STORMWATER MANAGEMENT PLAN

Block 37 Apartments

Harper
Houf Peterson
Righellis Inc.

Block 37

Stormwater Management Report

2/13/2014

Prepared For:

GBD Architects
1120 NW Couch St.
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GBD-49

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HHPR

ENGINEERS ◆ PLANNERS
LANDSCAPE ARCHITECTS ◆ SURVEYORS

Designer's Certification Statement

I hereby certify that this Stormwater Management Report for the South Waterfront Block 37 development has been prepared by me or under my supervision and meets minimum standards of the City of Portland and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of the drainage facilities designed by me.

EXPIRES: 12/31/15

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Project Description

The South Waterfront Block 37 project is located at SW River Parkway and SW Gaines Street. The proposed development includes construction of a mixed use building and pedestrian pathway to the South Waterfront Greenway Trail. Frontage improvements for the project includes construction of the sidewalk corridor on SW River Parkway and on SW Gaines Street.

Existing Site Conditions

The existing 1.67 acre site is undeveloped gravel with some raised planters. The existing roadway is developed to including curb and gutter with a temporary asphalt sidewalk behind the curb.

The site is directly west of the Willamette River, and generally slopes toward the river. Geotechnical Reports have been completed for the site by GeoDesign the most current dated February 1st 2013. The report generally describes the soil composed of fill overlying alluvial silt, sand, and gravel, then overlying the dense to very dense gravel of the Troutdale Formation. The fill was noted to be between 7 and 17 feet below the ground surface. Groundwater was noted to be at approximately 15 to 16 feet below the ground surface. During extreme flooding of the Willamette River, the groundwater levels are expected to rise to elevation 31 feet (COP Datum)

GeoDesign has completed a Level 1 Environmental Site Assessment for the project site, dated September 12, 2012. The project site was identified having historical operations that resulted in soil and groundwater contamination. Further investigation of the site is ongoing to determine if the soil is contaminated.

Proposed Site Improvements / Stormwater Management Requirements

The proposed public and private improvements will create additional impervious areas. These impervious surfaces will need to be managed per the 2008 City of Portland Stormwater Management Manual (SWMM). Per the SWMM, the Stormwater Infiltration and Discharge Hierarchy is to be used to determine the feasibility of the stormwater option to be used for the site. The following addresses each category in the Hierarchy;

Category 1: Requires total onsite infiltration with vegetated infiltration facilities.

Total on-site stormwater infiltration will not be feasible on this site due the contaminated soils.

Category 2: Requires total onsite infiltration with a vegetated facility that overflows to a subsurface infiltration facility.

Total on-site stormwater infiltration will not be feasible on this site due the contaminated soils.

Category 3: Requires onsite detention with vegetated facilities that overflow to a drainage way, river, or storm-only pipe.

The stormwater management for this project falls into this category. The building roof area and pedestrian easement area (SW Lane) will meet water quality requirements using a combination of flow through planters located on the second level terrace of the building, and water quality

swale located within the pedestrian easement. SW Gaines Street has been noted as a green street, with this project a stormwater planter will be constructed to treat stormwater runoff from the southerly half of SW Gaines from the intersection of SW River Parkway to the location of the stormwater planter.

Detention will not be required for this site since both the public storm only line in SW Gaines, and the private storm only line in SW Lane outfall to the Willamette River directly east of the site.

Category 4: Required onsite detention with vegetated facilities that overflow to the combined sewer system.

There is not a combined sewer system adjacent to the site.

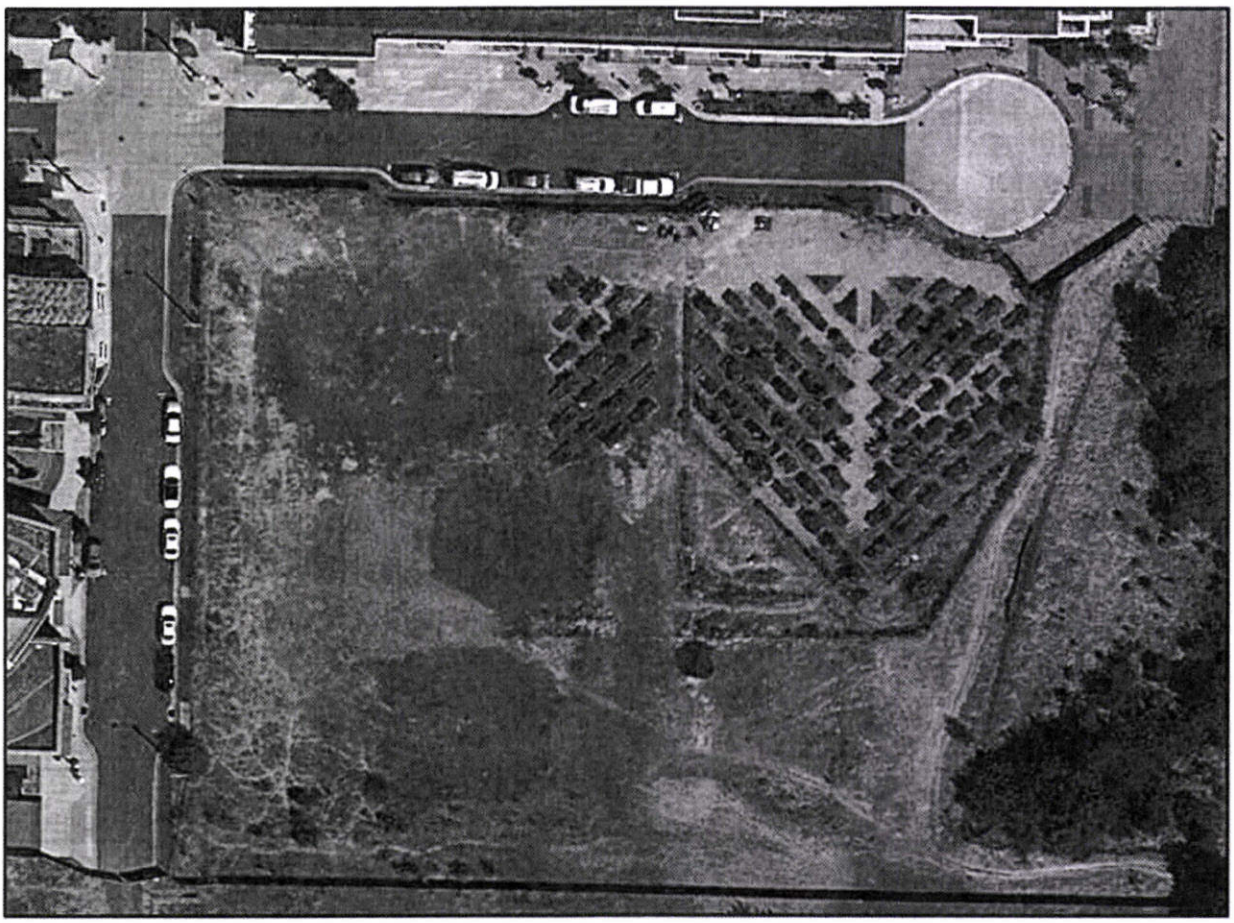
Conclusion

The stormwater management for the site falls under Category 3 of the Stormwater Infiltration and Discharge Hierarchy of the 2008 City of Portland Stormwater Management Manual. Stormwater management requirements for the 1.67 acre site will be met using a combination of Stormwater Planters and Swales.

Appendix

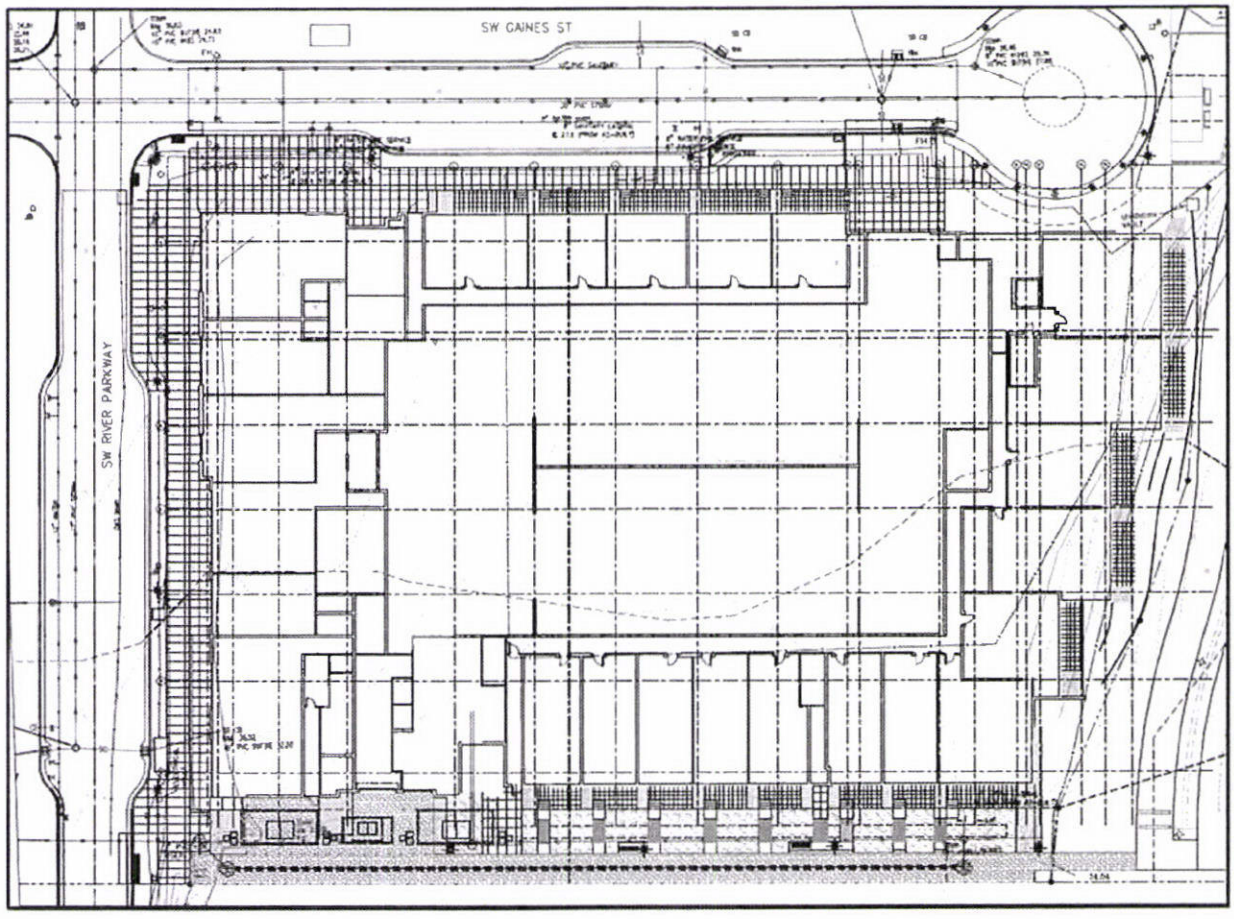
Maps and Calculations

Existing Conditions Aerial



EXISTING CONDITIONS
NTS

Proposed Site Plan



SITE PLAN
NTS

SW Gaines Street (Public)

SW Gaines Street has been identified as a green street. The proposed stormwater planter will be located toward the easterly end of the street, mirroring the stormwater planter on the north side of the street.

SW Gaines is developed with a concrete intersection at SW River Parkway and asphalt roadway with a cul-de-sac at the east end terminating the street. The basin area for the proposed planter will be the southerly half of SW Gaines, begin at the intersection of SW Gaines and SW River Parkway and continuing to the proposed planter location.

Impervious Area: 6,900sf
The proposed planter dimensions: 44lf by 9ft wide
Roadway slope 1.4%
Proposed Check Dam at 22lf

Using the City of Portland's PAC to calculate stormwater management requirements:

RESULTS

		Overflow Volume			
Pollution Reduction	PASS	0 CF	4%	Surf. Cap. Used	Run PAC
			17%	Rock Cap. Used	

Output File

	2-yr	5-yr	10-yr	25-yr
Peak cfs	0.005	0.043	0.122	0.144

FACILITY FACTS

Total Facility Area Including Freeboard =	396 SF
Sizing Ratio (Total Facility Area / Catchment Area) =	0.057

Building and Pedestrian Easement (Private)

The Building roof area is being collected in four locations, divided up in this report as basins A through D. SW Lane, Pedestrian Easement, is basin E. The following table summarizes the basin information:

Basin	Location	Area	WQ	WQ Location
A	Roof Area (West)	14,628sf	Planter A	Interior Courtyard
B	Roof Area (Middle), Interior Courtyard	33,945sf	Swale A	SW Lane
C	Roof Area (NE)	5,696sf	Planter B	East 2nd level Terrace
D	2nd Level Terrace	5,169sf	Swale B	SW Lane
E	SW Lane	4,664sf	Swale A	SW Lane

Planter A Calculations

Planer A is a flat flow through planter located in the Courtyard area of the building.

Impervious Area: 14,628sf
Proposed planter area: 366sf
Proposed storage depth: 4"
Proposed freeboard depth: 2"

Using the City of Portland's PAC to calculate stormwater management requirements:

RESULTS

		Overflow Volume		
Pollution Reduction	PASS	0 CF	67% Surf. Cap. Used	Run PAC

Output File

	2-yr	5-yr	10-yr	25-yr
Peak cfs	0.207	0.252	0.298	0.343

FACILITY FACTS

Total Facility Area Including Freeboard =	366 SF
Sizing Ratio (Total Facility Area / Catchment Area) =	0.025

Planter B Calculations

Planer B is a flat flow through planter located in the 2nd Level Terrace of the building.

Impervious Area: 5,696sf
Proposed planter area: 142sf
Proposed storage depth: 4"
Proposed freeboard depth: 2"

Using the City of Portland's PAC to calculate stormwater management requirements:

RESULTS		Overflow Volume			
Pollution Reduction	PASS	0 CF	68%	Surf. Cap. Used	Run PAC

Output File

	2-yr	5-yr	10-yr	25-yr
Peak cfs	0.080	0.098	0.116	0.134

FACILITY FACTS	
Total Facility Area Including Freeboard =	142 SF
Sizing Ratio (Total Facility Area / Catchment Area) =	0.025

SW Lane Swale Calculations

Swale A will treat basins B and the majority of basin E.

Impervious Area: 38,609sf
Swale dimensions: 4ft bottom, 3:1 side slopes, downstream depth 12"
Swale Length 140LF
Swale Slope 1.7%
Check Dam at 30lf

Using the City of Portland's PAC to calculate stormwater management requirements:

RESULTS		Overflow Volume			
Pollution Reduction	PASS	0 CF	82%	Surf. Cap. Used	Run PAC

Output File

	2-yr	5-yr	10-yr	25-yr
Peak cfs	0.523	0.643	0.763	0.883

FACILITY FACTS	
Total Facility Area Including Freeboard =	1,400 SF
Sizing Ratio (Total Facility Area / Catchment Area) =	0.036

Swale B will treat basins D and the adjacent portion of basin E.

