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POST CONSTRUCTION STORMWATER MANAGEMENT REPORT
120 VERANDA STREET
PORTLAND, MAINE
February 22, 2012 (Revised March 27th, 2013)

INTRODUCTION

The subject property (the Site) is located at 120 Veranda Street in Portland, Maine. The stormwater runoff from this project discharges via overland sheet flow to the northwest of the property where it drains along the abutting property line, eventually draining to the enclosed drainage system with Hodgins Street.

The approximately 18,094 ± square foot Site is currently a residential lot with a two-story, single family structure featuring associated driveway and walks. The owner proposes to subdivide the property into three separate, single-family lots with associated driveways and site features. This report discusses the Site's hydrological conditions and compares stormwater runoff between existing and proposed conditions.

DATA COLLECTION AND ASSUMPTIONS

Site Data was gathered from an on Site survey performed by Nadeau Land Surveys in March, 2011, as well as utility information on record at the City of Portland. Additionally, a Site visit to confirm existing conditions was performed in February, 2013. This data was used to create a HydroCAD stormwater model, which is based on the United States Department of Agriculture's (USDA) Technical Release 20 (TR-20) and Technical Release 55 (TR-55) hydraulic programs.

Curve numbers (CN's) assigned to differing land cover and soil types were taken from tables within the HydroCAD software, which are from the SCS TR-55 manual, revised 1986. Twenty-four-hour rainfall depths were taken from *Stormwater Management for Maine: Volume III BMP's Technical Design Manual, January 2006.* Time of concentrations were calculated with the HydroCAD software using the TR-55 methodologies including direct entry.

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The existing and proposed watershed subcatchments for this analysis are shown on attached Drawing, D-100, entitled "Pre and Post Development Drainage". The attached HydroCAD output summarizes modeling assumptions for both the pre-development and post-development conditions.

EXISTING SITE CONDITIONS

Land cover at the Site has been modeled as grass/open space and impervious. We have classified the existing structures and driveways as impervious area. For existing conditions, the total Site impervious area is 2,385 ± square feet.

Site topography generally slopes towards the northwest corner of the property. Slopes are generally mild to moderate. Stormwater runoff from the Site travels via overland flow from southeast to northwest.

According to the United States Department of Agriculture and Soil Conservation Service Soil Survey for Cumberland County, on Site soils are reported as "Elmwood", which has a "C" Hydrological Soil Grouping (HSG) classification. "Elmwood" soils are moderately to poorly draining, with a moderate to high rate of stormwater run-off.

PROPOSED SITE CONDITIONS

The proposed improvements include the creation of two new single family lots with construction of two residences with associated driveway and two small grass underdrainded soil filters to mitigate stormwater impacts. Land cover changes include converting grass areas to impervious areas. The proposed improvements will result in 6,265 ± square feet of impervious area, an increase of 3,880 ± square feet from pre-development conditions. Refer to the aforementioned Drawing and HydroCAD model for details of proposed Site improvements.

Two underdrained soil filter beds are proposed, one for each new lot, to mitigate stormwater quality. These ponds have the storage capacity to retain and treat a combination of 4,000 square feet of new impervious area (see calculations and Drawing D-1). The filter beds have been designed per the guidelines as issued by the Maine Department of Environmental Protection in the most recently updated BMP manual (update as of December, 2012).

WATER QUALITY

The two small underdrained soil filter beds have been designed to attenuate stormwater flows from the proposed increase in impervious areas for the two added single-family lots. They have been sized to detain and treat the "first flush", or 1" of stormwater run-off. For general hydrologic modeling purposes, we have included an analysis for the 1" and 2-year storm events. The grading and design for the filter basins has been indicated on the attached Drawing D-100.

WATER QUANTITY

We have provided the hydrologic modeling for the 2, 10 and 25 year storm events. The points of analysis from pre-development to post-development have been altered due to the collection of treated stormwater near Veranda Street (Lot A). In the pre-development conditions, All on-site stormwater runoff drains to POA#1 in Hodgins street. For the post-development conditions, POA#11 represents the flows from Lot A which drain via stormdrain to Veranda street. Due the creation of the new analysis point in the post-development conditions, a waiver for an increase in peak flow stormwater runoff into the City of Portland Stormdrain System will be required. Considering the flow increases are small, and that the stormdrain is separated from the sewer, there will be no significant downstream effects. See Sheet D-100 for graphic representation. A summary of peak flow analysis is below:

Table 1: Summary of Peak Flows

	Pre-Development			Post-Development		
Point of Analysis	2-Year (cfs)	10-Year (cfs)	25-Year (cfs)	2-Year (cfs)	10-Year (cfs)	25-Year (cfs)
POA1/10	0.45	0.97	1.23	0.45	0.85	1.05
POA11	n/a	n/a	n/a	0.04	0.31	0.37

CONCLUSIONS

The proposed stormwater design will use low impact development features, or Stormwater Best Management Practices (BMPs) such as the underdrained soil filters to receive and treat the initial 1", or "first flush", of stormwater runoff. These filter beds, as well as long-term and short-term erosion control measures, will mitigate stormwater runoff to the maximum extent practicable.

