Appendix K

Wetland Calculations
TP108 Calculations
HEC-HMS Outputs

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Northern Corridor Improvements - Wetlands Summary

Designed Matthew Yu
Reviewed Don Mackintosh
Date 12/12/2016

Wetland	Rook Wetland	Caribbean Wetland	Moro Wetland	Greville Northbound Off-Ramp Dry Pond	Alpurt A1 Pond 35	Alpurt A1 Pond 34	Greville Southbound On-Ramp Dry Pond	Greville Wetland	McClymonts Wetland	Oteha Valley East Wetland	Oteha Valley West Wetland
Sub-Catchment	PM2AH	C2PM	R2C	S2R					M2S	OV2M	
Stormmwater Management Criteria	WQ Detention - SMAF2 PFA Q2 + Q10	WQ Detention - SMAF2 PFA Q2 + Q10 + Q100	WQ Detention - SMAF2 PFA Q2 + Q10 + Q100	WQ Detention - SMAF2 PFA Q2 + Q10 + Q100					WQ Detention - SMAF1 PFA Q2 + Q10 + Q100	WQ Detention - SMAF1 PFA Q2 + Q10	
Impervious Area (ha)	2.93	3.09	8.43	2.07	4.61	2.33	0.25	2.86	2.21	1.71	0.43
Pervious Area (ha)	1.67	2.16	4.56	0.02	1.78	2.09	0.07	0.70	0.27	0.02	0.00
TP108 - Water Quality Volume with 50% discount (m3)	351	378	1005	N/A	535	295	N/A	325	246	186	47
TP108 - Detention Volume (m3)	447	245	874 (836 new + 38 ex)	1555 (785 new + 770 ex)					448 (148 new + 300 ex)	508 (268 new + 240 ex)	
TP108 - Attenuation Volume (m3)	1462	925	3151	2962					410	644	
Permanent WQV Provided (m3)	355	470	1195	0	230	300	0	525	405	480	150
Detention Volume Provided (m3)	480	250	1030	195	595	370	70	335	450	420	105
Live Volume Provided (m3)	2005	2400	4095	420	2800	2520	320	4420	1225	1345	495
Existing WQV Replaced (m3)	0	0	0	0	0	0	0	115	325	410	0
Existing EDV replaced (m3)	0	0	38	0	0	0	0	95	300	240	0
Base Level (mRL)	34.00	42.00	35.50	26.20	25.00	27.80	31.50	44.50	56.50	28.00	25.00
Permanent Water Level (mRL)	35.00	43.00	36.50	N/A	26.14	28.66	N/A	45.50	57.50	29.00	26.00
Detention slot invert (mRL)	35.00	43.00	36.50	26.21	26.14	28.66	31.51	45.50	57.50	29.00	26.00
2-year slot invert (mRL)	35.39	43.16	36.91	N/A	27.04	28.77	N/A	N/A	57.91	N/A	N/A
10-year slot invert (mRL)	36.01	43.47	37.33	N/A	N/A	N/A	N/A	N/A	58.17	N/A	N/A
100-year slot invert (mRL)	N/A	43.63	37.58	N/A	28.57	N/A	N/A	N/A	N/A	N/A	N/A
Peak Water Level (mRL)	36.29	43.72	37.72	27.30	29.00	30.60	32.70	48.00	58.50	30.00	27.00
Slot Width ED (m)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Slot Width 2-year (m)	0.20	1.95	2.65	N/A	0.25	0.16	N/A	N/A	0.55	N/A	N/A
Slot Width 10-year (m)	1.00	4.55	4.95	N/A	N/A	N/A	N/A	N/A	3.55	N/A	N/A
Slot Width 100-year (m)	N/A	4.85	11.35	N/A	3.75	N/A	N/A	N/A	N/A	N/A	N/A
Primary Manhole Spillway Size (mm Ø)	2550	3600	8m x 3m Box MH	1500	5m x 3m Box MH	1500	1500	2300	1500	1200	1050
Pre-dev Q2 (m3/s)	0.55	0.58	1.26	1.11					0.21	0.57	
Pre-dev Q10 (m3/s)	1.24	1.35	3.00	3.38					0.58	2.13	
Pre-dev Q100 (m3/s)	N/A	2.39	5.33	6.01					0.98	N/A	
Post-dev Q2 (m3/s)	0.39 -29.7%	0.58 -0.8%	1.24 -1.3%	0.71 -36.4%					0.15 -26.6%	0.57 0.0%	
Post-dev Q10 (m3/s)	0.93 -25.3%	1.33 -1.9%	2.99 -0.5%	1.80 -46.8%					0.54 -5.9%	1.93 -9.4%	
Post-dev Q100 (m3/s)	N/A	2.38 -0.2%	5.33 -0.1%	3.71 -38.3%					0.96 -1.7%	N/A	

Notes:

HEC-HMS has been used to determine peak flows and outlet sizings, with exception to C2PM and R2C. These two sub-catchments only have a single outlet point and therefore have been assessed using TP10 and TP108 graphical method.
The existing ("ex") detention volumes in the table have been determined by routing the detention event (95th and 90th percentile event for SMAF1 and SMAF2 respectively) through HEC-HMS to determine the peak volume.
The proposed ("new") detention volumes have been determined using TP108 graphical method.
The proposed ("new") detention volumes represent the difference between the pre- and post-development scenario for the detention rainfall event for the sub-catchment, in accordance with E10.6.3.1.1 of the PAUP Decisions Version.
For sub-catchments where detention is provided by multiple devices, the required total detention volume has been distributed to all devices based on the percetange of the sub-catchment area that the device is managing.

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Oteha Valley to McClymonts (OV2M)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	3.323	325.63
Pervious Area	C	74	2.328	172.24
			5.650	**497.87**

CN Weighted	88.1	
Ia Weighted	2.1	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.750	km
Catchment Slope, Sc	0.055	m/m
Runoff Factor	0.79	
Time of Concentration, tc	0.19	hours
SCS Lag for HEC-HMS	0.13	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
OV2M includes Oteha Valley East Wetland, Oteha Valley West Wetland, and Alpurt A1 Pond 30 in the post-development scenario

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Oteha Valley to McClymonts (OV2M)

Runoff Volume

Pervious

Catchment Area, A	0.0233	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.19	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	8.4	mm
Runoff Volume - Pervious	**948**	**2,472**	**4,614**	**93**	**197**	**m3**

Impervious

Catchment Area, A	0.0332	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.19	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	32.5	mm
Runoff Volume - Impervious	**2,795**	**5,448**	**8,803**	**720**	**1,078**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	yr
Total Runoff Volume - Pre-Dev	**3,742**	**7,920**	**13,417**	**813**	**1,275**	**m3**

Peak Flow Rate

Catchment Area, A	0.0565	km2
Runoff CN	88.1	
Initial Abstraction, Ia	2.1	mm
Time of concentration, tc	0.19	hours
Storage, S	34.3	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
c*	0.55	0.71	0.80	0.24	0.32	
q*	0.129	0.149	0.157	0.069	0.088	
Peak Flow Rate - Pre-Dev	**0.65**	**1.42**	**2.39**	**0.10**	**0.18**	**m3/s**

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name Oteha Valley to McClymonts (OV2M)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious	C	98	4.438	434.90
Pervious	C	74	1.213	89.73
			5.650	**524.63**

CN Weighted	92.8	
Ia Weighted	1.1	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.750	km
Catchment Slope, Sc	0.055	m/m
Runoff Factor	0.87	
Time of Concentration, tc	0.18	hours
SCS Lag for HEC-HMS	0.12	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
OV2M includes Oteha Valley East Wetland, Oteha Valley West Wetland, and Alpurt A1 Pond 30 in the post-development scenario

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Oteha Valley to McClymonts (OV2M)

Runoff Volume

Pervious

Catchment Area, A	0.0121	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.18	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	8.4	mm
Runoff Volume - Pervious	**494**	**1,288**	**2,404**	**49**	**102**	**m3**

Impervious

Catchment Area, A	0.0444	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.18	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	32.5	mm
Runoff Volume - Impervious	**3,732**	**7,277**	**11,756**	**962**	**1,440**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	yr
Total Runoff Volume - Post-Dev	**4,226**	**8,564**	**14,160**	**1,011**	**1,543**	**m3**

Peak Flow Rate

Catchment Area, A	0.0565	km2
Runoff CN	92.8	
Initial Abstraction, Ia	1.1	mm
Time of concentration, tc	0.18	hours
Storage, S	19.6	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
c*	0.69	0.81	0.87	0.38	0.47	
q*	0.149	0.160	0.161	0.101	0.118	
Peak Flow Rate - Post-Dev	**0.75**	**1.52**	**2.46**	**0.15**	**0.25**	**m3/s**

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DIFFERENCE BETWEEN PRE AND POST-DEVELOPMENT RUNOFF

Catchment Name: *Oteha Valley to McClymonts (OV2M)*

VOLUME

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
Pre-development Volume	3,742	7,920	13,417	813	1,275	m3
Post-Development Volume	4,226	8,564	14,160	1,011	1,543	m3
Difference - Volume	484	644	743	197	268	m3
Difference (% Change)	**13%**	**8%**	**6%**	**24%**	**21%**	**%**

PEAK FLOW

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
Pre-development Flow	0.649	1.422	2.393	0.101	0.183	m3/s
Post-Development Flow	0.750	1.524	2.460	0.148	0.248	m3/s
Difference - Flow	0.101	0.101	0.068	0.047	0.064	m3/s
Difference (% Change)	**16%**	**7%**	**3%**	**47%**	**35%**	**%**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: McClymonts to Spencer (M2S)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	1.596	156.42
Pervious Area	C	74	0.885	65.46
			2.481	**221.88**

CN Weighted	89.4	
Ia Weighted	1.8	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.350	km
Catchment Slope, Sc	0.046	m/m
Runoff Factor	0.81	
Time of Concentration, tc	0.17	hours
SCS Lag for HEC-HMS	0.11	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
M2S includes McClymonts Wetland in the post-development scenario

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
McClymonts to Spencer (M2S)

Runoff Volume

Pervious

Catchment Area, A	0.0088	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.17	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	8.4	mm
Runoff Volume - Pervious	**360**	**940**	**1,754**	**35**	**75**	**m3**

Impervious

Catchment Area, A	0.0160	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.17	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	32.5	mm
Runoff Volume - Impervious	**1,342**	**2,617**	**4,228**	**346**	**518**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	yr
Total Runoff Volume - Pre-Dev	**1,703**	**3,557**	**5,982**	**381**	**593**	**m3**

Peak Flow Rate

Catchment Area, A	0.0248	km2
Runoff CN	89.4	
Initial Abstraction, Ia	1.8	mm
Time of concentration, tc	0.17	hours
Storage, S	30.0	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
c*	0.59	0.73	0.82	0.27	0.36	
q*	0.138	0.156	0.162	0.079	0.098	
Peak Flow Rate - Pre-Dev	**0.31**	**0.66**	**1.09**	**0.05**	**0.09**	**m3/s**

