

Final Storm Drainage Report

FOR

**MI Treehouse
5631 E. Mercer Way,
Mercer Island, Washington 98040**



05/29/2020

Prepared For: Bill Summers
5631 E Mercer Way,
Mercer Island, WA 98040

Project Manager: Michael A. Moody, P.E., LEED AP

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Date: May 2020

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Core No.: 18039

Revised:

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1.0 PROJECT OVERVIEW

The 5637 E Mercer Way property includes one lot on Mercer Island, WA. See Figure 1. 1 Vicinity Map on the following page. The lot, which is currently entirely undeveloped, and a single-family residence will be constructed on the lot as well as a driveway which will connect to the adjacent access drive to the south. The parcel is in the SE ¼ of Section 19, Township 24, Range 5 East, W.M. The King County tax parcel ID numbers for the project parcel is provided below in Table 1. 1.

Table 1. 1 Parcel Areas

King County Parcel ID & Area
(1) Parcel A: 192405-9312 (0.86 Acres)

The parcel is bordered by E Mercer Way to the east by large single-family, hillside lots to the west and south, and a designated Open Space to the north. The existing, on-site area contains heavy vegetation, trees, a wetland, and a stream. The existing site topography slopes from 10% to approximately 80% on the far west end of the property. This project is permitted under reasonable use, and permanent onsite measure, as well as construction BMPs will be employed to mitigate impacts to the wetland, stream, or downstream drainage. Increased runoff will be addressed with a detention pipe at the downslope section of the driveway, per Mercer Island design requirements (see Appendix).

The project is designed using the guidelines and requirements established in the following reference: 2014 Department of Ecology Stormwater Management Manual for the Puget Sound Basin requirements for surface water runoff management and the City of Mercer Island Construction Stormwater Codes.

The King County Parcel and Districts Reports are included in the Appendix.

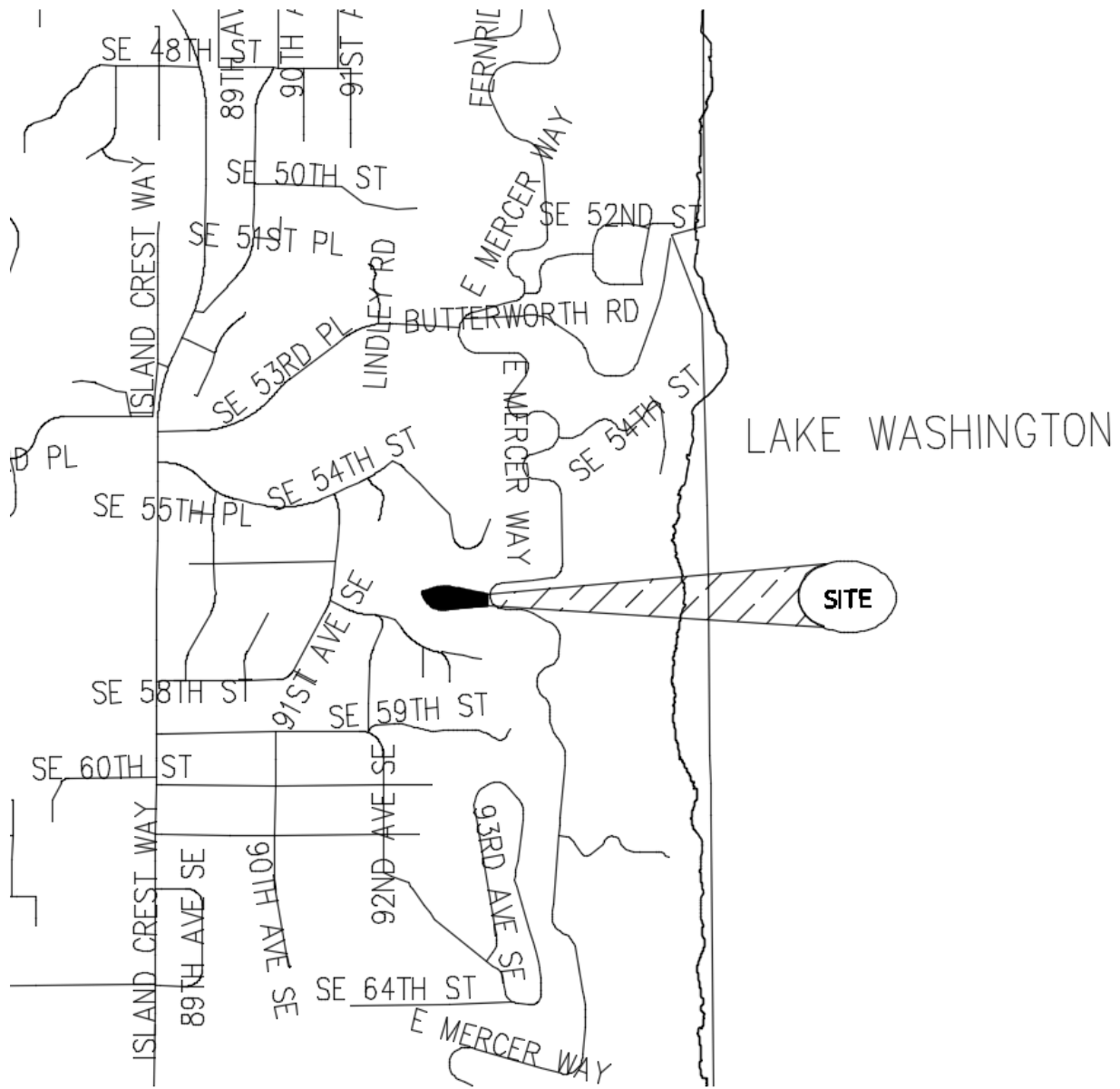


Figure 1. 1 Vicinity Map

2.0 CONDITIONS AND REQUIREMENTS SUMMARY

The site is covered with steep slopes and a wetland/creek designation that crosses the site, making typical construction almost impossible; therefore, construction of the proposed property will be completed under a “reasonable use” permit in the state of Washington.

The proposed project is classified as a development which includes less than 5,000 square feet of new plus replaced impervious surfaces and disturbs less than an acre but does result in a net increase of more than 2,000sqft of impervious surface. Therefore, only Minimum Requirements 1 through 5 will be addressed per the City of Mercer Island Stormwater Management Standards and the 2014 DOE Stormwater Management Manual for Western Washington (SWMMWW). Applicable minimum requirements, and how the project addresses each, are listed below.

2.1 Minimum Requirements

2.1.1 Minimum Requirement #1: Preparation of Stormwater Site Plans

See Site & Stormwater Plan under separate cover.

2.1.2 Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP/TESC)

Due to the sensitive nature of the site and the need for the “reasonable use” permit, the final SWPP will include an elevated degree of TESC BMPs and construction will occur over a reduced area (0.33 acres). A final SWPP report will be included in final submittal.

2.1.3 Minimum Requirements #3: Source Control of Pollutants

The SWMMWW requires that available and reasonable source control measures be adopted on all sites. Source control measures cannot be implemented due to severe site constraints, such as severe slopes and wetland protection. Adding Source Controls would require additional impact to the site.

