APPENDIX B
Model Parameters

RAINBOW CREEK SUB-WATERSHED STUDY
REFERENCE LIST FOE EXISTING PONDS

SWM_CA23	Design Drawings, Bilton Industrial Park, EMC Group Ltd., April 1987	Design Drawings	Design Drawings
SWM_CA14	Designed for modeling purposes as part of the Rainbow Creek Subwatershed Model		
SWM_CA11	Designed for modeling purposes as part of the Rainbow Creek Subwatershed Model		
SWM_BR_01	Designed for modeling purposes as part of the Rainbow Creek Subwatershed Model		
SWM_VA94	Open Storage Expansion - HWY 7 and 27 Hydro Lands, City of Vaughan, Urban Ecosystems Limited , August 27, 1998	Stage-storage curve	Stage discharge curve
SWM_VA95	HydrologicalAssesment of Urbanized Storm Water Runoff and Analysis of Storm Water Management Techniques for the Residential Development Proposal of Acument Investments Linited and Arrandene Construction Limited in Lots 9 and 10, Concession 8, Town of Vaughan, Ander Engineering & Associates Limited, June 30th, 1982	Stage-storage curve	Stage discharge curve
SWM_VA96	Design Drawings, Subdivision 65M-2155 (Town Of Vaughan), Marshall Macklin Monaghan Limited, November 1982	Design Drawings	Design Drawings
SWM_VA97	West Woddbrige Investment Ltd., Industrial Subdivision, HWY 27 & HWY 7, Mitchell & Perry Ltd., March 16, 1979	Design Drawings	Design Drawings
SWM_VA100	Storage curve from SWMSoft Contours, outlet rating curve from Humber Hydrology model[1]	SWMsoft Contours	Humber model
SWM_VA101	Stormwater Management Report, Woodbridge Highlands, Town of Vaughan, Marshall Macklin Monaghan Limited, March 1988	Design Drawings	Design Drawings
SWM_VA111	Storage curve from SWMSoft Contours, outlet rating curve from Humber Hydrology model[1]	SWMsoft Contours	Humber model
SWM_VA112	Stormwater Management Report for Vaughan West (South) Industrial Site, Urban Ecosystems Limited, July 1998	Stage-storage curve	Stage-discharge curve
SWM_VA117	Storage curve from SWMSoft Contours, outlet rating curve from Humber Hydrology model[1]	SWMsoft Contours	Humber model
SWM_VA118	Storage curve from SWMSoft Contours, outlet rating curve from Humber Hydrology model[1]	SWMsoft Contours	Humber model
SWM_VA130	Design Drawings, Project No. 10-82024 (Town Of Vaughan), Marshall Macklin Monaghan Limited, January 1986	Design Drawings	Design Drawings
SWM_VA132	Stormwater Management Plan Vaughan West (North) Business Park Proposed Industrial Development, Sernas Associates, February 2002	Stage	
SWM_VA137	Stormwater Management Report and Pond Design Report Regional Road 27and Nickel Gate, Valdor Engineering Inc., June 2006	Stage-Storage Table	Storage-discharge curve
SWM_VA_Milani	Stormwater Management Report for 611428 Ontario Limited, Condeland Engineering Ltd., November 8, 2006	SWMsoft Contours	Description in report
Rav_of_RC	Stormwater Management Report for Ravines of Rainbow Creek, Skira & Associates Limited, September 2009	Description in report	Description in report
SWM_WestVA2A	Suplementry Stromewater Management Report for Vaughan West II Business Park SWM Facility B, Urban Ecosystems Ltd., May 2006	Design Drawings	Stage-discharge Table
SWM_VAWEST_B	Suplementry Stromewater Management Report for Vaughan West II Business Park SWM Facility B, Urban Ecosystems Ltd., May 2006	Design Drawings	Stage-discharge Table
SWM_VA_BLK64_2			
SWM_VA_BLK64_3			
SWM_VA_BLK64_1			
SWM_BLK61_02	Master Environmental and Servicing Plan, Block 61, Schaeffers Consulting Engineers, December 2009	Stage-discharge Table	Stage-discharge Table
SWM_BLK61_01	Master Environmental and Servicing Plan, Block 61, Schaeffers Consulting Engineers, December 2009	Stage-discharge Table	Stage-discharge Table
SWM_VA_GOLF	Added to represent exiting pond for the residential subdivision / no information	VO3 model	VO3 model

Notes:

1 Hydrologic Study of Impacts on Flood Flows and Mitigation of Future Development in the Humber River – AMEC Environment and Infrastructure, June 2012 (Draft)

RAINBOW CREEK SUB-WATERSHED STUDY
LOOK-UP TABLES FOR PCSWMM MODEL

Soil parameter table from the PCSWMM model

Source Layer	Destination Layer		
Type	Conductivity (mm/hr)	Suction head (mm)	Initial Deficit (fraction)
Sand	120.4	49.02	0.024
Loamy Sand	29.97	60.96	0.047
Fox Sandy Loam	10.92	109.98	0.085
Loam	3.3	88.9	0.116
Silt Loam	6.6	169.93	0.135
Sandy Clay Loam	1.52	219.96	0.136
King Clay Loam	1.02	219.96	0.136
Silty Clay Loam	1.02	219.96	0.136
Sandy Clay	0.51	240.03	0.221
Silty Clay	0.51	290.07	0.251
Peel Clay	0.25	320.04	0.265
Monoghan Clay Loam	1.02	219.96	0.136
Pontypool Sandy Loam	10.92	109.98	0.085
Brighton Sandy Loam	10.92	109.98	0.085
Berrien Sandy Loam	10.92	109.98	0.085
Cashel Clay	0.25	320.04	0.265
Muck	0.25	320.04	0.265
Brighton Sandy Loam - over gravel	10.92	109.98	0.085
Bookton Sandy Loam	10.92	109.98	0.085
Malton	0.25	320.04	0.265

Flow path length table from the PCSWMM model

Source Layer	Destination Layer
Land Use	Length (m)
427 EXTENSION	150
AGRICULTURAL	150
COMMERCIAL MIXED-USE	75
GENERAL EMPLOYMENT	150
HIGH DENSITY RESIDENTIAL	50
HIGH-RISE RESIDENTIAL	50
INDUSTRIAL	50
INFRASTRUCTURE AND UTILITIES	100
INSTITUTIONAL	50
LOW-RISE MIXED-USE	100
LOW-RISE RESIDENTIAL	100
MAJOR INSTITUTIONAL	50
MEDIUM DENSITY RESIDENTIAL	75
MID-RISE MIXED-USE	75
MID-RISE RESIDENTIAL	75
MIXED RESIDENTIAL	75
NATURAL AREAS	100
PARKS	100
PARKWAY BELT WEST LANDS	100
POND BLOCK	50
PRESTIGE EMPLOYMENT	150
PRIVATE OPEN SPACE	100
RURAL RESIDENTIAL	100
SPORTS COMPLEX	150
TRANSPORTATION CORRIDOR	50
VACANT LANDS	100

Percent impervious table from the PCSWMM model

Source Layer	Destination Layer
	Impervious (%)
427 EXTENSION	5
AGRICULTURAL	5
COMMERCIAL MIXED-USE	88
GENERAL EMPLOYMENT	90
HIGH DENSITY RESIDENTIAL	80
HIGH-RISE RESIDENTIAL	80
INDUSTRIAL	93
INFRASTRUCTURE AND UTILITIES	5
INSTITUTIONAL	32
LOW-RISE MIXED-USE	88
LOW-RISE RESIDENTIAL	65
MAJOR INSTITUTIONAL	32
MEDIUM DENSITY RESIDENTIAL	73
MID-RISE MIXED-USE	88
MID-RISE RESIDENTIAL	73
MIXED RESIDENTIAL	70
NATURAL AREAS	0
PARKS	5
PARKWAY BELT WEST LANDS	5
POND BLOCK	60
PRESTIGE EMPLOYMENT	85
PRIVATE OPEN SPACE	5
RURAL RESIDENTIAL	15
SPORTS COMPLEX	30
TRANSPORTATION CORRIDOR	60
VACANT LANDS	5

RAINBOW CREEK SUB-WATERSHED STUDY
MODEL PARAMETERS FOR PCSWMM MODEL (Baseline Scenario)

COLE ENGINEERING
Experience Enhancing Excellence

Name	Tag	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit (fraction)
CEG_BR_01	RC_CEG_2012_BRAM	RC_20	35.8	3562.1	100.4	2.43	53.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_02	RC_CEG_2012_BRAM	RC_20	16.0	1330.0	120.1	1.81	29.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_02.1	RC_CEG_2012_BRAM	RC_20	22.3	2340.5	95.1	2.23	3.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_03	RC_CEG_2012_BRAM	RC_19	90.0	6735.2	133.7	1.81	6.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_04.2	RC_CEG_2012_BRAM	J12446.08	38.1	3114.5	122.2	1.81	8.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_05	RC_CEG_2012_BRAM	RC_18	143.7	10774.5	133.4	1.64	4.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_08	RC_CEG_2012_BRAM	ER_08	94.9	6590.6	144.0	1.71	13.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_10	RC_CEG_2012_BRAM	J17699.14	46.4	3561.1	130.3	1.8	4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_10.1	RC_CEG_2012_BRAM	J16021.18	44.9	3378.6	132.8	1.73	3.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_11	RC_CEG_2012_BRAM	RC_05	46.2	3147.7	146.7	1.82	6.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_12	RC_CEG_2012_BRAM	J2010.681	47.1	3336.5	141.1	1.67	11.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_01	RC_CEG_2012_CAL	J1329.443	21.2	1570.2	135.1	2.4	80	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_02	RC_CEG_2012_CAL	J1085.477	23.3	1643.8	141.9	2.14	80.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_03	RC_CEG_2012_CAL	J1085.477	25.0	3259.0	76.8	1.35	77.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_04	RC_CEG_2012_CAL	J1329.443	11.6	1501.5	77.0	2.16	62.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_05	RC_CEG_2012_CAL	J160.4485	24.6	1954.2	125.8	1.65	78.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_06	RC_CEG_2012_CAL	J1329.443	66.1	7472.5	88.4	2.62	63.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_07	RC_CEG_2012_CAL	J18562.38	51.4	3778.9	136.0	1.31	44.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_08_2	RC_CEG_2012_CAL	J17699.14	43.7	3225.7	135.4	1.8	24.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_11	RC_CEG_2012_CAL	RC_01	135.0	10011.2	134.8	1.71	56.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_16	RC_CEG_2012_CAL	J158.9141	95.3	10589.8	90.0	2.31	50.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_17	RC_CEG_2012_CAL	J160.4485	24.0	3030.8	79.2	1.65	86.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_01	RC_CEG_2012	j6316.758	9.2	860.7	106.7	2.69	12.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_02	RC_CEG_2012	j5677.197	15.0	1433.5	104.8	2.69	23.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_03	RC_CEG_2012	j8411.76	26.2	2077.8	126.0	2.5	2.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_04	RC_CEG_2012_PND	j115	114.8	8432.3	136.1	2.21	64.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_05	RC_CEG_2012	RC_15	25.1	1914.8	131.3	3.05	4.4	0.013	0.25	1	5	229.42	4.85	0.187
CEG_VA_06	RC_CEG_2012	j104	23.9	2000.3	119.3	2.34	4.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_07_1_1	RC_CEG_2012	RC_16	46.0	3621.3	127.0	2.35	7.4	0.013	0.25	1	5	319.89	0.26	0.265
CEG_VA_08	RC_CEG-2012	j606	60.0	4076.0	147.2	1.79	6.2	0.013	0.25	1	5	117.06	10.56	0.091
CEG_VA_09	RC_CEG_2012	RC_14	12.9	1023.3	126.4	2.4	3.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_10	RC_CEG-2012	j73	78.9	6185.0	127.5	1.8	7.5	0.013	0.25	1	5	116.71	10.58	0.091
CEG_VA_100	RC_CEG_2012	J2740.745	27.6	2689.2	102.5	2.9	14.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_101	RC_CEG_2012	J3054.366	24.5	2633.5	93.1	3.32	32.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_102	RC_CEG_2012_PND	J3054.366	14.1	1404.9	100.3	2.77	29.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_103	RC_CEG_2012	RC_25	17.7	1690.1	104.7	2.82	1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_104	RC_CEG_2012_PND	RC_25	126.8	8882.0	142.8	2.82	68.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_105	RC_CEG_2012	RC_24	78.4	6046.3	129.7	2.5	11.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_106	RC_CEG_2012_PND	j77	52.4	4859.9	107.8	2.15	82.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_107	RC_CEG_2012	RC_23	26.6	2065.5	129.0	2.16	4.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_108	RC_CEG_2012_PND	RC_23	72.8	5186.6	140.3	2.23	77.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_109	RC_CEG_2012	J00	13.3	1305.5	101.5	2.23	6.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_11	RC_CEG_2012	J4596.306	58.2	4086.9	142.4	1.54	5.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_110	RC_CEG_2012	ER_06	14.4	1081.4	133.6	2.34	4.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_111_1	RC_CEG_2012_PND	ER_06	65.7	4568.4	143.9	2.73	53.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_112	RC_CEG_2012_PND	RC_22	33.7	2397.2	140.6	2.23	77.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_113	RC_CEG_2012_PND	J5677.197	32.1	3636.6	88.3	1.54	52.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_12	RC_CEG_2012	RC_31	15.9	1853.3	85.9	4.45	17.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_13	RC_CEG-2012	RC_11	85.5	6138.0	139.3	1.79	6.3	0.013	0.25	1	5	202.01	6.25	0.164
CEG_VA_14	RC_CEG_2012	RC_01	14.5	1044.2	138.5	2.49	22	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_15	RC_CEG_2012	j2781.741	3.1	247.6	126.3	2.37	3.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_16	RC_CEG_2012	J2010.681	16.2	1213.1	133.8	1.99	29.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_17	RC_CEG_2012	j102	65.4	5197.7	125.8	1.49	5.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_18	RC_CEG_2012	j103	21.3	1717.8	124.1	2.16	7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_19	RC_CEG-2012	J608	54.1	3665.0	147.7	2.14	5.8	0.013	0.25	1	5	130.13	9.9	0.102
CEG_VA_20	RC_CEG_2012	j98	48.7	3828.9	127.3	2.25	7.8	0.013	0.25	1	5	267.79	2.9	0.22
CEG_VA_21	RC_CEG_2012	RC_08	20.9	1538.8	135.6	2.75	3.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_22	RC_CEG_2012	RC_03	4.2	345.6	120.6	3.2	4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_23	RC_CEG_2012	j2781.741	3.5	295.0	118.2	2.37	1.9	0.013	0.25	1	5	257.49	3.43	0.211
CEG_VA_24	RC_CEG_2012	j2781.741	112.2	8370.0	134.1	2.21	5.4	0.013	0.25	1	5	223.6	5.15	0.182
CEG_VA_25	RC_CEG_2012	J1085.477	9.9	842.5	117.9	2.37	8.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_26	RC_CEG_2012	RC_02	41.7	3161.7	131.9	2.21	4.6	0.013	0.25	1	5	266.71	2.96	0.219
CEG_VA_27	RC_CEG_2012	j2781.741	68.6	6274.5	109.4	2.49	7.1	0.013	0.25	1	5	168.72	7.94	0.135
CEG_VA_28	RC_CEG_2012	RC_03	38.4	2943.3	130.3	3.2	4.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_29_1	RC_CEG_2012	j9446.955	11.0	831.8	131.7	2.59	3.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_29_2	RC_CEG_2012	RC_10	41.8	3325.7	125.6	2.59	5.9	0.013	0.25	1	5	316.21	0.44	0.262
CEG_VA_30	RC_CEG_2012	J004	60.5	4429.1	136.5	2.4	3.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_31	RC_CEG_2012	RC_06	15.8	1238.7	127.3	1.67	6.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_32	RC_CEG-2012	ER_02	26.6	1882.0	141.2	2.35	9.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_33	RC_CEG_2012	RC_21	9.8	912.6	107.9	2.34	6.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_34	RC_CEG_2012_PND	j77	90.7	6796.2	133.4	1.55	86.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_35	RC_CEG_2012_PND	RC_17	7.8	785.0	99.4	4.47	40.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_36	RC_CEG_2012	j12167.66	47.3	3342.1	141.4	1.99	5.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_37	RC_CEG_2012	J561.824	42.3	4684.3	90.3	3.4	19.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_38	RC_CEG_2012	j73	16.0	1312.4	122.0	2.95	5.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_39	RC_CEG_2012	J2045.12	19.6	2038.8	96.0	3.54	48.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_40	RC_CEG_2012	J10251.75	9.4	825.3	114.3	2.59	12.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_41	RC_CEG_2012	J4596.306	21.3	2038.4	104.3	2.74	23.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_42	RC_CEG_2012	CA_PlunkettCre	26.6	2725.8	97.6	3.17	41.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_43	RC_CEG_2012	RC_04	6.9	620.4	111.8	1.98	4.9	0.013	0.25	1	5	306.69	0.93	0.254
CEG_VA_44	RC_CEG_2012	j5326.488	68.1	5216.1	130.6	2.35	3.8	0.013	0.25	1	5	310.94	0.71	0.257
CEG_VA_45	RC_CEG_2012	RC_21	6.8	561.5	120.4	2.16	12.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_46	RC_CEG_2012	RC_21	27.3	1995.5	136.6	2.34	38.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_47	RC_CEG_2012	RC_14-15	9.9	901.0	110.1	2.75	9.6	0.013	0.25	1	5	256.1	3.5	0.21
CEG_VA_48	RC_CEG_2012	j5677.197	7.7	776.6	98.7	2.46	5.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_49	RC_CEG_2012	RC_09	28.9	2578.5	111.9	2.56	3.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_50	RC_CEG_2012	j101	27.0	2084.7	129.3	3.05	4.4	0.013	0.25	1	5	313.65	0.57	0.26
CEG_VA_51	RC_CEG_2012	RC_21	9.3	644.2	145.1	2.16	5.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_52	RC_CEG_2012	j14196.1	42.6	3913.3	108.8	2.49	4.8	0.013	0.25	1	5	303.06	1.11	0.25
CEG_VA_54	RC_CEG_2012	J002	2.2	148.0	145.9	2.59	7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_55	RC_CEG_2012	RC_01	15.0	1066.8	140.9	2.85	73.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_56	RC_CEG_2012	RC_07	19.4	1516.6	128.2	1.75	6.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_57	RC_CEG_2012	J807.0064	13.5	1017.2	133.1	2.75	3.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_58	RC_CEG_2012	j73	158.2	11871.3	133.3	1.83	5.2	0.013	0.25	1	5	128.24	9.99	0.101
CEG_VA_59	RC_CEG_2012	RC_04	81.9	6685.4	122.5	1.98	5	0.013	0.25	1	5	114.42	10.69	0.089
CEG_VA_60	RC_CEG_2012	j73	1.1	114.2	93.3	2.95	12.4	0.013	0.25	1	5	320.04	0.25	0.265

RAINBOW CREEK SUB-WATERSHED STUDY
MODEL PARAMETERS FOR PCSWMM MODEL (Baseline Scenario)