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ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name McClymonts to Spencer (M2S)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious	C	98	2.211	216.69
Pervious	C	74	0.270	19.95
			2.481	**236.64**

CN Weighted	95.4	
Ia Weighted	0.5	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.350	km
Catchment Slope, Sc	0.046	m/m
Runoff Factor	0.91	
Time of Concentration, tc	0.17	hours
SCS Lag for HEC-HMS	0.11	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
M2S includes McClymonts Wetland in the post-development scenario

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
McClymonts to Spencer (M2S)

Runoff Volume

Pervious

Catchment Area, A	0.0027	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.17	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	8.4	mm
Runoff Volume - Pervious	**110**	**286**	**534**	**11**	**23**	**m3**

Impervious

Catchment Area, A	0.0221	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.17	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	32.5	mm
Runoff Volume - Impervious	**1,860**	**3,626**	**5,858**	**479**	**718**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	yr
Total Runoff Volume - Post-Dev	**1,969**	**3,912**	**6,392**	**490**	**740**	**m3**

Peak Flow Rate

Catchment Area, A	0.0248	km2
Runoff CN	95.4	
Initial Abstraction, Ia	0.5	mm
Time of concentration, tc	0.17	hours
Storage, S	12.3	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
c*	0.78	0.87	0.92	0.50	0.59	
q*	0.160	0.164	0.165	0.127	0.139	
Peak Flow Rate - Post-Dev	**0.35**	**0.69**	**1.11**	**0.08**	**0.13**	**m3/s**

DIFFERENCE BETWEEN PRE AND POST-DEVELOPMENT RUNOFF

Catchment Name: *McClymonts to Spencer (M2S)*

VOLUME

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
Pre-development Volume	1,703	3,557	5,982	381	593	m3
Post-Development Volume	1,969	3,912	6,392	490	740	m3
Difference - Volume	267	355	410	109	148	m3
Difference (% Change)	**16%**	**10%**	**7%**	**29%**	**25%**	**%**

PEAK FLOW

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
Pre-development Flow	0.305	0.655	1.088	0.051	0.090	m3/s
Post-Development Flow	0.354	0.688	1.107	0.082	0.128	m3/s
Difference - Flow	0.049	0.033	0.019	0.031	0.037	m3/s
Difference (% Change)	**16%**	**5%**	**2%**	**61%**	**41%**	**%**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Spencer to Rosedale (S2R)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	7.690	753.57
Pervious Area	C	74	9.098	673.23
			16.787	**1426.81**

CN Weighted	85.0	
Ia Weighted	2.7	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	1.100	km
Catchment Slope, Sc	0.050	m/m
Runoff Factor	0.74	
Time of Concentration, tc	0.26	hours
SCS Lag for HEC-HMS	0.17	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
S2R includes Greville Wetland, Alpurt A1 Pond 34, Alpurt A1 Pond 35, Greville Southbound On-Ramp Dry Pond, and Greville Northbound Off-Ramp Dry Pond in the post-development scenario

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Spencer to Rosedale (S2R)

Runoff Volume

Pervious

Catchment Area, A	0.0910	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.26	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**3,705**	**9,662**	**18,035**	**364**	**364**	**m3**

Impervious

Catchment Area, A	0.0769	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.26	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**6,467**	**12,609**	**20,371**	**1,667**	**1,667**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Pre-Dev	**10,172**	**22,271**	**38,406**	**2,031**	**2,031**	**m3**

Peak Flow Rate

Catchment Area, A	0.1679	km2
Runoff CN	85.0	
Initial Abstraction, Ia	2.7	mm
Time of concentration, tc	0.26	hours
Storage, S	44.8	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.48	0.65	0.75	0.19	0.19	
q*	0.109	0.130	0.140	0.050	0.050	
Peak Flow Rate - Pre-Dev	**1.63**	**3.68**	**6.36**	**0.22**	**0.22**	**m3/s**

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ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name Spencer to Rosedale (S2R)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious	C	98	12.133	1188.99
Pervious	C	74	4.655	344.45
			16.787	**1533.44**

CN Weighted	91.3	
Ia Weighted	1.4	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	1.100	km
Catchment Slope, Sc	0.050	m/m
Runoff Factor	0.84	
Time of Concentration, tc	0.24	hours
SCS Lag for HEC-HMS	0.16	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
S2R includes Greville Wetland, Alpurt A1 Pond 34, Alpurt A1 Pond 35, Greville Southbound On-Ramp Dry Pond, and Greville Northbound Off-Ramp Dry Pond in the post-development scenario

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Spencer to Rosedale (S2R)

Runoff Volume

Pervious

Catchment Area, A	0.0465	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.24	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**1,896**	**4,944**	**9,227**	**186**	**186**	**m3**

Impervious

Catchment Area, A	0.1213	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.24	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**10,204**	**19,894**	**32,141**	**2,630**	**2,630**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Post-Dev	**12,099**	**24,837**	**41,368**	**2,816**	**2,816**	**m3**

Peak Flow Rate

Catchment Area, A	0.1679	km2
Runoff CN	91.3	
Initial Abstraction, Ia	1.4	mm
Time of concentration, tc	0.24	hours
Storage, S	24.1	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.64	0.78	0.85	0.33	0.33	
q*	0.132	0.146	0.149	0.082	0.082	
Peak Flow Rate - Post-Dev	**1.97**	**4.14**	**6.76**	**0.36**	**0.36**	**m3/s**

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DIFFERENCE BETWEEN PRE AND POST-DEVELOPMENT RUNOFF

Catchment Name: *Spencer to Rosedale (S2R)*

VOLUME

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
Pre-development Volume	10,172	22,271	38,406	2,031	2,031	m3
Post-Development Volume	12,099	24,837	41,368	2,816	2,816	m3
Difference - Volume	1,927	2,566	2,962	785	785	m3
Difference (% Change)	**19%**	**12%**	**8%**	**39%**	**39%**	**%**

PEAK FLOW

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
Pre-development Flow	1.631	3.675	6.364	0.217	0.217	m3/s
Post-Development Flow	1.970	4.136	6.758	0.358	0.358	m3/s
Difference - Flow	0.338	0.461	0.393	0.140	0.140	m3/s
Difference (% Change)	**21%**	**13%**	**6%**	**64%**	**64%**	**%**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Rosedale to Constellation (R2C)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	3.703	362.85
Pervious Area	C	74	9.348	691.74
			13.050	**1054.59**

CN Weighted	80.8	
Ia Weighted	3.6	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.300	km
Catchment Slope, Sc	0.035	m/m
Runoff Factor	0.68	
Time of Concentration, tc	0.17	hours
SCS Lag for HEC-HMS	0.11	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
R2C includes Moro Wetland in the post-development scenario

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Rosedale to Constellation (R2C)

Runoff Volume

Pervious

Catchment Area, A	0.0935	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.17	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**3,807**	**9,928**	**18,531**	**374**	**374**	**m3**

Impervious

Catchment Area, A	0.0370	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.17	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**3,114**	**6,071**	**9,809**	**803**	**803**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Pre-Dev	**6,921**	**15,999**	**28,340**	**1,177**	**1,177**	**m3**

Peak Flow Rate

Catchment Area, A	0.1305	km2
Runoff CN	80.8	
Initial Abstraction, Ia	3.6	mm
Time of concentration, tc	0.17	hours
Storage, S	60.3	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.40	0.57	0.69	0.14	0.14	
q*	0.108	0.136	0.151	0.042	0.042	
Peak Flow Rate - Pre-Dev	**1.26**	**3.00**	**5.33**	**0.14**	**0.14**	**m3/s**

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name Rosedale to Constellation (R2C)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious	C	98	8.429	826.03
Pervious	C	74	4.622	341.99
			13.050	**1168.02**

CN Weighted	89.5	
Ia Weighted	1.8	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.300	km
Catchment Slope, Sc	0.035	m/m
Runoff Factor	0.81	
Time of Concentration, tc	0.17	hours
SCS Lag for HEC-HMS	0.11	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
R2C includes Moro Wetland in the post-development scenario

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Rosedale to Constellation (R2C)

Runoff Volume

Pervious

Catchment Area, A	0.0462	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.17	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**1,882**	**4,908**	**9,162**	**185**	**185**	**m3**

Impervious

Catchment Area, A	0.0843	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.17	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**7,089**	**13,821**	**22,329**	**1,827**	**1,827**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Post-Dev	**8,971**	**18,729**	**31,491**	**2,012**	**2,012**	**m3**

Peak Flow Rate

Catchment Area, A	0.1305	km2
Runoff CN	89.5	
Initial Abstraction, Ia	1.8	mm
Time of concentration, tc	0.17	hours
Storage, S	29.8	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.59	0.74	0.82	0.27	0.27	
q*	0.138	0.156	0.162	0.079	0.079	
Peak Flow Rate - Post-Dev	**1.61**	**3.45**	**5.73**	**0.27**	**0.27**	**m3/s**

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DIFFERENCE BETWEEN PRE AND POST-DEVELOPMENT RUNOFF

Catchment Name: *Rosedale to Constellation (R2C)*

VOLUME

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
Pre-development Volume	6,921	15,999	28,340	1,177	1,177	m3
Post-Development Volume	8,971	18,729	31,491	2,012	2,012	m3
Difference - Volume	2,050	2,730	3,151	836	836	m3
Difference (% Change)	**30%**	**17%**	**11%**	**71%**	**71%**	**%**

PEAK FLOW

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
Pre-development Flow	1.259	3.004	5.334	0.143	0.143	m3/s
Post-Development Flow	1.608	3.449	5.725	0.269	0.269	m3/s
Difference - Flow	0.349	0.445	0.391	0.126	0.126	m3/s
Difference (% Change)	**28%**	**15%**	**7%**	**88%**	**88%**	**%**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Constellation to Paul Matthews (C2PM)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	2.402	235.38
Pervious Area	C	74	3.973	294.02
			6.375	**529.39**

CN Weighted	83.0	
Ia Weighted	3.1	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.500	km
Catchment Slope, Sc	0.010	m/m
Runoff Factor	0.71	
Time of Concentration, tc	0.26	hours
SCS Lag for HEC-HMS	0.17	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
C2PM includes Caribbean Wetland in the post-development scenario

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Constellation to Paul Matthews (C2PM)

Runoff Volume

Pervious

Catchment Area, A	0.0397	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.26	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**1,618**	**4,220**	**7,876**	**159**	**159**	**m3**

Impervious

Catchment Area, A	0.0240	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.26	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**2,020**	**3,938**	**6,363**	**521**	**521**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Pre-Dev	**3,638**	**8,158**	**14,239**	**680**	**680**	**m3**

Peak Flow Rate

Catchment Area, A	0.0637	km2
Runoff CN	83.0	
Initial Abstraction, Ia	3.1	mm
Time of concentration, tc	0.26	hours
Storage, S	51.9	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.44	0.61	0.72	0.16	0.16	
q*	0.103	0.126	0.139	0.043	0.043	
Peak Flow Rate - Pre-Dev	**0.58**	**1.35**	**2.39**	**0.07**	**0.07**	**m3/s**

