hart Residence
6025 77th Avenue SE
Mercer Island, Washington

Project 1865-1
July 6, 2017

Prepared for:
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Hart Residence
6025 77th Ave SE
Mercer Island, Washington

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1.0 INTRODUCTION

The Galli Group performed a geotechnical investigation on the property located at 6025 77th Avenue SE, Mercer Island, Washington. The purpose of our investigation was to identify the subsurface soil conditions on the site and to provide recommendations for site development and foundation support of a new residence on the parcel.

This geotechnical report summarizes observations from our research and subsurface exploration performed for the above referenced property. It also presents our recommendations for the geotechnical design elements of the project.

2.0 PROJECT DESCRIPTION

The project site is located on the lower side of a slope that descends from 77th Avenue SE westerly toward Lake Washington (see Vicinity Map, Figure 1). The site is accessed from a shared driveway that descends from 77th Avenue southwesterly to the parcel. The topography of the parcel ascends moderately from an existing rock bulkhead on the shore of Lake Washington about 80 horizontal feet to the toe of a steep slope that ascends about 16 vertical feet in 16 horizontal feet to the relatively flat rear yard of the parcel above. The inclinations of the slope from the lake to the toe and from the toe to the top of the steep slope are about 13 percent and 100 percent respectively. The parcel is located within Environmentally Critical Areas due to geologic hazards identified in the Mercer Island Code as Landslide Hazard Areas, Erosion Hazard Areas, and Seismic Hazard Areas. The existing topography and site features are shown on Figure 2A, Site Survey.

We understand that the proposed development plan calls for removal of the existing single-story cottage on the lot and replacing it with a two-story single-family residence with full basement and detached garage. The residence will be excavated into the toe of the hillside creating cuts on the order of about 15 to 24 feet in overall height at the back (east end) of the residence. Based upon preliminary schematic drawings we estimate that the amount of excavation for the project will be on the order of about 1700 cubic yards. The proposed buildings can be supported on conventional spread footings provided that the footings are founded in native undisturbed dense glacial soil or compacted fill. Soldier pile shoring walls or soil nail walls will be required on the east side of the excavations. Temporary unsupported cuts may be utilized for the west, north, and south edges of the basement excavation provided they remain confined within the lot lines. A catchment wall might be recommended if the wall is located at the toe of the steep slope. The glacially consolidated soil will be able to stand temporarily in oversteepened cuts allowing for possible use of ecology blocks for temporary shoring or to contain cuts less than 6 feet in height with no backslope. Perched groundwater immediately above the dense underlying soil will likely result in the need for more aggressive waterproofing and subdrainage measures.

3.0 GEOLOGIC HAZARDS DISCUSSION

3.1 GEOLOGIC HAZARD AREAS AND CODE REQUIREMENTS

A review of the Uniform Land Development Code of the Mercer Island City Code (MICC) indicates that the site will be governed by Geologically Hazardous Areas regulations (Chapter 19.07.060). The site likely contains erosion hazard areas, and includes steep slopes that meet the definition of landslide hazard areas. The site also contains potential seismic hazard areas. Below we have discussed the elements that apply to the project site with reference to MICC Geologic Hazard requirements.

3.1.1 Erosion Hazard Areas

The MICC defines Erosion Hazard Areas as the following (MICC 19.16.010)

> "Those areas greater than 15 percent slope and subject to a severe risk of erosion due to wind, rain, water, slope and other natural agents including those soil types and/or areas identified by the U.S. Department of Agriculture's Natural Resources Conservation Service as having a "severe" or "very severe" rill and inter-rill erosion hazard."

The moderate slope between the lake and the toe of the steep slope is inclined at about 13 percent; the steep portion of the slope appears inclined at about 100 percent. The Soil Conservation Service maps the area as underlain by Kitsap silt loam and rates it a "severe" erosion hazard on slopes between 15 and 30 percent. Where left exposed and especially when exposed to concentrated discharges from stormwater culverts or pipes, the soil can present severe risks of erosion.

Because of these topographic and soil conditions a portion of the work area will be classified as an Erosion Hazard Area, that portion being the hillside ascending steeply to the east from the building footprint below. However, the site evidenced no signs of concentrated discharges on the slope, or surficial erosion that we could find. Existing surface water appears to be collected in a private storm drain system that directs water toward the toe of the slope and Lake Washington. Given the soil disturbance be confined largely within the existing developed area at the toe of the slope, we anticipate that conventional BMPs and maintaining a vegetative buffer between the building footprint and the lake should be adequate to prevent erosion, sediment transport, and slope incision during construction. Permanent vegetative cover and stormwater runoff control will adequately reduce long term risks of erosion.

3.1.2 Landslide Hazard Areas

The topography of the steep portion of the slope is mapped as inclined at about 100 percent or 1H:1V for a vertical distance of 16 feet. Geologic mapping indicates that the hillside is likely comprised of pre-Olympia glacial deposits. Based upon sampling from our subsurface exploration and site reconnaissance, the steep slope appears comprised of very dense silty SAND mantled by a loose unit of organic-rich topsoil and loose silty sand about 18 inches thick. Dense soil was encountered in our exploratory borings within 5 feet below existing grade.

Chapter 19.16.010 of the MICC defines "Landslide Hazard Areas" as follows:

> "Those areas subject to landslides based on a combination of geologic, topographic, and hydrologic factors, including:
>
> 1. Areas of historic failures;
> 2. Areas with all three of the following characteristics:
>   a. Slopes steeper than 15 percent; and
>   b. Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and
>   c. Springs or ground water seepage;
> 3. Areas that have shown evidence of past movement or that are underlain or covered by mass wastage debris from past movements;
> 4. Areas potentially unstable because of rapid stream incision and stream bank erosion; or
> 5. Steep Slope. Any slope of 40 percent or greater calculated by measuring the vertical rise over any 30-foot horizontal run."

Geologic maps of the area indicate that the site is likely underlain by Pre-Olympic glacial diamict (*Geologic Map of Mercer Island, Washington*, Troost et. al., 2006). A portion of the geologic map is provided on Figure 3, Geologic Map. These deposits generally appear comprised of silt, sand, clay, and gravel and appear very similar to glacial till. The unit appears very dense and hard after being consolidated by subsequent glacial advances.

We did not encounter any evidence of recent slope movement on the site. We did encounter seepage near the toe of the slope where the toe had been excavated. We interpreted the seepage as near surface water perched within the looser topsoil and flowing along the underlying dense soil unit. Because the hillside is inclined at more than 40 percent, the site would be classified as a "landslide hazard area." Mitigation measures for the slopes should address the control of stormwater runoff, address the potential of downslope creep by providing lateral support, and should address potential for shallow colluvial or "skin slides" from inadequate control of stormwater runoff or other influences such as broken irrigation or water services from upslope properties.

3.1.3 Seismic Hazard Area

Seismic hazard areas are defined as:

> "Seismic hazard areas are areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction or surface faulting."
> (MICC 19.16.010)

The project site appears underlain by dense glacially consolidated soil at depth and does not appear to have a permanent shallow groundwater table except at the lake. This dense material does not present a significant risk of deep-seated slope movement or seismic liquefaction. Provided the new foundations are supported on native undisturbed soil, the risk of seismic-induced settlement does not appear significant. The house will be protected by the proposed foundation and the soldier pile walls. In our opinion, the improvements as designed will not introduce risk of damage due to seismic induced ground shaking.

The topography of the site presents potential risk of near surface slope movement under seismic induced ground shaking. The potential for deep seated slope failures does not appear significant due to the very dense glacial till forming the core of the hillside. Given prolonged ground shaking and wet antecedent conditions, the upper foot or two of the slope surface might slough and migrate downslope. To reduce the risk of adverse impacts of this type as well as the potential risk of near surface failures from surface water or irrigation water upslope, we have recommended constructing a catchment wall to reduce risk of damage to the residence.

In the report sections that follow we have described the site soil conditions and the subsurface conditions. The site appears underlain by very dense glacially consolidated sediment blanketed by about 2.5 feet of loose silty SAND topsoil and another 3 feet of medium dense silty SAND. The work area does not appear to present significant risk of deep seated slope failures. In our opinion, the project area does not present a significant risk of seismic liquefaction, landslides, or erosion if conventional Best Management Practices are followed during the repair, and our recommendations for design and mitigation are followed during project development.

3.2 SURFACE CONDITIONS AND GEOLOGY

The site ascends from the lake at about 13 percent toward the steep hillside. From that point, the hillside continues to ascend easterly at an inclination of about 1H:1V. Existing vegetation consists of lawn and mature landscaping on the lower portion of the lot and several large Cedars and understory growth of Salal, ferns, and blackberries on the steep hillside. Small facing rockeries armor toe of the slope east of the existing residence.

Geologic maps of the area indicate that site is likely underlain by pre-Olympia deposits including till-like soil (*Geologic Map of Seattle – a Progress Report,* Troost, Booth et al, 1985). Pre-Olympia deposits generally appear comprised of layers of sediment deposited many thousands of years ago prior to the most recent glacial advance 15,000 years ago. The material was subsequently carved and compacted by tons of advancing ice and then incised again by meltwater runoff as the glacier retreated northward. The unit tends to appear stable except where left unprotected by vegetation, subjected to concentrated stormwater runoff, or where groundwater emerges on steep slopes.

Existing drainage on the site consists of sheet flow from impervious surfaces and patios, seepage and surficial runoff from the hillside collected in yard drains and a shallow interceptor trench at the toe of the steep hillside. These drains and the downspouts appear to be collected in a 6-inch drain pipe that is routed toward Lake Washington.

3.3 SITE SOIL AND GROUNDWATER CONDITIONS

On June 12, 2017, we conducted a subsurface investigation on the site utilizing a track-mounted drill rig. We drilled three borings to depths varying from 11 feet to 26 feet. We identified the soil samples in the field and documented the density at periodic intervals as the drilling progressed. The results of our subsurface exploration are provided on the boring logs in the attached Appendix.

Based upon our subsurface exploration the site and the hillside appears underlain by very dense silty SAND with gravel and cobbles, interpreted as Pre-Olympia glacial diamicts or glacial till. The soil became medium dense to dense within the upper 3 feet and appeared very dense consistently at and below 5 feet depth. The dense soil was mantled by a layer of loose to medium dense silty SAND in all holes.

No permanent groundwater was observed in our test holes except B-2, where we encountered a wet seam at 16 feet depth forming water on the rods at 25 feet depth. We observed seepage along the contact with the topsoil and the underlying very dense silty SAND unit at the cut near the toe of the hillside. We interpreted this as near-surface water perched on top of the dense soil that migrates downslope through the loose topsoil and organic material.

3.4 EROSION AND SLOPE MITIGATION MEASURES

The dense core of the hillside and the proposed building footprint appears mantled by a thin layer of loose to medium dense silty SAND about 3 to 5 feet thick. Glacially consolidated sediment was observed in our borings at about 5 feet below grade. To prevent adversely impacting the slope, adjacent properties, or increasing the risk of erosion and sediment transport we recommend the following mitigation measures.

1. A shoring wall should be constructed against the toe of the hillside where excavation is planned. The wall should include a catchment wall with at least 5 feet of freeboard behind the wall to collect minor sloughing, shallow skin slides, or erosion from man-made causes or extreme runoff events if the entire slope height remains above the wall.
2. Conventional BMPs discussed in sections below should be employed during construction to control sediment transport and limit erosion.
3. Mass excavation and construction of the shoring wall must be accomplished during the drier season and avoided between October 1, and April 1. Once the shoring wall is

installed, additional excavation may occur during the wet season if a grading extension is obtained. Additional erosion control measures might be required.

4. Upon completion of the project, the exposed soils in the work area should be protected by a landscape plan that will permanently stabilize disturbed portions of the slope and the site against surficial erosion.

Provided the recommendations in our report below are followed during design and construction it is our opinion that the proposed repairs may safely be constructed on the project site and in keeping with the Mercer Island City Code regulations related to geologically hazardous areas.

3.5 RISK ASSESSMENT

Most of the proposed development activity occurs within the previously developed area of the existing building, decks, or flatwork. There will be additional excavation at the toe of the hillside requiring shoring. Provided the recommendations in our report are incorporated into the proposed design and construction the development activity will not adversely impact the adjacent properties or the geologic hazard areas.

In keeping with MICC code requirements, we provide the following statement of risk:
"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."

More specifically, the proposed activity will provide a catchment wall to prevent soil from moving downslope to the residence. The residence will be supported on dense underlying soil and possibly the soldier pile wall. Best Management Practices will be incorporated into the construction erosion control and permanent site stabilization.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The site appears underlain very dense silty SAND with gravel, mantled by a layer of loose silty SAND and topsoil about 3 to 5 feet thick. The hillside behind the proposed residence appears comprised of dense glacially consolidated till with a thin layer of silty SAND and topsoil about 2 feet thick. The proposed residence can be supported on conventional foundations constructed on the underlying undisturbed glacially consolidated soil. In the report sections that follow we have addressed the following geotechnical elements:

- The residence may be supported on conventional foundations. Care should be exercised to preserve the bearing conditions of the foundation soils by keeping the excavation dry and preventing traffic on the bearing surface.
- Temporary cuts may be oversteepened according to our recommendations but cuts at the toe of the steep slope should be shored.

- We recommend use of the shoring piles to construct a catchment wall on the east side of the house at the toe of the slope.

4.1 SITE GRADING AND EARTHWORK

Site development will result in a large excavation footprint exposing dense silty SAND with gravel. These soils will be difficult to compact when wet and disturbed by equipment traffic. Best Management Practices commonly observed should be employed during construction. We anticipate these will include the following:

1. A construction entrance near the existing garage should be provided for the site and to act as a staging area for construction materials. The entrance should be constructed from 4" – 6" quarry spalls placed over a woven geotextile fabric such as Mirafi 500X.
2. It is important to avoid tracking sediment onto the roadway and shared driveway. The contractor should monitor the tracking of sediment from the site and clean up as necessary. Sand and silt tracked from the site should be removed or cleaned by the contractor. If tracking onto the roadway becomes a problem, the contractor will need to construct a wheel-wash area on site.
3. A silt fence should be erected along the downslope limits of the construction area. A highly visible construction fence should be erected along the edge of areas intended to be preserved as vegetative buffers for stormwater runoff.
4. Stormwater runoff or seepage can be handled by a system of sumps and trenches within the excavation and discharged to a suitable dispersion area. During the wet season additional measures such as gravel sumps and wattles might be needed to avoid transport of sediment or turbid water from the site.
5. Spoils should be removed immediately from the site or protected during wet weather by use of plastic sheeting. Generally, stockpiles should not remain uncovered for more than 2 days during the wet season or 5 days during the drier summer months.
6. The contractor should monitor the performance of the erosion control measures and contact the geotechnical engineer if the TESC measures do not provide the intended function.

4.2 TEMPORARY EXCAVATIONS AND GRADING

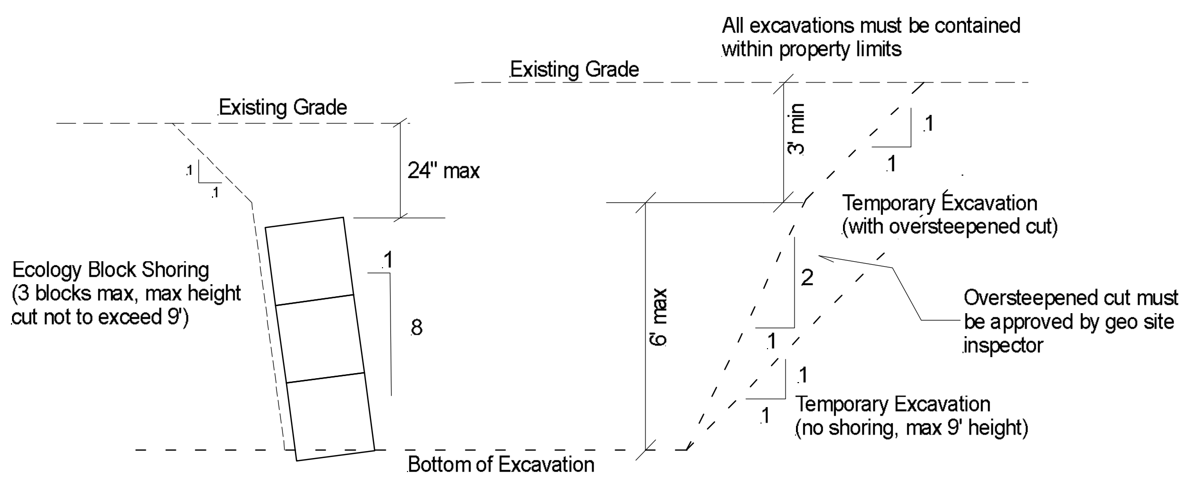
4.2.1 Fill Areas

The site soils will be unsuitable for fill beneath paved areas or structures. Generally, we anticipate that most of the site material will be removed from the site. The filled areas under proposed driveways or parking areas should consist of free draining sand and gravel with less than 7 percent passing the No. 200 sieve. It should be placed in thin lifts and compacted against horizontal surfaces in accordance with the criteria described in section 4.6 below. Permanent fill slopes should not exceed 2H:1V for ease of maintenance.

4.2.2 Unsupported Excavations

Temporary excavations should be shaped or benched to protect workers below. Generally, temporary construction cuts within site soils should be inclined no greater than 1H:1V (Horizontal to Vertical). The very dense consistency of the soil might allow for oversteepened cuts as shown in the illustration below where it is necessary to contain cuts within the property limits. This assumes that the excavation is undertaken during the dry summer months and that no seepage is encountered in the excavations. Oversteepened cuts will not be permitted if the excavation occurs during the wet season. The geotechnical engineer must monitor the excavation as it progresses where oversteepened cuts are planned. Once cuts are exposed, the soils must be protected during wet weather.

Where seepage is encountered or where the temporary cuts are not able to remain stable, or where cuts exceed 9 feet, additional measures such as ecology blocks or other temporary shoring might be required. Cuts may not be oversteepened without approval from the geotechnical engineer. Maintaining safe open excavations for workers and protecting the exposed cuts shall be the ongoing responsibility of the contractor.



