

MR 1-9 Storm Drainage Summary



Miller Residence
7238 SE 32nd Street
Mercer Island, WA 98040

6,155 SF
(NEW & REPLACED Impervious)

September 16, 2020

Co-authored by
Stephenie Seawall
Duffy Ellis, P.E.

General:

This site's new and replaced impervious area is **ABOVE 5,000** sf, site is subject to minimum DOE requirements MR1-9 identified below.

MR1 = Preparation of Storm Water Site Plans	See C2.0 Drainage Plan
MR2 = Construction Storm Water Pollution Prevention Plan	See C1.0 TESCP in plan set.
MR3 = Source Control of Pollution	See C1.0 for erosion control measures recommended to mitigate erosion and sediment discharge from site during construction phase.
MR4 = Preservation of Natural Drainage Systems and Outfalls	Drainage patterns are not being altered. 100% infiltration is proposed due to presence of advanced outwash sandy receptor soil.
MR5 = On-site Stormwater Management	100% infiltration is proposed for all impervious surfaces. See plans for locations. See WWHM continuous model infiltration calculations in appendix of this report.
MR6 = Runoff Treatment	N/A: PGIS area = 2,262 SF , less than the threshold of 5,000 sf for runoff treatment

MR7 = Flow Control	N/A – 100% infiltration is proposed.
MR8 = Wetlands Protection	N/A – no wetlands in vicinity
MR9 = Operations and Maintenance	N/A – Annual cleaning of infiltration catch basins recommended to help maintain long term performance of infiltration.

Background:

A 2-story house is proposed on this lot to replace the existing house. This residential lot is located in the northwestern quadrant of Mercer Island and is situated between First Hill Park and Mercerdale Park. Subject redevelopment project consists of demolishing the existing house and detached garage including removal of the existing circular driveway. Architect for the house is Rick Jones & Associates. The Builder is RKK Construction.

The site and area slope toward the west at an average grade of roughly 3%. Our storm design plan proposes all stormwater from roof and driveway discharge into one of two drywells, both sized for 100% infiltration using WWHM. We discuss this BMP in the table “MR5 On-site Stormwater Management” section below. See WWHM sizing reports attached to this drainage summary.

Soils and Infiltration Feasibility:

The receptor native soils are characterized as medium dense, advanced outwash. Outwash soils are typically well graded and sandy with void space to allow transmission of water. See the Infiltration Evaluation by Earth Solutions NW, August 2020 for full read. They visited the site, sampled two test pits and one shallow boring in July 2020. They performed a PIT test with a healthy 29 inch/hour rate and recommend a design rate of 9.7”/hour.

MR5 = On-site Stormwater Management

The List Approach (using List #2) selection process was applied to site to evaluate feasibility of BMP’s (reference 2019 DOE Manual):

Lawn and Landscaped Areas:

- Post-Construction Soil Quality and Depth in accordance with BMP T5.13 in Chapter 5 of Volume V of the DOE Manual.
Compost-Amended Soil is required and proposed.

MR 5 Roof Surface BMP Evaluation:

- **Full Dispersion:**
Infeasible due to lack of 100 LF flowpath
- **Downspout Full Infiltration:**
Proposed
Sized using WWHM using the following:
Design infiltration rate: 9.7"/hour
North drywell: 2,500 sf of roof
South drywell: 4,500 sf of roof and driveway

The balance of the BMP list order not evaluated given full infiltration is selected

MR 5 Driveway Surface BMP Evaluation:

- **Full Dispersion:**
Infeasible due to lack of 100 LF flowpath
- **Permeable Pavement:**
Not advised due to fact the new driveway (PGIS) substantially overlaps the existing driveway (ex. PGIS). This is a categorical exemption per DOE SWES Table D9.1.
- **Bioretention:**
Our opinion is infiltration is the optimal BMP due to presence of advanced outwash receptor soils.
- **Sheet Flow Dispersion / Concentrated Flow Dispersion:**
The flowpath requirement cannot be met

APPENDIX

Attachments

- Impervious Area Spreadsheet
- DOE Flowchart for Determining Requirements for New Development pointing to redevelopment
- DOE Flowchart for Determining Requirements for Re-Development showing MR1-9
- Infiltration Evaluation, Earth Solutions NW, August 2020
- WWHM infiltration drywell sizing reports
 - North drywell
 - South drywell

Impervious Area Spreadsheet		
Miller Residence - 7238 SE 32nd Street, Mercer Island, WA 98040		
Gross Site area	16,128	sf
	0.370	acres
Existing Impervious Area to be demolished		
Existing Impervious Area to be demolished	7,469	sf
total existing, to be demolished =	7,469	sf
Existing Impervious Area to remain		
Existing Impervious Area to remain	396	sf
total existing, to remain =	396	sf
total existing =	7,864	sf
Proposed Impervious Area		
House Roof	3,359	sf
Exposed Patio	534	sf
Exposed Driveway	2,262	sf
total on-site (new + replaced) proposed =	6,155	sf
total new impervious =	(1,314)	sf
total new + replaced + remaining impervious =	6,551	sf
PGIS =	2,262	sf