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name Constellation to Paul Matthews (C2PM)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious	C	98	3.790	371.40
Pervious	C	74	2.585	191.30
			6.375	**562.70**

CN Weighted	88.3	
Ia Weighted	2.0	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.500	km
Catchment Slope, Sc	0.010	m/m
Runoff Factor	0.79	
Time of Concentration, tc	0.24	hours
SCS Lag for HEC-HMS	0.16	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
C2PM includes Caribbean Wetland in the post-development scenario

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Constellation to Paul Matthews (C2PM)

Runoff Volume

Pervious

Catchment Area, A	0.0259	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.24	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**1,053**	**2,746**	**5,125**	**103**	**103**	**m3**

Impervious

Catchment Area, A	0.0379	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.24	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**3,187**	**6,214**	**10,040**	**822**	**822**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Post-Dev	**4,240**	**8,960**	**15,165**	**925**	**925**	**m3**

Peak Flow Rate

Catchment Area, A	0.0637	km2
Runoff CN	88.3	
Initial Abstraction, Ia	2.0	mm
Time of concentration, tc	0.24	hours
Storage, S	33.8	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.56	0.71	0.80	0.25	0.25	
q*	0.121	0.140	0.148	0.065	0.065	
Peak Flow Rate - Post-Dev	**0.69**	**1.51**	**2.54**	**0.11**	**0.11**	**m3/s**

DIFFERENCE BETWEEN PRE AND POST-DEVELOPMENT RUNOFF

Catchment Name: *Constellation to Paul Matthews (C2PM)*

VOLUME

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
Pre-development Volume	3,638	8,158	14,239	680	680	m3
Post-Development Volume	4,240	8,960	15,165	925	925	m3
Difference - Volume	602	802	925	245	245	m3
Difference (% Change)	**17%**	**10%**	**6%**	**36%**	**36%**	**%**

PEAK FLOW

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
Pre-development Flow	0.584	1.354	2.386	0.072	0.072	m3/s
Post-Development Flow	0.689	1.511	2.544	0.107	0.107	m3/s
Difference - Flow	0.105	0.157	0.159	0.036	0.036	m3/s
Difference (% Change)	**18%**	**12%**	**7%**	**50%**	**50%**	**%**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Paul Matthews to Albany Highway (PM2AH)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	2.362	231.51
Pervious Area	C	74	4.258	315.12
			6.621	**546.63**

CN Weighted	82.6	
Ia Weighted	3.2	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	1.000	km
Catchment Slope, Sc	0.020	m/m
Runoff Factor	0.70	
Time of Concentration, tc	0.33	hours
SCS Lag for HEC-HMS	0.22	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
PM2AH includes Rook Wetland in the post-development scenario

ANALYSIS OF PRE-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Paul Matthews to Albany Highway (PM2AH)

Runoff Volume

Pervious

Catchment Area, A	0.0426	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.33	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**1,734**	**4,523**	**8,442**	**170**	**170**	**m3**

Impervious

Catchment Area, A	0.0236	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.33	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**1,987**	**3,873**	**6,258**	**512**	**512**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Pre-Dev	**3,721**	**8,396**	**14,700**	**682**	**682**	**m3**

Peak Flow Rate

Catchment Area, A	0.0662	km2
Runoff CN	82.6	
Initial Abstraction, Ia	3.2	mm
Time of concentration, tc	0.33	hours
Storage, S	53.6	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.43	0.60	0.71	0.15	0.15	
q*	0.093	0.114	0.126	0.038	0.038	
Peak Flow Rate - Pre-Dev	**0.55**	**1.28**	**2.26**	**0.07**	**0.07**	**m3/s**

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ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name Paul Matthews to Albany Highway (PM2AH)

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious	C	98	4.894	479.58
Pervious	C	74	1.727	127.80
			6.621	**607.38**

CN Weighted	91.7	
Ia Weighted	1.3	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	1.000	km
Catchment Slope, Sc	0.020	m/m
Runoff Factor	0.85	
Time of Concentration, tc	0.30	hours
SCS Lag for HEC-HMS	0.20	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments
PM2AH includes Rook Wetland in the post-development scenario

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Paul Matthews to Albany Highway (PM2AH)

Runoff Volume

Pervious

Catchment Area, A	0.0173	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.30	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**703**	**1,834**	**3,424**	**69**	**69**	**m3**

Impervious

Catchment Area, A	0.0489	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.30	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**4,116**	**8,024**	**12,964**	**1,061**	**1,061**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Post-Dev	**4,819**	**9,858**	**16,388**	**1,130**	**1,130**	**m3**

Peak Flow Rate

Catchment Area, A	0.0662	km2
Runoff CN	91.7	
Initial Abstraction, Ia	1.3	mm
Time of concentration, tc	0.30	hours
Storage, S	22.9	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.65	0.78	0.85	0.34	0.34	
q*	0.125	0.137	0.140	0.079	0.079	
Peak Flow Rate - Post-Dev	**0.73**	**1.53**	**2.50**	**0.14**	**0.14**	**m3/s**

DIFFERENCE BETWEEN PRE AND POST-DEVELOPMENT RUNOFF

Catchment Name: *Paul Matthews to Albany Highway (PM2AH)*

VOLUME

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
Pre-development Volume	3,721	8,396	14,700	682	682	m3
Post-Development Volume	4,819	9,858	16,388	1,130	1,130	m3
Difference - Volume	1,098	1,462	1,688	447	447	m3
Difference (% Change)	**30%**	**17%**	**11%**	**66%**	**66%**	**%**

PEAK FLOW

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
Pre-development Flow	0.546	1.278	2.259	0.065	0.065	m3/s
Post-Development Flow	0.734	1.535	2.498	0.135	0.135	m3/s
Difference - Flow	0.188	0.257	0.240	0.070	0.070	m3/s
Difference (% Change)	**34%**	**20%**	**11%**	**107%**	**107%**	**%**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Oteha Valley East Wetland

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	1.710	167.61
Pervious Area	C	74	0.023	1.68
			1.733	**169.29**

CN Weighted	97.7	
Ia Weighted	0.1	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.590	km
Catchment Slope, Sc	0.045	m/m
Runoff Factor	0.95	
Time of Concentration, tc	0.17	hours
SCS Lag for HEC-HMS	0.11	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments

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ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Oteha Valley East Wetland

Runoff Volume

Pervious

Catchment Area, A	0.0002	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.17	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	8.4	mm
Runoff Volume - Pervious	**9**	**24**	**45**	**1**	**2**	**m3**

Impervious

Catchment Area, A	0.0171	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.17	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	32.5	mm
Runoff Volume - Impervious	**1,438**	**2,804**	**4,531**	**371**	**555**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	yr
Total Runoff Volume - Post-Dev	**1,448**	**2,829**	**4,576**	**372**	**557**	**m3**

Peak Flow Rate

Catchment Area, A	0.0173	km2
Runoff CN	97.7	
Initial Abstraction, Ia	0.1	mm
Time of concentration, tc	0.17	hours
Storage, S	6.0	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
c*	0.88	0.93	0.96	0.68	0.75	
q*	0.164	0.166	0.166	0.151	0.158	
Peak Flow Rate - Post-Dev	**0.25**	**0.49**	**0.78**	**0.07**	**0.10**	**m3/s**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Oteha Valley West Wetland

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	0.430	42.15
Pervious Area	C	74	0.000	0.00
			0.430	**42.15**

CN Weighted	98.0	
Ia Weighted	0.0	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.330	km
Catchment Slope, Sc	0.034	m/m
Runoff Factor	0.96	
Time of Concentration, tc	0.17	hours
SCS Lag for HEC-HMS	0.11	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments

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ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Oteha Valley West Wetland

Runoff Volume

Pervious

Catchment Area, A	0.0000	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.17	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	8.4	mm
Runoff Volume - Pervious	**0**	**0**	**0**	**0**	**0**	**m3**

Impervious

Catchment Area, A	0.0043	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.17	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	32.5	mm
Runoff Volume - Impervious	**362**	**705**	**1,139**	**93**	**140**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	yr
Total Runoff Volume - Post-Dev	**362**	**705**	**1,139**	**93**	**140**	**m3**

Peak Flow Rate

Catchment Area, A	0.0043	km2
Runoff CN	98.0	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.17	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
c*	0.90	0.94	0.96	0.71	0.78	
q*	0.165	0.166	0.167	0.155	0.160	
Peak Flow Rate - Post-Dev	**0.06**	**0.12**	**0.19**	**0.02**	**0.03**	**m3/s**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: McClymonts Wetland

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	2.214	217.01
Pervious Area	C	74	0.266	19.71
			2.481	**236.72**

CN Weighted	95.4	
Ia Weighted	0.5	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.350	km
Catchment Slope, Sc	0.030	m/m
Runoff Factor	0.91	
Time of Concentration, tc	0.17	hours
SCS Lag for HEC-HMS	0.11	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
McClymonts Wetland

Runoff Volume

Pervious

Catchment Area, A	0.0027	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.17	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	8.4	mm
Runoff Volume - Pervious	**108**	**283**	**528**	**11**	**22**	**m3**

Impervious

Catchment Area, A	0.0221	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.17	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	32.5	mm
Runoff Volume - Impervious	**1,862**	**3,631**	**5,866**	**480**	**719**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	yr
Total Runoff Volume - Post-Dev	**1,971**	**3,914**	**6,394**	**491**	**741**	**m3**

Peak Flow Rate

Catchment Area, A	0.0248	km2
Runoff CN	95.4	
Initial Abstraction, Ia	0.5	mm
Time of concentration, tc	0.17	hours
Storage, S	12.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF1	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	37.0	mm
c*	0.78	0.87	0.92	0.51	0.60	
q*	0.161	0.164	0.165	0.127	0.139	
Peak Flow Rate - Post-Dev	**0.35**	**0.69**	**1.11**	**0.08**	**0.13**	**m3/s**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Greville Wetland

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	2.863	280.59
Pervious Area	C	74	0.698	51.68
			3.562	**332.27**

CN Weighted	93.3	
Ia Weighted	1.0	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.540	km
Catchment Slope, Sc	0.035	m/m
Runoff Factor	0.87	
Time of Concentration, tc	0.17	hours
SCS Lag for HEC-HMS	0.11	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments

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ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Greville Wetland

Runoff Volume

Pervious

Catchment Area, A	0.0070	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.17	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**284**	**742**	**1,384**	**28**	**28**	**m3**

Impervious

Catchment Area, A	0.0286	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.17	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**2,408**	**4,695**	**7,585**	**621**	**621**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Post-Dev	**2,692**	**5,436**	**8,969**	**649**	**649**	**m3**