Temporary Excavation Schematic

4.2.3 Temporary Shoring: Ecology Block Walls

If oversteepened excavations evidence signs of seepage or sloughing, temporary shoring should be used to protect the adjacent properties and the workers in the excavation. We anticipate that this can be accomplished by using ecology block shoring system for excavations up to 7 feet deep, with the obvious exception of the cut at the toe of the hillside. The following recommendations are provided for a temporary shoring system comprised of ecology blocks.

The following recommendations apply to the construction of an ecology block wall.

1. The ecology blocks should be placed as the excavation progresses. We recommend that no more than 20 horizontal feet of the excavation face be exposed at a time to place ecology block members. The blocks must be placed on native, undisturbed soil.
2. The temporary back cut shall be shaped and the blocks erected so that they have a face no steeper than 8V:1H. Cuts above the wall must not extend onto the adjacent property. The face of the base block shall be at least 18 inches from the proposed outside edge of the basement retaining wall footing to allow room to form the walls. A schematic is provided in Figure 5.
3. The blocks should be staggered and stacked so that they overlap the joints of the course immediately below.
4. Blocks may not be stacked any higher than three blocks without approval from the geotechnical engineer. Voids behind the wall should be filled with granular free draining material.
5. The geotechnical engineer should monitor the installation of the ecology block shoring system to verify that the anticipated conditions are encountered in the field and that these recommendations are followed.

4.2.4 Soldier Pile Shoring System

If property offsets are too tight or depth of excavation is too deep for unsupported cuts as described above, then measures such as soldier pile shoring system will be required. Soldier pile shoring must be installed at the toe of the hillside on the east side of the excavation.

The east side of the excavation for the garage and the residence should be shored. Shoring consists of temporary structural retaining elements that are designed to preserve stability of cuts and prevent movement of adjacent property, as well as to create safe conditions for workers within the excavation. This is of concern especially for the forming and stripping of subgrade walls, installation of perimeter footings drains, and waterproofing.

A variety of shoring methods are common in residential construction. These include ecology block shoring, drilled soldier pile walls, and soil nail walls. Ecology block walls are typically only appropriate for retained soil heights of about 7 feet maximum unless the soil is very dense.

We recommend shoring the east side of the excavation and other areas as needed to stabilize the toe of the hillside and create safe working conditions. An ecology block wall may be used to shore cuts that are not deeper than 7 feet where there is a 5-foot property setback, or 8 feet where there is no setback. We recommend using a soldier pile shoring system to support the toe of the steep hillside.

The cantilevered soldier pile shoring system should consist of drilled shafts, grouted and reinforced with steel beams. The vertical members shall consist of steel H or WF sections placed in a predrilled hole and then filled with lean mix concrete. As the site is excavated, the lean mix is chipped away and lagging is placed between the flanges of the H-beams and tight against the soil.

The drilled piers should be advanced to a depth sufficient to provide support for the anticipated excavation depth. The structural engineer should provide detailed calculations for piles after selecting precise locations, height, spacing, diameter of the hole, reinforcing elements, and material strength.

We recommend the following design parameters for the temporary shoring system:

- Based upon the consistency of the underlying soil encountered, we have recommended earth pressures as shown in Figure 6 for design of the shoring system with level backslopes. Forces above the base of the excavation should be considered to act on the spacing of the piles. Below the excavation, passive forces should be considered to act on 2 pile diameters. The bottom of the perimeter footings shall be the base of the excavation.
- Surcharge loads within 10 feet of the wall such as traffic loads, material stockpiles, equipment or structure loads should be included in the design of the wall. It does not appear that long term surcharge loads will be a factor on this site.
- A pressure equivalent to 80 percent of the design active pressure may be used to size the timber lagging, provided the pile spacing does not exceed 8 feet. Pressure treated timber lagging should be placed as excavation proceeds. Voids behind the lagging should be filled with free draining material such as pea gravel; CDF must be used where earth anchors are planned. Maximum height of the exposed cut should not exceed 4 feet before placing lagging. Lagging should be completed to the base of the excavation at the end of every working day.
- An active earth pressure of 32 pcf may be used for calculating the lateral earth pressure against the shoring walls. This assumes level backfill. An active pressure of 70 pcf should be used for inclined backslopes. The earth pressure should be assumed to act against the lagging for the spacing of the piles above the excavation. If the system is only temporary then the active pressure on the pile below the excavation may be ignored.
- A passive earth pressure of 460 pcf may be used to calculate the lateral earth pressure below the bottom of the excavation for drilled piers. This value is ultimate. A factor of

safety of 1.2 is often used for design. It should be assumed to act on 2 pile diameters. Minimum pile embedment should be at least 12 feet below the base of excavation.

- If anchors are required (for example on the catchment wall) then we recommend use of pressure grouted anchors installed at each pile location. The anchors should be designed assuming an ultimate capacity of 8 kips/foot of bonded length. The anchor should include a bond breaker in the no load zone as depicted in Figure 7. The anchor should be designed to resist 200 percent of the design values.
- There was evidence of possible seasonal perched water seepage in the upper few feet of soil. The lagging should have spaces between the boards sufficient to allow water to drain through the lagging into the excavation and to avoid hydrostatic pressure against the lagging.
- Temporary excavations for the remainder of the site should conform to requirements described in section 4.2.2 above. All excavations must be contained within the site.
- The Galli Group should monitor the installation of the shoring system.

The above parameters are shown on the attached earth pressure diagrams in Figure 6 and Figure 7. Figure 7 shows the earth pressure diagram for a cantilevered soldier pile shoring system and catchment wall with an inclined backslope.

The design of the shoring wall and the piles shall be the responsibility of the structural engineer, utilizing the design parameters provided in this report. Additional requirements related to concrete strength, grout, reinforcing elements, construction monitoring, and material specifications should be provided by the structural engineer.

4.2.5 Shoring Wall Tiebacks

Construction of the shoring system might require installation of tiebacks on the east side of the excavation for the soldier pile wall system. The tiebacks can be connected at each soldier pile. We recommend the following for design of the tiebacks:

1. Anchors must extend beyond the "no load" zone shown on Figure 7. The no load zone consists of the area immediately behind the shoring wall described as beginning at a point H/4 (where H is the height of the wall) beyond the base of the excavation and extending upward at 60 degrees away from the wall toward the existing grade. A minimum embedment of 15 feet beyond the no load zone is required.
2. The anchors should be inclined downward at 15 to 30 degrees from horizontal. The inclination can be determined by the structural engineer and architect as needed to avoid utility conflicts and other site-specific criteria. The anchors must not extend beyond the property line without obtaining easements.
3. Anchors can be either strand anchors or bars. Selection is up to the structural engineer in consultation with the contractor. The design load shall not exceed 60 percent of the specified minimum tensile strength (SMTS) of the steel members. Lock-off load shall not exceed 70 percent of the SMTS and the maximum test load shall not exceed 80 percent of the SMTS. The steel in the anchors shall be at least 150 ksi steel. If the selection of the anchor type is different

from the plan documents or requires a different anchor assembly than shown on the plans, the contractor must submit shop drawings to the structural engineer prior to installingthe anchorage system.

4. The structural engineer shall provide the anchor head assembly detail including trumpet and connection to the pile. Web stiffeners may be required at the connection between the pile and the anchor headassembly.
5. All anchors should be designed to withstand at least 150 percent of the design load. A performance test shall be conducted on the first production anchor which might require additional capacity. Details regarding the performance test are provided in the section below. The remaining anchors should be proof tested.
6. A transfer load of 4000 psf per foot may be used for the design value of a pressure grouted anchor that is post grouted. The minimum diameter of the pressure grouted anchor shall be 5 inches.
7. The contractor should select the installation method and the method of grouting to develop the design loads indicated on the project plans. These capacities must be verified in accordance with the tieback testing program described below.

4.2.6 Tieback Testing

One of the production anchors shall be performance tested. The contractor shall be responsible for supplying the testing equipment. The geotechnical engineer shall monitor the testing. A performance test shall be conducted as follows:

Performance or Verification Test

1. An alignment load (AL) no more than 5 percent of the design load shall be applied to the anchor and the displacement equipment zeroedthereafter.
2. The anchors shall be loaded in 25 percent increments of the design load with the incremental movement of the anchor recorded at each loading cycle. Following each incremental load, the anchor load is reduced to the alignmentload.
3. The anchor shall be reloaded in increasing increments until the test load is reached.
4. The performance test load shall be 200 percent of the design load. The load must be held for ten minutes with movements recorded at 1, 2, 3, 4, 5, 6, and 10 minutes. The geotechnical engineer must monitor the performance testing.
5. Reduce the load to the design load and lock off theanchor.

Each additional anchor not subjected to a performance test shall be proof tested. The proof test shall be conducted as follows:

Proof Test

1. An initial alignment load shall be applied to the anchor and gauges adjusted to zero. The alignment load shall not exceed 5 percent of the design load (DL.)

2. Successively apply and record total movements for the following load increments: 0.25DL, 0.50DL, 0.75DL, 1.00DL, 1.20DL, and 1.33DL. The test load shall be 133 percent of the design load.
3. Hold the test load for 10 minutes and record total movement.
4. At the discretion of the geotechnical engineer, he or she might require some of the anchors to be unloaded to the alignment load to record residual movement.
5. Reduce the load on anchors that pass the acceptance criteria to the lock-off load.

Acceptance Criteria
Each performance tested anchor shall be considered acceptable if it passes the following:

- Creep of the anchor shall not exceed 1mm (0.045 inches) between 1 and 10 minutes. If it does not pass this test then the creep test shall be extended to 60 minutes. The anchor shall be considered acceptable if the total movement over the interval from 6 to 60 minutes does not exceed 2 mm, or 2mm per log cycle of time.

Lock-off Load and Lift-off Testing
The anchors shall be locked off at 80 percent of the design load. After the load has been transferred from the jack to the anchorage, the contractor should perform a lift-off test to verify the magnitude of the loaded anchor. The anchor shall be gradually stressed until the wedge plate lifts off the bearing plate. The load measured during lift-off should be within five percent of the lock-off load. If this criterion is not met, the anchor load should be adjusted and the lift-off test repeated.

4.2.7 Permanent Soldier Pile Walls and Catchment Walls
We recommend constructing the uphill wall as a catchment wall to reduce potential negative impacts of earth slides or debris in the event of a failure from upslope or upslope utilities. The catchment wall should be extended a minimum of 5 feet above finish grade on the eastern or uphill side of the residence. An additional impact load of 100 pcf should be used to design the wall for the potential earth or debris slide. We have a provided an earth pressure diagram for use in design of the catchment wall. It seems likely given the additional loading that the wall will require installation of anchors to resist the lateral forces. Design earth pressures and values are provided in Figure 7, Catchment Wall Earth Pressures.

4.2.8 Monitoring of Shoring System Performance

The contractor shall provide a monitoring program to evaluate the performance of the shoring system and the impact of the excavation on adjacent property. We recommend that horizontal and vertical survey points be established on the shoring piles. A licensed surveyor should establish the coordinates of the points and read the points at the following times: 1) prior to commencing excavation, 2) every other week during excavation activity, and 3) prior to commencing backfilling or construction of the retaining walls. If deflection of the piles exceeds ½ inch then more frequent readings might be required. The results of the performance monitoring should be supplied to the structural engineer and geotechnical site inspector in tabular form.

In addition, if applicable, we recommend documenting existing conditions of the adjacent building walls and footings by digital camera prior to commencing excavation and again prior to backfilling or construction of the walls. This helps protect all parties involved in the process.

4.2.9 Soil Nail Wall Alternative

Due to the anticipated height of the shoring wall on the east side of the excavation and the potential for tiered walls on the slope, it might be advantageous to consider a soil nail wall for stabilizing the east side of the project site. A soil nail wall consists of shorter earth anchors installed in a grid pattern along the face of the proposed wall. The wall is shotcreted as the excavation proceeds forming a temporary restraint system and then a permanent concrete wall caps the temporary wall. The advantages of the soil nail concept on this project relative to the soldier pile wall include shorten length of anchors, potential to have a tiered wall system that doesn’t transfer all the loads to the lowermost wall, and it avoids the use of the large steel sections required for a soldier pile wall. The disadvantages include the number of anchors required for the system.

The following parameters may be used for design of the soil nail wall. We typically recommend contacting someone with both a structural engineering license and a geotechnical license to design the soil nail wall. Ground Support LLC is a firm that provides this type of structural and geotechnical design support for soil nail walls or hybrid walls.

We recommend using the following parameters for evaluating the feasibility of the soil nail wall system. These values may be adjusted by the geotechnical engineer based upon the results of our subsurface investigation.

Design Parameter	Value
Soil Unit Weight, γ	120 pcf
Internal Friction, φ	36
Cohesion, c	300 to 400 psf
FOS Pullout	2.0

4.3 LATERAL EARTH PRESSURES AND RETAINING WALLS

The proposed residence incorporates retaining elements. These include possible braced walls or cantilevered retaining walls. Site development might also include concrete walls that are constructed as landscape features or to protect walkways or grade changes.

The table below provides soil parameters used in the analyses for this project.

Table 1

Soil design parameters used in determination of lateral earth pressures

Soil Type	**Unit Weight** γ, pcf	**Passive Resistance** (EFW)	**Active Earth Pressure** (EFW)	**At-Rest Earth Pressure** (EFW)	**Inclined Slope Condition**
Dense silty SAND	120	460 pcf	36 pcf	53 pcf	70 pcf
M. dense silty SAND	120	460 pcf	36 pcf	53 pcf	70 pcf
Compacted Fill	125	300 pcf	35 pcf	53 pcf	NA

(EFW) = Equivalent Fluid Unit Weight in pounds per cubic foot

For the conventional concrete walls, we recommend the following:

1. Excavation for the walls must be accomplished in accordance with the recommendations supplied in section 4.2 above. The excavation should be benched so that compaction of backfill may take place against horizontal soil surfaces.
2. All walls must be supported on native undisturbed soil. We recommend using an allowable bearing capacity of 4500 psf for design of footings supported on the dense very silty SAND with gravel.
3. The walls should be designed to resist an active earth pressure equivalent to 32 pcf per foot of retained soil height. This assumes level drained backfill. Wall backslopes must not exceed 4H:1V. Walls with backslopes should be designed using 70 pcf active earth pressure.
4. For braced walls or restrained walls, a lateral at-rest earth pressure of 53 pcf should be used for design of the walls.
5. A uniform load equivalent to 8H where H is the retained height of the wall, may be used to calculate the lateral load contributed by seismic induced ground acceleration.
6. Lateral resistance for basement retaining walls may be calculated at 300 pcf per foot of overburden. The contribution from the uppermost 12 inches of soil should be ignored except for basement walls or where compacted structural fill is placed beneath a slab. A coefficient of friction of 0.3 may be used for design.

7. A backwall drainage system must be supplied for all newly constructed walls. The drainage system shall include at a minimum, a 4-inch perforated, smooth-walled pipe, enveloped in ¾" to 1½" washed gravel, and wrapped in Mirafi 140N filter fabric for separation from adjacent soils. On this site, we recommend installing sheet drains against the new concrete for the basement walls. The composite drain shall be Enkadrain, Delta Drain, or equivalent approved by the engineer.
8. Backfill placed behind the wall should be placed and compacted in thin enough lifts to achieve the compaction criteria listed in the report sections below.
9. The geotechnical engineer should verify that the drainage system, bearing conditions, and backfill compaction are in accordance with the report recommendations.

4.4 FOUNDATIONS

Foundations for the residence will consist of spread footings supported on the undisturbed silty SAND unit. We anticipate that this unit will be encountered at depths on the order of 3 feet near the proposed structures. It appears likely that the basement walls will be supported on the very dense silty SAND unit or compacted backfill.

4.4.1 Seismic Design Parameters

The site is underlain by glacially consolidated silty SAND with gravel. Based upon the density of the underlying soil we do not think seismic liquefaction or lateral spreading will be a significant risk factor to site development. Seismic liquefaction typically occurs in loose to medium dense clean sands. We recommend using site Class D for this project site.
The site is mapped within 2 miles of the Seattle Fault Zone.

The site appears underlain by very dense glacially consolidated SAND with gravel and glacially consolidated SILT. Based upon these site factors seismic liquefaction does not appear to be a significant concern. The risk of seismically induced slope movement does not represent a significant threat to the project site.

The following seismic design parameters may be used for the site.

Table 2
Seismic Design Parameters

Site Class	Spectral Acceleration at 0.2 sec (g)	Spectral Acceleration at 1.0 sec (g)	Site Coefficients		Design Spectral Response Parameters	
	S_S	S_1	F_a	F_v	S_{DS}	S_{D1}
D	1.465	0.563	1	1.5	0.977	0.563

4.4.2 Spread Footings and Wall Footings

Column or wall loads within the excavation may be supported on spread footings. For spread footings within the excavation we recommend the following:

1. An allowable bearing pressure of 4,500 psf may be used for footings bearing on undisturbed dense glacial soil. This may be increased by 1/3 for temporary loads such as wind loads or seismic loads.
2. The passive resistance for the footings may be calculated at 350 psf in the native soil.
3. A coefficient of friction of 0.3 may be used for the interface between the bottom of the footing and the soil.
4. The footing area must be free from loose or wet soil prior to placing reinforcing or pouring concrete. The geotechnical engineer should verify the bearing.
5. Perimeter footing drains should be provided around all footings and discharge to an approved storm drain.
6. Deck or porch footings should bear on native undisturbed soils to avoid settlement. These can be provided by pouring a footing and bringing the support to grade using a concrete pier.

4.5 SLAB-ON-GRADE FLOORS

Reinforced concrete floors which are beneath structures ringed with perimeter footings or walls can be supported on a 6-inch drain rock layer placed over properly prepared subgrade or granular fill soils. For slabs on grade, we recommend that granular import be placed as soon as the subgrade is prepared to protect the subgrade soil.