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

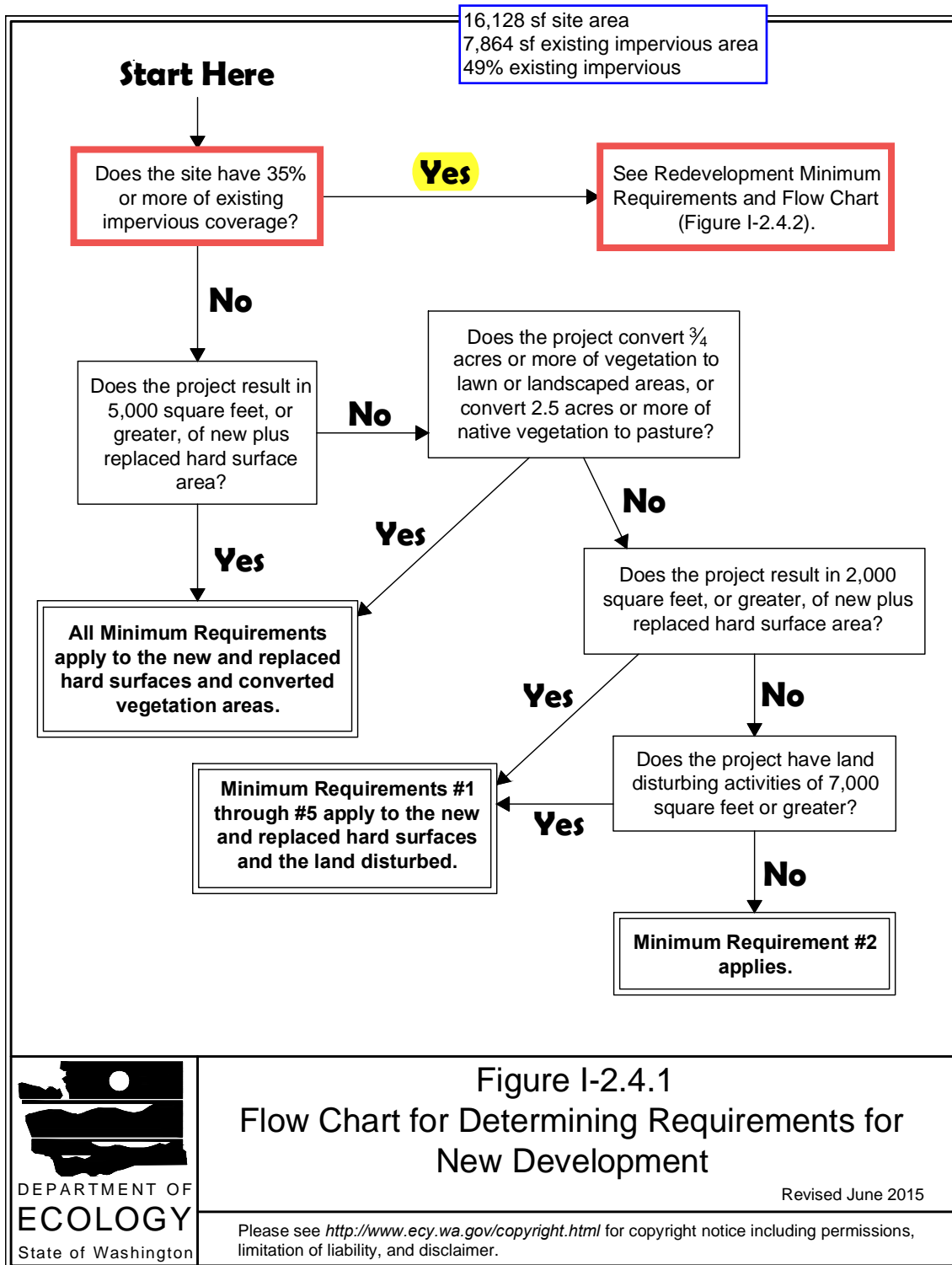


Figure I-2.4.1
Flow Chart for Determining Requirements for New Development

Revised June 2015

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7238 SE 32nd Street
Mercer Island, WA 98040

Figure I-2.4.2 Flow Chart for Determining Requirements for Redevelopment

16,128 sf site area
 (1,314) sf new impervious area
 6,115 sf new + replaced impervious area

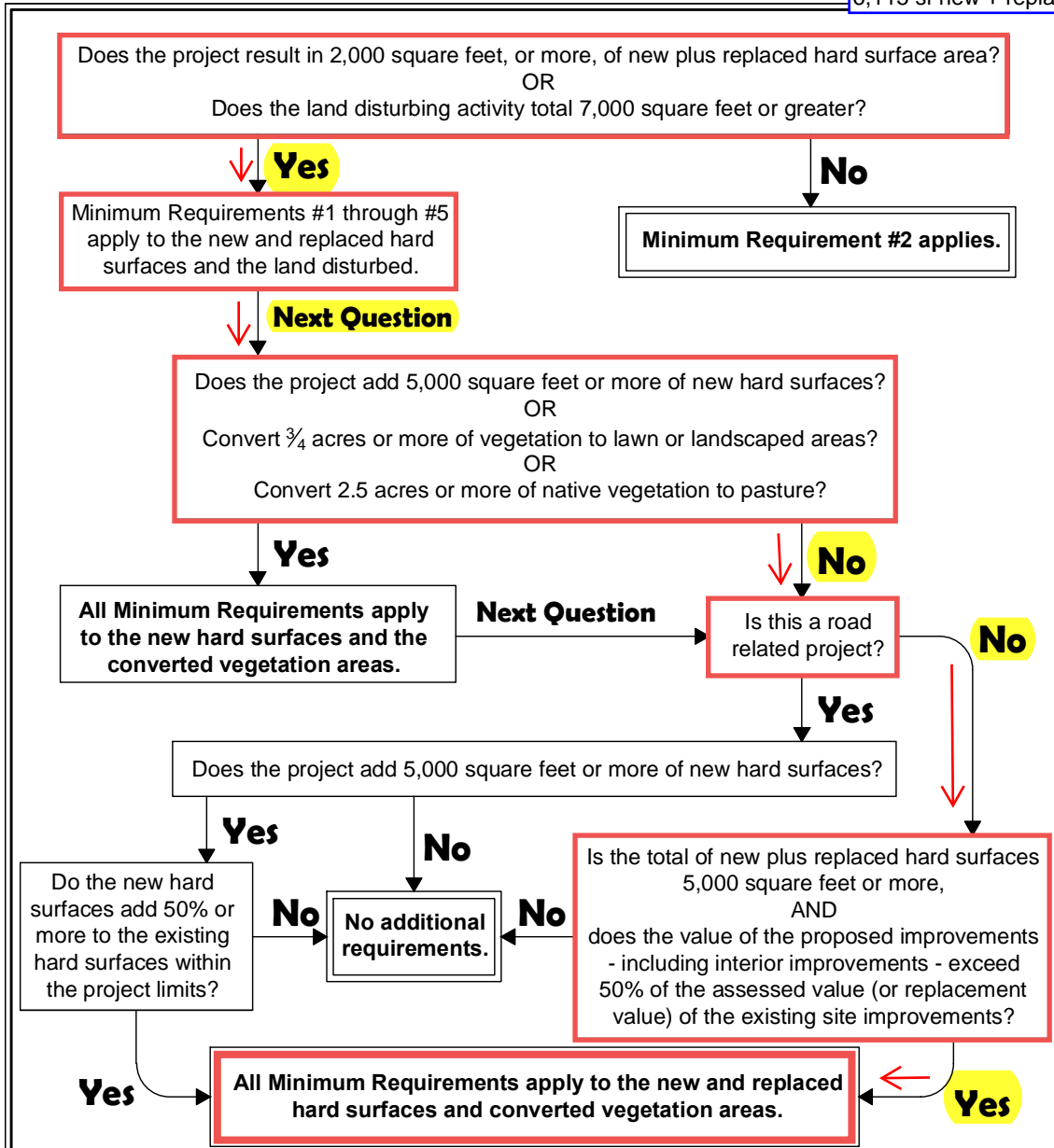


Figure I-2.4.2
 Flow Chart for Determining Requirements for Redevelopment

Revised June 2015

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7238 SE 32nd Street
 Mercer Island, WA 98040