Stormwater related calculations and computer modeling are also included with this report.

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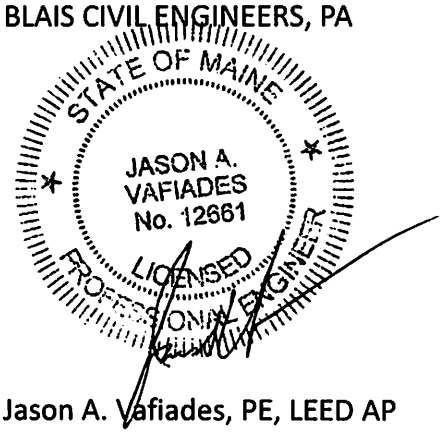

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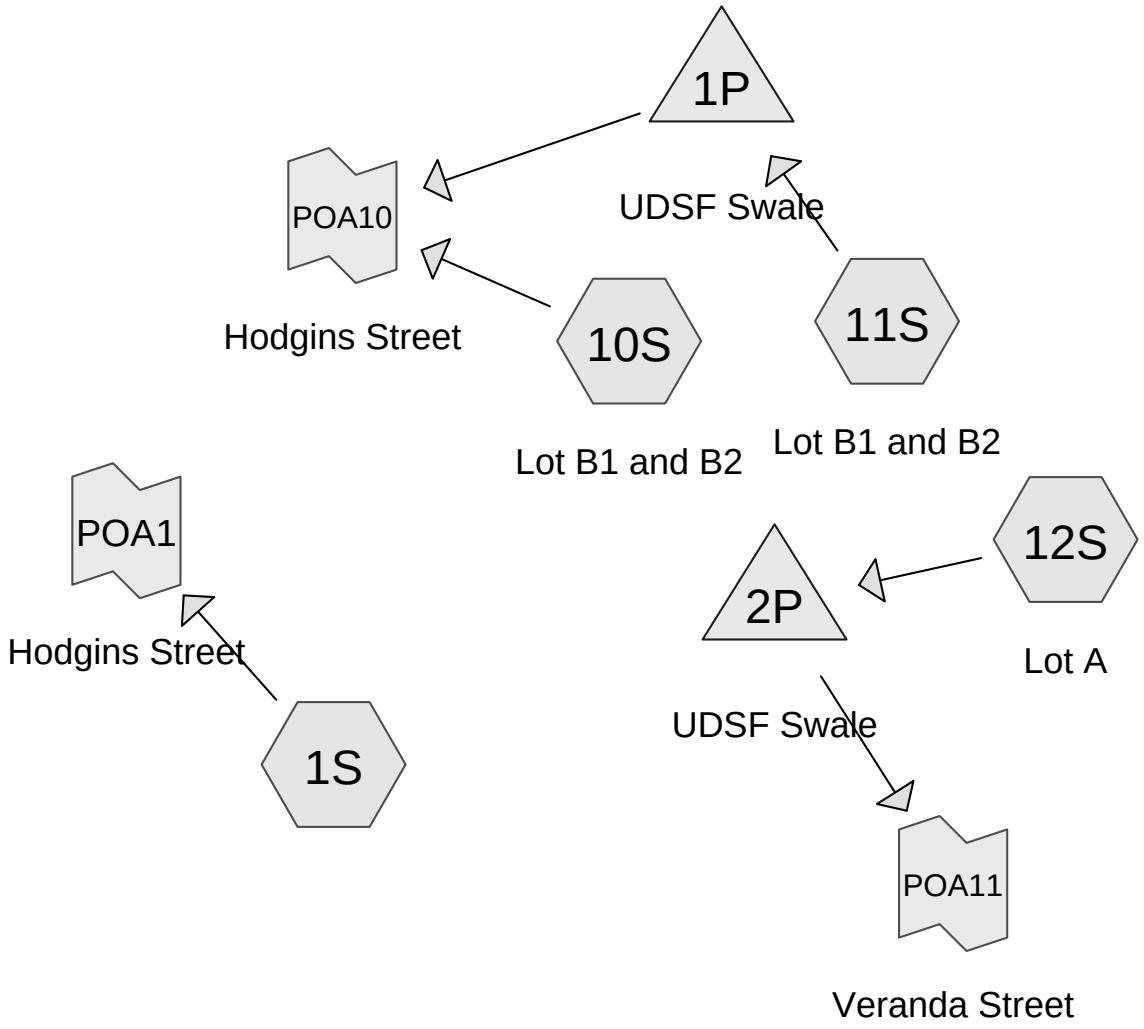