The following recommendations are provided for slabs constructed on the unyielding subgrade surface:

1. A four-inch layer of clean crushed rock (3\4" to 1 1/4" clean crushed rock works well) should be placed over the structural fill to provide a positive capillary moisture break and uniform slab support.
2. If the subgrade or crushed rock will be subject to equipment traffic we recommend placing a layer of 6-ounce non-woven geotechnical fabric such as Mirafi 160N to protect the subgrade and provide separation for the drainage zone beneath the slab.
3. An impermeable membrane, such as 10-mil plastic sheeting, should be placed over the crushed rock layer to further prevent upward migration of moisture vapor into and through the concrete slab.
4. To protect the membrane and provide more uniform curing of the slab, it is advisable to place one to two inches of chip rock on top of the membrane. The rock should be moistened prior to placing concrete.
5. Where insulation is required along the perimeter, the insulation may replace the 2-inch sand or chip rock layer.

We recommend that the contractor use deformed reinforcing steel for slab reinforcement rather than welded wire fabric. A minimum reinforcement scheme would be #3 or # 4 bars, 18 inches on center, both ways. Fibermesh may be used to help decrease drying shrinkage cracks, however it is not a replacement for structural reinforcing. All slabs tend to crack, therefore jointing at approximately 8 to 10 foot intervals, both directions, should significantly decrease random cracking in the open areas.

4.6 BACKFILL AND COMPACTION

Site soils are not suitable for backfill behind walls or under slabs. Imported fill soils or site soils used as backfill behind walls and under slabs should be moisture conditioned to within 3 percent of optimum moisture content, placed in loose, horizontal lifts less than 8 inches in thickness, and compacted to at least 92 percent of the maximum dry density, as determined using ASTM D1557 (Modified Proctor). The 92 percent compaction criteria should apply to any material intended to support pavement or intended as backfill behind walls. If structures are planned to be supported on structural fill the compaction criteria should be 95 percent of the Modified Proctor. All structural fill areas supporting structures should be density tested to verify compaction criteria is achieved. In areas not constructed as fill slopes or not intended to support pavement or structures, fill material should be placed in loose lifts less than 12 inches in thickness and compacted to at least 90 percent of the maximum dry density.

4.7 PERMANENT EROSION CONTROL

Following backfill of the retaining walls, installation of the subsurface utilities and drainage system, and completion of the flat work, the site must be permanently stabilized. All exposed soils on site must either be covered with a thick layer of mulch (3 – 4 inches) that is incorporated into the final landscaping plan or vegetated with lawn or other groundcover. Additional requirements for soil amendment may be specified by the landscape designer.

5.0 ADDITIONAL SERVICES AND LIMITATIONS

5.1 ADDITIONAL SERVICES

Additional services by the geotechnical engineer are important to help insure that report recommendations are correctly interpreted in final project design and to help verify compliance with project specifications during the construction process. For this project, we anticipate additional services may include the following:

1. Review final design and construction drawings for conformance with geotechnical recommendations.
2. Monitor erosion control measures.
3. Monitor temporary excavations and evaluate need for temporary shoring.
4. Monitor installation of Ecology Block and/or Soldier Pile shoring system
5. Verify soil bearing for walls and footings.
6. Monitor installation of perimeter subdrains.
7. Monitor compaction of backfill and drainage behind the retaining walls.
8. Provide periodic construction field reports, as requested by the client and required by the building department.

We would provide these additional services on a time-and-expense basis in accordance with our Standard Fee Schedule and General Conditions already in place for this project.

5.2 LIMITATIONS

This geotechnical investigation was planned and conducted in accordance with generally accepted engineering standards practiced presently within this geographic area. Geotechnical investigations performed by these standards reveal with reasonable regularity soils that are representative of subsurface conditions throughout the site under consideration. Recommendations contained in this report are based upon the assumption that soil conditions encountered in explorations are representative of actual conditions throughout the building site. However, inconsistent conditions can occur between exploratory borings or test pits and not be detected by a geotechnical study. If, during construction or subsequent exploration, subsurface or slope conditions are encountered which differ from those anticipated based upon results of this investigation, The Galli Group should be notified so that we can review and revise our recommendations where necessary. If conditions change prior to the proposed construction, we should be consulted so that we may alter our recommendations if necessary.

This report is prepared for the exclusive use of the owner or the owner's consultants for specific application on this project at this site. Copies of this report should be made available to the design team, and should be included with the contract drawings issued to the contractor. Our report, conclusions, and interpretations should not be construed as a warranty of the subsurface conditions on the site and should not be applied to neighboring sites. No warranty, expressed or implied is made. We recommend that geotechnical observation and testing be provided during the construction phases to verify that the recommendations provided in this report are incorporated into the actual construction.

Respectfully submitted,

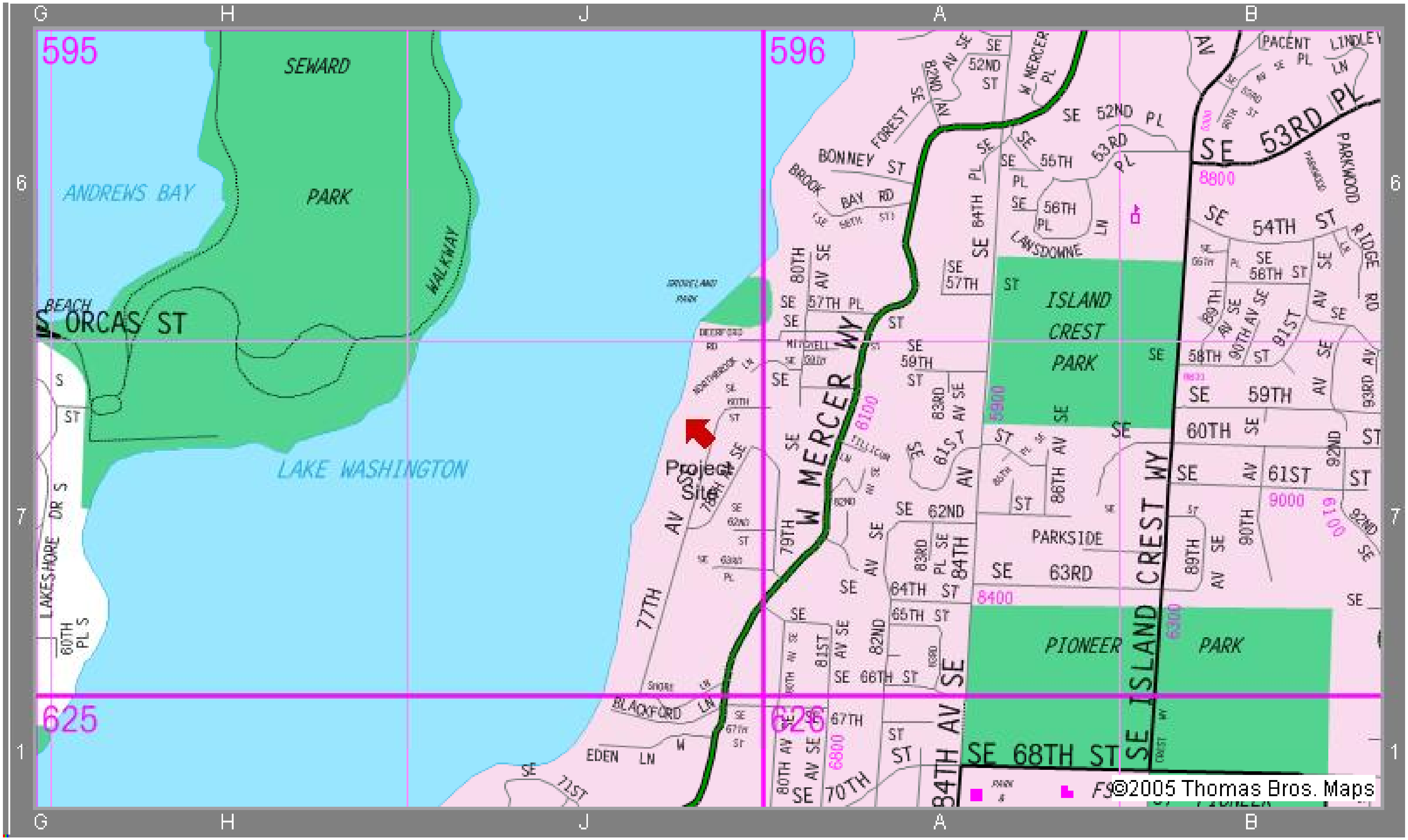
THE GALLI GROUP

Paul L. Stoltenberg, P.E.
Project Geotechnical Engineer

07-06-2017

Appendix

Logs of Exploratory Borings



Ref: Thomas Guide, 2005

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PO Box 30759
Seattle, WA 98113

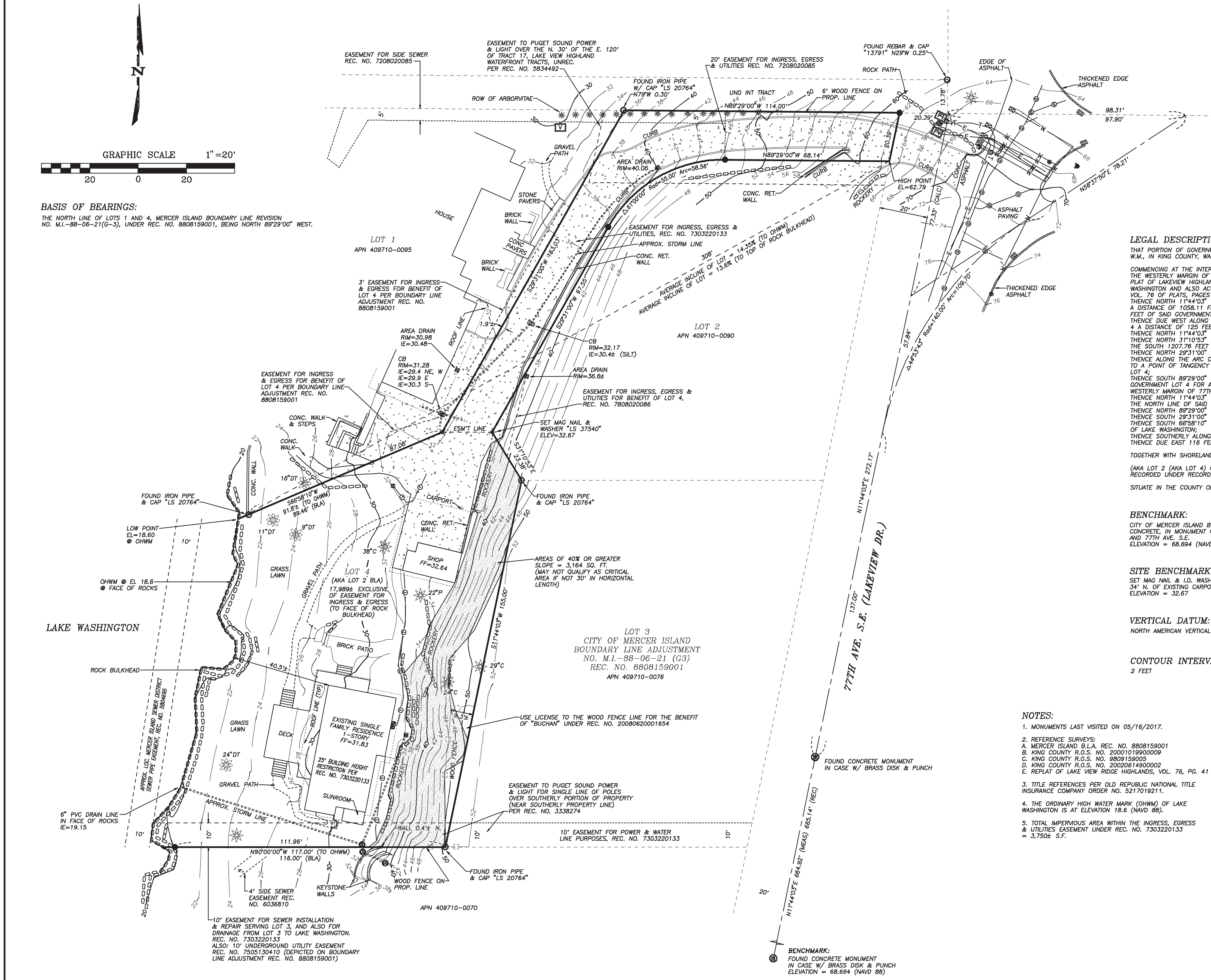
HART RESIDENCE
6025 77TH Avenue SE
Mercer Island, Washington

VICINITY MAP
FIGURE 1

TOPOGRAPHICAL SITE SURVEY

LOCATED IN THE S.W. 1/4, OF THE S.E. 1/4,
OF SECTION 24, TOWNSHIP 24 NORTH, RANGE 4 EAST, W.M.,
KING COUNTY, WASHINGTON

SITE SURVEY
Figure 2A



LEGAL DESCRIPTION:

THAT PORTION OF GOVERNMENT LOT 4, SECTION 24, TOWNSHIP 24 NORTH, RANGE 4 EAST, W.M., IN KING COUNTY, WASHINGTON, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE INTERSECTION OF THE SOUTH LINE OF SAID GOVERNMENT LOT 4 WITH THE WESTERLY MARGIN OF LAKE VIEW DRIVE (NOW KNOWN AS 77TH AVE. S.E.) ACCORDING TO PLAT OF LAKEVIEW HIGHLANDS, RECORDED IN VOLUME 33 OF PLATS, PAGE 34, IN KING COUNTY, WASHINGTON AND ALSO ACCORDING TO THE REPLAT OF LAKEVIEW HIGHLANDS, RECORDED IN VOL. 76 OF PLATS, PAGES 41 AND 42, IN KING COUNTY, WASHINGTON;
THENCE NORTH 11°44'03" EAST ALONG THE WESTERLY MARGIN OF SAID 77TH AVE. S.E. FOR A DISTANCE OF 1058.11 FEET TO AN INTERSECTION WITH THE NORTH LINE OF THE SOUTH 1036 FEET OF SAID GOVERNMENT LOT 4;
THENCE DUE WEST ALONG A LINE PARALLEL WITH THE SOUTH LINE OF SAID GOVERNMENT LOT 4 A DISTANCE OF 125 FEET TO THE TRUE POINT OF BEGINNING;
THENCE NORTH 11°44'03" EAST 155 FEET;
THENCE NORTH 31°10'53" WEST 23.38 FEET TO AN INTERSECTION WITH THE NORTH LINE OF THE SOUTH 1207.76 FEET OF SAID GOVERNMENT LOT 4;
THENCE NORTH 29°31'00" EAST 97.55 FEET TO A POINT OF CURVATURE TO THE RIGHT;
THENCE ALONG THE ARC OF A CURVE HAVING A RADIUS OF 55 FEET FOR A DISTANCE OF 58.56 FEET TO A POINT OF TANGENCY ON THE SOUTH LINE OF THE NORTH 20 FEET OF SAID GOVERNMENT LOT 4;
THENCE SOUTH 89°29'00" EAST ALONG A LINE PARALLEL TO THE NORTH LINE OF SAID GOVERNMENT LOT 4 FOR A DISTANCE OF 68.14 FEET TO AN INTERSECTION WITH THE SAID WESTERLY MARGIN OF 77TH AVE. S.E.;
THENCE NORTH 11°44'03" EAST ALONG SAID ROAD MARGIN 20.39 FEET, MORE OR LESS, TO THE NORTH LINE OF SAID GOVERNMENT LOT 4;
THENCE NORTH 89°29'00" WEST A DISTANCE OF 114.00 FEET;
THENCE SOUTH 29°31'00" WEST A DISTANCE OF 153.03 FEET;
THENCE SOUTH 66°58'10" WEST A DISTANCE OF 89.5 FEET, MORE OR LESS, TO THE SHORELINE OF LAKE WASHINGTON;
THENCE SOUTHERLY ALONG SAID SHORELINE TO A POINT WEST OF THE POINT OF BEGINNING;
THENCE DUE EAST 116 FEET, MORE OR LESS, TO THE TRUE POINT OF BEGINNING.

TOGETHER WITH SHORELANDS OF THE SECOND CLASS ADJOINING THERETO.

(AKA LOT 2 (AKA LOT 4) CITY OF MERCER ISLAND BOUNDARY LINE ADJUSTMENT MI-88-06-21 (G-3), RECORDED UNDER RECORDING NO. 8808159001.)