Peak Flow Rate

Catchment Area, A	0.0356	km2
Runoff CN	93.3	
Initial Abstraction, Ia	1.0	mm
Time of concentration, tc	0.17	hours
Storage, S	18.3	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.70	0.82	0.88	0.40	0.40	
q*	0.154	0.163	0.164	0.107	0.107	
Peak Flow Rate - Post-Dev	**0.49**	**0.98**	**1.58**	**0.10**	**0.10**	**m3/s**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Alpurt A1 Pond 34

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	2.334	228.78
Pervious Area	C	74	2.088	154.54
			4.423	**383.32**

CN Weighted	86.7	
Ia Weighted	2.4	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.330	km
Catchment Slope, Sc	0.022	m/m
Runoff Factor	0.76	
Time of Concentration, tc	0.17	hours
SCS Lag for HEC-HMS	0.11	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments

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ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Alpurt A1 Pond 34

Runoff Volume

Pervious

Catchment Area, A	0.0209	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.17	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**851**	**2,218**	**4,140**	**84**	**84**	**m3**

Impervious

Catchment Area, A	0.0233	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.17	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**1,963**	**3,828**	**6,184**	**506**	**506**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Post-Dev	**2,814**	**6,046**	**10,324**	**590**	**590**	**m3**

Peak Flow Rate

Catchment Area, A	0.0442	km2
Runoff CN	86.7	
Initial Abstraction, Ia	2.4	mm
Time of concentration, tc	0.17	hours
Storage, S	39.1	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.52	0.68	0.77	0.21	0.21	
q*	0.129	0.150	0.160	0.064	0.064	
Peak Flow Rate - Post-Dev	**0.51**	**1.12**	**1.91**	**0.07**	**0.07**	**m3/s**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Alpurt A1 Pond 35

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	4.608	451.54
Pervious Area	C	74	1.778	131.58
			6.386	**583.12**

CN Weighted	91.3	
Ia Weighted	1.4	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.580	km
Catchment Slope, Sc	0.021	m/m
Runoff Factor	0.84	
Time of Concentration, tc	0.21	hours
SCS Lag for HEC-HMS	0.14	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Alpurt A1 Pond 35

Runoff Volume

Pervious

Catchment Area, A	0.0178	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.21	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**724**	**1,888**	**3,525**	**71**	**71**	**m3**

Impervious

Catchment Area, A	0.0461	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.21	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**3,875**	**7,555**	**12,206**	**999**	**999**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Post-Dev	**4,599**	**9,443**	**15,731**	**1,070**	**1,070**	**m3**

Peak Flow Rate

Catchment Area, A	0.0639	km2
Runoff CN	91.3	
Initial Abstraction, Ia	1.4	mm
Time of concentration, tc	0.21	hours
Storage, S	24.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.64	0.77	0.85	0.32	0.32	
q*	0.137	0.152	0.155	0.086	0.086	
Peak Flow Rate - Post-Dev	**0.78**	**1.64**	**2.68**	**0.14**	**0.14**	**m3/s**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Moro Wetland

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	8.429	826.03
Pervious Area	C	74	4.565	337.79
			12.994	**1163.82**

CN Weighted	89.6	
Ia Weighted	1.8	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.920	km
Catchment Slope, Sc	0.032	m/m
Runoff Factor	0.81	
Time of Concentration, tc	0.25	hours
SCS Lag for HEC-HMS	0.17	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments

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ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Moro Wetland

Runoff Volume

Pervious

Catchment Area, A	0.0456	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.25	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**1,859**	**4,848**	**9,049**	**183**	**183**	**m3**

Impervious

Catchment Area, A	0.0843	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.25	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**7,089**	**13,821**	**22,329**	**1,827**	**1,827**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Post-Dev	**8,948**	**18,669**	**31,378**	**2,010**	**2,010**	**m3**

Peak Flow Rate

Catchment Area, A	0.1299	km2
Runoff CN	89.6	
Initial Abstraction, Ia	1.8	mm
Time of concentration, tc	0.25	hours
Storage, S	29.6	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.59	0.74	0.82	0.28	0.28	
q*	0.124	0.141	0.147	0.071	0.071	
Peak Flow Rate - Post-Dev	**1.43**	**3.10**	**5.15**	**0.24**	**0.24**	**m3/s**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Caribbean Wetland

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	3.091	302.89
Pervious Area	C	74	2.161	159.92
			5.252	**462.82**

CN Weighted	88.1	
Ia Weighted	2.1	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	0.900	km
Catchment Slope, Sc	0.027	m/m
Runoff Factor	0.79	
Time of Concentration, tc	0.26	hours
SCS Lag for HEC-HMS	0.18	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments

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ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Caribbean Wetland

Runoff Volume

Pervious

Catchment Area, A	0.0216	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.26	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**880**	**2,295**	**4,284**	**86**	**86**	**m3**

Impervious

Catchment Area, A	0.0309	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.26	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**2,599**	**5,068**	**8,188**	**670**	**670**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Post-Dev	**3,480**	**7,363**	**12,472**	**756**	**756**	**m3**

Peak Flow Rate

Catchment Area, A	0.0525	km2
Runoff CN	88.1	
Initial Abstraction, Ia	2.1	mm
Time of concentration, tc	0.26	hours
Storage, S	34.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.55	0.71	0.80	0.24	0.24	
q*	0.118	0.136	0.144	0.062	0.062	
Peak Flow Rate - Post-Dev	**0.55**	**1.21**	**2.04**	**0.08**	**0.08**	**m3/s**

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TP108 Calculations - Peak Flow and Volumes

Project Summary

Project No.	250310
Project Name	SH1/18 Northern Corridor Improvements
Date	24/11/2016
Designed	Matthew Yu

ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 1: Runoff Parameters and Time of Concentration

Catchment Name: Rook Wetland

1. Runoff Curve (CN) and initial Abstration (ia)

Description	Soil Class	CN	Area (ha)	CN x Area
Impervious Area	C	98	2.932	287.30
Pervious Area	C	74	1.667	123.32
			4.598	**410.62**

CN Weighted	89.3	
Ia Weighted	1.8	mm
Ia Impervious	0.0	mm

2. Time of concentration

Channelisation Factor, C	0.6	
Catchment length, L	1.000	km
Catchment Slope, Sc	0.022	m/m
Runoff Factor	0.81	
Time of Concentration, tc	0.30	hours
SCS Lag for HEC-HMS	0.20	hours

Note:
Volume calculated from heterogeneous (separate impervious and pervious) catchments
Peak flow calculated from homogeneous catchments

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ANALYSIS OF POST-DEVELOPMENT RUNOFF

TP 108 Worksheet 2: Graphical Peak Flow Rate

Catchment Name:
Rook Wetland

Runoff Volume

Pervious

Catchment Area, A	0.0167	km2
Runoff CN	74	
Initial Abstraction, Ia	5.0	mm
Time of concentration, tc	0.30	hours
Storage, S	89.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	40.7	106.2	198.2	4.0	4.0	mm
Runoff Volume - Pervious	**679**	**1,770**	**3,304**	**67**	**67**	**m3**

Impervious

Catchment Area, A	0.0293	km2
Runoff CN	98	
Initial Abstraction, Ia	0.0	mm
Time of concentration, tc	0.30	hours
Storage, S	5.2	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
Runoff Depth	84.1	164.0	264.9	21.7	21.7	mm
Runoff Volume - Impervious	**2,466**	**4,807**	**7,766**	**636**	**636**	**m3**

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	yr
Total Runoff Volume - Post-Dev	**3,144**	**6,577**	**11,070**	**702**	**702**	**m3**

Peak Flow Rate

Catchment Area, A	0.0460	km2
Runoff CN	89.3	
Initial Abstraction, Ia	1.8	mm
Time of concentration, tc	0.30	hours
Storage, S	30.4	mm

	2-Year ARI	10-Year ARI	100-Year ARI	WQV	Det - SMAF2	
24-Hour Rainfall Depth, P24	89.0	169.0	270.0	26.0	26.0	mm
c*	0.58	0.73	0.81	0.27	0.27	
q*	0.116	0.133	0.139	0.065	0.065	
Peak Flow Rate - Post-Dev	**0.48**	**1.03**	**1.72**	**0.08**	**0.08**	**m3/s**

HEC-HMS Outputs

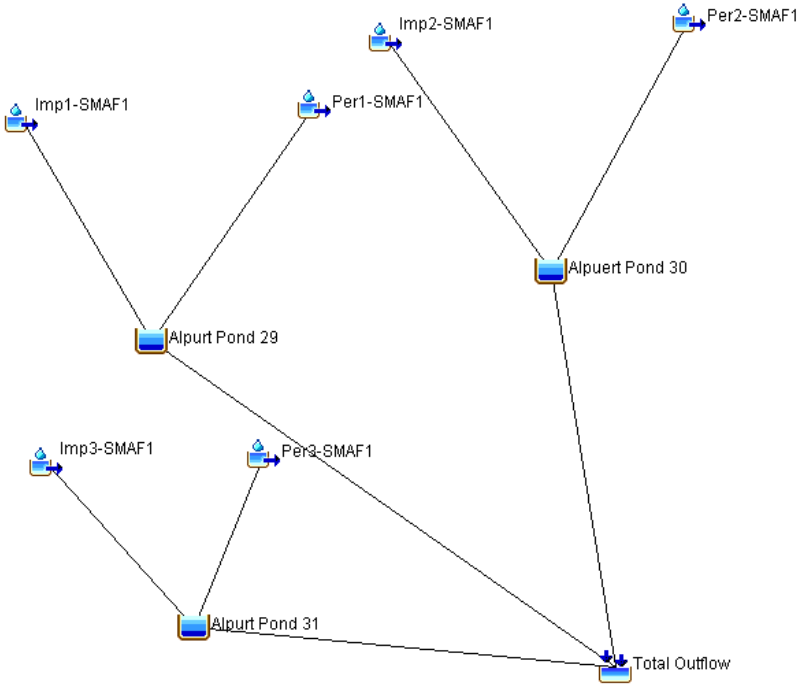
Designed: Matthew Yu

Reviewed: Don Mackintosh

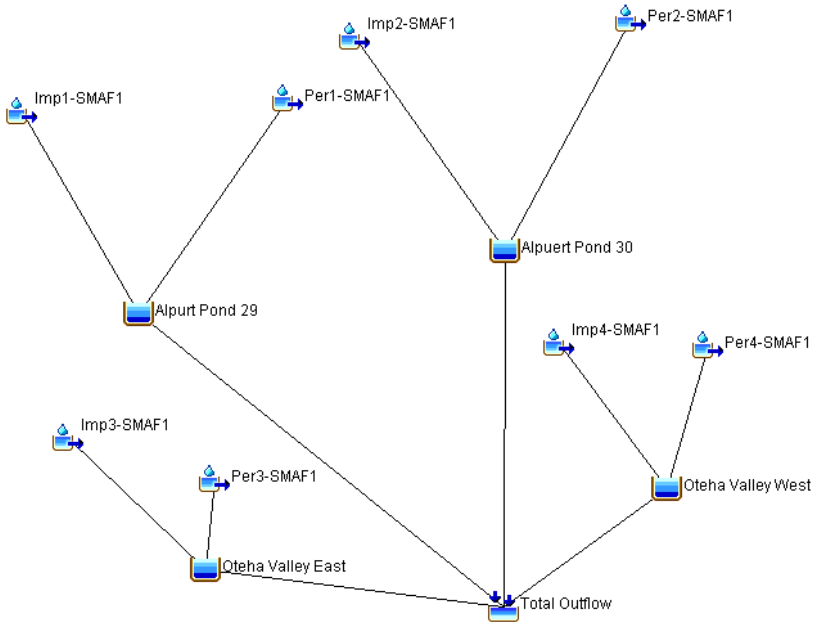
Date: 28/9/2016

Oteha Valley to McClymonts (OV2M) Sub-Catchment

Pre-Development



Post-Development



2-Year ARI (Pre-Dev)