Subcat Reach Pond Link

Routing Diagram for 12164, Pre and Post
Prepared by Blais Civil Engineers, PA, Printed 3/27/2013

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=14,090 sf 22.96% Impervious Runoff Depth=1.25"
Flow Length=115' Slope=0.0200 '/' Tc=6.3 min CN=80 Runoff=0.45 cfs 0.034 af

Subcatchment 10S: Lot B1 and B2 Runoff Area=2,078 sf 45.72% Impervious Runoff Depth=1.59"
Tc=5.0 min CN=85 Runoff=0.09 cfs 0.006 af

Subcatchment 11S: Lot B1 and B2 Runoff Area=8,300 sf 48.13% Impervious Runoff Depth=1.66"
Tc=5.0 min CN=86 Runoff=0.37 cfs 0.026 af

Subcatchment 12S: Lot A Runoff Area=3,690 sf 49.86% Impervious Runoff Depth=1.66"
Tc=5.0 min CN=86 Runoff=0.17 cfs 0.012 af

Pond 1P: UDSF Swale Peak Elev=16.56' Storage=211 cf Inflow=0.37 cfs 0.026 af
Outflow=0.37 cfs 0.030 af

Pond 2P: UDSF Swale Peak Elev=17.45' Storage=143 cf Inflow=0.17 cfs 0.012 af
Outflow=0.04 cfs 0.012 af

Link POA1: Hodgins Street Inflow=0.45 cfs 0.034 af
Primary=0.45 cfs 0.034 af

Link POA10: Hodgins Street Inflow=0.45 cfs 0.036 af
Primary=0.45 cfs 0.036 af

Link POA11: Veranda Street Inflow=0.04 cfs 0.012 af
Primary=0.04 cfs 0.012 af

Total Runoff Area = 0.646 ac Runoff Volume = 0.078 af Average Runoff Depth = 1.45"
64.42% Pervious = 0.416 ac 35.58% Impervious = 0.230 ac

Summary for Subcatchment 1S:

Runoff = 0.45 cfs @ 12.10 hrs, Volume= 0.034 af, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Yr Rainfall=3.00"

	Area (sf)	CN	Description
	10,855	74	>75% Grass cover, Good, HSG C
*	2,835	98	Roof and Driveway
*	400	98	Off-Site Impervious
	14,090	80	Weighted Average
	10,855		77.04% Pervious Area
	3,235		22.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0200	0.14		**Sheet Flow, A to B**
					Grass: Short n= 0.150 P2= 3.00"
0.5	65	0.0200	2.12		**Shallow Concentrated Flow, B to C**
					Grassed Waterway Kv= 15.0 fps
6.3	115	Total			

Summary for Subcatchment 10S: Lot B1 and B2

Runoff = 0.09 cfs @ 12.08 hrs, Volume= 0.006 af, Depth= 1.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Yr Rainfall=3.00"

	Area (sf)	CN	Description
	1,128	74	>75% Grass cover, Good, HSG C
*	950	98	Walkway and Drive
	2,078	85	Weighted Average
	1,128		54.28% Pervious Area
	950		45.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum**

Summary for Subcatchment 11S: Lot B1 and B2

Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.026 af, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Yr Rainfall=3.00"

	Area (sf)	CN	Description
	4,305	74	>75% Grass cover, Good, HSG C
*	1,720	98	Rooftop
*	1,875	98	Drive and Walkway
*	400	98	Off-Site Roof
	8,300	86	Weighted Average
	4,305		51.87% Pervious Area
	3,995		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum**

Summary for Subcatchment 12S: Lot A

Runoff = 0.17 cfs @ 12.08 hrs, Volume= 0.012 af, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Yr Rainfall=3.00"

	Area (sf)	CN	Description
	1,850	74	>75% Grass cover, Good, HSG C
*	1,180	98	Rooftop
*	660	98	Drive and Walkway
	3,690	86	Weighted Average
	1,850		50.14% Pervious Area
	1,840		49.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum**

Summary for Pond 1P: UDSF Swale

Inflow Area = 0.191 ac, 48.13% Impervious, Inflow Depth = 1.66" for 2-Yr event
Inflow = 0.37 cfs @ 12.08 hrs, Volume= 0.026 af
Outflow = 0.37 cfs @ 12.12 hrs, Volume= 0.030 af, Atten= 1%, Lag= 2.3 min
Primary = 0.37 cfs @ 12.12 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 16.56' @ 12.12 hrs Surf.Area= 445 sf Storage= 211 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 76.3 min (900.8 - 824.4)

