

Targeted Drainage Report

Harbour Pointe Townhomes

City of Mukilteo, Washington

Tax Parcel: 28042100103200

Group Four Job No. 18-4523



May 31, 2019

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Section I

Project Overview and Executive Summary

Name: Harbour Point Townhomes

PFN: Pending

Tax Parcel: 28042100103200

Owner/Applicant:

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This targeted drainage report was prepared as part of a preliminary drainage review for the City of Mukilteo per the Stormwater Management Manual for Western Washington, 2014 (SWMMWW 2014) and the City of Mukilteo Development Standards 2017.

The applicant proposes to build 31 residential townhomes on a 3.26 ac parcel zoned PCB-S on Harbour Pl in Mukilteo, WA. The project will disturb approximately 1.78 ac and proposes approximately 23,000 sf of new roofs, 12,700 sf of new road, and 8,500 sf of driveways, 3,400 sf of sidewalk and 2,500 sf of parking area.

Proposed impervious surface will be mitigated by an underground detention vault that is 80 ft long x 30 ft wide and 15 ft deep. Water quality will be provided by a combination wetpool below the dead storage.

Existing Conditions Summary

The existing site is 3.26 acres in an area zoned Planned Community Business-South (PCB-S). Approximately 50% of the area is cleared and the remainder is forested. An existing asphalt road runs along the northeast property boundary. The project site is confined to the north and east of the property due to steep slopes and wetlands in the south and west. The project site moderately slopes to the south and west with an average approximate slope in the project area is between 3% and 10%. See Figure 1 for the Vicinity Map and Figure 2 for the Existing Conditions site plan.

A geotechnical assessment was prepared for the site by Associated Earth Sciences dated February 8th, 2019. This assessment found the soils on site to be Vashon Lodgement Till which is not suitable for infiltration. The geotechnical assessment report is in Appendix A.

Mitigation Summary

Presented below is a summary of proposed impervious areas treated solely by on-site storm water management. See Figure 3 for Proposed Site Plan.

TDA	Area, SF	BMP	Note
Proposed Roofs	23,000	Detention Vault	
Proposed Road	12,700	Detention Vault	
Proposed Driveways	8,500	Detention Vault	
Proposed Sidewalk	3,400	Detention Vault	
Proposed Parking	2,500	Detention Vault	
Total	50,100		

Upstream Analysis

There are no areas upstream that are tributary to the project site. Runoff from the uphill Harbour Place is collected in an existing storm system. There is not visual evidence of surface runoff flowing onto project site. See photos below

Downstream Analysis

The downstream was walked by Curt Iffrig on 5/23/2019. The entire site is one drainage basin that is tributary to the big gulch creek. Runoff from the site sheet flows overland to the southwest, down steep slopes and into the big gulch creek. From the site, the big gulch creek flows approximately 1.5 miles to the Puget Sound. During the site visit the weather was 70 degrees F and sunny. No problems were observed during the site visit. Erosion over the steep slopes is a potential problem which will be answered in the SWPPP plan and narrative. See photos below.



Top Left: The site frontage on Harbour Place. **Top Right:** Cleared area on site, approximate building location. **Bottom:** Looking down into gulch approximately ¼ mile downstream.