Global Summary Results for Run "OV2M Pre-Dev 2yr"

Project: NCI Simulation Run: OV2M Pre-Dev 2yr

Start of Run: 01Jan2000, 00:00
End of Run: 04Jan2000, 00:00
Compute Time: 15Nov2016, 17:29:55
Basin Model: OV2M Pre-Dev
Meteorologic Model: 2y ARI 24h
Control Specifications: 3 days

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Per1-SMAF1	0.03702	0.273	01Jan2000, 12:14	40.729
Imp1-SMAF1	0.02669	0.384	01Jan2000, 12:13	89.000
Alpurt Pond 29	0.06371	0.450	01Jan2000, 12:21	60.935
Imp2-SMAF1	0.02621	0.383	01Jan2000, 12:13	89.000
Per2-SMAF1	0.01188	0.089	01Jan2000, 12:13	40.729
Alpuert Pond 30	0.03809	0.126	01Jan2000, 12:39	73.777
Imp3-SMAF1	0.00702	0.104	01Jan2000, 12:12	89.000
Per3-SMAF1	0.00463	0.035	01Jan2000, 12:13	40.729
Alpurt Pond 31	0.01165	0.031	01Jan2000, 12:44	69.631
Total Outflow	0.11345	0.566	01Jan2000, 12:21	66.139

2-Year ARI (Post-Dev)

Global Summary Results for Run "OV2M Post-Dev 2yr"

Project: NCI Simulation Run: OV2M Post-Dev 2yr

Start of Run: 01Jan2000, 00:00
End of Run: 04Jan2000, 00:00
Compute Time: 15Nov2016, 17:51:37
Basin Model: OV2M Post-Dev
Meteorologic Model: 2y ARI 24h
Control Specifications: 3 days

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Per1-SMAF1	0.03702	0.273	01Jan2000, 12:14	40.729
Imp1-SMAF1	0.02669	0.384	01Jan2000, 12:13	89.000
Alpurt Pond 29	0.06371	0.450	01Jan2000, 12:21	60.935
Imp2-SMAF1	0.02280	0.333	01Jan2000, 12:13	89.000
Per2-SMAF1	0.01040	0.078	01Jan2000, 12:13	40.729
Alpuert Pond 30	0.03320	0.087	01Jan2000, 13:02	73.688
Imp3-SMAF1	0.01710	0.254	01Jan2000, 12:12	89.000
Per3-SMAF1	0.00020	0.002	01Jan2000, 12:13	40.729
Oteha Valley East	0.01730	0.041	01Jan2000, 13:08	87.855
Imp4-SMAF1	0.00430	0.064	01Jan2000, 12:12	89.000
Per4-SMAF1	0.00010	0.001	01Jan2000, 12:13	40.729
Oteha Valley West	0.00440	0.016	01Jan2000, 12:38	87.817
Total Outflow	0.11861	0.574	01Jan2000, 12:21	69.428

10-Year ARI (Pre-Dev)

Global Summary Results for Run "OV2M Pre-Dev 10yr"

Project: NCI Simulation Run: OV2M Pre-Dev 10yr

Start of Run: 01Jan2000, 00:00 Basin Model: OV2M Pre-Dev
End of Run: 04Jan2000, 00:00 Meteorologic Model: 10y ARI 24h
Compute Time: 15Nov2016, 17:31:08 Control Specifications: 3 days

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Per1-SMAF1	0.03702	0.721	01Jan2000, 12:13	106.206
Imp1-SMAF1	0.02669	0.730	01Jan2000, 12:13	169.000
Alpurt Pond 29	0.06371	1.370	01Jan2000, 12:16	132.491
Imp2-SMAF1	0.02621	0.727	01Jan2000, 12:13	169.000
Per2-SMAF1	0.01188	0.235	01Jan2000, 12:13	106.206
Alpuert Pond 30	0.03809	0.675	01Jan2000, 12:19	149.235
Imp3-SMAF1	0.00702	0.198	01Jan2000, 12:12	169.000
Per3-SMAF1	0.00463	0.093	01Jan2000, 12:13	106.206
Alpurt Pond 31	0.01165	0.146	01Jan2000, 12:24	143.849
Total Outflow	0.11345	2.129	01Jan2000, 12:17	139.279

10-Year ARI (Post-Dev)

Global Summary Results for Run "OV2M Post-Dev 10yr"

Project: NCI Simulation Run: OV2M Post-Dev 10yr

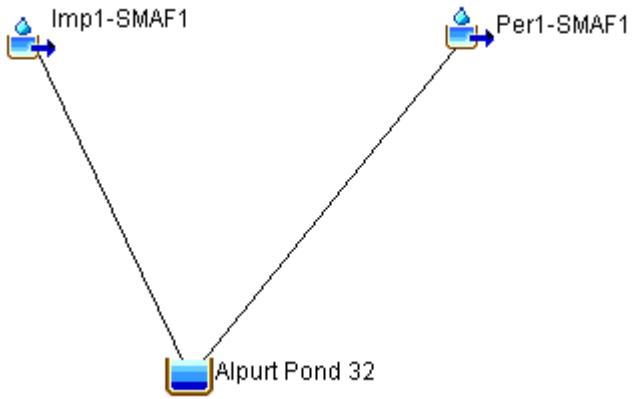
Start of Run: 01Jan2000, 00:00 Basin Model: OV2M Post-Dev
End of Run: 04Jan2000, 00:00 Meteorologic Model: 10y ARI 24h
Compute Time: 15Nov2016, 17:51:03 Control Specifications: 3 days

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

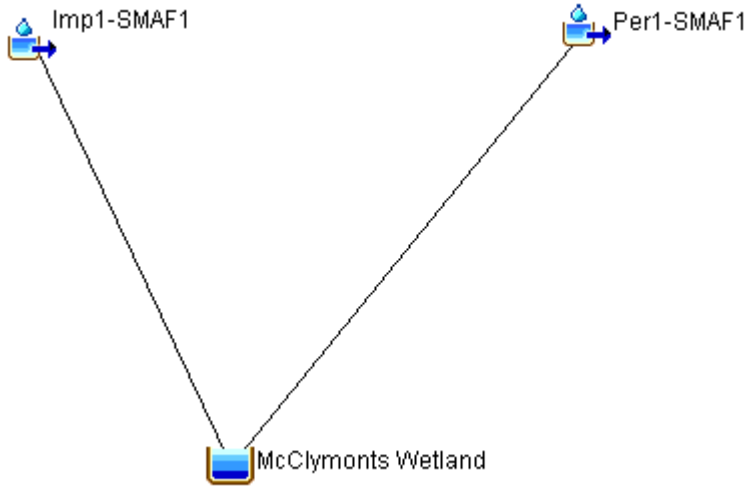
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Per1-SMAF1	0.03702	0.721	01Jan2000, 12:13	106.206
Imp1-SMAF1	0.02669	0.730	01Jan2000, 12:13	169.000
Alpurt Pond 29	0.06371	1.370	01Jan2000, 12:16	132.491
Imp2-SMAF1	0.02280	0.632	01Jan2000, 12:13	169.000
Per2-SMAF1	0.01040	0.206	01Jan2000, 12:13	106.206
Alpuert Pond 30	0.03320	0.513	01Jan2000, 12:21	149.127
Imp3-SMAF1	0.01710	0.482	01Jan2000, 12:12	169.000
Per3-SMAF1	0.00020	0.004	01Jan2000, 12:13	106.206
Oteha Valley East	0.01730	0.085	01Jan2000, 13:06	167.629
Imp4-SMAF1	0.00430	0.121	01Jan2000, 12:12	169.000
Per4-SMAF1	0.00010	0.002	01Jan2000, 12:13	106.206
Oteha Valley West	0.00440	0.036	01Jan2000, 12:35	167.481
Total Outflow	0.11861	1.931	01Jan2000, 12:17	143.571

McClymonts to Spencer (M2S) Sub-Catchment

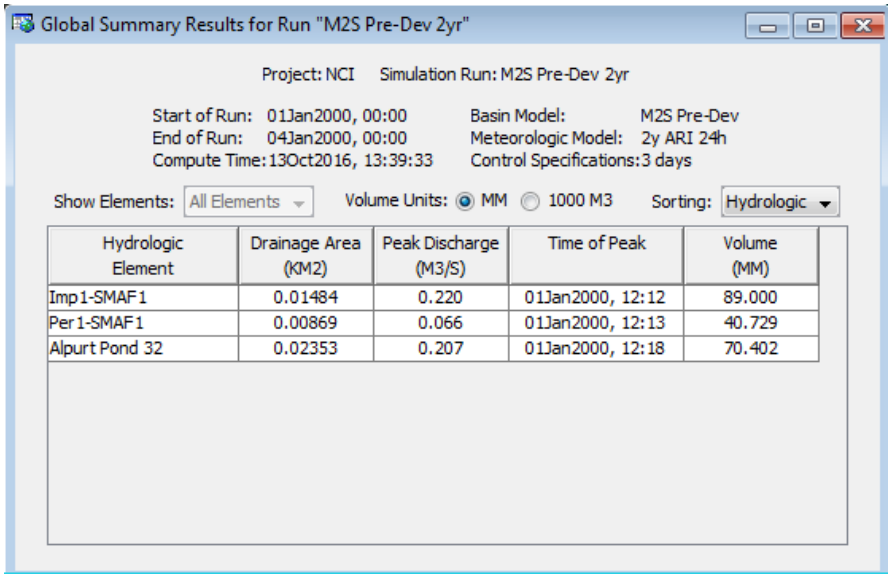
Pre-Development



Post-Development

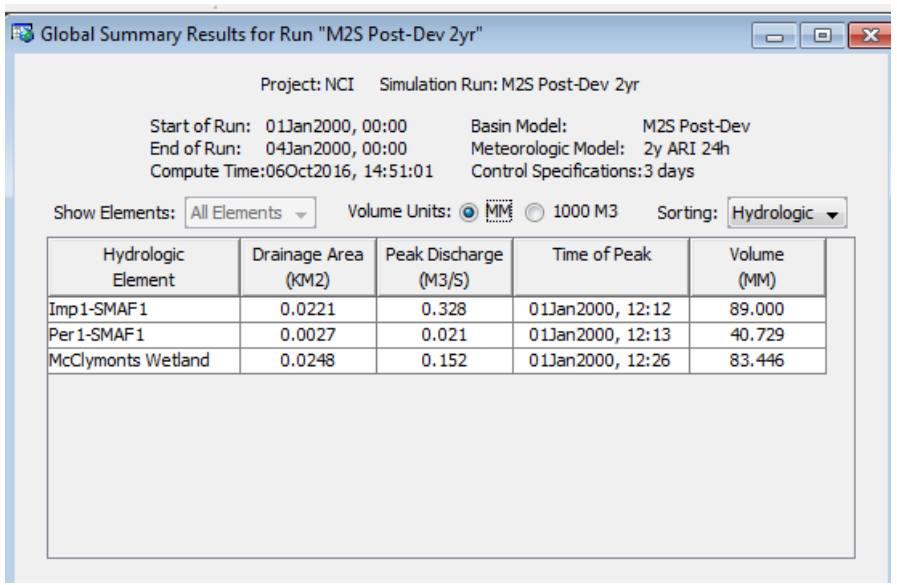


2-Year ARI (Pre-Dev)