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

Natural drainage patterns shall be maintained, and discharges from the project site will occur at the natural location to the east. The manner by which runoff is discharged from the project site must not cause a significant adverse impact to downstream receiving waters and down gradient properties, per SWMMWW Vol 1: 2.5.3. See Section 3 of this report for the downstream analysis and discussion of the natural discharge location.

2.1.5 Minimum Requirement #5: On-Site Stormwater Management

Projects are required to implement On-site Stormwater Management BMPs to infiltrate, disperse, and retain stormwater runoff onsite to the maximum extent feasible without causing groundwater contamination, flooding, or erosion impacts. Per Mercer Island Standards and Volume I of the 2014 SWMMWW, this project shall be required to meet the minimum standards for sites under 5,000ft² but over 2,000ft² of new impervious area. This requirement includes the implementation of LID standards as well as the establishment of a minimum soil depth.

Due to the severe slopes and sensitive wetland/stream concerns on the north end of the site, any LID BMP implementation would be both infeasible and result in an overall increase in impact to the site. Alternatively, the SWMMWW allows for the implementation of BMPs found in an approved list to be used in place of LID measures. This project is susceptible to List #1 Per list #1 the following BMPs were considered for the site:

Lawn and Landscaped Areas

- Post Construction Soil Quality and Depth in accordance with BMP T5.13 in Chapter 5 of Volume V (2014 SWMMWW).
 - Response: Amended soils will be applied to all disturbed pervious areas in accordance with BMP T5.13.

Roofs

- Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V of the DOE Manual, or Downspout Full Infiltration Systems in accordance with BMP T5.10A in Section 3.1.1 in Chapter 3 of Volume III (2014 SWMMWW).
 - Response: The project site has too steep of slopes to allow for full dispersion.
- Bioretention BMPs that have a minimum horizontally projected surface area below the overflow which is at least 5% of the total surface area draining to it.
 - Response: The project site does not meet the soil characterization requirements or special requirements with appropriate topography for bioretention BMPs.

- Downspout Dispersion Systems in accordance with BMP T5.01B in Section 3.1.2 in Chapter 3 of Volume III (2014 SWMMWW).
 - Response: The project site has limited applicability for downspout dispersion due to on-site steep slopes. Dispersion trenches for downspout dispersion are applied to the maximum extent feasible.
- Perforated Stub-out Connections in accordance with BMP T5.10C: Perforated Stub-out Connections in Section 3.1.3 in Chapter 3 of Volume III (2014 SWMMWW).
 - Response: Steep onsite slopes do not allow for infiltration.

Other Hard Surfaces

- Full Dispersion in accordance with BMP T5.30 in Chapter 5 Volume V (2014 SWMMWW).
 - Response: Full dispersion requires no more than 15% slope per any 20ft patch of dispersion area. This is not available, as much of the site, especially that downstream of the new impervious area, is on a steep slope.
- Permeable pavement in accordance with BMP T5.15 in Chapter 5 of Volume V of the DOE Manual, or Rain Gardens in accordance with Chapter 7 of Volume V of the DOE Manual. The rain garden or bioretention facility must have a minimum horizontally projected surface area below the overflow which is at least 5% of the total surface area draining to it.
 - Response: Permeable asphalt was considered for stormwater infiltration within the driveway; however, due to steep slopes and soil characterization concerns from the geotechnical report, permeable pavement will not be utilized.
- Bioretention BMPs that have a minimum horizontally projected surface area below the overflow which is at least 5% of the total surface area draining to it.
 - Response: The project site does not meet the soil characterization requirements or special requirements with appropriate topography for bioretention BMPs.
- Sheet Flow Dispersion in accordance with BMP T5.12, or Concentrated Flow Dispersion in accordance with BMP T5.11 in Chapter 5 of Volume V (2014 SWMMWW).

- Response: Due to existing site grades, runoff from the walkway cannot be routed over any infiltration facilities or over the necessary length for a dispersion facility without potentially compromising site stability. Therefore, no dispersion BMPs will be employed onsite.

Due to the severe slopes throughout the site, wetland buffers, and limited space for dispersion, geotechnical recommendations and our engineering judgement suggest that none of these list items be implemented.

City of Mercer Island Code 15.09, however, includes an additional alternative method to completing Minimum Requirement #5. This requires supplemental detention onsite when no LID options are considered viable, or a fee in lieu for cases where any detention would also be infeasible. The supplemental detention is not related to Minimum Requirement #7 or flow control standards, but rather a final, required design consideration to meet Minimum Requirement #5. The supplement detention is feasible, and therefore, the site design was adjusted to add the detention to meet this minimum requirement (for design details, see Section 4.2).

3.0 OFFSITE ANALYSIS

Downstream Investigation

Date of Field Inspection: April 20, 2018

Weather Conditions: 62 degrees Fahrenheit and mostly sunny. No rain in the past 12 hours.

Existing Conditions

The site maintains a consistent and steep slope, descending east, northeast towards E Mercer Way. The slope varies from 10% to 80% across the lot. Much of the site is saturated wetland or buffer for the stream that runs through the north end of the property. The site is currently undeveloped and remains largely forested with a Type 2 catch basin at the confluence of the E Mercer Way Swale system, the stream, and drainage from the neighboring lot to the south. The Parkwood Ridge Open Space public trail runs along the north end of the property and an access drive bends through the south east edge of the lot.

Upstream Drainage

The neighboring/uphill plats to the west and north of the site (including the Parkwood Ridge Open Space) have the flows from their respective steep slopes channeled via a mixed conveyance system, comprised of both ditches and PVC conveyance pipes, which runs through the open space or sheet flows into the stream on the north end of the property. Most of these flows enter the stream prior to reaching the property site, though a negligible portion sheet flows through the northwestern tip of the property. Uphill plats to the south and southwest contribute flows from the undeveloped sections of their respective lots which lie on steep slopes and constitute roughly 20% of their total lot areas.

Downstream Drainage

On-site flows drain east, northeast to the overflow catch basin at a local confluence ditch in the Right-of-Way of E Mercer Way. Flows enter the catch basin and are routed east under E Mercer Way by an 18" PVC pipe that outlets into a natural creek bed to the east of the street. The creek bed slopes precipitously down towards the water, before reaching a detention pond at 5646 E Mercer Way. The sediment pond also functions as a natural flow control measure and flows from this pond proceed underground due east, and through an orifice structure located in a catch basin on the east side of Glenhome Drive. From here flows are routed in an 18" PVC pipe into Lake Washington. The ¼ mile downstream analysis occurs 280 feet into Lake Washington. No observable siltation or other environmental concerns appear to exist in the vicinity of that 280-foot extension into the lake.

Additional Notes

Complaints relevant to the project site were reviewed prior to the inspection. All major complaints near the site are either not applicable to the project or have been resolved. One exception is a complaint regarding catch basin clogging due to debris. This can be resolved with standard catch basin maintenance. All catch basins and inlets included metal grating; however, some of the grating appeared covered or otherwise blocked, again resolved through standard catch basin maintenance. Any area-

drain or catch basin installations on-site will be designed to minimize clutter or clogging from debris, and construction BMPs will be applied to avoid debris entering the downstream storm system.

4.0 FLOW CONTROL AND WATER QUALITY DESIGN

4.1. Basin Modeling

The drainage analysis for detention sizing was modeled using the City of Mercer Island Detention Requirement Sheet. The sheet contains a table for pre-sized detention vaults for projects which cannot meet LID standards and are under 9,500 ft² of impervious surface (see appendix for additional details).

