



ATTACHMENTS

Attachment A - Scope of Work

Scope of Work

The following section outlines the scope of work completed in regards to the LID Demonstration Projects in accordance with the Work Plan as established in consultation with the City of Ottawa. The established Work Plan has been organized into three (3) distinct phases that are detailed below. It is acknowledged that the work plan will be subject to refinement as part of the review and consultation process with the City and the SWM Working Group.

Phase 1 – Development of Existing Conditions Report and LID Demonstration Project Scoping Document.

Phase 2 - Modelling and Interim Review of Draft Preliminary Design "Demonstration Plan" and includes the following sub-tasks:

- LID Demonstration Plan targets and criteria (water quality, erosion, flood control and infiltration)
 - § Targets for LID Demonstration Plan lot-level controls in regards to the ultimate land-

uses (i.e. residential vs. employment uses)

§ Targets LID Demonstration Plan for conveyance controls

§ Targets for LID Demonstration Plan end-of-pipe controls to be potentially implemented in future phases based on monitoring results.

- Model selection and agreement on model parameters/inputs for the LID Demonstration Project in consultation with the SWM Working Group
- Modelling, results, analysis and reporting
- Operations & Maintenance and Assumption Protocols

§ Potential LID operations and maintenance considerations, typical requirements and expected costs.

§ Recommended LID assumption protocols

- Strategies for subsequent phases and demonstration plans
- Implications for CDP

Phase 3 - Preliminary Design for LID Demonstration Project Phase 1 and includes the following sub-tasks:

- Final Review of Preliminary Design
- CDP Recommendations
- Implementation recommendations including but not limited to:
 - Monitoring program recommendations based on project objectives and targets developed from Stage 1
 - LID Demonstration Project reporting requirements
 - Adaptive Management Process (feedback process) whereby monitoring results are used to inform/refine future LID phases and used to refine modelling assumptions and SWM credits.

Phase 2 – Specifics

The following section provides greater detail in regards to the specific activities completed in the satisfaction of Phase 2 of the Work Plan.

1. Infiltration Testing

Infiltration testing of surficial soils will be completed to carry out the LID feasibility analysis and future design. The proposed Work Plan is based on borehole and test pit logs completed by DST. The in-situ infiltration testing is required for all infiltration-based LID designs and must be used to confirm and to refine the coarse estimates performed as part of the geotechnical assessment. The testing is required to determine the infiltration capacity of site specific soils, to design appropriate sizes of each facility, to determine if underdrains are required and to locate any drains within the facility cross-section. These data will allow an accurate forecast of post-development performance.

In-situ soil testing will be a combination of:

- Guelph Permeameter Testing apparatus and protocols to determine the in-situ

saturated hydraulic conductivity and the design infiltration rate as per the LID Stormwater Planning and Design Guide Version 1.0 (TRCA/CVC 2010). Testing locations will be targeted to the proposed footprint of the infiltration facilities as required. Approximately 22 locations are proposed for sampling.

- Double Ring Infiltrometer to provide an infiltration rate of shallow soils at the existing land surface, at the likely interface of the proposed grade raise, to account for the effects of micro-tubules, rootlets and other macropores. A total of 6 tests are anticipated.

2. Water Balance Model

The development of a water balance model for the Former CFB Rockcliffe CDP site will be completed using EPA-SWMM software, and will be based on the completed geotechnical and hydrogeological reports.

The model will be developed such that future (Stage 2 and beyond) LID options can be assessed in terms of flow reductions (water quantity and erosion), water quality, and infiltration. The model results will be utilized to develop LID SWM targets. It is

assumed that the model would include Phases 1-3 of the Rockcliffe Development.

The water balance assessment of the study area will analyze pre- and post-development hydrology and carry out an impact assessment using the following two methods:

- a) Assessment of the hydrologic regime: long term hydrologic modeling to assess the overall hydrology of the study area,
- b) Assessment of Infiltration Deficit: specific assessment for estimating the difference between water infiltrated into the ground under pre- and post-development conditions.

2.1 Assessment of the Hydrologic Regime

Long term hydrologic modeling for pre- and post-development conditions will be carried out to define general hydrologic processes, specifically surface runoff hydrology (flow rate and runoff volume) and infiltration and evaporation volumes. Since observed streamflow data are not available to calibrate and validate the hydrologic model, the model will not be calibrated. However, available background information from the

study area, in addition to previous modeling experience under similar conditions, will be used to refine the results as appropriate.

To develop the long term hydrologic model, a continuous precipitation and air temperature record has been gathered and will be applied.

The EPA SWMM model was used as a modeling platform. Developed by the U.S. Environmental Protection Agency (EPA); the EPA SWMM model and its variants (XPSWMM, PCSWMM, InfoSWMM) is a widely used model that is well suited for urban and rural areas, as it performs water quality, quantity and water balance assessments suitable for LID simulations. The model was successfully applied by Aquafor as part of subwatershed studies, stormwater management master plans, and site-based LID modeling and analysis.

2.2 Assessment of Infiltration Deficit

The assessment of the impact of development on infiltration to the ground will be done in accordance with Hydrogeological Assessment Submissions-Conservation Authority Guidelines (June,

2013). Accordingly, the following activities will be undertaken:

- a) Collect climate data (air temperature), soils data (soil types and hydraulic conductivity), and land use data (imperviousness and land cover) for the study area;
- b) Estimate the evapotranspiration component of the hydrologic regime for the Study Area using Thornthwaite (1948) and available climate data, and calculate total water surplus;
- c) Define catchment area/Management Unit area, including imperviousness, land cover, and runoff coefficient under pre- and post-development conditions;
- d) Pre-development assessment: Estimate inputs (including precipitation, run-on and other inputs) and outputs (including evapotranspiration, infiltration, and surface runoff).
- e) Post-development assessment: Estimate inputs and outputs.
- f) Estimate the output volume deficit between pre- and post-development (i.e. changes in hydrologic output volumes between pre- and post-development scenarios).

For the assessment of infiltration deficit, water balance spreadsheets (Microsoft Excel) will be used, and output volumes will be estimated using imperviousness values and other physical parameters deemed to change under post-development conditions for different land uses and catchment areas.

3. Stream Erosion Assessment

The erosion assessment scenarios would include the following:

- a) Pre-development conditions scenario
- b) Post-development conditions scenario (including all proposed development) without SWM control
- c) Post-development conditions scenario (including all proposed development) with SWM control

In order to run these scenarios, a long term hydrologic model will be carried out and statistical analyses will be done to estimate the change in time of exceedance (flow duration analysis) for storm events with different frequencies under pre- and post-development conditions. The flow regimes (magnitudes and frequencies) will be analyzed under pre- and post-development conditions, and comparative results will be

presented in figures and tables for the two flow regimes.

Moreover, the 2-year storm event, which is generally linked to bankfull flows responsible for sediment removal and channel maintenance, will be analyzed under pre- and post-development conditions (in addition to post-development with SWM control conditions). All relevant pond design information (including size, surface area, and control structures) will be included in the model.

It should be noted that the hydraulic assessment of stream erosion under pre- and post-development conditions will not be included at this stage. More specifically, developing a hydraulic model (HEC-RAS) for the two streams should be a subsequent step (see Step 5) that would use the hydrologic model input to investigate hydraulic variables including shear stress, velocity, and water depth along the two streams. Accordingly, key locations such as downstream of culverts and the potential impact of increasing flows on channel stability would be further investigated and analyzed.

4. Hydraulic Model Development

A detailed hydraulic modelling of the Eastern and Western tributaries will be developed to facilitate stream rehabilitation assessments and designs using the HEC-RAS modelling software.

5. Operations & Maintenance and Assumption Protocols

The completed tasks will be completed in parallel to the MSS including but not limited to:

- a) Potential LID operations and maintenance considerations, typical requirements and expected costs.
- b) Recommended LID assumption protocols

6. Strategies for Subsequent Phases and Demonstration Plans

In consultation with the City of Ottawa and the SWM Working Group strategies for each subsequent phase of development and servicing will be developed including plans for subsequent phases of the LID Demonstration Project

Phase 3 – Specifics

In the fulfillment of Phase 3 of the Work Plan, the following tasks were completed.

1. Development of Typical LID Details


Following the selection of the preferred LID controls for each land-use, typical LID design details will be prepared (i.e. preliminary design) in support of the CDP. LID Preliminary concepts will include:

- a) Location of proposed LID,
- b) Types of LIDs,
- c) Targets and design criteria,
- d) Anticipated performance of LIDs determined through modelling using the previously developed EPA-SWMM model (Phase 2).

2. LID Recommendations

At the conclusion of Phase 3, a comprehensive document will be prepared which will detail the results of Work Plan (Phases 1-3) and will conclude with implementation recommendations including but not limited to:

- a) By-law considerations
- b) Construction sequencing recommendations, protocols and erosion and sediment control requirements.

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- c) Reporting considerations for privately owned facilities
 - d) Assumption, operation and maintenance protocols (typical tasks, frequency and responsible party)
 - e) Inspection recommendations

- f) Monitoring program recommendations based on project objectives and targets developed from Phase 2
- g) LID demonstration project reporting requirements
- h) Adaptive Management Process (feedback process) whereby

monitoring results are used to inform/refine future LID phases and used to refine modelling assumptions and SWM credits.