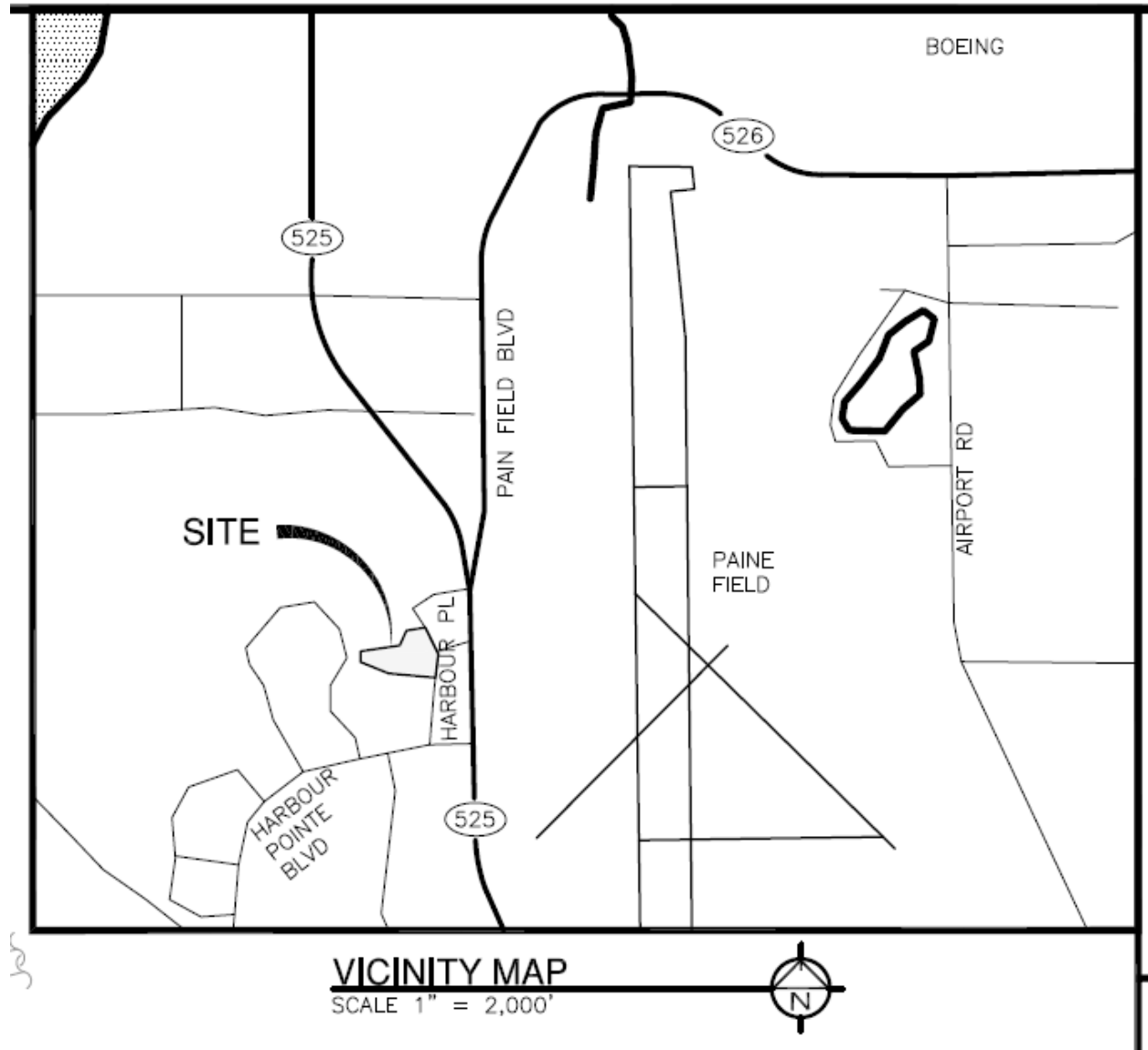


Figure 1: Vicinity Map

Section II: Minimum Requirements

Per the SWMMWW 2014, this project must comply with Minimum Requirements 1 through 9.

MR-1 Targeted Stormwater Site Plan

A Preliminary Targeted Drainage Plan has been prepared per the SWMMWW 2014 and the City of Mukilteo Development Standards. A full set of civil plans will be submitted for final design review

MR 2-SWPPP Narrative

A SWPP plan and narrative will be prepared for final design review.

MR 3-Water Pollution Source Control for New Development

Pollution source control is not required for this residential site.

MR 4-Preservation of Natural Drainage Systems and Outfalls

The detention vault will discharge to the west at the toe of the steep slope. This will maintain the site's natural discharge location. Off-site mitigation is not required for this project.

MR 5-On-site Stormwater Management

On-site stormwater water management will be accomplished by providing on-site stormwater BMP's from List #2 where feasible. A compost-amended soil management plan has been developed utilizing BMP T5.13. The compost amended soil management plan will apply to all landscape surfaces with an area of approximately 26,900 SF (0.62 Ac). The Snohomish County Soil Management Plan will be completed for final design and included in Appendix B.

Infiltration is not feasible for this site because a geotechnical study found fine soils unsuitable for infiltration. Full dispersion is not feasible because of the steep slopes downstream of the site. Bioretention is not feasible due to the space available and the fine soils.