WWHM2012
PROJECT REPORT

north

Miller Residence
7238 SE 32nd Street
Mercer Island, WA 98040

north drywell size
result: minimum 8.7' x 8.7' x 4'-depth

General Model Information

Project Name: 1940 north drywell
Site Name: Miller Residence
Site Address: 7238 SE 32nd Street
City: Mercer Island
Report Date: 9/15/2020
Gage: Seatac
Data Start: 1948/10/01
Data End: 2009/09/30
Timestep: 15 Minute
Precip Scale: 1.000
Version Date: 2019/09/13
Version: 4.2.17

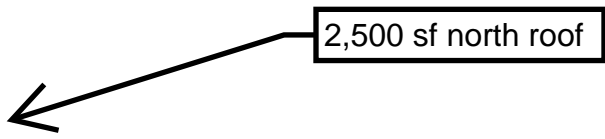
POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	100 Year

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.057
Impervious Total	0.057
Basin Total	0.057



Element Flows To:		
Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	8.67 ft.
Bottom Width:	8.67 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	6
Pour Space of material for first layer:	0.4
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	29
Infiltration safety factor:	0.334
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	8.755
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	8.755
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	4 ft.
Riser Diameter:	10 in.
Element Flows To:	
Outlet 1	Outlet 2

drywell size:
8.7' x 8.7' x 4'-storage

design infiltration rate
= 9.7 in/hr

100% of 100 yr. event
infiltrated

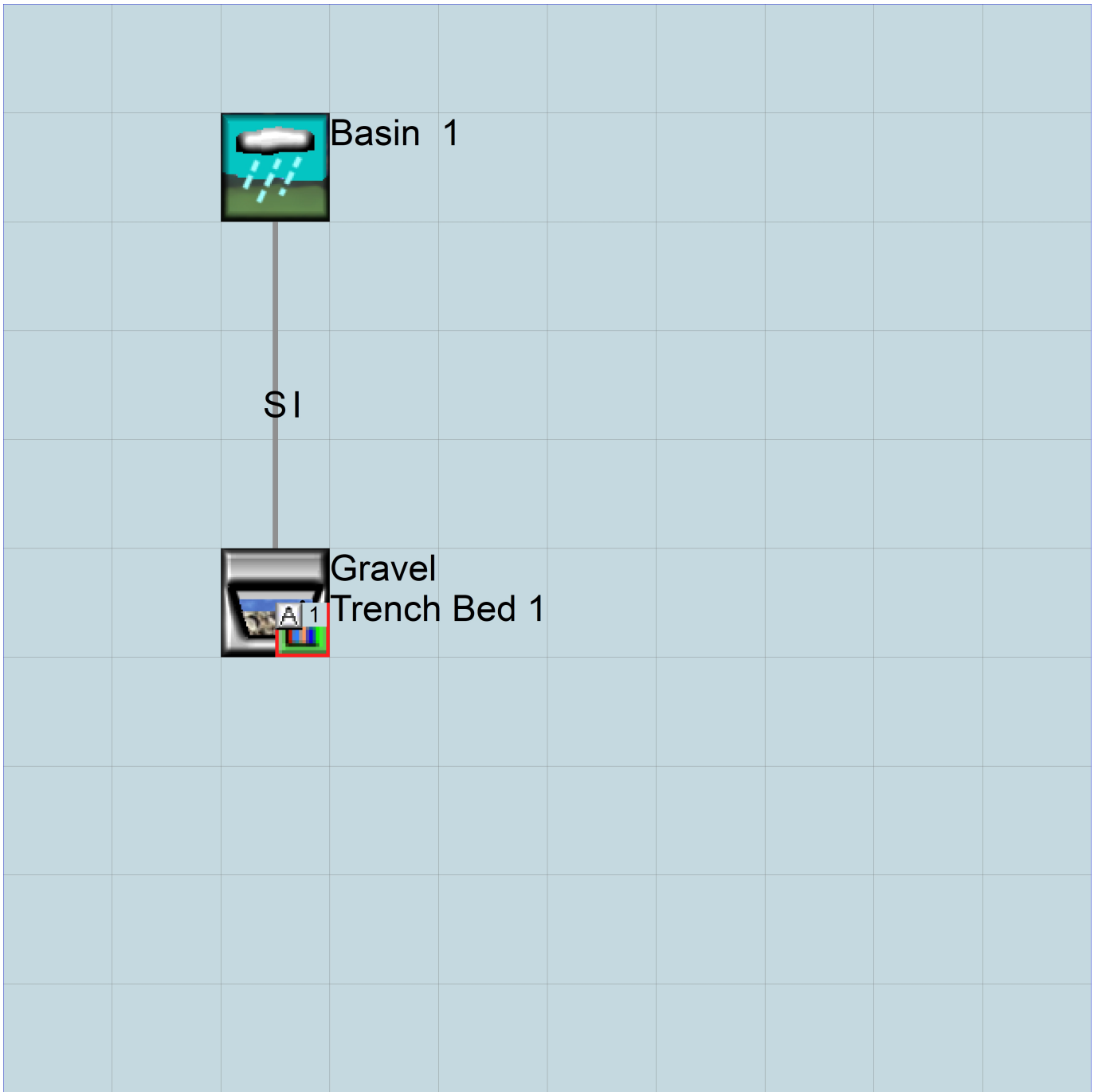
Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.001727	0.000000	0.000	0.000
0.0556	0.001727	0.000038	0.000	0.016
0.1111	0.001727	0.000077	0.000	0.016
0.1667	0.001727	0.000115	0.000	0.016
0.2222	0.001727	0.000154	0.000	0.016
0.2778	0.001727	0.000192	0.000	0.016
0.3333	0.001727	0.000230	0.000	0.016
0.3889	0.001727	0.000269	0.000	0.016
0.4444	0.001727	0.000307	0.000	0.016
0.5000	0.001727	0.000345	0.000	0.016
0.5556	0.001727	0.000384	0.000	0.016
0.6111	0.001727	0.000422	0.000	0.016
0.6667	0.001727	0.000461	0.000	0.016
0.7222	0.001727	0.000499	0.000	0.016
0.7778	0.001727	0.000537	0.000	0.016
0.8333	0.001727	0.000576	0.000	0.016
0.8889	0.001727	0.000614	0.000	0.016
0.9444	0.001727	0.000653	0.000	0.016
1.0000	0.001727	0.000691	0.000	0.016
1.0556	0.001727	0.000729	0.000	0.016
1.1111	0.001727	0.000768	0.000	0.016
1.1667	0.001727	0.000806	0.000	0.016
1.2222	0.001727	0.000844	0.000	0.016