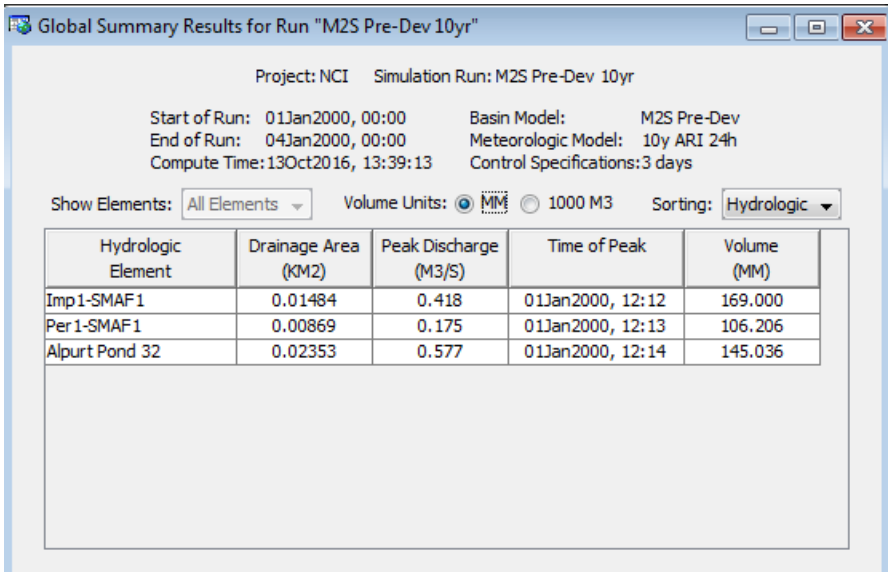
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Imp1-SMAF1	0.01484	0.220	01Jan2000, 12:12	89.000
Per1-SMAF1	0.00869	0.066	01Jan2000, 12:13	40.729
Alpurt Pond 32	0.02353	0.207	01Jan2000, 12:18	70.402

2-Year ARI (Post-Dev)



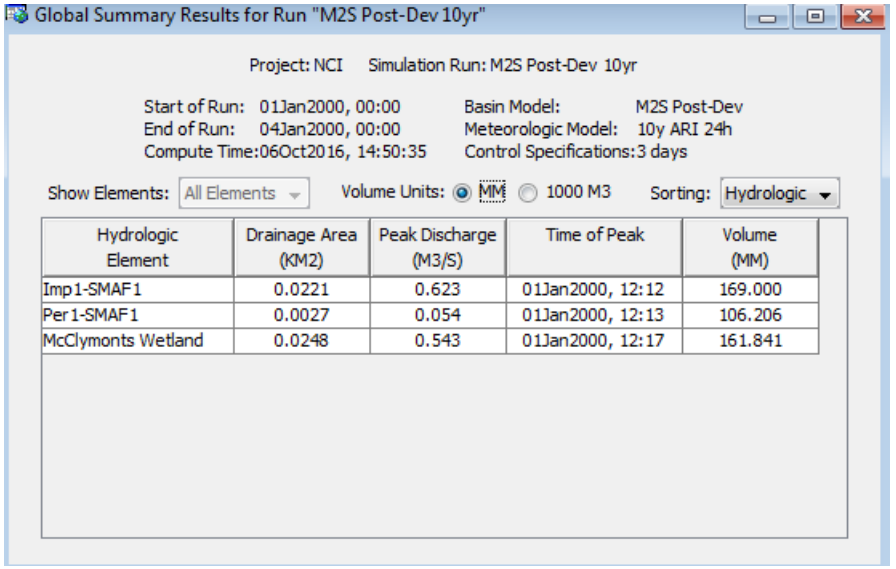
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Imp1-SMAF1	0.0221	0.328	01Jan2000, 12:12	89.000
Per1-SMAF1	0.0027	0.021	01Jan2000, 12:13	40.729
McClymonts Wetland	0.0248	0.152	01Jan2000, 12:26	83.446

10-Year ARI (Pre-Dev)



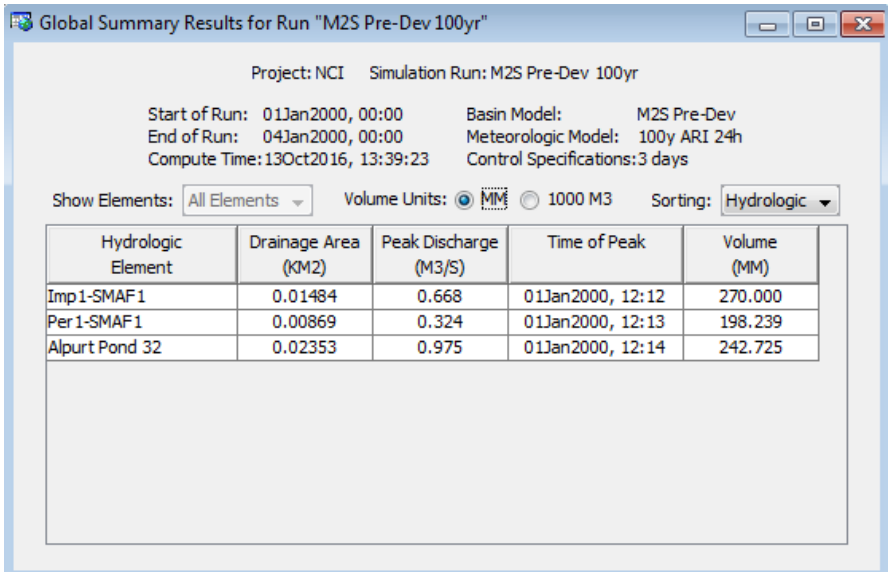
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Imp1-SMAF1	0.01484	0.418	01Jan2000, 12:12	169.000
Per1-SMAF1	0.00869	0.175	01Jan2000, 12:13	106.206
Alpurt Pond 32	0.02353	0.577	01Jan2000, 12:14	145.036

10-Year ARI (Post-Dev)



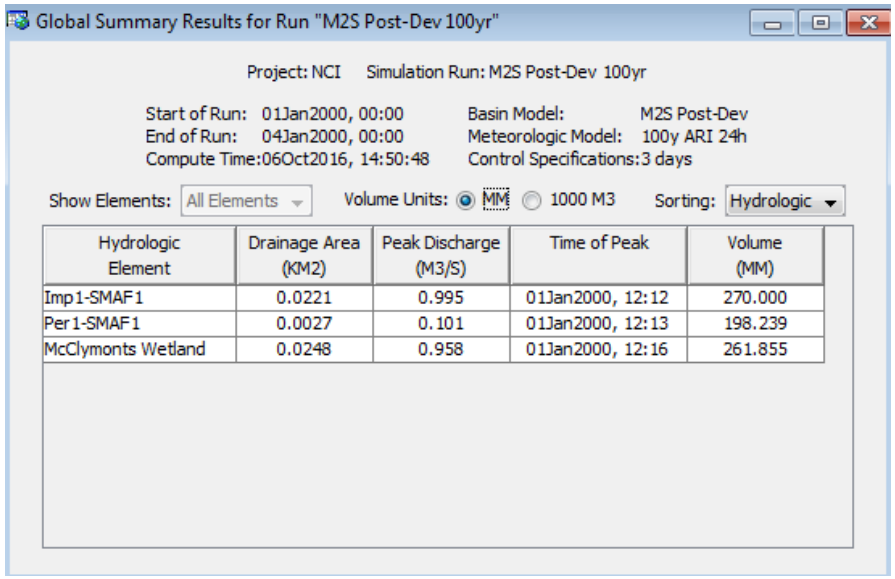
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Imp1-SMAF1	0.0221	0.623	01Jan2000, 12:12	169.000
Per1-SMAF1	0.0027	0.054	01Jan2000, 12:13	106.206
McClymonts Wetland	0.0248	0.543	01Jan2000, 12:17	161.841

100-Year ARI (Pre-Dev)



Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Imp1-SMAF1	0.01484	0.668	01Jan2000, 12:12	270.000
Per1-SMAF1	0.00869	0.324	01Jan2000, 12:13	198.239
Alpurt Pond 32	0.02353	0.975	01Jan2000, 12:14	242.725

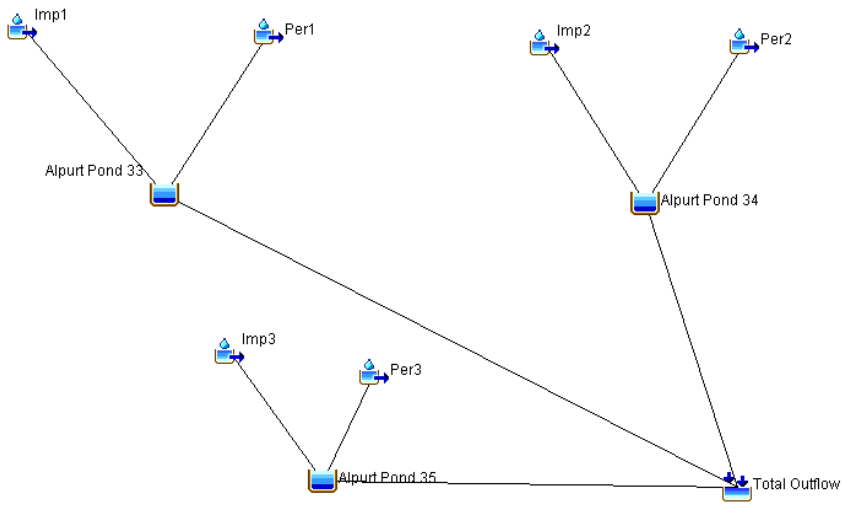
100-Year ARI (Post-Dev)