SITUATE IN THE COUNTY OF KING, STATE OF WASHINGTON

BENCHMARK:

CITY OF MERCER ISLAND BENCHMARK NO. 3113, BEING A 3/8" BRASS PLUG IN CONCRETE, IN MONUMENT CASE, AT THE INTERSECTION OF 78TH AVE. S.E. AND 77TH AVE. S.E.
ELEVATION = 68.694 (NAVD 88)

SITE BENCHMARK:

SET MAG NAIL & I.D. WASHER "LS 37540" IN CONCRETE DRIVEWAY, APPROX. 34' N. OF EXISTING CARPORT AND 4.0' W. OF AN EXISTING CONCRETE WALL.
ELEVATION = 32.67

VERTICAL DATUM:

NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

CONTOUR INTERVAL:

2 FEET

NOTES:

1. MONUMENTS LAST VISITED ON 05/16/2017.

2. REFERENCE SURVEYS:
A. MERCER ISLAND B.L.A. REC. NO. 8808159001
B. KING COUNTY R.O.S. NO. 20001019900009
C. KING COUNTY R.O.S. NO. 9809159005
D. KING COUNTY R.O.S. NO. 20020614900002
E. REPLAT OF LAKE VIEW RIDGE HIGHLANDS, VOL. 76, PG. 41

3. TITLE REFERENCES PER OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY ORDER NO. 5217019211.

4. THE ORDINARY HIGH WATER MARK (OHWM) OF LAKE WASHINGTON IS AT ELEVATION 18.6 (NAVD 88).

5. TOTAL IMPERVIOUS AREA WITHIN THE INGRESS, EGRESS & UTILITIES EASEMENT UNDER REC. NO. 7303220133 = 3,750± S.F.

LEGEND:

	FOUND CONCRETE MONUMENT IN CASE
	SET 1/2" REBAR & CAP "CASCADE LS 37540"
	FOUND IRON PIPE OR REBAR & CAP
	SET MAG NAIL & WASHER "LS 37540"
	CATCH BASIN
	AREA DRAIN
	STORM DRAIN CLEANOUT
	FIRE HYDRANT
	WATER VALVE
	WATER METER
	TELEPHONE RISER
	CABLE TV BOX
V	UTILITY VAULT
EPM	ELECTRIC POWER METER
PV	POWER VAULT
	GAS VALVE
	CONIFER TREE
	SMALL CONIFER TREE
	DECIDUOUS TREE
DT	DECIDUOUS TREE
C	CEDAR
P	PINE
	ROCKERY
W	WATER LINE
E	UNDERGROUND POWER
G	GAS LINE
T	TELEPHONE OR COMM LINE
	WOOD FENCE

SURVEYOR'S CERTIFICATE

THIS MAP CORRECTLY REPRESENTS A SURVEY MADE BY ME OR UNDER MY DIRECTION IN CONFORMANCE WITH THE REQUIREMENTS OF THE SURVEY RECORDING ACT AT THE REQUEST OF GREG & KRISTIN HART IN Jun. 2017

P.L.S. CERTIFICATE NO. 37540

JEFFREY ALLEN OTTERSON, STATE OF WASHINGTON, 37540, REGISTERED PROFESSIONAL LAND SURVEYOR

TOPOGRAPHICAL SITE SURVEY FOR GREG AND KRISTIN HART

CASCADE LAND SURVEYING
Complete Land Surveying Services
23257 SE 284th ST, Maple Valley, Washington 98038
(253) 820-4016 or (360) 897-1017
1-(800) 728-4993 (toll free) Email: jeff@cascadels.com

DRAWN BY: JAO CHECKED BY: JAO DATE: Wed., Jun. 7, 2017
JOB NO.: 2017-013 SCALE: 1"=20' SHEET: 1 of 1

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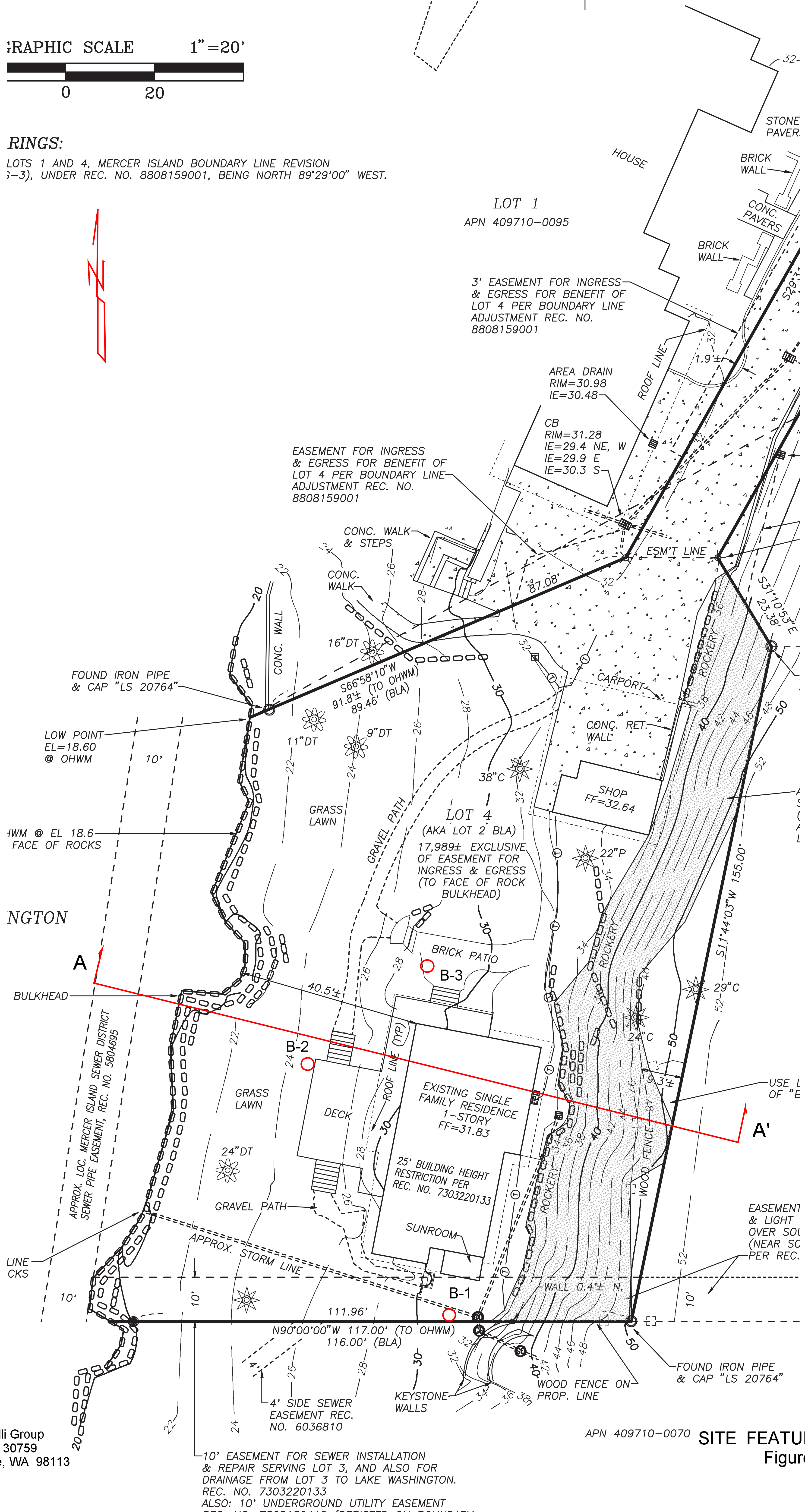

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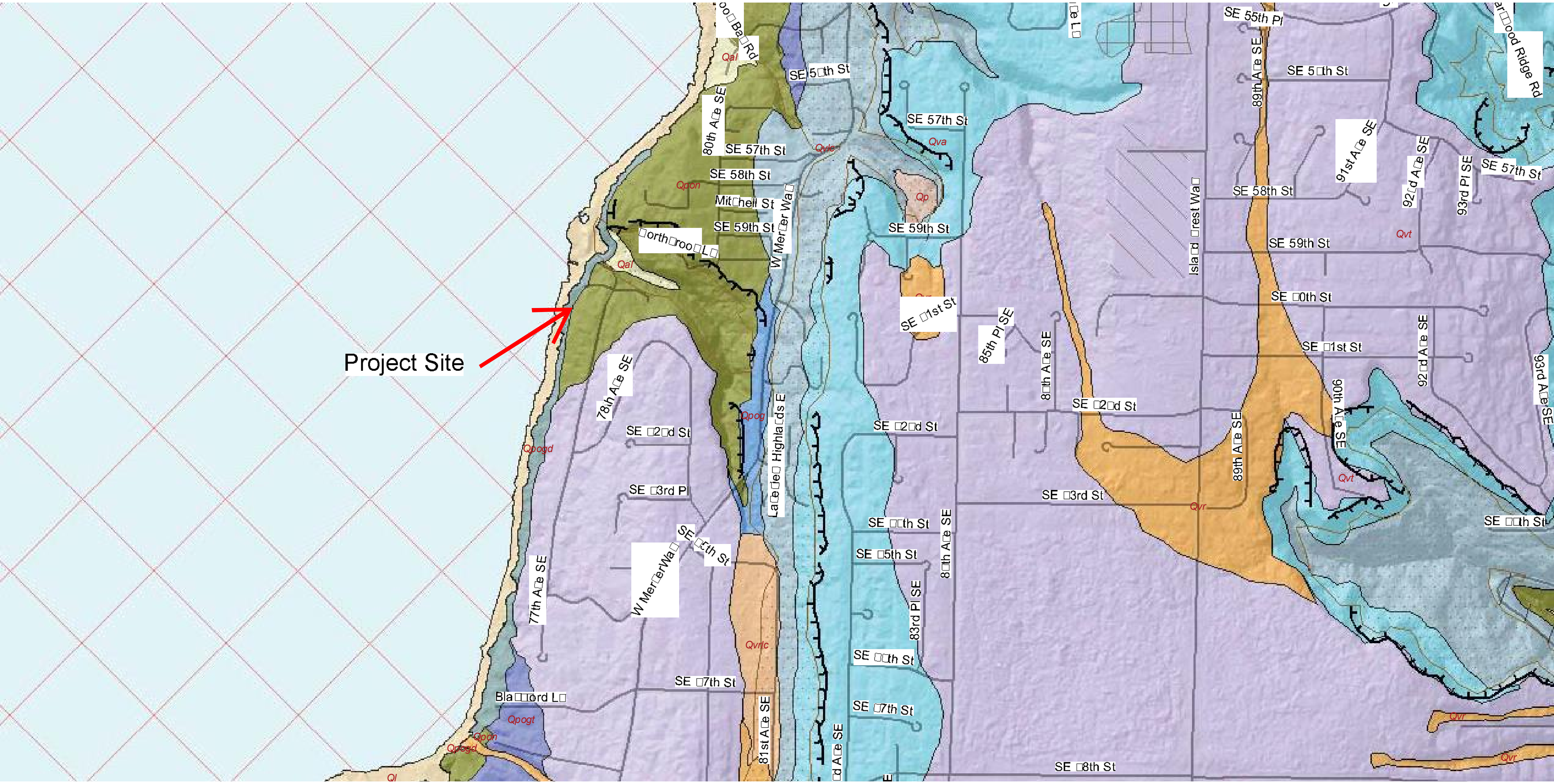
SITE FEATURES
Figure 2B

Ref: Geologic Map of Mercer Island, Troost & Wisher, 2006

	LEGEND
Ql	Lake deposits
Qpogd	Pre-Olympia glacial deposits
Qpon	Pre-Olympia non-glacial deposits
Qal	Alluvial Deposits
Qvt	Vashon Glacial Till



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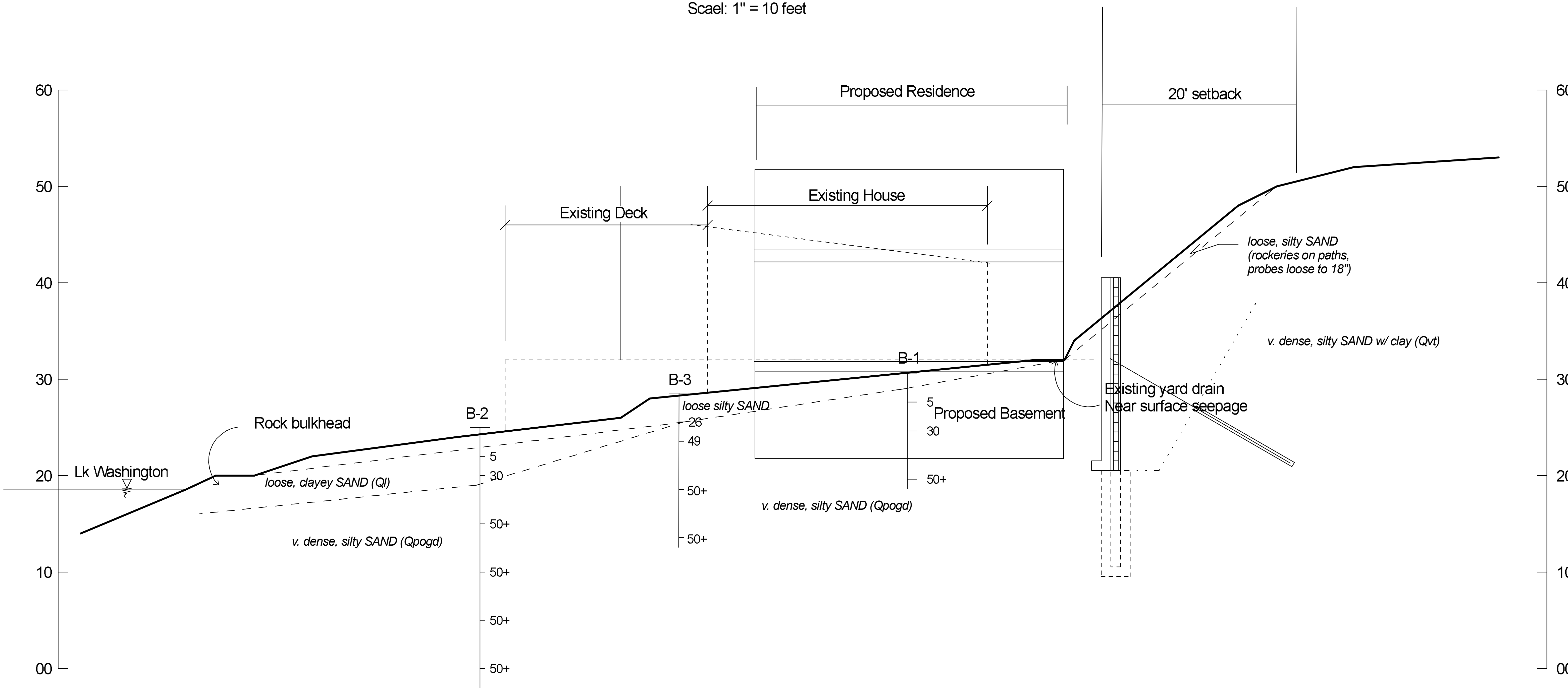
GEOLOGIC MAP
Figure 3

Section A - A'

Scael: 1" = 10 feet



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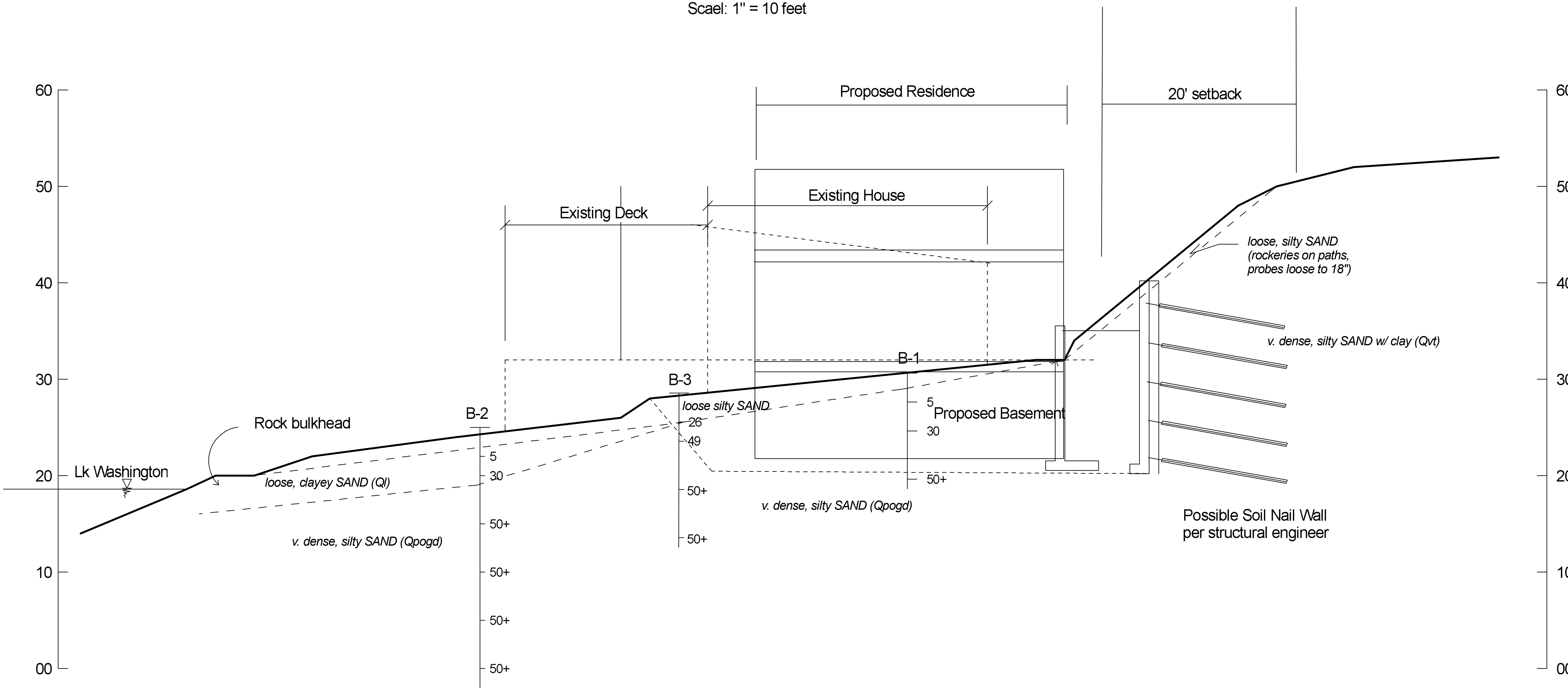
Generalized Subsurface Stratigraphy
Figure 4A

Section A - A'

Scael: 1" = 10 feet



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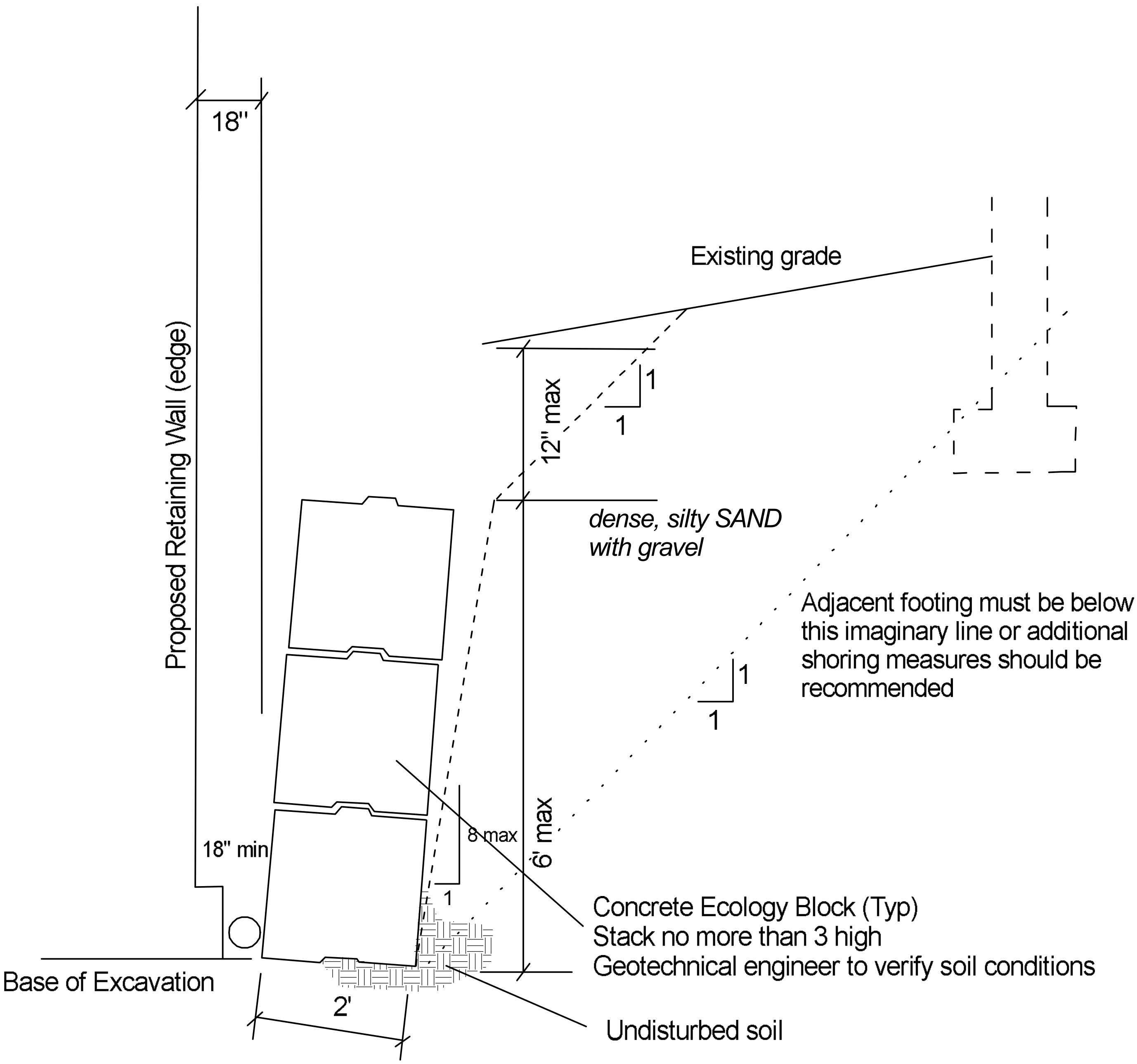
Generalized Subsurface Stratigraphy
Figure 4B

Ecology Block Shoring Schematic

No Scale



Note:
Adjacent footing elevations must be confirmed prior to final drawings and construction. Contractor to confirm in field.