MR 6-Runoff Treatment

The proposed PGIS is will be treated with the combination wetpool/detention method where a wetpool constructed below the live storage in the vault. The depth and capacity of this wetpool will be determined prior to final design. Per the 2014 SWMMWW, "*Combined detention and water quality facilities are very efficient for sites that also have detention requirements.*"

MR 7- Flow Control

The flow control requirement per the SWMMWW 2014 is described below;

“Stormwater discharges shall match developed discharge durations to predeveloped durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow”

Flow control will be provided by an underground detention vault. WWHM 2012 was used to model the drainage basin and size detention vault to meet the flow control requirement.

Detention Vault

A detention vault will be used to provide flow control for runoff from proposed impervious and proposed new pervious areas. The vault will be 80 ft long, 30 ft wide and 15 ft deep. The proposed vault is sized to meet the flow control standard per the Stormwater Management Manual for Western Washington, 2014. (SWMMWW, 2014) The vault will discharge into the big gulch creek below.

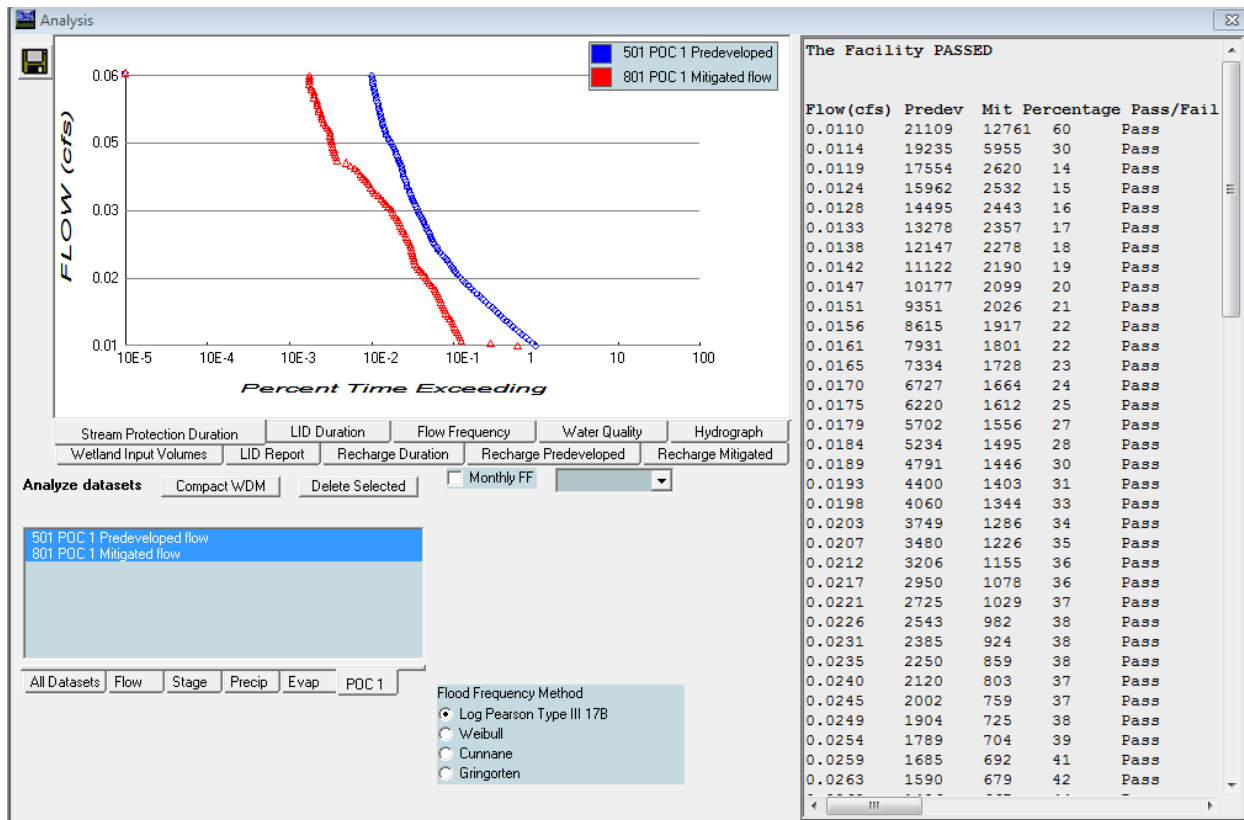
WWHM 2012 was used to model the predeveloped and developed condition, size the detention vault and demonstrate compliance with the flow control standard. The predeveloped and developed condition from that report are shown in the table below.