Attachment B – Hydrologic Model (Pre-Development)

 NOTE: The summary statistics displayed in this report are
 based on results found at every computational time step,
 not just on results from each reporting time step.

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Flow Routing Method KINWAVE
 Starting Date AUG-01-1996 00:00:00
 Ending Date JAN-01-2014 06:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:15:00
 Wet Time Step 00:15:00
 Dry Time Step 01:00:00
 Routing Time Step 30.00 sec

Rainfall File Summary

Station ID	First Date	Last Date	Recording Frequency	Periods w/Precip	Periods Missing	Periods Malfunc.
1	AUG-08-1996	DEC-31-2013	60 min	28488	0	0

	Volume hectare-m	Depth mm
Runoff Quantity Continuity		
Total Precipitation	3595.217	15454.656
Evaporation Loss	195.685	841.184
Infiltration Loss	2421.786	10410.465
Surface Runoff	992.447	4266.204
Final Surface Storage	0.004	0.018
Continuity Error (%)	-0.409	

	Volume hectare-m	Volume 10^6 ltr
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	992.447	9924.573
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	984.057	9840.669
Internal Outflow	9.336	93.357
Storage Losses	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.001
Continuity Error (%)	-0.095	

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step : 30.00 sec
 Average Time Step : 30.00 sec
 Maximum Time Step : 30.00 sec
 Percent in Steady State : 0.00
 Average Iterations per Step : 1.01

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	15454.66	0.00	423.97	12215.04	2853.71	410.37	1.14	0.185
EXT2	15454.66	0.00	978.90	7619.12	6939.50	204.72	0.28	0.449
BRSWM1	15454.66	0.00	1059.20	7627.17	6853.37	723.72	1.00	0.443
BRSWM2	15454.66	19250.81	1707.07	8318.19	24837.39	1515.09	2.10	0.716
BRSWM3	15454.66	0.00	1176.44	7019.39	7348.56	1174.31	1.53	0.475
EXT3	15454.66	0.00	429.51	12219.06	2843.68	522.96	1.42	0.184
EXTW	15454.66	0.00	225.91	13801.71	1446.36	266.28	0.88	0.094
EXN	15454.66	0.00	830.11	9724.26	4969.94	1806.09	3.42	0.322
EXTN	15454.66	0.00	292.53	13568.94	1625.97	387.31	1.79	0.105
EXW1	15454.66	4003.33	1239.31	9215.03	9082.42	6730.11	10.83	0.467
LIDPilot	15454.66	0.00	454.98	12239.70	2796.35	324.38	0.74	0.181

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min
2	JUNCTION	0.02	0.70	1.00	7 14:30
1	JUNCTION	0.02	0.70	1.70	7 14:23
5	JUNCTION	0.00	0.31	5.31	3623 17:00
6	JUNCTION	0.00	0.39	3.39	3623 17:00
WesternOutfall	OUTFALL	0.01	0.64	0.64	3653 22:00
EasternOutfall	OUTFALL	0.00	0.39	1.39	3623 17:00

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr
2	JUNCTION	0.883	5.521	3653 22:00	266.277	7647.375
1	JUNCTION	12.679	12.679	3623 17:00	7464.858	7464.858
5	JUNCTION	3.416	3.416	3623 17:00	1806.085	1806.085
6	JUNCTION	1.788	5.205	3623 17:00	387.307	2193.094
WesternOutfall	OUTFALL	0.000	5.520	3653 22:00	0.000	7647.500
EasternOutfall	OUTFALL	0.000	5.192	3623 17:00	0.000	2193.124

Node Surcharge Summary

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
2	JUNCTION	8.94	0.000	0.000
1	JUNCTION	10.19	0.000	0.000

Node Flooding Summary

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 ltr	Maximum Ponded Volume 1000 m3
1	10.19	8.009	3623 17:00	93.356	0.000

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CMS	Max. Flow CMS	Total Volume 10^6 ltr
WesternOutfall	27.64	0.050	5.520	7647.500
EasternOutfall	20.36	0.020	5.192	2193.124
System	24.00	0.070	10.512	9840.624

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Western2	CHANNEL	5.520	3653 22:00	2.81	0.91	0.92
Eastern1	CHANNEL	3.418	3623 17:00	7.16	0.06	0.24
Eastern2	CHANNEL	5.192	3623 17:00	8.04	0.09	0.30
Western1	CHANNEL	4.765	5440 15:59	2.38	1.03	1.00

Conduit Surcharge Summary

Conduit	----- Both Ends	Hours Full Upstream	----- Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
Western1	8.67	10.09	8.94	10.21	10.09

Analysis begun on: Wed Feb 18 17:14:20 2015

Analysis ended on: Wed Feb 18 17:22:14 2015
Total elapsed time: 00:07:54

 NOTE: The summary statistics displayed in this report are
 based on results found at every computational time step,
 not just on results from each reporting time step.

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES

Snowmelt NO

Groundwater NO

Flow Routing YES

Ponding Allowed NO

Water Quality NO

Infiltration Method GREEN_AMPT

Flow Routing Method KINWAVE

Starting Date AUG-01-1996 00:00:00

Ending Date JAN-01-2014 06:00:00

Antecedent Dry Days 0.0

Report Time Step 00:15:00

Wet Time Step 00:15:00

Dry Time Step 01:00:00

Routing Time Step 30.00 sec

Rainfall File Summary

Station ID	First Date	Last Date	Recording Frequency	Periods w/Precip	Periods Missing	Periods Malfunc.
1	AUG-08-1996	DEC-31-2013	60 min	28488	0	0

	Volume hectare-m	Depth mm
Runoff Quantity Continuity	-----	-----
Total Precipitation	3595.989	15454.656
Evaporation Loss	170.899	734.482
Infiltration Loss	2953.427	12693.086
Surface Runoff	486.490	2090.810
Final Surface Storage	0.040	0.171
Continuity Error (%)	-0.413	

	Volume hectare-m	Volume 10 ⁶ ltr
Flow Routing Continuity	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	486.490	4864.948
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	482.152	4821.574
Internal Outflow	4.873	48.726
Storage Losses	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.110	

 Highest Flow Instability Indexes

 All links are stable.

Routing Time Step Summary

Minimum Time Step	:	30.00 sec
Average Time Step	:	30.00 sec
Maximum Time Step	:	30.00 sec
Percent in Steady State	:	0.00

Average Iterations per Step : 1.00

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	15454.66	0.00	610.19	12215.04	2687.48	386.46	1.14	0.174
EXT2	15454.66	0.00	1456.21	7619.12	6524.68	192.48	0.28	0.422
BRSWM1	15454.66	0.00	1514.30	7627.17	6434.81	679.52	1.00	0.416
BRSWM2	15454.66	16771.03	1630.25	14953.71	15836.52	966.03	2.01	0.491
BRSWM3	15454.66	0.00	1533.71	7630.58	6401.96	1023.04	1.50	0.414
EXT3	15454.66	0.00	614.36	12219.06	2676.97	492.30	1.42	0.173
EXW	15454.66	2717.57	654.27	14247.23	3320.43	2847.29	9.11	0.183
EXTW	15454.66	0.00	319.77	13801.71	1363.37	251.00	0.88	0.088
EXN	15454.66	0.00	683.89	12049.48	2786.52	1012.63	3.13	0.180
EXTN	15454.66	0.00	388.06	13569.49	1543.03	367.55	1.79	0.100

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min
2	JUNCTION	0.01	0.70	1.00	7 14:59
1	JUNCTION	0.01	0.70	1.70	7 14:53
5	JUNCTION	0.00	0.30	5.30	3623 17:00
6	JUNCTION	0.00	0.38	3.38	3623 17:00
WesternOutfall	OUTFALL	0.01	0.64	0.64	3653 22:00
EasternOutfall	OUTFALL	0.00	0.38	1.38	3623 17:00

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr
2	JUNCTION	0.883	5.521	3653 22:00	250.998	3441.516
1	JUNCTION	10.224	10.224	3653 21:00	3233.750	3233.750
5	JUNCTION	3.130	3.130	3623 17:00	1012.627	1012.627
6	JUNCTION	1.788	4.915	3623 17:00	367.551	1379.962
WesternOutfall	OUTFALL	0.000	5.520	3653 22:00	0.000	3441.605
EasternOutfall	OUTFALL	0.000	4.911	3623 17:00	0.000	1379.947

Node Surcharge Summary

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
2	JUNCTION	5.53	0.000	0.000
1	JUNCTION	5.90	0.000	0.000

Node Flooding Summary

Flooding refers to all water that overflows a node, whether it ponds or not.