1.2778	0.001727	0.000883	0.000	0.016
1.3333	0.001727	0.000921	0.000	0.016
1.3889	0.001727	0.000960	0.000	0.016
1.4444	0.001727	0.000998	0.000	0.016
1.5000	0.001727	0.001036	0.000	0.016
1.5556	0.001727	0.001075	0.000	0.016
1.6111	0.001727	0.001113	0.000	0.016
1.6667	0.001727	0.001152	0.000	0.016
1.7222	0.001727	0.001190	0.000	0.016
1.7778	0.001727	0.001228	0.000	0.016
1.8333	0.001727	0.001267	0.000	0.016
1.8889	0.001727	0.001305	0.000	0.016
1.9444	0.001727	0.001343	0.000	0.016
2.0000	0.001727	0.001382	0.000	0.016
2.0556	0.001727	0.001420	0.000	0.016
2.1111	0.001727	0.001459	0.000	0.016
2.1667	0.001727	0.001497	0.000	0.016
2.2222	0.001727	0.001535	0.000	0.016
2.2778	0.001727	0.001574	0.000	0.016
2.3333	0.001727	0.001612	0.000	0.016
2.3889	0.001727	0.001651	0.000	0.016
2.4444	0.001727	0.001689	0.000	0.016
2.5000	0.001727	0.001727	0.000	0.016
2.5556	0.001727	0.001766	0.000	0.016
2.6111	0.001727	0.001804	0.000	0.016
2.6667	0.001727	0.001842	0.000	0.016
2.7222	0.001727	0.001881	0.000	0.016
2.7778	0.001727	0.001919	0.000	0.016
2.8333	0.001727	0.001958	0.000	0.016
2.8889	0.001727	0.001996	0.000	0.016
2.9444	0.001727	0.002034	0.000	0.016
3.0000	0.001727	0.002073	0.000	0.016
3.0556	0.001727	0.002111	0.000	0.016
3.1111	0.001727	0.002150	0.000	0.016
3.1667	0.001727	0.002188	0.000	0.016
3.2222	0.001727	0.002226	0.000	0.016
3.2778	0.001727	0.002265	0.000	0.016
3.3333	0.001727	0.002303	0.000	0.016
3.3889	0.001727	0.002342	0.000	0.016
3.4444	0.001727	0.002380	0.000	0.016
3.5000	0.001727	0.002418	0.000	0.016
3.5556	0.001727	0.002457	0.000	0.016
3.6111	0.001727	0.002495	0.000	0.016
3.6667	0.001727	0.002533	0.000	0.016
3.7222	0.001727	0.002572	0.000	0.016
3.7778	0.001727	0.002610	0.000	0.016
3.8333	0.001727	0.002649	0.000	0.016
3.8889	0.001727	0.002687	0.000	0.016
3.9444	0.001727	0.002725	0.000	0.016
4.0000	0.001727	0.002764	0.000	0.016
4.0556	0.001727	0.002802	0.115	0.016
4.1111	0.001727	0.002841	0.323	0.016
4.1667	0.001727	0.002879	0.575	0.016
4.2222	0.001727	0.002917	0.835	0.016
4.2778	0.001727	0.002956	1.067	0.016
4.3333	0.001727	0.002994	1.242	0.016
4.3889	0.001727	0.003032	1.355	0.016
4.4444	0.001727	0.003071	1.458	0.016

4.5000	0.001727	0.003109	1.546	0.016
4.5556	0.001727	0.003148	1.630	0.016
4.6111	0.001727	0.003186	1.709	0.016
4.6667	0.001727	0.003224	1.785	0.016
4.7222	0.001727	0.003263	1.858	0.016
4.7778	0.001727	0.003301	1.929	0.016
4.8333	0.001727	0.003340	1.996	0.016
4.8889	0.001727	0.003378	2.062	0.016
4.9444	0.001727	0.003416	2.125	0.016
5.0000	0.001727	0.003455	2.187	0.016

Mitigated Schematic



WWHM2012
PROJECT REPORT

south

Miller Residence
7238 SE 32nd Street
Mercer Island, WA 98040

south drywell size
result: minimum 11.7' x 11.7' x 4'-depth

General Model Information

Project Name: 1940 south drywell
Site Name: Miller Residence
Site Address: 7238 SE 32nd Street
City: Mercer Island
Report Date: 9/15/2020
Gage: Seatac
Data Start: 1948/10/01
Data End: 2009/09/30
Timestep: 15 Minute
Precip Scale: 1.000
Version Date: 2019/09/13
Version: 4.2.17

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	100 Year

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.103
Impervious Total	0.103
Basin Total	0.103

4,500 sf south roof + driveway



Element Flows To:
Surface Interflow Groundwater
Gravel Trench Bed 1 Gravel Trench Bed 1

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	11.67 ft.	←	drywell size: 11.7' x 11.7' x 4'-storage
Bottom Width:	11.67 ft.		
Trench bottom slope 1:	0 To 1		
Trench Left side slope 0:	0 To 1		
Trench right side slope 2:	0 To 1		
Material thickness of first layer:	6		
Pour Space of material for first layer:	0.4		
Material thickness of second layer:	0		
Pour Space of material for second layer:	0		
Material thickness of third layer:	0		
Pour Space of material for third layer:	0		
Infiltration On			
Infiltration rate:	29	←	design infiltration rate = 9.7 in/hr
Infiltration safety factor:	0.334		
Wetted surface area On			
Total Volume Infiltrated (ac-ft.):	15.974		
Total Volume Through Riser (ac-ft.):	0		
Total Volume Through Facility (ac-ft.):	15.974	←	100% of 100 yr. event infiltrated
Percent Infiltrated:	100		
Total Precip Applied to Facility:	0		
Total Evap From Facility:	0		
Discharge Structure			
Riser Height:	4 ft.		
Riser Diameter:	10 in.		
Element Flows To:			
Outlet 1	Outlet 2		