Impervious Area: 5,400sf
Swale dimensions: 4ft bottom, 3:1 side slopes, downstream depth 12"
Swale Length 200LF
Swale Slope 4.75%
Check Dam at 10lf

Using the City of Portland's PAC to calculate stormwater management requirements:

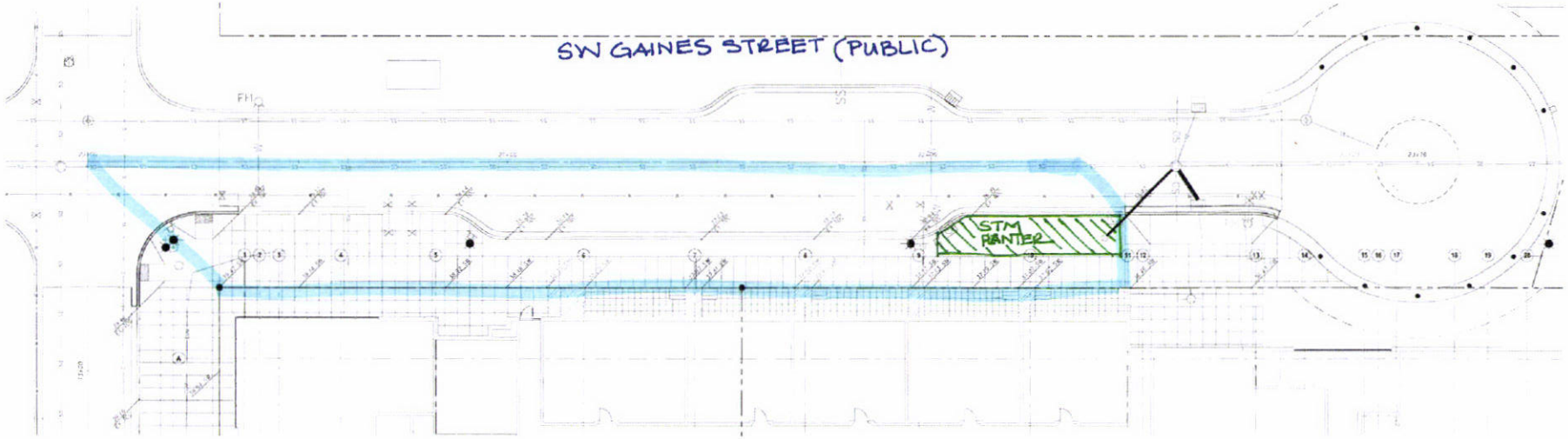
RESULTS		Overflow Volume			
Pollution Reduction	PASS	0 CF	73%	Surf. Cap. Used	Run PAC

Output File

	2-yr	5-yr	10-yr	25-yr
Peak cfs	0.073	0.090	0.107	0.123

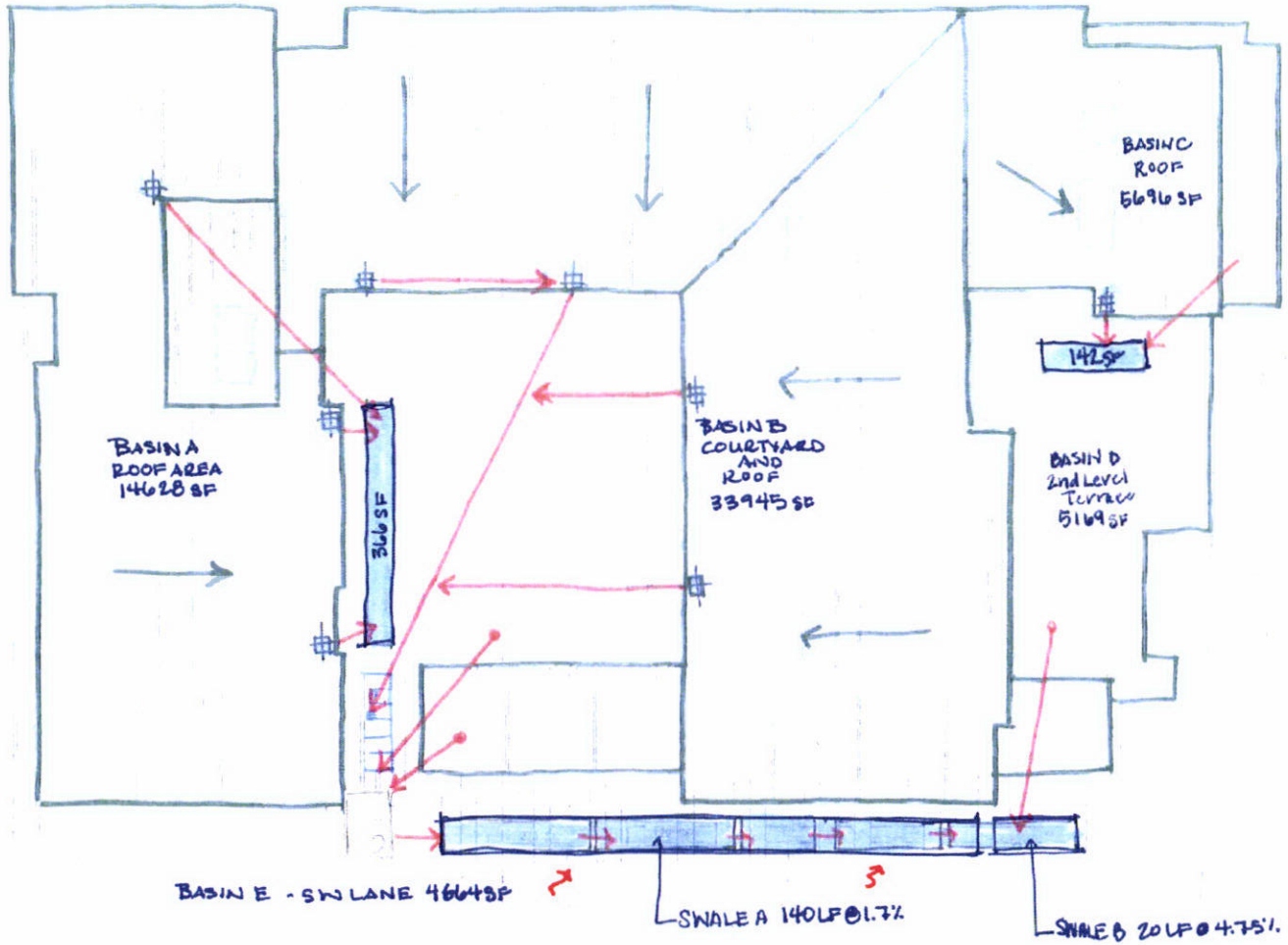
FACILITY FACTS	
Total Facility Area Including Freeboard =	200 SF
Sizing Ratio (Total Facility Area / Catchment Area) =	0.037

BASIN MAP



Impervious Area: 6900SF

BASIN MAP



BLOCK 37 - WC PLANTERS

Presumptive Approach Calculator ver. 1.2

Catchment Data

Catchment ID: Planter

Project Name:	SW Gaines
Project Address:	SW Gaines east of River Parkway
Designer:	JLB
Company:	HHPR
Date:	02/13/14
Permit Number:	0

Run Time 2/13/2014 9:37:22 AM

Drainage Catchment Information

Catchment ID	Planter	
	Catchment Area	
Impervious Area	6,900	SF
Impervious Area	0.16	ac
Impervious Area Curve Number, CN_{imp}	98	
Time of Concentration, Tc, minutes	5	min.

Site Soils & Infiltration Testing Data

Infiltration Testing Procedure:	Open Pit Falling Head	
Native Soil Field Tested Infiltration Rate (I_{test}):	2	in/hr
Bottom of Facility Meets Required Separation From High Groundwater Per BES SWMM Section 1.4:	Yes	

Correction Factor Component

CF_{test} (ranges from 1 to 3)	2	

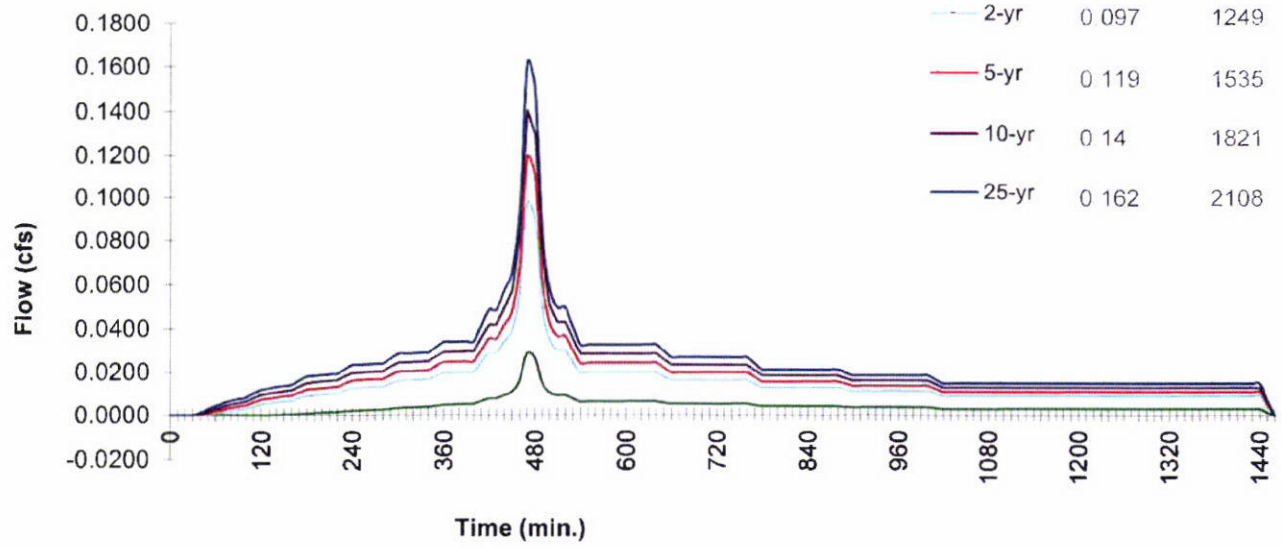
Design Infiltration Rates

I_{dsgn} for Native (I_{test} / CF_{test}):	1.00	in/hr
I_{dsgn} for Imported Growing Medium:	2.00	in/hr

Execute SBUH

SBUH Results

	Peak Rate (cfs)	Volume (cf)
PR	0.028	361
2-yr	0.097	1249
5-yr	0.119	1535
10-yr	0.14	1821
25-yr	0.162	2108



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Presumptive Approach Calculator ver. 1.2

Catchment ID: Planter

Run Time 2/13/2014 9:37:22 AM

Project Name: SW Gaines Catchment ID: Planter Date: 2/13/2014

Instructions:

1. Identify which Stormwater Hierarchy Category the facility.
2. Select Facility Type.
3. Identify facility shape of surface facility to more accurately estimate surface volume, except for Swales and sloped planters that use the PAC Sloped Facility Worksheet to enter data.
4. Select type of facility configuration.
5. Complete data entry for all highlighted cells.

Catchment facility will meet Hierarchy Category: 3

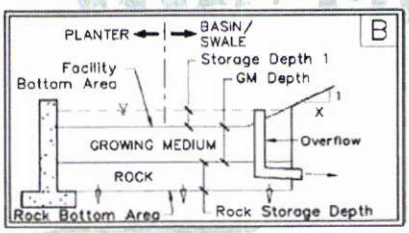
Goal Summary:

Hierarchy Category	SWMM Requirement	RESULTS box below needs to display...	
		Pollution Reduction as a	10-yr (aka disposal) as a
3	Off-site flow to drainageway, river, or storm-only pipe system	PASS	N/A

Facility Type = Planter (Sloped)

Facility Configuration: B

Refer to Sloped Facility Worksheet and enter Variable Parameters



Calculation Guide
Max. Rock Stor. Bottom Area
Per Swale Dims

DATA FOR ABOVE GRADE STORAGE COMPONENT

Infiltration Area = 395 sf
Surface Capacity Volume = 258.8 cf

Growing Medium Depth = 18 in
Freeboard Depth = N/A in

Surface Capacity at Depth 1 = 259 cf
Infiltration Area at 75% Depth1 = -3 SF
GM Design Infiltration Rate = 2.00 in/hr
Infiltration Capacity = 0.018 cfs

BELOW GRADE STORAGE

Rock Storage Bottom Area = 352 sf
Rock Storage Depth = 30 in
Rock Void Ratio = 0.3

Rock Storage Capacity = 264 cf

Native Design Infiltration Rate = 1.00 in/hr
Infiltration Capacity = 0.008 cfs

RESULTS

Pollution Reduction: PASS

Overflow Volume: 0 CF

4% Surf. Cap. Used

17% Rock Cap. Used

Run PAC

Output File

	2-yr	5-yr	10-yr	25-yr
Peak cfs	0.005	0.043	0.122	0.144

FACILITY FACTS

Total Facility Area Including Freeboard = 396 SF

Sizing Ratio (Total Facility Area / Catchment Area) = 0.057

Presumptive Approach Calculator Ver 1.2

Instructions:

1. Refer to facility graphics on the Graphics tab, then fill in all relevant facility parameters in the Data Entry table below. Data entry cells vary based on Facility Configuration selected on Facility Design Data tab.
2. Delete all facility parameters that may have been entered by the previous iteration that are no longer applicable.

Run Time 2/13/2014 9:37:22 AM

Project Name: SW Gaines

Date: 2/13/2014

Catchment ID: Planter

Data Entry

Parameters | **Rock Storage Parameters** | **Error Messages**

Facility Segment	Length of facility segment (ft) $L_{segment}$	Downstream Check Dam Length (ft) L_{dam}	Longitudinal Facility Slope (ft/ft) S	Bottom Width (ft) W_{bottom}	Side Slope Right X_{right}:1	Side Slope Left X_{left}:1	Downstream Depth (inches) D_{ds}	Landscape Width (ft) $W_{landscape}$	Rock Storage Width (ft) W_{rock}	Rock Storage Depth (inches) D_{rock}	Rock Void Ratio v
1	22	0	0.014	9	0	0	9.7	9	8	30	0.3
2	22	0.16	0.014	9	0	0	9.7	9	8		
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

Project Name:

Depth 2=

Depth 3=

Worksheet Calculations

Parameters | **Rock Storage Parameters**

Facility Segment	Adjusted Length of facility segment (ft) L_{adjust}	Adjusted Length if $D_{up} = 0$ (ft) $L_{adjust2}$	Upstream Depth (inches) D_{up}	Downstream Top Width (ft) $W_{top\text{-}ds}$	Upstream Top Width (ft) $W_{top\text{-}up}$	Downstream Cross-sectional Area (sf) A_{ds}	Upstream Cross-sectional Area (sf) A_{up}	**Surface Capacity Volume** (cf) $V_{surface}$	75% of Max Downstream Depth (inches) $D_{ds75\%}$	75% of Max Upstream Depth (inches) $D_{up75\%}$	75% of Max Adjusted Length if $D_{up75\%} = 0$ (ft) $L_{adjust3}$	75% of Max Downstream Top Width (ft) $W_{top\text{-}ds75\%}$	75% of Max Upstream Top Width (ft) $W_{top\text{-}up75\%}$	**Infiltration Area @ 75% Full** (sf) $A_{75\%}$	Rock Storage Length (ft) L_{rock}	**Rock Storage Bottom Area** (sf) A_{rock}	**Rock Storage Capacity Volume** (cf) V_{rock}
1	22.00	N/A	6.00	9.00	9.00	7.28	4.50	130	7.28	3.58	N/A	9.00	9.00	198	22	176	132
2	21.92	N/A	6.02	9.00	9.00	7.28	4.51	129	7.28	3.59	N/A	9.00	9.00	197	22	176	132
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
								259	$V_{surface}$ @ Depth1					**395**		**352**	**264**