Volume	Invert	Avail.Storage	Storage Description
#1	13.99'	478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.99	185	0.0	0	0
14.00	185	40.0	1	1
14.49	185	40.0	36	37
14.50	185	0.0	0	37
15.99	185	0.0	0	37
16.00	185	100.0	2	39
16.50	395	100.0	145	184
17.00	780	100.0	294	478

Device	Routing	Invert	Outlet Devices
#1	Primary	14.00'	**12.0" Round Culvert** L= 45.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 14.00' / 13.50' S= 0.0111 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	15.00'	**1.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	16.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.33 cfs @ 12.12 hrs HW=16.56' (Free Discharge)
└**1=Culvert** (Passes 0.33 cfs of 4.28 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 5.93 fps)
└**3=Orifice/Grate** (Weir Controls 0.30 cfs @ 0.80 fps)

Summary for Pond 2P: UDSF Swale

Inflow Area = 0.085 ac, 49.86% Impervious, Inflow Depth = 1.66" for 2-Yr event
Inflow = 0.17 cfs @ 12.08 hrs, Volume= 0.012 af
Outflow = 0.04 cfs @ 12.48 hrs, Volume= 0.012 af, Atten= 75%, Lag= 23.9 min
Primary = 0.04 cfs @ 12.48 hrs, Volume= 0.012 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 17.45' @ 12.48 hrs Surf.Area= 304 sf Storage= 143 cf

Plug-Flow detention time= 31.0 min calculated for 0.012 af (100% of inflow)
Center-of-Mass det. time= 32.4 min (856.9 - 824.4)

Volume	Invert	Avail.Storage	Storage Description
#1	14.99'	401 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
14.99	165	0.0	0	0
15.00	165	40.0	1	1
15.49	195	40.0	35	36
15.50	165	0.0	0	36
16.99	165	0.0	0	36
17.00	165	100.0	2	38
17.50	320	100.0	121	159
18.00	650	100.0	243	401

Device	Routing	Invert	Outlet Devices
#1	Primary	15.00'	**12.0" Round Culvert** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 15.00' / 14.50' S= 0.0045 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	15.00'	**1.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	17.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 12.48 hrs HW=17.45' (Free Discharge)
└**1=Culvert** (Passes 0.04 cfs of 3.80 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 7.47 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link POA1: Hodgins Street

Inflow Area = 0.323 ac, 22.96% Impervious, Inflow Depth = 1.25" for 2-Yr event
Inflow = 0.45 cfs @ 12.10 hrs, Volume= 0.034 af
Primary = 0.45 cfs @ 12.10 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link POA10: Hodgins Street

Inflow Area = 0.238 ac, 47.65% Impervious, Inflow Depth = 1.81" for 2-Yr event
Inflow = 0.45 cfs @ 12.11 hrs, Volume= 0.036 af
Primary = 0.45 cfs @ 12.11 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link POA11: Veranda Street

Inflow Area = 0.085 ac, 49.86% Impervious, Inflow Depth = 1.67" for 2-Yr event
Inflow = 0.04 cfs @ 12.48 hrs, Volume= 0.012 af
Primary = 0.04 cfs @ 12.48 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=14,090 sf 22.96% Impervious Runoff Depth=2.63"
Flow Length=115' Slope=0.0200 '/' Tc=6.3 min CN=80 Runoff=0.97 cfs 0.071 af

Subcatchment 10S: Lot B1 and B2 Runoff Area=2,078 sf 45.72% Impervious Runoff Depth=3.09"
Tc=5.0 min CN=85 Runoff=0.17 cfs 0.012 af

Subcatchment 11S: Lot B1 and B2 Runoff Area=8,300 sf 48.13% Impervious Runoff Depth=3.19"
Tc=5.0 min CN=86 Runoff=0.71 cfs 0.051 af

Subcatchment 12S: Lot A Runoff Area=3,690 sf 49.86% Impervious Runoff Depth=3.19"
Tc=5.0 min CN=86 Runoff=0.31 cfs 0.023 af

Pond 1P: UDSF Swale Peak Elev=16.60' Storage=227 cf Inflow=0.71 cfs 0.051 af
Outflow=0.68 cfs 0.047 af

Pond 2P: UDSF Swale Peak Elev=17.56' Storage=178 cf Inflow=0.31 cfs 0.023 af
Outflow=0.31 cfs 0.022 af