Hours	Maximum Rate	Time of Max Occurrence	Total Flood Volume	Maximum Ponded Volume
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Node	Flooded	CMS	days hr:min	10^6 ltr	1000 m3
1	5.90	5.578	3653 21:00	48.725	0.000

 Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CMS	Max. Flow CMS	Total Volume 10^6 ltr
WesternOutfall	24.74	0.025	5.520	3441.605
EasternOutfall	19.53	0.013	4.911	1379.947
System	22.14	0.038	10.230	4821.552

 Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Western2	CHANNEL	5.520	3653 22:00	2.81	0.91	0.92
Eastern1	CHANNEL	3.128	3623 17:00	6.97	0.06	0.23
Eastern2	CHANNEL	4.911	3623 17:00	7.91	0.09	0.29
Western1	CHANNEL	4.763	2961 11:16	2.30	1.03	1.00

 Conduit Surcharge Summary

Conduit	----- Both Ends	Hours Full Upstream	----- Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
Western1	5.41	5.86	5.53	5.94	5.86

Analysis begun on: Wed Feb 18 17:03:20 2015
 Analysis ended on: Wed Feb 18 17:11:11 2015
 Total elapsed time: 00:07:51



Attachment C– Hydrologic Model (Post Development No Control)

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.022)

 NOTE: The summary statistics displayed in this report are
 based on results found at every computational time step,
 not just on results from each reporting time step.

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Flow Routing Method KINWAVE
 Starting Date AUG-01-1996 00:00:00
 Ending Date JAN-01-2014 06:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:15:00
 Wet Time Step 00:15:00
 Dry Time Step 01:00:00
 Routing Time Step 30.00 sec

Rainfall File Summary

Station ID	First Date	Last Date	Recording Frequency	Periods w/Precip	Periods Missing	Periods Malfunc.
1	AUG-08-1996	DEC-31-2013	60 min	28488	0	0

	Volume hectare-m	Depth mm
Runoff Quantity Continuity		
Total Precipitation	3595.217	15454.656
Evaporation Loss	200.885	863.539
Infiltration Loss	2388.009	10265.265
Surface Runoff	1021.296	4390.215
Final Surface Storage	0.004	0.019
Continuity Error (%)	-0.417	

	Volume hectare-m	Volume 10^6 ltr
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1021.296	10213.064
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1012.441	10124.514
Internal Outflow	9.813	98.132
Storage Losses	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.001
Continuity Error (%)	-0.094	

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step : 30.00 sec
 Average Time Step : 30.00 sec
 Maximum Time Step : 30.00 sec
 Percent in Steady State : 0.00
 Average Iterations per Step : 1.01

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	15454.66	0.00	423.97	12215.04	2853.71	410.37	1.14	0.185
EXT2	15454.66	0.00	978.90	7619.12	6939.50	204.72	0.28	0.449
BRSWM1	15454.66	0.00	1059.20	7627.17	6853.37	723.72	1.00	0.443
BRSWM2	15454.66	19250.81	1707.07	8318.19	24837.39	1515.09	2.10	0.716
BRSWM3	15454.66	0.00	1176.44	7019.39	7348.56	1174.31	1.53	0.475
EXT3	15454.66	0.00	429.51	12219.06	2843.68	522.96	1.42	0.184
EXTW	15454.66	0.00	225.91	13801.71	1446.36	266.28	0.88	0.094
EXN	15454.66	0.00	830.11	9724.26	4969.94	1806.09	3.42	0.322
EXTN	15454.66	0.00	292.53	13568.94	1625.97	387.31	1.79	0.105
EXW1	15454.66	4003.33	1239.31	9215.03	9082.42	6730.11	10.83	0.467
LIDPilot	15454.66	0.00	903.31	9327.81	5283.31	612.87	0.90	0.342

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min
2	JUNCTION	0.02	0.70	1.00	7 14:27
1	JUNCTION	0.02	0.70	1.70	7 14:20
5	JUNCTION	0.00	0.31	5.31	3623 17:00
6	JUNCTION	0.00	0.39	3.39	3623 17:00
WesternOutfall	OUTFALL	0.02	0.64	0.64	3653 22:00
EasternOutfall	OUTFALL	0.00	0.39	1.39	3623 17:00

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr
2	JUNCTION	0.883	5.521	3653 22:00	266.277	7931.218
1	JUNCTION	12.871	12.871	3623 17:00	7753.348	7753.348
5	JUNCTION	3.416	3.416	3623 17:00	1806.085	1806.085
6	JUNCTION	1.788	5.205	3623 17:00	387.307	2193.094
WesternOutfall	OUTFALL	0.000	5.520	3653 22:00	0.000	7931.344
EasternOutfall	OUTFALL	0.000	5.192	3623 17:00	0.000	2193.124

Node Surcharge Summary

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
2	JUNCTION	9.50	0.000	0.000
1	JUNCTION	10.72	0.000	0.000

Node Flooding Summary

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 ltr	Maximum Ponded Volume 1000 m3
1	10.72	8.202	3623 17:00	98.132	0.000

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CMS	Max. Flow CMS	Total Volume 10^6 ltr
WesternOutfall	27.77	0.052	5.520	7931.344
EasternOutfall	20.36	0.020	5.192	2193.124
System	24.07	0.072	10.512	10124.467

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Western2	CHANNEL	5.520	3653 22:00	2.81	0.91	0.92
Eastern1	CHANNEL	3.418	3623 17:00	7.16	0.06	0.24
Eastern2	CHANNEL	5.192	3623 17:00	8.04	0.09	0.30
Western1	CHANNEL	4.765	5870 13:05	2.38	1.03	1.00

Conduit Surcharge Summary

Conduit	----- Both Ends	Hours Full Upstream	----- Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
Western1	9.21	10.62	9.50	10.76	10.62

Analysis begun on: Wed Feb 18 17:34:21 2015

Analysis ended on: Wed Feb 18 17:42:06 2015
Total elapsed time: 00:07:45

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.022)

 NOTE: The summary statistics displayed in this report are
 based on results found at every computational time step,
 not just on results from each reporting time step.

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Flow Routing Method KINWAVE
 Starting Date AUG-01-1996 00:00:00
 Ending Date JAN-01-2014 06:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:15:00
 Wet Time Step 00:15:00
 Dry Time Step 01:00:00
 Routing Time Step 30.00 sec

Rainfall File Summary

Station ID	First Date	Last Date	Recording Frequency	Periods w/Precip	Periods Missing	Periods Malfunc.
1	AUG-08-1996	DEC-31-2013	60 min	28488	0	0

	Volume hectare-m	Depth mm
Runoff Quantity Continuity		
Total Precipitation	3595.989	15454.656
Evaporation Loss	201.929	867.841
Infiltration Loss	2393.494	10286.634
Surface Runoff	1015.341	4363.680
Final Surface Storage	0.004	0.019
Continuity Error (%)	-0.411	

	Volume hectare-m	Volume 10^6 ltr
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	1015.341	10153.517
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1006.737	10067.471
Internal Outflow	9.529	95.291
Storage Losses	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.001
Continuity Error (%)	-0.091	

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step : 30.00 sec
 Average Time Step : 30.00 sec
 Maximum Time Step : 30.00 sec
 Percent in Steady State : 0.00
 Average Iterations per Step : 1.01

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	15454.66	0.00	423.97	12215.04	2853.71	410.37	1.14	0.185
EXT2	15454.66	0.00	978.90	7619.12	6939.50	204.72	0.28	0.449
BRSWM1	15454.66	0.00	1059.20	7627.17	6853.37	723.72	1.00	0.443
BRSWM2	15454.66	19250.81	1707.07	8318.19	24837.39	1515.09	2.10	0.716
BRSWM3	15454.66	0.00	1176.44	7019.39	7348.56	1174.31	1.53	0.475
EXT3	15454.66	0.00	429.51	12219.06	2843.68	522.96	1.42	0.184
EXW	15454.66	3459.44	1205.38	9288.93	8493.75	7283.44	11.57	0.449
EXTW	15454.66	0.00	225.91	13801.71	1446.36	266.28	0.88	0.094
EXN	15454.66	0.00	829.88	9724.21	4969.94	1806.09	3.42	0.322
EXTN	15454.66	0.00	292.64	13568.83	1625.97	387.31	1.79	0.105

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min
2	JUNCTION	0.02	0.70	1.00	7 14:28
1	JUNCTION	0.02	0.70	1.70	7 14:21
5	JUNCTION	0.00	0.31	5.31	3623 17:00
6	JUNCTION	0.00	0.39	3.39	3623 17:00
WesternOutfall	OUTFALL	0.02	0.64	0.64	3653 22:00
EasternOutfall	OUTFALL	0.00	0.39	1.39	3623 17:00

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr
2	JUNCTION	0.883	5.521	3653 22:00	266.277	7874.177
1	JUNCTION	12.708	12.708	3623 17:00	7693.802	7693.802
5	JUNCTION	3.416	3.416	3623 17:00	1806.085	1806.085
6	JUNCTION	1.788	5.205	3623 17:00	387.307	2193.094
WesternOutfall	OUTFALL	0.000	5.520	3653 22:00	0.000	7874.302
EasternOutfall	OUTFALL	0.000	5.192	3623 17:00	0.000	2193.124

Node Surge Summary

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
2	JUNCTION	9.21	0.000	0.000
1	JUNCTION	10.44	0.000	0.000

Node Flooding Summary

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 ltr	Maximum Ponded Volume 1000 m3
1	10.44	8.038	3623 17:00	95.291	0.000

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CMS	Max. Flow CMS	Total Volume 10^6 ltr
WesternOutfall	28.06	0.051	5.520	7874.302
EasternOutfall	20.36	0.020	5.192	2193.124
System	24.21	0.071	10.512	10067.425

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Western2	CHANNEL	5.520	3653 22:00	2.81	0.91	0.92
Eastern1	CHANNEL	3.418	3623 17:00	7.16	0.06	0.24
Eastern2	CHANNEL	5.192	3623 17:00	8.04	0.09	0.30
Western1	CHANNEL	4.766	5870 12:51	2.38	1.03	1.00

Conduit Surge Summary

Conduit	----- Both Ends	Hours Full Upstream	----- Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
Western1	8.92	10.34	9.21	10.49	10.34

Analysis begun on: Wed Feb 18 17:24:27 2015
Analysis ended on: Wed Feb 18 17:32:12 2015

Total elapsed time: 00:07:45

Attachment D– Hydrologic Model (Post Development LID Control)

 NOTE: The summary statistics displayed in this report are
 based on results found at every computational time step,
 not just on results from each reporting time step.