Stack ecology blocks so that adjoining ends of upper blocks are not immediately above adjoining ends of lower blocks

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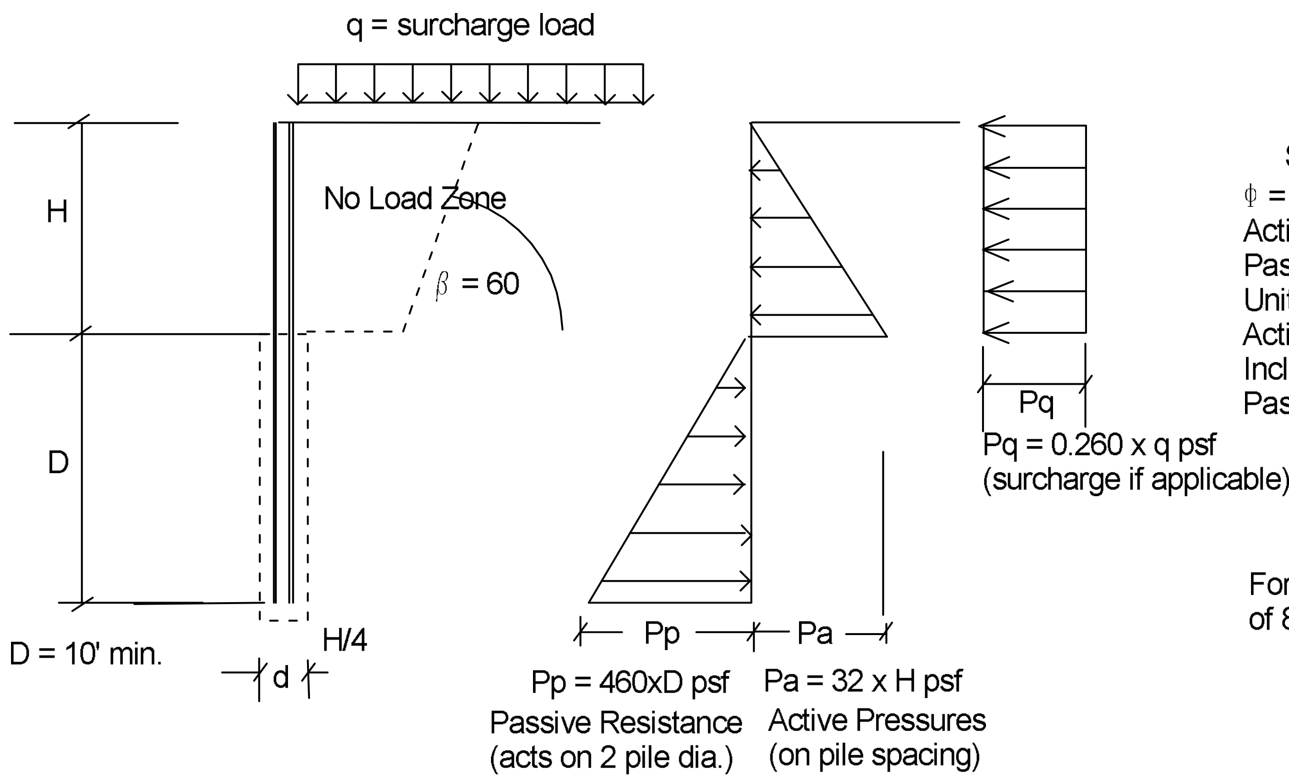
Mercer Island, Washington

Figure 5

Earth Pressure Diagrams
Cantilevered Soldier Pile Shoring System
(Level Backslope)



Soil Design Parameters

ϕ = 36 degrees
Active Ka = 0.26
Passive Kp = 3.85
Unit weight, γ = 120 pcf
Active Pressure = 32 pcf (EFW)
Inclined backslope = 40 pcf
Passive Pressure = 460 pcf (EFW) x 2d

For permanent walls add seismic force
of 8H uniform pressure against retaining wall.

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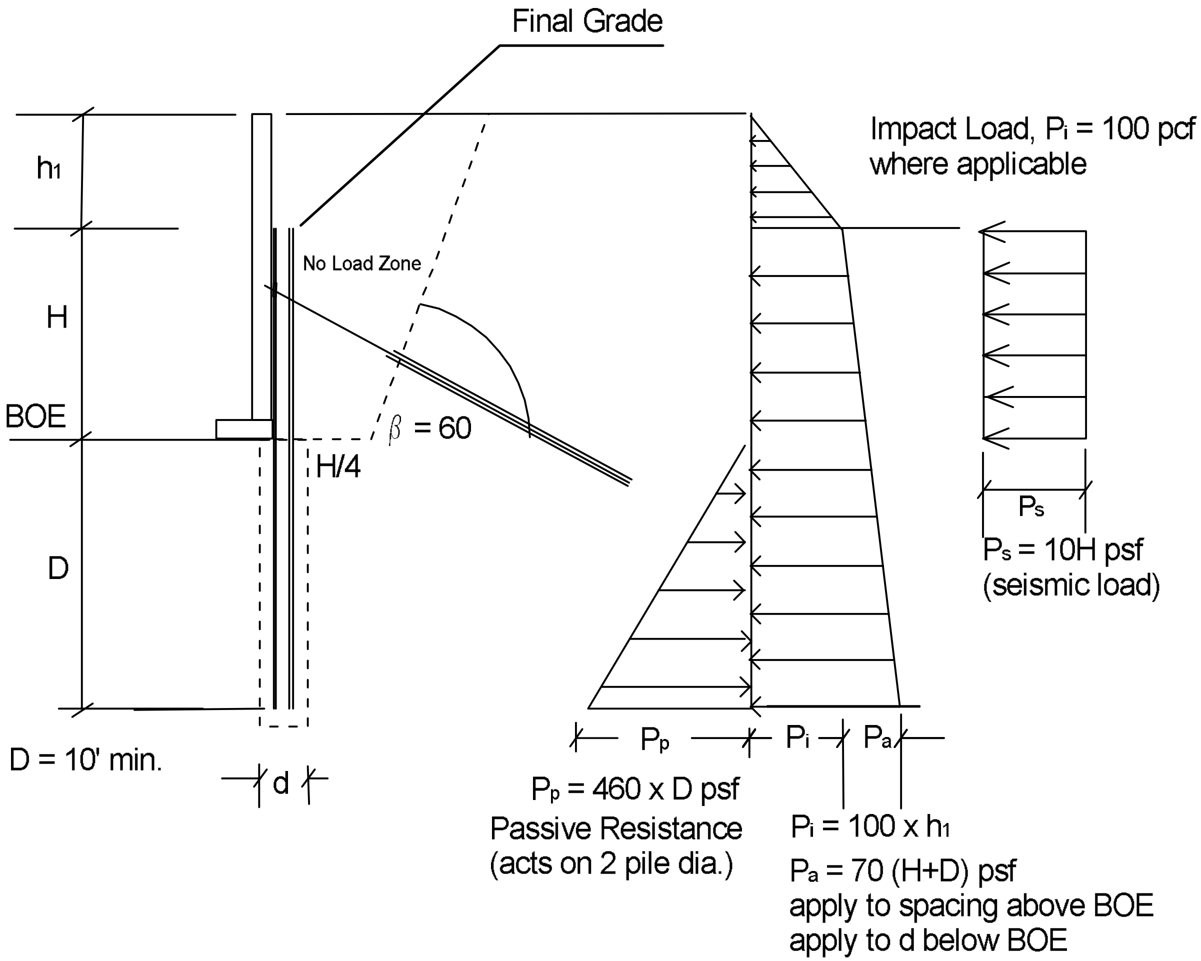
Mercer Island, Washington

Earth Pressure Diagrams
Figure 6

Earth Pressure Diagrams
Permanent Soldier Pile Catchment Wall
(Inclined Backslope Condition)



Soil Design Parameters

ϕ = 36 degrees
Active Ka = 0.283
Passive Kp = 3.53
Unit weight, γ = 120 pcf
Active Pressure = 32 pcf (EFW)
Active Inclined Slope = 40 pcf
Passive Pressure = 460 pcf (EFW) x 2d
(values ultimate)

For permanent walls use seismic load or impact loads, whichever controls. Impact load controls on east side of residence.

<u>Pressure Grouted Tieback Design Parameters</u>
Ulitmate Capacity = 8 kips/ft bonded length
Unbonded length in no load zone = 14' min.
Number and spacing per structural engineer
Steel elements per structural engineer
Performance spec per structural engineer
Apply FOS = 2 for design values

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Catchment Wall Earth Pressures
Figure 7

Appendix A: Logs of Exploratory Borings and Test Pits

Unified Soil Classification System; from American Society for Testing and Materials, 1985

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

FOR SAND AND GRAVELS

DENSITY	STANDARD PENETRATION RESISTANCE (SPT) BLOWS/FT.
VERY LOOSE	0 – 4
LOOSE	4 – 10
MEDIUM DENSE	10 – 30
DENSE	30 – 50
VERY DENSE	> 50

FOR SILTS AND CLAYS

CONSISTENCY	STANDARD PENETRATION RESISTANCE (SPT) BLOWS/FT.
VERY SOFT	0 – 2
SOFT	2 - 4
MEDIUM STIFF	4 – 8
STIFF	8 - 16
VERY STIFF	16 – 32
HARD	> 32

Project 1954 - 01

Boring Log B-1

6-13-2017

Log	Soil Description	Depth	Sample	SPT	Comments
	Loose, silty SAND; wet (Topsoil)				Surface soil wet from seepage
	Very dense, gray, silty SAND (GLACIAL TILL) -gray, silty SAND w/ gravel; moist		S1	3-3-2	Perched water seems to seep into the hole after drilling. Water at 5'4" after one hour.
	-gray, silty SAND w/ gravel; moist	5'	S2	3-3-27	
	-gray, silty SAND w/ gravel; moist clean SAND in tip of sampler	10'	S3	25-44-50	
	Bottom of boring at 11.5' depth (refusal) Seepage into the hole after drilling Drilled with mini-track drill rig				
		15'			
		20'			
		25'			
		30'			
		35'			
		40'			
		45'			

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Figure A2

Project 1954 - 01

Boring Log B-2

6-13-2017

Soil Description	Sample	SPT	Comments
Loose, silty SAND; moist (Topsoil)			
Loose, brown, SAND w/ fines (Lake Deposit) -brn, f-m SAND w/ silt; moist; topsoil in upper 4"	S1	3-3-2	
-brn, clayey SAND w/ organics; wet (lake deposit) gray silty SAND w/ gravel; moist (till-like)	S2	3-3-27	
Very dense, gray, silty SAND (GLACIAL TILL)			
-gray, silty SAND w/ gravel; moist	S3	25-44-50	
	S4	40-50/5"	
Very dense, interbedded silty SAND and SAND -gray, silty SAND w/ gravel; moist 3" brn, weathered SAND at 16.2'; wet			Sand zones appear to seep into the hole after drilling
Hard, gray, SILT (Glaciolacustrine) -gray, fine sandy SILT; moist	S5	16-30-37	
-gray, SILT; moist (water on rods at 25')	S6	14-28-40	
Bottom of boring at 26.5' depth Seepage into the hole after drilling Drilled with mini-track drill rig			

Depth: 5' 10' 15' 20' 25' 30' 35' 40' 45'

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Figure A-3

Project 1954 - 01

Boring Log B-3

6-13-2017

Log	Soil Description	Depth	Sample	SPT	Comments
	brick pavers in sand bed				
	Med dense, interbedded silty SAND and SAND; moist				
	-4" brn, silty SAND w/ organics (topsoil 6" brn, med. SAND; wet; 6" brn, silty SAND w/ gravel		S1	3-5-21	
	Very dense, interbedded SAND and silty SANDw/ gravel	5'			
	-12" brn, silty SAND w/ gravel; moist 6" brn, med. SAND w/ silt; weathered; wet		S2	25-27-22	Sand zones appear to seep into the hole after drilling
		10'			
	-gray/brn SAND w/ silt; some gravel; wet gray in tip		S3	16-24-33	
	-6" silty SAND w/ gravel; moist 12" brn, f-m SAND w/ silt; moist to wet	15'	S4	20-50/5"	
	Bottom of boring at 16.5' depth Seepage into the hole after drilling Drilled with mini-track drill rig				
		20'			
		25'			
		30'			
		35'			
		40'			
		45'			

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6025 77th Ave SE
Mercer Island, Washington

Figure A-4

APPENDIX B
MERCER ISLAND SMALL PROJECT STORMWATER REPORT

Mercer Island small project stormwater report.

17125

CITY OF MERCER ISLAND

DEVELOPMENT SERVICES GROUP

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Inspection Requests: Online: www.MyBuildingPermits.com VM: 206.275.7730

SECTION A: SMALL PROJECT STORMWATER SITE PLAN/REPORT

Narrative and Plan Submittal

Instructions: This is a template for a simplified Stormwater Report. This form or an equivalent must accompany your Building Permit Application if the answer is "Yes" to each statement below. If "No" is the answer to one or more of the statements below, a full Drainage Report is required and the project does not qualify for use of the Small Project Stormwater Site Plan/Report template.

Select "yes" or "no" for each statement below. Answer "yes" if the statement accurately describes your project.

Yes	No	Statement
✔		This project disturbs less than 1 acre and is not part of a larger common plan of development.
✔		This project converts less than 3/4 acre to lawn or landscape areas.
✔		This project will create, add, or replace (in any combination) 2,000 square feet or greater, but less than 5,000 square feet, of new plus replaced hard surface **OR** will have a land disturbing activity of 7,000 square feet or greater **OR** will result in a net increase of impervious surface of 500 square feet or greater.
✔		This project will not adversely impact a wetland, stream, water of the state, or change a natural drainage course.

Basic Project Information

Project Name: Tangled Ride Residence

Site Address: 6025 77th Ave SE

Total Lot Size: 22,620 s.f.

Total Proposed Area to be Disturbed (including stockpile area): 17,406 sq ft

Total Volume of Proposed Cut and Fill: 1,970 c.f. sq ft

Total Proposed New Hard Surface Area: 5,714 sq ft

Total Proposed Replaced Hard Surface Area: 2,545 sq ft

Total Proposed Converted Pervious Surface Area (Native vegetation to lawn or landscape): 0 sq ft

Net Increase in Impervious Surface: 1,986 sq ft

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SECTION A: SMALL PROJECT STORMWATER SITE PLAN/REPORT

Minimum Requirement #1 : Preparation of Stormwater Site Plan

Written Project Description:

The proposed development plans for the Site involve the demolition of the existing single family residence and constructing a new residence in roughly the same location on the Site along with new utility and drainage connections. The majority of the ex. driveway will remain. Portions of the ex. driveway will be widened.

Calculate new or replaced areas by surface type:

Lawn or Landscape Areas: 10,305 sq ft

Roof Area: 4,245 sq ft

Other Hard Surface Areas:

Driveway: 2,335 sq ft Patio: 619 sq ft Sidewalk: 624 sq ft

Parking Lot: ____ sq ft Other: 435 sq ft

☑ Attach Drainage Plan

Drainage Plan shall include the following:

- Scaled drawing with slopes, lot lines, any public-right-of-way and any easements, location of each on-site stormwater management BMP selected above and the areas served by them, buildings, roads, parking lots, driveways, landscape features, and areas of disturbed soils to be amended.
- The scaled drawing must be suitable to serve as a recordable document that will be attached to the property deed for each lot that includes on-site BMPs. Document submittal must follow the "Standard Formatting Requirements for Recording Documents" per King County: www.kingcounty.gov/depts/records-licensing/recorders-office/recording-documents.aspx
- Identify design details and maintenance instructions for each on-site BMP, and attach them to this Small Project Stormwater Site Plan/Report.