Link POA1: Hodgins Street Inflow=0.97 cfs 0.071 af
Primary=0.97 cfs 0.071 af

Link POA10: Hodgins Street Inflow=0.85 cfs 0.059 af
Primary=0.85 cfs 0.059 af

Link POA11: Veranda Street Inflow=0.31 cfs 0.022 af
Primary=0.31 cfs 0.022 af

Total Runoff Area = 0.646 ac Runoff Volume = 0.156 af Average Runoff Depth = 2.90"
64.42% Pervious = 0.416 ac 35.58% Impervious = 0.230 ac

Summary for Subcatchment 1S:

Runoff = 0.97 cfs @ 12.10 hrs, Volume= 0.071 af, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Yr Rainfall=4.70"

	Area (sf)	CN	Description
	10,855	74	>75% Grass cover, Good, HSG C
*	2,835	98	Roof and Driveway
*	400	98	Off-Site Impervious
	14,090	80	Weighted Average
	10,855		77.04% Pervious Area
	3,235		22.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0200	0.14		**Sheet Flow, A to B**
					Grass: Short n= 0.150 P2= 3.00"
0.5	65	0.0200	2.12		**Shallow Concentrated Flow, B to C**
					Grassed Waterway Kv= 15.0 fps
6.3	115	Total			

Summary for Subcatchment 10S: Lot B1 and B2

Runoff = 0.17 cfs @ 12.07 hrs, Volume= 0.012 af, Depth= 3.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Yr Rainfall=4.70"

	Area (sf)	CN	Description
	1,128	74	>75% Grass cover, Good, HSG C
*	950	98	Walkway and Drive
	2,078	85	Weighted Average
	1,128		54.28% Pervious Area
	950		45.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum**

Summary for Subcatchment 11S: Lot B1 and B2

Runoff = 0.71 cfs @ 12.07 hrs, Volume= 0.051 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Yr Rainfall=4.70"

	Area (sf)	CN	Description
	4,305	74	>75% Grass cover, Good, HSG C
*	1,720	98	Rooftop
*	1,875	98	Drive and Walkway
*	400	98	Off-Site Roof
	8,300	86	Weighted Average
	4,305		51.87% Pervious Area
	3,995		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum**

Summary for Subcatchment 12S: Lot A

Runoff = 0.31 cfs @ 12.07 hrs, Volume= 0.023 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Yr Rainfall=4.70"

	Area (sf)	CN	Description
	1,850	74	>75% Grass cover, Good, HSG C
*	1,180	98	Rooftop
*	660	98	Drive and Walkway
	3,690	86	Weighted Average
	1,850		50.14% Pervious Area
	1,840		49.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum**

Summary for Pond 1P: UDSF Swale

Inflow Area = 0.191 ac, 48.13% Impervious, Inflow Depth = 3.19" for 10-Yr event
Inflow = 0.71 cfs @ 12.07 hrs, Volume= 0.051 af
Outflow = 0.68 cfs @ 12.09 hrs, Volume= 0.047 af, Atten= 3%, Lag= 0.9 min
Primary = 0.68 cfs @ 12.09 hrs, Volume= 0.047 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 16.60' @ 12.09 hrs Surf.Area= 472 sf Storage= 227 cf

Plug-Flow detention time= 38.6 min calculated for 0.047 af (93% of inflow)
Center-of-Mass det. time= 1.2 min (807.1 - 805.9)

Volume	Invert	Avail.Storage	Storage Description
#1	13.99'	478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.99	185	0.0	0	0
14.00	185	40.0	1	1
14.49	185	40.0	36	37
14.50	185	0.0	0	37
15.99	185	0.0	0	37
16.00	185	100.0	2	39
16.50	395	100.0	145	184
17.00	780	100.0	294	478

Device	Routing	Invert	Outlet Devices
#1	Primary	14.00'	**12.0" Round Culvert** L= 45.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 14.00' / 13.50' S= 0.0111 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	15.00'	**1.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	16.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.66 cfs @ 12.09 hrs HW=16.60' (Free Discharge)
└**1=Culvert** (Passes 0.66 cfs of 4.32 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 6.01 fps)
  └**3=Orifice/Grate** (Weir Controls 0.63 cfs @ 1.02 fps)

Summary for Pond 2P: UDSF Swale

Inflow Area = 0.085 ac, 49.86% Impervious, Inflow Depth = 3.19" for 10-Yr event
Inflow = 0.31 cfs @ 12.07 hrs, Volume= 0.023 af
Outflow = 0.31 cfs @ 12.12 hrs, Volume= 0.022 af, Atten= 1%, Lag= 2.6 min
Primary = 0.31 cfs @ 12.12 hrs, Volume= 0.022 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 17.56' @ 12.12 hrs Surf.Area= 358 sf Storage= 178 cf