4.1.1 Existing Conditions

The site consists of one parcel for a total of 0.86 acres. The project parcel is currently undeveloped. The project proposes to construct a single-family home on the property with a walkway and a driveway to provide access. Much of the parcel is encumbered with steep slopes and an active wetland stream traversing the site. These conditions cause the developable area to be reduced to 0.33 acres of land.

4.1.2 Existing Soils

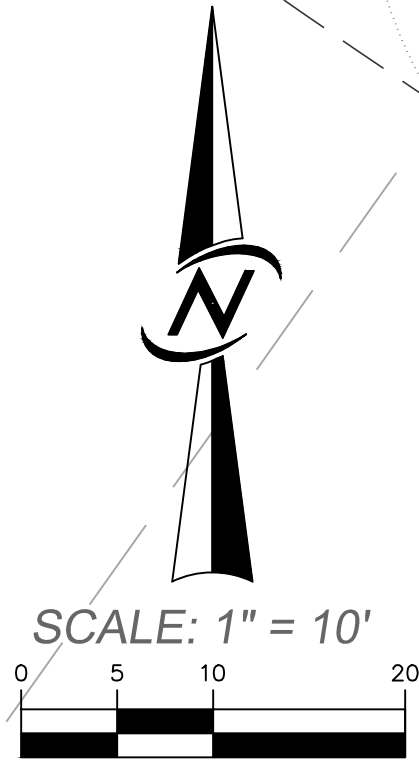
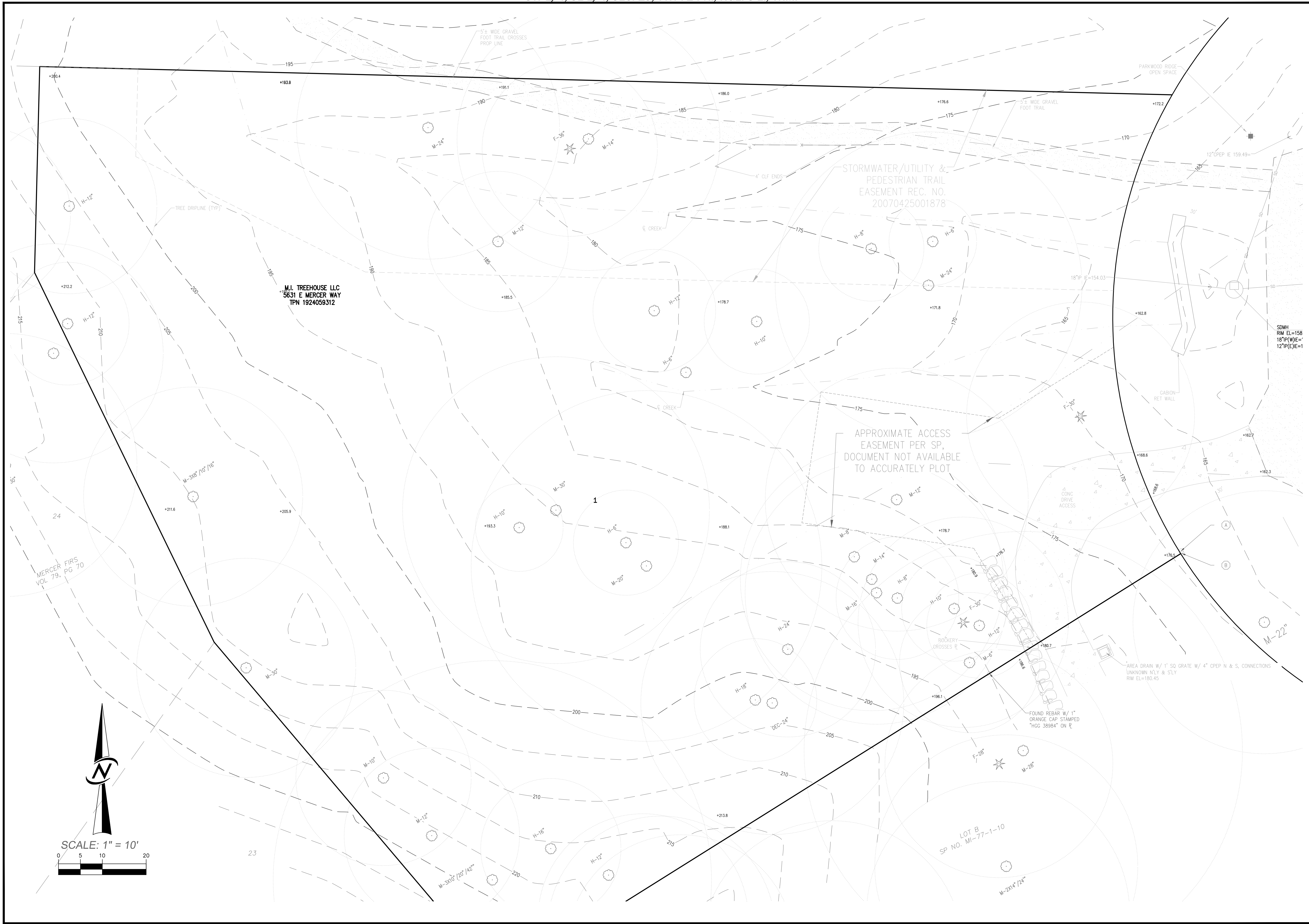
The onsite soil type is mapped by NRCS as Alderwood gravelly, sandy loam. Based on the King County Soil types the soil is considered hydraulic soil group C. The NRCS Site Soils Map and King County Soil Types Table are included in the Appendix.

4.1.3 Existing Site Summary

The pre-developed conditions were modeled in MGSFlood as Second Growth-Forested area with hydrologic soil group C. The uncontrolled peak runoff flow rates for the existing pre-developed condition is shown in 4.2 below.

Table 4.2 Predeveloped Return Periods

Event	Peak Q (cfs)	Area (ac)
2 year	0.005927	0.33
5 year	0.009972	0.33
10 year	0.01362	0.33
25 year	0.01611	0.33
100 year	0.02136	0.33



DATE	JULY, 2018	DESIGNED	NICHOLAS JOHNSON	DRAWN	NICHOLAS JOHNSON
APPROVED	MICHAEL A MOODY	PROJECT MANAGER			
SHEET	OF				
1	2				
PROJECT NUMBER					
18039					

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 ENGINEERING • PLANNING • SURVEYING

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7/11/2018 9:04 AM A:\2018\18039\DOCUMENTS\ENGINEERING REPORTS\SDP\PRELIM\DRAWINGS\EXISTING CONDITIONS EXHIBIT.DWG

4.1.4 Developed Conditions

The developed condition proposes the construction of a single-family residence and an access easement. Refer to Table 4. 1 below for a breakdown of the actual developed areas. An existing drive borders the west property line and has been modeled using the proposed impervious area. Refer to the developed conditions exhibit at the end of this section for an area breakdown. The developed conditions were modeled with till grass and impervious.