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES

Snowmelt NO

Groundwater NO

Flow Routing YES

Ponding Allowed NO

Water Quality NO

Infiltration Method GREEN_AMPT

Flow Routing Method KINWAVE

Starting Date AUG-01-1996 00:00:00

Ending Date JAN-01-2014 06:00:00

Antecedent Dry Days 0.0

Report Time Step 00:15:00

Wet Time Step 00:15:00

Dry Time Step 01:00:00

Routing Time Step 30.00 sec

Element Count

Number of rain gages 1

Number of subcatchments ... 11

Number of nodes 6

Number of links 4

Number of pollutants 0

Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
1	C:\Users\Ashraf\Desktop\CLC\Climate data\RainfallData_101ROPEC_24Sept14.dat		

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
EXT1	14.38	2000.00	20.00	2.0000	1	1
EXT2	2.95	2000.00	50.00	2.0000	1	EXW1
BRWSM1	10.56	2000.00	50.00	2.0000	1	EXW1
BRWSM2	6.10	2000.00	74.00	2.0000	1	EXW1
BRWSM3	15.98	2000.00	54.00	2.0000	1	BRWSM2
EXT3	18.39	2043.00	20.00	2.0000	1	EXW1
EXTW	18.41	1473.00	10.00	2.0000	1	2
EXN	36.34	3028.00	35.40	2.0000	1	5
EXTN	23.82	2382.00	10.00	2.0000	1	6
EXW1	74.10	3920.00	51.50	2.0000	1	1
LIDPilot	11.60	500.00	39.00	2.0000	1	1

LID Control Summary

Subcatchment	LID Control	No. of Units	Unit Area	Unit Width	% Area Covered	% Imperv Treated
LIDPilot	Bioswale	5	250.00	6.00	1.08	15.00
LIDPilot	VegetatedSwale	5	250.00	6.00	1.08	15.00

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
2	JUNCTION	0.30	0.70	0.0	
1	JUNCTION	1.00	0.70	0.0	
5	JUNCTION	5.00	1.30	0.0	
6	JUNCTION	3.00	1.30	0.0	
WesternOutfall	OUTFALL	0.00	0.70	0.0	
EasternOutfall	OUTFALL	1.00	1.30	0.0	

Link Summary

Name	From Node	To Node	Type	Length	%Slope	Roughness
Western2	2	WesternOutfall	CONDUIT	100.0	0.3000	0.0100
Eastern1	5	6	CONDUIT	50.0	4.0032	0.0100
Eastern2	6	EasternOutfall	CONDUIT	50.0	4.0032	0.0100
Western1	1	2	CONDUIT	400.0	0.1750	0.0100

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
Western2	Western2	0.70	2.35	0.32	7.00	1	6.07
Eastern1	Eastern1	1.30	4.00	0.59	6.00	1	56.19
Eastern2	Eastern2	1.30	4.00	0.59	6.00	1	56.19
Western1	Western1	0.70	2.35	0.32	7.00	1	4.64

Transect Summary

Transect Western1
Area:

0.0008	0.0033	0.0075	0.0133	0.0209
0.0300	0.0409	0.0529	0.0654	0.0784
0.0918	0.1057	0.1200	0.1347	0.1499
0.1655	0.1816	0.1981	0.2151	0.2325
0.2504	0.2687	0.2874	0.3066	0.3262
0.3463	0.3668	0.3878	0.4092	0.4311
0.4534	0.4761	0.4993	0.5230	0.5471
0.5716	0.5966	0.6220	0.6478	0.6742
0.7009	0.7281	0.7558	0.7848	0.8158
0.8488	0.8837	0.9205	0.9593	1.0000

Hrad:

0.0214	0.0428	0.0643	0.0857	0.1071
0.1285	0.1499	0.1840	0.2191	0.2531
0.2862	0.3183	0.3497	0.3804	0.4105
0.4400	0.4689	0.4973	0.5253	0.5529
0.5801	0.6069	0.6334	0.6596	0.6855
0.7111	0.7365	0.7617	0.7867	0.8114
0.8360	0.8603	0.8845	0.9086	0.9325
0.9563	0.9799	1.0034	1.0268	1.0500
1.0732	1.0962	1.1156	1.1135	1.1117
1.1103	1.1093	1.1090	1.1093	1.0000

Width:

0.0400	0.0800	0.1200	0.1600	0.2000
0.2400	0.2800	0.2949	0.3055	0.3162
0.3269	0.3375	0.3482	0.3589	0.3695
0.3802	0.3909	0.4015	0.4122	0.4229
0.4335	0.4442	0.4549	0.4655	0.4762
0.4869	0.4975	0.5082	0.5189	0.5295
0.5402	0.5509	0.5615	0.5722	0.5829
0.5935	0.6042	0.6149	0.6255	0.6362
0.6469	0.6575	0.6733	0.7200	0.7667
0.8133	0.8600	0.9067	0.9533	1.0000

Transect Western2
Area:

0.0008	0.0033	0.0075	0.0133	0.0209
0.0300	0.0409	0.0529	0.0654	0.0784
0.0918	0.1057	0.1200	0.1347	0.1499
0.1655	0.1816	0.1981	0.2151	0.2325

	0.2504	0.2687	0.2874	0.3066	0.3262
	0.3463	0.3668	0.3878	0.4092	0.4311
	0.4534	0.4761	0.4993	0.5230	0.5471
	0.5716	0.5966	0.6220	0.6478	0.6742
	0.7009	0.7281	0.7558	0.7848	0.8158
	0.8488	0.8837	0.9205	0.9593	1.0000

Hrad:

	0.0214	0.0428	0.0643	0.0857	0.1071
	0.1285	0.1499	0.1840	0.2191	0.2531
	0.2862	0.3183	0.3497	0.3804	0.4105
	0.4400	0.4689	0.4973	0.5253	0.5529
	0.5801	0.6069	0.6334	0.6596	0.6855
	0.7111	0.7365	0.7617	0.7867	0.8114
	0.8360	0.8603	0.8845	0.9086	0.9325
	0.9563	0.9799	1.0034	1.0268	1.0500
	1.0732	1.0962	1.1156	1.1135	1.1117
	1.1103	1.1093	1.1090	1.1093	1.0000

Width:

	0.0400	0.0800	0.1200	0.1600	0.2000
	0.2400	0.2800	0.2949	0.3055	0.3162
	0.3269	0.3375	0.3482	0.3589	0.3695
	0.3802	0.3909	0.4015	0.4122	0.4229
	0.4335	0.4442	0.4549	0.4655	0.4762
	0.4869	0.4975	0.5082	0.5189	0.5295
	0.5402	0.5509	0.5615	0.5722	0.5829
	0.5935	0.6042	0.6149	0.6255	0.6362
	0.6469	0.6575	0.6733	0.7200	0.7667
	0.8133	0.8600	0.9067	0.9533	1.0000

Transect Eastern1

Area:

	0.0068	0.0141	0.0220	0.0305	0.0395
	0.0491	0.0593	0.0700	0.0813	0.0932
	0.1056	0.1186	0.1321	0.1462	0.1609
	0.1761	0.1919	0.2083	0.2252	0.2427
	0.2607	0.2793	0.2985	0.3182	0.3384
	0.3591	0.3802	0.4019	0.4240	0.4466
	0.4697	0.4932	0.5173	0.5418	0.5668
	0.5923	0.6183	0.6448	0.6717	0.6991
	0.7271	0.7555	0.7843	0.8137	0.8435
	0.8739	0.9047	0.9360	0.9677	1.0000

Hrad:

	0.0417	0.0796	0.1145	0.1472	0.1779
	0.2072	0.2353	0.2623	0.2884	0.3139
	0.3387	0.3629	0.3867	0.4101	0.4331
	0.4558	0.4782	0.5004	0.5223	0.5440
	0.5656	0.5870	0.6082	0.6310	0.6536
	0.6761	0.6983	0.7203	0.7422	0.7638
	0.7853	0.8067	0.8279	0.8490	0.8699
	0.8908	0.9115	0.9321	0.9526	0.9731
	0.9934	1.0137	1.0338	1.0539	1.0740
	1.0939	1.1138	1.1337	1.1535	1.0000

Width:

	0.1811	0.1956	0.2100	0.2244	0.2389
	0.2533	0.2678	0.2822	0.2967	0.3111
	0.3256	0.3400	0.3544	0.3689	0.3833
	0.3978	0.4122	0.4267	0.4411	0.4556
	0.4700	0.4844	0.4989	0.5114	0.5238
	0.5362	0.5486	0.5610	0.5733	0.5857
	0.5981	0.6105	0.6229	0.6352	0.6476
	0.6600	0.6724	0.6848	0.6971	0.7095
	0.7219	0.7343	0.7467	0.7590	0.7714
	0.7838	0.7962	0.8086	0.8210	1.0000

Transect Eastern2

Area:

	0.0068	0.0141	0.0220	0.0305	0.0395
	0.0491	0.0593	0.0700	0.0813	0.0932
	0.1056	0.1186	0.1321	0.1462	0.1609
	0.1761	0.1919	0.2083	0.2252	0.2427
	0.2607	0.2793	0.2985	0.3182	0.3384
	0.3591	0.3802	0.4019	0.4240	0.4466
	0.4697	0.4932	0.5173	0.5418	0.5668
	0.5923	0.6183	0.6448	0.6717	0.6991
	0.7271	0.7555	0.7843	0.8137	0.8435
	0.8739	0.9047	0.9360	0.9677	1.0000

Hrad:

	0.0417	0.0796	0.1145	0.1472	0.1779
	0.2072	0.2353	0.2623	0.2884	0.3139
	0.3387	0.3629	0.3867	0.4101	0.4331
	0.4558	0.4782	0.5004	0.5223	0.5440
	0.5656	0.5870	0.6082	0.6310	0.6536

	0.6761	0.6983	0.7203	0.7422	0.7638
	0.7853	0.8067	0.8279	0.8490	0.8699
	0.8908	0.9115	0.9321	0.9526	0.9731
	0.9934	1.0137	1.0338	1.0539	1.0740
	1.0939	1.1138	1.1337	1.1535	1.0000

Width:

0.1811	0.1956	0.2100	0.2244	0.2389
0.2533	0.2678	0.2822	0.2967	0.3111
0.3256	0.3400	0.3544	0.3689	0.3833
0.3978	0.4122	0.4267	0.4411	0.4556
0.4700	0.4844	0.4989	0.5114	0.5238
0.5362	0.5486	0.5610	0.5733	0.5857
0.5981	0.6105	0.6229	0.6352	0.6476
0.6600	0.6724	0.6848	0.6971	0.7095
0.7219	0.7343	0.7467	0.7590	0.7714
0.7838	0.7962	0.8086	0.8210	1.0000

Transect Western

Area:

0.0008	0.0033	0.0075	0.0133	0.0209
0.0300	0.0409	0.0529	0.0654	0.0784
0.0918	0.1057	0.1200	0.1347	0.1499
0.1655	0.1816	0.1981	0.2151	0.2325
0.2504	0.2687	0.2874	0.3066	0.3262
0.3463	0.3668	0.3878	0.4092	0.4311
0.4534	0.4761	0.4993	0.5230	0.5471
0.5716	0.5966	0.6220	0.6478	0.6742
0.7009	0.7281	0.7558	0.7848	0.8158
0.8488	0.8837	0.9205	0.9593	1.0000

Hrad:

0.0214	0.0428	0.0643	0.0857	0.1071
0.1285	0.1499	0.1840	0.2191	0.2531
0.2862	0.3183	0.3497	0.3804	0.4105
0.4400	0.4689	0.4973	0.5253	0.5529
0.5801	0.6069	0.6334	0.6596	0.6855
0.7111	0.7365	0.7617	0.7867	0.8114
0.8360	0.8603	0.8845	0.9086	0.9325
0.9563	0.9799	1.0034	1.0268	1.0500
1.0732	1.0962	1.1156	1.1135	1.1117
1.1103	1.1093	1.1090	1.1093	1.0000

Width:

0.0400	0.0800	0.1200	0.1600	0.2000
0.2400	0.2800	0.2949	0.3055	0.3162
0.3269	0.3375	0.3482	0.3589	0.3695
0.3802	0.3909	0.4015	0.4122	0.4229
0.4335	0.4442	0.4549	0.4655	0.4762
0.4869	0.4975	0.5082	0.5189	0.5295
0.5402	0.5509	0.5615	0.5722	0.5829
0.5935	0.6042	0.6149	0.6255	0.6362
0.6469	0.6575	0.6733	0.7200	0.7667
0.8133	0.8600	0.9067	0.9533	1.0000

Rainfall File Summary

Station ID	First Date	Last Date	Recording Frequency	Periods w/Precip	Periods Missing	Periods Malfunc.
1	AUG-08-1996	DEC-31-2013	60 min	28488	0	0

	Volume hectare-m	Depth mm

Runoff Quantity Continuity		

Initial LID Storage	0.005	0.020
Total Precipitation	3595.217	15454.656
Evaporation Loss	202.802	871.779
Infiltration Loss	2426.025	10428.685
Surface Runoff	981.441	4218.891
Final Surface Storage	0.011	0.046
Continuity Error (%)	-0.419	

	Volume hectare-m	Volume 10^6 ltr

Flow Routing Continuity		

Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	981.441	9814.507
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000

External Outflow	972.715	9727.252
Internal Outflow	9.645	96.450
Storage Losses	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.001
Continuity Error (%)	-0.094	

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.01

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	15454.66	0.00	423.97	12215.04	2853.71	410.37	1.14	0.185
EXT2	15454.66	0.00	978.90	7619.12	6939.50	204.72	0.28	0.449
BRSWM1	15454.66	0.00	1059.20	7627.17	6853.37	723.72	1.00	0.443
BRSWM2	15454.66	19250.81	1707.07	8318.19	24837.39	1515.09	2.10	0.716
BRSWM3	15454.66	0.00	1176.44	7019.39	7348.56	1174.31	1.53	0.475
EXT3	15454.66	0.00	429.51	12219.06	2843.68	522.96	1.42	0.184
EXTW	15454.66	0.00	225.91	13801.71	1446.36	266.28	0.88	0.094
EXN	15454.66	0.00	829.64	9724.21	4969.94	1806.09	3.42	0.322
EXTN	15454.66	0.00	291.86	13568.73	1625.97	387.31	1.79	0.105
EXW1	15454.66	4003.33	1239.31	9215.03	9082.42	6730.11	10.83	0.467
LIDPilot	15454.66	0.00	1071.37	12605.69	1847.52	214.31	0.85	0.120

LID Performance Summary

Subcatchment	LID Control	Total Inflow mm	Evap Loss mm	Infil Loss mm	Surface Outflow mm	Drain Outflow mm	Init. Storage mm	Final Storage mm	Pcnt. Error
LIDPilot	Bioswale	43966.33	18626.92	25324.93	181.73	0.00	37.42	52.50	-0.41
LIDPilot	VegetatedSwale	43966.33	609.36	27476.93	16272.75	0.00	0.00	0.00	-0.89

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min
2	JUNCTION	0.02	0.70	1.00	7 14:30
1	JUNCTION	0.02	0.70	1.70	7 14:23
5	JUNCTION	0.00	0.31	5.31	3623 17:00
6	JUNCTION	0.00	0.39	3.39	3623 17:00
WesternOutfall	OUTFALL	0.01	0.64	0.64	3653 22:00
EasternOutfall	OUTFALL	0.00	0.39	1.39	3623 17:00

Node Inflow Summary

	Maximum Lateral	Maximum Total	Time of Max	Lateral Inflow	Total Inflow
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Node	Type	Inflow CMS	Inflow CMS	Occurrence days hr:min	Volume 10^6 ltr	Volume 10^6 ltr
2	JUNCTION	0.883	5.521	3653 22:00	266.277	7533.958
1	JUNCTION	12.822	12.822	3623 17:00	7354.793	7354.793
5	JUNCTION	3.416	3.416	3623 17:00	1806.085	1806.085
6	JUNCTION	1.788	5.205	3623 17:00	387.307	2193.094
WesternOutfall	OUTFALL	0.000	5.520	3653 22:00	0.000	7534.084
EasternOutfall	OUTFALL	0.000	5.192	3623 17:00	0.000	2193.124

Node Surcharge Summary

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
2	JUNCTION	9.21	0.000	0.000
1	JUNCTION	10.40	0.000	0.000

Node Flooding Summary

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 ltr	Maximum Ponded Volume 1000 m3
1	10.40	8.152	3623 17:00	96.450	0.000

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CMS	Max. Flow CMS	Total Volume 10^6 ltr
WesternOutfall	27.80	0.049	5.520	7534.084
EasternOutfall	20.36	0.020	5.192	2193.124
System	24.08	0.069	10.512	9727.208

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Western2	CHANNEL	5.520	3653 22:00	2.81	0.91	0.92
Eastern1	CHANNEL	3.418	3623 17:00	7.16	0.06	0.24
Eastern2	CHANNEL	5.192	3623 17:00	8.04	0.09	0.30
Western1	CHANNEL	4.767	694 22:55	2.37	1.03	1.00

Conduit Surcharge Summary

Conduit	----- Both Ends	Hours Full Upstream	----- Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
Western1	8.93	10.30	9.21	10.43	10.30

Analysis ended on: Thu Feb 19 13:40:05 2015
Total elapsed time: 00:08:06

 NOTE: The summary statistics displayed in this report are
 based on results found at every computational time step,
 not just on results from each reporting time step.