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SECTION A: SMALL PROJECT STORMWATER SITE PLAN/REPORT

Minimum Requirement #2 : Construction Stormwater Pollution Prevention

☑ Complete Section B of this submittal package: Construction Stormwater Pollution Prevention Plan Narrative (SWPPP)

☑ Attach construction SWPPP

Minimum Requirement #3 : Source Control of Pollution

This section contains practices and procedures to reduce the release of pollutants. Provide a description of all known, available and reasonable source control BMPs that will be, or are anticipated to be, used at this location to prevent stormwater from coming into contact with pollutants. Additional BMPs are found in Volume IV of the 2014 Stormwater Management Manual for Western Washington (SWMMWW).

Check the BMPs you will use:

☑ BMP S411 for Landscaping and Lawn/ Vegetation Management
Operational practices for sites with landscaping

☐ BMP S421 for Parking and Storage of Vehicles.
Public and commercial parking lots can be sources of suspended solids, metals, or toxic hydrocarbons such oils and greases.

☐ BMP S433 for Pools, Spas, Hot Tubs, Fountains
Discharge from pools, hot tubs, and fountains can degrade ambient water quality. Routine maintenance activities generate a variety of wastes. Direct disposal of these waters to drainage system and waters of the state are not permitted without prior treatment and approval.

☐ Other BMPs found in Volume IV of SWMMWW applicable to project:

☑ No source control BMPs are applicable for this project.

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SECTION A: SMALL PROJECT STORMWATER SITE PLAN/REPORT

Minimum Requirement #4 : Preservation of Natural Drainage Systems

Natural drainage patterns shall be maintained and discharges from the project site shall occur at the natural location, to the maximum extent practicable. All outfalls require energy dissipation.

Choose the option below that best describes your project:

☑ This site has existing drainage systems or outfalls. These items are shown on the Drainage Plan. Include the following items on the Drainage Plan:

- Pipe invert elevations, slopes, cover, and material
- Locations, grades, and direction of flow in ditches and swales, culverts, and pipes

Describe how these systems will be preserved:

The existing system serving the house will be replaced with two new systems with separate outfalls. Drainage from the existing system serving the driveway will be largely unaffected by the project.

☐ This site does not have any existing drainage systems or outfalls.

Additional Comments:

CITY OF MERCER ISLAND

<u>SECTION A</u>: SMALL PROJECT STORMWATER SITE PLAN/REPORT

Minimum Requirement #5 : On-site Stormwater Management

All projects meeting the thresholds for this Small Project Stormwater Report shall employ on-site stormwater management BMPs (See Small Project Stormwater Requirements Tip Sheet) to infiltrate, disperse, and retain stormwater runoff on-site to the extent feasible without causing flooding or erosion impacts.

List #1

For each category select the *<u>first</u>* feasible item on the list below. Document your justification for each infeasible BMP in Section C of this submittal package.

Check <u>one</u> option for <u>each category</u> below:

Lawn and Landscape Areas

- [ ] My project does not have *Lawn or Landscape* areas
- [x] Post-construction soil quality and depth
- [ ] Post-construction soil quality and depth is infeasible (see Section C of this submittal package)

Roofs

- [ ] My project does not have *Roof* areas
- [ ] 1. Full dispersion or downspout full infiltration
- [ ] 2. Rain garden or bioretention
- [ ] 3. Downspout dispersion system
- [ ] 4. Perforated stub-out connections
- [ ] 5. On-site detention system or fee-in-lieu of on-site detention authorized by the City Engineer (applicable if options #1-4 are infeasible and drainage from the site will be discharged to a storm or surface water system that includes a watercourse or there is a capacity constraint in the system)
- [x] 6. No Roof BMP (applicable if options #1-4 are infeasible and on-site detention is not required)

Measured Infiltration Rate: ________________ in/ hr

If #5 or #6 is selected, briefly describe why no Roof BMP is feasible (include detailed information in Section C of this submittal package):

The Site is within a mapped area where infiltrating LID facilities are not permitted. There is insufficient room for dispersion flow paths and the Site is located within an erosion hazard area and potential slide area. All collected runoff will be piped directly to Lake Washington which is a designated receiving water, and therefore no flow control facilities are required or proposed.

Minimum Requirement #5 : On-site Stormwater Management (cont.)

Other Hard Surfaces (such as driveway, sidewalk, parking lot, patio, etc.)

☐ My project does not have *Other Hard Surface* areas

☐ 1. Full dispersion

Measured Infiltration Rate: __________ in/ hr

☐ 2. Permeable pavement, rain gardens, or bioretention

☐ 3. Sheet flow dispersion or concentrated flow dispersion

☐ 4. On-site detention system or fee-in-lieu of on-site detention authorized by the City Engineer (applicable if options #1-3 are infeasible and drainage from the site will be discharged to a storm or surface water system that includes a watercourse or there is a capacity constraint in the system)

☑ 5. No Other Hard Surface BMP (applicable if options #1-3 are infeasible and on-site detention is not required)

If #4 or #5 is selected, briefly describe why no Other Hard Surface BMP is feasible (include detailed information in Section C of this submittal package):

The Site is within a mapped area where infiltrating LID facilities are not permitted. There is insufficient room for dispersion flow paths and the Site is located within an erosion hazard area and potential slide area. All collected runoff will be piped directly to Lake Washington which is a designated receiving water, and therefore no flow control facilities are required or proposed.

Flow Control Exempt List

Proceed with this list if your project discharges directly to Lake Washington or if findings from a downstream analysis confirm that the downstream system is free of capacity constraints for a minimum of ¼ mile and a maximum of 1 mile.

For flow control exempt discharges, the BMPs listed below for Roofs and Other Hard Surfaces do not need to be evaluated in priority order. You can select any BMP from the lists provided below and do not need to document infeasibility in Section C of this submittal package.

Check <u>one</u> option for <u>each category</u> below:

Lawn and Landscape Areas

☐ My project does not have *Lawn or Landscape* areas

☑ Post-construction soil quality and depth

Minimum Requirement #5 : On-site Stormwater Management (cont.)

Roofs

- [ ] My project does not have *Roof* areas
- [ ] Downspout full infiltration
- [ ] Downspout dispersion system
- [ ] Perforated stub-out connections
- [x] Each item above is infeasible

If "Each item above is infeasible" is selected, briefly describe why no Roof BMP is feasible:

The Site is within a mapped area where infiltrating LID facilities are not permitted. There is insufficient room for dispersion flow paths and the Site is located within an erosion hazard area and potential slide area. All collected runoff will be piped directly to Lake Washington which is a designated receiving water, and therefore no flow control facilities are required or proposed.

Other Hard Surfaces (such as driveway, sidewalk, parking lot, patio, etc.)

- [ ] My project does not have *Other Hard Surface* areas
- [ ] Sheet flow dispersion
- [ ] Concentrated flow dispersion
- [x] Each item above is infeasible

If "Each item above is infeasible" is selected, briefly describe why no Other Hard Surface BMP is feasible:

The Site is within a mapped area where infiltrating LID facilities are not permitted. There is insufficient room for dispersion flow paths and the Site is located within an erosion hazard area and potential slide area. All collected runoff will be piped directly to Lake Washington which is a designated receiving water, and therefore no flow control facilities are required or proposed.

CITY OF MERCER ISLAND

SECTION B: SMALL PROJECT CONSTRUCTION SWPPP NARRATIVE

Instructions

This is a template for a simplified Construction Stormwater Pollution Prevention Plan ("Construction SWPPP"). If "No" is the answer to one or more of the statements on the first page of Section A of this submittal package, then a full Construction SWPPP is required and the project does not quality for the use of the Small Project Construction SWPPP Narrative template. If the project is less than the thresholds on the first page of Section A of this submittal package, then Minimum Requirement #2 still applies, but this section (Section B) or a full construction SWPPP is not required. You should include your Construction SWPPP in your contract with your builder. A copy of the Construction SWPPP must be located at the construction site or within reasonable access to the site for construction and inspection personnel at all times.

General Information on the Existing Site and Project

Describe the following in the Project Narrative box below (attach additional pages if necessary):

- Nature and purpose of the construction project
- Existing topography, vegetation, and drainage, and building structures
- Adjacent areas, including streams, lakes, wetlands, residential areas, and roads that might be affected by the construction project
- How upstream drainage areas may affect the site
- Downstream drainage leading from the site to the receiving body of water
- Areas on or adjacent to the site that are classified as critical areas
- Critical areas that receive runoff from the site up to one-quarter mile away
- Special requirements and provisions for working near or within critical areas
- Areas on the site that have potential erosion problems

Project Narrative:

-The proposed development plans for the site involve the demolition of the existing single family residence and constructing a new residence in roughly the same location on the Site along with new utility and drainage connections. The majority of the ex. driveway will remain.
-The area between the house and Lake Washington is covered with lawn/landscaping. The remainder of the Site contains vegetated areas of evergreen and deciduous trees with light underbrush. The Site mainly has slopes ranging from 3-33% down to the western property line with an area of steeper slopes east of the residence and garage. Slopes in the landscaped area west of the existing residence range from 3-15%.
-Adjacent areas that may be affected by this project include 77th Ave SE due to construction traffic and adjacent residential areas due to typical residential construction activities. Lake Washington is located along the western side of the Site. There are no other known streams or wetlands adjacent to the Site.
-The upstream area consists of developed residential parcels to the east. the parcel immediately upstream to the south is currently being redeveloped and will have a new drainage system installed. Runoff from upstream areas to the east will be collected and piped directly to Lake Washington.
-Runoff sheet flows from east to west across the Site to Lake Washington.
-There are potential slide and erosion hazard areas on Site.
-There are no special requirements or provisions for working near or within critical areas for this project.
-Potential erosion problems on the site may include temporary soil stockpiles and the house foundation cuts.

Construction SWPPP Drawings

Refer to the general Drawing Requirements in Stormwater Management Manual for Western Washington (SWMMWW) Volume I, Chapter 3.

Vicinity Map

Provide a map with enough detail to identify the location of the construction site, adjacent roads, and receiving waters.

Site Map

Include the following (where applicable):

- ✔ Legal description of the property boundaries or an illustration of property lines (including distances) on the drawings.
- ✔ North arrow.
- ✔ Existing structures and roads.
- ✔ Boundaries and identification of different soil types.
- ✔ Areas of potential erosion problems.
- ✔ Any on-site and adjacent surface waters, critical areas, buffers, flood plain boundaries, and Shoreline Management boundaries.
- ✔ Existing contours and drainage basins and the direction of flow for the different drainage areas.
- ✔ Where feasible, contours extend a minimum of 25 feet beyond property lines and extend sufficiently to depict existing conditions.
- ✔ Final and interim grade contours as appropriate, drainage basins, and the direction of stormwater flow during and upon completion of construction.
- ✔ Areas of soil disturbance, including all areas affected by clearing, grading, and excavation.
- ✔ Locations where stormwater will discharge to surface waters during and upon completion of construction.
- ✔ Existing unique or valuable vegetation and vegetation to be preserved.
- ✔ Cut-and-fill slopes indicating top and bottom of slope catch lines.
- ✔ Total cut-and-fill quantities and the method of disposal for excess material.
- ✔ Stockpile; waste storage; and vehicle storage, maintenance, and washdown areas.

Temporary and Permanent BMPs

Include the following on site map (where applicable):

- ✔ Locations for temporary and permanent swales, interceptor trenches, or ditches.
- ✔ Drainage pipes, ditches, or cut-off trenches associated with erosion and sediment control and stormwater management.
- ✔ Temporary and permanent pipe inverts and minimum slopes and cover.
- ✔ Grades, dimensions, and direction of flow in all ditches and swales, culverts, and pipes.
- ✔ Locations and outlets of any dewatering systems.
- ✔ Details for bypassing off-site runoff around disturbed areas.
- ✔ Locations of temporary and permanent stormwater treatment and/or flow control best management practices (BMPs).
- ✔ Details for all structural and nonstructural erosion and sediment control (ESC) BMPs (including, but not limited to, silt fences, construction entrances, sedimentation facilities, etc.)
- ✔ Details for any construction-phase BMPs or techniques used for Low Impact Development (LID) BMP protection.

CITY OF MERCER ISLAND

SECTION B: SMALL PROJECT CONSTRUCTION SWPPP NARRATIVE

Element 1: Preserve Vegetation / Mark Clearing Limits

The goal of this element is to preserve native vegetation and to clearly show the limits of disturbance.

*This element **does not** apply to my project because:*

- [ ] The site was cleared as part of clearing activity that is subject to an enforcement action and is re-vegetated. Restoration may be necessary to comply with Critical Area Regulations or NPDES requirements. Buffer Zones-BMP C102 may apply if Critical Areas exist on-site and buffer zones shall be protected.

- [ ] Other Reason / Additional Comments:

*If it **does** apply, describe the steps you will take and select the best management practices (BMPs) you will use:*

- [ ] The perimeter of the area to be cleared shall be marked prior to clearing operation with visible flagging, orange plastic barrier fencing and/or orange silt fencing as shown on the SWPPP site map. The total disturbed area shall be less than 7,000 square feet. Vehicles will only be allowed in the areas to be graded, so no compaction of the undeveloped areas will occur.

Additional Comments:

Limits of disturbance will be marked with a high visibility construction fence.

Check the BMPs you will use:

- [ ] C101 Preserving Natural Vegetation
- [ ] C102 Buffer Zones
- [x] C103 High Visibility Fence

Element 2: Construction Access

The goal of this element is to provide a stabilized construction entrance/exit to prevent or reduce or sediment track out.

*This element **does not** apply to my project because:*

- [ ] The driveway to the construction area already exists and will be used for construction access. All equipment and vehicles will be restricted to staying on that existing impervious surface.
- [ ] Other Reason / Additional Comments:

*If it **does** apply, describe the steps you will take and select the BMPs you will use:*

- [x] A stabilized construction entrance will be installed prior to any vehicles entering the site, at the location shown on the SWPPP site map.

Additional Comments:

Check the BMPs you will use:

- [x] C105 Stabilized Construction Entrance / Exit
- [ ] C106 Wheel Wash
- [ ] C107 Construction Road / Parking Area Stabilization

Element 3: Control Flow Rates

The goal of this element is to construct retention or detention facilities when necessary to protect properties and waterways downstream of development sites from erosion and turbid discharges.

This element ***does not*** *apply to my project because:*

☐ Other Reason / Additional Comments:

If it ***does*** *apply, describe the steps you will take and select the BMPs you will use:*

☑ Flow rates will be controlled by using SWPPP Element 4 sediment controls and BMP T5.13 Post-Construction Soil Quality and Depth if necessary.

Additional Comments:

Element 4: Sediment Control

The goal of this element is to construct sediment control BMPs that minimize sediment discharges from the site.

*This element **does not** apply to my project because:*

- [ ] The site has already been stabilized and re-vegetated.
- [ ] Other Reason / Additional Comments:

*If it **does** apply, describe the steps you will take and select the BMPs you will use:*

- [x] Sediment control BMPs shall be placed at the locations shown on the SWPPP site map

Additional Comments:

Check the BMPs you will use:

- [ ] C231 Brush Barrier
- [ ] C232 Gravel Filter Berm
- [x] C233 Silt Fence
- [ ] C234 Vegetated Strip
- [x] C235 Wattles

Element 5: Stabilize Soils

The goal of this element is to stabilize exposed and unworked soils by implementing erosion control BMPs.

This element ***does not*** *apply to my project because:*

☐ Other Reason / Additional Comments:

If it ***does*** *apply, describe the steps you will take and select the BMPs you will use:*

☑ Exposed soils shall be worked during the week until they have been stabilized. Soil stockpiles will be located within the disturbed area shown on the SWPPP site map. Soil excavated for the foundation will be backfilled against the foundation and graded to drain away from the building. No soils shall remain exposed and unworked for more than 7 days from May 1 to September 30 or more than 2 days from October 1 to April 30. Once the disturbed landscape areas are graded, the grass areas will be amended using BMP T5.13 Post-Construction Soil Quality and Depth. All stockpiles will be covered with plastic or burlap if left unworked.

Additional Comments:

Check the BMPs you will use:

- ☑ C120 Temporary & Permanent Seeding
- ☐ C122 Nets & Blankets
- ☐ C124 Sodding
- ☐ C131 Gradient Terraces
- ☑ C235 Wattles
- ☑ C121 Mulching
- ☑ C123 Plastic Covering
- ☐ C125 Topsoil / Composting
- ☑ C140 Dust Control

Element 6: Protect Slopes

The goal of this element is to design and construct cut-and-fill slopes in a manner to minimize erosion.

*This element **does not** apply to my project because:*

☐ No cut slopes over 4 feet high or slopes steeper than 2 feet horizontal to 1 foot vertical, and no fill slopes over 4 feet high will exceed 3 feet horizontal to 1 foot vertical. Therefore, there is no requirement for additional engineered slope protection.

☐ Other Reason / Additional Comments:

*If it **does** apply, describe the steps you will take and select the BMPs you will use:*

Additional Comments:

Check the BMPs you will use:

- ☑ C120 Temporary & Permanent Seeding
- ☐ C205 Subsurface Drains
- ☐ C207 Check Dams
- ☐ C204 Pipe Slope Drains
- ☐ C206 Level Spreader
- ☐ C208 Triangular Silt Dike (Geotextile-Encased Check Dam)

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SECTION B: SMALL PROJECT CONSTRUCTION SWPPP NARRATIVE

Element 7: Protect Permanent Drain Inlets

The goal of this element is to protect storm drain inlets during construction to prevent stormwater runoff from entering the conveyance system without being filtered or treated.

*This element **does not** apply to my project because:*

- [ ] The site has open ditches in the right-of-way or private road right-of-way.
- [ ] There are no catch basins on or near the site.
- [ ] Other Reason / Additional Comments:

*If it **does** apply, describe the steps you will take and select the BMPs you will use:*

- [x] Catch basins on the site or immediately off site in the right-of-way are shown on the SWPPP site map. Storm drain inlet protection shall be installed.

Additional Comments:

Check the BMPs you will use:

- [x] C220 Storm Drain Inlet Protection

Element 8: Stabilize Channels and Outlets

The goal of this element is to design, construct, and stabilize on-site conveyance channels to prevent erosion from entering existing stormwater outfalls and conveyance systems.

