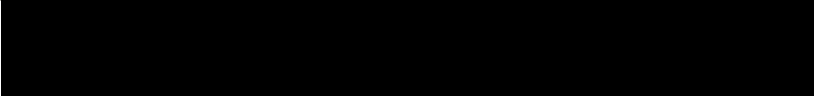




Kennedy Road Environmental Assessment - Steeles to Major Mackenzie Drive

Drainage Area Plan for Rouge River Tributary (Tributary 5, Twin Culvert Crossing)

Based on the Environmental Master Drainage Plan - OPA 22, South Unionville Secondary Plan (Cosburn Patterson Mather Limited and Gartner Lee Limited, November and the South Unionville Square Functional Servicing Report (Masongsong Associates Engineering Limited, August 2009). Additional sources: Google Maps, YorkMaps



Appendix C: Hydraulic Assessment Output Files



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	1-May-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 1
ROUGE RIVER TRIBUTARY (TRIBUTARY 5) HYDROLOGIC CALCULATIONS

Catchment Properties

Contributing Area 63.4 ha
Runoff Coefficient 0.49

Time of Concentration

Using Bransby William Formula: $t_c = 0.057L / (S^{0.2} \cdot A^{0.1})$
Length (L) 1240 m
Slope (Sw) 2.4% %
Time of Concentration 98.2 minutes

Rational Method

Return Period	IDF Parameters (York Region)				Rainfall Intensity (mm/hr)	Flow Rate (m ³ /s)
	A	B	C	C _f		
5-yr	1045.41	4.9	0.83	1	22.29	1.93
10-yr	1331.42	5.26	0.84	1	27.02	2.34
25-yr	1045.41	4.9	0.83	1.39	30.98	2.68
50-yr	1045.41	4.9	0.83	1.54	34.33	2.97
100-yr	1045.41	4.9	0.83	1.69	37.67	3.26
Check Flow (130% of 100-year flow)						4.24

Note: Analysis based on the Environmental Master Drainage Plan - OPA 22, South Unionville Secondary Plan (Cosburn Patterson Mather Limited and Gartner Lee Limited, November 1996), and the South Unionville Square Functional Servicing Report (Masongsong Associates Engineering Limited, August 2009)

Crossing C-1: Rouge River Tributary Crossing

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 1 - Summary of Culvert Flows at Crossing: Tributary 5 Existing

Headwater Elevation (m)	Discharge Name	Total Discharge (cms)	Twin CSP Discharge (cms)	Roadway Discharge (cms)	Iterations
174.22	50 Year	2.97	2.97	0.00	1
174.31	100 Year	3.26	3.26	0.00	1
174.78	Check	4.24	4.24	0.00	1
175.10	Overtopping	4.79	4.79	0.00	Overtopping

Rating Curve Plot for Crossing: Tributary 5 Existing

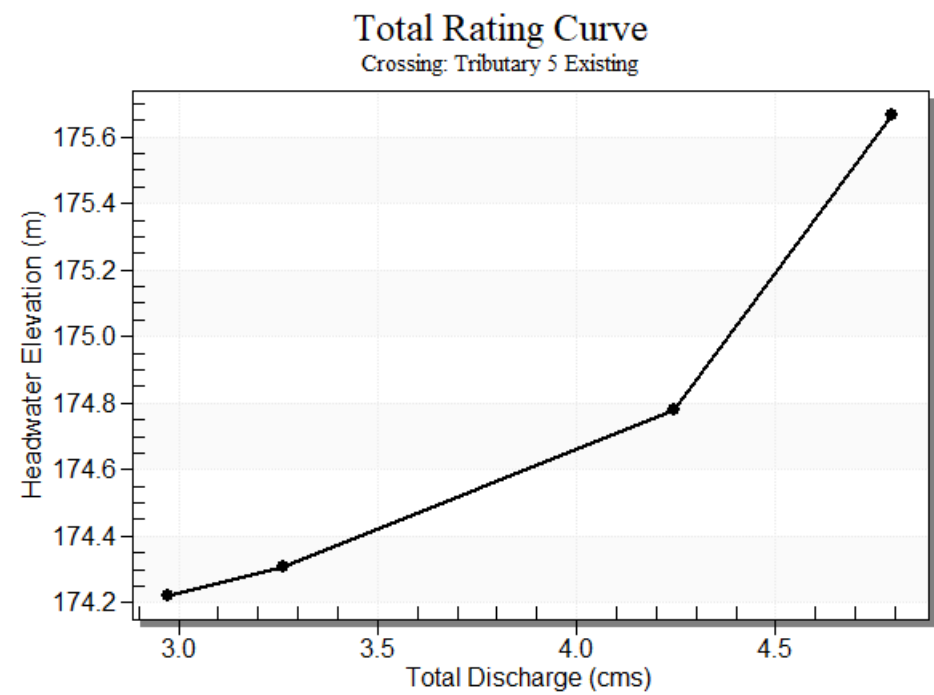
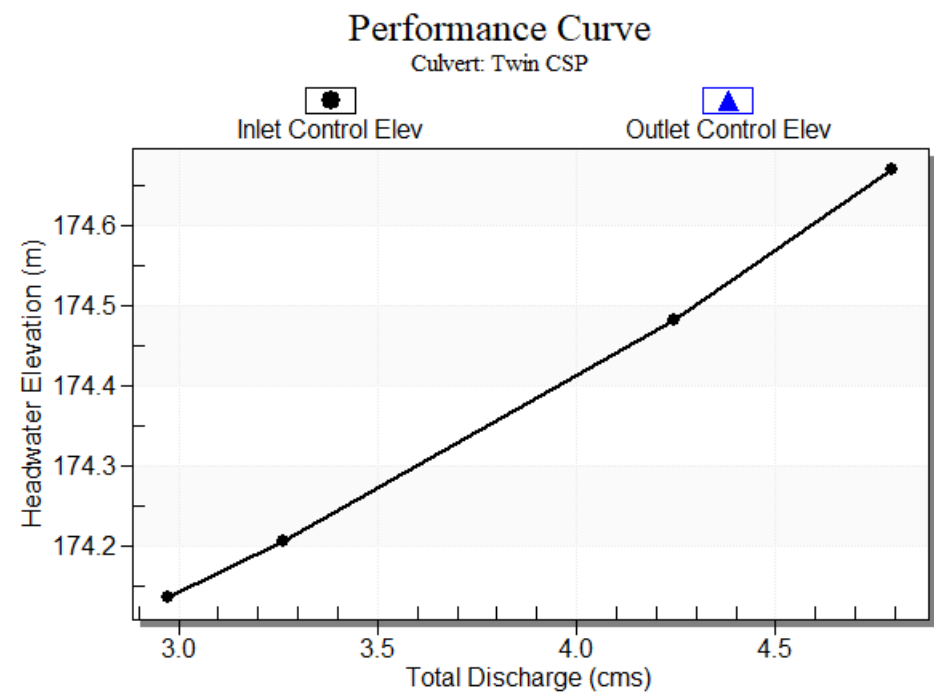


Table 2 - Culvert Summary Table: Twin CSP

Discharge Name	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
50 Year	2.97	2.97	174.22	0.896	0.984	7-M2c	0.902	0.499	0.499	0.379	2.240	1.529
100 Year	3.26	3.26	174.31	0.966	1.069	7-M2c	0.902	0.528	0.528	0.399	2.326	1.574
Check	4.24	4.24	174.78	1.242	1.537	7-M2c	0.902	0.615	0.615	0.461	2.621	1.708

Straight Culvert
Inlet Elevation (invert): 173.24 m, Outlet Elevation (invert): 173.00 m
Culvert Length: 47.50 m, Culvert Slope: 0.0051

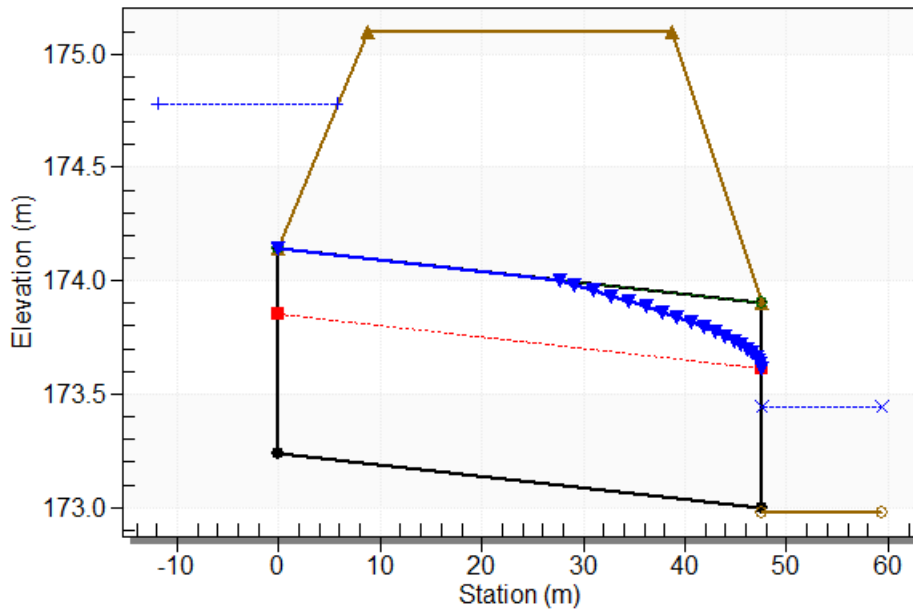
Culvert Performance Curve Plot: Twin CSP



Water Surface Profile Plot for Culvert: Twin CSP

Crossing - Tributary 5 Existing, Design Discharge - 4.24 cms

Culvert - Twin CSP, Culvert Discharge - 4.24 cms



Site Data - Twin CSP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 173.24 m