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Flow Routing Method KINWAVE
 Starting Date AUG-01-1996 00:00:00
 Ending Date JAN-01-2014 06:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:15:00
 Wet Time Step 00:15:00
 Dry Time Step 01:00:00
 Routing Time Step 30.00 sec

Rainfall File Summary

Station ID	First Date	Last Date	Recording Frequency	Periods w/Precip	Periods Missing	Periods Malfunc.
1	AUG-08-1996	DEC-31-2013	60 min	28488	0	0

	Volume hectare-m	Depth mm
Runoff Quantity Continuity		
Initial LID Storage	0.019	0.080
Total Precipitation	3595.989	15454.656
Evaporation Loss	216.887	932.127
Infiltration Loss	2940.633	12638.100
Surface Runoff	456.481	1961.841
Final Surface Storage	0.031	0.131
Continuity Error (%)	-0.501	

	Volume hectare-m	Volume 10^6 ltr
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	456.481	4564.860
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	448.180	4481.848
Internal Outflow	8.810	88.099
Storage Losses	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.111	

Highest Flow Instability Indexes

 All links are stable.

Routing Time Step Summary

Minimum Time Step : 30.00 sec
 Average Time Step : 30.00 sec
 Maximum Time Step : 30.00 sec
 Percent in Steady State : 0.00
 Average Iterations per Step : 1.00

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	15454.66	0.00	423.97	12215.04	2853.71	410.37	1.14	0.185
EXT2	15454.66	0.00	978.90	7619.12	6939.50	204.72	0.28	0.449
BRSWM1	15454.66	0.00	1059.20	7627.17	6853.37	723.72	1.00	0.443
BRSWM2	15454.66	19250.81	1815.05	17223.55	15992.65	975.56	2.02	0.461
BRSWM3	15454.66	0.00	1176.44	7019.39	7348.56	1174.31	1.53	0.475
EXT3	15454.66	0.00	429.51	12219.06	2843.68	522.96	1.42	0.184
EXTW	15454.66	0.00	225.91	13801.71	1446.36	266.28	0.88	0.094
EXN	15454.66	0.00	1006.34	12565.80	1966.78	714.73	3.35	0.127
EXTN	15454.66	0.00	291.86	13568.73	1625.97	387.31	1.79	0.105
EXW	15454.66	2830.25	1297.57	13831.86	3249.15	2786.16	10.97	0.178

LID Performance Summary

Subcatchment	LID Control	Total Inflow mm	Evap Loss mm	Infil Loss mm	Surface Outflow mm	Drain Outflow mm	Init. Storage mm	Final Storage mm	Pe En
EXN	Bioswale	56429.29	19857.31	36578.34	446.95	0.00	37.42	52.50	-0
EXN	VegetatedSwale	56429.29	718.10	25231.23	30756.14	0.00	0.00	0.00	-0
EXW	Bioswale	181894.96	22853.49	143355.88	17553.99	0.00	37.42	52.51	-1
EXW	VegetatedSwale	181894.96	758.14	52437.61	129195.83	0.00	0.00	0.00	-0

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min
2	JUNCTION	0.01	0.70	1.00	7 14:41
1	JUNCTION	0.01	0.70	1.70	7 14:36
5	JUNCTION	0.00	0.31	5.31	3623 17:00
6	JUNCTION	0.00	0.39	3.39	3623 17:00
WesternOutfall	OUTFALL	0.01	0.64	0.64	3653 22:00
EasternOutfall	OUTFALL	0.00	0.39	1.39	3623 17:00

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min		Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr
2	JUNCTION	0.883	5.521	3653	22:00	266.277	3380.094
1	JUNCTION	12.115	12.115	3623	17:00	3196.524	3196.524
5	JUNCTION	3.351	3.351	3623	17:00	714.731	714.731
6	JUNCTION	1.788	5.137	3623	17:00	387.307	1101.718
WesternOutfall	OUTFALL	0.000	5.520	3653	22:00	0.000	3380.210
EasternOutfall	OUTFALL	0.000	5.132	3623	17:00	0.000	1101.617

Node Surcharge Summary

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
2	JUNCTION	8.26	0.000	0.000
1	JUNCTION	9.14	0.000	0.000

Node Flooding Summary

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days hr:min		Total Flood Volume 10^6 ltr	Maximum Ponded Volume 1000 m3
1	9.14	7.434	3623	17:00	88.099	0.000

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CMS	Max. Flow CMS	Total Volume 10^6 ltr
WesternOutfall	26.31	0.023	5.520	3380.210
EasternOutfall	20.43	0.010	5.132	1101.617
System	23.37	0.033	10.452	4481.828

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min		Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Western2	CHANNEL	5.520	3653	22:00	2.81	0.91	0.92
Eastern1	CHANNEL	3.349	3623	17:00	7.10	0.06	0.24
Eastern2	CHANNEL	5.132	3623	17:00	8.00	0.09	0.30
Western1	CHANNEL	4.765	6216	00:02	2.29	1.03	1.00

 Conduit Surcharge Summary

Conduit	Hours Full			Hours	
	Both Ends	Upstream	Dnstream	Above Full Normal Flow	Capacity Limited
Western1	8.05	9.05	8.25	9.27	9.05

Analysis begun on: Wed Feb 18 17:47:32 2015
 Analysis ended on: Wed Feb 18 17:55:47 2015
 Total elapsed time: 00:08:15

 NOTE: The summary statistics displayed in this report are
 based on results found at every computational time step,
 not just on results from each reporting time step.

 Analysis Options

 Flow Units CMS
 Process Models:
 Rainfall/Runoff YES
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
 Infiltration Method GREEN_AMPT
 Flow Routing Method KINWAVE
 Starting Date AUG-01-1996 00:00:00
 Ending Date SEP-01-1996 06:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:15:00
 Wet Time Step 00:15:00
 Dry Time Step 01:00:00
 Routing Time Step 30.00 sec

WARNING 01: wet weather time step reduced to recording interval for Rain Gage 1

Element Count

Number of rain gages 1
 Number of subcatchments ... 11
 Number of nodes 6
 Number of links 4
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
1	100year	INTENSITY	10 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
EXT1	14.38	2000.00	20.00	2.0000	1	1
EXT2	2.95	2000.00	50.00	2.0000	1	EXW1
BRWSM1	10.56	2000.00	50.00	2.0000	1	EXW1
BRWSM2	6.10	2000.00	74.00	2.0000	1	EXW1
BRWSM3	15.98	2000.00	54.00	2.0000	1	BRWSM2
EXT3	18.39	2043.00	20.00	2.0000	1	EXW1
EXTW	18.41	1473.00	10.00	2.0000	1	2
EXN	36.34	3028.00	35.40	2.0000	1	5
EXTN	23.82	2382.00	10.00	2.0000	1	6
EXW1	74.10	3920.00	51.50	2.0000	1	1
LIDPilot	11.60	500.00	39.00	2.0000	1	1

LID Control Summary

Subcatchment	LID Control	No. of Units	Unit Area	Unit Width	% Area Covered	% Imperv Treated
LIDPilot	Bioswale	5	250.00	6.00	1.08	15.00
LIDPilot	VegetatedSwale	5	250.00	6.00	1.08	15.00

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
2	JUNCTION	0.30	0.70	0.0	
1	JUNCTION	1.00	0.70	0.0	
5	JUNCTION	5.00	1.30	0.0	
6	JUNCTION	3.00	1.30	0.0	
WesternOutfall	OUTFALL	0.00	0.70	0.0	
EasternOutfall	OUTFALL	1.00	1.30	0.0	

Link Summary

Name	From Node	To Node	Type	Length	%Slope	Roughness
Western2	2	WesternOutfall	CONDUIT	100.0	0.3000	0.0100
Eastern1	5	6	CONDUIT	50.0	4.0032	0.0100
Eastern2	6	EasternOutfall	CONDUIT	50.0	4.0032	0.0100
Western1	1	2	CONDUIT	400.0	0.1750	0.0100

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
Western2	Western2	0.70	2.35	0.32	7.00	1	6.07
Eastern1	Eastern1	1.30	4.00	0.59	6.00	1	56.19
Eastern2	Eastern2	1.30	4.00	0.59	6.00	1	56.19
Western1	Western1	0.70	2.35	0.32	7.00	1	4.64

Transect Summary

Transect Western1
Area:

0.0008	0.0033	0.0075	0.0133	0.0209
0.0300	0.0409	0.0529	0.0654	0.0784
0.0918	0.1057	0.1200	0.1347	0.1499
0.1655	0.1816	0.1981	0.2151	0.2325
0.2504	0.2687	0.2874	0.3066	0.3262
0.3463	0.3668	0.3878	0.4092	0.4311
0.4534	0.4761	0.4993	0.5230	0.5471
0.5716	0.5966	0.6220	0.6478	0.6742
0.7009	0.7281	0.7558	0.7848	0.8158
0.8488	0.8837	0.9205	0.9593	1.0000

Hrad:

0.0214	0.0428	0.0643	0.0857	0.1071
0.1285	0.1499	0.1840	0.2191	0.2531
0.2862	0.3183	0.3497	0.3804	0.4105
0.4400	0.4689	0.4973	0.5253	0.5529