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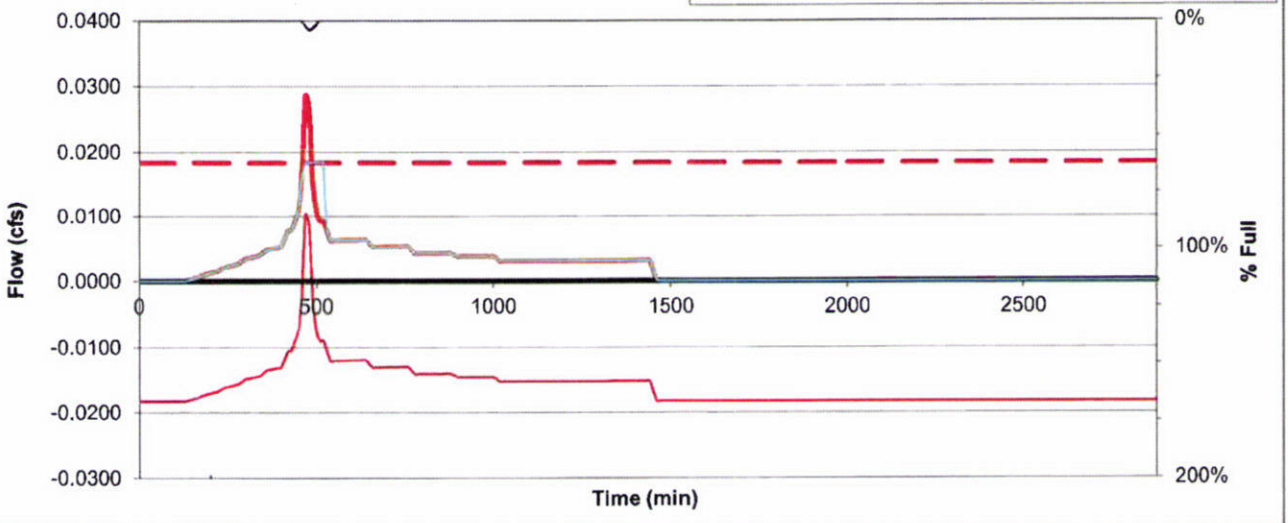
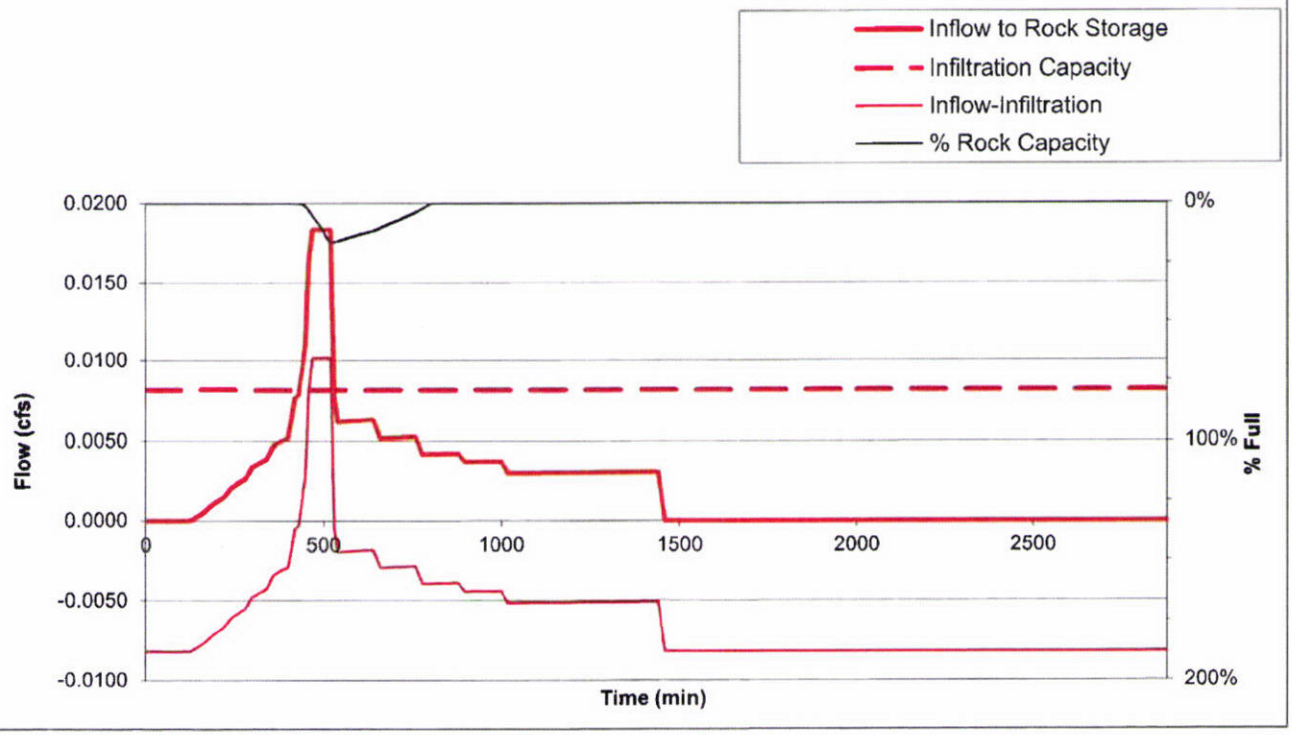
PR Con-A&B

Pollution Reduction Event
Surface Facility Modeling

Project Name: SW Gaines
Run Time: 2/13/2014 9:37:22 AM
Catchment ID: Planter
Hierarchy: 3
Facility Type: Planter (
Facility Configuration: B



Pollution Reduction Event
Below Grade Modeling



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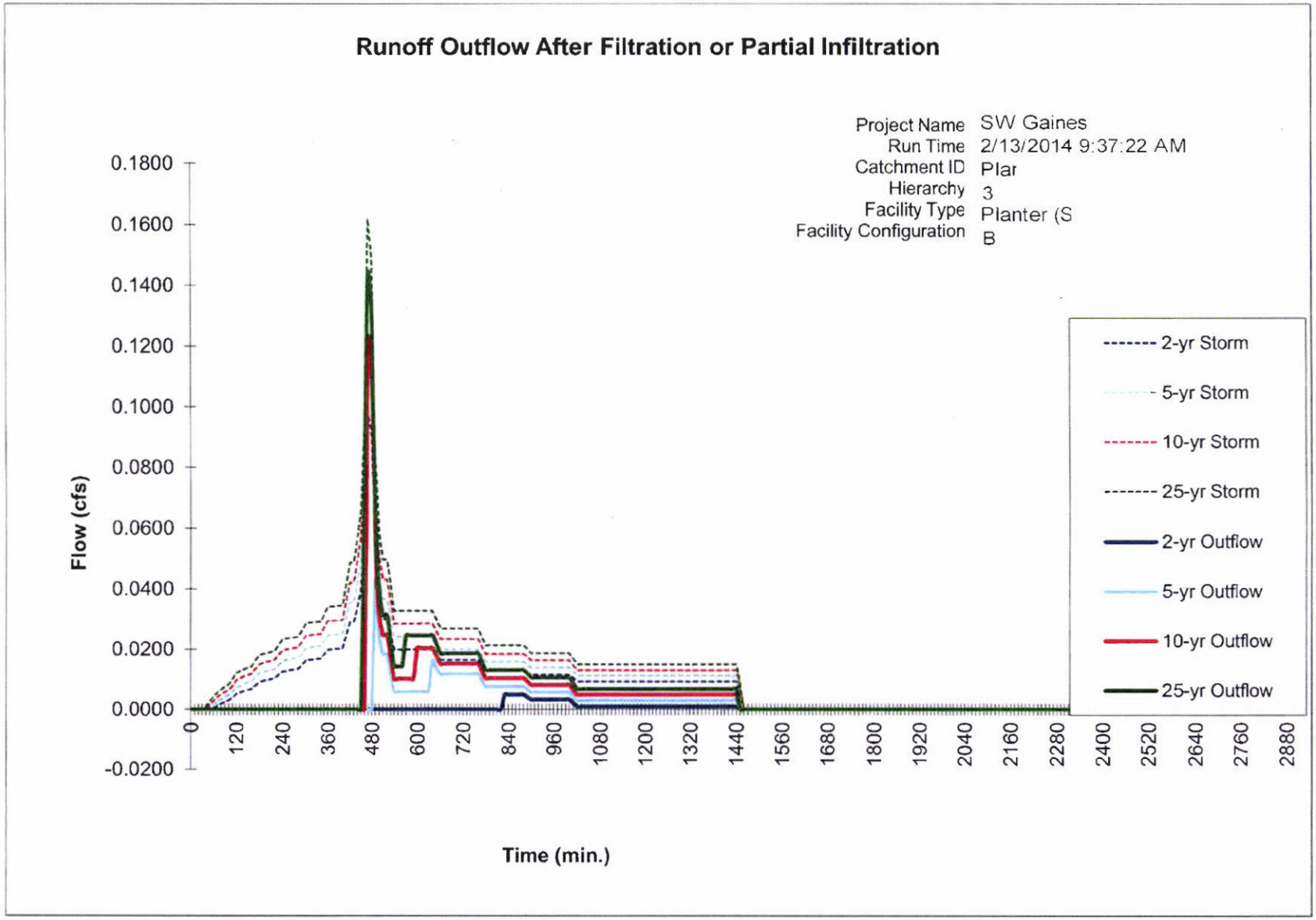
Output Chart



Presumptive Approach Calculator ver. 1.2

Catchment Data

Catchment ID: Planter A
Date: 02/03/14
Permit Number: 0
Run Time 2/14/2014 7:26:32 AM

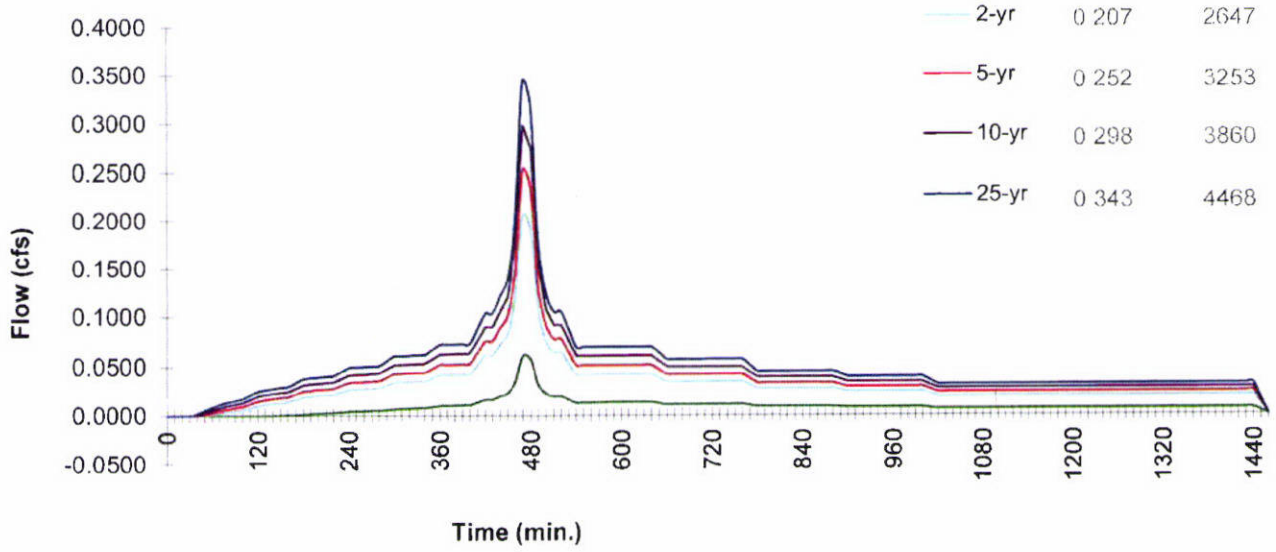
Project Name: SouthWaterFront - Block37
Project Address: SW River Parkway and SW Gaines
Portland Oregon
Designer: JLB
Company: HHPR

Drainage Catchment Information		
Catchment ID	Planter A	
	Catchment Area	
Impervious Area	14,628	SF
Impervious Area	0.34	ac
Impervious Area Curve Number, CN_{imp}	98	
Time of Concentration, Tc, minutes	5	min.
Site Soils & Infiltration Testing Data		
Infiltration Testing Procedure:	Open Pit Falling Head	
Native Soil Field Tested Infiltration Rate (I_{test}):	10	in/hr
Bottom of Facility Meets Required Separation From High Groundwater Per BES SWMM Section 1.4:	Yes	
Correction Factor Component		
CF_{test} (ranges from 1 to 3)	2	
Design Infiltration Rates		
I_{dsgn} for Native (I_{test} / CF_{test}):	5.00	in/hr
I_{dsgn} for Imported Growing Medium:	2.00	in/hr

Execute SBUH

SBUH Results

	Peak Rate (cfs)	Volume (cf)
PR	0.06	764
2-yr	0.207	2647
5-yr	0.252	3253
10-yr	0.298	3860
25-yr	0.343	4468



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Presumptive Approach Calculator ver. 1.2

Catchment ID: Planter A

Run Time 2/14/2014 7:26:32 AM

Project Name: SouthWaterFront - Block37 **Catchment ID:** Planter A **Date:** 2/3/2014

imported file Planter A 02132014.xls - 2/14/2014 7:26:34 AM

Instructions:

1. Identify which Stormwater Hierarchy Category the facility.
2. Select Facility Type.
3. Identify facility shape of surface facility to more accurately estimate surface volume, except for Swales and sloped planters that use the PAC Sloped Facility Worksheet to enter data.
4. Select type of facility configuration.
5. Complete data entry for all highlighted cells.

Catchment facility will meet Hierarchy Category: 3

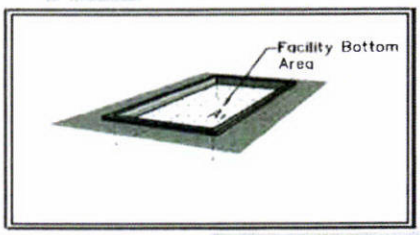
Goal Summary:

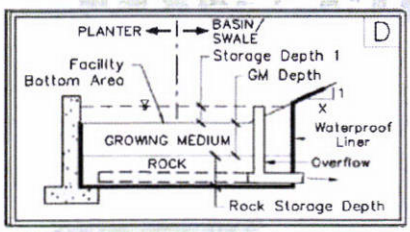
Hierarchy Category	SWMM Requirement	RESULTS box below needs to display...	
		Pollution Reduction as a	10-yr (aka disposal) as a
3	Off-site flow to drainageway, river, or storm-only pipe system	PASS	N/A

Facility Type = Planter (Flat)

Facility Shape: Rectangle/Square

Facility Configuration: D





Calculation Guide
Max. Rock Stor. Bottom Area
366 SF

DATA FOR ABOVE GRADE STORAGE COMPONENT

Facility Bottom Area =	366	sf
Bottom Width =	10.0	ft
Facility Side Slope =	0	to 1
Storage Depth 1 =	4	in <Warning
Growing Medium Depth =	18	in
Freeboard Depth =	N/A	in
Surface Capacity at Depth 1 =	122	cf
GM Design Infiltration Rate =	2.00	in/hr
Infiltration Capacity =	0.017	cfs

BELOW GRADE STORAGE

Rock Storage Capacity =		cf
Native Design Infiltration Rate =		in/hr
Infiltration Capacity =		cfs

RESULTS

Pollution Reduction: **PASS** | Overflow Volume: 0 CF | 67% Surf. Cap. Used | Run PAC

Output File

	2-yr	5-yr	10-yr	25-yr
Peak cfs	0.207	0.252	0.298	0.343

Current data has been imported:

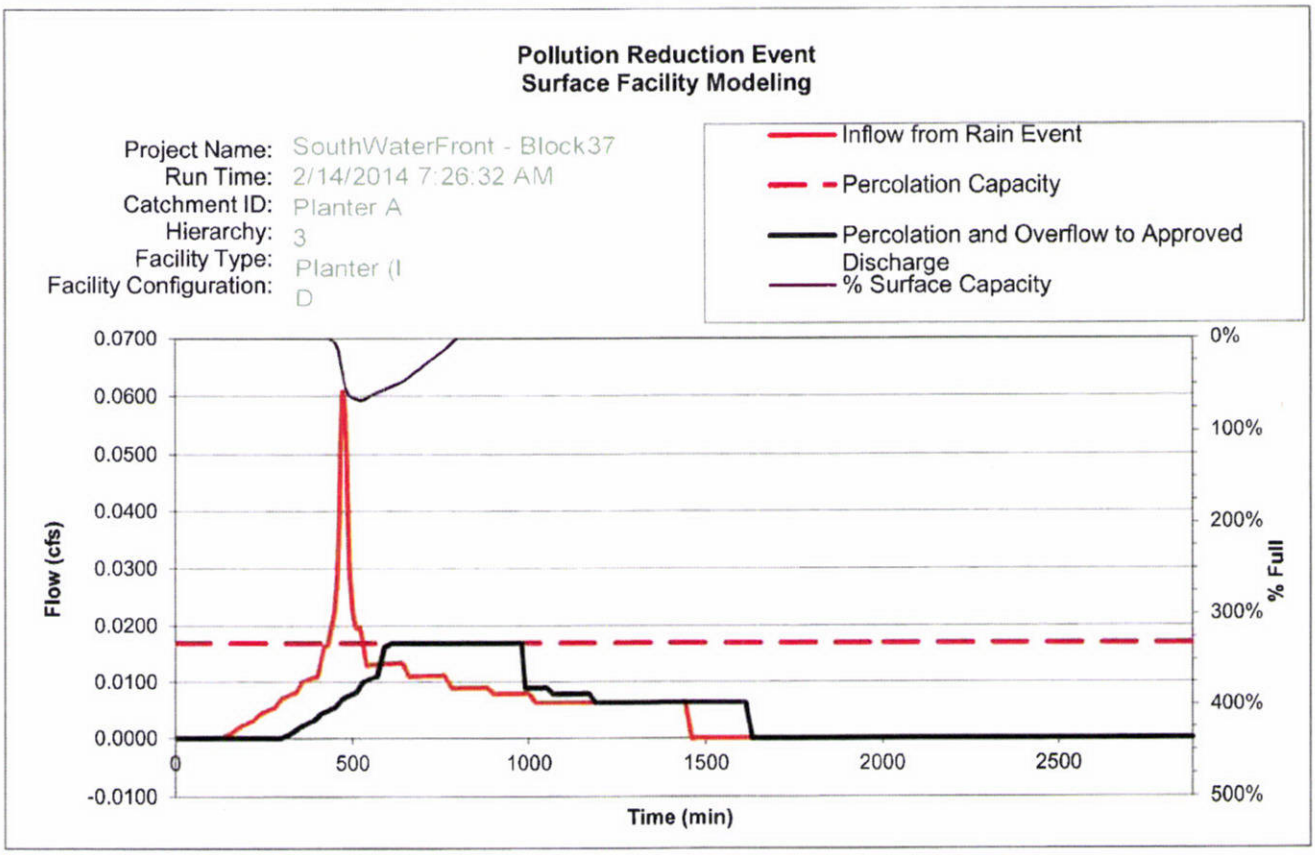
Planter A 02132014.xls 2/14/2014 7:26:34 AM