COLE ENGINEERING
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Name	Tag	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit (fraction)
CEG_VA_61	RC_CEG_2012	J13056.87	19.2	1628.7	118.1	2.95	3.6	0.013	0.25	1	5	262.54	3.17	0.216
CEG_VA_62	RC_CEG_2012_PND	J1678.551	5.7	395.8	144.5	2.39	80.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_63_1	RC_CEG_2012	RC_13	20.7	1694.3	122.4	1.99	3.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_63_2_2	RC_CEG_2012	RC_13	19.2	1270.0	150.8	1.99	6.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_64	RC_CEG_2012	r22.08	23.5	1814.2	129.5	2.02	23.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_65	RC_CEG_2012	RC_27	10.7	1115.2	96.0	3.16	31	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_66	RC_CEG_2012	RC_24	30.5	2177.7	140.1	2.83	6.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_67	RC_CEG_2012	J4596.306	21.9	2190.0	100.0	2.55	44.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_68	RC_CEG_2012	RC_27	4.0	401.9	100.0	3.16	24.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_69	RC_CEG_2012	J1328.091	3.6	332.3	108.0	3.2	19.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_70	RC_CEG_2012_PND	RC_21	95.2	6586.4	144.5	2.43	83.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_71	RC_CEG_2012	J4596.306	27.3	2627.4	103.9	2.74	47.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_72	RC_CEG_2012	ER_05	69.6	5000.4	139.1	2.34	4.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_73	RC_CEG_2012	J002	4.6	445.6	104.1	2.59	18.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_74	RC_CEG_2012	ER_06	13.4	1029.3	130.0	2.34	3.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_75	RC_CEG_2012	ER_08	71.5	5038.2	142.0	1.8	25	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_76	RC_CEG_2012	RC_28	27.8	2566.0	108.2	2.39	30.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_77	RC_CEG_2012	j132	42.9	4887.4	87.8	2.68	32.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_78	RC_CEG_2012	j76	19.2	2107.8	91.3	3.2	14.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_79	RC_CEG_2012	J1328.091	21.8	2204.2	99.0	3.35	25.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_80	RC_CEG_2012_PND	j132	46.1	4614.3	100.0	2.42	10.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_81	RC_CEG_2012	j22	3.4	435.5	77.8	3.44	27.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_82	RC_CEG_2012	j99	49.4	4810.2	102.6	2.93	72.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_83	RC_CEG_2012	RC_28	28.3	2843.9	99.5	2.38	5.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_84_1	RC_CEG_2012	RC_30	9.8	985.2	99.1	3.44	4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_84_2	RC_CEG_2012	RC_29	10.6	1190.5	89.1	3.44	16.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_85	RC_CEG_2012	j1654.414	27.8	2775.2	100.0	3.44	3.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_86	RC_CEG_2012	J2740.745	18.7	1911.2	98.0	2.57	58.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_87	RC_CEG_2012	RC_26	10.6	1076.7	98.4	3.16	51.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_88	RC_CEG_2012	j1678.551	82.1	7125.8	115.2	2.09	48.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_89	RC_CEG_2012	r23.01	15.8	1549.7	101.8	2.45	45.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_90	RC_CEG_2012	r23.01	14.4	1337.3	107.5	3.2	37.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_91	RC_CEG_2012	J4596.306	96.0	9966.4	96.3	2.41	62	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_92	RC_CEG_2012_PND	J6316.758	92.2	6998.7	131.8	2.2	77.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_93	RC_CEG_2012_PND	J4596.306	23.8	2672.5	88.9	1.54	56.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_94	RC_CEG_2012_PND	J5677.197	18.8	1385.1	135.7	1.93	80.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_95	RC_CEG_2012_PND	J3054.366	46.7	4738.8	98.6	2.68	52.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_96	RC_CEG_2012_PND	J1328.091	37.6	3763.0	100.0	2.74	56.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_97	RC_CEG_2012_PND	J4596.306	29.8	2981.8	100.0	2.59	50.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_98	RC_CEG_2012_PND	R23.01	11.8	1182.7	100.0	2.74	58.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_99	RC_CEG_2012	RC_17	16.0	1683.4	95.1	4.47	14.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA53	RC_CEG-2012	RC_12	88.2	5638.5	156.4	2.12	6.1	0.013	0.25	1	5	241.45	4.24	0.198

RAINBOW CREEK SUB-WATERSHED STUDY
MODEL PARAMETERS FOR PCSWMM MODEL (2031 Scenario)

COLE ENGINEERING
Experience Enhancing Excellence

Name	Tag	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit (fraction)
CEG_BR_01	RC_CEG_2012_BRAM	RC_20	35.8	3562.1	100.4	2.43	53.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_02	RC_CEG_2012_BRAM	RC_20	16.0	1330.0	120.1	1.81	29.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_02.1	RC_CEG_2012_BRAM	RC_20	22.3	2340.5	95.1	2.23	3.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_03	RC_CEG_2012_BRAM	RC_19	37.0	4710.1	78.5	1.81	58.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_04	RC_CEG_2012_BRAM	RC_19	59.7	4180.8	142.7	1.81	87.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_04.1	RC_CEG_2012_BRAM	RC_19	26.8	2676.6	100.0	1.81	0	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_04.2	RC_CEG_2012_BRAM	J12446.08	14.3	1429.4	100.0	1.81	4.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_05	RC_CEG_2012_BRAM	RC_18	39.6	2674.4	148.2	1.64	82.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_06	RC_CEG_2012_BRAM	RC_18	29.2	1983.5	147.0	1.64	87.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_06.1	RC_CEG_2012_BRAM	J14965.99	30.6	3061.3	100.0	1.64	0.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_06.2	RC_CEG_2012_BRAM	RC_18	14.4	1443.7	100.0	1.64	0	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_07	RC_CEG_2012_BRAM	J14965.99	35.5	2379.1	149.3	1.64	89.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_08	RC_CEG_2012_BRAM	ER_08	81.8	5643.6	144.9	1.71	88.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_10	RC_CEG_2012_BRAM	J17104.81	43.0	2924.0	147.0	1.76	88.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_10.1	RC_CEG_2012_BRAM	J17104.81	16.2	1631.7	99.3	1.8	1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_11	RC_CEG_2012_BRAM	RC_05	71.4	4922.8	145.0	1.68	82.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_11.1	RC_CEG_2012_BRAM	J16021.18	13.7	1381.6	99.5	1.73	0.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_12	RC_CEG_2012_BRAM	J2010.681	36.5	2525.5	144.4	1.67	83.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_13	RC_CEG_2012_BRAM	J17104.81	11.1	764.7	145.0	1.67	79.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_01	RC_CEG_2012_CAL	J1329.443	21.2	1570.2	135.1	2.4	81.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_02	RC_CEG_2012_CAL	J1085.477	23.3	1643.8	141.9	2.14	81	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_03	RC_CEG_2012_CAL	J1085.477	25.0	3259.0	76.8	1.35	86.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_04	RC_CEG_2012_CAL	J1329.443	11.6	1501.5	77.0	2.16	84.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_05	RC_CEG_2012_CAL	J160.4485	24.6	1954.2	125.8	1.65	85.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_06	RC_CEG_2012_CAL	J1329.443	66.1	7472.5	88.4	2.62	72.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_07	RC_CEG_2012_CAL	J18562.38	51.4	3778.9	136.1	1.31	86.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_08	RC_CEG_2012_CAL	J17104.81	43.2	3225.7	133.9	1.8	76.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_11	RC_CEG_2012_CAL	RC_01	134.9	10011.2	134.8	1.71	85.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_16	RC_CEG_2012_CAL	J158.9141	95.3	10589.8	90.0	2.31	51.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_17	RC_CEG_2012_CAL	J160.4485	24.0	3030.8	79.2	1.65	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5901	RC_CEG_2031_DEV	J001	2.0	162.3	123.6	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5903	RC_CEG_2031_DEV	ER_05	36.2	2094.7	173.0	2	85.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5904	RC_CEG_2031_DEV	ER_05	33.1	2346.3	140.9	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5905	RC_CEG_2031_DEV	J4596.306	35.3	2820.4	125.3	2	87	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5906	RC_CEG_2031_DEV	J102	36.4	1819.6	199.9	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5908	RC_CEG_2031_DEV	RC_16	45.4	1254.0	362.2	2	89.1	0.013	0.25	1	5	248.29	3.89	0.204
CEG_DEV_5911	RC_CEG_2031_DEV	J3	7.7	669.4	114.9	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5912	RC_CEG_2031_DEV	ER_06	48.5	2138.4	226.9	2	89.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5913	RC_CEG_2031_DEV	J5326.488	9.7	706.6	137.8	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5915	RC_CEG_2031_DEV	RC_23	13.3	952.9	139.9	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6001	RC_CEG_2031_DEV	RC_21	1.1	78.1	143.2	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6002	RC_CEG_2031_DEV	j003	11.1	883.9	125.7	2	87	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6003	RC_CEG_2031_DEV	J004	50.4	3400.8	148.2	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6004	RC_CEG_2031_DEV	J101	13.7	945.2	144.5	2	90	0.013	0.25	1	5	196.78	6.51	0.159
CEG_DEV_6005	RC_CEG_2031_DEV	J101	5.7	386.6	148.0	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6006	RC_CEG_2031_DEV	ER_02	20.5	1380.8	148.5	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6007	RC_CEG_2031_DEV	ER_02	4.0	354.9	112.7	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6008	RC_CEG_2031_DEV	RC_11	4.7	318.7	148.6	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6009	RC_CEG_2031_DEV	J104	7.0	648.2	107.6	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6201_1	RC_CEG_2031_DEV	J608	3.1	206.4	148.4	2	70	0.013	0.25	1	5	109.98	10.92	0.085
CEG_DEV_6201_2	RC_CEG_2031_DEV	j005	13.3	1459.0	90.9	2	70	0.013	0.25	1	5	109.98	10.92	0.085
CEG_DEV_6202	RC_CEG_2031_DEV	J73	15.8	1581.8	100.0	2	61	0.013	0.25	1	5	109.98	10.92	0.085
CEG_DEV_6501	RC_CEG_2031_DEV	J003	0.4	29.6	149.2	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6502	RC_CEG_2031_DEV	J003	4.5	304.2	147.8	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6503	RC_CEG_2031_DEV	J003	3.6	265.3	134.2	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6504	RC_CEG_2031_DEV	J003	1.4	134.7	102.9	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6505	RC_CEG_2031_DEV	J8411.76	16.8	1388.4	121.2	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6506	RC_CEG_2031_DEV	J10251.75	11.1	768.0	144.6	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6601	RC_CEG_2031_DEV	R22.08	5.7	387.2	148.2	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6602	RC_CEG_2031_DEV	ER_08	17.3	1187.8	145.8	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6603	RC_CEG_2031_DEV	ER_08	38.1	2586.3	147.2	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6604	RC_CEG_2031_DEV	ER_08	5.7	401.5	141.1	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6605	RC_CEG_2031_DEV	ER_08	4.9	347.9	140.9	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6606	RC_CEG_2031_DEV	ER_10	20.6	1389.9	148.5	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6607	RC_CEG_2031_DEV	J12167.66	22.9	1538.1	148.6	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6608	RC_CEG_2031_DEV	J12167.66	9.6	790.0	121.2	2	40	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6609	RC_CEG_2031_DEV	J13056.87	17.8	1257.8	141.4	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6610	RC_CEG_2031_DEV	RC_07	6.1	432.0	141.8	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_01	RC_CEG_2012	j6316.758	9.2	860.7	106.7	2.69	12.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_02	RC_CEG_2012	j5677.197	15.0	1433.5	104.8	2.69	23.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_03	RC_CEG_2031_NAT	j8411.76	23.9	1973.7	120.9	2.5	12.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_04	RC_CEG_2012_PND	j115	100.6	7345.9	137.0	2.21	68.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_05	RC_CEG_2031_NAT	RC_15	7.9	788.9	99.8	3.05	1.5	0.013	0.25	1	5	187.37	6.99	0.151
CEG_VA_06	RC_CEG_2031_NAT	j104	14.9	1271.2	117.3	2.34	4.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_07	RC_CEG_2031_NAT	RC_16	6.5	644.3	100.4	2.35	0.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_07.1	RC_CEG_2031_NAT	RC_16	10.2	1057.4	96.2	2.35	15	0.013	0.25	1	5	319.27	0.29	0.264
CEG_VA_08	RC_CEG_2012	j606	49.0	3565.1	137.4	1.79	4.5	0.013	0.25	1	5	118.65	10.48	0.092
CEG_VA_09	RC_CEG_2031_NAT	RC_14	7.6	683.2	111.7	2.4	2.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_10	RC_CEG_2012	j73	50.8	3956.4	128.5	1.8	19.2	0.013	0.25	1	5	118.51	10.49	0.092
CEG_VA_100	RC_CEG_2012	J2740.745	27.6	2694.5	102.3	2.9	14.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_101	RC_CEG_2012	J3054.366	24.5	2675.5	91.4	3.32	32.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_102	RC_CEG_2012_PND	J3054.366	14.1	1404.9	100.3	2.77	29.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_103	RC_CEG_2012	RC_25	17.7	1700.0	104.1	2.82	1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_104	RC_CEG_2012_PND	RC_25	126.8	8882.0	142.8	2.82	68.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_105	RC_CEG_2012	RC_24	76.6	5922.3	129.4	2.5	11.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_106	RC_CEG_2012_PND	j77	52.4	4859.9	107.8	2.15	82.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_107	RC_CEG_2031_NAT	RC_23	7.9	788.1	99.8	2.16	1.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_108	RC_CEG_2012_PND	RC_23	73.3	5186.6	141.4	2.23	77.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_109	RC_CEG_2012	RC_22	13.2	1300.0	101.7	2.23	6.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_11	RC_CEG_2031_NAT	RC_24	41.1	3002.5	136.9	2.16	4.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_111	RC_CEG_2012_PND	ER_06	65.8	4568.4	144.0	2.73	53.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_112	RC_CEG_2012_PND	RC_22	33.7	2397.2	140.6	2.23	77.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_113	RC_CEG_2012_PND	J5677.197	32.1	3636.6	88.3	1.54	52.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_12	RC_CEG_2012	RC_31	15.9	1853.3	85.9	4.45	17.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_13	RC_CEG_2012	j005	17.0	1184.8	143.5	1.79	5.6	0.013	0.25	1	5	139.02	9.44	0.11
CEG_VA_14	RC_CEG_2012	RC_01	14.5	1050.3	137.7	2.49	22	0.013	0.25	1	5	320.04	0.25	0.265

RAINBOW CREEK SUB-WATERSHED STUDY
MODEL PARAMETERS FOR PCSWMM MODEL (2031 Scenario)

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Name	Tag	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit (fraction)
CEG_VA_15	RC_CEG_2012	j2781.741	3.1	218.9	142.8	2.37	3.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_16	RC_CEG_2012	J2010.681	16.2	1213.0	133.8	1.99	29.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_17	RC_CEG_2031_NAT	J102	16.9	1740.3	97.3	1.49	13.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_18	RC_CEG_2031_NAT	j103	4.3	437.1	99.2	2.16	1.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_19.1	RC_CEG_2012_PND	j005	144.4	15820.3	91.3	1.8	63.4	0.013	0.25	1	5	173.2	7.71	0.139
CEG_VA_19.2	RC_CEG_2012_PND	j608	51.4	5187.1	99.1	1.9	30.6	0.013	0.25	1	5	226.21	5.02	0.185
CEG_VA_20	RC_CEG_2031_NAT	j98	44.7	3541.8	126.2	2.25	4.1	0.013	0.25	1	5	265.67	3.01	0.218
CEG_VA_21	RC_CEG_2031_NAT	RC_08	5.8	581.0	100.0	2.75	0.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_22	RC_CEG_2012	RC_03	4.2	345.6	120.6	3.2	4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_23	RC_CEG_2012	j2781.741	3.5	259.2	134.5	2.37	1.9	0.013	0.25	1	5	257.49	3.43	0.211
CEG_VA_24	RC_CEG_2012	j2781.741	112.2	8363.7	134.2	2.21	5.4	0.013	0.25	1	5	223.6	5.15	0.182
CEG_VA_25	RC_CEG_2012	J1085.477	9.9	842.5	117.9	2.37	8.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_26	RC_CEG_2012	RC_02	41.7	3161.7	131.9	2.21	4.6	0.013	0.25	1	5	266.71	2.96	0.219
CEG_VA_27	RC_CEG_2012	j2781.741	68.6	6274.5	109.4	2.49	7.1	0.013	0.25	1	5	168.72	7.94	0.135
CEG_VA_28	RC_CEG_2012	RC_03	38.4	2943.3	130.3	3.2	4.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_29.1	RC_CEG_2031_NAT	j9446.955	7.6	615.2	123.8	2.59	4.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_29.2	RC_CEG_2031_NAT	RC_10	11.5	1161.9	99.2	2.59	4.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_29.3	RC_CEG_2031_NAT	J9446.955	25.7	1715.4	150.0	2.59	5.2	0.013	0.25	1	5	314.59	0.53	0.26
CEG_VA_30	RC_CEG_2031_NAT	j004	40.9	3126.9	130.7	2.4	6.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_31	RC_CEG_2012	RC_06	15.8	1238.5	127.4	1.67	6.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_32	RC_CEG_2031_NAT	ER_02	4.4	438.5	100.1	2.35	0.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_34	RC_CEG_2012_PND	j77	90.7	6796.2	133.4	1.55	86.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_35	RC_CEG_2012_PND	RC_17	7.8	785.0	99.4	4.47	40.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_36	RC_CEG_2031_NAT	J12167.66	30.7	2220.7	138.4	2	5.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_37	RC_CEG_2012	J561.824	42.3	4689.5	90.2	3.4	19.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_38	RC_CEG_2012	j73	16.4	1367.9	119.8	2.95	5.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_39	RC_CEG_2012	J2045.12	19.6	1957.3	100.0	3.54	48.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_40	RC_CEG_2031_NAT	J10251.75	8.1	683.4	118.0	2.59	34.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_41	RC_CEG_2012	J4596.306	21.3	2038.4	104.3	2.74	23.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_42	RC_CEG_2012	CA_PlunkettCre	26.6	2725.8	97.6	3.17	41.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_43	RC_CEG_2012	RC_04	6.9	620.4	111.8	1.98	4.9	0.013	0.25	1	5	306.69	0.93	0.254
CEG_VA_44	RC_CEG_2031_NAT	J5326.488	38.7	3092.7	125.2	2.35	3.5	0.013	0.25	1	5	319.36	0.28	0.264
CEG_VA_46	RC_CEG_2031_NAT	j003	21.5	1659.1	129.7	2.34	57.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_47	RC_CEG_2031_NAT	RC_14-15	6.2	649.8	94.7	2.75	11.3	0.013	0.25	1	5	272.33	2.67	0.224
CEG_VA_48	RC_CEG_2012	j5677.197	7.7	775.8	98.8	2.46	5.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_49	RC_CEG_2031_NAT	RC_09	15.1	1464.0	103.2	2.86	2.17	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_50_2	RC_CEG_2031_NAT	J101	2.3	230.0	100.1	2.38	2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_50_3	RC_CEG_2031_NAT	J101	7.2	733.2	97.7	3.05	3.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_51	RC_CEG_2031_NAT	RC_21	7.4	3906.1	18.8	2.49	5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_52	RC_CEG_2012	j14196.1	42.6	3913.3	108.8	2.49	4.8	0.013	0.25	1	5	303.06	1.11	0.25
CEG_VA_53.1	RC_CEG_2031_NAT	RC_11	4.1	421.4	98.3	2.12	5.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_53.2	RC_CEG_2031_NAT	RC_12	4.0	360.0	110.4	2.12	6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_54	RC_CEG_2031_NAT	J10251.75	2.1	147.0	145.8	2.85	7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_55	RC_CEG_2012	RC_01	15.0	656.4	229.0	1.75	4.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_56	RC_CEG_2031_NAT	RC_07	6.5	457.5	142.2	2.75	2.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_57	RC_CEG_2031_NAT	J807.0064	4.6	9580.9	4.8	1.83	0.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_58	RC_CEG_2012	j73	131.9	6679.9	197.5	1.98	7.4	0.013	0.25	1	5	126.52	10.08	0.099
CEG_VA_59	RC_CEG_2012	RC_04	81.9	1242.8	659.0	2.95	5	0.013	0.25	1	5	114.42	10.69	0.089
CEG_VA_61	RC_CEG_2031_NAT	J13056.87	14.5	571.9	252.7	2.39	3.5	0.013	0.25	1	5	241.42	4.24	0.198
CEG_VA_62	RC_CEG_2012_PND	J1678.551	5.7	395.8	144.5	2.39	80.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_63_1	RC_CEG_2031_NAT	RC_13	8.8	6981.1	12.7	1.99	2.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_63_2_2	RC_CEG_2012	RC_13	19.2	1270.0	150.8	1.99	59.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_64	RC_CEG_2031_NAT	r22.08	18.8	1503.6	125.0	2.02	6.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_65	RC_CEG_2012	RC_27	10.7	1094.7	97.8	3.16	26.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_66	RC_CEG_2031_NAT	J001	26.9	1893.0	142.1	2.83	38.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_67	RC_CEG_2012	J4596.306	21.9	2190.0	100.0	2.55	44.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_68	RC_CEG_2012	RC_27	4.0	401.9	100.0	3.16	24.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_69	RC_CEG_2012	J1328.091	3.6	332.3	108.0	3.2	19.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_70	RC_CEG_2012_PND	RC_21	95.2	6586.4	144.5	2.43	83.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_70.1	RC_CEG_2031_NAT	RC_21	3.6	361.7	98.2	2.16	2.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_71	RC_CEG_2012	J4596.306	27.3	2627.4	103.9	2.74	47.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_72	RC_CEG_2031_NAT	ER_05	9.8	966.4	101.4	2.34	1.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_73	RC_CEG_2031_NAT	J10251.75	4.5	409.6	109.5	2.59	23.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_74	RC_CEG_2031_NAT	ER_06	9.8	480.8	203.6	2.34	3.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_75	RC_CEG_2031_NAT	ER_08	9.2	818.7	112.4	1.99	28.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_76	RC_CEG_2012	RC_28	27.8	2549.6	108.9	2.39	32	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_77	RC_CEG_2012	j132	42.9	4887.4	87.8	2.68	32.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_78	RC_CEG_2012	j76	19.2	2107.8	91.3	3.2	14.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_79	RC_CEG_2012	J1328.091	21.8	2204.2	99.0	3.35	25.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_80	RC_CEG_2012_PND	j132	46.1	4614.3	100.0	2.42	10.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_81	RC_CEG_2012	j22	3.4	375.6	90.2	3.44	13.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_82	RC_CEG_2012	j99	49.4	4805.6	102.7	2.93	72.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_83	RC_CEG_2012	RC_28	28.3	2843.9	99.5	2.38	5.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_84.1	RC_CEG_2012	RC_30	10.1	1014.4	100.0	3.44	3.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_84.2	RC_CEG_2012	RC_29	10.6	1190.5	89.1	3.44	16.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_85	RC_CEG_2012	j1654.414	27.8	2775.2	100.0	3.44	3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_86	RC_CEG_2012	J2740.745	18.7	1911.2	98.0	2.57	58.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_87	RC_CEG_2012	RC_26	10.6	1076.7	98.4	3.16	51.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_88	RC_CEG_2012	j1678.551	82.1	7119.6	115.3	2.09	49.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_89	RC_CEG_2012	r23.01	15.8	1549.7	101.8	2.45	45.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_90	RC_CEG_2012	r23.01	14.4	1337.3	107.5	3.2	37.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_91	RC_CEG_2012	J4596.306	96.0	9909.0	96.9	2.41	61.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_92	RC_CEG_2012_PND	J6316.758	92.2	6998.7	131.8	2.2	77.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_93	RC_CEG_2012_PND	J4596.306	23.6	2672.5	88.4	1.54	56.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_94	RC_CEG_2012_PND	J5677.197	18.8	1385.1	135.7	1.93	80.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_95	RC_CEG_2012_PND	J3054.366	46.7	4738.8	98.5	2.68	52.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_96	RC_CEG_2012_PND	J1328.091	37.6	3763.0	100.0	2.74	56.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_97	RC_CEG_2012_PND	J4596.306	29.8	2981.8	100.0	2.59	50.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_98	RC_CEG_2012_PND	R23.01	11.8	1182.7	100.0	2.74	58.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_99	RC_CEG_2012	RC_17	16.0	1683.4	95.1	4.47	14.8	0.013	0.25	1	5	320.04	0.25	0.265