*This element **does not** apply to my project because:*

- [ ] Construction will occur during the dry weather. No storm drainage channels or ditches shall be constructed either temporary or permanent. A small swale shall be graded to convey yard drainage around the structure using a shallow slope; it shall be seeded after grading and stabilized.

- [ ] Other Reason / Additional Comments:

*If it **does** apply, describe the steps you will take and select the BMPs you will use:*

- [ ] A wattle shall be placed at the end of the swale to prevent erosion at the outlet of the swale.

Additional Comments:

Permanent channel east of soil nail wall will be constructed using "shot-crete" method in conjunction with storm drainage conveyance system and french drain. Temporary stabilization will not be necessary since the channel will discharge to a tight line drainage system.

Check the BMPs you will use:

- [x] C202 Channel Lining
- [ ] C207 Check Dams
- [ ] C209 Outlet Protection
- [ ] C235 Wattles

Element 9: Control Pollutants

The goal of this element is to design, install, implement and maintain BMPs to minimize the discharge of pollutants from material storage areas, fuel handling, equipment cleaning, management of waste materials, etc.

*This element **does not** apply to my project because:*

☐ Other Reason / Additional Comments:

*If it **does** apply, describe the steps you will take and select the BMPs you will use:*

☑ Any and all pollutants, chemicals, liquid products and other materials that have the potential to pose a threat to human health or the environment will be covered, contained, and protected from vandalism. All such products shall be kept under cover in a secure location on-site. Concrete handling shall follow BMP C151.

Additional Comments:

Check the BMPs you will use:

☑ C151 Concrete Handling

☑ C152 Sawcutting and Surfacing Pollution Prevention

☑ C153 Material Delivery, Storage, and Containment

☑ C154 Concrete Washout Area

Element 10: Control De-watering

The goal of this element is to handle turbid or contaminated dewatering water separately from stormwater.

*This element **does not** apply to my project because:*

☐ No dewatering of the site is anticipated.

☐ Other Reason / Additional Comments:

*If it **does** apply, describe the steps you will take and select the BMPs you will use:*

Additional Comments:

Stormwater runoff or seepage can be handled by a system of sumps and trenches within the building excavation and discharged to a suitable dispersion area as shown on the TESC plan. During the wet season additional measures such as gravel sumps and wattles might be needed to avoid transport of sediment or turbid water from the site.

Check the BMPs you will use:

☐ C203 Water Bars

☑ C236 Vegetated Filtration

☑ C206 Level Spreader

Element 11: Maintain Best Management Practices

The goal of this element is to maintain and repair all temporary and permanent erosion and sediment control BMPs to assure continued performance.

Describe the steps you will take:

- [x] Best Management Practices or BMPs shall be inspected and maintained during construction and removed within 30 days after the City Inspector or Engineer determines that the site is stabilized, provided that they may be removed when they are no longer needed.

Element 12: Manage the Project

The goal of this element is to ensure that the construction SWPPP is properly coordinated and that all BMPs are deployed at the proper time to achieve full compliance with City regulations throughout the project.

If it ***does*** *apply, describe the steps you will take and select the BMPs you will use:*

The Construction SWPPP will be implemented at all times. The applicable erosion control BMPs will be implemented in the following sequence:

- [x] 1. Mark clearing limits
- [x] 2. Install stabilized construction entrance
- [x] 3. Install protection for existing drainage systems and permanent drain inlets
- [x] 4. Establish staging areas for storage and handling polluted material and BMPs
- [x] 5. Install sediment control BMPs
- [x] 6. Grade and install stabilization measures for disturbed areas
- [x] 7. Maintain BMPs until site stabilization, at which time they may be removed

Additional Comments:

Element 13: Protect Low Impact Development BMPs

The goal of this element is to protect on-site stormwater management BMPs (also known as "Low Impact Development BMPs") from siltation and compaction during construction. On-site stormwater management BMPs used for runoff from roofs and other hard surfaces include: full dispersion, roof downspout full infiltration or dispersion systems, perforated stubout connections, rain gardens, bioretention systems, permeable pavement, sheetflow dispersion, and concentrated flow dispersion. Methods for protecting on-site stormwater management BMPs include sequencing the construction to install these BMPs at the latter part of the construction grading operations, excluding equipment from the BMPs and the associated areas, and using the erosion and sedimentation control BMPs listed below.

Describe the construction sequencing you will use:

Additional Comments:

1. Arrange and attend a pre-construction meeting with the city inspector.
2. Flag or fence clearing limits.
3. Call one-call utility locate service prior to any excavation work.
4. Grade access road & construct/install rock construction entrance if necessary.
5. Install perimeter protection (silt fence, brush barrier, etc.).
6. Install soil nail wall.
7. Construct residence and other site improvements.
8. Maintain erosion control measures in accordance with city or county standards and manufacturer's recommendations.
9. Maintain access to off-site roads and driveways at all times during the duration of the project.
10. Relocate erosion control measures or install new measures so that as site conditions change the erosion and sediment control is always in accordance with the city TESC minimum requirements.
11. Cover all areas that will be unworked for more than seven days during the dry season or two days during the wet season with straw, wood fiber mulch, compost, plastic sheeting or equivalent.
12. Stabilize all areas that reach final grade within seven days.
13. Seed or sod any areas to remain unworked for more than 30 days.
14. Upon completion of the project, all disturbed areas must be stabilized and BMPs removed if appropriate after acceptance by inspector.

Select the BMPs you will use:

- [ ] C102 Buffer Zone
- [x] C103 High Visibility Fence
- [ ] C231 Brush Barrier
- [x] C233 Silt Fence
- [ ] C234 Vegetated Strip

CITY OF MERCER ISLAND

SECTION C: INFEASIBILITY CRITERIA

Minimum Requirement #5 (On-Site Stormwater Management)

The following tables summarize infeasibility criteria that can be used to justify not using various on-site stormwater management best management practices (BMPs) for consideration for Minimum Requirement #5. This information is also included under the detailed descriptions of each BMP in the 2014 Stormwater Management Manual for Western Washington (Stormwater Manual), but is provided here in this worksheet for additional clarity and efficiency. Where any inconsistencies or lack of clarity exists, the requirements in the main text of the Stormwater Manual shall be applied. If a project is limited by one or more of the infeasibility criteria specified below, but an applicant is interested in implementing a specific BMP, a functionally equivalent design may be submitted to the City for review and approval. Evaluate the feasibility of the BMPs in priority order based on List #1 or #2 (Small Project Stormwater Requirements Tip Sheet and Stormwater Manual). Select the first BMP that is considered feasible for each surface type. Document the infeasibility (narrative description and rationale) for each BMP that was not selected. Only one infeasibility criterion needs to be selected for a BMP before evaluating the next BMP on the list. Attach additional pages for supporting information if necessary.

Note: If your project discharges directly to Lake Washington (flow control exempt) or a downstream analysis confirms that the downstream system is free of capacity constraints for a minimum of ¼ mile and a maximum of 1 mile, then you do not need to complete this worksheet, but should still refer to the infeasibility criteria when selecting BMPs.

Lawn and Landscaped Areas		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Post-construction Soil Quality and Depth List #1 and #2	☐ Siting and design criteria provided in BMP T5.13 (**Stormwater Manual** Volume V, Section 5.3) cannot be achieved. ☐ Lawn and landscape area is on till slopes greater than 33 percent.	

Roofs		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Full Dispersion List #1 and #2	☑ Site setbacks and design criteria provided in BMP T5.30 (**Stormwater Manual** Volume V, Section 5.3) cannot be achieved. ☑ A 65 to 10 ratio of forested or native vegetation area to impervious area cannot be achieved. ☑ A minimum forested or native vegetation flowpath length of 100 feet (25 feet for sheet flow from a non-native pervious surface) cannot be achieved.	Insufficient flowpath and no existing forested area.
Downspout Full Infiltration List #1 and #2	☑ Evaluation of infiltration is not required per the Infiltration Infeasibility Map due to steep slopes, erosion hazards, or landslide hazards. ☐ Site setbacks and design criteria provided in BMP T5.10A (**Stormwater Manual** Volume III, Section 3.1.1) cannot be achieved. ☐ The lot(s) or site does not have out-wash or loam soils. ☐ There is not at least 3 feet or more of permeable soil from the proposed final grade to the seasonal high groundwater table or other impermeable layer. ☐ There is not at least 1 foot or more of permeable soil from the proposed bottom of the infiltration system to the seasonal high groundwater table or other impermeable layer.	

Roofs (cont.)		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Bioretention or Rain Gardens List #1 (both) and List #2 (bioretention only)	*Note: Criteria with setback distances are as measured from the bottom edge of the bioretention soil mix.* Citation of any of the following infeasibility criteria must be based on an evaluation of site-specific conditions and a written recommendation from an appropriate licensed professional (e.g., engineer, geologist, hydrogeologist): ☐ Where professional geotechnical evaluation recommends infiltration not be used due to reasonable concerns about erosion, slope failure, or down-gradient flooding. ☐ Within an area whose ground water drains into an erosion hazard, or landslide hazard area. ☐ Where the only area available for siting would threaten the safety or reliability of pre-existing underground utilities, pre-existing underground storage tanks, pre-existing structures, or pre-existing road or parking lot surfaces. ☐ Where the only area available for siting does not allow for a safe overflow pathway to stormwater drainage system or private storm sewer system. ☐ Where there is a lack of usable space for bioretention areas at re-development sites, or where there is insufficient space within the existing public right-of-way on public road projects. ☐ Where infiltrating water would threaten existing below grade basements. ☐ Where infiltrating water would threaten shoreline structures such as bulkheads. The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation): ☑ Evaluation of infiltration is not required per the Infiltration Infeasibility Map due to steep slopes, erosion hazards, or landslide hazards ☐ Within setback provided for BMP T7.30 (**Stormwater Manual** Volume V, Section 7.4) ☐ Where they are not compatible with surrounding drainage system as determined by the city (e.g., project drains to an existing stormwater collection system whose elevation or location precludes connection to a properly functioning bioretention area).	

Roofs (cont.)		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Bioretention or Rain Gardens (cont.)	The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation): ☐ Where land for bioretention is within an erosion hazard, or landslide hazard area (as defined by MICC 19.07.060). ☐ Where the site cannot be reasonably designed to locate bioretention areas on slopes less than 8 percent. ☐ Within 50 feet from the top of slopes that are greater than 20 percent and over 10 feet of vertical relief. ☐ For properties with known soil or groundwater contamination (typically federal Superfund sites or state cleanup sites under the Model Toxics Control Act [MTCA]): • Within 100 feet of an area known to have deep soil contamination. • Where groundwater modeling indicates infiltration will likely increase or change the direction of the migration of pollutants in the groundwater. • Wherever surface soils have been found to be contaminated unless those soils are removed within 10 horizontal feet from the infiltration area. • Any area where these facilities are prohibited by an approved cleanup plan under the state MTCA or Federal Superfund Law, or an environmental covenant under Chapter 64.70 RCW. ☐ Within 100 feet of a closed or active landfill. ☐ Within 10 feet of an underground storage tank and connecting underground pipes when the capacity of the tank and pipe system is 1,100 gallons or less. As used in these criteria, an underground storage tank means any tank used to store petroleum products, chemicals, or liquid hazardous wastes of which 10 percent or more of the storage volume (including volume in the connecting piping system) is beneath the ground surface. ☐ Within 100 feet of an underground storage tank and connecting underground pipes when the capacity of the tank and pipe system is greater than 1,100 gallons.	

Roofs (cont.)		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Bioretention or Rain Gardens (cont.)	The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation): ☐ Where field testing indicates potential bioretention/rain garden sites have a measured (a.k.a., initial) native soil saturated hydraulic conductivity less than 0.30 inches per hour. A small-scale or large-scale PIT in accordance with **Stormwater Manual** Volume III, Section 3.3.6 (or an alternative small scale test specified by the City) shall be used to demonstrate infeasibility of bioretention areas. If the measured native soil infiltration rate is less than 0.30 in/hour, bioretention/rain garden BMPs are not required to be evaluated as an option in List #1 or List #2. In these slow draining soils, a bioretention area with an underdrain may be used to treat pollution-generating surfaces to help meet Minimum Requirement #6, Runoff Treatment. If the underdrain is elevated within a base course of gravel, it will also provide some modest flow reduction benefit that will help achieve Minimum Requirement #7. ☐ Where the minimum vertical separation of 3 feet to the seasonal high groundwater elevation or other impermeable layer would not be achieved below bioretention that would serve a drainage area that exceeds the following thresholds (and cannot reasonably be broken down into amounts smaller than indicated): o 5,000 square feet of pollution-generating impervious surface (PGIS) o 10,000 square feet of impervious area o 0.75 acres of lawn and landscape. ☐ Where the minimum vertical separation of 1 foot to the seasonal high groundwater or other impermeable layer would not be achieved below bioretention that would serve a drainage area less than the above thresholds. ☐ Within 100 feet of a drinking water well, or a spring used for drinking water supply. ☐ Within 10 feet of small on-site sewage disposal drainfield, including reserve areas, and grey water reuse systems. For setbacks from a “large on-site sewage disposal system,” see Chapter 246-272B WAC.	

Roofs (cont.)		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Downspout Dispersion Systems List #1 and #2	☐ Site setbacks and design criteria provided in BMP T5.10B (**Stormwater Manual** Volume III, Section 3.1.2) cannot be achieved. ☑ For splash blocks, a vegetated flowpath at least 50 feet in length from the downspout to the downstream property line, structure, stream, wetland, slope over 15 percent, or other impervious surface is not feasible. ☑ For trenches, a vegetated flowpath of at least 25 feet in between the outlet of the trench and any property line, structure, stream, wetland, or impervious surface is not feasible. A vegetated flowpath of at least 50 feet between the outlet of the trench and any slope steeper than 15 percent is not feasible.	Presence of erosion hazard and potential slide areas
Perforated Stub-Out Connections List #1 and #2	☑ Evaluation of infiltration is not required per the Infiltration Infeasibility Map due to steep slopes, erosion hazards, or landslide hazards ☐ For sites with septic systems, the only location available for the perforated portion of the pipe is located up-gradient of the drainfield primary and reserve areas. This requirement can be waived if site topography will clearly prohibit flows from intersecting the drainfield or where site conditions (soil permeability, distance between systems, etc.) indicate that this is unnecessary. ☐ Site setbacks and design criteria provided in BMP T5.10C (**Stormwater Manual** Volume III, Section 3.1.3) cannot be achieved. ☐ There is not at least 1 foot of permeable soil from the proposed bottom (final grade) of the perforated stub-out connection trench to the highest estimated groundwater table or other impermeable layer. ☐ The only location available for the perforated stub-out connection is under impervious or heavily compacted soils.	
On-site Detention List #1 and #2	☑ Project discharges directly to Lake Washington. ☐ Findings from a 1/4 mile downstream analysis confirm that the downstream system is free of capacity constraints. ☐ Site setbacks and design criteria provided in the **Stormwater Manual** (Volume III, Section 3.2.2) cannot be achieved.	

Other Hard Surfaces		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Full Dispersion List #1 and #2	☑ Site setbacks and design criteria provided in BMP T5.30 (**Stormwater Manual** Volume V, Section 5.3) cannot be achieved. ☑ A 65 to 10 ratio of forested or native vegetation area to impervious area cannot be achieved. ☑ A minimum forested or native vegetation flowpath length of 100 feet (25 feet for sheet flow from a non-native pervious surface) cannot be achieved.	
Permeable Pavement List #1 and #2	Citation of any of the following infeasibility criteria must be based on an evaluation of site-specific conditions and a written recommendation from an appropriate licensed professional (e.g., engineer, geologist, hydrogeologist): ☐ Where professional geotechnical evaluation recommends infiltration not be used due to reasonable concerns about erosion, slope failure, or downgradient flooding. ☐ Within an area whose ground water drains into an erosion hazard, or landslide hazard area. ☐ Where infiltrating and ponded water below the new permeable pavement area would compromise adjacent impervious pavements. ☐ Where infiltrating water below a new permeable pavement area would threaten existing below grade basements. ☐ Where infiltrating water would threaten shoreline structures such as bulkheads. ☐ Down slope of steep, erosion prone areas that are likely to deliver sediment. ☐ Where fill soils are used that can become unstable when saturated. ☐ Excessively steep slopes where water within the aggregate base layer or at the subgrade surface cannot be controlled by detention structures and may cause erosion and structural failure, or where surface runoff velocities may preclude adequate infiltration at the pavement surface. ☐ Where permeable pavements cannot provide sufficient strength to support heavy loads at industrial facilities such as ports. ☐ Where installation of permeable pavement would threaten the safety or reliability of pre-existing underground utilities, pre-existing underground storage tanks, or pre-existing road subgrades.	

Other Hard Surfaces (cont.)		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Permeable Pavement (cont.)	The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation): ☑ Evaluation of infiltration is not required per the Infiltration Infeasibility Map due to steep slopes, erosion hazards, or landslide hazards ☐ Within an area designated as an erosion hazard, or landslide hazard. ☐ Within 50 feet from the top of slopes that are greater than 20 percent. ☐ For properties with known soil or groundwater contamination (typically federal Superfund sites or state cleanup sites under MTCA): • Within 100 feet of an area known to have deep soil contamination. • Where groundwater modeling indicates infiltration will likely increase or change the direction of the migration of pollutants in the groundwater. • Wherever surface soils have been found to be contaminated unless those soils are removed within 10 horizontal feet from the infiltration area. • Any area where these facilities are prohibited by an approved cleanup plan under the state MTCA or Federal Superfund Law, or an environmental covenant under Chapter 64.70 RCW. ☐ Within 100 feet of a closed or active landfill. ☐ Within 100 feet of a drinking water well, or a spring used for drinking water supply, if the pavement is a pollution-generating surface. ☐ Within 10 feet of a small on-site sewage disposal drainfield, including reserve areas, and grey water reuse systems. For setbacks from a “large on-site sewage disposal system,” see Chapter 246-272B WAC. ☐ Within 10 feet of any underground storage tank and connecting underground pipes, regardless of tank size. As used in these criteria, an underground storage tank means any tank used to store petroleum products, chemicals, or liquid hazardous wastes of which 10 percent or more of the storage volume (including volume in the connecting piping system) is beneath the ground surface. ☐ At multi-level parking garages, and over culverts and bridges. ☐ Where the site design cannot avoid putting pavement in areas likely to have long-term excessive sediment deposition after construction (e.g., construction and landscaping material yards).	