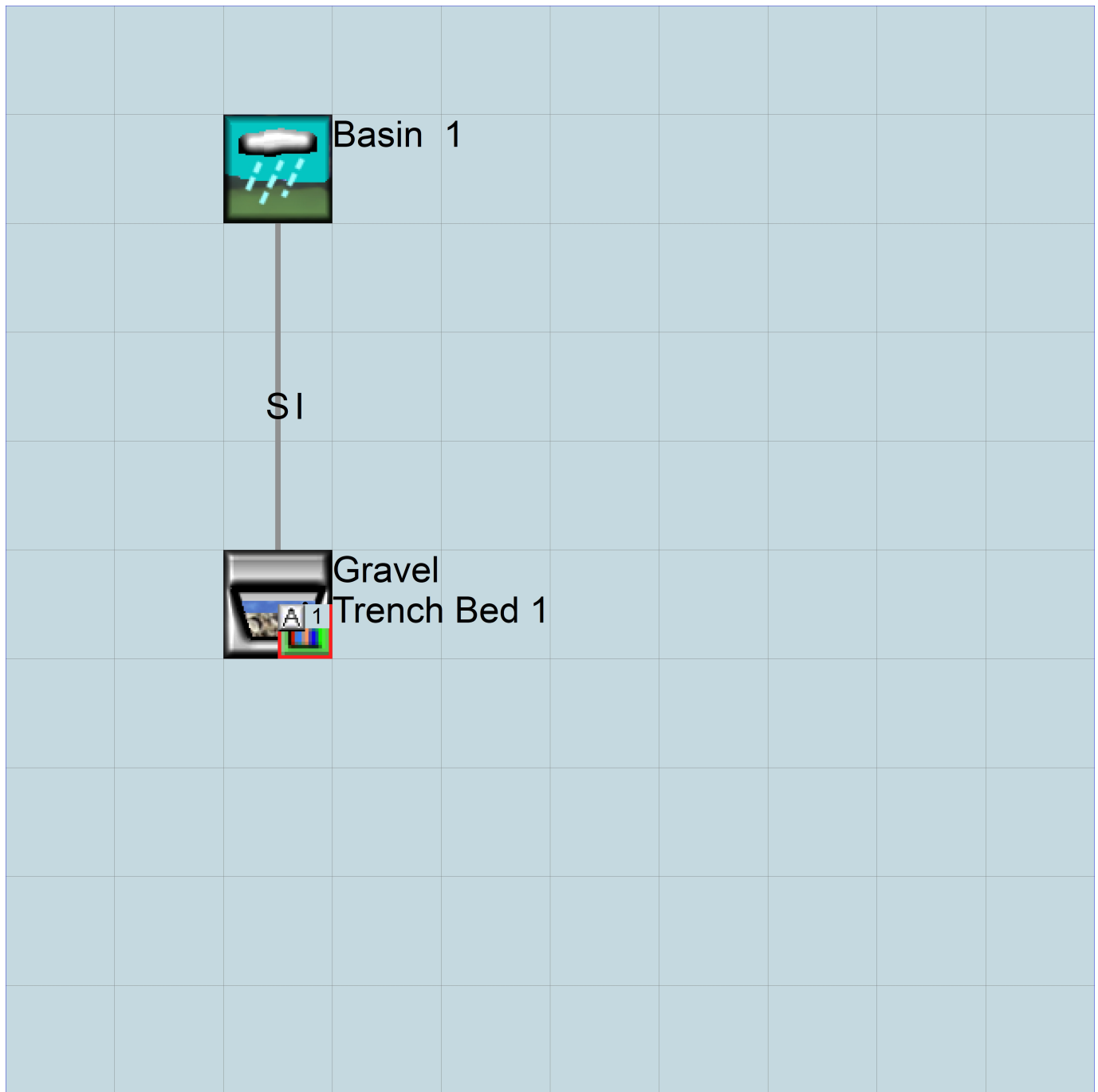
Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.003	0.000	0.000	0.000
0.0556	0.003	0.000	0.000	0.030
0.1111	0.003	0.000	0.000	0.030
0.1667	0.003	0.000	0.000	0.030
0.2222	0.003	0.000	0.000	0.030
0.2778	0.003	0.000	0.000	0.030
0.3333	0.003	0.000	0.000	0.030
0.3889	0.003	0.000	0.000	0.030
0.4444	0.003	0.000	0.000	0.030
0.5000	0.003	0.000	0.000	0.030
0.5556	0.003	0.000	0.000	0.030
0.6111	0.003	0.000	0.000	0.030
0.6667	0.003	0.000	0.000	0.030
0.7222	0.003	0.000	0.000	0.030
0.7778	0.003	0.001	0.000	0.030
0.8333	0.003	0.001	0.000	0.030
0.8889	0.003	0.001	0.000	0.030
0.9444	0.003	0.001	0.000	0.030
1.0000	0.003	0.001	0.000	0.030
1.0556	0.003	0.001	0.000	0.030
1.1111	0.003	0.001	0.000	0.030
1.1667	0.003	0.001	0.000	0.030
1.2222	0.003	0.001	0.000	0.030

1.2778	0.003	0.001	0.000	0.030
1.3333	0.003	0.001	0.000	0.030
1.3889	0.003	0.001	0.000	0.030
1.4444	0.003	0.001	0.000	0.030
1.5000	0.003	0.001	0.000	0.030
1.5556	0.003	0.001	0.000	0.030
1.6111	0.003	0.002	0.000	0.030
1.6667	0.003	0.002	0.000	0.030
1.7222	0.003	0.002	0.000	0.030
1.7778	0.003	0.002	0.000	0.030
1.8333	0.003	0.002	0.000	0.030
1.8889	0.003	0.002	0.000	0.030
1.9444	0.003	0.002	0.000	0.030
2.0000	0.003	0.002	0.000	0.030
2.0556	0.003	0.002	0.000	0.030
2.1111	0.003	0.002	0.000	0.030
2.1667	0.003	0.002	0.000	0.030
2.2222	0.003	0.002	0.000	0.030
2.2778	0.003	0.002	0.000	0.030
2.3333	0.003	0.002	0.000	0.030
2.3889	0.003	0.003	0.000	0.030
2.4444	0.003	0.003	0.000	0.030
2.5000	0.003	0.003	0.000	0.030
2.5556	0.003	0.003	0.000	0.030
2.6111	0.003	0.003	0.000	0.030
2.6667	0.003	0.003	0.000	0.030
2.7222	0.003	0.003	0.000	0.030
2.7778	0.003	0.003	0.000	0.030
2.8333	0.003	0.003	0.000	0.030
2.8889	0.003	0.003	0.000	0.030
2.9444	0.003	0.003	0.000	0.030
3.0000	0.003	0.003	0.000	0.030
3.0556	0.003	0.003	0.000	0.030
3.1111	0.003	0.003	0.000	0.030
3.1667	0.003	0.004	0.000	0.030
3.2222	0.003	0.004	0.000	0.030
3.2778	0.003	0.004	0.000	0.030
3.3333	0.003	0.004	0.000	0.030
3.3889	0.003	0.004	0.000	0.030
3.4444	0.003	0.004	0.000	0.030
3.5000	0.003	0.004	0.000	0.030
3.5556	0.003	0.004	0.000	0.030
3.6111	0.003	0.004	0.000	0.030
3.6667	0.003	0.004	0.000	0.030
3.7222	0.003	0.004	0.000	0.030
3.7778	0.003	0.004	0.000	0.030
3.8333	0.003	0.004	0.000	0.030
3.8889	0.003	0.004	0.000	0.030
3.9444	0.003	0.004	0.000	0.030
4.0000	0.003	0.005	0.000	0.030
4.0556	0.003	0.005	0.115	0.030
4.1111	0.003	0.005	0.323	0.030
4.1667	0.003	0.005	0.575	0.030
4.2222	0.003	0.005	0.835	0.030
4.2778	0.003	0.005	1.067	0.030
4.3333	0.003	0.005	1.242	0.030
4.3889	0.003	0.005	1.355	0.030
4.4444	0.003	0.005	1.458	0.030