Outlet Station: 47.50 m

Outlet Elevation: 173.00 m

Number of Barrels: 2

Culvert Data Summary - Twin CSP

Barrel Shape: Pipe Arch

Barrel Span: 1468.12 mm

Barrel Rise: 901.70 mm

Barrel Material: Steel or Aluminum

Embedment: 0.00 mm

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Projecting

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Tributary 5 Existing)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
2.97	173.36	0.38	1.53	51.97	0.88
3.26	173.38	0.40	1.57	54.75	0.88
4.24	173.44	0.46	1.71	63.32	0.90

Tailwater Channel Data - Tributary 5 Existing

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 m

Side Slope (H:V): 3.00 (3:1)

Channel Slope: 0.0140

Channel Manning's n: 0.0350

Channel Invert Elevation: 172.98 m

Roadway Data for Crossing: Tributary 5 Existing

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 m

Crest Elevation: 175.10 m

Roadway Surface: Paved

Roadway Top Width: 30.00 m

Crossing Discharge Data

Discharge Selection Method: User Defined

Table 4 - Summary of Culvert Flows at Crossing: Tributary 5 Proposed

Headwater Elevation (m)	Discharge Name	Total Discharge (cms)	Twin Concrete Box with HW and Extension Discharge (cms)	Roadway Discharge (cms)	Iterations
174.00	50 Year	2.97	2.97	0.00	1
174.05	100 Year	3.26	3.26	0.00	1
174.19	Check	4.24	4.24	0.00	1
175.00	Overtopping	7.44	7.44	0.00	Overtopping

Rating Curve Plot for Crossing: Tributary 5 Proposed

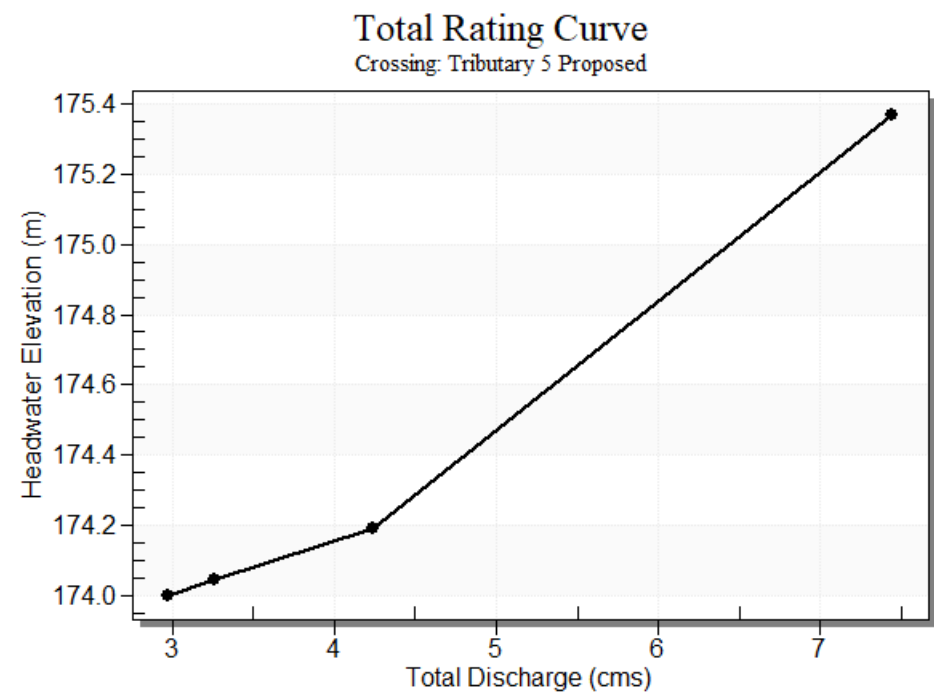
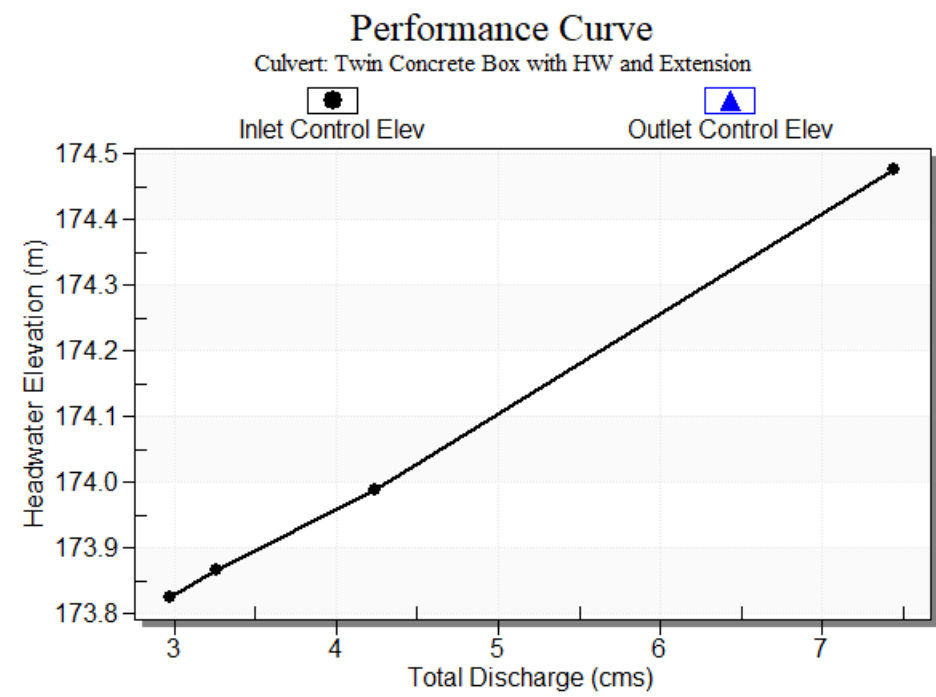


Table 5 - Culvert Summary Table: Twin Concrete Box with HW and Extension

Discharge Name	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
50 Year	2.97	2.97	174.00	0.595	0.773	2-M2c	0.649	0.413	0.413	0.357	1.999	1.496
100 Year	3.26	3.26	174.05	0.636	0.817	2-M2c	0.686	0.439	0.439	0.376	2.065	1.541
Check	4.24	4.24	174.19	0.758	0.962	7-M2c	0.900	0.518	0.518	0.436	2.274	1.676

Straight Culvert
Inlet Elevation (invert): 173.23 m, Outlet Elevation (invert): 173.00 m
Culvert Length: 48.60 m, Culvert Slope: 0.0047

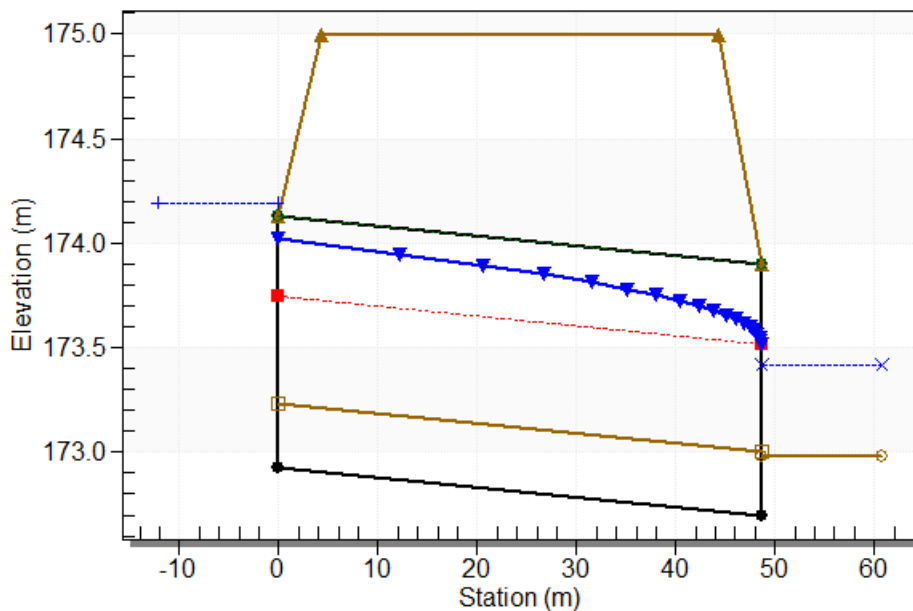
Culvert Performance Curve Plot: Twin Concrete Box with HW and Extension



Water Surface Profile Plot for Culvert: Twin Concrete Box with HW and Extension

Crossing - Tributary 5 Proposed, Design Discharge - 4.24 cms

Culvert - Twin Concrete Box with HW and Extension, Culvert Discharge - 4.24 cms



Site Data - Twin Concrete Box with HW and Extension

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 172.93 m

Outlet Station: 48.60 m

Outlet Elevation: 172.70 m

Number of Barrels: 2

Culvert Data Summary - Twin Concrete Box with HW and Extension

Barrel Shape: Concrete Box

Barrel Span: 1800.00 mm

Barrel Rise: 1200.00 mm

Barrel Material: Concrete

Embedment: 300.00 mm

Barrel Manning's n: 0.0130 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 6 - Downstream Channel Rating Curve (Crossing: Tributary 5 Proposed)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
2.97	173.34	0.36	1.50	48.98	0.87
3.26	173.36	0.38	1.54	51.63	0.88
4.24	173.42	0.44	1.68	59.83	0.90

Tailwater Channel Data - Tributary 5 Proposed

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.50 m

Side Slope (H:V): 3.00 (3:1)