CITY OF MERCER ISLAND

SECTION C: INFEASIBILITY CRITERIA

Other Hard Surfaces (cont.)		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Permeable Pavement (cont.)	The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation): ☐ Where the site cannot reasonably be designed to have: • Porous asphalt surface < 5% slope • Pervious concrete surface < 10% slope • Permeable interlocking concrete pavement surface < 12% slope • Grid systems < 6-12% slope (check with manufacturer and local supplier to confirm maximum slope) ☐ Where the subgrade soils below a pollution-generating permeable pavement (e.g., road or parking lot) do not meet the soil suitability criteria for providing treatment. See soil suitability criteria for treatment in the **Stormwater Manual** Volume III, Section 3.3.7. Note: In these instances, the city may approve installation of a 6 inch sand filter layer meeting city specifications for treatment as a condition of construction. ☐ Where underlying soils are unsuitable for supporting traffic loads when saturated. Soils meeting a California Bearing Ratio of 5 percent are considered suitable for residential access roads. ☐ Where replacing existing impervious surfaces unless the existing surface is a non-pollution generating surface over an outwash soil with a saturated hydraulic conductivity of 4 inches per hour or greater. ☐ Where appropriate field testing indicates soils have a measured (a.k.a., initial) subgrade soil saturated hydraulic conductivity less than 0.3 inches per hour. Only small-scale PIT or large-scale PIT methods in accordance with **Stormwater Manual** Volume III, Section 3.3.6 (or an alternative small scale test specified by the City) shall be used to evaluate infeasibility of permeable pavement areas. (Note: In these instances, unless other infeasibility restrictions apply, roads and parking lots may be built with an underdrain, preferably elevated within the base course, if flow control benefits are desired.) ☐ Roads that receive more than very low traffic volumes, and areas having more than very low truck traffic. Roads with a projected average daily traffic volume of 400 vehicles or less are very low volume roads (AASHTO 2001) (U.S. Department of Transportation, 2013). Areas with very low truck traffic volumes are roads and other areas not subject to through truck traffic but may receive up to weekly use by utility trucks (e.g., garbage, recycling), daily school bus use, and multiple daily use by pick-up trucks, mail/parcel delivery trucks, and maintenance vehicles. (Note: This infeasibility criterion does not extend to sidewalks and other non-traffic bearing surfaces associated with the collector or arterial).	

Other Hard Surfaces (cont.)		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Permeable Pavement (cont.)	The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation): ☐ At sites defined as "high-use sites" (refer to the Glossary in the **Stormwater Manual** Volume I). ☐ In areas with "industrial activity" as identified in 40 CFR 122.26(b)(14). ☐ Where the risk of concentrated pollutant spills is more likely such as gas stations, truck stops, and industrial chemical storage sites. ☐ Where routine, heavy applications of sand occur in frequent snow zones to maintain traction during weeks of snow and ice accumulation. ☐ Where the seasonal high groundwater or an underlying impermeable/ low permeable layer would create saturated conditions within 1 foot of the bottom of the lowest gravel base course.	
Bioretention or Rain Gardens List #1 (both) and List #2 (bioretention only)	*Note: Criteria with setback distances are as measured from the bottom edge of the bioretention soil mix.* Citation of any of the following infeasibility criteria must be based on an evaluation of site-specific conditions and a written recommendation from an appropriate licensed professional (e.g., engineer, geologist, hydrogeologist): ☐ Where professional geotechnical evaluation recommends infiltration not be used due to reasonable concerns about erosion, slope failure, or down-gradient flooding. ☐ Within an area whose ground water drains into an erosion hazard, or landslide hazard area. ☐ Where the only area available for siting would threaten the safety or reliability of pre-existing underground utilities, pre-existing underground storage tanks, pre-existing structures, or pre-existing road or parking lot surfaces. ☐ Where the only area available for siting does not allow for a safe overflow pathway to stormwater drainage system or private storm sewer system. ☐ Where there is a lack of usable space for bioretention areas at re-development sites, or where there is insufficient space within the existing public right-of-way on public road projects. ☐ Where infiltrating water would threaten existing below grade basements. ☐ Where infiltrating water would threaten shoreline structures such as bulkheads.	

Other Hard Surfaces (cont.)		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Bioretention or Rain Gardens (cont.)	The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation): ☑ Where evaluation of infiltration is not required per the Infiltration Infeasibility Map due to steep slopes, erosion hazards, or landslide hazards. ☐ Within setback provided for BMP T7.30 (**Stormwater Manual** Volume V, Section 7.4) ☐ Where they are not compatible with surrounding drainage system as determined by the city (e.g., project drains to an existing stormwater collection system whose elevation or location precludes connection to a properly functioning bioretention area). ☐ Where land for bioretention is within an erosion hazard, or landslide hazard area (as defined by MICC 19.07.060). ☐ Where the site cannot be reasonably designed to locate bioretention areas on slopes less than 8 percent. ☐ Within 50 feet from the top of slopes that are greater than 20 percent and over 10 feet of vertical relief. ☐ For properties with known soil or groundwater contamination (typically federal Superfund sites or state cleanup sites under the Model Toxics Control Act [MTCA]): • Within 100 feet of an area known to have deep soil contamination. • Where groundwater modeling indicates infiltration will likely increase or change the direction of the migration of pollutants in the groundwater. • Wherever surface soils have been found to be contaminated unless those soils are removed within 10 horizontal feet from the infiltration area. • Any area where these facilities are prohibited by an approved cleanup plan under the state MTCA or Federal Superfund Law, or an environmental covenant under Chapter 64.70 RCW. ☐ Within 100 feet of a closed or active landfill. ☐ Within 10 feet of an underground storage tank and connecting underground pipes when the capacity of the tank and pipe system is 1,100 gallons or less. As used in these criteria, an underground storage tank means any tank used to store petroleum products, chemicals, or liquid hazardous wastes of which 10 percent or more of the storage volume (including volume in the connecting piping system) is beneath the ground surface.	

<table>
<tr><th colspan="3">Other Hard Surfaces (cont.)</th></tr>
<tr><th>BMP and Applicable Lists</th><th>Infeasibility Criteria</th><th>Infeasibility Description and Rationale for Each BMP Not Selected</th></tr>
<tr><td>Bioretention or Rain Gardens (cont.)</td><td>The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation):

☐ Within 100 feet of an underground storage tank and connecting underground pipes when the capacity of the tank and pipe system is greater than 1,100 gallons.

☐ Where field testing indicates potential bioretention/rain garden sites have a measured (a.k.a., initial) native soil saturated hydraulic conductivity less than 0.30 inches per hour. A small-scale or large-scale PIT in accordance with Stormwater Manual Volume III, Section 3.3.6 (or an alternative small scale test specified by the City) shall be used to demonstrate infeasibility of bioretention areas. If the measured native soil infiltration rate is less than 0.30 in/hour, bioretention/rain garden BMPs are not required to be evaluated as an option in List #1 or List #2. In these slow draining soils, a bioretention area with an underdrain may be used to treat pollution-generating surfaces to help meet Minimum Requirement #6, Runoff Treatment. If the underdrain is elevated within a base course of gravel, it will also provide some modest flow reduction benefit that will help achieve Minimum Requirement #7.

☐ Where the minimum vertical separation of 3 feet to the seasonal high groundwater elevation or other impermeable layer would not be achieved below bioretention that would serve a drainage area that exceeds the following thresholds (and cannot reasonably be broken down into amounts smaller than indicated):
o 5,000 square feet of pollution-generating impervious surface (PGIS)
o 10,000 square feet of impervious area
o 0.75 acres of lawn and landscape.

☐ Where the minimum vertical separation of 1 foot to the seasonal high groundwater or other impermeable layer would not be achieved below bioretention that would serve a drainage area less than the above thresholds

☐ Within 100 feet of a drinking water well, or a spring used for drinking water supply.

☐ Within 10 feet of small on-site sewage disposal drainfield, including reserve areas, and grey water reuse systems. For setbacks from a “large on-site sewage disposal system,” see Chapter 246-272B WAC.</td><td></td></tr>
</table>

Other Hard Surfaces (cont.)		
BMP and Applicable Lists	**Infeasibility Criteria**	**Infeasibility Description and Rationale for Each BMP Not Selected**
Sheet Flow Dispersion List #1 and #2	☑ Site setbacks and design criteria provided in BMP T5.12 (**Stormwater Manual** Volume V, Section 5.3) cannot be achieved. ☐ Positive drainage for sheet flow runoff cannot be achieved. ☐ Area to be dispersed (e.g., driveway, patio) cannot be graded to have less than a 15 percent slope. ☐ For flat to moderately sloped areas, at least a 10 foot-wide vegetation buffer for dispersion of the adjacent 20 feet of contributing surface cannot be achieved. For variably sloped areas, at least a 25 foot vegetated flowpath between berms cannot be achieved.	Presence of erosion hazard and potential slide areas
Concentrated Flow Dispersion List #1 and #2	☑ Site setbacks and design criteria provided in BMP T5.11 (**Stormwater Manual** Volume V, Section 5.3) cannot be achieved. ☐ A minimum 3 foot length of rock pad and 50 foot flowpath OR a dispersion trench and 25 foot flowpath for every 700 square feet of drainage area followed with applicable setbacks cannot be achieved. ☐ More than 700 square feet drainage area drains to any dispersion device.	Presence of erosion hazard and potential slide areas
On-site Detention List #1 and #2	☑ Project discharges directly to Lake Washington. ☐ Findings from a 1/4 mile downstream analysis confirm that the downstream system is free of capacity constraints. ☐ Site setbacks and design criteria provided in the **Stormwater Manual** (Volume III, Section 3.2.2) cannot be achieved.	

CITY OF MERCER ISLAND

SECTION D: POST-CONSTRUCTION SOIL MANAGEMENT

Attachments Required *(Check off required items that are attached)*

- [x] Site Plan showing, to scale:
  - [ ] Areas of undisturbed native vegetation (no amendment required)
  - [ ] New planting beds (amendment required)
  - [x] New turf areas (amendment required)
  - [ ] Type of soil improvement proposed for each area
- [ ] Soil test results (required if proposing custom amendment rates)
- [ ] Product test results for proposed amendments

Total Amendment / Topsoil / Mulch for All Areas

Calculate the quantities needed for the entire site based on all of the areas identified on the Site Plan and the calculations on the following page(s):

Product	Total Quantity (CY)	Test Results
Product #1: TBD	56 CY	______ % organic matter ______ C:N ratio "Stable"? yes ☐ no ☐
Product #2: ______	______ CY	______ % organic matter ______ C:N ratio "Stable"? yes ☐ no ☐
Product #3: ______	______ CY	______ % organic matter ______ C:N ratio "Stable"? yes ☐ no ☐

CY = cubic yards, C:N = Carbon:Nitrogen

CITY OF MERCER ISLAND

SECTION D: POST-CONSTRUCTION SOIL MANAGEMENT

Amendment / Topsoil / Mulch by Area

For each identified area on your Site Plan, provide the following information: (Use additional sheets if necessary)

Area # A (should match identified Area # on Site Plan)

Planting type: ☑ Turf ☐ Undisturbed native vegetation ☐ Planting Beds ☐ Other: ____________

Pre-Approved Amendment Method		
☐ Amend with compost	Turf:________ SF x 5.4 CY ÷ 1,000 SF = _________CY Planting beds:______ SF x 9.3 CY ÷ 1,000 SF= ______CY Total Quantity = _______CY Scarification depth: 8 inches	Product: ____________
☑ Stockpile and amend	Turf: 10,305 SF x 5.4 CY ÷ 1,000 SF = 56 CY Planting beds: 0 SF x 9.3 CY ÷ 1,000 SF= _______CY Total Quantity = 56 CY Scarification depth: 8 inches	Product: TBD
☐ Topsoil import	Turf:________ SF x 18.6 CY÷1,000 SF = _________CY Planting beds:______ SF x 18.6 CY ÷ 1,000 SF= ______CY Total Quantity = _______CY Scarification depth: 6 inches	Product: ____________
Custom Amendment		
☐ Amend with compost	Attach information on bulk density, percent organic matter, moisture content, C:N ratio, and heavy metals analysis to support custom amendment rate and scarification depth. Total Quantity = __________CY Scarification depth: ________inches	Product: ____________
☐ Stockpile and amend	Attach information on bulk density, percent organic matter, moisture content, C:N ratio, and heavy metals analysis to support custom amendment rate and scarification depth. Total Quantity = __________CY Scarification depth: ________inches	Product: ____________
Mulch		
☐ Amend with compost	Planting beds: ______ SF x 12.4 CY ÷ 1,000 SF= __________CY Total Quantity = ____________CY	Product: ____________
☐ Stockpile and amend	Planting beds: ______ SF x 12.4 CY ÷ 1,000 SF= __________CY Total Quantity = ____________CY	Product: ____________
☐ Topsoil import	Planting beds: ______ SF x 12.4 CY ÷ 1,000 SF= __________CY Total Quantity = ____________CY	Product: ____________

CY = cubic yards, C:N = Carbon:Nitrogen

CITY OF MERCER ISLAND

SECTION E: SIGNATURE PAGE

Project Engineer's Certification for Section B

For Stormwater Site Plans with engineered elements, the Construction SWPPP is stamped by a professional engineer licensed in the State of Washington in civil engineering.

If required, attach a page with the project engineer's seal with the following statement:

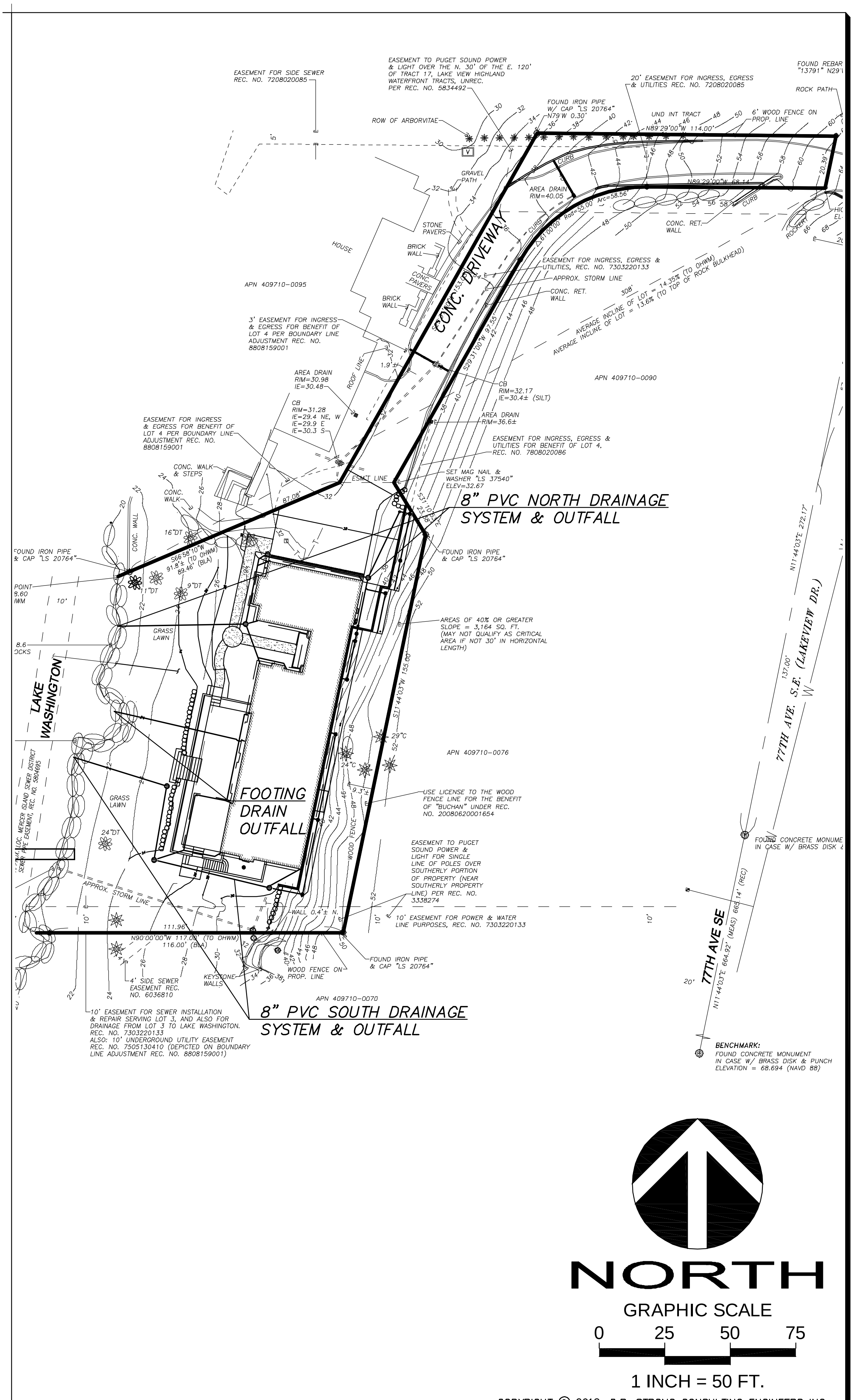
"I hereby state that this Construction Stormwater Pollution Prevention Plan for 6025 77th Ave SE *(name of project)* *has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that the City of Mercer Island does not and will not assume liability for the sufficiency, suitability, or performance of Construction SWPPP BMPs prepared by me."*

Applicant Signature for Full Stormwater Package (Sections A through D)

I have read and completed the Stormwater Submittal Package and know the information provided to be true and correct.

Print Applicant Name: Walter J. Shostak, P.E. (Engineer)

Applicant Signature: Walter J. Shostak Date 2-26-18



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6025 77TH AVE SE

BMP SITE PLAN

DRAFTED BY: DLR
DESIGNED BY:
PROJECT ENGINEER: WJS
DATE: 2.26.18
PROJECT NO.: 17125

DRAWING: 1
SHEET: 1 OF 1