Plug-Flow detention time= 33.6 min calculated for 0.022 af (99% of inflow)
Center-of-Mass det. time= 30.0 min (835.9 - 805.9)

Volume	Invert	Avail.Storage	Storage Description
#1	14.99'	401 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
14.99	165	0.0	0	0
15.00	165	40.0	1	1
15.49	195	40.0	35	36
15.50	165	0.0	0	36
16.99	165	0.0	0	36
17.00	165	100.0	2	38
17.50	320	100.0	121	159
18.00	650	100.0	243	401

Device	Routing	Invert	Outlet Devices
#1	Primary	15.00'	**12.0" Round Culvert** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 15.00' / 14.50' S= 0.0045 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	15.00'	**1.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	17.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.27 cfs @ 12.12 hrs HW=17.55' (Free Discharge)
└**1=Culvert** (Passes 0.27 cfs of 3.90 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 7.63 fps)
  └**3=Orifice/Grate** (Weir Controls 0.23 cfs @ 0.73 fps)

Summary for Link POA1: Hodgins Street

Inflow Area = 0.323 ac, 22.96% Impervious, Inflow Depth = 2.63" for 10-Yr event
Inflow = 0.97 cfs @ 12.10 hrs, Volume= 0.071 af
Primary = 0.97 cfs @ 12.10 hrs, Volume= 0.071 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link POA10: Hodgins Street

Inflow Area = 0.238 ac, 47.65% Impervious, Inflow Depth = 2.98" for 10-Yr event
Inflow = 0.85 cfs @ 12.09 hrs, Volume= 0.059 af
Primary = 0.85 cfs @ 12.09 hrs, Volume= 0.059 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link POA11: Veranda Street

Inflow Area = 0.085 ac, 49.86% Impervious, Inflow Depth = 3.17" for 10-Yr event
Inflow = 0.31 cfs @ 12.12 hrs, Volume= 0.022 af
Primary = 0.31 cfs @ 12.12 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=14,090 sf 22.96% Impervious Runoff Depth=3.33"
Flow Length=115' Slope=0.0200 '/' Tc=6.3 min CN=80 Runoff=1.23 cfs 0.090 af

Subcatchment 10S: Lot B1 and B2 Runoff Area=2,078 sf 45.72% Impervious Runoff Depth=3.83"
Tc=5.0 min CN=85 Runoff=0.21 cfs 0.015 af

Subcatchment 11S: Lot B1 and B2 Runoff Area=8,300 sf 48.13% Impervious Runoff Depth=3.94"
Tc=5.0 min CN=86 Runoff=0.87 cfs 0.062 af

Subcatchment 12S: Lot A Runoff Area=3,690 sf 49.86% Impervious Runoff Depth=3.94"
Tc=5.0 min CN=86 Runoff=0.39 cfs 0.028 af

Pond 1P: UDSF Swale Peak Elev=16.62' Storage=234 cf Inflow=0.87 cfs 0.062 af
Outflow=0.84 cfs 0.063 af

Pond 2P: UDSF Swale Peak Elev=17.56' Storage=180 cf Inflow=0.39 cfs 0.028 af
Outflow=0.37 cfs 0.028 af

Link POA1: Hodgins Street Inflow=1.23 cfs 0.090 af
Primary=1.23 cfs 0.090 af

Link POA10: Hodgins Street Inflow=1.05 cfs 0.078 af
Primary=1.05 cfs 0.078 af

Link POA11: Veranda Street Inflow=0.37 cfs 0.028 af
Primary=0.37 cfs 0.028 af

Total Runoff Area = 0.646 ac Runoff Volume = 0.195 af Average Runoff Depth = 3.63"
64.42% Pervious = 0.416 ac 35.58% Impervious = 0.230 ac

Summary for Subcatchment 1S:

Runoff = 1.23 cfs @ 12.10 hrs, Volume= 0.090 af, Depth= 3.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

	Area (sf)	CN	Description
	10,855	74	>75% Grass cover, Good, HSG C
*	2,835	98	Roof and Driveway
*	400	98	Off-Site Impervious
	14,090	80	Weighted Average
	10,855		77.04% Pervious Area
	3,235		22.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0200	0.14		**Sheet Flow, A to B**
					Grass: Short n= 0.150 P2= 3.00"
0.5	65	0.0200	2.12		**Shallow Concentrated Flow, B to C**
					Grassed Waterway Kv= 15.0 fps
6.3	115	Total			

Summary for Subcatchment 10S: Lot B1 and B2

Runoff = 0.21 cfs @ 12.07 hrs, Volume= 0.015 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