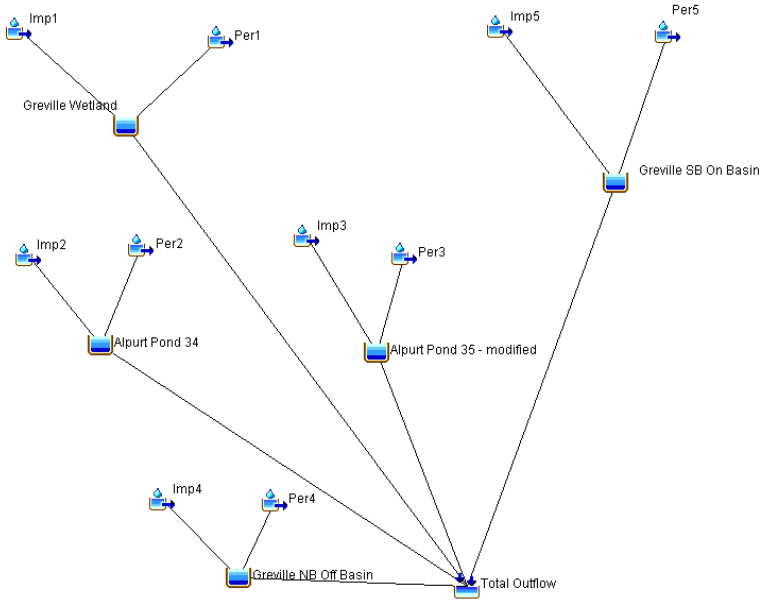
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Imp1-SMAF1	0.0221	0.995	01Jan2000, 12:12	270.000
Per1-SMAF1	0.0027	0.101	01Jan2000, 12:13	198.239
McClymonts Wetland	0.0248	0.958	01Jan2000, 12:16	261.855

Spencer to Rosedale (S2R) Sub-Catchment

Pre-Development



Post-Development



2-Year ARI (Pre-Dev)

Global Summary Results for Run "S2R Pre-Dev 2yr"

Project: NCI Simulation Run: S2R Pre-Dev 2yr

Start of Run: 01Jan2000, 00:00 Basin Model: S2R Pre-Dev
End of Run: 04Jan2000, 00:00 Meteorologic Model: 2y ARI 24h
Compute Time: 28Sep2016, 12:04:03 Control Specifications: 3 days

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Per3	0.04420	0.298	01Jan2000, 12:16	1.800
Imp3	0.03884	0.514	01Jan2000, 12:15	3.457
Alpurt Pond 35	0.08304	0.599	01Jan2000, 12:23	5.256
Per2	0.04206	0.321	01Jan2000, 12:13	1.713
Imp2	0.02718	0.404	01Jan2000, 12:12	2.419
Alpurt Pond 34	0.06924	0.469	01Jan2000, 12:20	4.127
Imp1	0.00801	0.119	01Jan2000, 12:12	0.713
Per1	0.00755	0.058	01Jan2000, 12:13	0.308
Alpurt Pond 33	0.01556	0.061	01Jan2000, 12:32	1.019
Total Outflow	0.16784	1.114	01Jan2000, 12:23	10.402

2-Year ARI (Post-Dev)

Global Summary Results for Run "S2R Post-Dev Final 2yr"

Project: NCI Simulation Run: S2R Post-Dev Final 2yr

Start of Run: 01Jan2000, 00:00 Basin Model: S2R Post-Dev Final
End of Run: 04Jan2000, 00:00 Meteorologic Model: 2y ARI 24h
Compute Time: 13Oct2016, 14:10:28 Control Specifications: 3 days

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Imp3	0.0461	0.637	01Jan2000, 12:14	89.000
Per3	0.0178	0.125	01Jan2000, 12:15	40.729
Alpurt Pond 35 - modi...	0.0639	0.378	01Jan2000, 12:28	75.527
Imp2	0.0233	0.346	01Jan2000, 12:12	89.000
Per2	0.0209	0.160	01Jan2000, 12:13	40.729
Alpurt Pond 34 - modi...	0.0442	0.149	01Jan2000, 12:36	65.945
Imp1	0.0286	0.425	01Jan2000, 12:12	89.000
Per1	0.0070	0.053	01Jan2000, 12:13	40.729
Greville Wetland	0.0356	0.079	01Jan2000, 13:08	78.869
Imp4	0.0207	0.286	01Jan2000, 12:14	89.000
Per4	0.0002	0.001	01Jan2000, 12:15	40.729
Greville NB Off Dry Pond	0.0209	0.096	01Jan2000, 12:37	88.431
Imp5	0.0025	0.037	01Jan2000, 12:12	89.000
Per5	0.0007	0.005	01Jan2000, 12:13	40.729
Greville SB On Dry Pond	0.0032	0.014	01Jan2000, 12:32	77.977
Total Outflow	0.1678	0.706	01Jan2000, 12:30	75.366

10-Year ARI (Pre-Dev)

Global Summary Results for Run "S2R Pre-Dev 10yr"

Project: NCI Simulation Run: S2R Pre-Dev 10yr

Start of Run: 01Jan2000, 00:00 Basin Model: S2R Pre-Dev
End of Run: 04Jan2000, 00:00 Meteorologic Model: 10y ARI 24h
Compute Time: 28Sep2016, 12:31:57 Control Specifications: 3 days

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Per3	0.04420	0.788	01Jan2000, 12:16	106.206
Imp3	0.03884	0.976	01Jan2000, 12:15	169.000
Alpurt Pond 35	0.08304	1.694	01Jan2000, 12:18	135.561
Per2	0.04206	0.847	01Jan2000, 12:13	106.206
Imp2	0.02718	0.766	01Jan2000, 12:12	169.000
Alpurt Pond 34	0.06924	1.351	01Jan2000, 12:17	130.778
Imp1	0.00801	0.226	01Jan2000, 12:12	169.000
Per1	0.00755	0.152	01Jan2000, 12:13	106.206
Alpurt Pond 33	0.01556	0.346	01Jan2000, 12:15	138.460
Total Outflow	0.16784	3.375	01Jan2000, 12:17	133.857

10-Year ARI (Post-Dev)

Global Summary Results for Run "S2R Post-Dev Final 10yr"

Project: NCI Simulation Run: S2R Post-Dev Final 10yr

Start of Run: 01Jan2000, 00:00 Basin Model: S2R Post-Dev Final
End of Run: 04Jan2000, 00:00 Meteorologic Model: 10y ARI 24h
Compute Time: 13Oct2016, 14:07:38 Control Specifications: 3 days

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Imp3	0.0461	1.210	01Jan2000, 12:14	169.000
Per3	0.0178	0.332	01Jan2000, 12:14	106.206
Alpurt Pond 35 - modi...	0.0639	0.841	01Jan2000, 12:26	151.480
Imp2	0.0233	0.657	01Jan2000, 12:12	169.000
Per2	0.0209	0.421	01Jan2000, 12:13	106.206
Alpurt Pond 34 - modi...	0.0442	0.360	01Jan2000, 12:32	139.067
Imp1	0.0286	0.806	01Jan2000, 12:12	169.000
Per1	0.0070	0.141	01Jan2000, 12:13	106.206
Greville Wetland	0.0356	0.172	01Jan2000, 13:06	155.958
Imp4	0.0207	0.543	01Jan2000, 12:14	169.000
Per4	0.0002	0.004	01Jan2000, 12:14	106.206
Greville NB Off Dry Pond	0.0209	0.505	01Jan2000, 12:17	168.289
Imp5	0.0025	0.070	01Jan2000, 12:12	169.000
Per5	0.0007	0.014	01Jan2000, 12:13	106.206
Greville SB On Dry Pond	0.0032	0.032	01Jan2000, 12:28	154.800
Total Outflow	0.1678	1.797	01Jan2000, 12:21	151.317

100-Year ARI (Pre-Dev)

Global Summary Results for Run "S2R Pre-Dev 100yr"

Project: NCI Simulation Run: S2R Pre-Dev 100yr

Start of Run: 01Jan2000, 00:00 Basin Model: S2R Pre-Dev
End of Run: 04Jan2000, 00:00 Meteorologic Model: 100y ARI 24h
Compute Time: 28Sep2016, 12:32:33 Control Specifications: 3 days

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Per3	0.04420	1.465	01Jan2000, 12:15	8.762
Imp3	0.03884	1.560	01Jan2000, 12:15	10.487
Alpurt Pond 35	0.08304	2.933	01Jan2000, 12:17	19.248
Per2	0.04206	1.570	01Jan2000, 12:13	8.338
Imp2	0.02718	1.224	01Jan2000, 12:12	7.339
Alpurt Pond 34	0.06924	2.515	01Jan2000, 12:15	15.671
Imp1	0.00801	0.361	01Jan2000, 12:12	2.163
Per1	0.00755	0.282	01Jan2000, 12:13	1.497
Alpurt Pond 33	0.01556	0.610	01Jan2000, 12:15	3.658
Total Outflow	0.16784	6.012	01Jan2000, 12:16	38.577

100-Year ARI (Post-Dev)

Global Summary Results for Run "S2R Post-Dev Final 100yr"

Project: NCI Simulation Run: S2R Post-Dev Final 100yr

Start of Run: 01Jan2000, 00:00 Basin Model: S2R Post-Dev Final
End of Run: 04Jan2000, 00:00 Meteorologic Model: 100y ARI 24h
Compute Time: 13Oct2016, 14:09:04 Control Specifications: 3 days

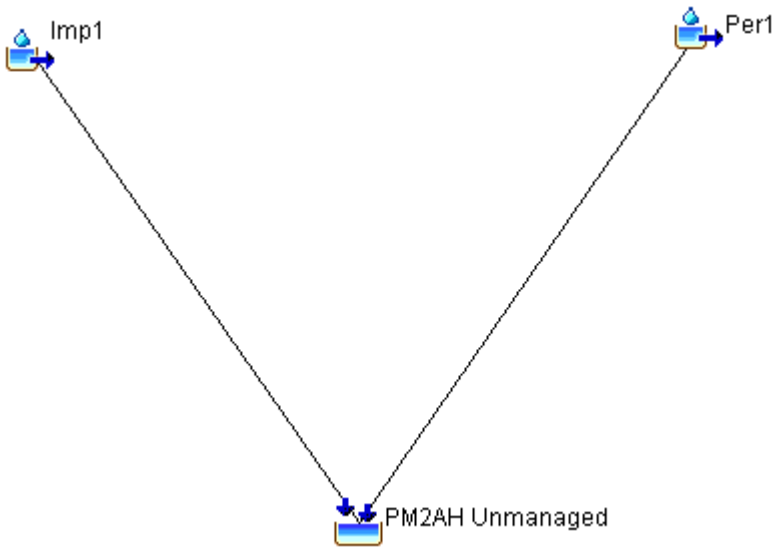
Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Imp3	0.0461	1.934	01Jan2000, 12:14	270.000
Per3	0.0178	0.617	01Jan2000, 12:14	198.239
Alpurt Pond 35 - modi...	0.0639	2.019	01Jan2000, 12:20	249.989
Imp2	0.0233	1.049	01Jan2000, 12:12	270.000
Per2	0.0209	0.780	01Jan2000, 12:13	198.239
Alpurt Pond 34 - modi...	0.0442	0.651	01Jan2000, 12:30	235.820
Imp1	0.0286	1.288	01Jan2000, 12:12	270.000
Per1	0.0070	0.261	01Jan2000, 12:13	198.239
Greville Wetland	0.0356	0.291	01Jan2000, 13:05	255.153
Imp4	0.0207	0.868	01Jan2000, 12:14	270.000
Per4	0.0002	0.007	01Jan2000, 12:14	198.239
Greville NB Off Dry Pond	0.0209	0.838	01Jan2000, 12:16	269.206
Imp5	0.0025	0.113	01Jan2000, 12:12	270.000
Per5	0.0007	0.026	01Jan2000, 12:13	198.239
Greville SB On Dry Pond	0.0032	0.051	01Jan2000, 12:29	253.836
Total Outflow	0.1678	3.710	01Jan2000, 12:20	249.819