SURFACE	SLOPE	COVER	AREA (ac)
PRE-DEVELOPED			
Existing Forest	3-10%	Forest	1.78
DEVELOPED			
Proposed Roof	0%	Roof	0.53
Proposed Road and Frontage	3-10%	Road	0.29
Proposed Driveways and Walkways	3-10%	Driveways	0.33
Lawn and Landscape	3-10%	Lawn	0.63

The vault parameters for WWHM 2012 are shown in the table below. Due to space requirements the vault proposed is 80 ft long, 30 ft wide and 15 ft deep. The orifice size modeled below is smaller than the 0.5 in diameter required so a 0.5 in diameter orifice will be constructed. Final orifice calculations will be produced as the project approaches final design.

Model Input	Value	Note
Vault Type	Underground	
Width	30 ft	Design Width
Depth	15 ft	Design Depth
Length	80 ft	Design Length
Volume	36,281 cf	Live Storage Volume
Infiltration Rate	0	No Infiltration
Riser Height	14 ft	
Riser Diameter	18 in	Design Diameter
Notch Width	0.011 ft	Rectangular Notch
Notch Height	1.019 ft	
Orifice 1 Diameter	0.347 in	Design Diameter
Orifice 1 Elev.	0	From bottom of live storage

The probability exceedance curve below shows that the vault as designed is in compliance with the SWMMWW, 2014 flow control standard. See the full WWHM output in Appendix C.



MR 8- Wetland Protection

Runoff being discharged into downstream wetlands will be controlled by the detention vault. Uncontrolled flows will not be discharged into wetlands. The stream area receiving the controlled runoff is not a depressional wetland so no additional calculations are required.

MR 9- Operation and Maintenance

SCC 30.63A.575 through SCC 30.63A.605

The detention vault and stormwater system are to be owned, operated and maintained by the homeowner’s association according to the standards contained in the SWMMWW, 2014.

Appendices

A - Geotechnical Report

B - Post Construction Amended Soils (To be included for final design)

C - WWHM2012 Output

**WWHM2012
PROJECT REPORT**

Project Name: Harbor Point Prelim Revised
Site Name:
Site Address:
City :
Report Date: 4/2/2020
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 0.80
Version Date: 2017/04/14
Version : 4.2.13

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Forest, Mod	1.78

Pervious Total	1.78
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<u>Impervious Land Use</u>	<u>acre</u>
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Impervious Total	0
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Basin Total	1.78
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Element Flows To:		
Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Lawn, Mod	.63
Pervious Total	0.63
<u>Impervious Land Use</u>	<u>acre</u>
ROADS MOD	0.29
ROOF TOPS FLAT	0.53
DRIVEWAYS MOD	0.33
Impervious Total	1.15
Basin Total	1.78

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Name : Vault 1
Width : 30 ft.
Length : 80 ft.
Depth: 15 ft.
Discharge Structure
Riser Height: 14 ft.
Riser Diameter: 18 in.
Notch Type: Rectangular
Notch Width: 0.011 ft.
Notch Height: 1.019 ft.
Orifice 1 Diameter: 0.347 in. Elevation: 0 ft.

Element Flows To:

Outlet 1	Outlet 2
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Vault Hydraulic Table

<u>Stage(feet)</u>	<u>Area(ac.)</u>	<u>Volume(ac-ft.)</u>	<u>Discharge(cfs)</u>	<u>Infilt(cfs)</u>
0.0000	0.055	0.000	0.000	0.000
0.1667	0.055	0.009	0.001	0.000
0.3333	0.055	0.018	0.001	0.000
0.5000	0.055	0.027	0.002	0.000
0.6667	0.055	0.036	0.002	0.000
0.8333	0.055	0.045	0.003	0.000
1.0000	0.055	0.055	0.003	0.000
1.1667	0.055	0.064	0.003	0.000
1.3333	0.055	0.073	0.003	0.000
1.5000	0.055	0.082	0.004	0.000
1.6667	0.055	0.091	0.004	0.000
1.8333	0.055	0.101	0.004	0.000
2.0000	0.055	0.110	0.004	0.000