Channel Slope: 0.0140

Channel Manning's n: 0.0350

Channel Invert Elevation: 172.98 m

Roadway Data for Crossing: Tributary 5 Proposed

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 m

Crest Elevation: 175.00 m

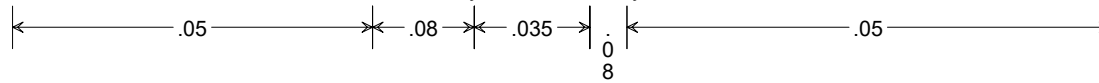
Roadway Surface: Paved

Roadway Top Width: 40.00 m

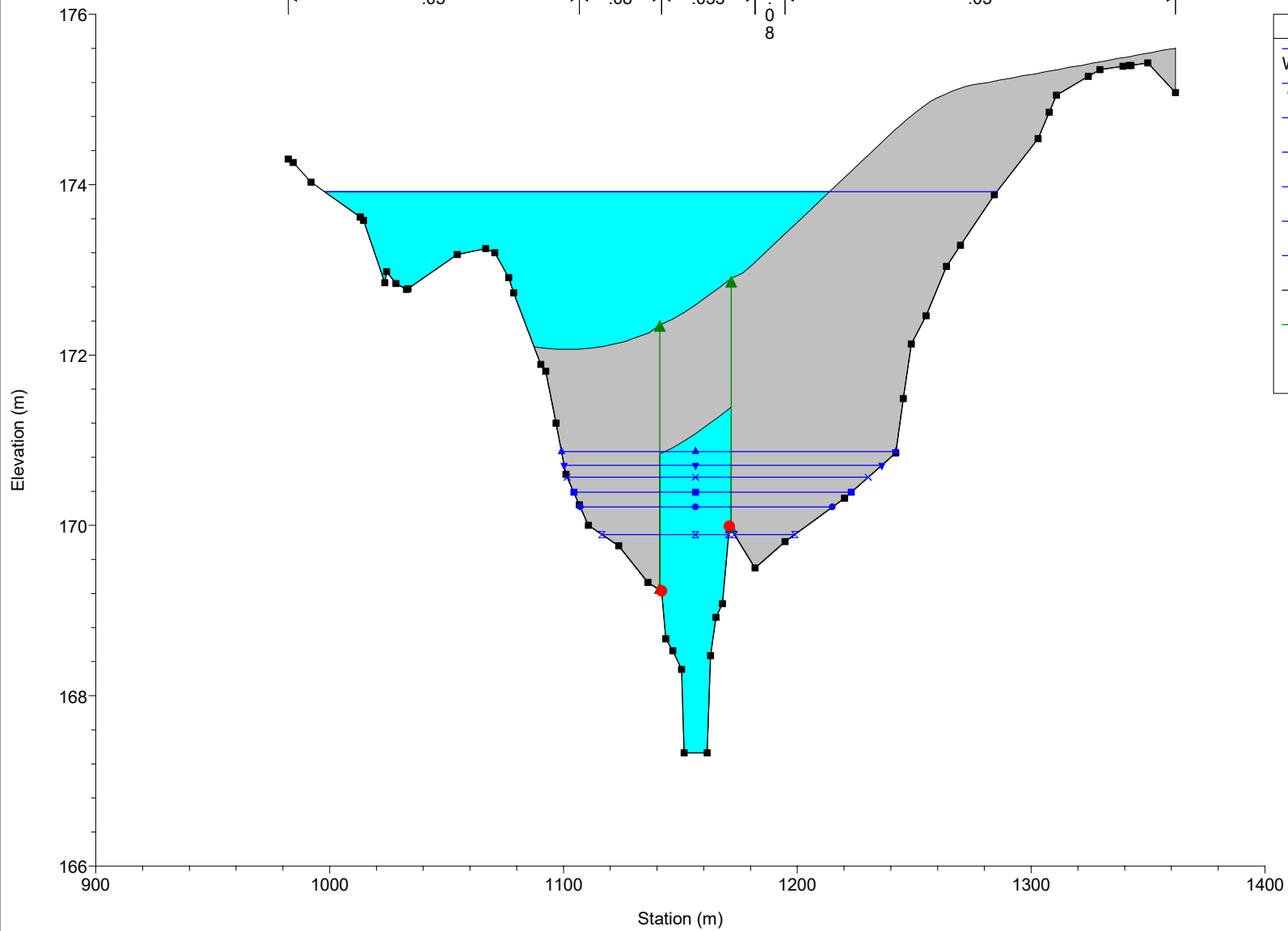
Crossing C-2: Rouge River Crossing

Rouge River Plan: Upd Ex 11/17/2020

Kennedy Rd North of Hwy 7

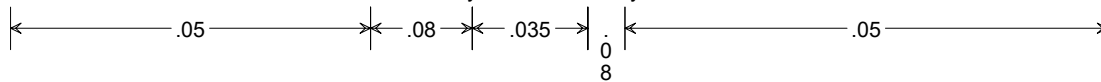


Legend	
WS Regional	▲
WS 100 YR	▼
WS 50 YR	×
WS 25 YR	■
WS 10 YR	●
WS 5 YR	×
WS 2 YR	■
Ground	—
Ineff	▲
Bank Sta	●

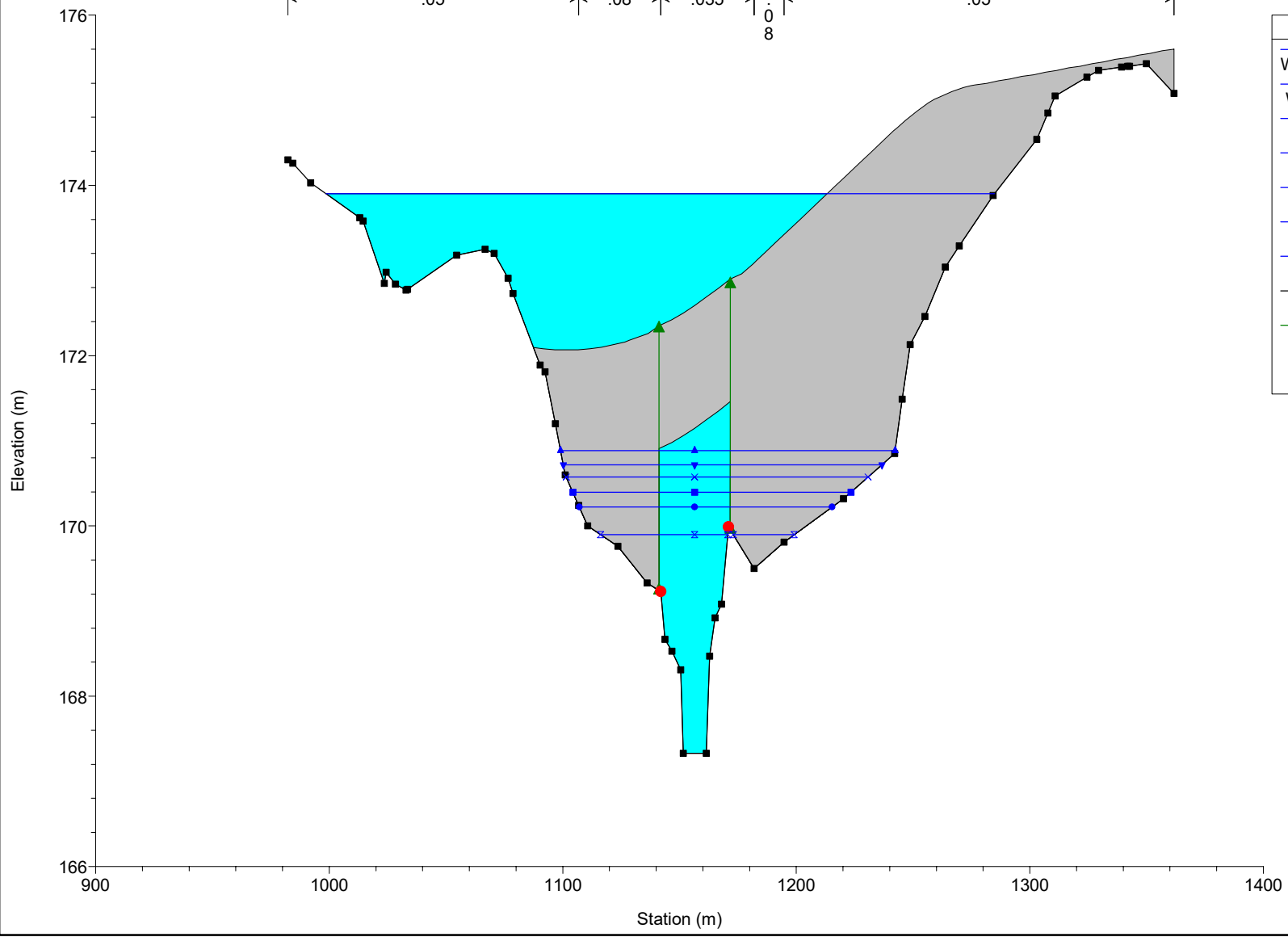


Rouge River Plan: HDR Proposed 11/16/2020

Kennedy Rd North of Hwy 7



Legend	
WS Regional	▲
WS 100 YR	▼
WS 50 YR	×
WS 25 YR	■
WS 10 YR	●
WS 5 YR	×
WS 2 YR	■
Ground	—
Ineff	▲
Bank Sta	●