	0.5801	0.6069	0.6334	0.6596	0.6855
	0.7111	0.7365	0.7617	0.7867	0.8114
	0.8360	0.8603	0.8845	0.9086	0.9325
	0.9563	0.9799	1.0034	1.0268	1.0500
	1.0732	1.0962	1.1156	1.1135	1.1117
Width:	1.1103	1.1093	1.1090	1.1093	1.0000
	0.0400	0.0800	0.1200	0.1600	0.2000
	0.2400	0.2800	0.2949	0.3055	0.3162
	0.3269	0.3375	0.3482	0.3589	0.3695
	0.3802	0.3909	0.4015	0.4122	0.4229
	0.4335	0.4442	0.4549	0.4655	0.4762
	0.4869	0.4975	0.5082	0.5189	0.5295
	0.5402	0.5509	0.5615	0.5722	0.5829
	0.5935	0.6042	0.6149	0.6255	0.6362
	0.6469	0.6575	0.6733	0.7200	0.7667
	0.8133	0.8600	0.9067	0.9533	1.0000
Transect Western2					
Area:	0.0008	0.0033	0.0075	0.0133	0.0209
	0.0300	0.0409	0.0529	0.0654	0.0784
	0.0918	0.1057	0.1200	0.1347	0.1499
	0.1655	0.1816	0.1981	0.2151	0.2325
	0.2504	0.2687	0.2874	0.3066	0.3262
	0.3463	0.3668	0.3878	0.4092	0.4311
	0.4534	0.4761	0.4993	0.5230	0.5471
	0.5716	0.5966	0.6220	0.6478	0.6742
	0.7009	0.7281	0.7558	0.7848	0.8158
Hrad:	0.8488	0.8837	0.9205	0.9593	1.0000
	0.0214	0.0428	0.0643	0.0857	0.1071
	0.1285	0.1499	0.1840	0.2191	0.2531
	0.2862	0.3183	0.3497	0.3804	0.4105
	0.4400	0.4689	0.4973	0.5253	0.5529
	0.5801	0.6069	0.6334	0.6596	0.6855
	0.7111	0.7365	0.7617	0.7867	0.8114
	0.8360	0.8603	0.8845	0.9086	0.9325
	0.9563	0.9799	1.0034	1.0268	1.0500
	1.0732	1.0962	1.1156	1.1135	1.1117
Width:	1.1103	1.1093	1.1090	1.1093	1.0000
	0.0400	0.0800	0.1200	0.1600	0.2000
	0.2400	0.2800	0.2949	0.3055	0.3162
	0.3269	0.3375	0.3482	0.3589	0.3695
	0.3802	0.3909	0.4015	0.4122	0.4229
	0.4335	0.4442	0.4549	0.4655	0.4762
	0.4869	0.4975	0.5082	0.5189	0.5295
	0.5402	0.5509	0.5615	0.5722	0.5829
	0.5935	0.6042	0.6149	0.6255	0.6362
	0.6469	0.6575	0.6733	0.7200	0.7667
	0.8133	0.8600	0.9067	0.9533	1.0000
Transect Eastern1					
Area:	0.0068	0.0141	0.0220	0.0305	0.0395
	0.0491	0.0593	0.0700	0.0813	0.0932
	0.1056	0.1186	0.1321	0.1462	0.1609
	0.1761	0.1919	0.2083	0.2252	0.2427
	0.2607	0.2793	0.2985	0.3182	0.3384
	0.3591	0.3802	0.4019	0.4240	0.4466
	0.4697	0.4932	0.5173	0.5418	0.5668
	0.5923	0.6183	0.6448	0.6717	0.6991
	0.7271	0.7555	0.7843	0.8137	0.8435
Hrad:	0.8739	0.9047	0.9360	0.9677	1.0000
	0.0417	0.0796	0.1145	0.1472	0.1779
	0.2072	0.2353	0.2623	0.2884	0.3139
	0.3387	0.3629	0.3867	0.4101	0.4331
	0.4558	0.4782	0.5004	0.5223	0.5440
	0.5656	0.5870	0.6082	0.6310	0.6536

	0.6761	0.6983	0.7203	0.7422	0.7638
	0.7853	0.8067	0.8279	0.8490	0.8699
	0.8908	0.9115	0.9321	0.9526	0.9731
	0.9934	1.0137	1.0338	1.0539	1.0740
Width:	1.0939	1.1138	1.1337	1.1535	1.0000
	0.1811	0.1956	0.2100	0.2244	0.2389
	0.2533	0.2678	0.2822	0.2967	0.3111
	0.3256	0.3400	0.3544	0.3689	0.3833
	0.3978	0.4122	0.4267	0.4411	0.4556
	0.4700	0.4844	0.4989	0.5114	0.5238
	0.5362	0.5486	0.5610	0.5733	0.5857
	0.5981	0.6105	0.6229	0.6352	0.6476
	0.6600	0.6724	0.6848	0.6971	0.7095
	0.7219	0.7343	0.7467	0.7590	0.7714
	0.7838	0.7962	0.8086	0.8210	1.0000
Transect Eastern2					
Area:	0.0068	0.0141	0.0220	0.0305	0.0395
	0.0491	0.0593	0.0700	0.0813	0.0932
	0.1056	0.1186	0.1321	0.1462	0.1609
	0.1761	0.1919	0.2083	0.2252	0.2427
	0.2607	0.2793	0.2985	0.3182	0.3384
	0.3591	0.3802	0.4019	0.4240	0.4466
	0.4697	0.4932	0.5173	0.5418	0.5668
	0.5923	0.6183	0.6448	0.6717	0.6991
	0.7271	0.7555	0.7843	0.8137	0.8435
Hrad:	0.8739	0.9047	0.9360	0.9677	1.0000
	0.0417	0.0796	0.1145	0.1472	0.1779
	0.2072	0.2353	0.2623	0.2884	0.3139
	0.3387	0.3629	0.3867	0.4101	0.4331
	0.4558	0.4782	0.5004	0.5223	0.5440
	0.5656	0.5870	0.6082	0.6310	0.6536
	0.6761	0.6983	0.7203	0.7422	0.7638
	0.7853	0.8067	0.8279	0.8490	0.8699
	0.8908	0.9115	0.9321	0.9526	0.9731
	0.9934	1.0137	1.0338	1.0539	1.0740
Width:	1.0939	1.1138	1.1337	1.1535	1.0000
	0.1811	0.1956	0.2100	0.2244	0.2389
	0.2533	0.2678	0.2822	0.2967	0.3111
	0.3256	0.3400	0.3544	0.3689	0.3833
	0.3978	0.4122	0.4267	0.4411	0.4556
	0.4700	0.4844	0.4989	0.5114	0.5238
	0.5362	0.5486	0.5610	0.5733	0.5857
	0.5981	0.6105	0.6229	0.6352	0.6476
	0.6600	0.6724	0.6848	0.6971	0.7095
	0.7219	0.7343	0.7467	0.7590	0.7714
	0.7838	0.7962	0.8086	0.8210	1.0000
Transect Western					
Area:	0.0008	0.0033	0.0075	0.0133	0.0209
	0.0300	0.0409	0.0529	0.0654	0.0784
	0.0918	0.1057	0.1200	0.1347	0.1499
	0.1655	0.1816	0.1981	0.2151	0.2325
	0.2504	0.2687	0.2874	0.3066	0.3262
	0.3463	0.3668	0.3878	0.4092	0.4311
	0.4534	0.4761	0.4993	0.5230	0.5471
	0.5716	0.5966	0.6220	0.6478	0.6742
	0.7009	0.7281	0.7558	0.7848	0.8158
Hrad:	0.8488	0.8837	0.9205	0.9593	1.0000
	0.0214	0.0428	0.0643	0.0857	0.1071
	0.1285	0.1499	0.1840	0.2191	0.2531
	0.2862	0.3183	0.3497	0.3804	0.4105
	0.4400	0.4689	0.4973	0.5253	0.5529
	0.5801	0.6069	0.6334	0.6596	0.6855
	0.7111	0.7365	0.7617	0.7867	0.8114

	0.8360	0.8603	0.8845	0.9086	0.9325
	0.9563	0.9799	1.0034	1.0268	1.0500
	1.0732	1.0962	1.1156	1.1135	1.1117
	1.1103	1.1093	1.1090	1.1093	1.0000
Width:					
	0.0400	0.0800	0.1200	0.1600	0.2000
	0.2400	0.2800	0.2949	0.3055	0.3162
	0.3269	0.3375	0.3482	0.3589	0.3695
	0.3802	0.3909	0.4015	0.4122	0.4229
	0.4335	0.4442	0.4549	0.4655	0.4762
	0.4869	0.4975	0.5082	0.5189	0.5295
	0.5402	0.5509	0.5615	0.5722	0.5829
	0.5935	0.6042	0.6149	0.6255	0.6362
	0.6469	0.6575	0.6733	0.7200	0.7667
	0.8133	0.8600	0.9067	0.9533	1.0000

	Volume hectare-m	Depth mm

Runoff Quantity Continuity		

Initial LID Storage	0.005	0.020
Total Precipitation	16.681	71.708
Evaporation Loss	0.230	0.987
Infiltration Loss	6.886	29.601
Surface Runoff	9.873	42.442
Final Surface Storage	0.000	0.000
Continuity Error (%)	-1.815	