Table 4. 1 Developed Site Areas

	Lot 1 (sf)	Lot 2 (sf)	Lot 3 (sf)	Access Drive (sf)	Total (sf)
Total Area	15,542	8,400	9,600	2,404	35,946
Roofs (with eaves)	1,945	2,061	2,019	0	6,025
Driveway	1,323	1,323	1,251	1,888	5,785
Walkway/Patio	65	65	65	0	195
Impervious Subtotal	3,333	3,449	3,335	1,888	12,005
Lawn/Landscaping	12,209	4,951	6,265	516	23,941
Pervious Subtotal	12,209	4,951	6,265	516	23,941

Total Area	14,404
Roofs (with eaves)	3,045
Driveway	1,283
Walkway/Patio	630
Impervious Subtotal	4,958
Lawn/Landscaping	5,098
Impacted Area to be Restored	4,348
Pervious Subtotal	9,446

Table 4. 2 Developed Areas

DEVELOPED CONDITIONS	Total Area = 0.33 acres
GROUND COVER	AREA (acres)
Grass/Lawn	0.21
Impervious	0.12

Table 4. 3 Developed Flows

Event	Match Q (cfs)	Q Increase (cfs)	Area (ac)
2-year	0.05400	0.04807	0.33
10-year	0.08929	0.07567	0.33
100-year	0.1530	0.1316	0.33

4.2. Flow Control BMPs

Per the City of Mercer Island regulation, the project follows the Mercer Island City Code in addendum to the 2014 DOE Manual. As such, the Minimum Requirements 1 through 5 determine whether or not various stormwater BMP measures are required and to what degree. The Mercer Way Project includes less than 5,000 ft² of replaced/new impervious surfaces and therefore is not subject to standard Flow Control BMPs. LID BMPs are typically used to meet minimum requirement 5; however, all LID options are not feasible onsite due to the severe nature of the site constraints. The City of Mercer Island then requires supplemental detention in place of any LID requirements and has provided a pre-sized detention tank table for sites, such as this one, which do not have available LID options (see Appendix for sizing table).

This site will employ a detention pipe, designed using this Table to meet Minimum Requirement 5 in accordance with Mercer Island City Code. The 5637 E Mercer Way project site will add approximately 4,839ft² of impervious area, and the site is covered in primarily Class C soils (see Appendix for the NRCS Soils Map of the area). A 4-foot diameter pipe was selected in order to minimize trenching impact for utility placement. The dimensions of the pipe are therefore as follows:

- 48" diameter
- 49' in length
- First orifice Diameter 0.5"
- Second Orifice Diameter 1.5"
- Separation between first and second orifices, 2.9'

Additional details and placement information can be found on the Stormwater Site Plans.

5.0 FINANCIAL LIABILITY

A site improvement Bond Quantities Worksheet will be provided prior to permit approval.

6.0 APPENDIX

King County Parcel Report

DOE Flow Minimum Requirement Flow Charts

NRCS Soil Survey Map

Technical Memo

Mercer Island Detention Requirement Guidelines

King County Department of Assessments

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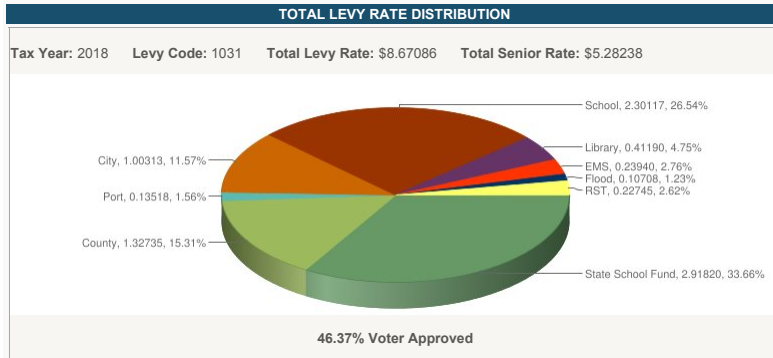
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PARCEL	
Parcel Number	192405-9312
Name	MI TREEHOUSE LLC
Site Address	
Legal	LOT A MERCER IS SP 77-1-10 REC AF #7703310851 SD SP DAF POR OF NE 1/4 OF SW 1/4 AND OF GL 3 LY BTWN LNS PLW & DIST 1700 FT & 2350 FT N OF SLY LN OF SEC & LY WLY OF E MERCER WAY BLVD LESS POR PLATTED EL DORADO ESTATES ALSO LESS POR PLATTED MERCER FIRS

BUILDING 1	
Year Built	<input type="text" value=""/>
Total Square Footage	
Number Of Bedrooms	
Number Of Baths	
Grade	
Condition	
Lot Size	37554
Views	No
Waterfront	



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TAX ROLL HISTORY							
Valued Year	Tax Year	Appraised Land Value (\$)	Appraised Imps Value (\$)	Appraised Total (\$)	Taxable Land Value (\$)	Taxable Imps Value (\$)	Taxable Total (\$)
2017	2018	35,000	0	35,000	35,000	0	35,000
2016	2017	32,094	0	32,094	32,094	0	32,094
2015	2016	32,094	0	32,094	32,094	0	32,094
2014	2015	32,094	0	32,094	32,094	0	32,094
2013	2014	190,000	0	190,000	190,000	0	190,000
2012	2013	176,000	0	176,000	176,000	0	176,000
2011	2012	186,000	0	186,000	186,000	0	186,000
2010	2011	195,000	0	195,000	195,000	0	195,000
2009	2010	201,000	0	201,000	201,000	0	201,000
2008	2009	250,000	0	250,000	250,000	0	250,000
2007	2008	250,000	0	250,000	250,000	0	250,000
2006	2007	359,000	0	359,000	359,000	0	359,000
2005	2006	359,000	0	359,000	359,000	0	359,000
2004	2005	330,000	0	330,000	330,000	0	330,000
2003	2004	330,000	0	330,000	330,000	0	330,000
2002	2003	330,000	0	330,000	330,000	0	330,000
2001	2002	210,000	0	210,000	210,000	0	210,000
2000	2001	183,000	0	183,000	183,000	0	183,000
1999	2000	147,000	0	147,000	147,000	0	147,000
1998	1999	140,000	0	140,000	140,000	0	140,000
1997	1998	0	0	0	87,000	0	87,000

Reference Links:

- [King County Taxing Districts Codes and Levies \(PDF\)](#)
- [King County Tax Links](#)
- [Property Tax Advisor](#)
- [Washington State Department of Revenue \(External link\)](#)
- [Washington State Board of Tax Appeals \(External link\)](#)
- [Board of Appeals/Equalization](#)
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1996	1997	0	0	0	80,000	0	80,000
1994	1995	0	0	0	80,000	0	80,000
1992	1993	0	0	0	63,700	0	63,700
1990	1991	0	0	0	65,000	0	65,000
1988	1989	0	0	0	40,500	0	40,500
1986	1987	0	0	0	54,000	0	54,000
1984	1985	0	0	0	46,000	0	46,000
1982	1983	0	0	0	46,000	0	46,000

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Figure I-2.4.1 Flow Chart for Determining Requirements for New Development