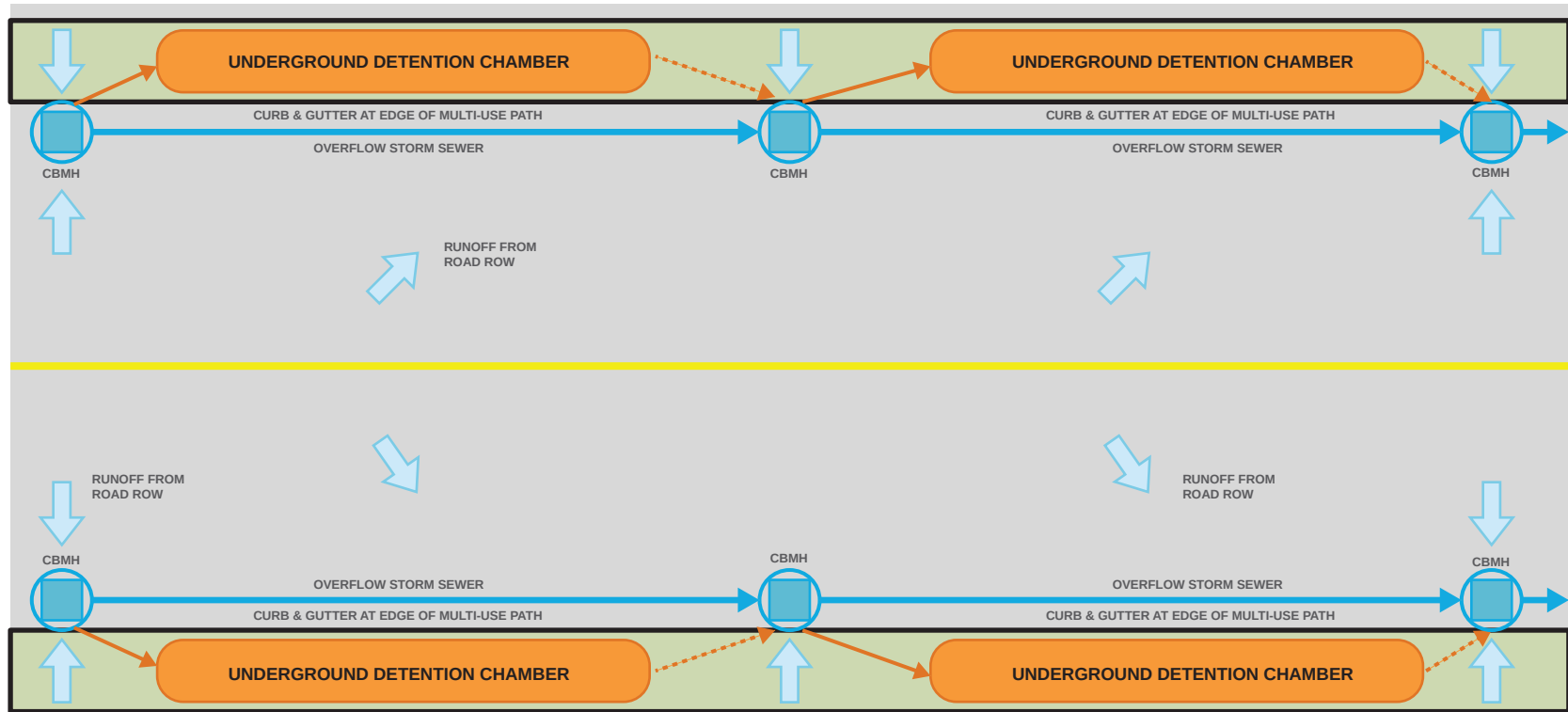


HEC-RAS River: MainRouge Reach: Milne-Warden2

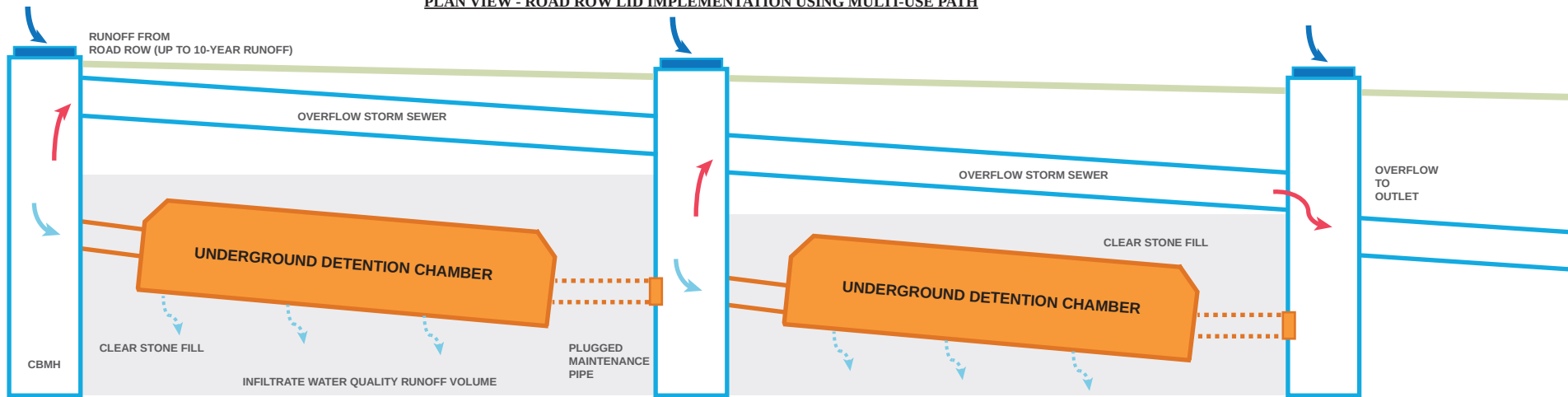
Reach	River Sta	Profile	Plan	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Milne-Warden2	6315.11	Regional	UptEx	643.02	167.33	173.92	171.90	173.99	0.000335	1.62	755.55	287.53	0.22
Milne-Warden2	6315.11	Regional	HDR Proposed	643.02	167.33	173.90	171.90	173.97	0.000339	1.63	750.74	286.20	0.22
Milne-Warden2	6315.11	100 YR	UptEx	162.23	167.33	170.89	169.69	171.11	0.001535	2.09	78.70	143.33	0.41
Milne-Warden2	6315.11	100 YR	HDR Proposed	162.23	167.33	170.89	169.69	171.11	0.001529	2.09	78.79	143.36	0.41
Milne-Warden2	6315.11	50 YR	UptEx	139.84	167.33	170.72	169.55	170.91	0.001418	1.93	73.66	136.75	0.39
Milne-Warden2	6315.11	50 YR	HDR Proposed	139.84	167.33	170.73	169.54	170.91	0.001413	1.93	73.73	136.86	0.39
Milne-Warden2	6315.11	25 YR	UptEx	118.72	167.33	170.58	169.39	170.73	0.001250	1.74	69.27	129.59	0.36
Milne-Warden2	6315.11	25 YR	HDR Proposed	118.72	167.33	170.58	169.39	170.73	0.001248	1.74	69.30	129.65	0.36
Milne-Warden2	6315.11	10 YR	UptEx	92.13	167.33	170.40	169.18	170.51	0.000983	1.46	63.83	119.34	0.32
Milne-Warden2	6315.11	10 YR	HDR Proposed	92.13	167.33	170.40	169.19	170.51	0.000983	1.46	63.84	119.35	0.32
Milne-Warden2	6315.11	5 YR	UptEx	71.80	167.33	170.23	168.97	170.30	0.000795	1.24	58.46	108.43	0.28
Milne-Warden2	6315.11	5 YR	HDR Proposed	71.80	167.33	170.23	168.97	170.30	0.000795	1.24	58.46	108.42	0.28
Milne-Warden2	6315.11	2 YR	UptEx	45.54	167.33	169.90	168.64	169.95	0.000575	0.94	48.59	80.84	0.23
Milne-Warden2	6315.11	2 YR	HDR Proposed	45.54	167.33	169.90	168.65	169.95	0.000576	0.95	48.58	80.80	0.23
Milne-Warden2	6315.105			Bridge									
Milne-Warden2	6315.10	Regional	UptEx	643.02	167.33	173.40	171.54	173.56	0.000805	2.36	632.76	254.57	0.33
Milne-Warden2	6315.10	Regional	HDR Proposed	643.02	167.33	173.37	171.54	173.54	0.000822	2.38	626.71	253.08	0.34
Milne-Warden2	6315.10	100 YR	UptEx	162.23	167.33	170.81	169.69	171.04	0.001718	2.17	76.15	137.53	0.43
Milne-Warden2	6315.10	100 YR	HDR Proposed	162.23	167.33	170.81	169.70	171.04	0.001718	2.17	76.15	137.52	0.43
Milne-Warden2	6315.10	50 YR	UptEx	139.84	167.33	170.65	169.54	170.85	0.001575	1.99	71.40	131.70	0.41
Milne-Warden2	6315.10	50 YR	HDR Proposed	139.84	167.33	170.65	169.54	170.85	0.001576	1.99	71.39	131.69	0.41
Milne-Warden2	6315.10	25 YR	UptEx	118.72	167.33	170.52	169.39	170.68	0.001374	1.79	67.34	125.66	0.38
Milne-Warden2	6315.10	25 YR	HDR Proposed	118.72	167.33	170.52	169.39	170.68	0.001374	1.79	67.34	125.66	0.38
Milne-Warden2	6315.10	10 YR	UptEx	92.13	167.33	170.36	169.18	170.47	0.001060	1.50	62.39	118.30	0.33
Milne-Warden2	6315.10	10 YR	HDR Proposed	92.13	167.33	170.35	169.18	170.47	0.001061	1.50	62.38	118.28	0.33
Milne-Warden2	6315.10	5 YR	UptEx	71.80	167.33	170.19	168.98	170.27	0.000847	1.27	57.34	108.34	0.29
Milne-Warden2	6315.10	5 YR	HDR Proposed	71.80	167.33	170.19	168.97	170.27	0.000847	1.27	57.33	108.32	0.29
Milne-Warden2	6315.10	2 YR	UptEx	45.54	167.33	169.87	168.64	169.92	0.000603	0.96	47.83	74.14	0.24
Milne-Warden2	6315.10	2 YR	HDR Proposed	45.54	167.33	169.87	168.64	169.92	0.000604	0.96	47.82	74.09	0.24