RAINBOW CREEK SUB-WATERSHED STUDY
MODEL PARAMETERS FOR PCSWMM MODEL (2051 Scenario)

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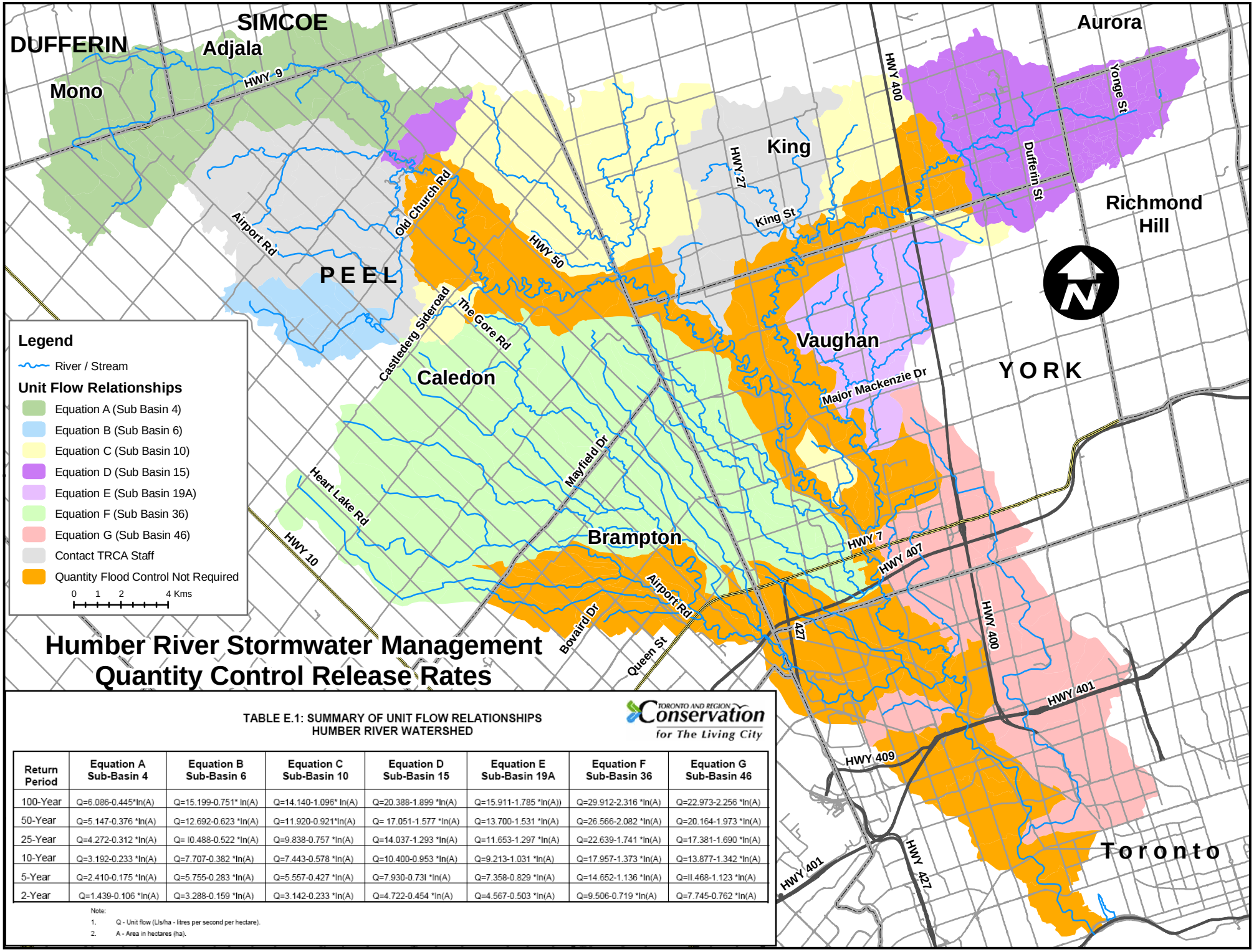
Name	Tag	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit (fraction)
CEG_BR_01	RC_CEG_2012_BRAM	RC_20	35.8	3562.1	100.4	2.43	53.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_02	RC_CEG_2012_BRAM	RC_20	16.0	1330.0	120.1	1.81	29.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_02.1	RC_CEG_2012_BRAM	RC_20	22.3	2340.5	95.1	2.23	3.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_03	RC_CEG_2012_BRAM	RC_19	37.0	4710.1	78.5	1.81	58.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_04	RC_CEG_2012_BRAM	RC_19	59.7	4180.8	142.7	1.81	87.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_04.1	RC_CEG_2012_BRAM	RC_19	26.8	2676.6	100.0	1.81	0	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_04.2	RC_CEG_2012_BRAM	J12446.08	14.3	1429.4	100.0	1.81	4.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_05	RC_CEG_2012_BRAM	RC_18	39.6	2674.4	148.2	1.64	82.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_06	RC_CEG_2012_BRAM	RC_18	29.2	1983.5	147.0	1.64	87.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_06.1	RC_CEG_2012_BRAM	J14965.99	30.6	3061.3	100.0	1.64	0.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_06.2	RC_CEG_2012_BRAM	RC_18	14.4	1443.7	100.0	1.64	0	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_07	RC_CEG_2012_BRAM	J14965.99	35.5	2379.1	149.3	1.64	89.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_08	RC_CEG_2012_BRAM	ER_08	81.8	5643.6	144.9	1.71	88.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_10	RC_CEG_2012_BRAM	J17104.81	43.0	2924.0	147.0	1.76	88.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_10.1	RC_CEG_2012_BRAM	J17104.81	16.2	1631.7	99.3	1.8	1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_11	RC_CEG_2012_BRAM	RC_05	71.4	4922.8	145.0	1.68	82.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_11.1	RC_CEG_2012_BRAM	J16021.18	13.7	1381.6	99.5	1.73	0.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_12	RC_CEG_2012_BRAM	J2010.681	36.5	2525.5	144.4	1.67	83.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_BR_13	RC_CEG_2012_BRAM	J17104.81	11.1	764.7	145.0	1.67	79.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_01	RC_CEG_2012_CAL	J1329.443	21.2	1570.2	135.1	2.4	81.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_02	RC_CEG_2012_CAL	J1085.477	23.3	1643.8	141.9	2.14	81	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_03	RC_CEG_2012_CAL	J1085.477	25.0	3259.0	76.8	1.35	86.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_04	RC_CEG_2012_CAL	J1329.443	11.6	1501.5	77.0	2.16	84.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_05	RC_CEG_2012_CAL	J160.4485	24.6	1954.2	125.8	1.65	85.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_06	RC_CEG_2012_CAL	J1329.443	66.1	7472.5	88.4	2.62	72.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_07	RC_CEG_2012_CAL	J18562.38	51.4	3778.9	136.1	1.31	86.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_08	RC_CEG_2012_CAL	J17104.81	43.2	3225.7	133.9	1.8	76.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_11	RC_CEG_2012_CAL	RC_01	134.9	10011.2	134.8	1.71	85.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_16	RC_CEG_2012_CAL	J158.9141	76.8	10589.8	72.5	2.31	51.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_CA_17	RC_CEG_2012_CAL	J160.4485	24.0	3030.8	79.2	1.65	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5901	RC_CEG_2031_DEV	J001	2.0	162.3	123.6	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5903	RC_CEG_2031_DEV	ER_05	36.2	2094.7	173.0	2	85.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5904	RC_CEG_2031_DEV	ER_05	33.1	2346.3	140.9	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5905	RC_CEG_2031_DEV	J4596.306	35.3	2820.4	125.3	2	87	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5906	RC_CEG_2031_DEV	J102	36.4	1819.6	199.9	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5908	RC_CEG_2031_DEV	RC_16	45.4	1254.0	362.2	2	89.1	0.013	0.25	1	5	257.62	3.05	0.222
CEG_DEV_5911	RC_CEG_2031_DEV	J5326.488	7.7	669.4	114.9	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5912	RC_CEG_2031_DEV	ER_06	48.5	2138.4	226.9	2	89.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5913	RC_CEG_2031_DEV	J5326.488	9.7	706.6	137.8	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_5915	RC_CEG_2031_DEV	RC_23	13.3	952.9	139.9	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6001	RC_CEG_2031_DEV	RC_21	1.1	78.1	143.2	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6002	RC_CEG_2031_DEV	j003	11.1	883.9	125.7	2	87	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6003	RC_CEG_2031_DEV	J004	50.4	3400.8	148.2	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6004	RC_CEG_2031_DEV	J101	13.7	945.2	144.5	2	90	0.013	0.25	1	5	196.78	6.51	0.159
CEG_DEV_6005	RC_CEG_2031_DEV	J101	5.7	386.6	148.0	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6006	RC_CEG_2031_DEV	ER_02	20.5	1380.8	148.5	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6007	RC_CEG_2031_DEV	ER_02	4.0	354.9	112.7	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6008	RC_CEG_2031_DEV	RC_11	4.7	318.7	148.6	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6009	RC_CEG_2031_DEV	J104	7.0	648.2	107.6	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6201_1	RC_CEG_2031_DEV	J608	3.1	206.4	148.4	2	70	0.013	0.25	1	5	109.98	10.92	0.085
CEG_DEV_6201_2	RC_CEG_2031_DEV	j005	13.3	1459.0	90.9	2	70	0.013	0.25	1	5	109.98	10.92	0.085
CEG_DEV_6202	RC_CEG_2031_DEV	J73	15.8	1581.8	100.0	2	61	0.013	0.25	1	5	109.98	10.92	0.085
CEG_DEV_6501	RC_CEG_2031_DEV	J003	0.4	29.6	149.2	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6502	RC_CEG_2031_DEV	J003	4.5	304.2	147.8	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6503	RC_CEG_2031_DEV	J003	3.6	265.3	134.2	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6504	RC_CEG_2031_DEV	J003	1.4	134.7	102.9	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6505	RC_CEG_2031_DEV	J8411.76	16.8	1388.4	121.2	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6506	RC_CEG_2031_DEV	J10251.75	11.1	768.0	144.6	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6601	RC_CEG_2031_DEV	R22.08	5.7	387.2	148.2	2	90	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6602	RC_CEG_2031_DEV	ER_08	17.3	1187.8	145.8	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6603	RC_CEG_2031_DEV	ER_08	38.1	2586.3	147.2	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6604	RC_CEG_2031_DEV	ER_08	5.7	401.5	141.1	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6605	RC_CEG_2031_DEV	ER_08	4.9	347.9	140.9	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6606	RC_CEG_2031_DEV	ER_10	20.6	1389.9	148.5	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6607	RC_CEG_2031_DEV	J12167.66	22.9	1538.1	148.6	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6608	RC_CEG_2031_DEV	J12167.66	9.6	790.0	121.2	2	40	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6609	RC_CEG_2031_DEV	J13056.87	17.8	1257.8	141.4	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_DEV_6610	RC_CEG_2031_DEV	RC_07	6.1	432.0	141.8	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6651	RC_CEG_2051_DEV	J606	17.6	1173.5	150.0	2	86	0.013	0.25	1	5	109.98	10.92	0.085
CEG_FUT_6652	RC_CEG_2051_DEV	J606	26.3	1756.3	150.0	2	90	0.013	0.25	1	5	174.24	7.66	0.14
CEG_FUT_6653	RC_CEG_2051_DEV	J98	7.2	481.4	150.0	2	50	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6654	RC_CEG_2051_DEV	J98	14.5	969.7	149.8	2	50	0.013	0.25	1	5	163.84	8.18	0.131
CEG_FUT_6655	RC_CEG_2051_DEV	J606	8.4	557.7	150.0	2	86	0.013	0.25	1	5	109.98	10.92	0.085
CEG_FUT_6657	RC_CEG_2051_DEV	ER_11	13.8	927.3	149.2	2	90	0.013	0.25	1	5	125.45	10.13	0.098
CEG_FUT_6701	RC_CEG_2051_DEV	ER_11	25.6	1711.1	149.6	2	87	0.013	0.25	1	5	109.98	10.92	0.085
CEG_FUT_6702	RC_CEG_2051_DEV	J73	14.2	953.6	149.2	2	87	0.013	0.25	1	5	109.98	10.92	0.085
CEG_FUT_6703	RC_CEG_2051_DEV	J73	112.1	7494.8	149.6	2	89	0.013	0.25	1	5	111.39	10.85	0.086
CEG_FUT_6704	RC_CEG_2051_DEV	J73	17.3	1361.2	127.3	2	85	0.013	0.25	1	5	109.98	10.92	0.085
CEG_FUT_6705	RC_CEG_2051_DEV	J73	25.5	1747.2	145.9	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6706	RC_CEG_2051_DEV	J12167.66	25.9	1750.7	148.1	2	89	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6707	RC_CEG_2051_DEV	RC_06	5.8	423.0	136.9	2	88	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6708	RC_CEG_2051_DEV	J2010.681	12.7	877.7	144.2	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6709	RC_CEG_2051_DEV	RC_01	28.9	1961.9	147.1	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6710	RC_CEG_2051_DEV	j14196.1	7.6	518.1	147.5	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6711	RC_CEG_2051_DEV	RC_03	10.1	692.1	145.5	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6801	RC_CEG_2051_DEV	J2781.741	16.4	1152.5	142.6	2	86	0.013	0.25	1	5	119.61	10.43	0.093
CEG_FUT_6802	RC_CEG_2051_DEV	J2781.741	6.4	478.3	133.3	2	86	0.013	0.25	1	5	223.46	5.16	0.182
CEG_FUT_6803	RC_CEG_2051_DEV	J2781.741	6.6	475.1	138.6	2	90	0.013	0.25	1	5	128.96	9.96	0.101
CEG_FUT_6804	RC_CEG_2051_DEV	J2781.741	5.4	420.1	128.4	2	90	0.013	0.25	1	5	210.74	5.8	0.171
CEG_FUT_6805	RC_CEG_2051_DEV	J2781.741	21.6	1556.8	139.0	2	90	0.013	0.25	1	5	139.42	9.42	0.11
CEG_FUT_6901	RC_CEG_2051_DEV	J2781.741	3.6	258.0	140.0	2	90	0.013	0.25	1	5	296.63	1.44	0.245
CEG_FUT_6902	RC_CEG_2051_DEV	RC_02	16.8	1213.1	138.1	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6903	RC_CEG_2051_DEV	RC_02	10.4	712.3	145.6	2	90	0.013	0.25	1	5	190.3	6.84	0.154
CEG_FUT_6904	RC_CEG_2051_DEV	J1085.477	7.1	503.2	141.7	2	85	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6905	RC_CEG_2051_DEV	J1085.477	11.7	832.7	140.8	2	90	0.013	0.25	1	5	295.44	1.5	0.244
CEG_FUT_6906	RC_CEG_2051_DEV	J158.9141	20.4	1573.8	129.5	2	87	0.013	0.25	1	5	320.04	0.25	0.265
CEG_FUT_6907	RC_CEG_2051_DEV	J2781.741	32.4	2159.3	149.9	2	90	0.013	0.25	1	5	310.22	0.75	0.257
CEG_VA_01	RC_CEG_2012	j6316.758	9.2	860.7	106.7	2.69	12.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_02	RC_CEG_2012	j5677.197	15.0	1433.5	104.8	2.69	23.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_03	RC_CEG_2031_NAT	j8411.76	23.9	1973.7	120.9	2.5	12.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_04	RC_CEG_2012_PND	j115	100.6	7345.9	137.0	2.21	68.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_05	RC_CEG_2031_NAT	RC_15	7.9	788.9	99.8	3.05	1.5	0.013	0.25	1	5	187.37	6.99	0.151
CEG_VA_06	RC_CEG_2031_NAT	j104	14.9	1271.2	117.3	2.34	4.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_07	RC_CEG_2031_NAT	RC_16	6.5	644.3	100.4	2.35	0.7	0.013	0.25	1	5	251.42	3.74	0.206
CEG_VA_07.1	RC_CEG_2031_NAT	RC_16	10.2	1057.4	96.2	2.35	15	0.013	0.25	1	5	319.27	0.29	0.264
CEG_VA_09	RC_CEG_2031_NAT	RC_14	7.6	683.2	111.7	2.4	2.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_100	RC_CEG_2012	J2740.745	27.6	2694.5	102.3	2.9	14.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_101	RC_CEG_2012	J3054.366	24.5	2675.5	91.4	3.32	32.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_102	RC_CEG_2012_PND	J3054.366	14.1	1404.9	100.3	2.77	29.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_103	RC_CEG_2012	RC_25	17.7	1700.0	104.1	2.82	1	0.013	0.25	1	5	320.04	0.25	0.265

RAINBOW CREEK SUB-WATERSHED STUDY
MODEL PARAMETERS FOR PCSWMM MODEL (2051 Scenario)