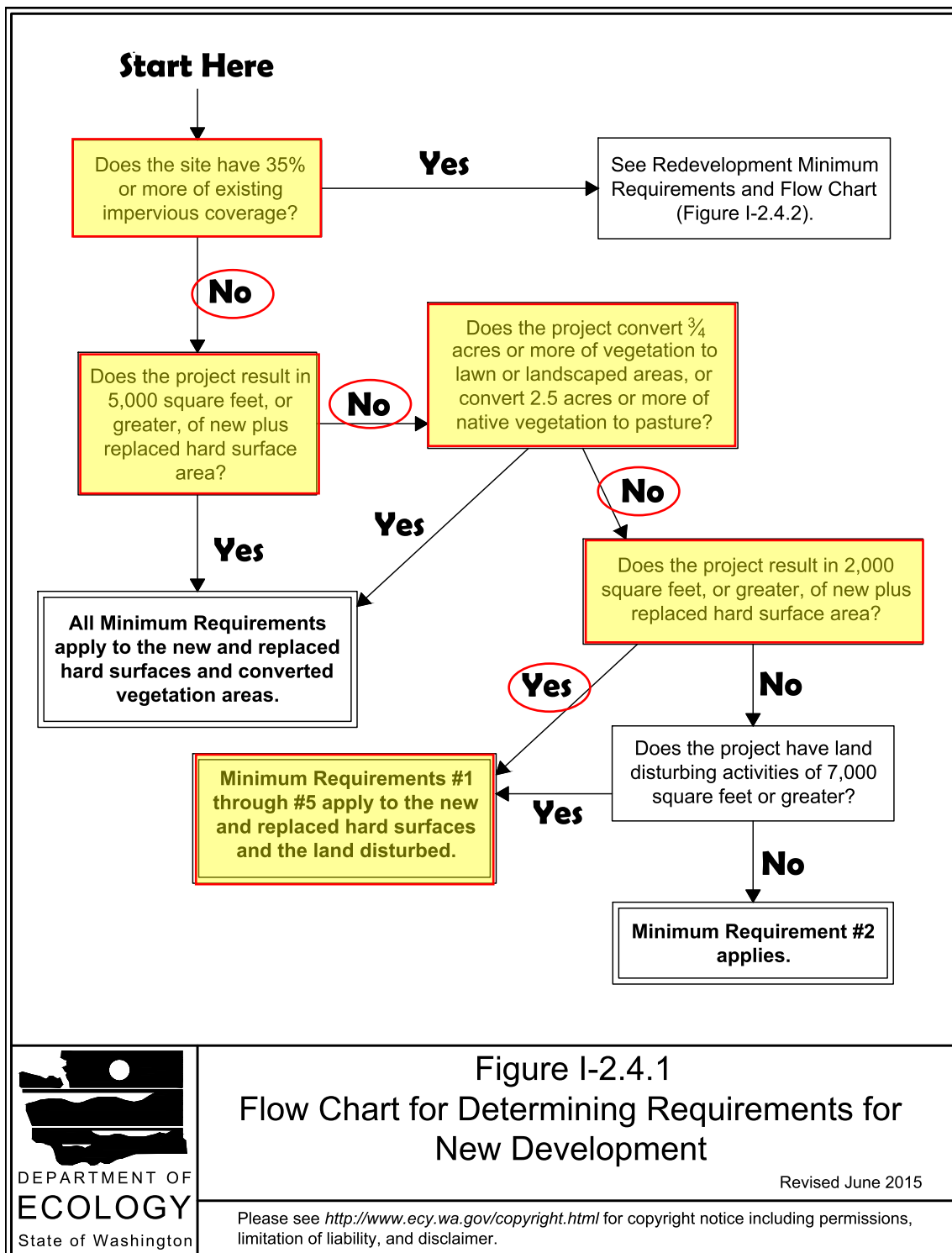
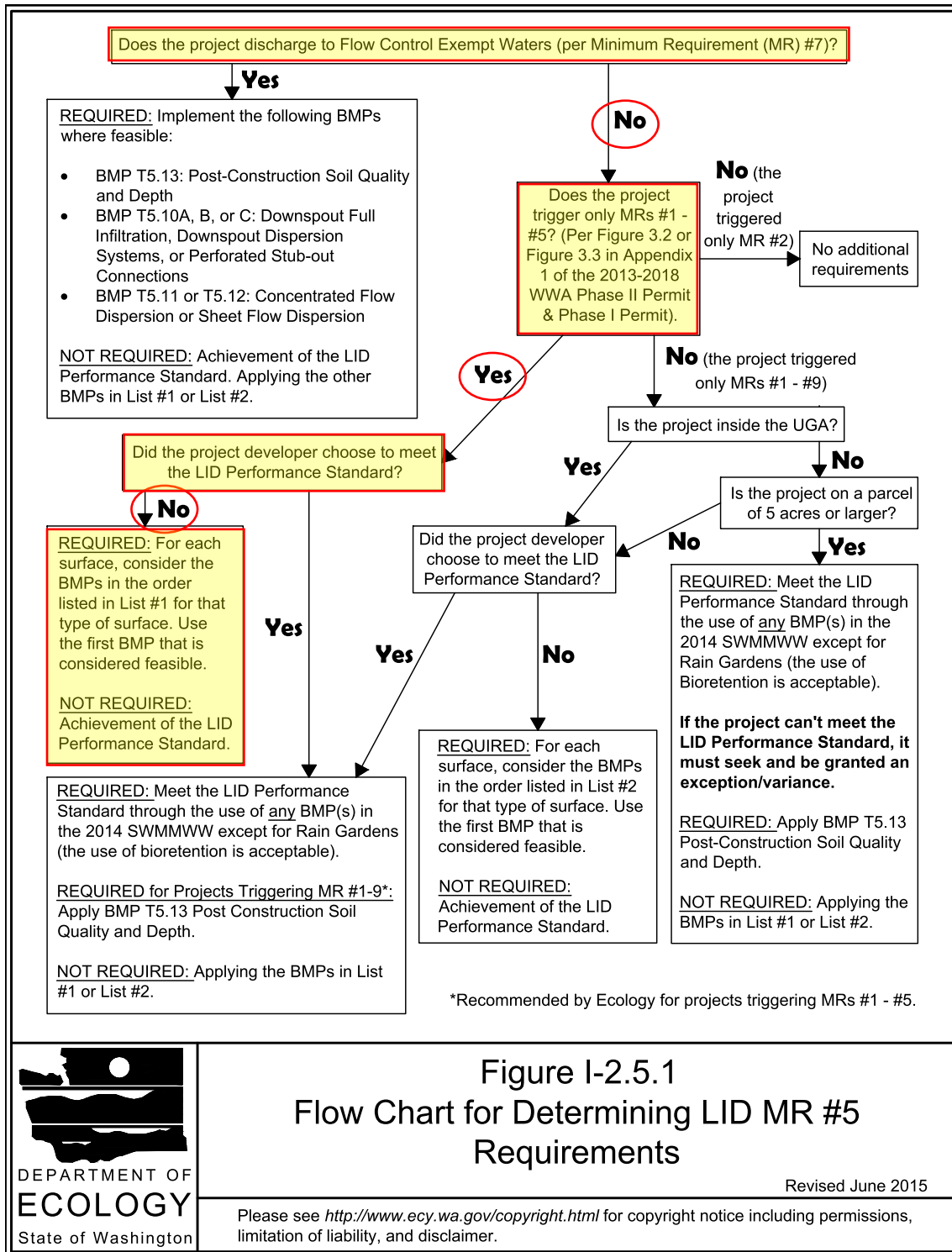