Appendix D: Infiltration Trench Schematic

SCHEMATIC OF LINEAR LID FEATURE (UNDERGROUND DETENTION) - FIGURE NOT TO SCALE



PLAN VIEW - ROAD ROW LID IMPLEMENTATION USING MULTI-USE PATH



PROFILE VIEW - SUB-SURFACE INFRASTRUCTURE



Appendix E: Stormwater Management Calculations

Stormwater Management Calculations

TABLE 01 QUALITY CONTROL REQUIREMENT CALCULATION																		
Drainage Area ID	Drainage Area (ha)	Existing			Proposed			Increased Paved Area (ha)	Contributing Pavement Area (ha)	Required Treatment Volume ¹ (m³)	Water Balance Storage ³ (m³)	Total Required Storage (m³)	Infiltration Trench Area ² (m²)	Required Infiltration Trench Length (m)	Infiltration Trench Width (m)	Proposed Infiltration Trench Length (m)	Proposed Storage Volume (m³)	Discharge Location
		Paved Area (ha)	% Impervious	Req. Volume (m³)	Paved Area (ha)	% Impervious	Req. Volume (m³)											
A8	1.39	1.04	75%	38.22	1.20	86%	47.88	0.15	0.15	10	8	10	77	51	1.5	51	15	Rouge River Tributary
A9	0.82	0.47	58%	14.89	0.55	67%	18.75	0.07	0.35	4	18	18	175	103	1.7	103	35	Rouge River Tributary
A10	2.92	1.81	62%	59.34	2.18	75%	79.51	0.37	2.04	20	102	102	1020	680	1.5	680	204	Rouge River Tributary
A12	2.01	1.20	60%	38.45	1.68	83%	65.67	0.48	1.68	66	84	84	838	493	1.7	372	126	Rouge River* ⁴
A13	1.31	0.68	52%	20.33	1.04	79%	39.39	0.36	1.04	39	52	52	519	305	1.7	426	145	Austin Dr. sewer & pond, outlets to Rouge River* ⁴
A18	4.67	2.67	57%	83.34	3.33	71%	118.25	0.66	1.70	35	85	85	850	567	1.5	567	170	Outfall to pond upstream of Bruce Creek
Total		7.88			9.96			2.09	6.96	174	348	350	3479	2199		2199	696	

¹ From Table 3.2 of MOE SWM Planning and Design Manual (2003)

² 5% of the contributing pavement area

³ Based on TRCA target of 5 mm retention

⁴ Entire pavement area treated due to discharge to Redside Dace contributing habitat

* Contributing habitat of Redside Dace

MOE Table 3.2

Impervious Level (%)	W.Q. Storage Vol. (m³/ha)
35%	25
55%	30
70%	35
85%	40

Infiltration Trench Dimensions

Hydraulic Conductivity =	3.50E-03 cm/s
Infiltration Rate, i =	96 mm/hr
Safety Factor =	3
t _s =	48 hr
V _r =	0.4
d _{rmax} =	3833 mm
d _r =	0.5 m

LID SWM GUIDE Table C1

Kfs cm/s	T min/cm	1/T mm/hr
0.1	2	300
0.01	4	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region			
Date	21-Oct-20	No.	--	Page
By	J. Look	Checked	S. Kashi	

TABLE 02
QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	Existing			Proposed			Increased Paved Area (ha)	Existing Flow (m³/s)	Proposed Flow (m³/s)	Required Storage Volume (m³)	Unitary Discharge Storage Volume (m³)	Proposed Storage Volume (m³)	Discharge Location
	Drainage Area (ha)	Paved Area (ha)	Runoff Coefficient	Drainage Area (ha)	Paved Area (ha)	Runoff Coefficient							
A1	2.54	1.45	0.62	2.54	1.86	0.73	0.41	0.59	0.69	60	n/a	60	Storm sewer along Kennedy Rd. (South of Steeles Ave.)
A2	0.83	0.29	0.47	0.83	0.50	0.64	0.21	0.15	0.57	273	n/a	273	Storm sewer along Kennedy Rd. (South of Steeles Ave.)
A3	0.80	0.36	0.54	0.80	0.57	0.71	0.21	0.72					0.85
A4	3.08	1.75	0.62	3.08	2.32	0.74	0.57		0.85	79	n/a	79	
A5	2.40	1.39	0.63	2.40	1.90	0.76	0.50	0.46	0.69	134	n/a	134	Storm sewer along Fresno Ct.
A6_100yr	0.64	0.42	0.67	0.64	0.53	0.78	0.11	0.23	0.26	22	n/a	22	Storm sewer along 14th Ave. ²
A7	3.12	1.96	0.66	3.12	2.49	0.77	0.53	0.63	0.90	160	n/a	160	Storm sewer along Main St. Unionville ³
A8	1.39	1.04	0.74	1.39	1.20	0.81	0.15	0.32	0.42	63	n/a	63	Storm sewer along Main St. Unionville ³
A9	0.82	0.47	0.63	0.82	0.55	0.68	0.07	0.27	0.29	15	n/a	15	Tributary of Rouge River
A10	2.92	1.81	0.65	2.92	2.18	0.73	0.37	1.00	1.12	74	n/a	74	Storm sewer which outlets to Tributary
A11	1.89	1.24	0.68	1.89	1.42	0.74	0.18	0.48	0.52	27	n/a	27	Storm sewer along Highway 7
A13	1.31	0.68	0.59	1.31	1.04	0.77	0.36	0.24	0.38	83	n/a	83	Storm sewer which outlets to Rouge River
A14	1.28	0.72	0.62	1.28	1.00	0.76	0.28	0.24	0.36	72	n/a	72	Storm sewer along Carlton Rd.
A15	2.11	1.17	0.61	2.11	1.62	0.75	0.45	0.40	0.59	118	n/a	118	Storm sewer along The Bridle Trail
A16	1.94	1.27	0.67	1.94	1.62	0.79	0.35	0.40	0.58	104	n/a	104	Storm sewer along Rosemead Close
A17_100yr	2.47	1.51	0.65	2.47	2.04	0.79	0.53	0.83	1.01	107	631	107	Storm sewer along 16th Ave. ²
A18	4.67	2.67	0.62	4.67	3.33	0.71	0.66	0.90	1.25	212	794	212	Storm sewer outfall at Bur Oak Ave. ³
A19_100yr	1.70	1.03	0.65	1.70	1.33	0.76	0.29	0.57	0.67	60	353	60	Storm sewer along Major Mackenzie Dr. ²
Total	35.90	21.23		35.90	27.48		6.24			1663		1663	

¹ Discharges to storm sewer along Denison Avenue under existing conditions
² 100-year post-to-pre storage volume, which exceeds the 10-year post-to-pre storage volume
³ 10-year post to 5-year pre storage volume exceeds 100-year post-to-pre storage volume



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 03

DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A1
Existing Drainage Area	2.5373 ha
Existing Pavement Area	1.45 ha
Existing Runoff Coefficient	0.62 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	2.5373 ha
Proposed Pavement Area	1.86 ha
Proposed Runoff Coefficient	0.73 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (York Region)				Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = C_f \times A / (T_c + B)^C$					
	A	B	C	C_f		
2-yr						
5-yr	1045.41	4.9	0.83	1	111.06	487.30
10-yr	1331.42	5.26	0.84	1	134.94	592.09
25-yr	1045.41	4.9	0.83	1.39	154.37	677.35
50-yr	1045.41	4.9	0.83	1.54	171.03	750.45
100-yr	1045.41	4.9	0.83	1.69	187.68	823.54

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C _f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

10 Year Post to 10 Year Pre - Discharging to regional storm sewer on Steeles Ave East

Storage Volume Calculation - 10 Year Post to 10 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	134.94	691.92	415.15	355.25	59.90
15	106.35	545.34	490.80	532.88	0.00
20	88.36	453.11	543.73	710.51	0.00
25	75.93	389.33	583.99	888.13	0.00
30	66.77	342.39	616.31	1065.76	0.00
40	54.14	277.62	666.28	1421.01	0.00
50	45.78	234.76	704.27	1776.27	0.00
60	39.81	204.15	734.92	2131.52	0.00
70	35.32	181.10	760.64	2486.77	0.00
80	31.80	163.09	782.81	2842.03	0.00
90	28.98	148.58	802.33	3197.28	0.00
100	26.64	136.63	819.77	3552.53	0.00
120	23.02	118.05	849.99	4263.04	0.00
360	9.37	48.05	1037.79	12789.12	0.00
720	5.27	27.00	1166.57	25578.25	0.00
1440	2.95	15.13	1307.38	51156.49	0.00
Required Storage Volume:			59.90	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.69	m ³ /s	10 Year Proposed Conditions
Controlled Discharge Flow Rate	0.59	m ³ /s	10 Year Existing Flow
Required Storage Volume	59.90	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 04
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A2	A3	Total	
Existing Drainage Area	0.8326 ha	0.7982 ha	1.6308 ha	
Existing Pavement Area	0.29 ha	0.36 ha	0.6449 ha	
Existing Runoff Coefficient	0.47	0.54	0.51	Assume pavement C = 0.9,
Proposed Drainage Area	0.8326 ha	0.7982 ha	1.6308 ha	landscaped C = 0.25
Proposed Pavement Area	0.50 ha	0.57 ha	1.0652 ha	
Proposed Runoff Coefficient	0.64	0.71	0.67	Assume pavement C = 0.9,
Time of Concentration	10 minute	10 minute	10 minute	landscaped C = 0.25

Existing Conditions

Return Period	IDF Parameters (York Region)				Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = C_f \times A / (T_c + B)^C$					
	A	B	C	C_f		
2-yr						
5-yr	1045.41	4.9	0.83	1	111.06	121.58
10-yr	1331.42	5.26	0.84	1	134.94	147.72
25-yr	1045.41	4.9	0.83	1.39	154.37	168.99
50-yr	1045.41	4.9	0.83	1.54	171.03	187.23
100-yr	1045.41	4.9	0.83	1.69	187.68	205.47