FACILITY FACTS

Total Facility Area Including Freeboard =	366 SF
Sizing Ratio (Total Facility Area / Catchment Area) =	0.025

BES - Presumptive Approach Calculator - Ver 1.2

PR Con-D



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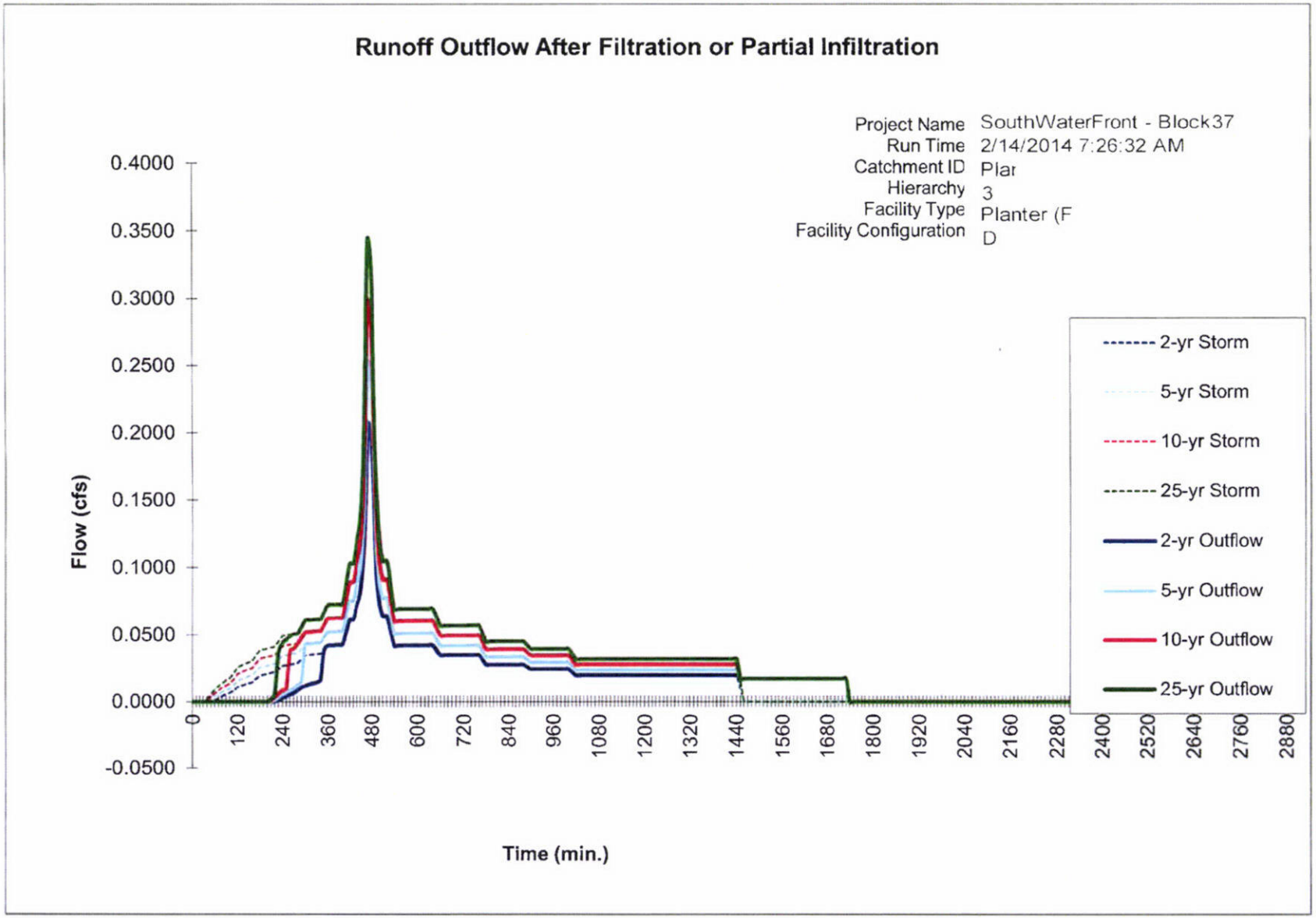
BES - Presumptive Approach Calculator - Ver 1.2

Output Chart



Presumptive Approach Calculator ver. 1.2

Catchment Data

Catchment ID: Planter B
Date: 02/03/14
Permit Number: 0

Run Time 2/14/2014 7:28:00 AM

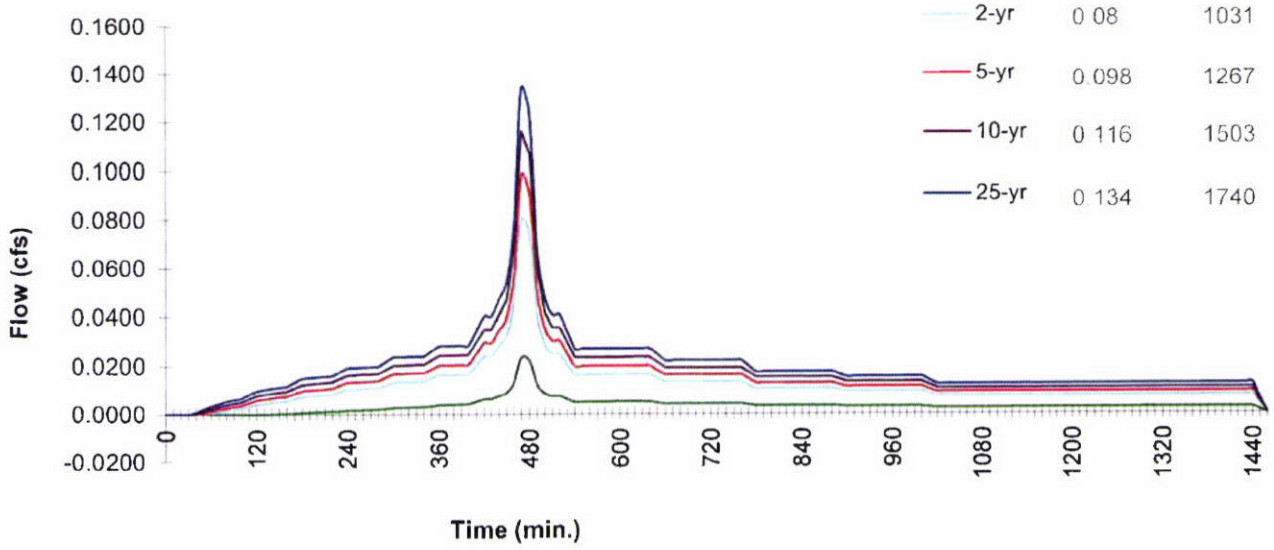
Project Name: SouthWaterFront - Block37
Project Address: SW River Parkway and SW Gaines
Portland Oregon
Designer: JLB
Company: HHPR

Drainage Catchment Information		
Catchment ID	Planter B	
	Catchment Area	
Impervious Area	5,696	SF
Impervious Area	0.13	ac
Impervious Area Curve Number, CN_{imp}	98	
Time of Concentration, Tc, minutes	5	min.
Site Soils & Infiltration Testing Data		
Infiltration Testing Procedure:	Open Pit Falling Head	
Native Soil Field Tested Infiltration Rate (I_{test}):	10	in/hr
Bottom of Facility Meets Required Separation From High Groundwater Per BES SWMM Section 1.4:	Yes	
Correction Factor Component		
CF_{test} (ranges from 1 to 3)	2	
Design Infiltration Rates		
I_{dsgn} for Native (I_{test} / CF_{test}):	5.00	in/hr
I_{dsgn} for Imported Growing Medium:	2.00	in/hr

Execute SBUH

SBUH Results

	Peak Rate (cfs)	Volume (cf)
PR	0.024	298
2-yr	0.08	1031
5-yr	0.098	1267
10-yr	0.116	1503
25-yr	0.134	1740



Printed: 2/14/2014 7:28 AM

Presumptive Approach Calculator ver. 1.2

Catchment ID: Planter B

Run Time 2/14/2014 7:28:00 AM

Project Name: SouthWaterFront - Block37 **Catchment ID:** Planter B **Date:** 2/3/2014

imported file Planter B 02132014.xls - 2/14/2014 7:28:02 AM

Instructions:

1. Identify which Stormwater Hierarchy Category the facility.
2. Select Facility Type.
3. Identify facility shape of surface facility to more accurately estimate surface volume, except for Swales and sloped planters that use the PAC Sloped Facility Worksheet to enter data.
4. Select type of facility configuration.
5. Complete data entry for all highlighted cells.

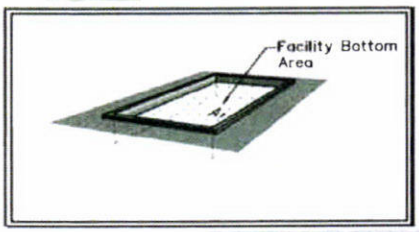
Catchment facility will meet Hierarchy Category: 3

Goal Summary:

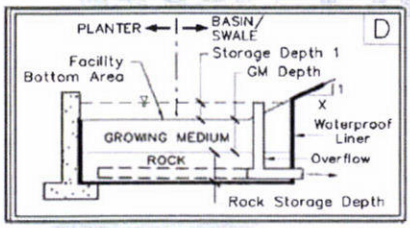
Hierarchy Category	SWMM Requirement	RESULTS box below needs to display...	
		Pollution Reduction as a	10-yr (aka disposal) as a
3	Off-site flow to drainageway, river, or storm-only pipe system	PASS	N/A

Facility Type = Planter (Flat)

Facility Shape: Rectangle/Square



Facility Configuration: D



Calculation Guide
Max. Rock Stor. Bottom Area
142 SF

DATA FOR ABOVE GRADE STORAGE COMPONENT

BELOW GRADE STORAGE

Facility Bottom Area =	142	sf
Bottom Width =	10.0	ft
Facility Side Slope =	0	to 1
Storage Depth 1 =	4	in <Warning
Growing Medium Depth =	18	in
Freeboard Depth =	N/A	in
Surface Capacity at Depth 1 =	47	cf
GM Design Infiltration Rate =	2.00	in/hr
Infiltration Capacity =	0.007	cfs

Rock Storage Capacity =		cf
Native Design Infiltration Rate =		in/hr
Infiltration Capacity =		cfs

RESULTS

Pollution Reduction: **PASS** | Overflow Volume: 0 CF | 68% Surf. Cap. Used | Run PAC

Output File

	2-yr	5-yr	10-yr	25-yr
Peak cfs	0.080	0.098	0.116	0.134

Current data has been imported:

Planter B 02132014.xls 2/14/2014 7:28:02 AM

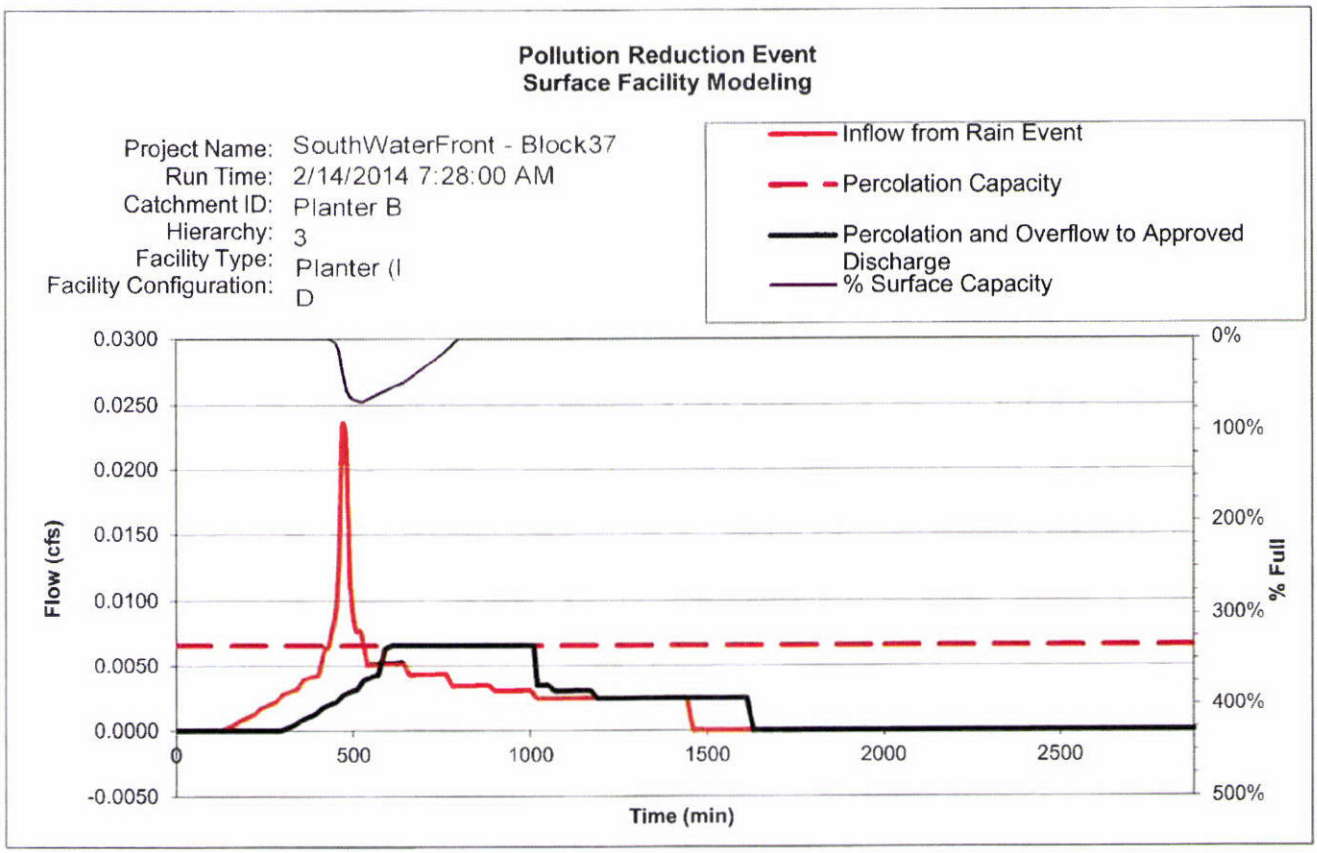
FACILITY FACTS

Total Facility Area Including Freeboard = 142 SF

Sizing Ratio (Total Facility Area / Catchment Area) = 0.025

BES - Presumptive Approach Calculator - Ver 1.2

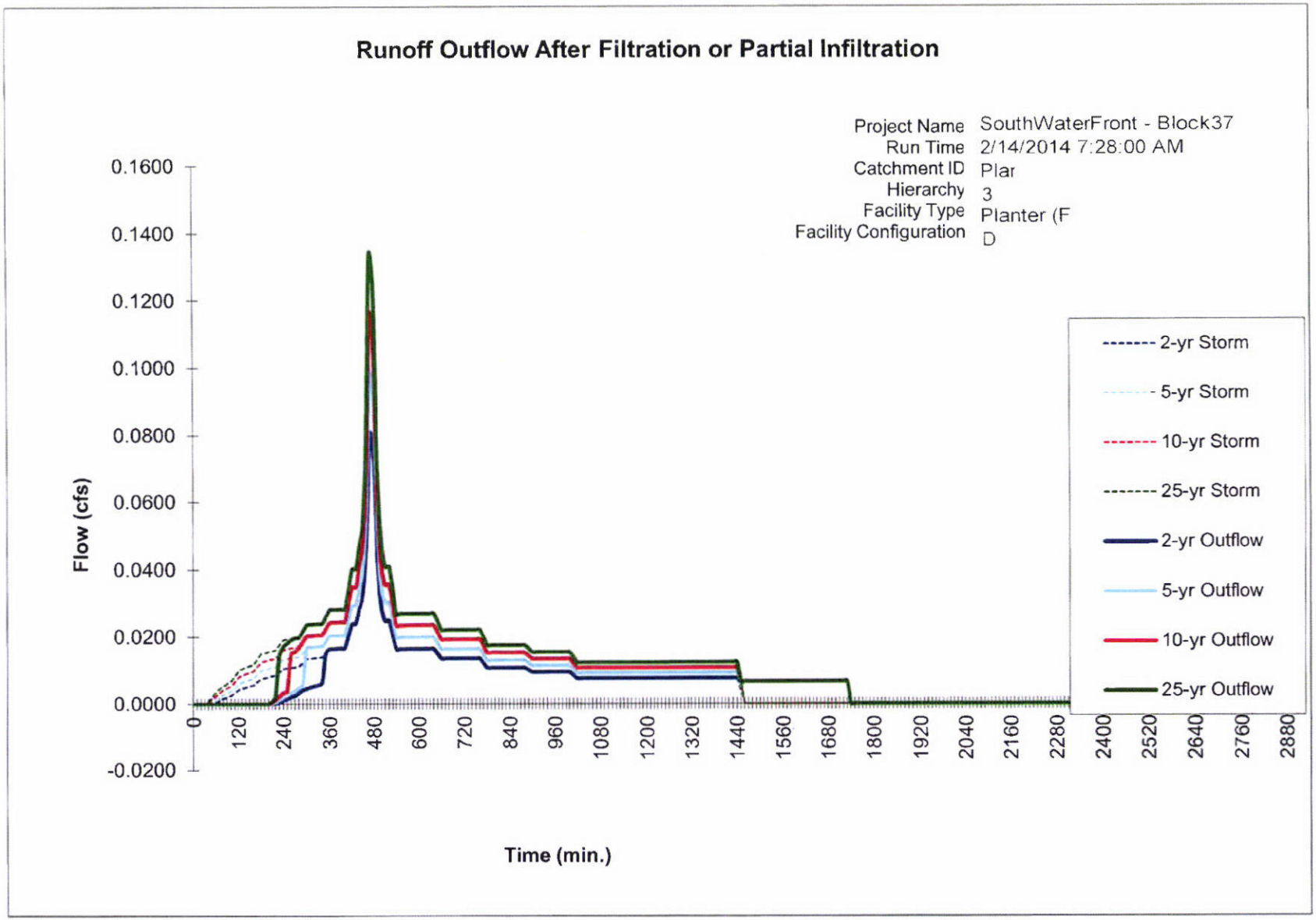
PR Con-D



Printed: 2/14/2014 7:28 AM

BES - Presumptive Approach Calculator - Ver 1.2

Output Chart



Presumptive Approach Calculator ver. 1.2

Catchment Data

Catchment ID: Swale A
Date: 02/12/14
Permit Number: 0
Run Time 2/12/2014 5:52:28 PM

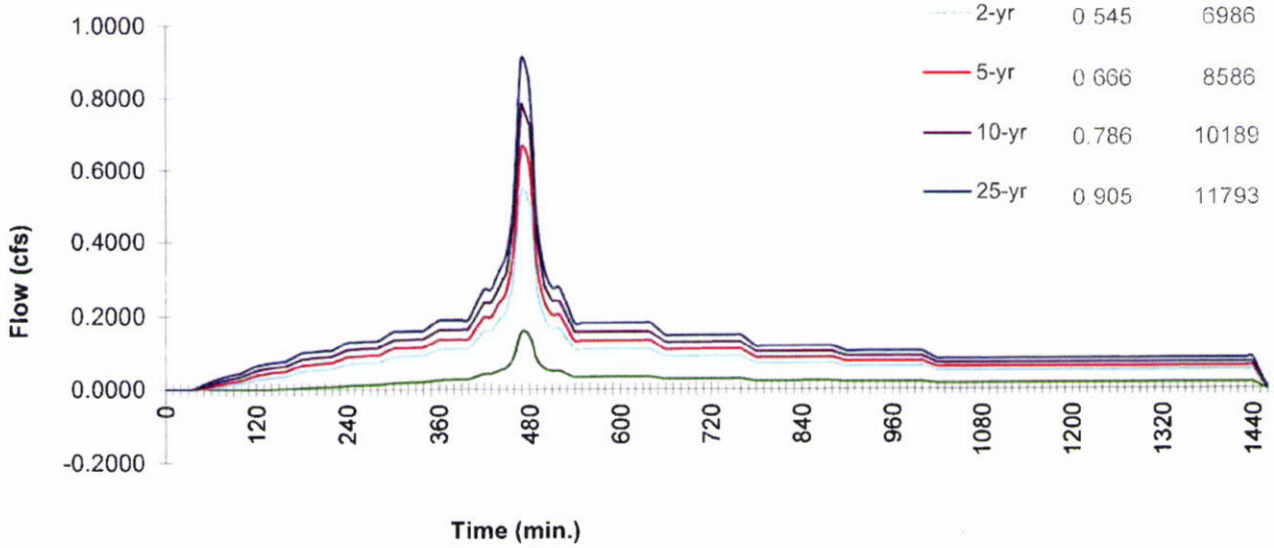
Project Name: BLOCK 37
Project Address: SW River Parkway and SW Gaines
Portland Oregon
Designer: JLB
Company: HHPR

Drainage Catchment Information		
Catchment ID	Swale A	
	Catchment Area	
Impervious Area	38,609	SF
Impervious Area	0.89	ac
Impervious Area Curve Number, CN_{imp}	98	
Time of Concentration, Tc, minutes	5	min.
Site Soils & Infiltration Testing Data		
Infiltration Testing Procedure:	Open Pit Falling Head	
Native Soil Field Tested Infiltration Rate (I_{test}):	2	in/hr
Bottom of Facility Meets Required Separation From High Groundwater Per BES SWMM Section 1.4:	Yes	
Correction Factor Component		
CF_{test} (ranges from 1 to 3)	2	
Design Infiltration Rates		
I_{dsgn} for Native (I_{test} / CF_{test}):	1.00	in/hr
I_{dsgn} for Imported Growing Medium:	2.00	in/hr

Execute SBUH

SBUH Results

	Peak Rate (cfs)	Volume (cf)
PR	0.159	2017
2-yr	0.545	6986
5-yr	0.666	8586
10-yr	0.786	10189
25-yr	0.905	11793



Printed: 2/12/2014 5:53 PM

Presumptive Approach Calculator ver. 1.2

Catchment ID: Swale

Run Time 2/12/2014 5:52:28 PM

Project Name: BLOCK 37 **Catchment ID:** Swale **Date:** 2/12/2014

Instructions:

1. Identify which Stormwater Hierarchy Category the facility.
2. Select Facility Type.
3. Identify facility shape of surface facility to more accurately estimate surface volume, except for Swales and sloped planters that use the PAC Sloped Facility Worksheet to enter data.
4. Select type of facility configuration.
5. Complete data entry for all highlighted cells.

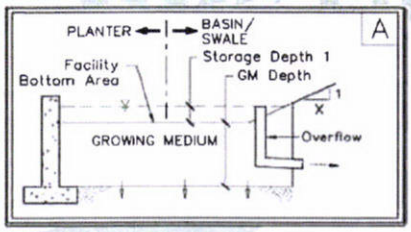
Catchment facility will meet Hierarchy Category: 3

Goal Summary:

Hierarchy Category	SWMM Requirement	RESULTS box below needs to display ...	
		Pollution Reduction as a	10-yr (aka disposal) as a
3	Off-site flow to drainageway, river, or storm-only pipe system.	PASS	N/A

Facility Type = Swale

Facility Configuration: A



Refer to Sloped Facility Worksheet and enter Variable Parameters

Calculation Guide
Max. Rock Stor. Bottom Area
Per Swale Dims

DATA FOR ABOVE GRADE STORAGE COMPONENT

Infiltration Area = 969 sf
Surface Capacity Volume = 661.1 cf

BELOW GRADE STORAGE

Rock Storage Bottom Area = 969 sf
Rock Storage Depth = 0 in

Growing Medium Depth = 18 in
Freeboard Depth = N/A in

Surface Capacity at Depth 1 = 661 cf
Infiltration Area at 75% Depth1 = 11 SF
GM Design Infiltration Rate = 2.00 in/hr
Infiltration Capacity = 0.045 cfs

Rock Storage Capacity = 0 cf

Native Design Infiltration Rate = 1.00 in/hr
Infiltration Capacity = 0.022 cfs

Native Infiltration Rate Used in PA

RESULTS

Pollution Reduction: PASS

Overflow Volume: 0 CF

82% Surf. Cap. Used

Run PAC

Output File

	2-yr	5-yr	10-yr	25-yr
Peak cfs	0.523	0.643	0.763	0.883

Current data has been exported:

Swale 02122014.xls 2/12/2014 5:52:40 PM

FACILITY FACTS

Total Facility Area Including Freeboard = 1,400 SF
Sizing Ratio (Total Facility Area / Catchment Area) = 0.036

Presumptive Approach Calculator Ver 1.2

Instructions:

1. Refer to facility graphics on the Graphics tab, then fill in all relevant facility parameters in the Data Entry table below. Data entry cells vary based on Facility Configuration selected on Facility Design Data tab.
2. Delete all facility parameters that may have been entered by the previous iteration that are no longer applicable.

Run Time 2/12/2014 5:52:28 PM

Project Name: BLOCK 37 Date: 2/12/2014 Catchment ID: Swale

Data Entry

Parameters

Facility Segment	Length of facility segment (ft) $L_{segment}$	Downstream Check Dam Length (ft) L_{dam}	Longitudinal Facility Slope (ft/ft) S	Bottom Width (ft) W_{bottom}	Side Slope Right X_{right}:1	Side Slope Left X_{left}:1	Downstream Depth (inches) D_{ds}	Landscape Width (ft) $W_{landscape}$
1	30	0	0.017	4	3	3	12	10
2	30	0.16	0.017	4	3	3	12	10
3	30	0.16	0.017	4	3	3	12	10
4	30	0.16	0.017	4	3	3	12	10
5	20	0.16	0.017	4	3	3	10	10
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Rock Storage Parameters

Rock Storage Width (ft) W_{rock}	Rock Storage Depth (inches) D_{rock}	Rock Void Ratio v

Error Messages

Project Name: Depth 2= Depth 3=

Worksheet Calculations

Parameters

Facility Segment	Adjusted Length of facility segment (ft) L_{adjust}	Adjusted Length if $D_{up} = 0$ (ft) $L_{adjust2}$	Upstream Depth (inches) D_{up}	Downstream Top Width (ft) $W_{top\text{-}ds}$	Upstream Top Width (ft) $W_{top\text{-}up}$	Downstream Cross-sectional Area (sf) A_{ds}	Upstream Cross-sectional Area (sf) A_{up}	**Surface Capacity Volume** (cf) $V_{surface}$	75% of Max Downstream Depth (inches) $D_{ds75\%}$	75% of Max Upstream Depth (inches) $D_{up75\%}$	75% of Max Adjusted Length if $D_{up75\%} = 0$ (ft) $L_{adjust3}$	75% of Max Downstream Top Width (ft) $W_{top\text{-}ds75\%}$	75% of Max Upstream Top Width (ft) $W_{top\text{-}up75\%}$	**Infiltration Area @ 75% Full** (sf) $A_{75\%}$
1	30.00	N/A	5.88	10.00	6.94	7.00	2.68	145	9.00	2.88	N/A	8.50	5.44	209
2	29.92	N/A	5.90	10.00	6.95	7.00	2.69	145	9.00	2.90	N/A	8.50	5.45	209
3	29.92	N/A	5.90	10.00	6.95	7.00	2.69	145	9.00	2.90	N/A	8.50	5.45	209
4	29.92	N/A	5.90	10.00	6.95	7.00	2.69	145	9.00	2.90	N/A	8.50	5.45	209
5	19.92	N/A	5.94	9.00	6.97	5.42	2.71	81	7.50	3.44	N/A	7.75	5.72	134
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0
								661 $V_{surface}$ @ Depth1						969

Rock Storage Parameters

Rock Storage Length (ft) L_{rock}	**Rock Storage Bottom Area** (sf) A_{rock}	**Rock Storage Capacity Volume** (cf) V_{rock}
30	209	0
30	209	0
30	209	0
30	209	0
20	134	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	969	0

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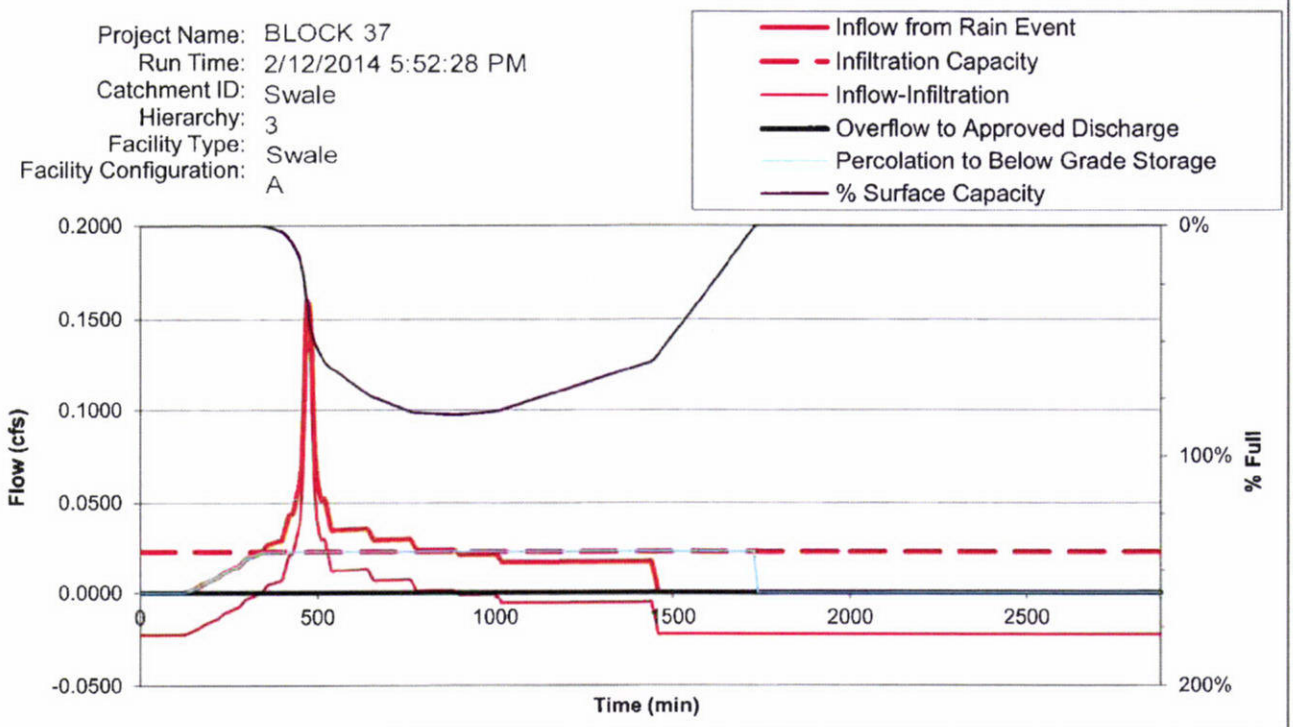
BES - Presumptive Approach Calculator - Ver 1.2