Figure I-2.4.1
Flow Chart for Determining Requirements for
New Development

Revised June 2015

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Figure I-2.5.1 Flow Chart for Determining LID MR #5 Requirements



**Figure I-2.5.1
Flow Chart for Determining LID MR #5
Requirements**

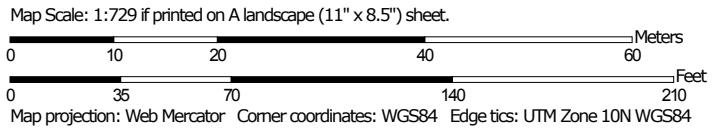
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Soil Map—King County Area, Washington




Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: King County Area, Washington

Survey Area Data: Version 13, Sep 7, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 31, 2013—Oct 6, 2013

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	1.4	99.6%
KpD	Kitsap silt loam, 15 to 30 percent slopes	0.0	0.4%
Totals for Area of Interest		1.4	100.0%



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TECHNICAL MEMORANDUM

To: Evan Maxim
Planning Manager
City of Mercer Island

From: Michael A. Moody, P.E., LEED-AP
Project Engineer

Date: March 23, 2018

Re: RUE CAO 15-001 (MI Treehouse Project) Supplemental Evaluation

The purpose of this memorandum is to provide additional documentation and evaluation for the above referenced project as requested in your email dated February 2, 2018 and a letter from the City Attorney (Kari L. Sand) dated December 26, 2017 (both provided as attachments for reference).

More specifically this memo intends to provide the City with our Civil Engineering opinion and/or technical responses to Items A, B and E in the City's December 26, 2017 letter so that processing of the Reasonable Use Exemption permit may continue.

Item A: Geotechnical / Civil (drainage) Engineering:

Our additional analysis of the existing condition for the Type 2 Watercourse located on-site and conveying water downstream of the project site discovered that the system currently experiences siltation throughout the year.

The proposed project will likely adversely impact siltation in the watercourse during construction without temporary erosion and sediment control measures beyond those required at minimum. The project will therefore apply additional BMPs to reduce impacts during construction including:

- Restricted construction dates (dry season construction only)
- Additional filter fabric fence (double layer)
- Restricted clearing limit footprint (clear only what is necessary for the home and driveway as discussed in the *Revised Critical Areas Report* provided under separate cover)
- Restricted construction entrance disturbance (no excavation at existing driveway, add quarry spalls per typical, maintain daily)

The proposed project is unlikely to impact siltation or flooding in the watercourse in the permanent condition. Refer to the *Revised Critical Areas Report* for more information and detail regarding permanent impacts and proposed mitigation.

The proposed project will apply and comply with the Washington State Department of Ecology's 2014 Stormwater Management Manual for Western Washington (2014 DOE) per City of Mercer Island Stormwater Code.

In addition to the 2014 DOE Manual, the project proposes to apply downstream analysis standards and recommendations in the 2016 King County Surface Water Design Manual considered equivalent to the 2014 DOE Manual.

Item B: Wetland / watercourse impacts:

A Revised Critical Areas Report has been prepared and is included under separate cover (by Sewall Wetland Consulting Inc). Also included under separate cover (by Healey-Jorgensen Architects) is a Site Plan Wetland that shows the optimized site shifted to minimize critical area and critical area buffer impacts.

It is our professional opinion that together these supplemental documents address Item B from the City's December 2017 comment letter. Temporary and permanent critical area impacts are well documented in the revised report and clearly shown on the updated site plan. These documents also provide both narrative and graphical representation of reductions to critical area impacts as a result of the revised site plan.

Item E: Technical corrections:

A Revised Critical Areas Report has been prepared and is included under separate cover (by Sewall Wetland Consulting Inc). Also included under separate cover (by Healey-Jorgensen Architects) is a Site Plan Wetland that shows the optimized site shifted to minimize critical area and critical area buffer impacts.

It is our professional opinion that together these supplemental documents address Item E from the City's December 2017 comment letter. Temporary and permanent critical area impacts are well documented in the revised report and clearly shown on the updated site plan.

CITY OF MERCER ISLAND

DEVELOPMENT SERVICES GROUP

9611 SE 36TH STREET | MERCER ISLAND, WA 98040

PHONE: 206.275.7605 | www.mercergov.org

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



ON-SITE DETENTION DESIGN REQUIREMENTS

General Requirements

This guidance applies only to projects that meet the thresholds specified below in “Is On-site Detention Required for My Project?” if all of the on-site stormwater BMPs included on List #1 and List #2 are determined to be infeasible for roofs and/or other hard surfaces.

Is On-site Detention Required For My Project?

YES, if my project:

- 1) Results in 2,000 square feet, or greater, of new plus replaced hard surface area, or
- 2) Has a land disturbing activity or 7,000 square feet or greater, or
- 3) Results in a **net increase** of impervious surface of 500 square feet or greater.

AND

- 1) All of the on-site stormwater BMPs included on List #1 and List #2 are determined to be infeasible for roofs and/or other hard surfaces, and
- 2) Drainage from the site will be discharged to a storm and surface water system that includes a watercourse or there is a capacity constraint in the system.

NO, if my project:

- 1) Results in less than 2,000 square feet of new plus replaced hard surface area, and
- 2) Has a land disturbing activity less than 7,000 square feet, and
- 3) Results in a **net increase of less than 500 square feet** of impervious surface area.
- 4) The project discharges **directly** to Lake Washington, or findings from a ¼-mile downstream analysis confirm that the downstream system is free of capacity constraints.

Designing Your On-Site Detention System

All on-site detention system designs must be prepared by a professional engineer registered in the State of Washington. The Standard On-site Detention System worksheet (Attachment 1) must be submitted on 18” x 24” (minimum) size sheets.

Construction that results in 500 to 9,500 square feet of new plus replaced impervious surfaces:

Size system according to Table 1. The configuration of the on-site detention system shall be as shown on Attachment 1 (Standard On-Site Detention Systems Worksheet) or as specifically designed by the engineer for the site.

Note:

- The applicant may pay a fee-in-lieu-of constructing an on-site detention system when allowed by the City Engineer. The fee will not be an option when in the opinion of the City Engineer, undetained runoff from the development may adversely exacerbate an existing problem (MICC 15.11) or if flow control is required by Minimum Requirement #7.
- **Construction that results in more than 9,500 square feet of new plus replaced impervious surfaces and/or exceeds a 100-year flow frequency of 0.15 cubic feet per second (for moderate and steep sloped sites greater than a 5% slope):** Size system according to Minimum Requirement #7 (Flow Control) in the Stormwater Management Manual for Western Washington (Ecology 2014).

Table 1

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

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

Notes:

▪ Minimum Requirement #7 (Flow Control) is required when the 100-year flow frequency causes a 0.15 cubic feet per second increase (when modeled in WWHM with a 15-minute timestep). Breakpoints shown in this table are based on a flat slope (0-5%). The 100-year flow frequency will need to be evaluated on a site-specific basis for projects on moderate (5-15%) or steep (> 15%) slopes.

- Soil type to be determined by geotechnical analysis or soil map.
- Sizing includes a Volume Correction Factor of 120%.
- Upper bound contributing area used for sizing.