COLE ENGINEERING
Experience Enhancing Excellence

Name	Tag	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit (fraction)
CEG_VA_104	RC_CEG_2012_PND	RC_25	126.8	8882.0	142.8	2.82	68.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_105	RC_CEG_2012	RC_24	76.6	5922.3	129.4	2.5	11.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_106	RC_CEG_2012_PND	j77	52.4	4859.9	107.8	2.15	82.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_107	RC_CEG_2031_NAT	RC_23	7.9	788.1	99.8	2.16	1.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_108	RC_CEG_2012_PND	RC_23	73.3	5186.6	141.4	2.23	77.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_109	RC_CEG_2012	J00	13.2	1300.0	101.7	2.23	6.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_11	RC_CEG_2031_NAT	RC_24	41.1	3002.5	136.9	2.16	4.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_111	RC_CEG_2012_PND	ER_06	65.8	4568.4	144.0	2.73	53.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_112	RC_CEG_2012_PND	RC_22	33.7	2397.2	140.6	2.23	77.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_113	RC_CEG_2012_PND	J5677.197	32.1	3636.6	88.3	1.54	52.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_12	RC_CEG_2012	RC_31	15.9	1853.3	85.9	4.45	17.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_13	RC_CEG_2051_NAT	J005	2.7	1185.6	22.9	1.79	5.6	0.013	0.25	1	5	124.85	10.16	0.098
CEG_VA_13.1	RC_CEG_2012	J005	1.9	190.3	100.0	1.79	5	0.013	0.25	1	5	109.98	10.92	0.085
CEG_VA_15	RC_CEG_2012	J2781.741	1.3	126.6	103.7	2.37	3.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_16	RC_CEG_2051_NAT	J2010.681	3.8	379.7	100.6	1.99	34.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_17	RC_CEG_2031_NAT	J102	16.9	1740.3	97.3	1.49	13.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_18	RC_CEG_2031_NAT	j103	4.3	437.1	99.2	2.16	1.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_19.1	RC_CEG_2012_PND	j005	144.4	15820.3	91.3	1.8	63.4	0.013	0.25	1	5	173.2	7.71	0.139
CEG_VA_19.2	RC_CEG_2012_PND	j608	51.4	5187.1	99.1	1.9	30.6	0.013	0.25	1	5	226.21	5.02	0.185
CEG_VA_20	RC_CEG_2031_NAT	j98	20.6	3541.8	58.0	2.25	4.1	0.013	0.25	1	5	265.67	3.01	0.218
CEG_VA_21	RC_CEG_2031_NAT	RC_08	5.8	581.0	100.0	2.75	0.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_22	RC_CEG_2051_NAT	RC_03	17.0	1615.6	105.5	3.2	12.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_24	RC_CEG_2051_NAT	J2781.741	31.8	2773.5	114.8	2.21	5.4	0.013	0.25	1	5	227.13	4.97	0.185
CEG_VA_25	RC_CEG_2051_NAT	J1085.477	3.0	275.5	110.3	2.37	9.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_26	RC_CEG_2051_NAT	RC_02	13.0	1248.9	104.0	2.21	5	0.013	0.25	1	5	208.5	5.92	0.169
CEG_VA_27	RC_CEG_2051_NAT	J2781.741	50.5	4972.9	101.5	2.49	6.8	0.013	0.25	1	5	172.69	7.73	0.139
CEG_VA_29.1	RC_CEG_2031_NAT	j9446.955	7.6	615.2	123.8	2.59	4.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_29.2	RC_CEG_2031_NAT	RC_10	11.5	1161.9	99.2	2.59	4.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_29.3	RC_CEG_2031_NAT	J9446.955	23.7	1715.4	138.1	2.59	5.2	0.013	0.25	1	5	314.59	0.53	0.26
CEG_VA_30	RC_CEG_2031_NAT	j004	40.9	3126.9	130.7	2.4	6.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_31	RC_CEG_2051_NAT	RC_06	6.2	612.9	101.1	1.67	6.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_32	RC_CEG_2031_NAT	ER_02	4.4	438.5	100.1	2.35	0.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_34	RC_CEG_2012_PND	j77	90.7	6796.2	133.4	1.55	86.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_35	RC_CEG_2012_PND	RC_17	7.8	785.0	99.4	4.47	40.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_36	RC_CEG_2031_NAT	J12167.66	5.4	2220.7	24.2	2	5.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_37	RC_CEG_2012	J561.824	42.3	4689.5	90.2	3.4	19.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_39	RC_CEG_2012	J2045.12	19.6	1957.3	100.0	3.54	48.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_40	RC_CEG_2031_NAT	J10251.75	8.1	683.4	118.0	2.59	34.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_41	RC_CEG_2012	J4596.306	21.3	2038.4	104.3	2.74	23.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_42	RC_CEG_2012	CA_PlunkettCre	26.6	2725.8	97.6	3.17	41.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_44	RC_CEG_2031_NAT	J5326.488	38.7	3092.7	125.2	2.35	3.5	0.013	0.25	1	5	319.36	0.28	0.264
CEG_VA_46	RC_CEG_2031_NAT	j003	21.5	1659.1	129.7	2.34	57.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_47	RC_CEG_2031_NAT	RC_14-15	6.2	649.8	94.7	2.75	11.3	0.013	0.25	1	5	272.33	2.67	0.224
CEG_VA_48	RC_CEG_2012	j5677.197	7.7	775.8	98.8	2.46	5.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_49	RC_CEG_2031_NAT	RC_09	14.8	1464.0	100.8	2.86	2.17	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_50	RC_CEG_2031_NAT	J101	9.5	549.3	172.3	2.38	2.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_51	RC_CEG_2031_NAT	RC_21	7.4	3906.1	18.8	2.49	5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_53.1	RC_CEG_2031_NAT	RC_11	4.1	421.4	98.3	2.12	5.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_53.2	RC_CEG_2031_NAT	RC_12	4.0	360.0	110.4	2.12	6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_54	RC_CEG_2031_NAT	J10251.75	2.1	147.0	145.8	2.85	7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_55	RC_CEG_2051_NAT	RC_01	3.1	273.7	114.1	1.75	29.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_56	RC_CEG_2031_NAT	RC_07	6.5	457.5	142.2	2.75	2.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_57	RC_CEG_2031_NAT	J807.0064	4.6	9580.9	4.8	1.83	0.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_58	RC_CEG_2051_NAT	J73	6.4	481.1	132.9	1.98	6.2	0.013	0.25	1	5	109.98	10.92	0.085
CEG_VA_61	RC_CEG_2031_NAT	J13056.87	11.7	571.9	204.0	2.39	3.5	0.013	0.25	1	5	241.42	4.24	0.198
CEG_VA_62	RC_CEG_2012_PND	J1678.551	5.7	395.8	144.5	2.39	80.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_63_1	RC_CEG_2031_NAT	RC_13	8.9	6981.1	12.7	1.99	2.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_63_2_2	RC_CEG_2012	RC_13	19.2	1270.0	150.8	1.99	59.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_64	RC_CEG_2031_NAT	r22.08	17.0	1503.6	112.8	2.02	6.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_65	RC_CEG_2012	RC_27	10.7	1094.7	97.8	3.16	26.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_66	RC_CEG_2031_NAT	J001	26.9	1893.0	142.1	2.83	38.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_67	RC_CEG_2012	J4596.306	21.9	2190.0	100.0	2.55	44.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_68	RC_CEG_2012	RC_27	4.0	401.9	100.0	3.16	24.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_69	RC_CEG_2012	J1328.091	3.6	332.3	108.0	3.2	19.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_70	RC_CEG_2012_PND	RC_21	95.2	6586.4	144.5	2.43	83.3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_70.1	RC_CEG_2031_NAT	RC_21	3.6	361.7	98.2	2.16	2.9	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_71	RC_CEG_2012	J4596.306	27.3	2627.4	103.9	2.74	47.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_72	RC_CEG_2031_NAT	ER_05	9.8	966.4	101.4	2.34	1.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_73	RC_CEG_2031_NAT	J10251.75	4.5	409.6	109.5	2.59	23.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_74	RC_CEG_2031_NAT	ER_06	9.8	480.8	203.6	2.34	3.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_75	RC_CEG_2031_NAT	ER_08	9.2	818.7	112.4	1.99	28.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_76	RC_CEG_2012	RC_28	27.8	2549.6	108.9	2.39	32	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_77	RC_CEG_2012	j132	42.9	4887.4	87.8	2.68	32.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_78	RC_CEG_2012	j76	19.2	2107.8	91.3	3.2	14.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_79	RC_CEG_2012	J1328.091	21.8	2204.2	99.0	3.35	25.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_80	RC_CEG_2012_PND	j132	46.1	4614.3	100.0	2.42	10.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_81	RC_CEG_2012	j22	3.4	375.6	90.2	3.44	13.6	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_82	RC_CEG_2012	j99	49.4	4800.9	102.8	2.93	72.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_83	RC_CEG_2012	RC_28	28.3	2843.9	99.5	2.38	5.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_84.1	RC_CEG_2012	RC_30	10.1	1014.4	100.0	3.44	3.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_84.2	RC_CEG_2012	RC_29	10.6	1190.5	89.1	3.44	16.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_85	RC_CEG_2012	j1654.414	27.8	2775.2	100.0	3.44	3	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_86	RC_CEG_2012	J2740.745	18.7	1911.2	98.0	2.57	58.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_87	RC_CEG_2012	RC_26	10.6	1076.7	98.4	3.16	51.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_88	RC_CEG_2012	j1678.551	82.1	7119.6	115.3	2.09	49.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_89	RC_CEG_2012	r23.01	15.8	1549.7	101.8	2.45	45.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_90	RC_CEG_2012	r23.01	14.4	1337.3	107.5	3.2	37.1	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_91	RC_CEG_2012	J4596.306	96.0	9909.0	96.9	2.41	61.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_92	RC_CEG_2012_PND	J6316.758	92.2	6998.7	131.8	2.2	77.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_93	RC_CEG_2012_PND	J4596.306	23.6	2672.5	88.4	1.54	56.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_94	RC_CEG_2012_PND	J5677.197	18.8	1385.1	135.7	1.93	80.7	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_95	RC_CEG_2012_PND	J3054.366	46.7	4738.8	98.5	2.68	52.8	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_96	RC_CEG_2012_PND	J1328.091	37.6	3763.0	100.0	2.74	56.4	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_97	RC_CEG_2012_PND	J4596.306	29.8	2981.8	100.0	2.59	50.5	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_98	RC_CEG_2012_PND	R23.01	11.8	1182.7	100.0	2.74	58.2	0.013	0.25	1	5	320.04	0.25	0.265
CEG_VA_99	RC_CEG_2012	RC_17	16.0	1683.4	95.1	4.47	14.8	0.013	0.25	1	5	320.04	0.25	0.265
RC_CEG_58	RC_CEG_2051_NAT	J73	30.8	2632.1	117.0	1.98	7.5	0.013	0.25	1	5	227.33	4.96	0.186
S1	RC_CEG_2051_NAT	ER_11	4.2	366.5	113.8	1.8	5	0.013	0.25	1	5	109.98	10.92	0.085
S22	RC_CEG_2051_NAT	ER_11	4.0	399.6	99.4	1.8	19.2	0.013	0.25	1	5	109.98	10.92	0.085
S27	RC_CEG_2051_NAT	RC_04	76.3	7100.2	107.4	2.49	5	0.013	0.25	1	5	190.63	6.82	0.154
S30	RC_CEG_2051_NAT	J606	14.4	1321.3	108.8	1.79	5	0.013	0.25	1	5	109.98	10.92	0.085
S34	RC_CEG_2051_NAT	j14196.1	7.1	697.1	101.7	1.79	7.8	0.013	0.25	1	5	320.04	0.25	0.265
S39	RC_CEG_2051_NAT	J98	3.2	320.2	100.2	2.25	4.5	0.013	0.25	1	5	318.23	0.34	0.263
S7	RC_CEG_2051_NAT	ER_11	3.9	267.3	146.5	1.8	3.5	0.013	0.25	1	5	147.29	9.02	0.117



Humber River Stormwater Management Quantity Control Release Rates

TABLE E.1: SUMMARY OF UNIT FLOW RELATIONSHIPS
HUMBER RIVER WATERSHED

Return Period	Equation A Sub-Basin 4	Equation B Sub-Basin 6	Equation C Sub-Basin 10	Equation D Sub-Basin 15	Equation E Sub-Basin 19A	Equation F Sub-Basin 36	Equation G Sub-Basin 46
100-Year	Q=6.086-0.445*ln(A)	Q=15.199-0.751* ln(A)	Q=14.140-1.096* ln(A)	Q=20.388-1.899 *ln(A)	Q=15.911-1.785 *ln(A))	Q=29.912-2.316 *ln(A)	Q=22.973-2.256 *ln(A)
50-Year	Q=5.147-0.376 *ln(A)	Q=12.692-0.623 *ln(A)	Q=11.920-0.921*ln(A)	Q= 17.051-1.577 *ln(A)	Q=13.700-1.531 *ln(A)	Q=26.566-2.082 *ln(A)	Q=20.164-1.973 *ln(A)
25-Year	Q=4.272-0.312 *ln(A)	Q= l0.488-0.522 *ln(A)	Q=9.838-0.757 *ln(A)	Q=14.037-1.293 *ln(A)	Q=11.653-1.297 *ln(A)	Q=22.639-1.741 *ln(A)	Q=17.381-1.690 *ln(A)
10-Year	Q=3.192-0.233 *ln(A)	Q=7.707-0.382 *ln(A)	Q=7.443-0.578 *ln(A)	Q=10.400-0.953 *ln(A)	Q=9.213-1.031 *ln(A)	Q=17.957-1.373 *ln(A)	Q=13.877-1.342 *ln(A)
5-Year	Q=2.410-0.175 *ln(A)	Q=5.755-0.283 *ln(A)	Q=5.557-0.427 *ln(A)	Q=7.930-0.73l *ln(A)	Q=7.358-0.829 *ln(A)	Q=14.652-1.136 *ln(A)	Q=ll.468-1.123 *ln(A)
2-Year	Q=1.439-0.106 *ln(A)	Q=3.288-0.159 *ln(A)	Q=3.142-0.233 *ln(A)	Q=4.722-0.454 *ln(A)	Q=4.567-0.503 *ln(A)	Q=9.506-0.719 *ln(A)	Q=7.745-0.762 *ln(A)

Note:
1. Q - Unit flow (Lls/ha - litres per second per hectare).
2. A - Area in hectares (ha).

TORONTO AND REGION Conservation for The Living City

RAINBOW CREEK SUB-WATERSHED STUDY
UNIT FLOW RATES FOR 2031 DEVELOPMENT

COLE ENGINEERING
Experience Enhancing Excellence

Q_{2yr} (L/s/ha) = 9.506 - 0.719*LN (Area)
Q_{5yr} (L/s/ha) = 14.652 - 1.136*LN (Area)
Q_{10yr} (L/s/ha) = 17.957 - 1.373*LN (Area)
Q_{25yr} (L/s/ha) = 22.639 - 1.741*LN (Area)
Q_{50yr} (L/s/ha) = 26.566 - 2.082*LN (Area)
Q_{100yr} (L/s/ha) = 29.912 - 2.316*LN (Area)

Brampton Ponds

Name	Area (ha)	Allowable Release Rate (L/s/ha)							Allowable Release Rate (m3/s)					
		2y	5y	10y	25y	50y	100y		2y	5y	10y	25y	50y	100y
Br01	35.5	6.94	10.60	13.06	16.42	19.13	21.64							
Br02	15.9	7.52	11.51	14.16	17.82	20.81	23.51							
BR01+BR02	**51.4**								**0.366**	**0.559**	**0.689**	**0.866**	**1.010**	**1.142**
Br03	37.0	6.91	10.55	13.00	16.35	19.05	21.55							
Br04	58.1	6.59	10.04	12.38	15.57	18.11	20.50							
BR03+BR04	**95.1**								**0.638**	**0.974**	**1.200**	**1.509**	**1.757**	**1.989**
Br05	**39.6**	6.86	10.47	12.91	16.23	18.91	21.39		**0.272**	**0.415**	**0.511**	**0.643**	**0.749**	**0.847**
Br06	29.3	7.08	10.82	13.32	16.76	19.53	22.09							
Br07	36.2	6.93	10.57	13.03	16.39	19.09	21.60							
BR06+BR07	**65.5**								**0.458**	**0.700**	**0.862**	**1.084**	**1.264**	**1.429**
BR08	**81.9**	6.34	9.65	11.91	14.97	17.39	19.71		**0.519**	**0.790**	**0.975**	**1.226**	**1.425**	**1.614**
Br10	43.0	6.80	10.38	12.79	16.09	18.74	21.20							
Br13	11.1	7.78	11.92	14.65	18.45	21.55	24.34							
BR10+BR13	**54.1**								**0.379**	**0.579**	**0.713**	**0.897**	**1.045**	**1.182**
Br09	5.1	8.33	12.80	15.72	19.80	23.17	26.14							
Br11	66.0	6.49	9.89	12.20	15.34	17.84	20.21							
BR09+BR11	**71.1**								**0.471**	**0.718**	**0.886**	**1.114**	**1.296**	**1.467**
Br12	**34.8**	6.95	10.62	13.08	16.46	19.18	21.69		**0.242**	**0.370**	**0.455**	**0.573**	**0.667**	**0.755**

Caledon Ponds

Name	Area (ha)	Allowable Release Rate (L/s/ha)							Allowable Release Rate (m3/s)					
		2y	5y	10y	25y	50y	100y		2y	5y	10y	25y	50y	100y
Ca-01	21.2	7.31	11.18	13.76	17.32	20.21	22.95							
Ca-04	11.6	7.74	11.87	14.59	18.37	21.46	22.81							
Ca01+Ca04	**32.8**	**15.05**	**23.05**	**28.36**	**35.69**	**41.67**	**45.76**		**0.245**	**0.375**	**0.461**	**0.580**	**0.677**	**0.751**
Ca-07	**51.4**	6.67	10.18	12.55	15.78	18.36	23.17		**0.343**	**0.523**	**0.645**	**0.811**	**0.944**	**1.191**
Ca-08	**90.1**	6.27	9.54	11.78	14.80	17.20	23.32		**0.565**	**0.859**	**1.061**	**1.334**	**1.549**	**2.101**

Nashville and Huntington - Pond design from Draft Functional Servicing report, Cole Engineering Consultants Ltd., Nov. 2012

Name	Area (ha)	Allowable Release Rate (L/s/ha)							Allowable Release Rate (m3/s)					
		2y	5y	10y	25y	50y	100y		2y	5y	10y	25y	50y	100y
6201	**15.8**	7.52	11.52	14.17	17.83	20.82	23.52		**0.119**	**0.182**	**0.224**	**0.282**	**0.329**	**0.372**
6202	**13.2**	7.65	11.72	14.41	18.15	21.19	23.94		**0.101**	**0.155**	**0.190**	**0.240**	**0.280**	**0.316**

RAINBOW CREEK SUB-WATERSHED STUDY
UNIT FLOW RATES FOR 2031 DEVELOPMENT

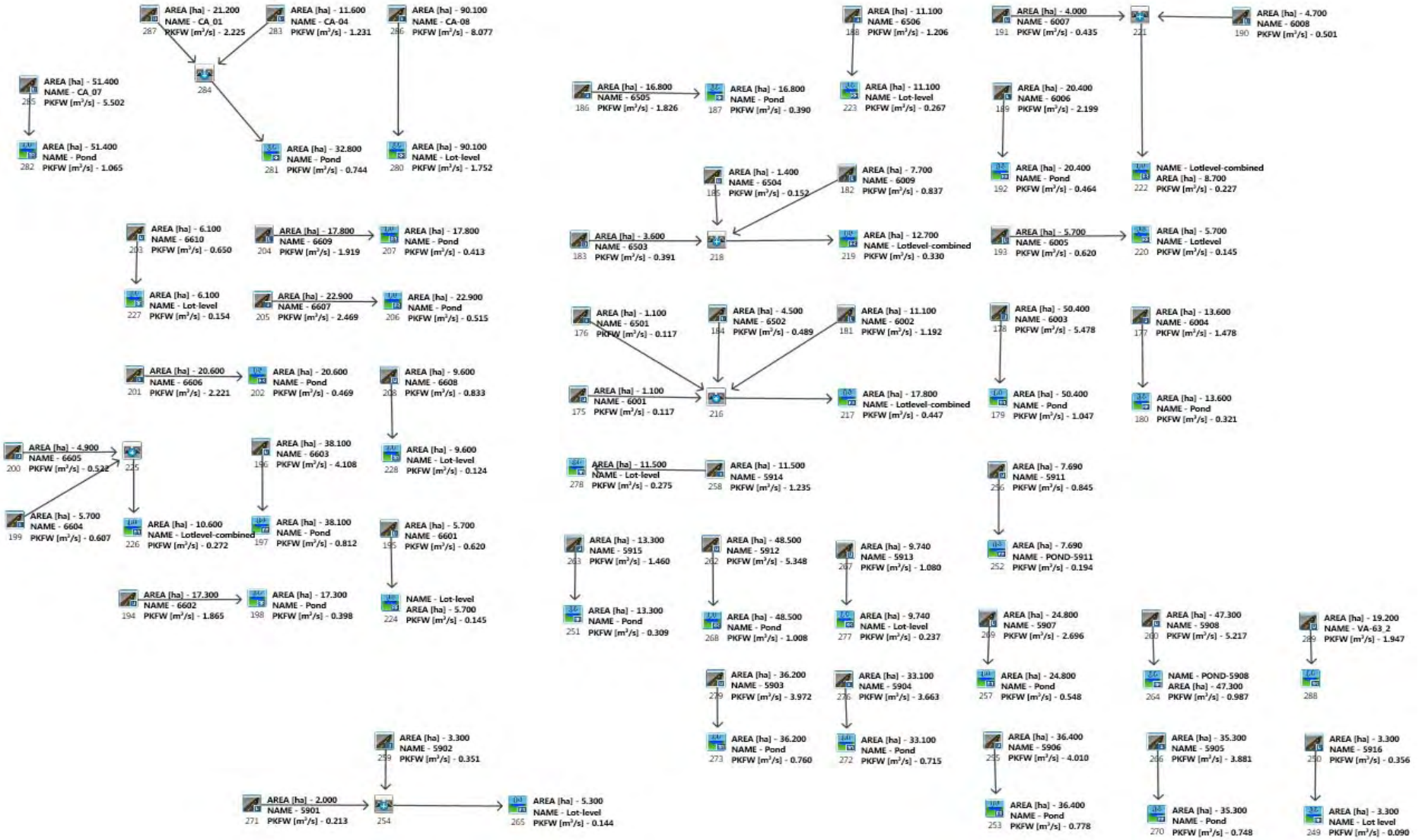
COLE ENGINEERING
Experience Enhancing Excellence