4.5000	0.003	0.005	1.546	0.030
4.5556	0.003	0.005	1.630	0.030
4.6111	0.003	0.005	1.709	0.030
4.6667	0.003	0.005	1.785	0.030
4.7222	0.003	0.005	1.858	0.030
4.7778	0.003	0.006	1.929	0.030
4.8333	0.003	0.006	1.996	0.030
4.8889	0.003	0.006	2.062	0.030
4.9444	0.003	0.006	2.125	0.030
5.0000	0.003	0.006	2.187	0.030

Mitigated Schematic





August 11, 2020
ES-7397

Earth Solutions NW LLC

Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

RKK Construction, Inc.
3056 – 70th Avenue Southeast
Mercer Island, Washington 98040

Attention: Mr. Jason Koehler

**Subject: Infiltration Evaluation
Proposed Single-Family Residence Reconstruction
7238 Southeast 32nd Street
Mercer Island, Washington**

Reference: Terrane, Inc.
Topographic & Boundary Survey, dated January 2020

Rick Jones & Associates, Inc.
Preliminary Architectural Plans, dated June 16, 2020

Washington State Department of Ecology
2014 Stormwater Management Manual for Western Washington (2014 Manual)

Kathy G. Troost and Aaron P. Wisher
Geologic Map of Mercer Island, Washington, October 2006

United States Department of Agriculture (USDA)
Natural Resources Conservation Service (NRCS)
Online Web Soil Survey (WSS) resource

Dear Mr. Koehler:

As requested, Earth Solutions NW, LLC (ESNW), has prepared this letter for the subject project. This letter was prepared in general accordance with the scope of services outline in our proposal dated June 24, 2020 and authorized by you on June 25, 2020. A summary of the subsurface exploration and an infiltration evaluation in general accordance with the 2014 Manual are provided in this letter.

Project Description

The subject site is located north of the intersection between Southeast 32nd Street and 73rd Avenue Southeast, in Mercer Island, Washington. The approximate project area location is illustrated on Plate 1 (Vicinity Map). The property is comprised of one tax parcel (King County Parcel No. 531510-0775), totaling roughly 0.37 acres. Per the referenced survey, the existing topography is relatively level, with less than three feet of elevation change across the site.

We understand existing single-family improvements will be removed, and a new single-family residence and related improvements will be constructed. Stormwater will be managed using infiltration BMPs where feasible.

Subsurface Conditions

An ESNW representative observed, logged, and sampled two test pits and one shallow boring (using hand tools) on July 13, 2020. The test pits were advanced within the probable infiltration areas using a trackhoe and operator provided by the client. The field exploration was completed to evaluate soil conditions, classify site soils, and characterize the presence of groundwater or soil mottling. The approximate test locations are depicted on Plate 2 (Subsurface Exploration Plan). The information provided in this section is intended as a general overview of soil and groundwater conditions; please refer to the attached exploration logs for more detailed descriptions of conditions encountered at each test location.

Underlying about six inches of topsoil and roughly three to four feet of silty sand (USCS: SM) overburden, the native soil was comprised largely of free-draining gravel (USCS: GW or GP) to the maximum exploration depth of approximately eight feet below the existing ground surface (bgs). The in-situ density of the native soil was characterized mainly as medium dense, and caving was not observed at the test locations.

The referenced geologic map resource identifies glacial till (Qvt) as the primary geologic unit underlying the site. Based on our field observations, the native soil encountered at depth at the test locations is consistent with advance outwash (Qva), which is mapped nearby and east of the site. It is possible that the glacial till "cap" is relatively thin across the site and is represented by the silty sand overburden encountered at the test locations.

Groundwater seepage was not observed during the July 2020 subsurface exploration. It should be noted that seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the winter, spring, and early summer months.

Infiltration Evaluation

In-situ testing was completed in accordance with the small-scale Pilot Infiltration Test (PIT) procedure, as outlined in Chapter 3 of Volume III of the referenced 2014 Manual. The testing was completed at TP-2 at a depth of approximately four feet bgs, and at the conclusion of testing, the measured rate was 29.0 inches per hour (in/hr).

Because the infiltration rate obtained from in-situ testing is a short-term rate, correction factors must be applied to determine a long-term design rate. The correction factors outlined below were determined in accordance with Table III-3.3.1 of the 2014 Manual. The correction factors, along with the measured infiltration rate, were incorporated into the following equation:

$$K_{sat\ design} = K_{sat\ initial} \times CF_v \times CF_t \times CF_m$$

- Short-term infiltration rate ($K_{sat\ initial}$) 29.0 in/hr
- Site variability $CF_v = 0.75$
- Test method $CF_t = 0.5$
- Degree of influent control $CF_m = 0.9$
- Long-term infiltration rate ($K_{sat\ design}$) 9.7 in/hr

The long-term infiltration rate is applicable to facilities located in proximity to the infiltration test location (such as the footing drain drywell), as verified by ESNW during plan review. Should a revised location be pursued, ESNW should be contacted to perform additional in-situ testing.

ESNW should be retained to observe the construction of infiltration facilities on the subject site to confirm soil conditions are as anticipated and perform confirmation infiltration testing at the infiltration design depth and location, if required. Supplementary geotechnical recommendations may be provided at the time of construction, where necessary.

Limitations

This letter has been prepared for the exclusive use of RKK Construction, Inc., and its representatives. No warranty, express or implied, is made. This letter was prepared in a manner consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area.

If the assumptions outlined in this letter either change or are incorrect, ESNW must be contacted to review the recommendations and conclusions provided herein. Variations in the soil and groundwater conditions observed at the test sites may exist and may not become evident until construction. ESNW should reevaluate the conclusions in this letter if variations are encountered.

Additional Services

ESNW should have an opportunity to review final designs with respect to the geotechnical recommendations provided in this letter. ESNW should also be retained to provide testing and consultation services during the earthwork phase of construction.