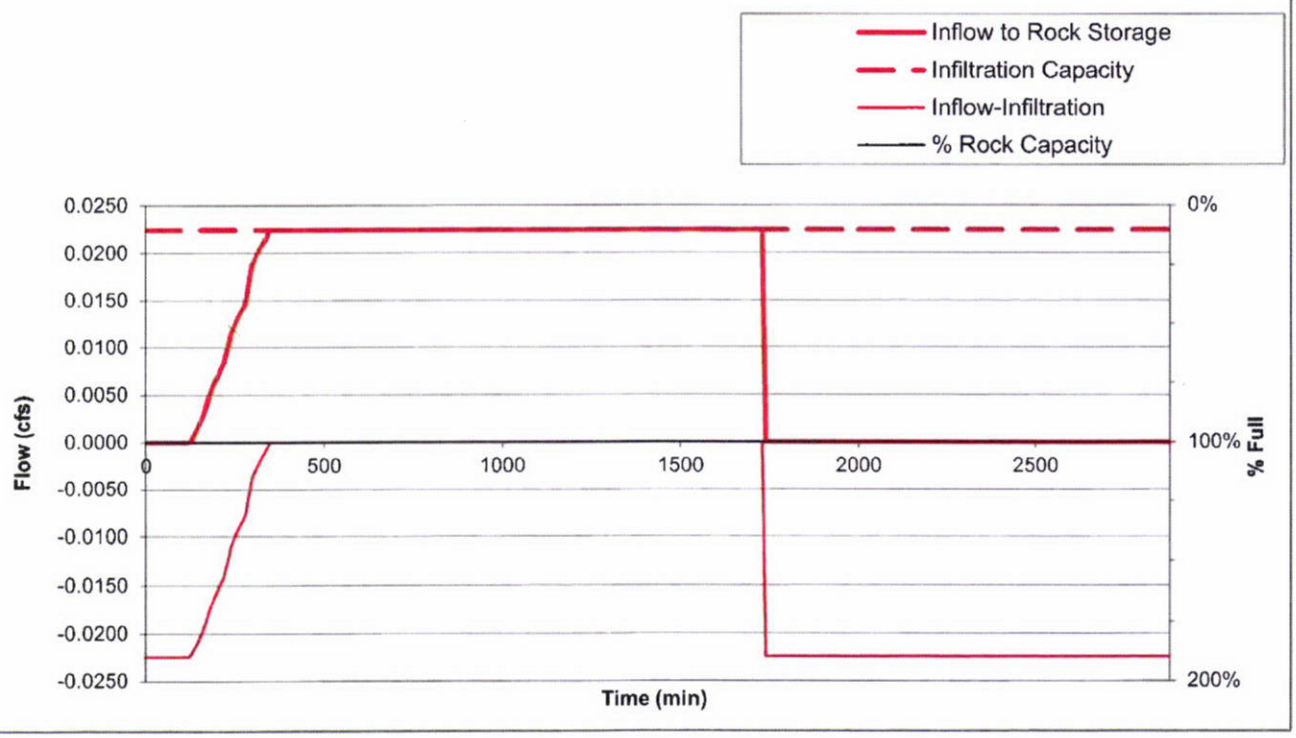
PR Con-A&B

Pollution Reduction Event
Surface Facility Modeling

Project Name: BLOCK 37
Run Time: 2/12/2014 5:52:28 PM
Catchment ID: Swale
Hierarchy: 3
Facility Type: Swale
Facility Configuration: A



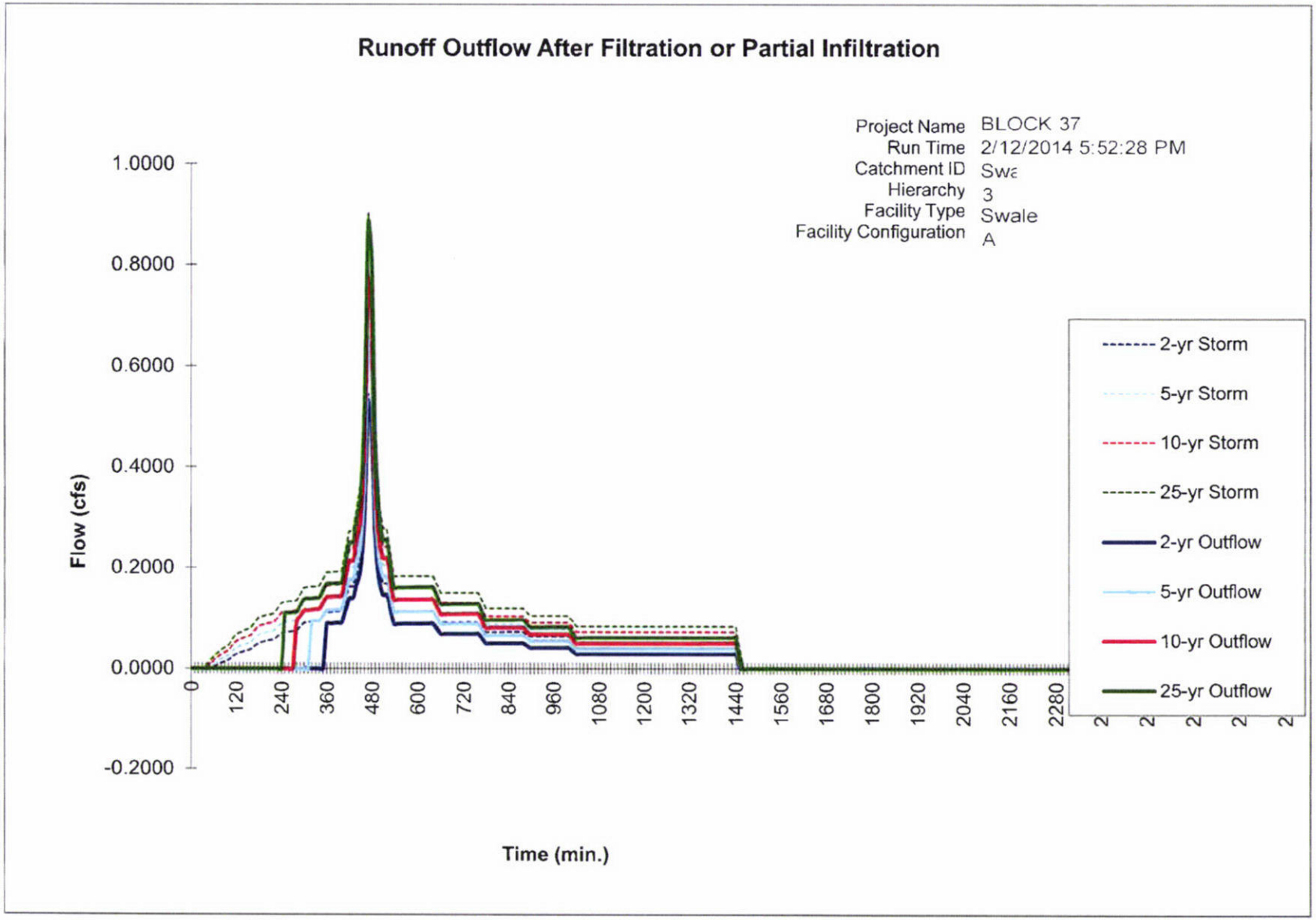
Pollution Reduction Event
Below Grade Modeling



Printed: 2/12/2014 5:53 PM

BES - Presumptive Approach Calculator - Ver 1.2

Output Chart



Presumptive Approach Calculator ver. 1.2

Catchment Data

Catchment ID: Swale B
Date: 02/12/14
Permit Number: 0
Run Time 2/12/2014 5:53:45 PM

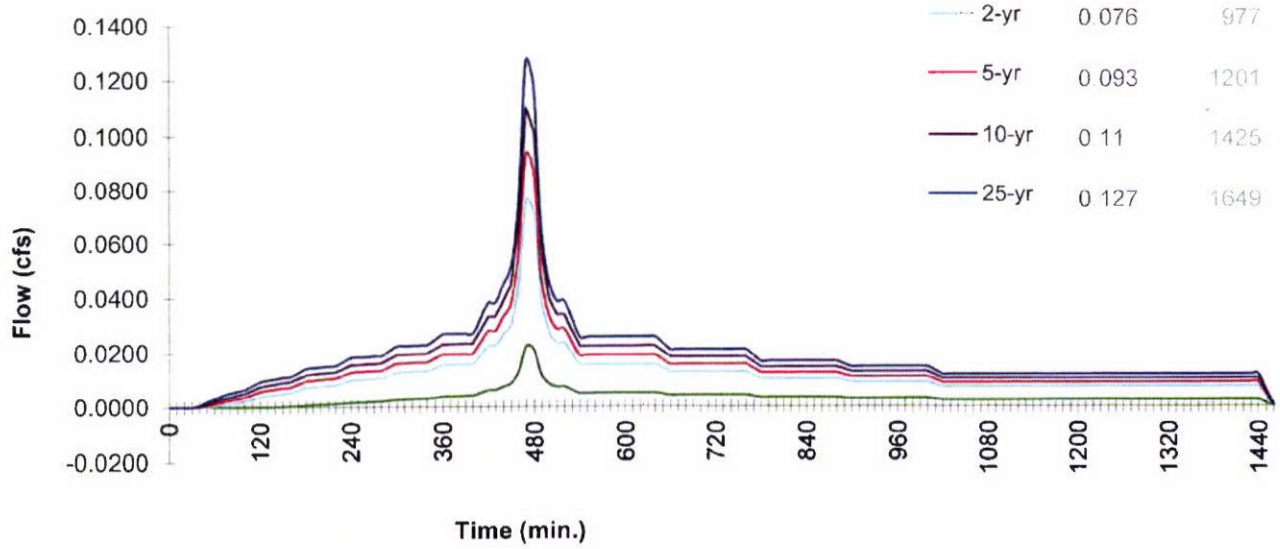
Project Name: BLOCK 37
Project Address: SW River Parkway and SW Gaines
Portland Oregon
Designer: JLB
Company: HHPR

Drainage Catchment Information		
Catchment ID	Swale B	
	Catchment Area	
Impervious Area	5,400	SF
Impervious Area	0.12	ac
Impervious Area Curve Number, CN_{imp}	98	
Time of Concentration, Tc, minutes	5	min.
Site Soils & Infiltration Testing Data		
Infiltration Testing Procedure:	Open Pit Falling Head	
Native Soil Field Tested Infiltration Rate (I_{test}):	2	in/hr
Bottom of Facility Meets Required Separation From High Groundwater Per BES SWMM Section 1.4:	Yes	
Correction Factor Component		
CF_{test} (ranges from 1 to 3)	2	
Design Infiltration Rates		
I_{dsgn} for Native (I_{test} / CF_{test}):	1.00	in/hr
I_{dsgn} for Imported Growing Medium:	2.00	in/hr

Execute SBUH

SBUH Results

	Peak Rate (cfs)	Volume (cf)
PR	0.022	282
2-yr	0.076	977
5-yr	0.093	1201
10-yr	0.11	1425
25-yr	0.127	1649



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Presumptive Approach Calculator ver. 1.2

Catchment ID: Swale B

Run Time 2/12/2014 5:53:45 PM

Project Name: BLOCK 37

Catchment ID: Swale B Date: 2/12/2014

imported file Swale b 02122014.xls - 2/12/2014 5:53:47 PM

Instructions:

1. Identify which Stormwater Hierarchy Category the facility.
2. Select Facility Type.
3. Identify facility shape of surface facility to more accurately estimate surface volume, except for Swales and sloped planters that use the PAC Sloped Facility Worksheet to enter data.
4. Select type of facility configuration.
5. Complete data entry for all highlighted cells.

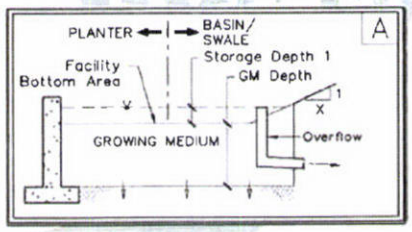
Catchment facility will meet Hierarchy Category: 3

Goal Summary:

Hierarchy Category	SWMM Requirement	RESULTS box below needs to display	
		Pollution Reduction as a	10-yr (aka disposal) as a
3	Off-site flow to drainageway, river, or storm-only pipe system.	PASS	N/A

Facility Type = Swale

Facility Configuration: A



Refer to Sloped Facility Worksheet and enter Variable Parameters

Calculation Guide
Max. Rock Stor. Bottom Area
Per Swale Dims

DATA FOR ABOVE GRADE STORAGE COMPONENT

Infiltration Area = 141 sf
Surface Capacity Volume = 99.0 cf

BELOW GRADE STORAGE

Rock Storage Bottom Area = 141 sf
Rock Storage Depth = 0 in

Growing Medium Depth = 18 in
Freeboard Depth = N/A in

Surface Capacity at Depth 1 = 99 cf
Infiltration Area at 75% Depth1 = 3 SF
GM Design Infiltration Rate = 2.00 in/hr
Infiltration Capacity = 0.007 cfs

Rock Storage Capacity = 0 cf

Native Design Infiltration Rate = 1.00 in/hr
Infiltration Capacity = 0.003 cfs

Native Infiltration Rate Used in PA

RESULTS

Pollution Reduction: PASS | Overflow Volume: 0 CF | 73% Surf. Cap. Used | Run PAC

Output File

	2-yr	5-yr	10-yr	25-yr
Peak cfs	0.073	0.090	0.107	0.123

FACILITY FACTS

Total Facility Area Including Freeboard = 200 SF
Sizing Ratio (Total Facility Area / Catchment Area) = 0.037

Current data has been imported:

Swale b 02122014.xls 2/12/2014 5:53:47 PM

Presumptive Approach Calculator Ver 1.2

Instructions:

1. Refer to facility graphics on the Graphics tab, then fill in all relevant facility parameters in the Data Entry table below. Data entry cells vary based on Facility Configuration selected on Facility Design Data tab.
2. Delete all facility parameters that may have been entered by the previous iteration that are no longer applicable.

Run Time 2/12/2014 5:53:45 PM

Project Name: BLOCK 37 Date: 2/12/2014 Catchment ID: Swale B

Data Entry

Parameters | **Rock Storage Parameters** | **Error Messages**

Facility Segment	Length of facility segment (ft) $L_{segment}$	Downstream Check Dam Length (ft) L_{dam}	Longitudinal Facility Slope (ft/ft) S	Bottom Width (ft) W_{bottom}	Side Slope Right X_{right}:1	Side Slope Left X_{left}:1	Downstream Depth (inches) D_{ds}	Landscape Width (ft) $W_{landscape}$	Rock Storage Width (ft) W_{rock}	Rock Storage Depth (inches) D_{rock}	Rock Void Ratio v
1	10	0	0.0475	4	3	3	12	10			
2	10	0.16	0.0475	4	3	3	12	10			
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

Project Name: Depth 2= Depth 3=

Worksheet Calculations

Parameters | **Rock Storage Parameters**

Facility Segment	Adjusted Length of facility segment (ft) L_{adjust}	Adjusted Length if $D_{up} = 0$ (ft) $L_{adjust2}$	Upstream Depth (inches) D_{up}	Downstream Top Width (ft) $W_{top\text{-}ds}$	Upstream Top Width (ft) $W_{top\text{-}up}$	Downstream Cross-sectional Area (sf) A_{ds}	Upstream Cross-sectional Area (sf) A_{up}	Surface Capacity Volume (cf) $V_{surface}$	75% of Max. Downstream Depth (inches) $D_{ds75\%}$	75% of Max Upstream Depth (inches) $D_{up75\%}$	75% of Max Adjusted Length if $D_{up75\%} = 0$ (ft) $L_{adjust3}$	75% of Max Downstream Top Width (ft) $W_{top\text{-}ds75\%}$	75% of Max Upstream Top Width (ft) $W_{top\text{-}up75\%}$	Infiltration Area @ 75% Full (sf) $A_{75\%}$	Rock Storage Length (ft) L_{rock}	Rock Storage Bottom Area (sf) A_{rock}	Rock Storage Capacity Volume (cf) V_{rock}
1	10.00	N/A	6.30	10.00	7.15	7.00	2.93	50	9.00	3.30	N/A	8.50	5.65	71	10	71	0
2	9.92	N/A	6.35	10.00	7.17	7.00	2.95	49	9.00	3.35	N/A	8.50	5.67	70	10	70	0
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0
								99	$V_{surface}$ @ Depth1					**141**		**141**	**0**