Vaughan Ponds and Storage (2031)

Name	Area (ha)	Allowable Release Rate (L/s/ha)							Allowable Release Rate (m3/s)					
		2y	5y	10y	25y	50y	100y		2y	5y	10y	25y	50y	100y
5901	2.0	9.01	13.86	17.01	21.43	25.12	28.31							
5902	3.3	8.65	13.30	16.32	20.56	24.08	27.15							
	5.3								**0.047**	**0.072**	**0.088**	**0.111**	**0.130**	**0.146**
5903	**36.2**	6.93	10.57	13.03	16.39	19.09	21.60		**0.251**	**0.383**	**0.472**	**0.593**	**0.691**	**0.782**
5904	**33.1**	6.99	10.68	13.15	16.55	19.28	21.81		**0.231**	**0.353**	**0.435**	**0.548**	**0.638**	**0.722**
5905	**35.3**	6.94	10.60	13.06	16.43	19.15	21.66		**0.245**	**0.374**	**0.461**	**0.580**	**0.676**	**0.765**
5906	**36.4**	6.92	10.57	13.02	16.38	19.08	21.59		**0.252**	**0.385**	**0.474**	**0.596**	**0.695**	**0.786**
5908	**47.3**	6.73	10.27	12.66	15.92	18.54	20.98		**0.318**	**0.486**	**0.599**	**0.753**	**0.877**	**0.992**
5911	**7.7**	8.04	12.33	15.16	19.09	22.32	25.19		**0.062**	**0.095**	**0.117**	**0.147**	**0.172**	**0.194**
5912	**48.5**	6.72	10.24	12.63	15.88	18.48	20.92		**0.326**	**0.497**	**0.612**	**0.770**	**0.897**	**1.015**
5913	**9.7**	7.87	12.07	14.83	18.68	21.83	24.64		**0.077**	**0.118**	**0.144**	**0.182**	**0.213**	**0.240**
5914	**11.5**	7.75	11.88	14.60	18.39	21.48	24.26		**0.089**	**0.137**	**0.168**	**0.211**	**0.247**	**0.279**
5915	**13.3**	7.65	11.71	14.40	18.13	21.18	23.92		**0.102**	**0.156**	**0.192**	**0.241**	**0.282**	**0.318**
5916	**3.3**	8.65	13.30	16.32	20.56	24.08	27.15		**0.029**	**0.044**	**0.054**	**0.068**	**0.079**	**0.090**
6001	1.1	9.44	14.54	17.83	22.47	26.37	29.69							
6002	11.1	7.78	11.92	14.65	18.45	21.55	24.34							
6501	1.1	9.44	14.54	17.83	22.47	26.37	29.69							
6502	4.5	8.42	12.94	15.89	20.02	23.43	26.43							
	17.8								**0.145**	**0.223**	**0.273**	**0.344**	**0.403**	**0.454**
6003	**50.4**	6.69	10.20	12.57	15.81	18.40	20.83		**0.337**	**0.514**	**0.634**	**0.797**	**0.928**	**1.050**
6004	**13.6**	7.63	11.69	14.37	18.09	21.13	23.87		**0.104**	**0.159**	**0.195**	**0.246**	**0.287**	**0.325**
6005	**5.7**	8.25	12.67	15.57	19.61	22.94	25.88		**0.047**	**0.072**	**0.089**	**0.112**	**0.131**	**0.148**
6006	**20.4**	7.34	11.23	13.82	17.39	20.29	22.93		**0.150**	**0.229**	**0.282**	**0.355**	**0.414**	**0.468**
6007	4.0	8.51	13.08	16.05	20.23	23.68	26.70							
6008	4.7	8.39	12.89	15.83	19.94	23.34	26.33							
	8.7								**0.073**	**0.113**	**0.139**	**0.175**	**0.204**	**0.231**
6009	7.7	8.04	12.33	15.15	19.09	22.32	25.18							
6503	3.6	8.59	13.20	16.20	20.41	23.90	26.95							
6504	1.4	9.26	14.27	17.50	22.05	25.87	29.13							
	5.0								**0.106**	**0.162**	**0.199**	**0.251**	**0.294**	**0.332**
6505	**16.8**	7.48	11.45	14.08	17.73	20.69	23.38		**0.126**	**0.192**	**0.237**	**0.298**	**0.348**	**0.393**
6506	**11.1**	7.78	11.92	14.65	18.45	21.55	24.34		**0.086**	**0.132**	**0.163**	**0.205**	**0.239**	**0.270**
6601	**5.7**	8.25	12.67	15.57	19.61	22.94	25.88		**0.047**	**0.072**	**0.089**	**0.112**	**0.131**	**0.148**
6602	**17.3**	7.46	11.41	14.04	17.68	20.63	23.31		**0.129**	**0.197**	**0.243**	**0.306**	**0.357**	**0.403**
6603	**38.1**	6.89	10.52	12.96	16.30	18.99	21.48		**0.262**	**0.401**	**0.494**	**0.621**	**0.723**	**0.818**
6604	5.7	8.25	12.67	15.57	19.61	22.94	25.88							
6605	4.9	8.36	12.85	15.77	19.87	23.26	26.23							
	10.6								**0.088**	**0.135**	**0.166**	**0.209**	**0.245**	**0.276**
6606	**20.6**	7.33	11.22	13.80	17.37	20.27	22.91		**0.151**	**0.231**	**0.284**	**0.358**	**0.418**	**0.472**
6607	**22.9**	7.25	11.10	13.66	17.19	20.05	22.66		**0.166**	**0.254**	**0.313**	**0.394**	**0.459**	**0.519**
6608	**4.8**	8.38	12.87	15.80	19.91	23.30	26.28		**0.040**	**0.062**	**0.076**	**0.096**	**0.112**	**0.126**
6609	**17.8**	7.44	11.38	14.00	17.63	20.57	23.24		**0.132**	**0.203**	**0.249**	**0.314**	**0.366**	**0.414**
6610	**6.1**	8.21	12.60	15.47	19.49	22.80	25.72		**0.050**	**0.077**	**0.094**	**0.119**	**0.139**	**0.157**

Prepared by: R.S.Archer
Date: Nov. 2013

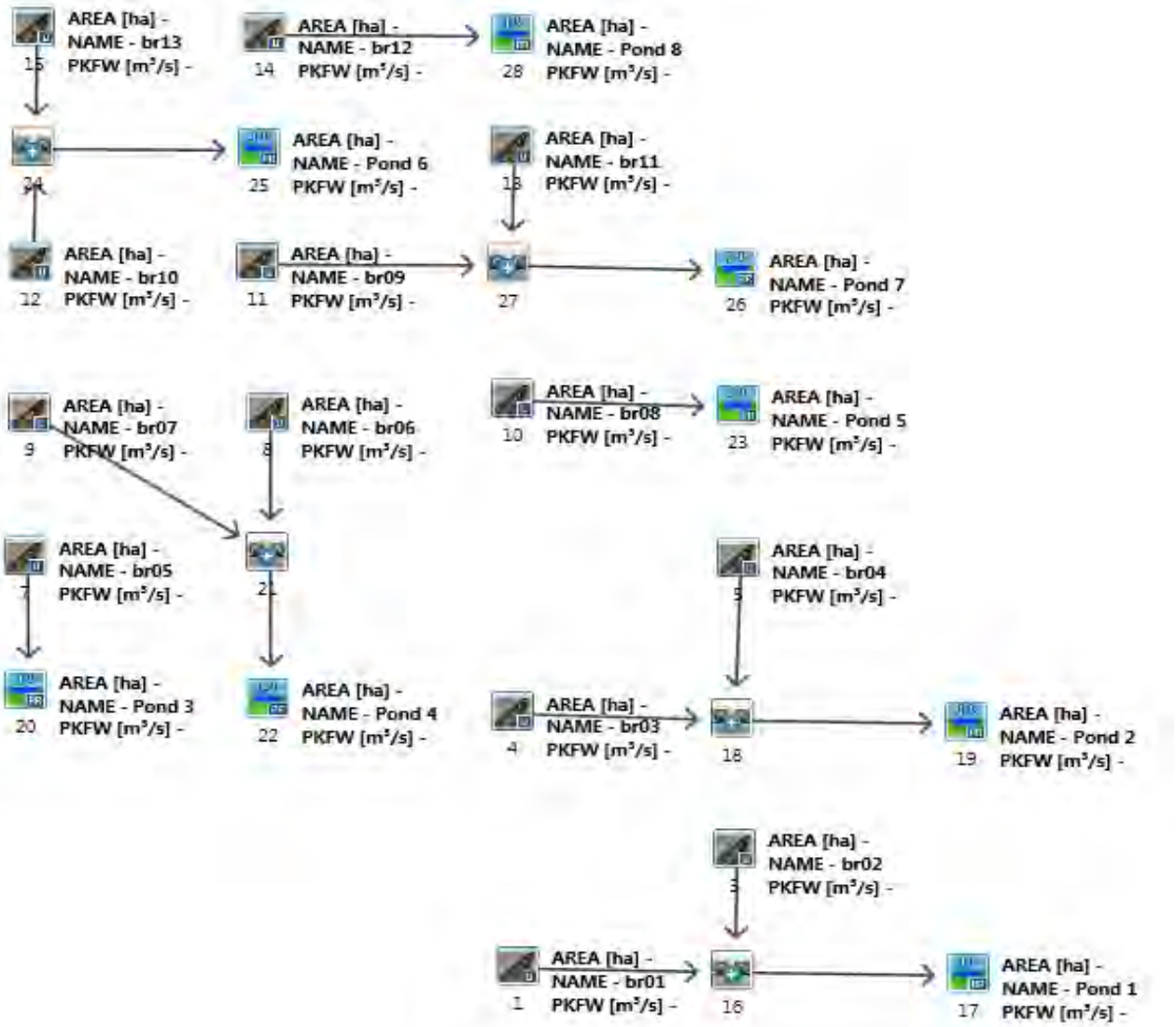
RAINBOW CREEK SUB-WATERSHED STUDY
VO2 MODEL SCHEMATIC - 2031 PONDS



Prepared by: R.S.Archer
Date: Nov. 2013

S:\2011 Projects\D-EE(E11)\Water Resources\W11-259 Vaughan Storm Drainage SWM Master Plan\Calcs\PCSWMM\Model Schematic

RAINBOW CREEK SUB-WATERSHED STUDY
VO2 MODEL SCHEMATIC - 2031 PONDS



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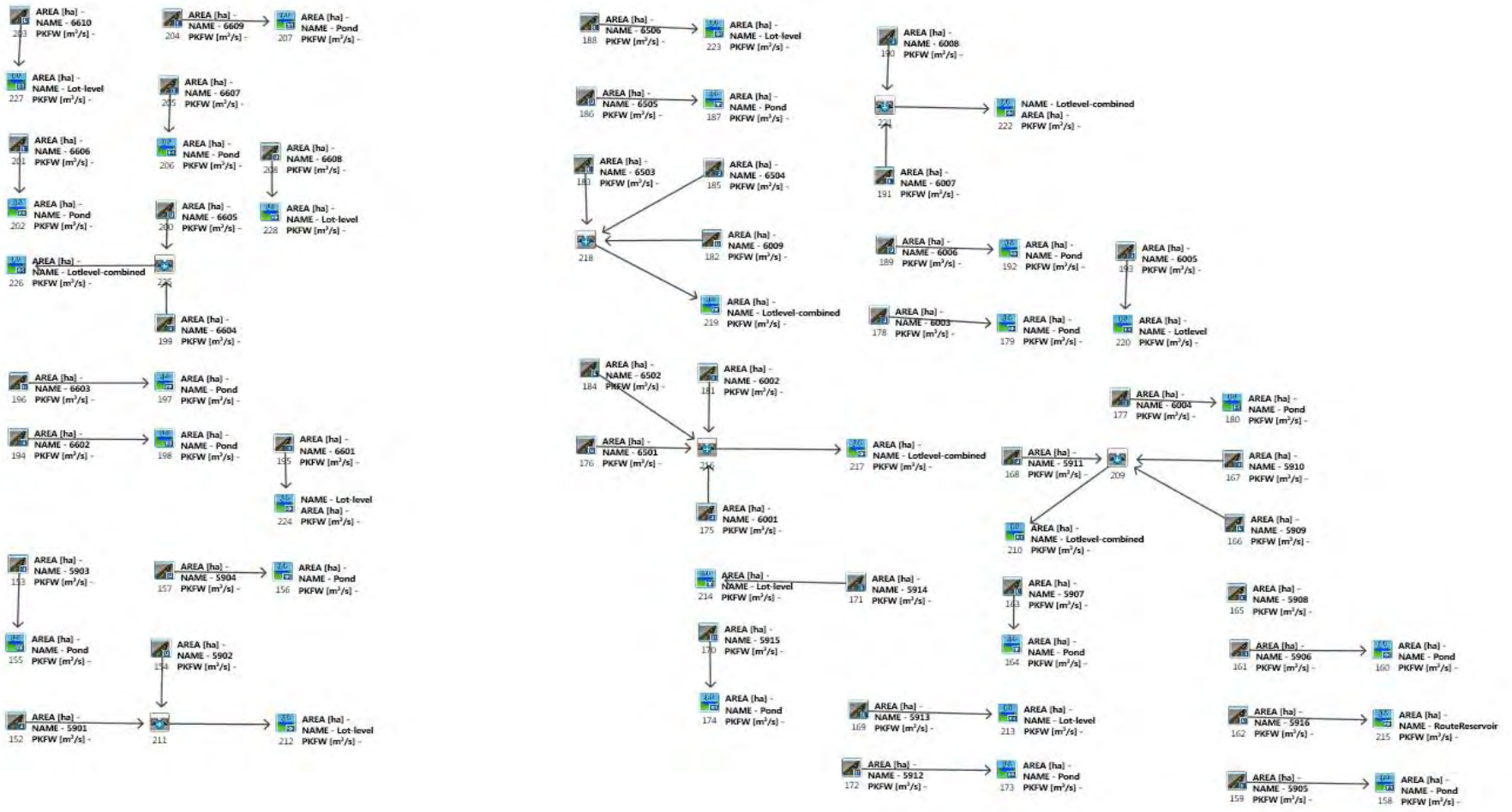
Date: Nov. 2013

RAINBOW CREEK SUB-WATERSHED STUDY
UNIT FLOW RATES FOR 2051 DEVELOPMENT

COLE ENGINEERING
Experience Enhancing Excellence

Name	Area (ha)	Allowable Release Rate (L/s/ha)							Allowable Release Rate (m3/s)					
		2y	5y	10y	25y	50y	100y		2y	5y	10y	25y	50y	100y
6651	17.60	7.44	11.39	14.02	17.65	20.59	23.27							
6652	26.35	7.15	10.94	13.47	16.94	19.76	22.34							
6655	8.37	7.98	12.24	15.04	18.94	22.14	24.99							
6651+6652+6653	**52.31**	**6.66**	**10.16**	**12.52**	**15.75**	**18.33**	**20.75**		**0.348**	**0.531**	**0.655**	**0.824**	**0.959**	**1.085**
6653	7.22	8.08	12.41	15.24	19.20	22.45	25.33							
6654	14.53	7.58	11.61	14.28	17.98	20.99	23.71							
6653+6654	**21.75**	**7.29**	**11.15**	**13.73**	**17.28**	**20.15**	**22.78**		**0.159**	**0.243**	**0.299**	**0.376**	**0.438**	**0.495**
6657	13.83	7.62	11.67	14.35	18.07	21.10	23.83							
6701	25.60	7.17	10.97	13.51	16.99	19.82	22.40							
6657+6701	**39.43**	**6.86**	**10.48**	**12.91**	**16.24**	**18.92**	**21.40**		**0.271**	**0.413**	**0.509**	**0.640**	**0.746**	**0.844**
6702	14.23	7.60	11.64	14.31	18.02	21.04	23.76							
6703	112.12	6.11	9.29	11.48	14.42	16.74	18.98							
6704	17.33	7.46	11.41	14.04	17.67	20.63	23.31							
6702+6703+6704	**143.68**	**5.93**	**9.01**	**11.14**	**13.99**	**16.22**	**18.41**		**0.853**	**1.294**	**1.600**	**2.010**	**2.331**	**2.645**
6705	**25.49**	7.18	10.97	13.51	17.00	19.82	22.41		**0.183**	**0.280**	**0.344**	**0.433**	**0.505**	**0.571**
6706	**25.93**	7.17	10.95	13.49	16.97	19.79	22.37		**0.186**	**0.284**	**0.350**	**0.440**	**0.513**	**0.580**
6707	**5.79**	8.24	12.66	15.55	19.58	22.91	25.84		**0.048**	**0.073**	**0.090**	**0.113**	**0.133**	**0.150**
6708	**12.66**	7.68	11.77	14.47	18.22	21.28	24.03		**0.097**	**0.149**	**0.183**	**0.231**	**0.269**	**0.304**
6709	**28.86**	7.09	10.83	13.34	16.78	19.57	22.12		**0.205**	**0.313**	**0.385**	**0.484**	**0.565**	**0.639**
6710	7.64	8.04	12.34	15.16	19.10	22.33	25.20							
6711	10.07	7.85	12.03	14.79	18.62	21.76	24.56							
6710+6711	**17.71**	**7.44**	**11.39**	**14.01**	**17.64**	**20.58**	**23.26**		**0.132**	**0.202**	**0.248**	**0.312**	**0.365**	**0.412**
6801	16.43	7.49	11.47	14.11	17.77	20.74	23.43							
6802	6.38	8.17	12.55	15.41	19.41	22.71	25.62							
6803	6.58	8.15	12.51	15.37	19.36	22.64	25.55							
6804	5.39	8.29	12.74	15.64	19.71	23.06	26.01							
6805	21.64	7.30	11.16	13.74	17.29	20.16	22.79							
6901	3.61	8.58	13.19	16.19	20.40	23.89	26.94							
6801-6805+6901	**60.04**	**6.56**	**10.00**	**12.33**	**15.51**	**18.04**	**20.43**		**0.394**	**0.600**	**0.741**	**0.931**	**1.083**	**1.226**
6902	16.75	7.48	11.45	14.09	17.73	20.70	23.38							
6903	10.37	7.82	11.99	14.75	18.57	21.70	24.49							
6902+6903	**27.12**	**7.13**	**10.90**	**13.43**	**16.89**	**19.69**	**22.27**		**0.193**	**0.296**	**0.364**	**0.458**	**0.534**	**0.604**
6904	7.13	8.09	12.42	15.26	19.22	22.48	25.36							
6905	11.72	7.74	11.86	14.58	18.35	21.44	24.21							
6904+6905	**18.86**	**7.39**	**11.32**	**13.92**	**17.53**	**20.45**	**23.11**		**0.139**	**0.213**	**0.263**	**0.330**	**0.386**	**0.436**
6906	20.38	7.34	11.23	13.82	17.39	20.29	22.93		**0.150**	**0.229**	**0.282**	**0.354**	**0.414**	**0.467**
6907	32.37	7.01	10.70	13.18	16.59	19.33	21.86		**0.227**	**0.346**	**0.427**	**0.537**	**0.626**	**0.708**