	Area (sf)	CN	Description
	1,128	74	>75% Grass cover, Good, HSG C
*	950	98	Walkway and Drive
	2,078	85	Weighted Average
	1,128		54.28% Pervious Area
	950		45.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum**

Summary for Subcatchment 11S: Lot B1 and B2

Runoff = 0.87 cfs @ 12.07 hrs, Volume= 0.062 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

	Area (sf)	CN	Description
	4,305	74	>75% Grass cover, Good, HSG C
*	1,720	98	Rooftop
*	1,875	98	Drive and Walkway
*	400	98	Off-Site Roof
	8,300	86	Weighted Average
	4,305		51.87% Pervious Area
	3,995		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum**

Summary for Subcatchment 12S: Lot A

Runoff = 0.39 cfs @ 12.07 hrs, Volume= 0.028 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Yr Rainfall=5.50"

	Area (sf)	CN	Description
	1,850	74	>75% Grass cover, Good, HSG C
*	1,180	98	Rooftop
*	660	98	Drive and Walkway
	3,690	86	Weighted Average
	1,850		50.14% Pervious Area
	1,840		49.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum**

Summary for Pond 1P: UDSF Swale

Inflow Area = 0.191 ac, 48.13% Impervious, Inflow Depth = 3.94" for 25-Yr event
Inflow = 0.87 cfs @ 12.07 hrs, Volume= 0.062 af
Outflow = 0.84 cfs @ 12.09 hrs, Volume= 0.063 af, Atten= 3%, Lag= 0.9 min
Primary = 0.84 cfs @ 12.09 hrs, Volume= 0.063 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 16.62' @ 12.09 hrs Surf.Area= 484 sf Storage= 234 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 24.1 min (824.1 - 799.9)

Volume	Invert	Avail.Storage	Storage Description
#1	13.99'	478 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.99	185	0.0	0	0
14.00	185	40.0	1	1
14.49	185	40.0	36	37
14.50	185	0.0	0	37
15.99	185	0.0	0	37
16.00	185	100.0	2	39
16.50	395	100.0	145	184
17.00	780	100.0	294	478

Device	Routing	Invert	Outlet Devices
#1	Primary	14.00'	**12.0" Round Culvert** L= 45.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 14.00' / 13.50' S= 0.0111 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	15.00'	**1.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	16.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.82 cfs @ 12.09 hrs HW=16.61' (Free Discharge)
└**1=Culvert** (Passes 0.82 cfs of 4.34 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 6.04 fps)
└**3=Orifice/Grate** (Weir Controls 0.78 cfs @ 1.10 fps)

Summary for Pond 2P: UDSF Swale

Inflow Area = 0.085 ac, 49.86% Impervious, Inflow Depth = 3.94" for 25-Yr event
Inflow = 0.39 cfs @ 12.07 hrs, Volume= 0.028 af
Outflow = 0.37 cfs @ 12.09 hrs, Volume= 0.028 af, Atten= 4%, Lag= 1.2 min
Primary = 0.37 cfs @ 12.09 hrs, Volume= 0.028 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 17.56' @ 12.09 hrs Surf.Area= 361 sf Storage= 180 cf

Plug-Flow detention time= 26.9 min calculated for 0.028 af (100% of inflow)
Center-of-Mass det. time= 27.8 min (827.7 - 799.9)

Volume	Invert	Avail.Storage	Storage Description
#1	14.99'	401 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
14.99	165	0.0	0	0
15.00	165	40.0	1	1
15.49	195	40.0	35	36
15.50	165	0.0	0	36
16.99	165	0.0	0	36
17.00	165	100.0	2	38
17.50	320	100.0	121	159
18.00	650	100.0	243	401

Device	Routing	Invert	Outlet Devices
#1	Primary	15.00'	**12.0" Round Culvert** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 15.00' / 14.50' S= 0.0045 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	15.00'	**1.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	17.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.36 cfs @ 12.09 hrs HW=17.56' (Free Discharge)
└**1=Culvert** (Passes 0.36 cfs of 3.91 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 7.64 fps)
  └**3=Orifice/Grate** (Weir Controls 0.32 cfs @ 0.81 fps)

Summary for Link POA1: Hodgins Street

Inflow Area = 0.323 ac, 22.96% Impervious, Inflow Depth = 3.33" for 25-Yr event
Inflow = 1.23 cfs @ 12.10 hrs, Volume= 0.090 af
Primary = 1.23 cfs @ 12.10 hrs, Volume= 0.090 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link POA10: Hodgins Street

Inflow Area = 0.238 ac, 47.65% Impervious, Inflow Depth = 3.92" for 25-Yr event
Inflow = 1.05 cfs @ 12.09 hrs, Volume= 0.078 af
Primary = 1.05 cfs @ 12.09 hrs, Volume= 0.078 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Link POA11: Veranda Street