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C_f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

100 Year Post to 10 Year Pre - Underpass, discharging to regional storm sewer on Steeles Ave East

Storage Volume Calculation - 100 Year Post to 10 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	187.68	573.98	344.39	88.63	255.76
15	147.61	451.43	406.29	132.95	273.34
20	122.55	374.80	449.76	177.26	272.49
25	105.28	321.98	482.98	221.58	261.40
30	92.60	283.20	509.76	265.90	243.87
40	75.13	229.76	551.43	354.53	196.90
50	63.58	194.45	583.34	443.16	140.18
60	55.34	169.23	609.23	531.79	77.44
70	49.13	150.25	631.06	620.42	10.64
80	44.28	135.41	649.97	709.06	0.00
90	40.37	123.46	666.66	797.69	0.00
100	37.15	113.61	681.63	886.32	0.00
120	32.14	98.29	707.67	1063.58	0.00
360	13.20	40.37	871.95	3190.75	0.00
720	7.47	22.84	986.50	6381.50	0.00
1440	4.21	12.88	1112.99	12762.99	0.00
Required Storage Volume:			273.34	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.57	m ³ /s	100 Year Proposed Conditions
Controlled Discharge Flow Rate	0.15	m ³ /s	10 Year Existing Flow
Required Storage Volume	273.34	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 05
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A4	A3	Total	
Existing Drainage Area	3.0829 ha	0.7982 ha	3.8811 ha	
Existing Pavement Area	1.75 ha	0.36 ha	2.1115 ha	
Existing Runoff Coefficient	0.62	0.54	0.60	Assume pavement C = 0.9,
Proposed Drainage Area	3.0829 ha	0.7982 ha	3.8811 ha	landscaped C = 0.25
Proposed Pavement Area	2.32 ha	0.57 ha	2.8846 ha	
Proposed Runoff Coefficient	0.74	0.71	0.73	Assume pavement C = 0.9,
Time of Concentration	10 minute	10 minute	10 minute	landscaped C = 0.25

Existing Conditions

Return Period	IDF Parameters (City of Markham)			Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = A / (Tc + B)^C$				
	A	B	C		
2-yr	651.63	3.75	0.80	80.05	521.35
5-yr	1045.41	4.9	0.83	111.06	723.29
10-yr	1331.42	5.26	0.84	134.94	878.82
25-yr	1817.88	6.22	0.87	161.00	1048.56
50-yr	1918.97	6	0.86	176.82	1151.58
100-yr	2167.43	6.03	0.86	199.39	1298.59

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C _f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

10 Year Post to 5 Year Pre - Discharging to municipal storm sewer on Denison St

Storage Volume Calculation - 10 Year Post to 5 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	134.94	854.96	512.98	433.97	79.00
15	106.35	673.84	606.46	650.96	0.00
20	88.36	559.87	671.85	867.95	0.00
25	75.93	481.06	721.60	1084.94	0.00
30	66.77	423.07	761.53	1301.92	0.00
40	54.14	343.03	823.27	1735.90	0.00
50	45.78	290.07	870.22	2169.87	0.00
60	39.81	252.25	908.10	2603.85	0.00
70	35.32	223.78	939.87	3037.82	0.00
80	31.80	201.52	967.27	3471.79	0.00
90	28.98	183.59	991.39	3905.77	0.00
100	26.64	168.82	1012.94	4339.74	0.00
120	23.02	145.87	1050.28	5207.69	0.00
360	9.37	59.37	1282.34	15623.08	0.00
720	5.27	33.37	1441.46	31246.15	0.00
1440	2.95	18.70	1615.45	62492.30	0.00
Required Storage Volume:			79.00	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.85	m ³ /s	10 Year Proposed Conditions
Controlled Discharge Flow Rate	0.72	m ³ /s	5 Year Existing Flow
Required Storage Volume	79.00	m ³	



Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

Stormwater Management Calculations

TABLE 06
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A5
Existing Drainage Area	2.3976 ha
Existing Pavement Area	1.39 ha
Existing Runoff Coefficient	0.63 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	2.3976 ha
Proposed Pavement Area	1.90 ha
Proposed Runoff Coefficient	0.76 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (City of Markham)			Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = A / (T_c + B)^C$				
	A	B	C		
2-yr	651.63	3.75	0.80	80.05	334.81
5-yr	1045.41	4.9	0.83	111.06	464.50
10-yr	1331.42	5.26	0.84	134.94	564.38
25-yr	1817.88	6.22	0.87	161.00	673.39
50-yr	1918.97	6	0.86	176.82	739.55
100-yr	2167.43	6.03	0.86	199.39	833.96

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C _f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

10 Year Post to 5 Year Pre - Discharging to municipal storm sewer on Fresno Ct

Storage Volume Calculation - 10 Year Post to 5 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	134.94	687.01	412.21	278.70	133.51
15	106.35	541.47	487.32	418.05	69.27
20	88.36	449.89	539.87	557.40	0.00
25	75.93	386.56	579.85	696.75	0.00
30	66.77	339.97	611.94	836.10	0.00
40	54.14	275.65	661.55	1114.80	0.00
50	45.78	233.09	699.27	1393.50	0.00
60	39.81	202.70	729.71	1672.20	0.00
70	35.32	179.82	755.24	1950.90	0.00
80	31.80	161.93	777.26	2229.60	0.00
90	28.98	147.53	796.64	2508.30	0.00
100	26.64	135.66	813.96	2787.00	0.00
Required Storage Volume			133.51	m ³	

Required Storage Summary

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Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 07A
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A6
Existing Drainage Area	0.6446 ha
Existing Pavement Area	0.42 ha
Existing Runoff Coefficient	0.67 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	0.6446 ha
Proposed Pavement Area	0.53 ha
Proposed Runoff Coefficient	0.78 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (York Region)				Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = C_f \times A / (T_c + B)^C$					
	A	B	C	C_f		
2-yr						
5-yr	1045.41	4.9	0.83	1	111.06	133.98
10-yr	1331.42	5.26	0.84	1	134.94	162.79
25-yr	1045.41	4.9	0.83	1.39	154.37	186.23
50-yr	1045.41	4.9	0.83	1.54	171.03	206.33
100-yr	1045.41	4.9	0.83	1.69	187.68	226.42

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C_f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

10 Year Post to 10 Year Pre - Discharging to regional storm sewer on 14th Ave

Storage Volume Calculation - 10 Year Post to 10 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	134.94	188.88	113.33	97.67	15.66
15	106.35	148.87	133.98	146.51	0.00
20	88.36	123.69	148.43	195.34	0.00
25	75.93	106.28	159.42	244.18	0.00
30	66.77	93.47	168.24	293.02	0.00
40	54.14	75.78	181.88	390.69	0.00
50	45.78	64.08	192.25	488.36	0.00
60	39.81	55.73	200.62	586.03	0.00
70	35.32	49.44	207.64	683.70	0.00
80	31.80	44.52	213.69	781.38	0.00
90	28.98	40.56	219.02	879.05	0.00
100	26.64	37.30	223.78	976.72	0.00
120	23.02	32.23	232.03	1172.06	0.00
360	9.37	13.12	283.30	3516.19	0.00
720	5.27	7.37	318.45	7032.38	0.00
1440	2.95	4.13	356.89	14064.77	0.00
Required Storage Volume:			15.66	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.19	m ³ /s	10 Year Proposed Conditions
Controlled Discharge Flow Rate	0.16	m ³ /s	10 Year Existing Flow
Required Storage Volume	15.66	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 07B
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A6
Existing Drainage Area	0.6446 ha
Existing Pavement Area	0.42 ha
Existing Runoff Coefficient	0.67 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	0.6446 ha
Proposed Pavement Area	0.53 ha
Proposed Runoff Coefficient	0.78 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (York Region)				Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = C_i \times A / (T_c + B)^C$					
	A	B	C	C_i		
2-yr						
5-yr	1045.41	4.9	0.83	1	111.06	133.98
10-yr	1331.42	5.26	0.84	1	134.94	162.79
25-yr	1045.41	4.9	0.83	1.39	154.37	186.23
50-yr	1045.41	4.9	0.83	1.54	171.03	206.33
100-yr	1045.41	4.9	0.83	1.69	187.68	226.42

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C _f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

100 Year Post to 100 Year Pre - Discharging to regional storm sewer on 14th Ave - Ultimate Outfall to Rouge Tributary

Storage Volume Calculation - 100 Year Post to 100 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	187.68	262.72	157.63	135.85	21.78
15	147.61	206.63	185.96	203.78	0.00
20	122.55	171.55	205.86	271.71	0.00
25	105.28	147.38	221.06	339.63	0.00
30	92.60	129.62	233.32	407.56	0.00
40	75.13	105.16	252.39	543.41	0.00
50	63.58	89.00	267.00	679.27	0.00
60	55.34	77.46	278.85	815.12	0.00
70	49.13	68.77	288.84	950.97	0.00
80	44.28	61.98	297.50	1086.82	0.00
90	40.37	56.51	305.14	1222.68	0.00
100	37.15	52.00	311.99	1358.53	0.00
120	32.14	44.99	323.91	1630.24	0.00
360	13.20	18.48	399.10	4890.71	0.00
720	7.47	10.45	451.53	9781.42	0.00
1440	4.21	5.90	509.43	19562.84	0.00
Required Storage Volume:			21.78	m ³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.26	m ³ /s	100 Year Proposed Conditions
Controlled Discharge Flow Rate	0.23	m ³ /s	100 Year Existing Flow
Required Storage Volume	21.78	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 08A
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A7
Existing Drainage Area	3.1191 ha
Existing Pavement Area	1.96 ha
Existing Runoff Coefficient	0.66 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	3.1191 ha
Proposed Pavement Area	2.49 ha
Proposed Runoff Coefficient	0.77 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (City of Markham)			Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = A / (T_c + B)^C$				
	A	B	C		
2-yr	651.63	3.75	0.80	80.05	456.36
5-yr	1045.41	4.9	0.83	111.06	633.13
10-yr	1331.42	5.26	0.84	134.94	769.27
25-yr	1817.88	6.22	0.87	161.00	917.85
50-yr	1918.97	6	0.86	176.82	1008.04
100-yr	2167.43	6.03	0.86	199.39	1136.72

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C _f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

10 Year Post to 5 Year Pre - Discharging to municipal storm sewer along Main St. Unionville right-of-way (formerly Kennedy Rd.)