We trust this letter meets your current needs. Please call if you have any questions about this letter or if we can be of further assistance.

Sincerely,

EARTH SOLUTIONS NW, LLC



Adam Z. Shier, L.G.
Project Geologist



Keven D. Hoffmann, P.E.
Senior Project Manager

Attachments: Plate 1 – Vicinity Map
Plate 2 – Subsurface Exploration Plan
Hand Auger Boring and Test Pit Logs
Grain Size Distribution



Lake Washington



Earth Solutions NW LLC
 Geotechnical Engineering, Construction
 Observation/Testing and Environmental Services

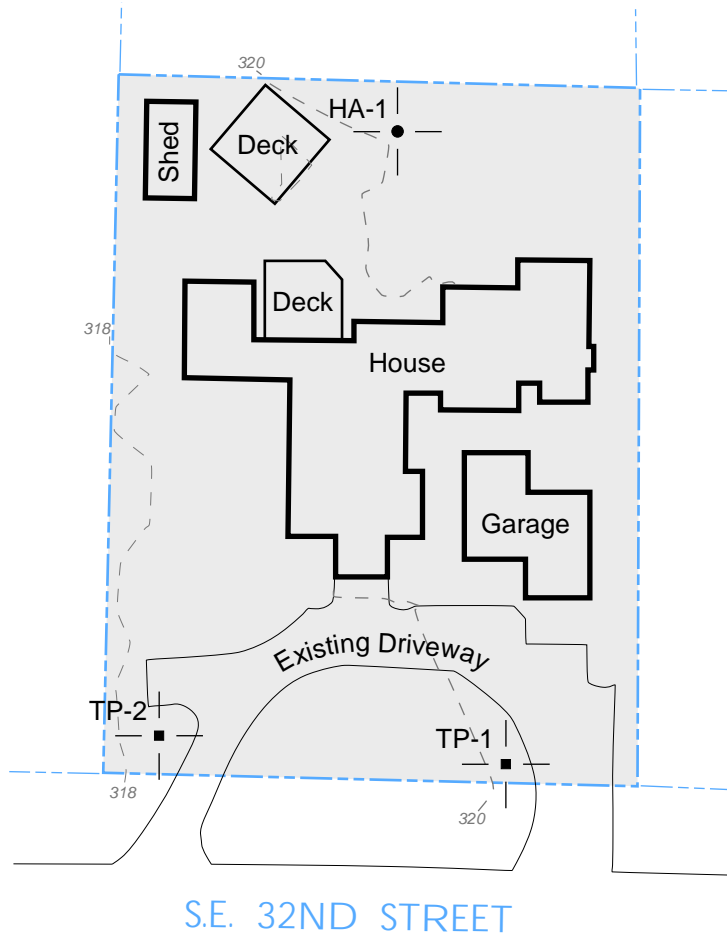


Reference:
 King County, Washington
 OpenStreetMap.org

Vicinity Map
 Miller Residence
 Mercer Island, Washington

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Drwn. CAM	Date 08/11/2020	Proj. No. 7397
Checked KDH	Date Aug. 2020	Plate 1



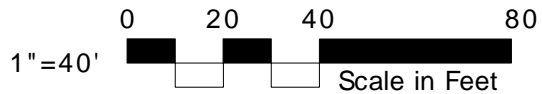
LEGEND

HA-1 | — ● — | Approximate Location of ESNW Hand Auger Boring, Proj. No. ES-7397, July 2020

TP-1 | — ■ — | Approximate Location of ESNW Test Pit, Proj. No. ES-7397, July 2020

 Subject Site

 Existing Building



NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.



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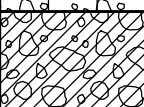
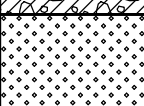
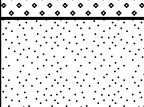
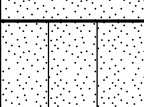
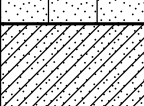
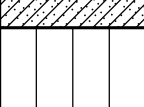
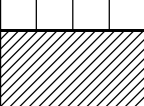
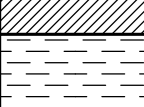
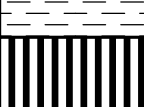

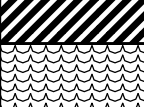
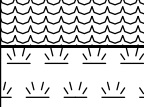
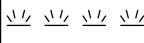
Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

**Subsurface Exploration Plan
Miller Residence
Mercer Island, Washington**

Drwn. CAM	Date 08/11/2020	Proj. No. 7397
Checked KDH	Date Aug. 2020	Plate 2

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SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS (LITTLE OR NO FINES)	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE (APPRECIABLE AMOUNT OF FINES)	GRAVELS WITH FINES		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		CLEAN SANDS		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	SAND AND SANDY SOILS (LITTLE OR NO FINES)	CLEAN SANDS		SM	SILTY SANDS, SAND - SILT MIXTURES
		(LITTLE OR NO FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
		SANDS WITH FINES		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	(LITTLE OR NO FINES)		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		(APPRECIABLE AMOUNT OF FINES)		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
		SANDS WITH FINES		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50	(LITTLE OR NO FINES)		CH	INORGANIC CLAYS OF HIGH PLASTICITY
		(APPRECIABLE AMOUNT OF FINES)		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
		SANDS WITH FINES		PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.



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 15365 N.E. 90th Street, Suite 100
 Redmond, Washington 98052
 Telephone: 425-449-4704
 Fax: 425-449-4711

PROJECT NUMBER ES-7397 PROJECT NAME Miller Residence
 DATE STARTED 7/13/20 COMPLETED 7/13/20 GROUND ELEVATION 320 ft HOLE SIZE _____
 DRILLING CONTRACTOR ESNW Rep GROUND WATER LEVELS:
 DRILLING METHOD _____ AT TIME OF DRILLING ---
 LOGGED BY AZS CHECKED BY KDH AT END OF DRILLING ---
 NOTES Surface Conditions: exposed soil AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						
		MC = 9.90%	SM		Tan silty SAND, medium dense, moist -roots	
		MC = 8.30%				317.0
		MC = 5.80%	SP-SM		Brown poorly graded SAND with silt, medium dense, moist	316.0

Hand auger boring terminated at 4.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.