RAINBOW CREEK SUB-WATERSHED STUDY
VO2 MODEL SCHEMATIC - 2031 PONDS



Prepared by: R.S.Archer
Date: Nov. 2013

APPENDIX C
Modeling Files
(2 year, 5 year, 100 year and Regional Storm)

RAINBOW CREEK SUB-WATERSHED STUDY
RESULTS FROM PCSWMM WITH DESIGN STORMS (QUANTITY CONTROL)

COLE ENGINEERING
Experience Enhancing Excellence

Design storm: 5yr-12hr AES distribution

Name	Maximum Total Inflow (m^3/s)		% decrease in flow	Maximum Total Inflow (m^3/s)		% decrease in flow
	2012	2031		2012	2051	
RC_01	9.22	8.06	13%	9.22	7.63	17%
RC_02	5.40	5.35	1%	5.40	5.39	0%
RC_03	9.05	8.02	11%	9.05	7.38	18%
RC_04	4.88	4.86	0%	4.88	3.57	27%
RC_05	1.95	0.45	77%	1.95	0.45	77%
RC_06	3.38	1.69	50%	3.38	0.43	87%
RC_07	5.52	2.15	61%	5.52	0.96	83%
RC_08	4.76	2.03	57%	4.76	1.12	76%
RC_09	12.32	12.12	2%	12.32	11.19	9%
RC_10	13.62	12.98	5%	13.62	11.81	13%
RC_11	0.86	0.49	43%	0.86	0.84	2%
RC_12	1.08	0.65	40%	1.08	0.65	40%
RC_13	3.03	1.70	44%	3.03	1.66	45%
RC_14	13.47	13.47	0%	13.47	12.13	10%
RC_14-15	13.68	13.92	-2%	13.68	13.01	5%
RC_15	3.41	2.20	36%	3.41	1.97	42%
RC_16	9.41	11.58	-23%	9.41	11.15	-18%
RC_17	9.49	11.92	-26%	9.49	11.47	-21%
RC_18	5.78	2.86	51%	5.78	2.86	51%
RC_19	5.70	3.49	39%	5.70	3.49	39%
RC_20	6.46	4.22	35%	6.46	4.23	35%
RC_21	12.66	9.85	22%	12.66	9.85	22%
RC_22	7.70	5.16	33%	7.70	5.18	33%
RC_23	13.48	9.93	26%	13.48	9.87	27%
RC_24	19.71	13.07	34%	19.71	12.97	34%
RC_25	20.10	13.55	33%	20.10	13.52	33%
RC_26	20.42	15.22	25%	20.42	15.28	25%
RC_27	9.67	12.30	-27%	9.67	11.84	-22%
RC_28	7.95	8.21	-3%	7.95	8.21	-3%
RC_29	10.42	10.55	-1%	10.42	10.81	-4%
RC_30	25.57	20.55	20%	25.57	20.43	20%
RC_31	26.69	25.45	5%	26.69	26.10	2%

Design storm: 10yr-12hr AES distribution

Name	Maximum Total Inflow (m^3/s)		% decrease in flow	Maximum Total Inflow (m^3/s)		% decrease in flow
	2012	2031		2012	2051	
RC_01	11.51	10.02	13%	11.51	9.32	19%
RC_02	7.08	7.04	1%	7.08	6.63	6%
RC_03	11.23	9.93	12%	11.23	8.96	20%
RC_04	7.00	7.01	0%	7.00	4.88	30%
RC_05	2.49	0.57	77%	2.49	0.57	77%
RC_06	4.30	2.10	51%	4.30	0.58	87%
RC_07	7.21	2.68	63%	7.21	1.21	83%
RC_08	6.25	2.53	60%	6.25	1.42	77%
RC_09	17.42	16.86	3%	17.42	14.92	14%
RC_10	19.92	17.77	11%	19.92	15.00	25%
RC_11	1.71	0.73	57%	1.71	1.07	37%
RC_12	2.02	0.87	57%	2.02	0.87	57%
RC_13	4.08	2.30	44%	4.08	2.21	46%
RC_14	19.05	18.31	4%	19.05	15.86	17%
RC_14-15	19.97	19.79	1%	19.97	17.47	13%
RC_15	4.85	2.84	41%	4.85	2.53	48%
RC_16	12.76	16.55	-30%	12.76	15.12	-18%
RC_17	12.89	17.63	-37%	12.89	15.25	-18%
RC_18	7.44	3.69	50%	7.44	3.69	50%
RC_19	7.79	4.48	43%	7.79	4.47	43%
RC_20	8.58	5.44	37%	8.58	5.45	36%
RC_21	15.76	11.97	24%	15.76	11.97	24%
RC_22	10.21	6.66	35%	10.21	6.68	35%
RC_23	16.92	12.04	29%	16.92	11.95	29%
RC_24	26.68	16.30	39%	26.68	16.24	39%
RC_25	27.03	17.10	37%	27.03	17.00	37%
RC_26	28.03	19.37	31%	28.03	19.37	31%
RC_27	13.08	16.54	-26%	13.08	15.03	-15%
RC_28	9.73	9.99	-3%	9.73	9.99	-3%
RC_29	13.78	13.79	0%	13.78	14.20	-3%
RC_30	35.47	26.77	25%	35.47	26.34	26%
RC_31	36.77	32.62	11%	36.77	33.11	10%

RAINBOW CREEK SUB-WATERSHED STUDY
RESULTS FROM PCSWMM WITH DESIGN STORMS (QUANTITY CONTROL)

COLE ENGINEERING
Experience Enhancing Excellence

Design storm: 25yr-12hr AES distribution

Name	Maximum Total Inflow (m^3/s)		% decrease in flow	Maximum Total Inflow (m^3/s)		% decrease in flow
	2012	2031		2012	2051	
RC_01	14.71	12.63	14%	14.71	11.61	21%
RC_02	9.27	9.23	0%	9.27	7.75	16%
RC_03	14.21	12.44	12%	14.21	11.07	22%
RC_04	10.96	10.82	1%	10.96	6.63	40%
RC_05	3.15	0.74	77%	3.15	0.74	77%
RC_06	5.44	2.62	52%	5.44	0.79	86%
RC_07	9.38	3.41	64%	9.38	1.59	83%
RC_08	8.19	3.22	61%	8.19	1.89	77%
RC_09	24.90	23.65	5%	24.90	19.68	21%
RC_10	29.45	25.13	15%	29.45	20.51	30%
RC_11	3.04	1.15	62%	3.04	1.39	54%
RC_12	3.44	1.18	66%	3.44	1.18	66%
RC_13	5.89	3.27	44%	5.89	3.07	48%
RC_14	27.68	26.05	6%	27.68	21.43	23%
RC_14-15	29.21	28.38	3%	29.21	23.86	18%
RC_15	6.94	3.75	46%	6.94	3.37	51%
RC_16	21.08	25.63	-22%	21.08	21.04	0%
RC_17	22.45	26.81	-19%	22.45	22.98	-2%
RC_18	9.52	4.75	50%	9.52	4.75	50%
RC_19	10.24	5.77	44%	10.24	5.77	44%
RC_20	11.54	7.09	39%	11.54	7.09	39%
RC_21	19.80	14.78	25%	19.80	14.79	25%
RC_22	13.66	8.80	36%	13.66	8.82	35%
RC_23	21.24	14.61	31%	21.24	14.49	32%
RC_24	34.26	21.66	37%	34.26	21.42	37%
RC_25	35.11	22.58	36%	35.11	22.37	36%
RC_26	37.43	25.27	32%	37.43	25.18	33%
RC_27	21.15	24.53	-16%	21.15	21.28	-1%
RC_28	11.78	12.05	-2%	11.78	12.05	-2%
RC_29	18.26	18.26	0%	18.26	18.71	-2%
RC_30	47.42	40.72	14%	47.42	36.66	23%
RC_31	49.67	41.12	17%	49.67	41.86	16%

Design storm: 50yr-12hr AES distribution

Name	Maximum Total Inflow (m^3/s)		% decrease in flow	Maximum Total Inflow (m^3/s)		% decrease in flow
	2012	2031		2012	2051	
RC_01	17.14	14.70	14%	17.14	13.47	21%
RC_02	10.91	10.88	0%	10.91	8.40	23%
RC_03	16.47	14.44	12%	16.47	12.77	22%
RC_04	14.35	14.04	2%	14.35	7.73	46%
RC_05	3.65	0.85	77%	3.65	0.85	77%
RC_06	6.29	3.01	52%	6.29	0.97	85%
RC_07	11.00	3.99	64%	11.00	1.91	83%
RC_08	9.69	3.77	61%	9.69	2.26	77%
RC_09	31.99	29.84	7%	31.99	23.21	27%
RC_10	38.05	32.33	15%	38.05	24.55	35%
RC_11	4.14	1.60	61%	4.14	1.74	58%
RC_12	4.61	1.43	69%	4.61	1.43	69%
RC_13	7.39	4.08	45%	7.39	3.74	49%
RC_14	35.45	32.41	9%	35.45	25.68	28%
RC_14-15	37.12	35.13	5%	37.12	28.62	23%
RC_15	8.49	4.58	46%	8.49	4.08	52%
RC_16	31.80	35.92	-13%	31.80	28.18	11%
RC_17	30.86	34.39	-11%	30.86	28.17	9%
RC_18	11.06	5.56	50%	11.06	5.56	50%
RC_19	12.07	6.75	44%	12.07	6.75	44%
RC_20	13.81	8.40	39%	13.81	8.41	39%
RC_21	22.87	16.97	26%	22.87	16.97	26%
RC_22	16.15	10.41	36%	16.15	10.43	35%
RC_23	24.49	16.62	32%	24.49	16.46	33%
RC_24	40.15	25.01	38%	40.15	24.83	38%
RC_25	40.93	26.35	36%	40.93	26.10	36%
RC_26	43.36	30.89	29%	43.36	30.66	29%
RC_27	29.39	32.16	-9%	29.39	26.58	10%
RC_28	13.28	13.54	-2%	13.28	13.54	-2%
RC_29	24.00	22.38	7%	24.00	23.00	4%
RC_30	55.96	52.66	6%	55.96	44.43	21%
RC_31	59.32	51.91	12%	59.32	50.22	15%

APPENDIX D
Flood Evaluation Matrix

RAINBOW CREEK UPDATE STUDY
Flood Evaluation Matrix - Flood Vulnerable Areas

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Flood Vulnerable Structures (FVAs)	Location	Identified by			Description / Notes	Elevation at which flooding starts (Ground elevation)	Starts Flooding at Storm Event			Exceeds Emergency Vehicle Threshold			Original Regional WS elevation	Updated Regional WS elevation	Updated Regional flow	Updated Regional Velocity
		1989 Rainbow Creek Master Plan Update	TRCA shape fie of flood vulnerable site (Site_ID)	CEG preliminary flood analysis			2012	2031	2051	2012	2031	2051				
						(m)							(m)	(m)	(m^3/s)	(m/s)
1	7370 Martin Grove Rd, north of Hwy 407			x	Southwest portion of property in floodplain, no structures affected. Lowest structure is a shed.	164.85	25 yr	25 yr	25 yr	25 yr	25 yr	25 yr	167.19	167.19	20.60	0.17
2	5780 Highway 7, west of Martin Grove Rd	Flood Susceptible Site #4			Graphic Transportation Group Warehouse, previously identified as a flood susceptible site. Flood susceptible portion of the site has since been removed out of the floodplain, likely due to the expansion of the building and parking lot and filling in the flood plain. Lowest structure is the warehouse.	173.8	Does not Flood	Does not Flood	Does not Flood	Does not Flood	Does not Flood	Does not Flood	168.3	168.31	179.3	0.53
3	8934 Huntington Rd, north of Langstaff Rd	Flood Susceptible Site #6			Small private pond on the property located within the floodplain. Flood lines extend into the backyard of the house. No	189.30	25 yr	Regional	Regional	50 yr	Regional	Regional	190.54	190.50	52.60	0.28
4	6666 Rutherford Rd, east of Huntington Rd			x	Driveway of the property (connecting to Rutherford Rd) is overtopped. No structures are affected, however. Lowest structure is a garage.	192.77	100 yr	Regional	Regional	Regional	Regional	Regional	193.47	193.49	63.00	1.23
5	9307 Huntington Rd, north of Rutherford Rd			x	Mazza Landscaping Enterprise lands. Driveway crossing overtopped. Flood lines extend well into the property almost to the storage yard area. Lowest structure is a storage building on the south portion of the yard that borders floodplain.	192.90	2yr	2yr	2yr	2yr	2yr	2yr	194.22	194.28	63.00	0.84
6	10961 Cold Creek Rd, north of Nashville Rd		2202		Floodplain extends west into the backyard of a single family house. No structures are affected.	216.23	100 yr	Regional	Regional	n/a Backyard flooding	n/a Backyard flooding	n/a Backyard flooding	216.65	216.65	44.70	1.43
7	11245 Highway 50, south of Albion-Vaughan Rd			x	Best Choice Express & Delivery Ltd., outdoor storage yard for shipping containers. Floodplain extends north into the storage yard area. No structures are affected.	224.00	Regional	Regional	Regional	n/a Backyard flooding	n/a Backyard flooding	n/a Backyard flooding	224.40	224.41	50.30	0.22
8	11151 Highway 50, South of Albion Vaughan Rd			x	Single family dwelling. No structures affected	224.00	Regional	Regional	Regional	n/a Backyard flooding	n/a Backyard flooding	n/a Backyard flooding	224.40	224.41	50.30	0.22

Sites with no increase in flood risk and no buildings affected - these sites could have improvements but are low priority

Sites with an increase in flood risk and sites where buildings are flooding - these sites may require mitigation but further study is required

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Sites which no longer flood in existing of future conditions - no mitigation required

Pedestrian bridges which are built in the flood plain and not required to convey the regional storm - no mitigation required

RAINBOW CREEK UPDATE STUDY
Flood Evaluation Matrix - Flood Vulnerable Areas

Flood Vulnerable Structures (FVAs)	Regional WS elevation 2031	Regional flow 2031	Regional velocity 2031	Regional WS elevation 2051	Regional flow 2051	Regional velocity 2051	Regional Flooding Depth (mm)			Is there a change in flood magnitude	Has the frequency of flooding increased	Is the a change in accessibility for emergency vehicles	Is there and impact due to increased velocity	Impact	Action required / mitigation
							Existing	2031	2051						
	(m)	(m^3/s)	(m/s)	(m)	(m^3/s)	(m/s)	(m)	(m)	(m)						
1	167.19	20.60	0.17	167.19	20.60	0.17	2.34	2.34	2.34	N	N	N	N	Property located partially within the floodplain	No action or mitigation required
		0.0%	0.0%		0.0%	0.0%								No change in flooding, no structures affected	
2	168.32	187.2	0.55	168.3	184.3	0.55	No Flooding	No Flooding	No Flooding	N	N	N	N		No action or mitigation required
3	190.55	58.20	0.30	190.55	58.40	0.30	1.2	1.25	1.25	N	N	N/A	N	Small increase in depth of flooding	No action or mitigation required
		10.6%	7.1%		11.0%	7.1%								Small increase in area flooded	
4	193.47	59.20	1.18	193.47	59.20	1.18	0.72	0.70	0.70	N	N	N	N	Flooding during regional storm but no structures are flooding	No action or mitigation required
		-6.0%	-4.1%		-6.0%	-4.1%								Not accessible to emergency vehicles Flooding is reduced with development	
5	194.22	59.20	0.84	194.22	59.20	0.84	1.38	1.32	1.32	N	N	N	N	Flooding during 2 yr storm but no structures are flooding even during the regional event	More detailed analysis required to asses the flood risk
		-6.0%	0.0%		-6.0%	0.0%								Not accessible to emergency vehicles Flooding is reduced with development	Possible mitigation includes flood proofing buildings and building land forms
6	216.65	45.00	1.44	216.64	44.00	1.43	0.42	0.42	0.41	N	N	N/A	N	Flooding during regional storm but no structures are flooding	No action or mitigation required
		0.7%	0.7%		-1.6%	0.0%									
7	224.40	48.90	0.22	224.41	48.90	0.22	0.41	0.40	0.41	N	N	N	N	Property located partially within the floodplain	More detailed analysis required to asses the flood risk
		-2.8%	0.0%		-2.8%	0.0%								Accessible to emergency vehicles, driveway located outside of flooded area	Possible mitigation includes flood proofing buildings and building land forms
8	224.40	48.90	0.22	224.41	48.90	0.22	0.41	0.40	0.41	N	N	N	N	Property located partially within the floodplain	More detailed analysis required to asses the flood risk
		-2.8%	0.0%		-2.8%	0.0%								Accessible to emergency vehicles, driveway located outside of flooded area	Possible mitigation includes flood proofing buildings and building land forms

Sites with no increase in flood risk and no buildings affected - these sites could have

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Pedestrian bridges which are built in the flood plain and not required to convey the

RAINBOW CREEK UPDATE STUDY
Flood Evaluation Matrix - Flood Vulnerable Roads

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Flood Vulnerable Roads (FVRs)	Location	Identified by			Description / Notes	Structure	Existing Road Classification (MTO equivalent)	Span (m)	Lowest Road Elevation (m)	Emergency Access Threshold Elevation (m)	Becomes inaccessible to Emergency Vehicles at	Service Design Event for Crossing	WL at Design Storm	Freeboard	Meeting MTO Standard	Original Regional WS elevation	Updated Regional WS elevation	Updated Regional flow	Updated Regional Velocity
		1989 Rainbow Creek Master Plan Update	TRCA shape file of flood vulnerable site (Site_ID)	CEG preliminary flood analysis														(m^3/s)	(m/s)
1	Highway 407, east of Martin Grove Road		1280		Crossing does not overtop	Bridge	Freeway	36.7	144	144.3	Always Accessible	100 yr	139.62	4.38	Yes	143.04	142.25		
2	Highway 7, west of Kipling Avenue		2694			Bridge	Regional	15.2	157.3	157.6	Regional	100 yr	154.62	2.68	Yes	158.71	158.52	305.6	2.03
3	Martin Grove Road, north of Highway 407		2648			Culvert	Collector	2.4	167.01	167.31	Always Accessible	50 yr	165.51	1.5	Yes	167.57	167.19	20.6	0.07
4	Highway 27, north of Highway 7		2607			Culvert	Regional	7.6	171.85	172.15	Regional	100 yr	170.81	1.04	Yes	172.68	172.67	179.3	0.32
5	Woodbridge Ave, west of Kipling Ave		2666			Culvert	Local	2	165.44	165.74	Regional	10 yr	160.45	4.99	Yes	166.38	166.21	169.3	0.22
6	Martin Grove Road, north of Highway 7		2637			Culvert	Collector	4.3	167	167.3	Regional	25 yr	164.91	2.09	Yes	167.90	168.06	179.3	1.08
7	Highway 27, north of Langstaff Rd		2663			Culvert	Regional	6.1	182.9	183.2	Always Accessible	100 yr	175.74	7.16	Yes	183.66	183.17	172.8	0.15
8.00	Langstaff Rd, east of Huntington Rd		2647.00			Bridge	Urban Arterial	27.00	183.14	183.44	Always Accessible	100 yr	180.05	3.09	Yes	181.85	181.33		
9	Huntington Rd, south of Rutherford Road		2615			Culvert	Urban Arterial	3.4	190	190.3	Regional	50 yr	189.84	0.16	No	190.54	190.50	52.6	0.28
10	Rutherford Rd, west of Hwy 27	Historic Flooding Sites #2 and #3	2657			Bridge	Regional	6.7	187	187.3	Regional	100 yr	186.16	0.84	No	187.65	187.61	152.2	0.42
11	Rutherford Rd, east of Huntington Rd		2634			Culvert	Regional	7	193.1	193.4	Regional	100 yr	192.8	0.30	No	193.47	193.54	63	0.46
12	Huntington Rd, north of Rutherford Rd		1295		Creek turns into a roadside ditch along the east side of Huntington Rd - flow parallel to road	Roadside ditch (parallel to road)	Urban Arterial	n/a	194.3	194.6	50 yr	City Standard, max flooding of 0.1 m above crown	194.38	n/a	No (City Standard)	194.76	194.82	50.3	1.43
13	McGillivray Rd, north of Rutherford Rd		2632			Culvert	Collector	3	189.2	189.5	Regional	25 yr	188.52	0.68	No	190.01	190.04	152.2	0.6
14	McGillivray Rd, west of CP Railway		2633			Culvert	Collector	1.5	196.19	196.49	25 yr	25 yr	196.54	-0.35	No	197.61	197.61	31.5	0.09
15	Huntington Rd, south of Major Mackenzie Dr		1294			Culvert	Urban Arterial	2.2	200.4	200.7	25 yr	50 yr	200.76	-0.36	No	200.90	200.95	50.3	0.17
16	Major Mackenzie Dr, west of CP Railway		1306			Culvert	Regional	1.2	200.8	201.1	Regional	50 yr	200.83	-0.03	No	202.03	201.12	15.3	0.29
17	Major Mackenzie Dr, east of Huntington Rd		2606			Culvert	Regional	1.5	201.95	202.25	Regional	50 yr	202.24	-0.29	No	202.28	202.51	14.2	0.12
18	Major Mackenzie Dr, west of Huntington Rd		2671			Culvert	Regional	5.1	201.1	201.4	Regional	50 yr	201.18	-0.08	No	202.68	202.71	150.4	0.42
19	Nashville Rd, east of Cold Creek Rd		2646		Highest WL is at the 25 yr storm	Culvert	Regional	1.2	218	218.3	Always Accessible	50 yr	218.07	-0.07	No	218.27	218.14	10.6	0.09
20	Nashville Rd, west of Huntington Rd		2645		Highest WL at Regional and 25 yr storms	Culvert	Regional	3	211.5	211.8	Regional	50 yr	211.7	-0.20	No	212.58	212.22	124	0.53
21	Highway 50, south of Rutherford Rd		2614			Culvert	Regional	3.7	201.3	201.6	Always Accessible	50 yr	197.77	3.53	Yes	201.60	201.55	48.8	0.07
22	Cold Creek Rd, south of Kirby Rd		2638			Culvert	Collector	2.2	223.36	223.66	Regional	25 yr	223.65	-0.29	No	223.77	223.99	42.9	0.26
23	Huntington Rd, south of Major Mackenzie Dr		1293			Culvert	Urban Arterial	3	196.9	197.2	50 yr	50 yr	197.26	-0.36	No	197.98	197.82	150.4	0.43
24	McGillivray Rd, east of Huntington Rd			X		Culvert	Collector	2.1	200	200.3	Always Accessible	25 yr	197.61	2.39	Yes	199.75	199.69	31.5	1.7