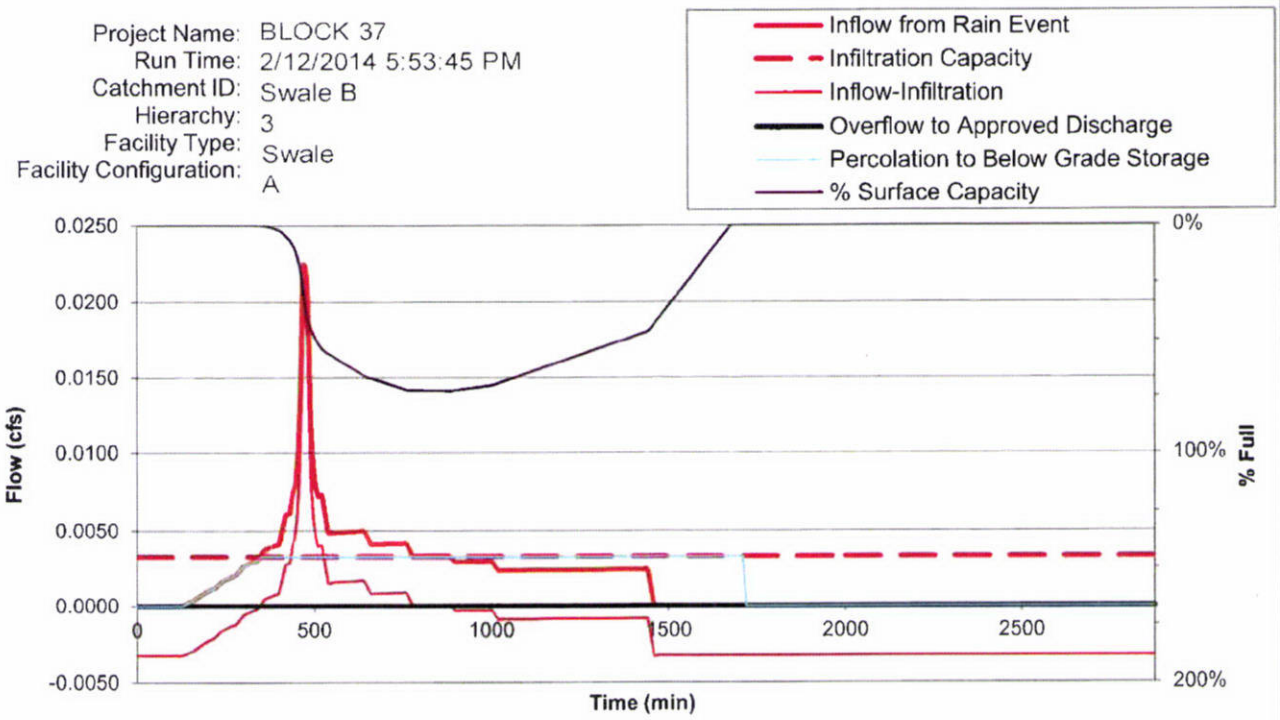
Printed: 2/12/2014 5:54 PM

BES - Presumptive Approach Calculator - Ver 1.2

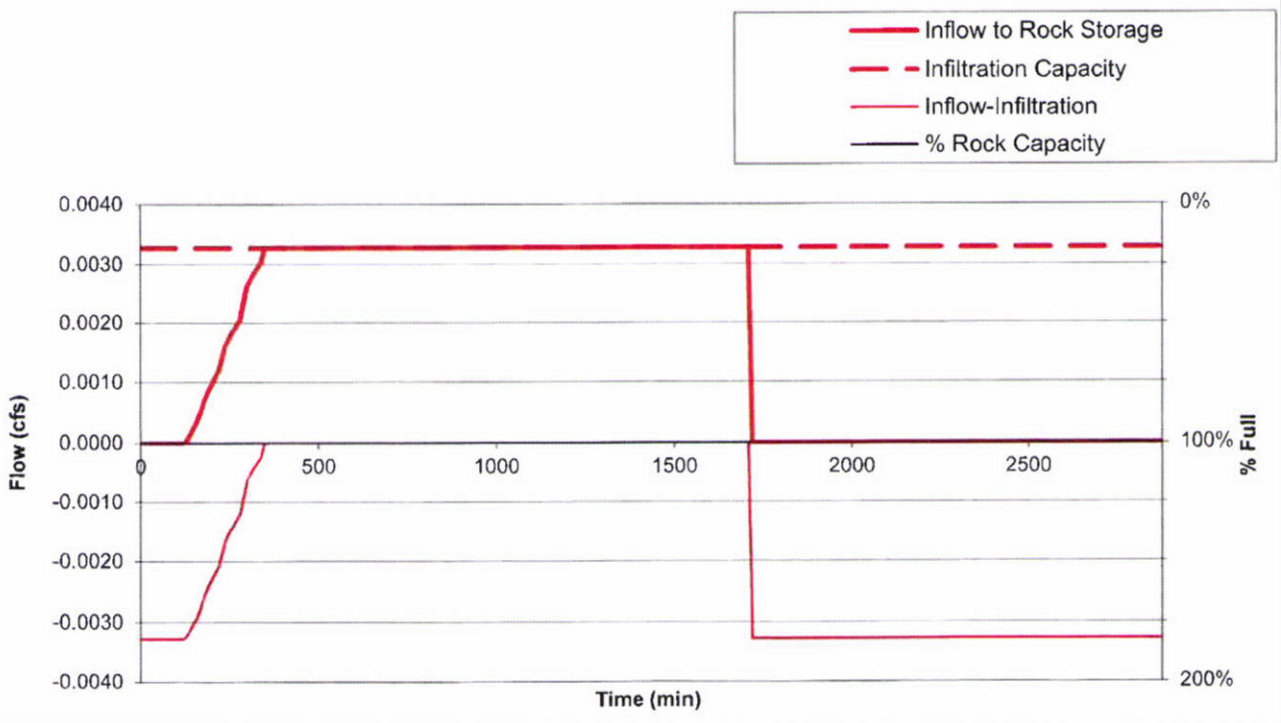
PR Con-A&B

Pollution Reduction Event
Surface Facility Modeling

Project Name: BLOCK 37
Run Time: 2/12/2014 5:53:45 PM
Catchment ID: Swale B
Hierarchy: 3
Facility Type: Swale
Facility Configuration: A



Pollution Reduction Event
Below Grade Modeling



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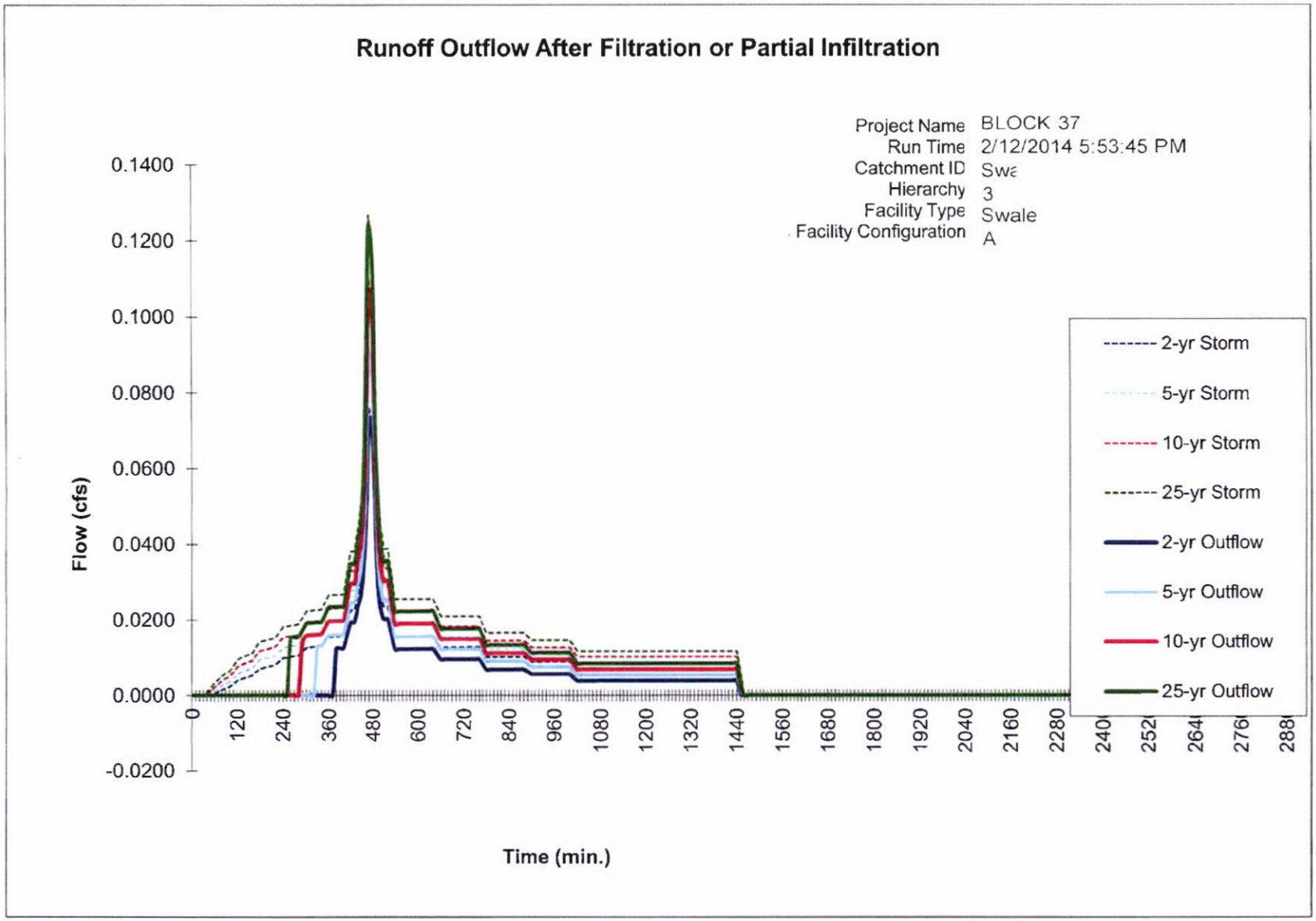
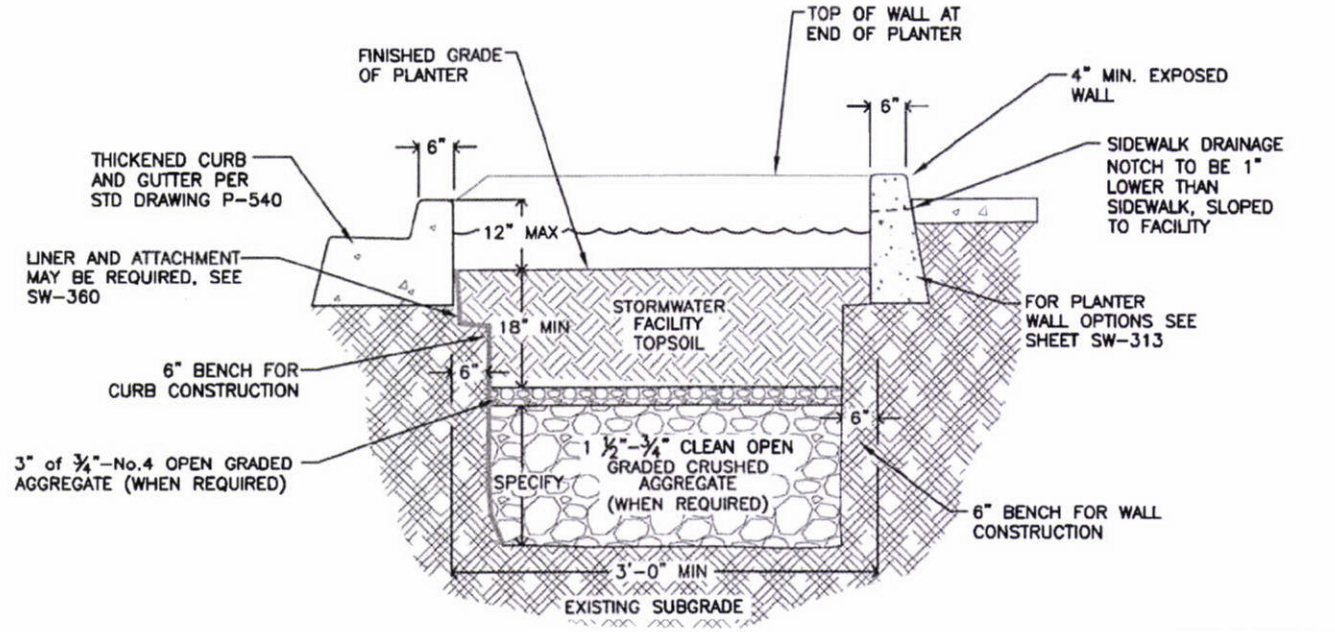
BES - Presumptive Approach Calculator - Ver 1.2

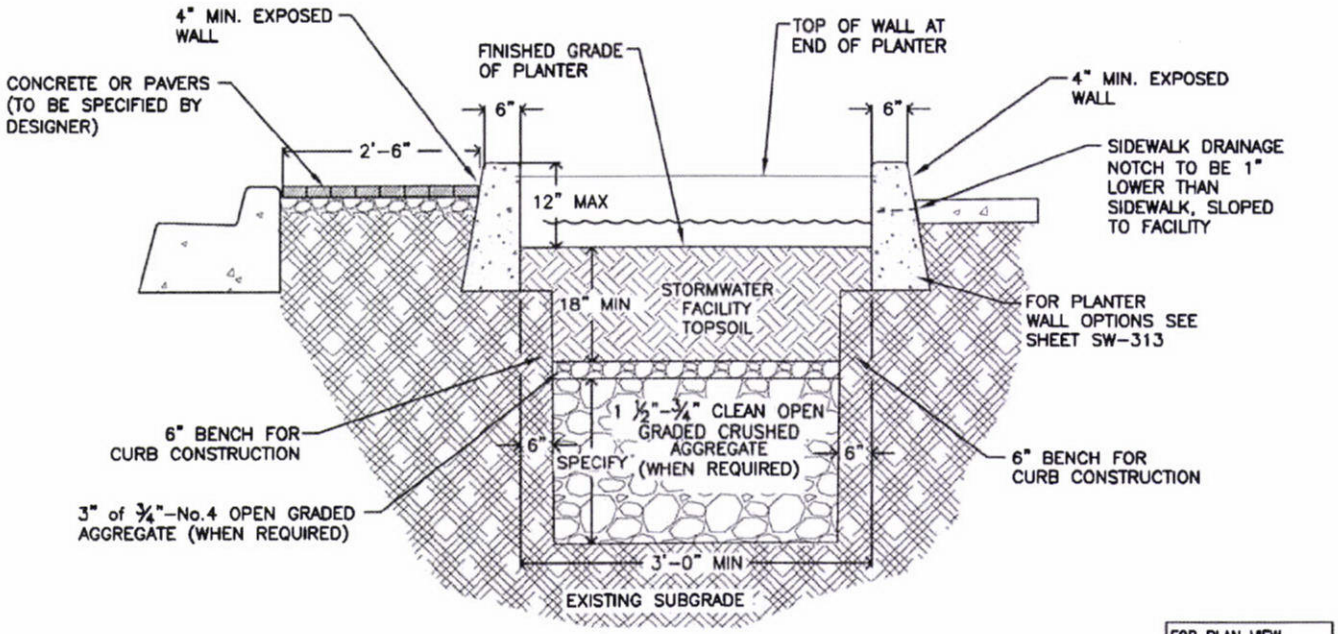
Output Chart





SECTION A-A
PLANTER WITHOUT PARKING

FOR PLAN VIEW REFER TO SW-310



SECTION B-B
PLANTER WITH PARKING

FOR PLAN VIEW REFER TO SW-311

DESIGNER INFORMATION

See SW-335 and SW-336 for Channel and Grate.

CONSTRUCTION NOTE

Scarify the native soil following the initial excavation and before installing topsoil or rock.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT MANUAL TYPICAL DETAILS

NUMBER

SW-312

- 2011 GREEN STREETS -

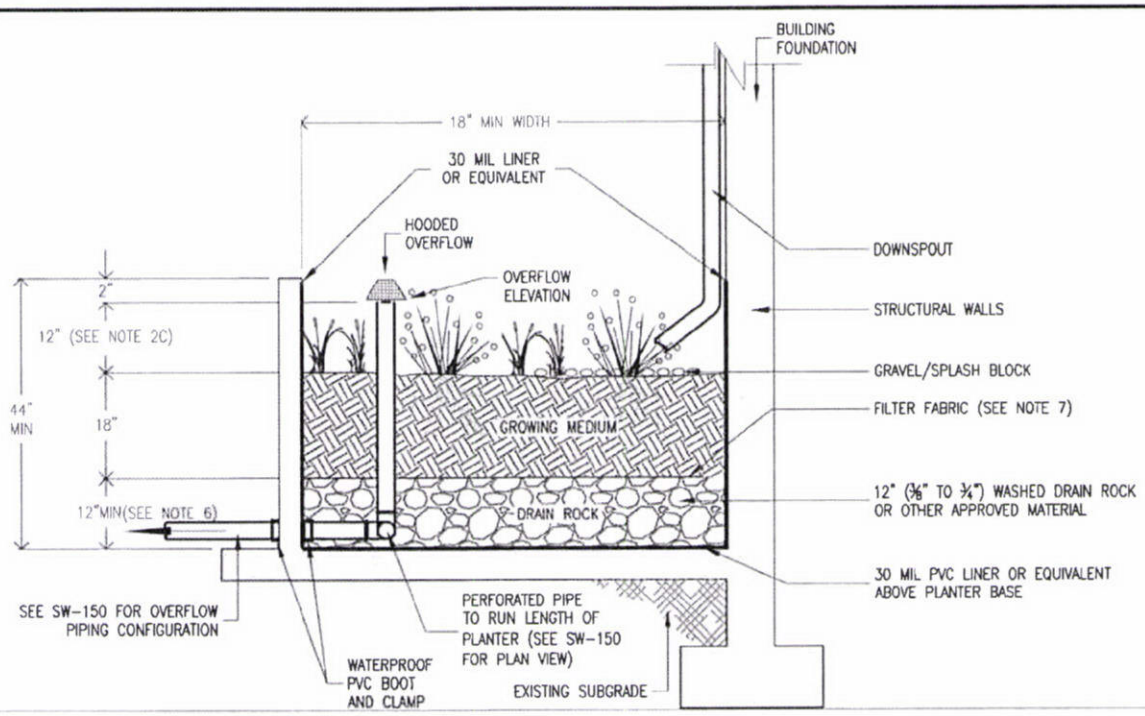
Sections Views

Planters

Bureau of Environmental Services

City of Portland

SET REVISED: 12-08-2011



1. Provide protection from all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during, and after construction.

2. Dimensions:
   a. Width of flow-through planter: 18" minimum.
   b. Width of infiltration planter: 30" minimum.
   c. Depth of planter (from top of growing medium to overflow elevation). Simplified: 12"; Presumptive: 6"- 18".
   d. Slope of planter: 0.5% or less.