2.1667	0.055	0.119	0.004	0.000
2.3333	0.055	0.128	0.005	0.000
2.5000	0.055	0.137	0.005	0.000
2.6667	0.055	0.146	0.005	0.000
2.8333	0.055	0.156	0.005	0.000
3.0000	0.055	0.165	0.005	0.000
3.1667	0.055	0.174	0.005	0.000
3.3333	0.055	0.183	0.006	0.000
3.5000	0.055	0.192	0.006	0.000
3.6667	0.055	0.202	0.006	0.000
3.8333	0.055	0.211	0.006	0.000
4.0000	0.055	0.220	0.006	0.000
4.1667	0.055	0.229	0.006	0.000
4.3333	0.055	0.238	0.006	0.000
4.5000	0.055	0.247	0.006	0.000
4.6667	0.055	0.257	0.007	0.000
4.8333	0.055	0.266	0.007	0.000
5.0000	0.055	0.275	0.007	0.000
5.1667	0.055	0.284	0.007	0.000
5.3333	0.055	0.293	0.007	0.000
5.5000	0.055	0.303	0.007	0.000
5.6667	0.055	0.312	0.007	0.000
5.8333	0.055	0.321	0.007	0.000
6.0000	0.055	0.330	0.008	0.000
6.1667	0.055	0.339	0.008	0.000
6.3333	0.055	0.348	0.008	0.000
6.5000	0.055	0.358	0.008	0.000
6.6667	0.055	0.367	0.008	0.000
6.8333	0.055	0.376	0.008	0.000
7.0000	0.055	0.385	0.008	0.000
7.1667	0.055	0.394	0.008	0.000
7.3333	0.055	0.404	0.008	0.000
7.5000	0.055	0.413	0.008	0.000
7.6667	0.055	0.422	0.009	0.000
7.8333	0.055	0.431	0.009	0.000
8.0000	0.055	0.440	0.009	0.000
8.1667	0.055	0.450	0.009	0.000
8.3333	0.055	0.459	0.009	0.000
8.5000	0.055	0.468	0.009	0.000
8.6667	0.055	0.477	0.009	0.000
8.8333	0.055	0.486	0.009	0.000
9.0000	0.055	0.495	0.009	0.000
9.1667	0.055	0.505	0.009	0.000
9.3333	0.055	0.514	0.010	0.000
9.5000	0.055	0.523	0.010	0.000
9.6667	0.055	0.532	0.010	0.000
9.8333	0.055	0.541	0.010	0.000
10.000	0.055	0.551	0.010	0.000
10.167	0.055	0.560	0.010	0.000
10.333	0.055	0.569	0.010	0.000
10.500	0.055	0.578	0.010	0.000
10.667	0.055	0.587	0.010	0.000
10.833	0.055	0.596	0.010	0.000
11.000	0.055	0.606	0.010	0.000
11.167	0.055	0.615	0.010	0.000
11.333	0.055	0.624	0.011	0.000
11.500	0.055	0.633	0.011	0.000

11.667	0.055	0.642	0.011	0.000
11.833	0.055	0.652	0.011	0.000
12.000	0.055	0.661	0.011	0.000
12.167	0.055	0.670	0.011	0.000
12.333	0.055	0.679	0.011	0.000
12.500	0.055	0.688	0.011	0.000
12.667	0.055	0.697	0.011	0.000
12.833	0.055	0.707	0.011	0.000
13.000	0.055	0.716	0.011	0.000
13.167	0.055	0.725	0.014	0.000
13.333	0.055	0.734	0.019	0.000
13.500	0.055	0.743	0.024	0.000
13.667	0.055	0.753	0.030	0.000
13.833	0.055	0.762	0.036	0.000
14.000	0.055	0.771	0.042	0.000
14.167	0.055	0.780	1.116	0.000
14.333	0.055	0.789	2.925	0.000
14.500	0.055	0.798	4.681	0.000
14.667	0.055	0.808	5.797	0.000
14.833	0.055	0.817	6.512	0.000
15.000	0.055	0.826	7.129	0.000
15.167	0.055	0.835	7.697	0.000
15.333	0.000	0.000	8.226	0.000

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1

Total Pervious Area:1.78

Total Impervious Area:0

Mitigated Landuse Totals for POC #1

Total Pervious Area:0.63

Total Impervious Area:1.15

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.021917
5 year	0.034279
10 year	0.041973
25 year	0.050939
50 year	0.057053
100 year	0.062702

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.009781
5 year	0.016801
10 year	0.023236