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RAINBOW CREEK UPDATE STUDY
Flood Evaluation Matrix - Flood Vulnerable Roads

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Flood Vulnerable Roads (FVRs)	Regional WS elevation 2031	Regional flow 2031	Regional velocity 2031	Regional WS elevation 2051	Regional flow 2051	Regional velocity 2051	Lowest Road Elevation	Overtops Road at (2011)	Overtops Road at (2031)	Overtops Road at (2051)	Regional Flooding Depth (mm)			Increase in water surface elevation from 2011-2051	Is there a change in flood magnitude	Has the frequency of flooding increased	Is the a change in accessibility for emergency vehicles	Is there and impact due to increased velocity	Impact	mitigation
											Existing	2031	2051							
		(m^3/s)	(m/s)		(m^3/s)	(m/s)	(m)				(m)	(m)	(m)							
1	142.17			142.18			144	No Flooding	No Flooding	No Flooding	No Flooding	No Flooding	No Flooding	-0.07	N	N	N	N	No increase in flood risk Meets vehicle Access criteria	-
2	158.56	321.1 5.1%	2.02 -0.5%	158.59	329.2 7.7%	2.02 -0.5%	157.3	Regional	Regional	Regional	1.22	1.26	1.29	0.07	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
3	167.19	20.6 0.0%	0.07 0.0%	167.19	20.6 0.0%	0.07 0.0%	167.01	Regional	Regional	Regional	0.18	0.18	0.18	0.00	N	N	N	N	No increase in flood risk Meets vehicle Access criteria	-
4	172.69	187.2 4.4%	0.33 3.1%	172.68	184.3 2.8%	0.33 3.1%	171.85	Regional	Regional	Regional	0.82	0.84	0.83	0.01	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
5	166.22	171.5 1.3%	0.22 0.0%	166.28	186.3 10.0%	0.24 9.1%	165.44	Regional	Regional	Regional	0.77	0.78	0.84	0.07	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
6	168.08	187.2 4.4%	1.11 2.8%	168.08	184.3 2.8%	1.09 0.9%	167	Regional	Regional	Regional	1.06	1.08	1.08	0.02	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
7	183.16	173.8 0.6%	0.15 0.0%	183.26	188.8 9.3%	0.16 6.7%	182.9	Regional	Regional	Regional	0.27	0.26	0.36	0.09	N	N	Y	N	**Increase in flood risk** Not accessible for emergency vehicles	Upgrade culvert
8.00	181.37			181.37			183.14	No Flooding	No Flooding	No Flooding	No Flooding	No Flooding	No Flooding	0.04	N	N	N	N	Not flooding	-
9	190.55	58.2 10.6%	0.3 7.1%	190.55	58.4 11.0%	0.3 7.1%	190	100 yr	Regional	Regional	0.50	0.55	0.55	0.05	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
10	187.59	148.4 -2.5%	0.41 -2.4%	187.62	159.9 5.1%	0.44 4.8%	187	Regional	Regional	Regional	0.61	0.59	0.62	0.01	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
11	193.54	59.2 -6.0%	0.43 -6.5%	193.54	59.2 -6.0%	0.43 -6.5%	193.1	Regional	Regional	Regional	0.44	0.44	0.44	0.00	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
12	194.79	48.9 -2.8%	1.45 1.4%	194.79	48.9 -2.8%	1.45 1.4%	194.3	2 yr	50yr	50yr	0.52	0.49	0.49	-0.03	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
13	190.03	148.4 -2.5%	0.59 -1.7%	190.07	159.9 5.1%	0.62 3.3%	189.2	50yr	100yr	Regional	0.84	0.83	0.87	0.03	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
14	197.64	38.6 22.5%	0.11 22.2%	197.69	42.2 34.0%	0.12 33.3%	196.19	2 yr	2 yr	2 yr	1.42	1.45	1.50	0.08	N	N	N	Y	No increase in flood risk Not accessible for emergency vehicles	Verify effect of increased flow/velocity
15	200.94	48.9 -2.8%	0.17 0.0%	200.94	48.9 -2.8%	0.17 0.0%	200.4	5 yr	5 yr	5 yr	0.55	0.54	0.54	-0.01	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
16	201.31	7.8 -49.0%	0.1 -65.5%	201.38	7.5 -51.0%	0.09 -69.0%	200.8	50 yr	Regional	Regional	0.32	0.51	0.58	0.26	Y	N	Y	N	**Increase in flood risk** Not accessible for emergency vehicles	Re-evaluate with approed Block 61 pond design and regional storage
17	202.35	27.4 93.0%	0.3 150.0%	202.38	31.3 120.4%	0.33 175.0%	201.95	50 yr	Regional	Regional	0.56	0.40	0.43	-0.13	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
18	202.51	144.7 -3.8%	0.44 4.8%	202.87	155.3 3.3%	0.41 -2.4%	201.1	50 yr	100 yr	Regional	1.61	1.41	1.77	0.16	Y	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
19	218.11	9.7 -8.5%	0.08 -11.1%	218.13	9.8 -7.5%	0.08 -11.1%	218	2 yr	25 yr	Regional	0.14	0.11	0.13	-0.01	N	N	N	N	No increase in flood risk Meets vehicle Access criteria	-
20	212.21	120.3 -3.0%	0.52 -1.9%	212.23	128.5 3.6%	0.55 3.8%	211.5	25 yr	25 yr	50 yr	0.72	0.71	0.73	0.01	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
21	201.61	54.4 11.5%	0.08 14.3%	201.61	54.5 11.7%	0.08 14.3%	201.3	Regional	Regional	Regional	0.25	0.31	0.31	0.06	N	N	N	N	No increase in flood risk Meets vehicle Access criteria	-
22	223.99	42.9 0.0%	0.26 0.0%	224	43.8 2.1%	0.26 0.0%	223.36	5 yr	10 yr	10 yr	0.63	0.63	0.64	0.01	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	
23	197.80	144.7 -3.8%	0.42 -2.3%	197.85	155.3 3.3%	0.44 2.3%	196.9	5 yr	5 yr	10 yr	0.92	0.90	0.95	0.03	N	N	N	N	No increase in flood risk Not accessible for emergency vehicles	-
24	200.04	38.6 22.5%	0.26 -84.7%	200.06	42.2 34.0%	0.27 -84.1%	200	No Flooding	Regional	Regional	No Flooding	0.04	0.06	0.37	Y	N	Y	N	**Increase in flood risk** Accessible for emergency vehicles	Upgrade culvert

Sites with no increase in flood risk and no buildings affected - these sites could have

Sites with an increase in flood risk and sites where buildings are flooding - these sites

Sites on which flooding is not affecting structures or accessibility - no mitigation is

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RAINBOW CREEK UPDATE STUDY
Flood Evaluation Matrix - Flood Vulnerable Structures

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Flood Vulnerable Structures (FVSs)	Location	Identified by			Description / Notes	Elevation at which flooding starts (Ground elevation)	Starts Flooding at Storm Event			Exceeds Emergency Vehicle Threshold			Original Regional WS elevation	Updated Regional WS elevation	Updated Regional flow	Updated Regional Velocity
		1989 Rainbow Creek Master Plan Update	TRCA shape file of flood vulnerable site (Site_ID)	CEG preliminary flood analysis			2012	2031	2051	2012	2031	2051				
						(m)							(m)	(m)	(m^3/s)	(m/s)
1	7231 Martin Grove Rd, north of Hwy 407		2183, 2184, 2185		Private driveway, barns and sheds	157.5	10 yr	10 yr	10 yr	25 yr	25 yr	25 yr	158.6	158.06	20.6	0.91
2	Rainbow Creek Park, north of Hwy 7		1544		Footbridge	155.86	100 yr	100 yr	100 yr	n/a Footbridge	n/a Footbridge	n/a Footbridge	158.72	158.55	305.6	0.95
3	Rainbow Creek Park, south of Woodbridge Ave			x	Footbridge	159.44	100 yr	50 yr	100 yr	n/a Footbridge	n/a Footbridge	n/a Footbridge	159.86	160.14	169.3	2.01
4	Rainbow Creek Park, east of Martin Grove Rd		746		Footbridge	159.62	50 yr	Regional	Regional	n/a Footbridge	n/a Footbridge	n/a Footbridge	160.78	161.11	179.3	2.12
5	Robinson Creek, north of Woodbridge Ave		1428		Footbridge	162	25 yr	50 yr	50 yr	n/a Footbridge	n/a Footbridge	n/a Footbridge	166.4	166.23	169.3	0.34
6	Woodbridge Foam Factory, on Meeting House Rd	Flood Susceptible Site #1	2087		Factory	162.7	50 yr	50 yr	100 yr	100 yr	100 yr	Regional	166.47	166.26	169.3	0.5
7	Houses on south end of Woodcroft Ln and Blossom Ct		Many		Single family dwellings, flooding from the backyard	166.1	Regional	Regional	Regional	n/a Backyard flooding	n/a Backyard flooding	n/a Backyard flooding	166.51	166.3	169.3	0.44
8	Houses on north end of Woodcroft Ln		Many		Single family dwellings, flooding from the backyard	165.9	Regional	Regional	Regional	n/a Backyard flooding	n/a Backyard flooding	n/a Backyard flooding	166.84	166.47	169.3	0.48
9	6560 Langstaff Road, east of Huntington Rd	Flood Susceptible Site #5 and Historic Flooding Site #4			Building demolished	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
10	8811 Huntington Road, south of Rutherford Rd		710		Private driveway	186	2 yr	5 yr	5 yr	50 yr	50 yr	50 yr	186.88	186.88	130.3	1.06
11	Block 64 - previously golf course ponds		2310, 2311		Previously crossings for golf course ponds. Crossing will be upgraded, and ponds to be incorporated into valley system.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
12	Block 64 - previously a swimming pool and change house	Flood Susceptible Site #7			Has since been razed for residential development in Block 64	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
13	9290 McGillivray Rd, north of Rutherford Rd	Flood Susceptible Site #2	2199		Small horse barn	188.4	25 yr	25 yr	50 yr	n/a No driveway	n/a No driveway	n/a No driveway	190.01	190.04	152.2	0.6
14	9471 McGillivray Rd, north of Rutherford Rd		2292		Private driveway	190.08	Regional	Regional	Regional	Regional	Regional	Regional	190.49	190.51	35.10	0.79
15	9441 Huntington Rd, north of Rutherford Rd	Flood Susceptible Site #10	2200		Storage yard and small office building	195	2 yr	2 yr	2 yr	25 yr	50 yr	50 yr	195.69	195.82	50.3	0.75
18	10335 Highway 50, north of Major Mackenzie Dr		2677		Private driveway	207.80	100 yr	Regional	Regional	Regional	Regional	Regional	208.53	208.27	20.80	0.37
19	731 Kirby Road, east of Cold Creek Rd		2295		Private driveway, part of Hydro One lands	219.40	25 yr	25 yr	25 yr	Regional	Regional	Regional	219.74	219.80	25.90	1.33
20	731 Kirby Road, east of Cold Creek Rd		2294		Private driveway, part of Hydro One lands	223.27	5 yr	5 yr	5 yr	Always accessible	Always accessible	Always accessible	223.36	223.45	25.90	0.15
21	11221 Highway 50, south of Kirby Rd		2201		Commercial land (Tire Junction and Road King Truck Centre)	224.20	Regional	Regional	Regional	Always accessible	Regional	Regional	224.20	224.40	42.90	0.98
22	Houses on north side of Albany Dr			x	Single family dwellings, flooding from the backyard	168.20	Regional	Regional	Regional	n/a Backyard flooding	n/a Backyard flooding	n/a Backyard flooding	167.90	168.25	179.30	0.56
23	10223 Highway 50, north of Major Mackenzie Dr		1455		Small barn or shed on the east side of the property is located within the floodplain	203.10	100 yr	Regional	Regional	n/a No driveway	n/a No driveway	n/a No driveway	203.75	203.75	150.40	1.31

RAINBOW CREEK UPDATE STUDY
Flood Evaluation Matrix - Flood Vulnerable Structures

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Flood Vulnerable Structures (FVSs)	Regional WS elevation 2031	Regional flow 2031	Regional velocity 2031	Regional WS elevation 2051	Regional flow 2051	Regional velocity 2051	Regional Flooding Depth (mm)			Is there a change in flood magnitude	Has the frequency of flooding increased	Is the a change in accessibility for emergency vehicles	Is there and impact due to increased velocity	Impact	Action required / mitigation
							Existing	2031	2051						
	(m)	(m^3/s)	(m/s)	(m)	(m^3/s)	(m/s)	(m)	(m)	(m)						
1	158.06	20.60 0.0%	0.91 0.0%	158.06	20.60 0.0%	0.91 0.0%	0.56	0.56	0.56	N	N	N	N	No increase in flood risk Building is located in flood plain	No site plan available for this site
2	158.6	321.10 5.1%	0.97 2.1%	158.62	239.20 -21.7%	0.99 4.2%	2.69	2.74	2.76	Y	N	n/a Footbridge	N	n/a Footbridge	No action or mitigation required
3	160.15	171.50 1.3%	2.01 0.0%	160.21	186.30 10.0%	2.07 3.0%	0.7	0.71	0.77	N	N	n/a Footbridge	N	n/a Footbridge	No action or mitigation required
4	161.15	187.20 4.4%	2.16 1.9%	161.14	184.30 2.8%	2.14 0.9%	1.49	1.53	1.52	N	N	n/a Footbridge	N	n/a Footbridge	No action or mitigation required
5	166.24	171.50 1.3%	0.34 0.0%	166.3	186.30 10.0%	0.36 5.9%	4.23	4.24	4.3	N	N	n/a Footbridge	N	n/a Footbridge	No action or mitigation required
6	166.27	171.50 1.3%	0.50 0.0%	166.34	186.30 10.0%	0.53 6.0%	3.56	3.57	3.64	N	N	N	N	No increase in flood risk Building is located in flood plain	No site plan available for this site
7	166.31	171.50 1.3%	0.44 0.0%	166.39	186.30 10.0%	0.47 6.8%	0.2	0.21	0.29	N	N	n/a Backyard flooding	N	Impacts homes More detailed analysis required	Have updated flood lines based
8	166.48	171.50 1.3%	0.49 2.1%	166.57	186.30 10.0%	0.51 6.3%	0.57	0.58	0.67	N	N	n/a Backyard flooding	N	Impacts homes More detailed analysis required	Have updated flood lines based
9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Building has been demolished	No action or mitigation required
10	186.92	141.30 8.4%	1.11 4.7%	186.92	141.90 8.9%	1.12 5.7%	0.88	0.92	0.92	N	N	N	N	No increase in flood risk Not accessible to emergency vehicles	
11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Under development	No action or mitigation required
12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Under development	No action or mitigation required
13	190.03	148.40 -2.5%	0.59 -1.7%	190.08	159.90 5.1%	0.62 3.3%	1.64	1.63	1.68	N	N	n/a No driveway	N	Built in valley	
14	190.67	42.00 19.7%	0.79 0.0%	190.75	45.20 28.8%	0.77 -2.5%	0.43	0.59	0.67	Y	N	N	N	No increase in flood risk Not accessible to emergency vehicles	
15	195.8	48.90 -2.8%	0.75 0.0%	195.8	48.90 -2.8%	0.75 0.0%	0.82	0.80	0.80	N	N	N	N	Built in valley More detailed analysis required	No site plan available for this site
18	208.33	23.20 11.5%	0.40 8.1%	208.33	23.20 11.5%	0.40 8.1%	0.47	0.53	0.53	N	N	N	N	No increase in flood risk Not accessible to emergency vehicles	
19	219.80	25.90 0.0%	1.33 0.0%	219.84	28.20 8.9%	1.37 3.0%	0.40	0.4	0.44	N	N	N	N	No increase in flood risk Not accessible to emergency vehicles	
20	223.45	25.90 0.0%	0.15 0.0%	223.46	28.20 8.9%	0.16 6.7%	0.18	0.18	0.19	N	N	N	N	No increase in flood risk Accessible to emergency vehicles	
21	224.40	42.90 0.0%	0.98 0.0%	224.41	43.80 2.1%	0.98 0.0%	0.20	0.2	0.21	N	N	Y	N	No increase in flood risk Accessible to emergency vehicles	No action or mitigation required
22	168.28	187.20 4.4%	0.58 3.6%	168.26	184.30 2.8%	0.57 1.8%	0.05	0.08	0.06	N	N	n/a Backyard flooding	N	Culverts modeled larger in previous model	Have updated flood lines based on grading plan
23	203.71	144.70 -3.8%	1.29 -1.5%	203.80	155.30 3.3%	1.31 0.0%	0.65	0.61	0.70	N	N	n/a No driveway	N	Built in valley	

RAINBOW CREEK UPDATE STUDY
Flood Evaluation Matrix - Flood Vulnerable Structures

Flood Vulnerable Structures (FVSs)	Location	Identified by			Description / Notes	Elevation at which flooding starts (Ground elevation)	Starts Flooding at Storm Event			Exceeds Emergency Vehicle Threshold			Original Regional WS elevation	Updated Regional WS elevation	Updated Regional flow	Updated Regional Velocity
		1989 Rainbow Creek Master Plan Update	TRCA shape file of flood vulnerable site (Site_ID)	CEG preliminary flood analysis			2012	2031	2051	2012	2031	2051				
						(m)							(m)	(m)	(m^3/s)	(m/s)
24	9751 McGillivray Rd, north of Rutherford Rd	Flood Susceptible Site #3 and Historic Flooding Site #1	2298		House located south of a storage yard for shipping containers. The creek has been filled in and realigned by the property owner. As a result, the entire property is located within the floodplain	196.00	2 yr	2 yr	2 yr	2 yr	5 yr	5 yr	197.59	197.58	31.50	0.15
25	CP Railway east of McGillivray Rd		2297		Railway crossing	197.00	100 yr	Regional	Regional	n/a Railway	n/a Railway	n/a Railway	197.57	197.57	31.50	0.10
26	9751 McGillivray Rd, north of Rutherford Rd		2299		Storage yard for shipping containers, with several small office and storage buildings located within the property. The creek has been filled in and realigned by the property owner. As a result, the entire property is located within the floodplain	196.60	50 yr	Regional	Regional	100 yr	Regional	Regional	197.59	197.58	31.50	0.15
27	CP Railway east of McGillivray Rd		2296		Railway crossing	195.67	Regional	Regional	Regional	n/a Railway	n/a Railway	n/a Railway	196.05	196.02	35.10	0.06
28	CP Railway north of McGillivray Rd			x	Railway crossing	201.20	Does not flood	Regional	Regional	n/a Railway	n/a Railway	n/a Railway	200.56	200.51	31.50	1.53
Site in Brampton	West of Hwy 50 on West Rainbow Creek	Flood Susceptible Site #8			Farm house and building no longer exist	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Site in Brampton	West of Hwy 50 on West Rainbow Creek	Flood Susceptible Site #9			Barn no longer exists	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Sites with no increase in flood risk and no buildings affected - these sites could have improvements but are low priorit