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TEST PIT NUMBER TP-1
 PAGE 1 OF 1

PROJECT NUMBER ES-7397 PROJECT NAME Miller Residence
 DATE STARTED 7/13/20 COMPLETED 7/13/20 GROUND ELEVATION 320.5 ft TEST PIT SIZE _____
 EXCAVATION CONTRACTOR Client Provided GROUND WATER LEVELS:
 EXCAVATION METHOD _____ AT TIME OF EXCAVATION ---
 LOGGED BY AZS CHECKED BY KDH AT END OF EXCAVATION ---
 NOTES Depth of Topsoil & Sod 6": grass AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						
		MC = 12.30%	TPSL		Dark brown TOPSOIL	320.0
			SM		Tan silty SAND, medium dense, moist	
		MC = 2.60% Fines = 1.10%				317.0
5			GW		Gray well-graded GRAVEL with sand, medium dense, moist [USDA Classification: extremely gravelly coarse SAND]	
		MC = 5.50%				313.5

Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.







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TEST PIT NUMBER TP-2

PAGE 1 OF 1

PROJECT NUMBER ES-7397 PROJECT NAME Miller Residence
 DATE STARTED 7/13/20 COMPLETED 7/13/20 GROUND ELEVATION 319 ft TEST PIT SIZE _____
 EXCAVATION CONTRACTOR Client Provided GROUND WATER LEVELS:
 EXCAVATION METHOD _____ AT TIME OF EXCAVATION ---
 LOGGED BY AZS CHECKED BY KDH AT END OF EXCAVATION ---
 NOTES Surface Conditions: exposed soil AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						
		MC = 9.00%	SM		Brown silty SAND, loose to medium dense, moist (Fill) -brick, roots	318.0
			SM		Tan silty SAND, medium dense, moist -roots	315.0
5		MC = 2.30% Fines = 1.90%	GW		Gray well-graded GRAVEL with sand, medium dense, moist -infiltration test at 4.5' [USDA Classification: extremely gravelly coarse SAND]	312.0
		MC = 3.00% Fines = 0.60%	GP		Gray poorly graded GRAVEL with sand, medium dense, moist [USDA Classification: extremely gravelly coarse SAND]	311.0

Test pit terminated at 8.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

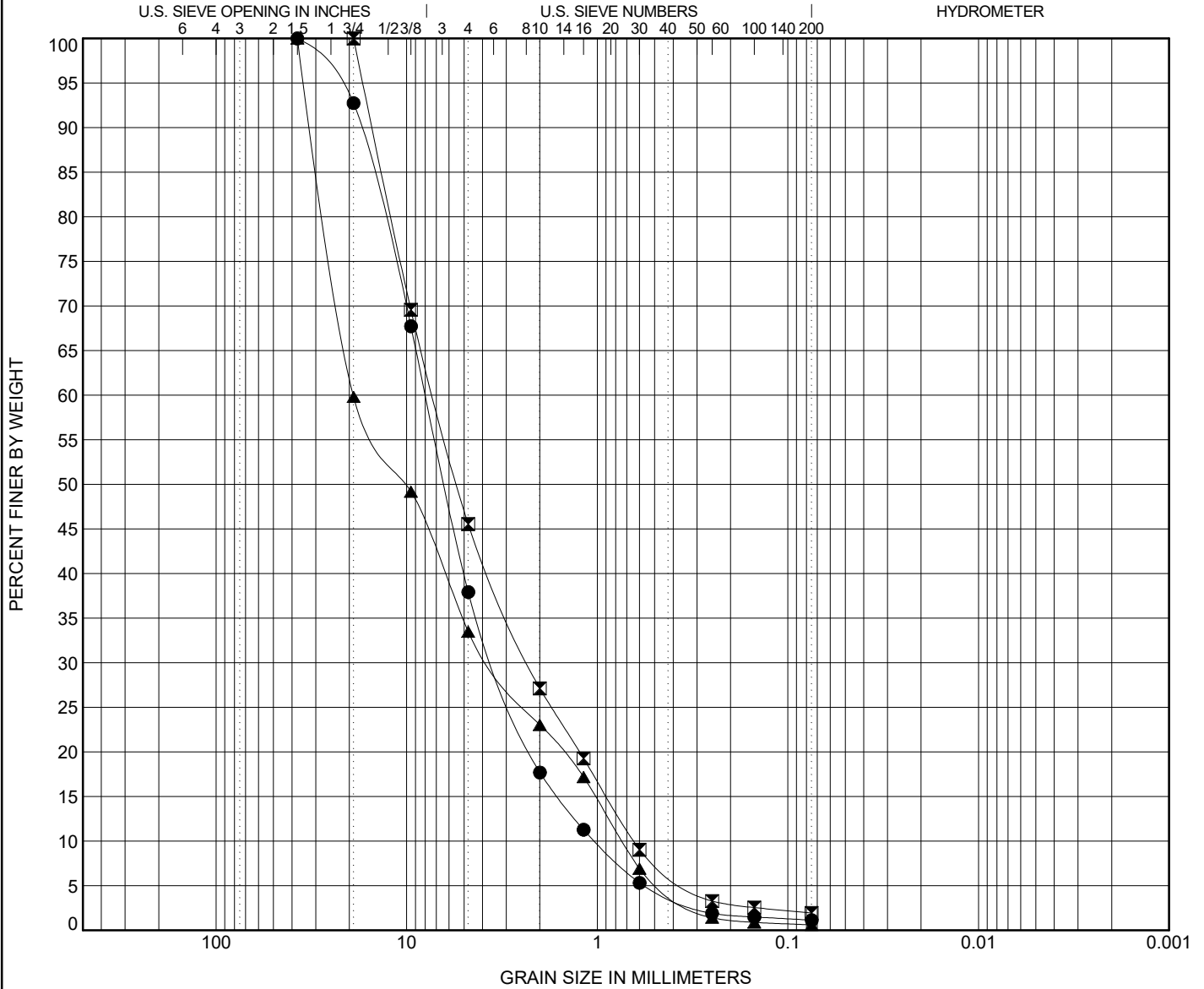


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GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-7397

PROJECT NAME Miller Residence



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification				Cc	Cu
● TP-01 4.00ft.	USDA: Gray Extremely Gravelly Coarse Sand. USCS: GW with Sand.				1.41	7.77
⊠ TP-02 4.50ft.	USDA: Gray Extremely Gravelly Coarse Sand. USCS: GW with Sand.				1.14	11.28
▲ TP-02 8.00ft.	USDA: Gray Extremely Gravelly Coarse Sand. USCS: GP with Sand.				0.90	25.93

Specimen Identification	D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
● TP-01 4.0ft.	37.5	7.937	3.385	1.021				1.1	
⊠ TP-02 4.5ft.	19	7.209	2.291	0.639				1.9	
▲ TP-02 8.0ft.	37.5	19.063	3.561	0.735				0.6	

GRAIN SIZE USDA ES-7397 MILLER RESIDENCE.GPJ GINT US LAB.GDT 8/6/20