Storage Volume Calculation - 10 Year Post to 5 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	134.94	899.18	539.51	379.88	159.63
15	106.35	708.69	637.82	569.82	68.00
20	88.36	588.83	706.59	759.76	0.00
25	75.93	505.94	758.91	949.70	0.00
30	66.77	444.95	800.91	1139.63	0.00
40	54.14	360.77	865.85	1519.51	0.00
50	45.78	305.07	915.22	1899.39	0.00
60	39.81	265.29	955.06	2279.27	0.00
70	35.32	235.35	988.48	2659.15	0.00
80	31.80	211.94	1017.29	3039.03	0.00
90	28.98	193.08	1042.65	3418.90	0.00
100	26.64	177.55	1065.32	3798.78	0.00
120	23.02	153.42	1104.59	4558.54	0.00
360	9.37	62.44	1348.65	13675.62	0.00
720	5.27	35.09	1516.00	27351.24	0.00
1440	2.95	19.66	1698.99	54702.47	0.00
Required Storage Volume:			159.63	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.90	m ³ /s	10 Year Proposed Conditions
Controlled Discharge Flow Rate	0.63	m ³ /s	5 Year Existing Flow
Required Storage Volume	159.63	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 08B
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A7
Existing Drainage Area	3.1191 ha
Existing Pavement Area	1.96 ha
Existing Runoff Coefficient	0.66 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	3.1191 ha
Proposed Pavement Area	2.49 ha
Proposed Runoff Coefficient	0.77 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (City of Markham)			Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = A / (T_c + B)^C$				
	A	B	C		
2-yr	651.63	3.75	0.80	80.05	456.36
5-yr	1045.41	4.9	0.83	111.06	633.13
10-yr	1331.42	5.26	0.84	134.94	769.27
25-yr	1817.88	6.22	0.87	161.00	917.85
50-yr	1918.97	6	0.86	176.82	1008.04
100-yr	2167.43	6.03	0.86	199.39	1136.72

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C _f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

100 Year Post to 100 Year Pre - Discharging to municipal storm sewer along Main St. Unionville ROW (formerly Kennedy Rd.) - Ultimate Outfall to Rouge Tributary

Storage Volume Calculation - 100 Year Post to 100 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	187.68	1250.67	750.40	682.03	68.37
15	147.61	983.65	885.29	1023.05	0.00
20	122.55	816.66	980.00	1364.06	0.00
25	105.28	701.59	1052.38	1705.08	0.00
30	92.60	617.08	1110.75	2046.10	0.00
40	75.13	500.64	1201.53	2728.13	0.00
50	63.58	423.69	1271.06	3410.16	0.00
60	55.34	368.74	1327.48	4092.19	0.00
70	49.13	327.39	1375.05	4774.22	0.00
80	44.28	295.05	1416.24	5456.25	0.00
90	40.37	269.00	1452.62	6138.29	0.00
100	37.15	247.54	1485.24	6820.32	0.00
120	32.14	214.16	1541.96	8184.38	0.00
360	13.20	87.96	1899.93	24553.15	0.00
720	7.47	49.76	2149.52	49106.29	0.00
1440	4.21	28.07	2425.14	98212.59	0.00
Required Storage Volume:			68.37	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	1.25	m ³ /s	100 Year Proposed Conditions
Controlled Discharge Flow Rate	1.14	m ³ /s	100 Year Existing Flow
Required Storage Volume	68.37	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 09A

DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A8
Existing Drainage Area	1.3861 ha
Existing Pavement Area	1.04 ha
Existing Runoff Coefficient	0.74 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	1.3861 ha
Proposed Pavement Area	1.20 ha
Proposed Runoff Coefficient	0.81 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (City of Markham)			Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = A / (T_c + B)^C$				
	A	B	C		
2-yr	651.63	3.75	0.80	80.05	227.80
5-yr	1045.41	4.9	0.83	111.06	316.03
10-yr	1331.42	5.26	0.84	134.94	383.99
25-yr	1817.88	6.22	0.87	161.00	458.15
50-yr	1918.97	6	0.86	176.82	503.17
100-yr	2167.43	6.03	0.86	199.39	567.40

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (Tc + B)^C$			
	A	B	C	C _f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

10 Year Post to 5 Year Pre - Discharging to municipal storm sewer along Main St. Unionville right-of-way (formerly Kennedy Rd.)

Storage Volume Calculation - 10 Year Post to 5 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	134.94	421.57	252.94	189.62	63.32
15	106.35	332.26	299.03	284.43	14.60
20	88.36	276.06	331.28	379.24	0.00
25	75.93	237.20	355.81	474.05	0.00
30	66.77	208.61	375.50	568.86	0.00
40	54.14	169.14	405.94	758.47	0.00
50	45.78	143.03	429.09	948.09	0.00
60	39.81	124.38	447.77	1137.71	0.00
70	35.32	110.34	463.43	1327.33	0.00
80	31.80	99.36	476.94	1516.95	0.00
90	28.98	90.52	488.83	1706.57	0.00
100	26.64	83.24	499.46	1896.19	0.00
120	23.02	71.93	517.87	2275.42	0.00
360	9.37	29.27	632.30	6826.27	0.00
720	5.27	16.45	710.76	13652.54	0.00
1440	2.95	9.22	796.55	27305.09	0.00
Required Storage Volume:			63.32	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.42	m ³ /s	10 Year Proposed Conditions
Controlled Discharge Flow Rate	0.32	m ³ /s	5 Year Existing Flow
Required Storage Volume	63.32	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 09B
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A8
Existing Drainage Area	1.3861 ha
Existing Pavement Area	1.04 ha
Existing Runoff Coefficient	0.74 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	1.3861 ha
Proposed Pavement Area	1.20 ha
Proposed Runoff Coefficient	0.81 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (City of Markham)			Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = A / (T_c + B)^C$				
	A	B	C		
2-yr	651.63	3.75	0.80	80.05	227.80
5-yr	1045.41	4.9	0.83	111.06	316.03
10-yr	1331.42	5.26	0.84	134.94	383.99
25-yr	1817.88	6.22	0.87	161.00	458.15
50-yr	1918.97	6	0.86	176.82	503.17
100-yr	2167.43	6.03	0.86	199.39	567.40

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C _f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

100 Year Post to 100 Year Pre - Discharging to municipal storm sewer along Main St. Unionville ROW (formerly Kennedy Rd.) - Ultimate Outfall to Rouge Tributary

Storage Volume Calculation - 100 Year Post to 100 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	187.68	586.36	351.82	340.44	11.38
15	147.61	461.17	415.05	510.66	0.00
20	122.55	382.88	459.46	680.88	0.00
25	105.28	328.93	493.39	851.10	0.00
30	92.60	289.31	520.76	1021.32	0.00
40	75.13	234.72	563.32	1361.76	0.00
50	63.58	198.64	595.92	1702.20	0.00
60	55.34	172.88	622.37	2042.64	0.00
70	49.13	153.49	644.67	2383.08	0.00
80	44.28	138.33	663.98	2723.52	0.00
90	40.37	126.12	681.04	3063.97	0.00
100	37.15	116.06	696.33	3404.41	0.00
120	32.14	100.41	722.93	4085.29	0.00
360	13.20	41.24	890.76	12255.86	0.00
720	7.47	23.33	1007.77	24511.72	0.00
1440	4.21	13.16	1137.00	49023.44	0.00
Required Storage Volume:			11.38	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.59	m ³ /s	100 Year Proposed Conditions
Controlled Discharge Flow Rate	0.57	m ³ /s	100 Year Existing Flow
Required Storage Volume	11.38	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 10
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A9
Existing Drainage Area	0.821 ha
Existing Pavement Area	0.47 ha
Existing Runoff Coefficient	0.63 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	0.821 ha
Proposed Pavement Area	0.55 ha
Proposed Runoff Coefficient	0.68 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (York Region)				Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = C_f \times A / (T_c + B)^C$					
	A	B	C	C_f		
2-yr						
5-yr	1045.41	4.9	0.83	1	111.06	158.45
10-yr	1331.42	5.26	0.84	1	134.94	192.52
25-yr	1045.41	4.9	0.83	1.39	154.37	220.24
50-yr	1045.41	4.9	0.83	1.54	171.03	244.01
100-yr	1045.41	4.9	0.83	1.69	187.68	267.78

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C_f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