	Volume hectare-m	Volume 10^6 ltr

Flow Routing Continuity		

Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	9.873	98.734
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	5.682	56.826
Internal Outflow	4.200	41.996
Storage Losses	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.088	

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	30.00 sec
Average Time Step	:	30.00 sec
Maximum Time Step	:	30.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.00

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	71.71	0.00	0.69	35.76	37.21	5.35	4.21	0.519

EXT2	71.71	0.00	0.78	20.77	51.42	1.52	1.35	0.717
BRSWM1	71.71	0.00	0.84	21.46	51.16	5.40	4.43	0.713
BRSWM2	71.71	136.98	1.16	14.51	193.77	11.82	7.27	0.929
BRSWM3	71.71	0.00	0.90	20.03	52.29	8.36	6.50	0.729
EXT3	71.71	0.00	0.69	36.38	36.36	6.69	4.93	0.507
EXTW	71.71	0.00	0.89	49.47	21.93	4.04	1.79	0.306
EXN	71.71	0.00	0.99	25.94	46.23	16.80	11.36	0.645
EXTN	71.71	0.00	0.94	37.90	34.12	8.13	4.18	0.476
EXW1	71.71	34.31	1.08	25.03	81.06	60.07	27.51	0.765
LIDPilot	71.71	0.00	1.70	34.11	37.48	4.35	1.88	0.523

LID Performance Summary

Subcatchment	LID Control	Total Inflow mm	Evap Loss mm	Infil Loss mm	Surface Outflow mm	Drain Outflow mm	Init. Storage mm	Final Storage mm	Po En
LIDPilot	Bioswale	222.44	67.43	168.06	23.87	0.00	37.42	0.00	0
LIDPilot	VegetatedSwale	222.44	0.53	28.16	205.88	0.00	0.00	0.00	-5

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min
2	JUNCTION	0.00	0.70	1.00	0 01:00
1	JUNCTION	0.00	0.70	1.70	0 00:57
5	JUNCTION	0.00	0.58	5.58	0 01:10
6	JUNCTION	0.00	0.67	3.67	0 01:10
WesternOutfall	OUTFALL	0.00	0.70	0.70	0 01:10
EasternOutfall	OUTFALL	0.00	0.67	1.67	0 01:10

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr
2	JUNCTION	1.788	6.425	0 01:10	4.038	31.969
1	JUNCTION	33.506	33.506	0 01:10	69.766	69.766
5	JUNCTION	11.355	11.355	0 01:10	16.802	16.802
6	JUNCTION	4.175	15.470	0 01:10	8.128	24.929
WesternOutfall	OUTFALL	0.000	6.220	0 01:17	0.000	31.896
EasternOutfall	OUTFALL	0.000	15.395	0 01:10	0.000	24.930

Node Surge Summary

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
2	JUNCTION	0.95	0.000	0.000
1	JUNCTION	0.98	0.000	0.000

Node Flooding Summary

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 ltr	Maximum Ponded Volume 1000 m3
2	0.15	0.339	0 01:10	0.090	0.000
1	0.98	28.675	0 01:10	41.905	0.000

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CMS	Max. Flow CMS	Total Volume 10^6 ltr
WesternOutfall	0.99	1.191	6.220	31.896
EasternOutfall	0.50	1.835	15.395	24.930
System	0.75	3.025	21.581	56.825

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Western2	CHANNEL	6.220	0 01:17	2.82	1.02	1.00
Eastern1	CHANNEL	11.295	0 01:10	9.90	0.20	0.45
Eastern2	CHANNEL	15.395	0 01:10	10.80	0.27	0.52
Western1	CHANNEL	4.732	0 01:58	2.31	1.02	1.00

Conduit Surcharge Summary

Conduit	----- Both Ends	Hours Full Upstream	----- Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
Western2	0.10	0.14	0.11	0.16	0.14
Western1	0.93	0.97	0.95	0.99	0.97

Analysis begun on: Thu Feb 19 13:46:10 2015
Analysis ended on: Thu Feb 19 13:46:10 2015
Total elapsed time: < 1 sec

NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.

Analysis Options

Flow Units CMS

Process Models:

Rainfall/Runoff YES
Snowmelt NO
Groundwater NO
Flow Routing YES
Ponding Allowed NO
Water Quality NO
Infiltration Method GREEN_AMPT
Flow Routing Method KINWAVE
Starting Date AUG-01-1996 00:00:00
Ending Date SEP-01-1996 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:15:00
Wet Time Step 00:15:00
Dry Time Step 01:00:00
Routing Time Step 30.00 sec

WARNING 01: wet weather time step reduced to recording interval for Rain Gage 1

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Initial LID Storage	0.019	0.080
Total Precipitation	16.685	71.708
Evaporation Loss	0.265	1.137
Infiltration Loss	7.330	31.503
Surface Runoff	9.430	40.529
Final Surface Storage	0.000	0.000
Continuity Error (%)	-1.925	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	9.430	94.305
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	5.432	54.316
Internal Outflow	4.019	40.188
Storage Losses	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.212	

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step : 30.00 sec
 Average Time Step : 30.00 sec
 Maximum Time Step : 30.00 sec
 Percent in Steady State : 0.00
 Average Iterations per Step : 1.00

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	71.71	0.00	0.69	35.76	37.21	5.35	4.21	0.519
EXT2	71.71	0.00	0.78	20.77	51.42	1.52	1.35	0.717
BRSWM1	71.71	0.00	0.84	21.46	51.16	5.40	4.43	0.713
BRSWM2	71.71	136.98	1.22	16.50	191.37	11.67	5.82	0.917
BRSWM3	71.71	0.00	0.90	20.03	52.29	8.36	6.50	0.729
EXT3	71.71	0.00	0.69	36.38	36.36	6.69	4.93	0.507
EXTW	71.71	0.00	0.89	49.47	21.93	4.04	1.79	0.306
EXN	71.71	0.00	1.48	28.94	43.12	15.67	7.89	0.601
EXTN	71.71	0.00	0.94	37.90	34.12	8.13	4.18	0.476
EXW	71.71	29.48	1.36	30.01	71.27	61.12	24.22	0.704

LID Performance Summary

Subcatchment	LID Control	Total Inflow mm	Evap Loss mm	Infil Loss mm	Surface Outflow mm	Drain Outflow mm	Init. Storage mm	Final Storage mm	Pe En
EXN	Bioswale	287.08	67.83	184.80	71.79	0.00	37.42	0.00	0
EXN	VegetatedSwale	287.08	0.63	22.14	275.89	0.00	0.00	0.00	-4
EXW	Bioswale	1123.33	68.62	226.08	862.53	0.00	37.42	0.00	0
EXW	VegetatedSwale	1123.33	0.66	34.75	1092.29	0.00	0.00	0.00	-0

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min
2	JUNCTION	0.00	0.70	1.00	0 01:03
1	JUNCTION	0.00	0.70	1.70	0 01:01
5	JUNCTION	0.00	0.48	5.48	0 01:10
6	JUNCTION	0.00	0.60	3.60	0 01:10
WesternOutfall	OUTFALL	0.00	0.70	0.70	0 01:10
EasternOutfall	OUTFALL	0.00	0.60	1.60	0 01:10

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr
2	JUNCTION	1.788	6.425	0 01:10	4.038	30.590

1	JUNCTION	26.108	26.108	0	01:20	66.468	66.468
5	JUNCTION	7.885	7.885	0	01:10	15.671	15.671
6	JUNCTION	4.175	12.010	0	01:10	8.128	23.799
WesternOutfall	OUTFALL	0.000	6.220	0	01:17	0.000	30.517
EasternOutfall	OUTFALL	0.000	12.026	0	01:10	0.000	23.799

Node Surcharge Summary

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
2	JUNCTION	1.03	0.000	0.000
1	JUNCTION	1.05	0.000	0.000

Node Flooding Summary

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 ltr	Maximum Ponded Volume 1000 m3
2	0.15	0.339	0 01:10	0.090	0.000
1	1.05	21.401	0 01:20	40.098	0.000

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CMS	Max. Flow CMS	Total Volume 10^6 ltr
WesternOutfall	1.12	1.010	6.220	30.517
EasternOutfall	0.96	0.921	12.026	23.799
System	1.04	1.932	18.128	54.316

Link Flow Summary

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Veloc m/sec	Max/ Full Flow	Max/ Full Depth
Western2	CHANNEL	6.220	0 01:17	2.82	1.02	1.00
Eastern1	CHANNEL	7.878	0 01:10	9.02	0.14	0.37
Eastern2	CHANNEL	12.026	0 01:10	10.08	0.21	0.46
Western1	CHANNEL	4.751	0 02:07	2.29	1.02	1.00

Conduit Surcharge Summary

Conduit	Hours Full			Hours	
	Both Ends	Upstream	Dnstream	Above Full Normal Flow	Capacity Limited
Western2	0.10	0.14	0.11	0.16	0.14
Western1	1.01	1.04	1.03	1.08	1.04

Analysis begun on: Thu Feb 19 13:45:02 2015
 Analysis ended on: Thu Feb 19 13:45:02 2015
 Total elapsed time: < 1 sec