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

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

⁽³⁾ Minimum orifice diameter = 0.5 inches

in = inch

ft = feet

sf = square feet

Basis of Sizing Assumptions:

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

SBUH, Type 1A, 24-hour hydrograph

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

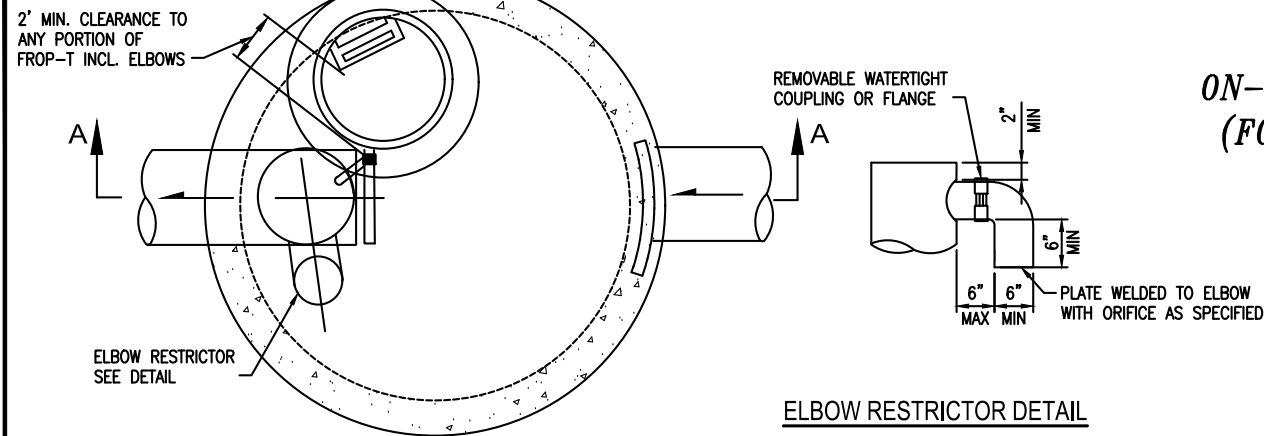
Predeveloped = second growth forest (CN = 72 for Type B soils, CN = 81 for Type C soils)

Developed = impervious (CN = 98)

0.5 foot of sediment storage in detention pipe

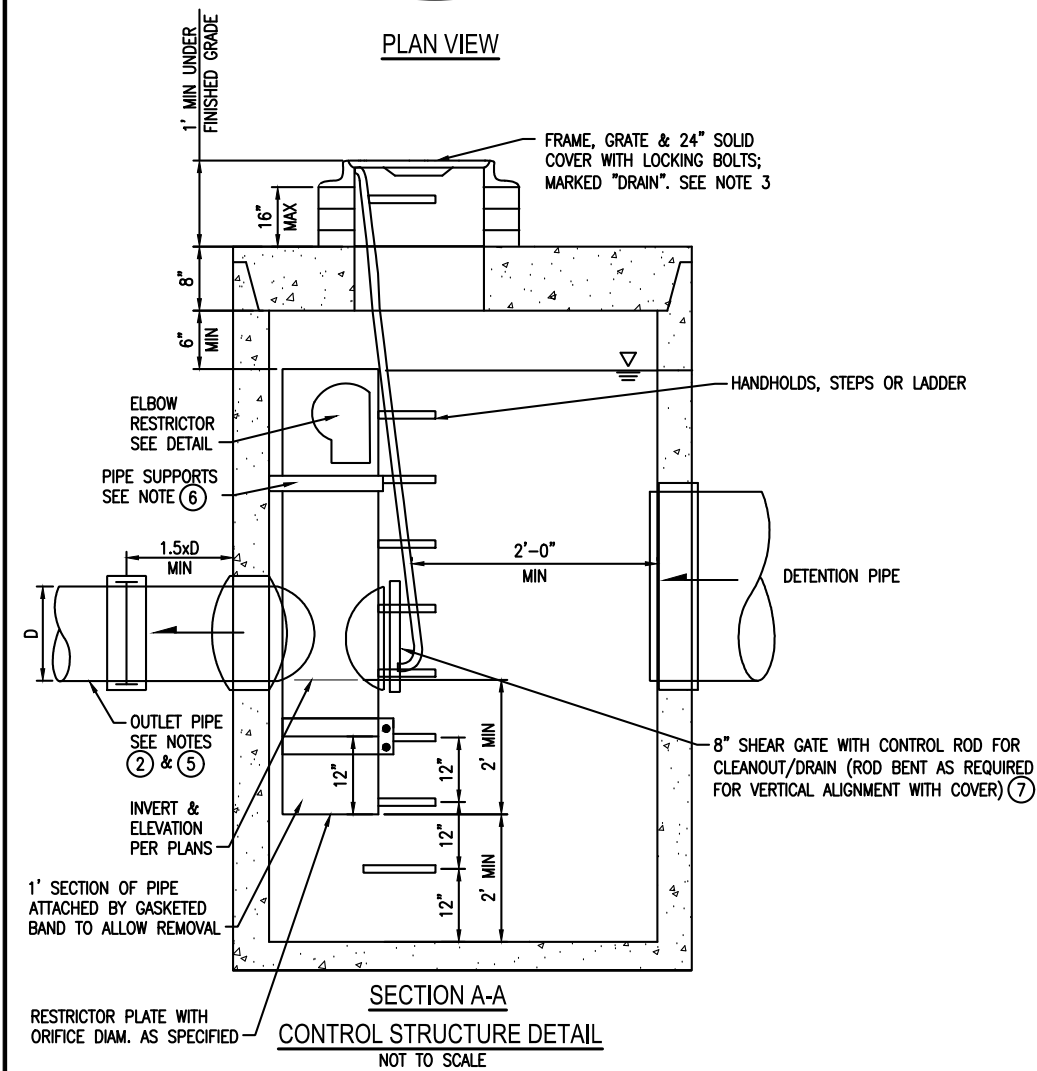
Overland slope = 5%

ATTACHMENT 1
CITY OF MERCER ISLAND
ON-SITE DETENTION SYSTEM WORKSHEET
(FOR NEW PLUS REPLACED IMPERVIOUS
AREA OF 9,500 SF OR LESS)