25 year	0.033925
50 year	0.044124
100 year	0.056599

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

<u>Year</u>	<u>Predeveloped</u>	<u>Mitigated</u>
1949	0.003	0.007
1950	0.028	0.010
1951	0.021	0.009
1952	0.015	0.008
1953	0.013	0.008
1954	0.038	0.010
1955	0.037	0.039
1956	0.030	0.147
1957	0.035	0.008
1958	0.024	0.010
1959	0.023	0.009
1960	0.021	0.008
1961	0.024	0.010
1962	0.014	0.007
1963	0.018	0.008
1964	0.021	0.008
1965	0.022	0.010
1966	0.012	0.008
1967	0.031	0.009
1968	0.030	0.010
1969	0.016	0.009
1970	0.017	0.009
1971	0.026	0.023
1972	0.024	0.007
1973	0.013	0.009
1974	0.026	0.011
1975	0.018	0.008
1976	0.017	0.010
1977	0.008	0.007
1978	0.016	0.008
1979	0.032	0.007
1980	0.019	0.008
1981	0.016	0.007
1982	0.024	0.010
1983	0.023	0.010
1984	0.021	0.011
1985	0.032	0.017
1986	0.083	0.011
1987	0.028	0.011
1988	0.018	0.009
1989	0.013	0.008
1990	0.023	0.009
1991	0.025	0.010
1992	0.018	0.009
1993	0.012	0.007
1994	0.008	0.009
1995	0.022	0.010
1996	0.050	0.011
1997	0.090	0.145

1998	0.012	0.009
1999	0.023	0.011
2000	0.013	0.010
2001	0.003	0.005
2002	0.022	0.012
2003	0.014	0.007
2004	0.021	0.009
2005	0.018	0.008
2006	0.050	0.035
2007	0.037	0.018
2008	0.049	0.010
2009	0.019	0.009

Stream Protection Duration

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0904	0.1466
2	0.0832	0.1447
3	0.0498	0.0393
4	0.0495	0.0355
5	0.0487	0.0233
6	0.0380	0.0183
7	0.0375	0.0165
8	0.0374	0.0117
9	0.0347	0.0113
10	0.0321	0.0109
11	0.0320	0.0108
12	0.0310	0.0107
13	0.0304	0.0107
14	0.0303	0.0106
15	0.0278	0.0104
16	0.0276	0.0104
17	0.0259	0.0102
18	0.0256	0.0100
19	0.0250	0.0100
20	0.0242	0.0100
21	0.0239	0.0100
22	0.0238	0.0099
23	0.0238	0.0097
24	0.0232	0.0097
25	0.0232	0.0097
26	0.0230	0.0096
27	0.0229	0.0095
28	0.0223	0.0093
29	0.0219	0.0093
30	0.0218	0.0093
31	0.0214	0.0092
32	0.0210	0.0091
33	0.0209	0.0090
34	0.0207	0.0090
35	0.0206	0.0090
36	0.0187	0.0089
37	0.0186	0.0088
38	0.0185	0.0088
39	0.0184	0.0087
40	0.0184	0.0086

41	0.0181	0.0083
42	0.0176	0.0083
43	0.0174	0.0082
44	0.0170	0.0081
45	0.0164	0.0080
46	0.0161	0.0080
47	0.0160	0.0080
48	0.0152	0.0079
49	0.0142	0.0077
50	0.0140	0.0077
51	0.0132	0.0076
52	0.0130	0.0076
53	0.0130	0.0075
54	0.0126	0.0073
55	0.0125	0.0072
56	0.0118	0.0072
57	0.0115	0.0072
58	0.0080	0.0068
59	0.0079	0.0067
60	0.0032	0.0066
61	0.0028	0.0049

Stream Protection Duration

POC #1

The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0110	21109	12761	60	Pass
0.0114	19235	5955	30	Pass
0.0119	17554	2620	14	Pass
0.0124	15962	2532	15	Pass
0.0128	14495	2443	16	Pass
0.0133	13278	2357	17	Pass
0.0138	12147	2278	18	Pass
0.0142	11122	2190	19	Pass
0.0147	10177	2099	20	Pass
0.0151	9351	2026	21	Pass
0.0156	8615	1917	22	Pass
0.0161	7931	1801	22	Pass
0.0165	7334	1728	23	Pass
0.0170	6727	1664	24	Pass
0.0175	6220	1612	25	Pass
0.0179	5702	1556	27	Pass
0.0184	5234	1495	28	Pass
0.0189	4791	1446	30	Pass
0.0193	4400	1403	31	Pass
0.0198	4060	1344	33	Pass
0.0203	3749	1286	34	Pass
0.0207	3480	1226	35	Pass
0.0212	3206	1155	36	Pass
0.0217	2950	1078	36	Pass
0.0221	2725	1029	37	Pass
0.0226	2543	982	38	Pass
0.0231	2385	924	38	Pass