3. Setbacks (from centerline of facility):
   a. Infiltration planters must be 10' from foundations and 5' from property lines.
   b. Flow-through planters must be less than 30" in height above surrounding area if within 5 feet of property line.

4. Overflow:
   a. Overflow required for Simplified Approach.
   b. Inlet elevation must allow for 2" of freeboard, minimum.
   c. Protect from debris and sediment with strainer or grate.

5. Piping: shall be ABS Sch.40, cast iron, or PVS Sch.40. 3" pipe required for up to 1,500 sq ft of impervious area, otherwise 4" min. Piping must have 1% grade and follow the Uniform Plumbing Code.

6. Drain rock:
   a. Size for infiltration planter: 1½" - ¾" washed
   b. Size for flow-through planter: ¾" washed
   c. Depth for Simplified: 12"
   d. Depth for Presumptive: 0-48", see calcs.

7. Separation between drain rock and growing medium: Use filter fabric (see SWMM Exhibit 2-4 Geotextile table) or a gravel lens (¾ - ¼ inch washed, crushed rock 2 to 3 inches deep).

8. Growing medium:
   a. 18" minimum
   b. See Appendix F.3 for specification or use sand/loam/compost 3-way mix.

9. Vegetation: Follow landscape plans otherwise refer to plant list in SWMM Appendix F. Minimum container size is 1 gallon. # of plantings per 100sf of facility area:
   a. Zone A (wet) 115 herbaceous plants, OR
   b. Zone A (wet) 100 herbaceous plants and 4 small shrubs.

10. Planter walls:
    a. Material shall be stone, brick, concrete, wood, or other durable material (no chemically treated wood).
    b. Concrete, brick, or stone walls shall be included on foundation plans.

11. Waterproof liner: Shall be 30 mil PVC or equivalent, for flow-through facilities.

12. Install washed pea gravel or river rock to transition from inlet or splash pad to growing medium.

13. Inspections: Call BDS IVR Inspection Line, (503) 823-7000, for appropriate inspections.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT MANUAL TYPICAL DETAILS

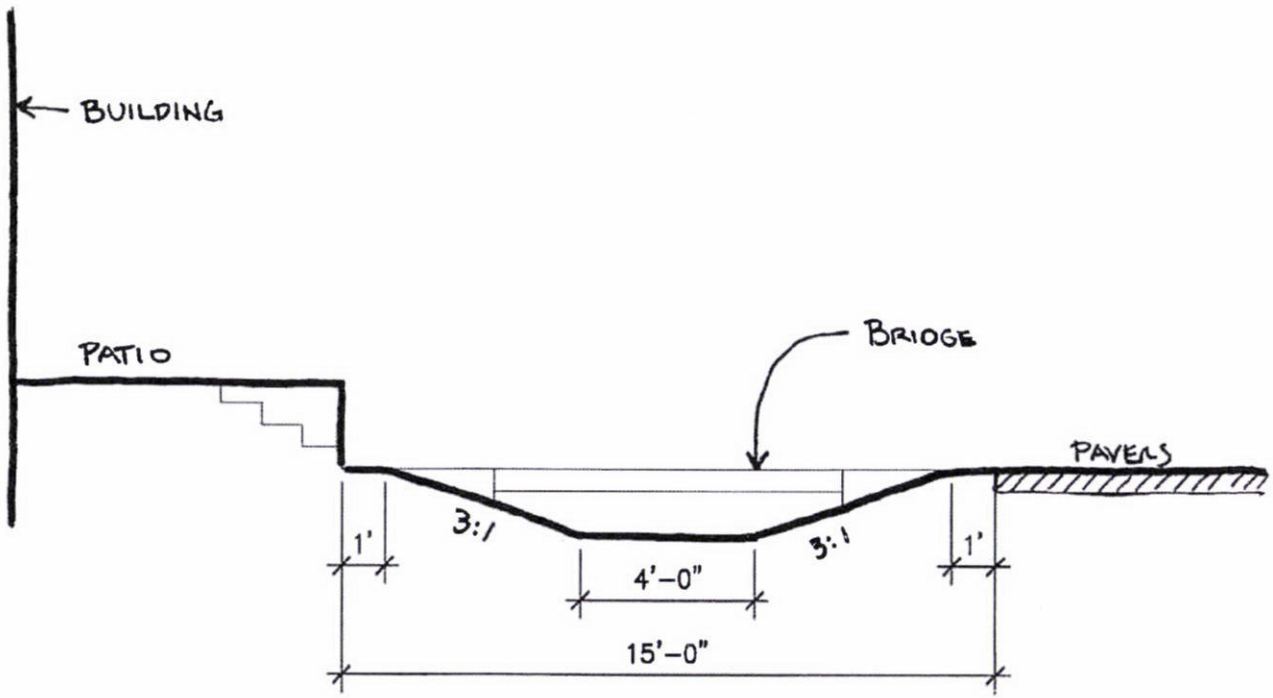
- Simplified / Presumptive Design Approach -

Planter

NUMBER

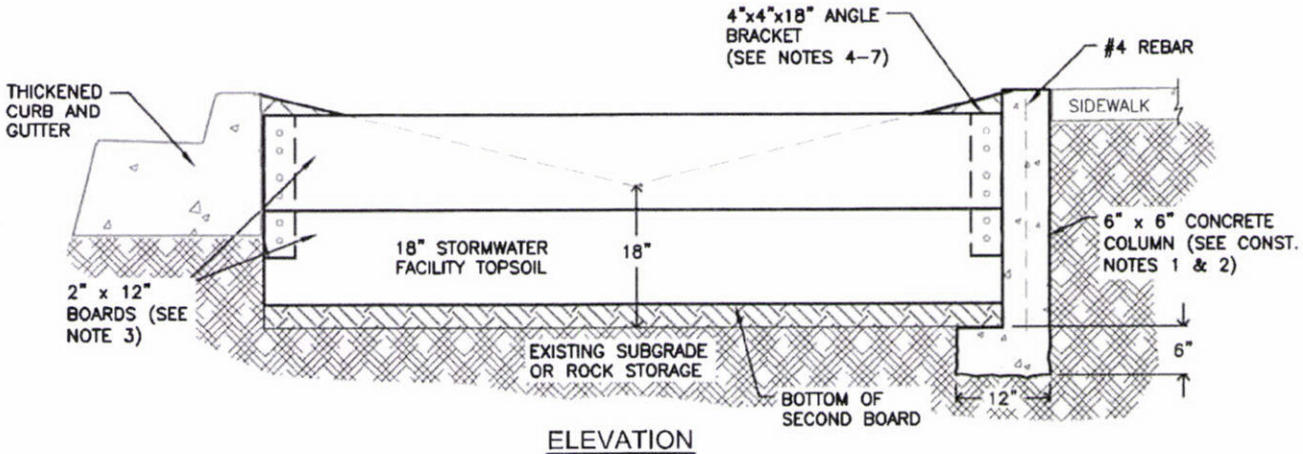
SW-130

Bureau of Environmental Services

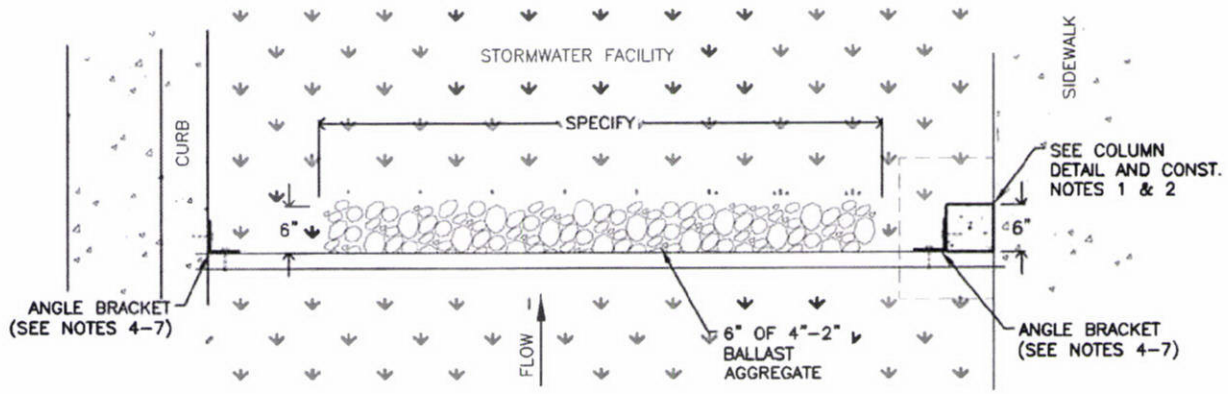


BLOCK 37 - SECTION @ SWALE

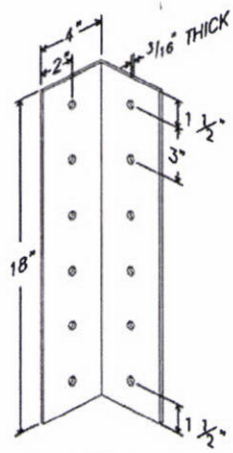
2.10.14
1/4"=1'-0"



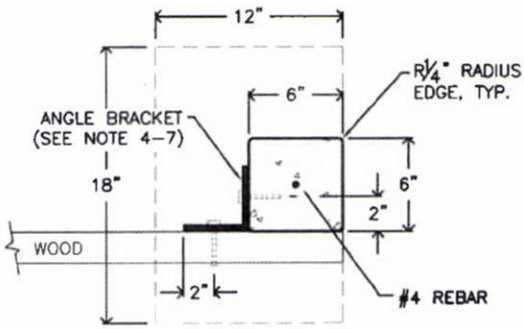
ELEVATION



PLAN



BRACKET DETAIL



COLUMN DETAIL

DESIGNER INFORMATION

1. Provide elevations and stationing and/or dimensioning for check dams.
2. Ensure that check dam elevations do not cause stormwater to overflow to sidewalk.

CONSTRUCTION NOTES

1. Construction grade concrete to be 3000 psi.
2. Base of column is 12" x 18" and 6" thick.
3. Lumber to be a naturally rot-resistant wood (e.g. Cedar, etc.). Manufactured products can be used with approval. No chemically treated wood will be allowed.
4. All fastners to be stainless steel or aluminum.
5. 4" x 4" x 18" angle bracket to be made of min. 3/16" stainless steel, or aluminum.
6. Top of bracket to be no higher than top of check dam.
7. Min. 3 bolts to concrete, min. 2 bolts per board, and 5/16" dia.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT MANUAL TYPICAL DETAILS

NUMBER

SW-341

- 2011 GREEN STREETS -

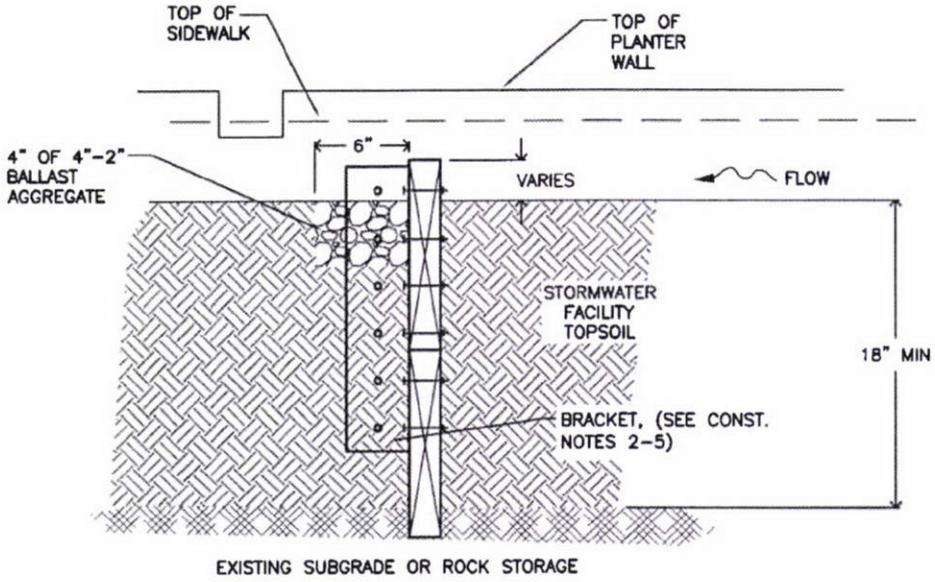
Wood Check Dam for Swales

Check Dams

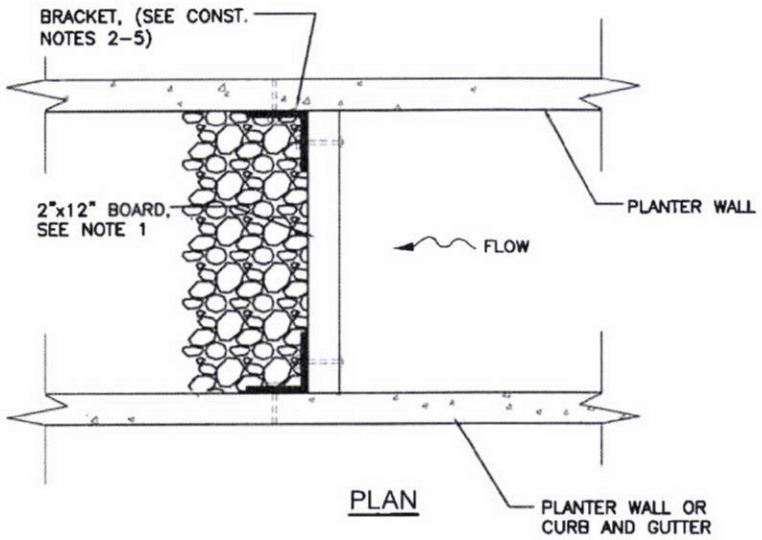
Bureau of Environmental Services

City of Portland

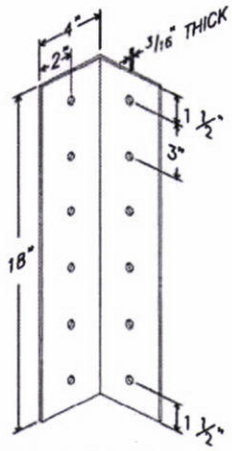
SET REVISED: 12–08–2011



ELEVATION



PLAN



BRACKET DETAIL

DESIGNER INFORMATION

1. For use in planters and curb extension planters.
2. Provide elevations and stationing and/or dimensioning for check dams.
3. Ensure check dam elevations do not cause stormwater to overflow to sidewalk.
4. Cannot be used with "L-shaped" planter wall.

CONSTRUCTION NOTES

1. Lumber to be a naturally rot-resistant wood (e.g. cedar, etc.). Manufactured products may be used with approval. No chemically treated wood will be allowed.
2. All fasteners to be stainless steel or aluminum.
3. 4" x 4" x 18" angle bracket to be made of min. $3/16$" stainles steel or aluminum.
4. Top of bracket to be no higher than top of check dam.
5. Minimum 3 bolts to concrete, minimum 2 bolts per board and $5/16$" diameter bolts.

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT MANUAL TYPICAL DETAILS

NUMBER

SW-342

- 2011 GREEN STREETS -

Wood Check Dam for Planters

Check Dams

Bureau of Environmental Services

City of Portland

SET REVISED: 12-08-2011