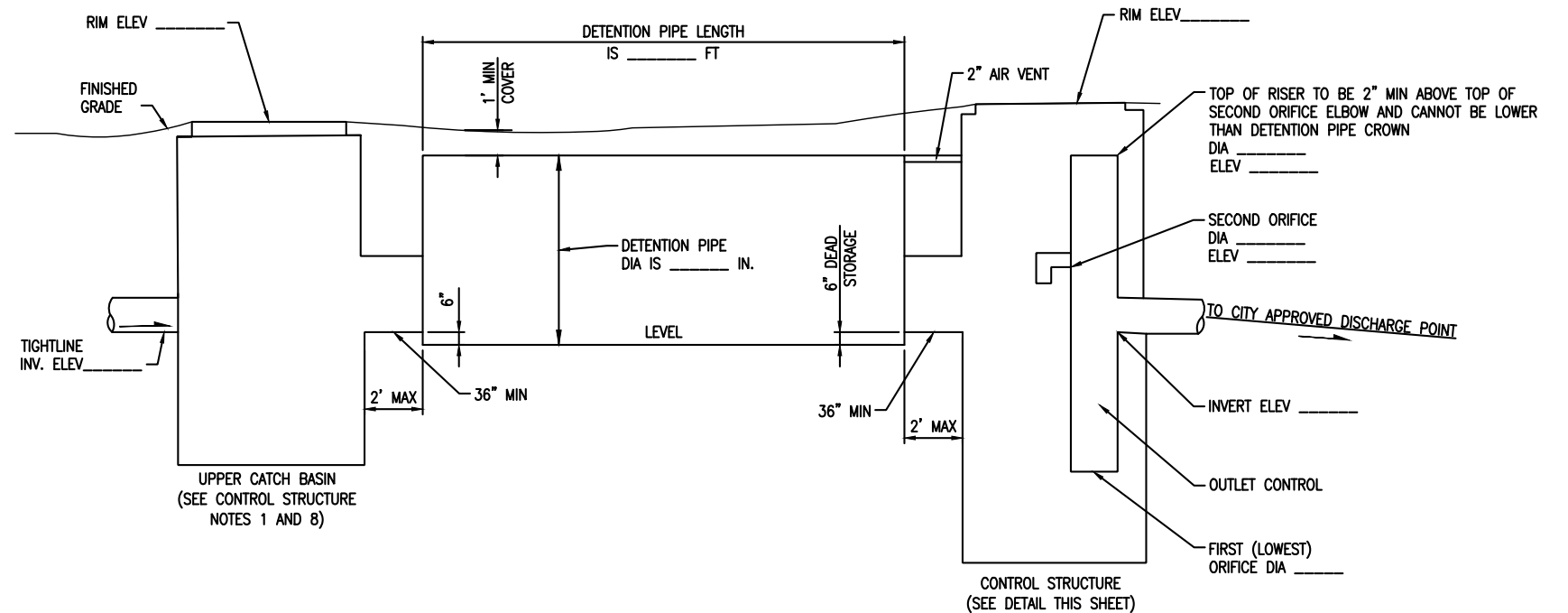


ELBOW RESTRICTOR DETAIL

OWNER: _____	ADDRESS: _____	PREPARED BY: _____	
PERMIT #: _____	PHONE: _____	DATE: _____	
NEW PLUS REPLACED IMPERVIOUS SURFACE AREA (SF): _____	DETENTION PIPE DIA (INCH): _____	DETENTION PIPE LENGTH (FT): _____	ORIFICE #1 DIA ____ INCH, ELEV _____
SOIL TYPE: _____	PIPE MATERIAL: _____		ORIFICE #2 DIA ____ INCH, ELEV _____



SECTION A-A
CONTROL STRUCTURE DETAIL
 NOT TO SCALE



ON-SITE DETENTION SYSTEM
 NOT TO SCALE (ENGINEER TO FILL IN BLANKS)

CONTROL STRUCTURE NOTES:

- ① USE A MINIMUM OF A 54 IN. DIAM. TYPE 2 CATCH BASIN. THE ACTUAL SIZE IS DEPENDENT ON CONNECTING PIPE MATERIAL AND DIAMETER.
- ② OUTLET PIPE: MIN. 6 INCH.
- ③ METAL PARTS: CORROSION RESISTANT. NON-GALVANIZED PARTS PREFERRED. GALVANIZED PIPE PARTS TO HAVE ASPHALT TREATMENT 1.
- ④ FRAME AND LADDER OR STEPS OFFSET SO:
 - A. CLEANOUT GATE IS VISIBLE FROM TOP;
 - B. CLIMB-DOWN SPACE IS CLEAR OF RISER AND CLEANOUT GATE;
 - C. FRAME IS CLEAR OF CURB.
- ⑤ IF METAL OUTLET PIPE CONNECTS TO CEMENT CONCRETE PIPE, OUTLET PIPE TO HAVE SMOOTH O.D. EQUAL TO CONCRETE PIPE I.D. LESS 1/4 IN.

- ⑥ PROVIDE AT LEAST ONE 3 X 0.090 GAUGE SUPPORT BRACKET ANCHORED TO CONCRETE WALL WITH 5/8 IN. STAINLESS STEEL EXPANSION BOLTS OR EMBEDDED SUPPORTS 2 IN. INTO CATCH BASIN WALL (MAXIMUM 3'-0" VERTICAL SPACING).
- ⑦ THE SHEAR GATE SHALL BE MADE OF ALUMINUM ALLOY IN ACCORDANCE WITH ASTM B 26M AND ASTM B 275, DESIGNATION ZG32A; OR CAST IRON IN ACCORDANCE WITH ASTM A 48, CLASS 30B. THE LIFT HANDLE SHALL BE MADE OF A SIMILAR METAL TO THE GATE (TO PREVENT GALVANIC CORROSION), IT MAY BE OF SOLID ROD OR HOLLOW TUBING, WITH ADJUSTABLE HOOK AS REQUIRED. A NEOPRENE RUBBER GASKET IS REQUIRED BETWEEN THE RISER MOUNTING FLANGE AND THE GATE FLANGE. INSTALL THE GATE SO THAT THE LEVEL-LINE MARK IS LEVEL WHEN THE GATE IS CLOSED. THE MATING SURFACES OF THE LID AND THE BODY SHALL BE MACHINED FOR PROPER FIT. ALL SHEAR GATE BOLTS SHALL BE STAINLESS STEEL.
- ⑧ THE UPPER CATCH BASIN IS REQUIRED IF THE LENGTH OF THE DETENTION PIPE IS GREATER THAN 50 FT.

ON-SITE DETENTION SYSTEM NOTES:

1. CALL DEVELOPMENT SERVICES (206-275-7605) 24 HOURS IN ADVANCE FOR A DETENTION SYSTEM INSPECTION BEFORE BACKFILLING AND FOR FINAL INSPECTIONS.
2. RESPONSIBILITY FOR OPERATION AND MAINTANANCE OF DRAINAGE SYSTEMS ON PRIVATE PROPERTY IS RESPONSIBILITY OF THE PROPERTY OWNER. MATERIAL ACCUMULATED IN THE STORAGE PIPE MUST BE REMOVED FROM CATCH BASINS TO ALLOW PROPER OPERATION. THE OUTLET CONTROL ORIFICE MUST BE KEPT OPEN AT ALL TIMES.
3. PIPE MATERIAL, JOINT, AND PROTECTIVE TREATMENT SHALL BE IN ACCORDANCE WITH SECTION 7.04 AND 9.05 OF THE WSDOT STANDARD SPECIFICATION FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION, LATEST VERSION. SUCH MATERIALS INCLUDE THE FOLLOWING, LINED CORRUGATED POLYETHYLENE PIPE (LCPE), ALUMINIZED TYPE 2 CORRUGATED STEEL PIPE AND PIPE ARCH (MEETS AASHTO DESIGNATIONS M274 AND M36), CORRUGATED OR SPIRAL RIB ALUMINUM PIPE, OR REINFORCED CONCRETE PIPE. CORRUGATED STEEL PIPE IS NOT ALLOWED.
4. FOOTING DRAINS SHALL NOT BE CONNECTED TO THE DETENTION SYSTEM.