100 Year Post to 100 Year Pre - Discharging to Rouge River Tributary

Storage Volume Calculation - 100 Year Post to 100 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	187.68	293.13	175.88	160.67	15.21
15	147.61	230.54	207.49	241.00	0.00
20	122.55	191.41	229.69	321.34	0.00
25	105.28	164.43	246.65	401.67	0.00
30	92.60	144.63	260.33	482.00	0.00
40	75.13	117.34	281.61	642.67	0.00
50	63.58	99.30	297.90	803.34	0.00
60	55.34	86.42	311.13	964.01	0.00
70	49.13	76.73	322.28	1124.67	0.00
80	44.28	69.15	331.93	1285.34	0.00
90	40.37	63.05	340.46	1446.01	0.00
100	37.15	58.02	348.10	1606.68	0.00
120	32.14	50.19	361.40	1928.01	0.00
360	13.20	20.62	445.30	5784.03	0.00
720	7.47	11.66	503.79	11568.07	0.00
1440	4.21	6.58	568.39	23136.14	0.00
Required Storage Volume:			15.21	m ³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.29	m ³ /s	100 Year Proposed Conditions
Controlled Discharge Flow Rate	0.27	m ³ /s	100 Year Existing Flow
Required Storage Volume	15.21	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 11
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A10
Existing Drainage Area	2.92 ha
Existing Pavement Area	1.81 ha
Existing Runoff Coefficient	0.65 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	2.92 ha
Proposed Pavement Area	2.18 ha
Proposed Runoff Coefficient	0.73 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (York Region)				Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = C_f \times A / (T_c + B)^C$					
	A	B	C	C_f		
2-yr						
5-yr	1045.41	4.9	0.83	1	111.06	589.33
10-yr	1331.42	5.26	0.84	1	134.94	716.06
25-yr	1045.41	4.9	0.83	1.39	154.37	819.17
50-yr	1045.41	4.9	0.83	1.54	171.03	907.57
100-yr	1045.41	4.9	0.83	1.69	187.68	995.97

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C_f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

100 Year Post to 100 Year Pre - Discharging to storm sewer which outlets to Rouge River Tributary

Storage Volume Calculation - 100 Year Post to 100 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	187.68	1119.92	671.95	597.58	74.37
15	147.61	880.81	792.73	896.37	0.00
20	122.55	731.29	877.54	1195.16	0.00
25	105.28	628.24	942.36	1493.96	0.00
30	92.60	552.57	994.63	1792.75	0.00
40	75.13	448.30	1075.92	2390.33	0.00
50	63.58	379.39	1138.17	2987.91	0.00
60	55.34	330.19	1188.70	3585.49	0.00
70	49.13	293.17	1231.29	4183.08	0.00
80	44.28	264.20	1268.18	4780.66	0.00
90	40.37	240.88	1300.75	5378.24	0.00
100	37.15	221.66	1329.96	5975.82	0.00
120	32.14	191.77	1380.76	7170.99	0.00
360	13.20	78.76	1701.30	21512.96	0.00
720	7.47	44.56	1924.80	43025.93	0.00
1440	4.21	25.13	2171.60	86051.85	0.00
Required Storage Volume:			74.37	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	1.12	m ³ /s	100 Year Proposed Conditions
Controlled Discharge Flow Rate	1.00	m ³ /s	100 Year Existing Flow
Required Storage Volume	74.37	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 12
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A11
Existing Drainage Area	1.8904 ha
Existing Pavement Area	1.24 ha
Existing Runoff Coefficient	0.68 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	1.8904 ha
Proposed Pavement Area	1.42 ha
Proposed Runoff Coefficient	0.74 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (York Region)				Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = C_f \times A / (T_c + B)^C$					
	A	B	C	C_f		
2-yr						
5-yr	1045.41	4.9	0.83	1	111.06	394.55
10-yr	1331.42	5.26	0.84	1	134.94	479.39
25-yr	1045.41	4.9	0.83	1.39	154.37	548.42
50-yr	1045.41	4.9	0.83	1.54	171.03	607.61
100-yr	1045.41	4.9	0.83	1.69	187.68	666.79

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C_f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

10 Year Post to 10 Year Pre - Discharging to regional storm sewer on along Highway 7

Storage Volume Calculation - 10 Year Post to 10 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	134.94	523.90	314.34	287.63	26.71
15	106.35	412.91	371.62	431.45	0.00
20	88.36	343.07	411.69	575.27	0.00
25	75.93	294.78	442.17	719.08	0.00
30	66.77	259.25	466.65	862.90	0.00
40	54.14	210.20	504.48	1150.53	0.00
50	45.78	177.75	533.25	1438.17	0.00
60	39.81	154.57	556.46	1725.80	0.00
70	35.32	137.13	575.93	2013.43	0.00
80	31.80	123.48	592.72	2301.07	0.00
90	28.98	112.50	607.49	2588.70	0.00
100	26.64	103.45	620.70	2876.33	0.00
120	23.02	89.39	643.58	3451.60	0.00
360	9.37	36.38	785.78	10354.80	0.00
720	5.27	20.45	883.29	20709.60	0.00
1440	2.95	11.46	989.90	41419.20	0.00
Required Storage Volume:			26.71	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.52	m ³ /s	10 Year Proposed Conditions
Controlled Discharge Flow Rate	0.48	m ³ /s	10 Year Existing Flow
Required Storage Volume	26.71	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 13
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A13
Existing Drainage Area	1.3077 ha
Existing Pavement Area	0.68 ha
Existing Runoff Coefficient	0.59 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	1.3077 ha
Proposed Pavement Area	1.04 ha
Proposed Runoff Coefficient	0.77 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (City of Markham)			Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = A / (T_c + B)^C$				
	A	B	C		
2-yr	651.63	3.75	0.80	80.05	171.52
5-yr	1045.41	4.9	0.83	111.06	237.96
10-yr	1331.42	5.26	0.84	134.94	289.12
25-yr	1817.88	6.22	0.87	161.00	344.97
50-yr	1918.97	6	0.86	176.82	378.86
100-yr	2167.43	6.03	0.86	199.39	427.23

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (Tc + B)^C$			
	A	B	C	C _f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

10 Year Post to 5 Year Pre - Discharging to Municipal Storm Sewer and Pond System Outletting to Rouge River

Storage Volume Calculation - 10 Year Post to 5 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	134.94	375.69	225.41	142.77	82.64
15	106.35	296.10	266.49	214.16	52.33
20	88.36	246.02	295.22	285.55	9.68
25	75.93	211.39	317.08	356.93	0.00
30	66.77	185.91	334.63	428.32	0.00
40	54.14	150.73	361.76	571.10	0.00
50	45.78	127.46	382.39	713.87	0.00
60	39.81	110.84	399.04	856.64	0.00
70	35.32	98.33	413.00	999.42	0.00
80	31.80	88.55	425.04	1142.19	0.00
90	28.98	80.67	435.64	1284.97	0.00
100	26.64	74.18	445.11	1427.74	0.00
120	23.02	64.10	461.51	1713.29	0.00
360	9.37	26.09	563.48	5139.86	0.00
720	5.27	14.66	633.41	10279.72	0.00
1440	2.95	8.22	709.86	20559.44	0.00
Required Storage Volume:			82.64	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.38	m ³ /s	10 Year Proposed Conditions
Controlled Discharge Flow Rate	0.24	m ³ /s	5 Year Existing Flow
Required Storage Volume	82.64	m ³	



Stormwater Management Calculations

Project	Kennedy Road Class EA, York Region		
Date	21-Oct-20	No.	--
By	J. Look	Checked	S. Kashi

TABLE 14A
DRAINAGE AREA QUANTITY CONTROL REQUIREMENT CALCULATION

Drainage Area ID	A14
Existing Drainage Area	1.278 ha
Existing Pavement Area	0.72 ha
Existing Runoff Coefficient	0.62 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Proposed Drainage Area	1.278 ha
Proposed Pavement Area	1.00 ha
Proposed Runoff Coefficient	0.76 <i>Assume pavement C = 0.9, landscaped C = 0.25</i>
Time of Concentration	10 minute

Existing Conditions

Return Period	IDF Parameters (City of Markham)			Rainfall Intensity (mm/hr)	Allowable Release Rate (L/s)
	$i = A / (T_c + B)^C$				
	A	B	C		
2-yr	651.63	3.75	0.80	80.05	175.42
5-yr	1045.41	4.9	0.83	111.06	243.37
10-yr	1331.42	5.26	0.84	134.94	295.70
25-yr	1817.88	6.22	0.87	161.00	352.81
50-yr	1918.97	6	0.86	176.82	387.48
100-yr	2167.43	6.03	0.86	199.39	436.95

Proposed Conditions

Return Period	IDF Parameters (York Region)			
	$i = C_f \times A / (T_c + B)^C$			
	A	B	C	C _f
2-yr				
5-yr	1045.41	4.9	0.83	1
10-yr	1331.42	5.26	0.84	1
25-yr	1045.41	4.9	0.83	1.39
50-yr	1045.41	4.9	0.83	1.54
100-yr	1045.41	4.9	0.83	1.69

Peak Flow Control Requirement

10 Year Post to 5 Year Pre - Discharging to municipal storm sewer on Carlton Rd

Storage Volume Calculation - 10 Year Post to 5 Year Pre

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m ³)	Ex. Discharge Flow Vol. (m ³)	Required Storage Volume (m ³)
10	134.94	363.86	218.32	146.02	72.30
15	106.35	286.78	258.10	219.03	39.07
20	88.36	238.28	285.93	292.04	0.00
25	75.93	204.74	307.10	365.06	0.00
30	66.77	180.06	324.10	438.07	0.00
40	54.14	145.99	350.38	584.09	0.00
50	45.78	123.45	370.36	730.11	0.00
60	39.81	107.35	386.48	876.13	0.00
70	35.32	95.24	400.00	1022.15	0.00
80	31.80	85.76	411.66	1168.18	0.00
90	28.98	78.13	421.92	1314.20	0.00
100	26.64	71.85	431.10	1460.22	0.00
120	23.02	62.08	446.99	1752.27	0.00
360	9.37	25.27	545.75	5256.80	0.00
720	5.27	14.20	613.47	10513.59	0.00
1440	2.95	7.96	687.52	21027.18	0.00
Required Storage Volume:			72.30	m³	

Required Storage Summary

Uncontrolled Discharge Flow Rate	0.36	m ³ /s	10 Year Proposed Conditions
Controlled Discharge Flow Rate	0.24	m ³ /s	5 Year Existing Flow
Required Storage Volume	72.30	m ³	