0.0235	2250	859	38	Pass
0.0240	2120	803	37	Pass
0.0245	2002	759	37	Pass
0.0249	1904	725	38	Pass
0.0254	1789	704	39	Pass
0.0259	1685	692	41	Pass
0.0263	1590	679	42	Pass
0.0268	1486	667	44	Pass
0.0273	1384	656	47	Pass
0.0277	1321	642	48	Pass
0.0282	1252	631	50	Pass
0.0287	1201	610	50	Pass
0.0291	1158	589	50	Pass
0.0296	1120	567	50	Pass
0.0300	1077	543	50	Pass
0.0305	1032	509	49	Pass
0.0310	993	493	49	Pass
0.0314	965	479	49	Pass
0.0319	928	464	50	Pass
0.0324	895	445	49	Pass
0.0328	857	423	49	Pass
0.0333	822	402	48	Pass
0.0338	791	389	49	Pass
0.0342	758	366	48	Pass
0.0347	732	336	45	Pass
0.0352	707	317	44	Pass
0.0356	683	300	43	Pass
0.0361	664	278	41	Pass
0.0366	645	253	39	Pass
0.0370	626	232	37	Pass
0.0375	607	218	35	Pass
0.0380	584	208	35	Pass
0.0384	567	198	34	Pass
0.0389	556	188	33	Pass
0.0394	541	175	32	Pass
0.0398	526	165	31	Pass
0.0403	515	155	30	Pass
0.0408	505	144	28	Pass
0.0412	495	132	26	Pass
0.0417	483	117	24	Pass
0.0422	471	104	22	Pass
0.0426	459	81	17	Pass
0.0431	443	79	17	Pass
0.0436	428	77	17	Pass
0.0440	417	74	17	Pass
0.0445	405	74	18	Pass
0.0449	388	72	18	Pass
0.0454	371	70	18	Pass
0.0459	355	69	19	Pass
0.0463	339	68	20	Pass
0.0468	325	67	20	Pass
0.0473	318	66	20	Pass
0.0477	307	65	21	Pass
0.0482	302	61	20	Pass
0.0487	291	59	20	Pass
0.0491	287	55	19	Pass
0.0496	279	53	18	Pass

0.0501	274	52	18	Pass
0.0505	268	52	19	Pass
0.0510	265	49	18	Pass
0.0515	262	49	18	Pass
0.0519	257	46	17	Pass
0.0524	253	46	18	Pass
0.0529	245	46	18	Pass
0.0533	242	42	17	Pass
0.0538	236	42	17	Pass
0.0543	231	42	18	Pass
0.0547	226	39	17	Pass
0.0552	224	39	17	Pass
0.0557	222	37	16	Pass
0.0561	220	37	16	Pass
0.0566	217	37	17	Pass
0.0571	211	37	17	Pass

Water Quality BMP Flow and Volume for POC #1

On-line facility volume: 0.0197 acre-feet
On-line facility target flow: 0.0099 cfs.
Adjusted for 15 min: 0.0099 cfs.
Off-line facility target flow: 0.0068 cfs.
Adjusted for 15 min: 0.0068 cfs.

LID Report

LID Technique	Used for	Total Volume	Volume	Infiltration	Cumulative
Percent	Water Quality	Percent	Through	Volume	Volume
Volume	Treatment?	Needs	Facility	(ac-ft.)	Infiltration
Infiltrated	Treated	Treatment	(ac-ft)	(ac-ft)	Credit
Vault 1 POC	N	151.45			N
0.00					
Total Volume Infiltrated		151.45	0.00	0.00	0.00
0.00	0%	No Treat.			Credit
Compliance with LID Standard 8					
Duration Analysis Result = Failed					

Perln and Implnd Changes

No changes have been made.

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