Inflow Area = 0.085 ac, 49.86% Impervious, Inflow Depth = 3.94" for 25-Yr event
Inflow = 0.37 cfs @ 12.09 hrs, Volume= 0.028 af
Primary = 0.37 cfs @ 12.09 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

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Post Stormwater Management Plan: Inspection and Maintenance
For Stormwater Best Management Practices (BMPS)

120 Veranda Street
Portland, Maine

March 2013

Stormwater management facilities include paved surfaces, vegetated areas and underdrained filter ponds. During construction activities, the maintenance of all stormwater measures will be the direct responsibility of the Contractor. After acceptance by the Owner, the maintenance of all stormwater management facilities, the establishment of any contract services required for implementing the program, and the keeping of records and maintenance log book will be the responsibility of the Owner. At a minimum, the following maintenance activities for each stormwater management system shall be performed on the prescribed schedule.

RECERTIFICATION REQUIREMENT

Each one-year interval from June 30, within 12 months of the date of issuance of the permit, the permittee is technically required to certify the following to the City of Portland, Department of Public Services, as described in Chapter 32 of the City of Portland, Maine Ordinances.

(a) All areas of the project site have been inspected for areas of erosion, and appropriate steps have been taken to permanently stabilize these areas.
(b) All aspects of the stormwater control system have been inspected for damage, wear, and malfunction, and appropriate steps have been taken to repair or replace the facilities.
(c) The erosion and stormwater maintenance plan for the site is being implemented as written, or modifications to the plan have been submitted to and approved by the City of Portland and by June 30 or each year, provide a completed and signed certification to the Department of Public Services on the proper form.

Considering that this is a small project, the permittee seeks to waive the recertification requirement.

PAVED SURFACES

Accumulations of sediment, wood debris, and winter sand along paved surfaces shall be cleared at least once a month, and periodically during the year on an as-needed basis, to

780 Broadway
South Portland, ME · 04106
207-767-7300 · BLAISce.com

minimize transportation of sediment during rainfall events. Accumulations on pavement may be removed by pavement sweeping or vacuuming. Accumulations of sand along road shoulders may be removed by grading excess sand to the pavement edge and removing it manually or by a front-end loader. Grading of gravel roads, or grading of the gravel shoulders of gravel or paved roads, must be routinely performed to ensure that stormwater drains immediately off the road surface to adjacent buffer areas or stable ditches, and is not impeded by accumulations of graded material on the road shoulder or by excavation of false ditches in the shoulder.

VEGETATED AREAS

Vegetated areas should be inspected monthly and after significant rainfall/snow melt events. Slopes or embankments should be inspected for erosion and sediment buildup. All debris should be removed. Bare areas or areas with sparse growth should be re-vegetated as soon as possible to prevent erosion. Areas of rill erosion should be lined with an appropriate lining or the erosive flow diverted to an area able to withstand the concentrated flow.

A maintenance program should be set up to maintain the vegetative cover of the vegetated area. Periodic liming and fertilizing shall be based on soil tests or visual observations. Vegetated areas should be mowed at least once annually.

The removed material must be disposed of in accordance with all applicable federal, state, and local regulations.

The date and initials of the inspector should be recorded on the forms provided as well as notations of any corrective actions that were taken and the approximated volume of sediment or materials that were removed. Any damage, unusual conditions, or maintenance procedures needed/performed should be noted by the inspector on the forms provided.

UNDERDRAINED FILTER PONDS

Underdrained filter ponds are impoundments designed to temporarily store runoff and release it at a controlled rate through an underdrain system, ultimately draining into the existing City storm drainage system.

Ponds should be inspected annually for erosion, destabilization of side slopes, embankment settling and other signs of structural failure, and loss of storage volume due to sediment accumulation. Corrective action should be taken immediately upon identification of problems.

Embankments should be maintained to preserve their integrity as impoundment structures, including, but not necessarily limited to, vegetative maintenance (mowing, control of woody vegetation), rodent control, erosion control and repair.

DISPOSAL

Any sediment or debris removed during maintenance of the stormwater system must be disposed of in accordance with the Maine Solid Waste Disposal Rules.

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Maintenance Log

Sample Inspection Report:

120 VERANDA STREET
STORMWATER FACILITIES INSPECTION REPORT

NAME: _____ SIGNATURE: _____

TITLE: _____ COMPANY: _____

DATE: _____

OBSERVATIONS:

BMP	Defects	Location(s)	Repair/Action Needed	Date/Action taken
Paved Sufaces	Yes/no			
Vegetated Areas	Yes/no			
UD Filter Ponds	Yes/no			

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