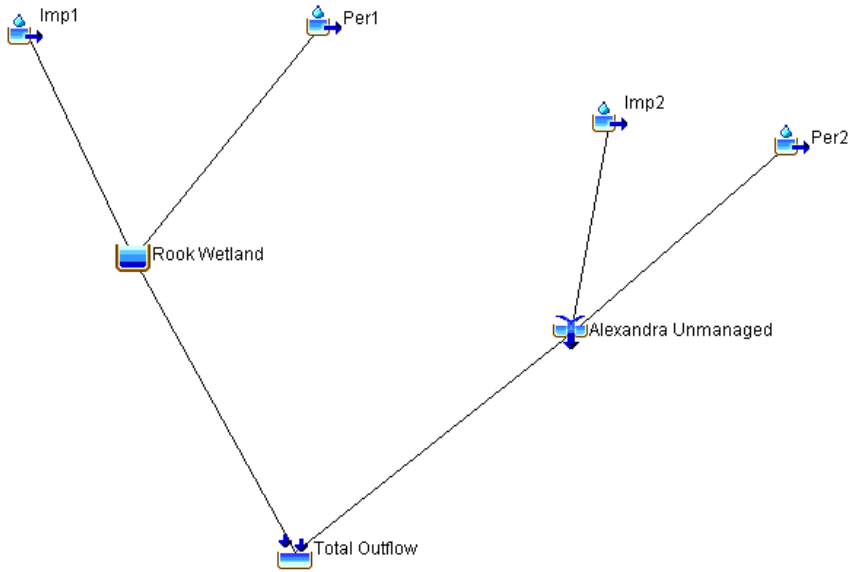
Paul Matthews to Albany Highway (PM2AH)

Sub-Catchment

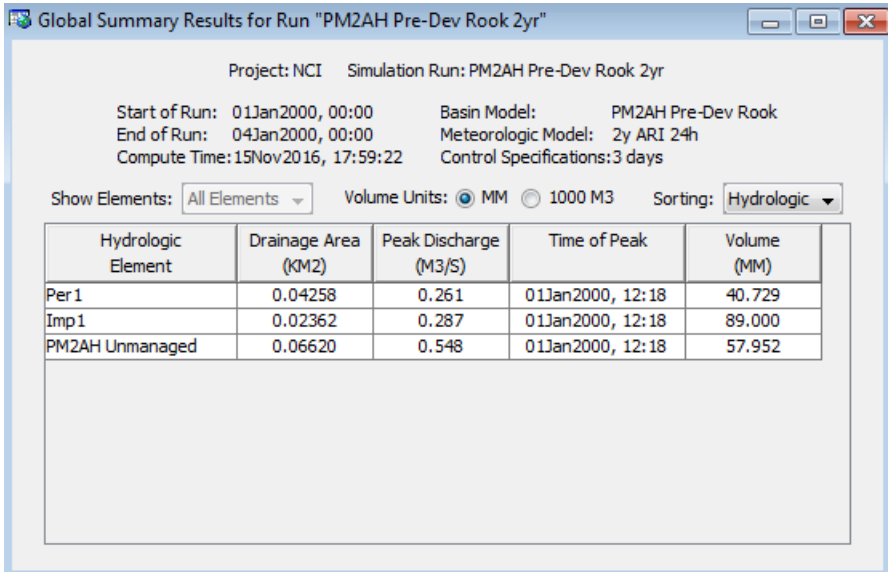
Pre-Development



Post-Development

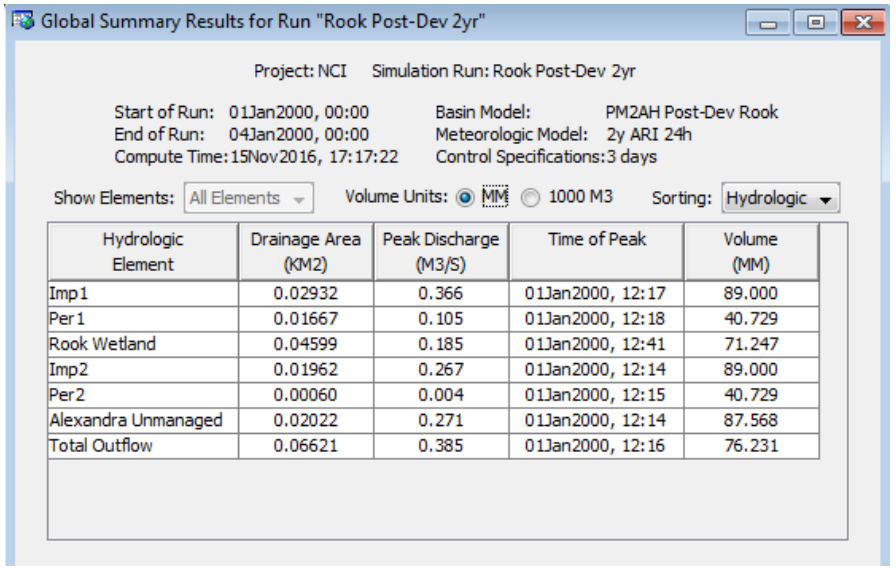


2-Year ARI (Pre-Dev)



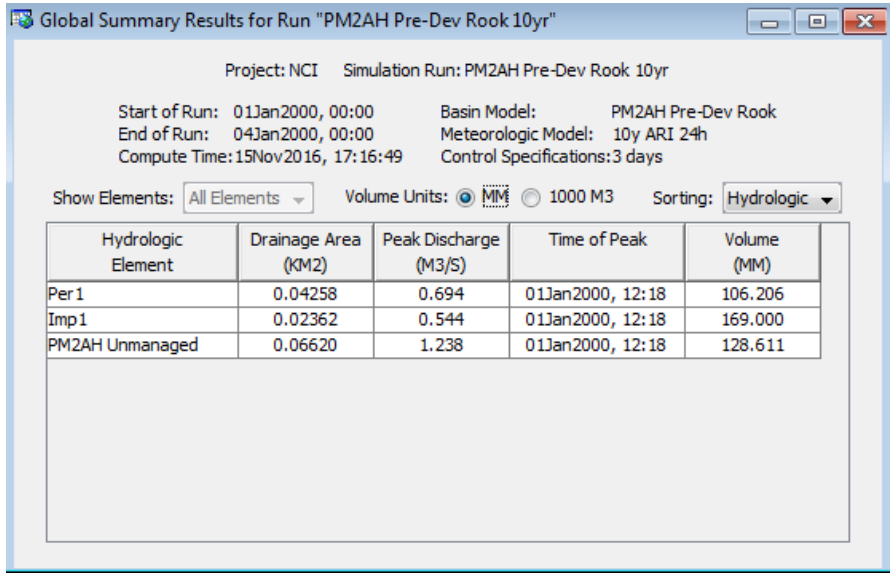
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Per1	0.04258	0.261	01Jan2000, 12:18	40.729
Imp1	0.02362	0.287	01Jan2000, 12:18	89.000
PM2AH Unmanaged	0.06620	0.548	01Jan2000, 12:18	57.952

2-Year ARI (Post-Dev)



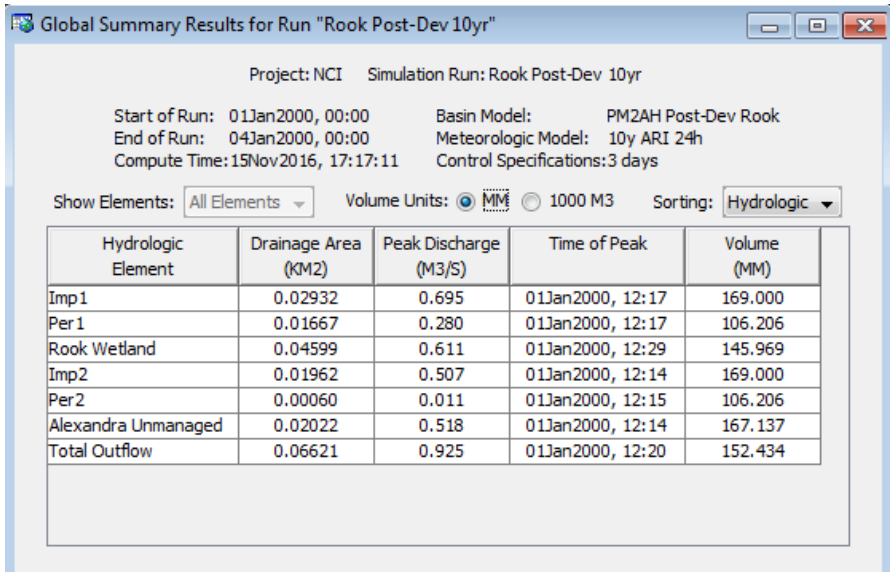
Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Imp1	0.02932	0.366	01Jan2000, 12:17	89.000
Per1	0.01667	0.105	01Jan2000, 12:18	40.729
Rook Wetland	0.04599	0.185	01Jan2000, 12:41	71.247
Imp2	0.01962	0.267	01Jan2000, 12:14	89.000
Per2	0.00060	0.004	01Jan2000, 12:15	40.729
Alexandra Unmanaged	0.02022	0.271	01Jan2000, 12:14	87.568
Total Outflow	0.06621	0.385	01Jan2000, 12:16	76.231

10-Year ARI (Pre-Dev)



Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Per1	0.04258	0.694	01Jan2000, 12:18	106.206
Imp1	0.02362	0.544	01Jan2000, 12:18	169.000
PM2AH Unmanaged	0.06620	1.238	01Jan2000, 12:18	128.611

10-Year ARI (Post-Dev)



Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Imp1	0.02932	0.695	01Jan2000, 12:17	169.000
Per1	0.01667	0.280	01Jan2000, 12:17	106.206
Rook Wetland	0.04599	0.611	01Jan2000, 12:29	145.969
Imp2	0.01962	0.507	01Jan2000, 12:14	169.000
Per2	0.00060	0.011	01Jan2000, 12:15	106.206
Alexandra Unmanaged	0.02022	0.518	01Jan2000, 12:14	167.137
Total Outflow	0.06621	0.925	01Jan2000, 12:20	152.434