Sites with an increase in flood risk and sites where buildings are flooding - these sites may require mitigation but further study is require

Sites on which flooding is not affecting structures or accessibility - no mitigation is required

Sites which no longer flood in existing of future conditions - no mitigation required

Pedestrian bridges which are built in the flood plain and not required to convey the regional storm - no mitigation required

RAINBOW CREEK UPDATE STUDY
Flood Evaluation Matrix - Flood Vulnerable Structures

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Flood Vulnerable Structures (FVSs)	Regional WS elevation 2031	Regional flow 2031	Regional velocity 2031	Regional WS elevation 2051	Regional flow 2051	Regional velocity 2051	Regional Flooding Depth (mm)			Is there a change in flood magnitude	Has the frequency of flooding increased	Is the a change in accessibility for emergency vehicles	Is there and impact due to increased velocity	Impact	Action required / mitigation
							Existing	2031	2051						
	(m)	(m^3/s)	(m/s)	(m)	(m^3/s)	(m/s)	(m)	(m)	(m)						
24	197.64	38.60 22.5%	0.18 20.0%	197.67	42.20 34.0%	0.19 26.7%	1.58	1.64	1.67	Y	N	N	Y	Property located within the floodplain	No site plan available for this site
25	197.62	38.60 22.5%	0.12 20.0%	197.64	42.20 34.0%	0.13 30.0%	0.57	0.62	0.64	Y	N	n/a Railway	Y	Small increase in flood elevations Decrease in flooding frequency	No action or mitigation required
26	197.64	38.60 22.5%	0.18 20.0%	197.67	42.20 34.0%	0.13 -13.3%	0.98	1.04	1.07	Y	N	N	N	Property located within the floodplain	
27	196.05	42.00 19.7%	0.08 33.3%	196.08	45.20 28.8%	0.08 33.3%	0.35	0.38	0.41	Y	N	n/a Railway	Y	Small increase in flood elevations	No action or mitigation required
28	201.30	38.60 22.5%	0.07 -95.4%	201.37	42.20 34.0%	0.08 -94.8%	No Flooding	0.10	0.17	Y	Y	n/a Railway	N	Site is not flooding under existing conditions and floods with future development	
Site in Brampton	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Building has been demolished	No action or mitigation required
Site in Brampton	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Building has been demolished	No action or mitigation required

Sites with no increase in flood risk and no buildings affected - these sites could have

Sites with an increase in flood risk and sites where buildings are flooding - these sites

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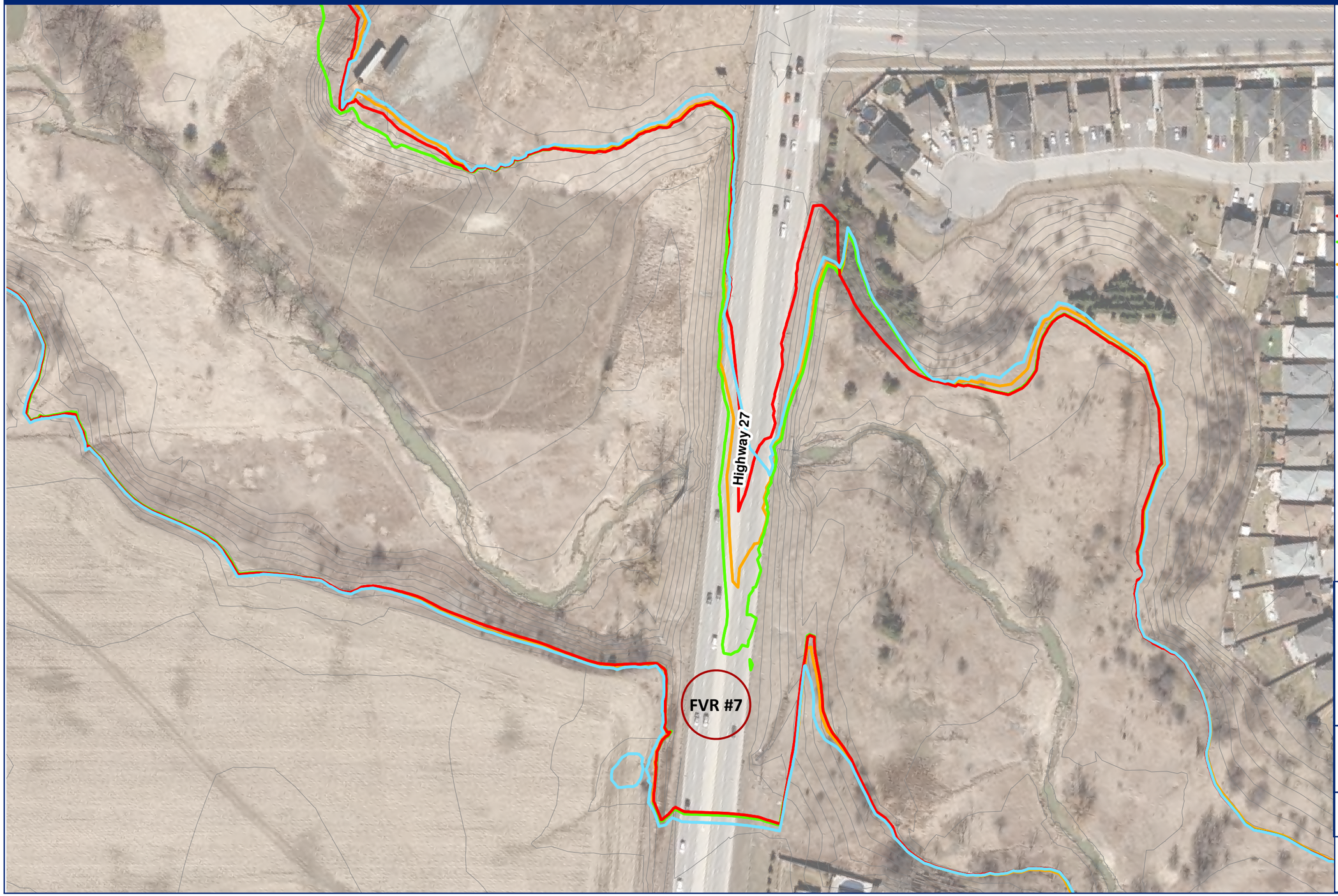
Flood Vulnerable Sites



Legend

- FVR #1 — Flood Vulnerable Areas
- FVS #1 — Flood Vulnerable Structures
- FVA #1 — Flood Vulnerable Roads
- Draft 2011 Floodlines (Block 61W Pre-development)
- Draft 2031 Floodlines
- Draft 2051 Floodlines
- TRCA Approved Floodlines (With New Topography)

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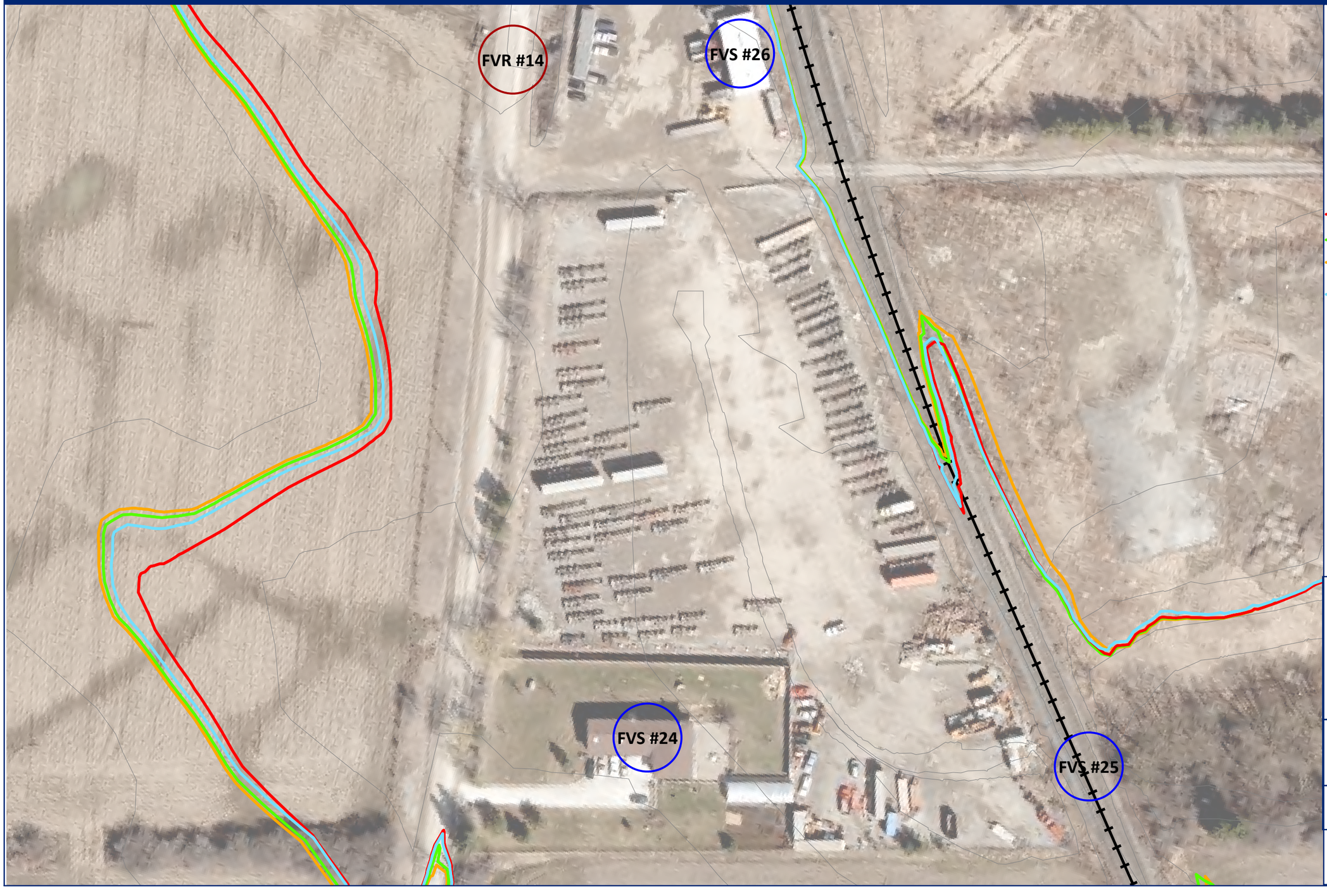
Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Road 7

SCALE 1:1,500
0 5 10 20 30 40 Meters

FIGURE
1

Flood Vulnerable Sites



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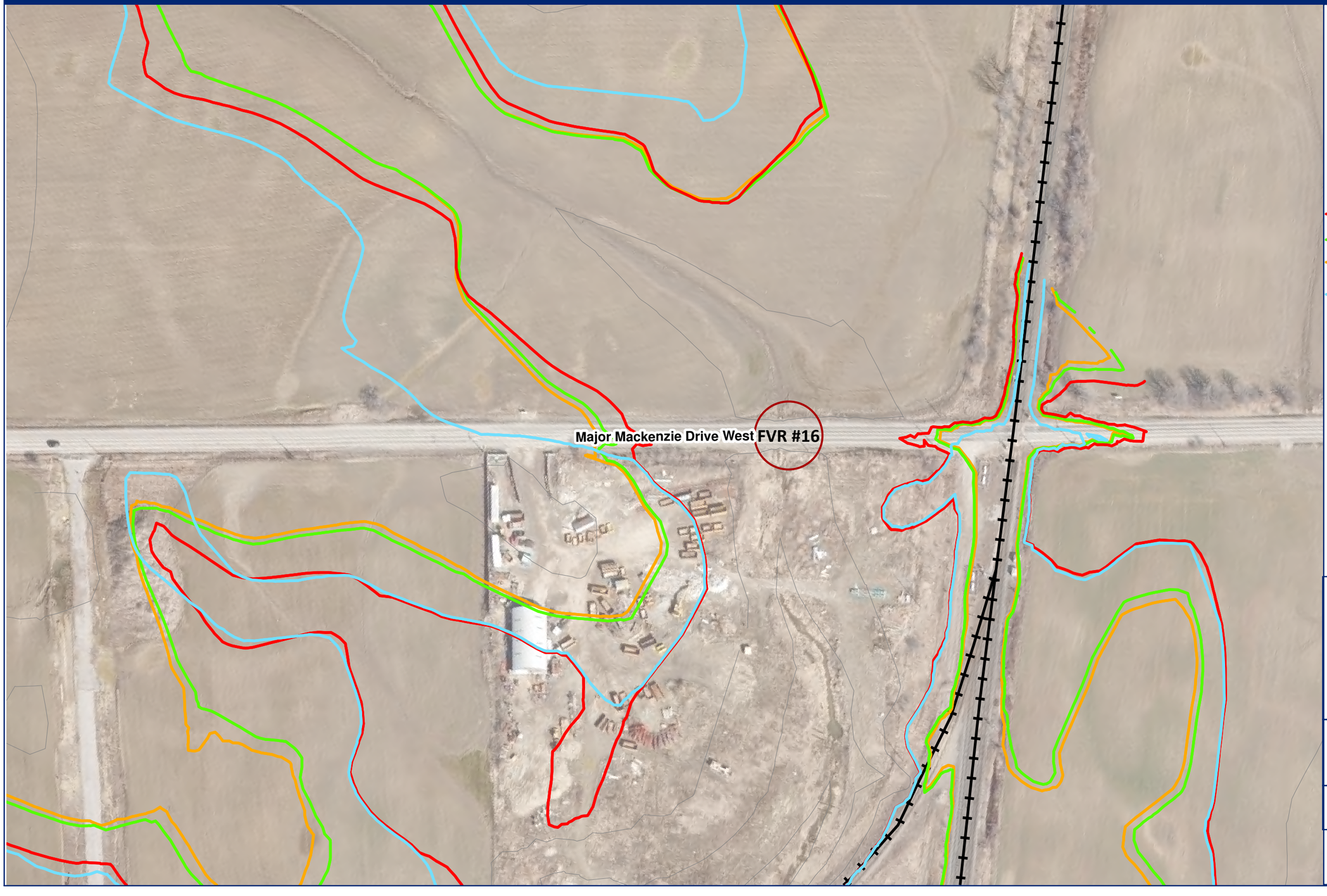
Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Road 14
Flood Vulnerable Structure 24

SCALE 1:1,000
0 3.5 7 14 21 28 Meters

FIGURE
2

Flood Vulnerable Sites



Legend

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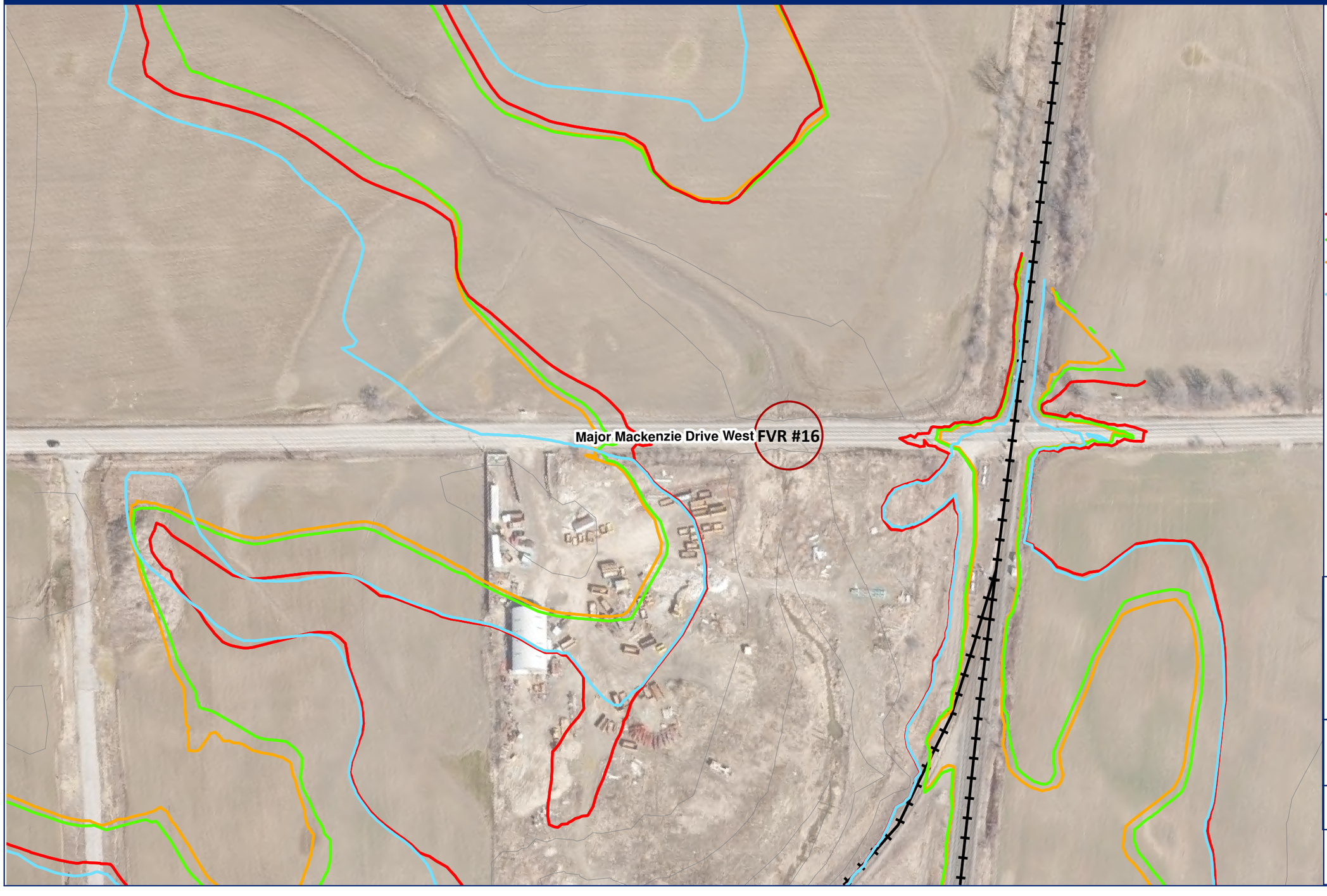
Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Road 16

SCALE 1:1,500
0 5 10 20 30 40 Meters

FIGURE
3

Flood Vulnerable Sites



Legend

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Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Road 24

SCALE 1:1,500
0 5 10 20 30 40 Meters

FIGURE
4

Flood Vulnerable Sites

Legend

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- FVA #1 — Flood Vulnerable Roads
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Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Structure 1

SCALE 1:500
0 1.75 3.5 7 10.5 14 Meters

FIGURE
5

Flood Vulnerable Sites

Legend

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Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Structure 6

SCALE 1:1000
0 3.5 7 14 21 28 Meters

FIGURE
6

Flood Vulnerable Sites

Legend

- FVR #1 — Flood Vulnerable Areas
- FVS #1 — Flood Vulnerable Structures
- FVA #1 — Flood Vulnerable Roads
- Draft 2011 Floodlines (Block 61W Pre-development)
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Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Structure 7

SCALE 1:1000
0 3.5 7 14 21 28 Meters

FIGURE
7

Flood Vulnerable Sites

Legend

- FVR #1 — Flood Vulnerable Areas
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Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Structure 8

SCALE 1:1000
0 3.5 7 14 21 28 Meters

FIGURE
8

Flood Vulnerable Sites

Legend

- FVR #1 — Flood Vulnerable Areas
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Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Structure 13

SCALE 1:750
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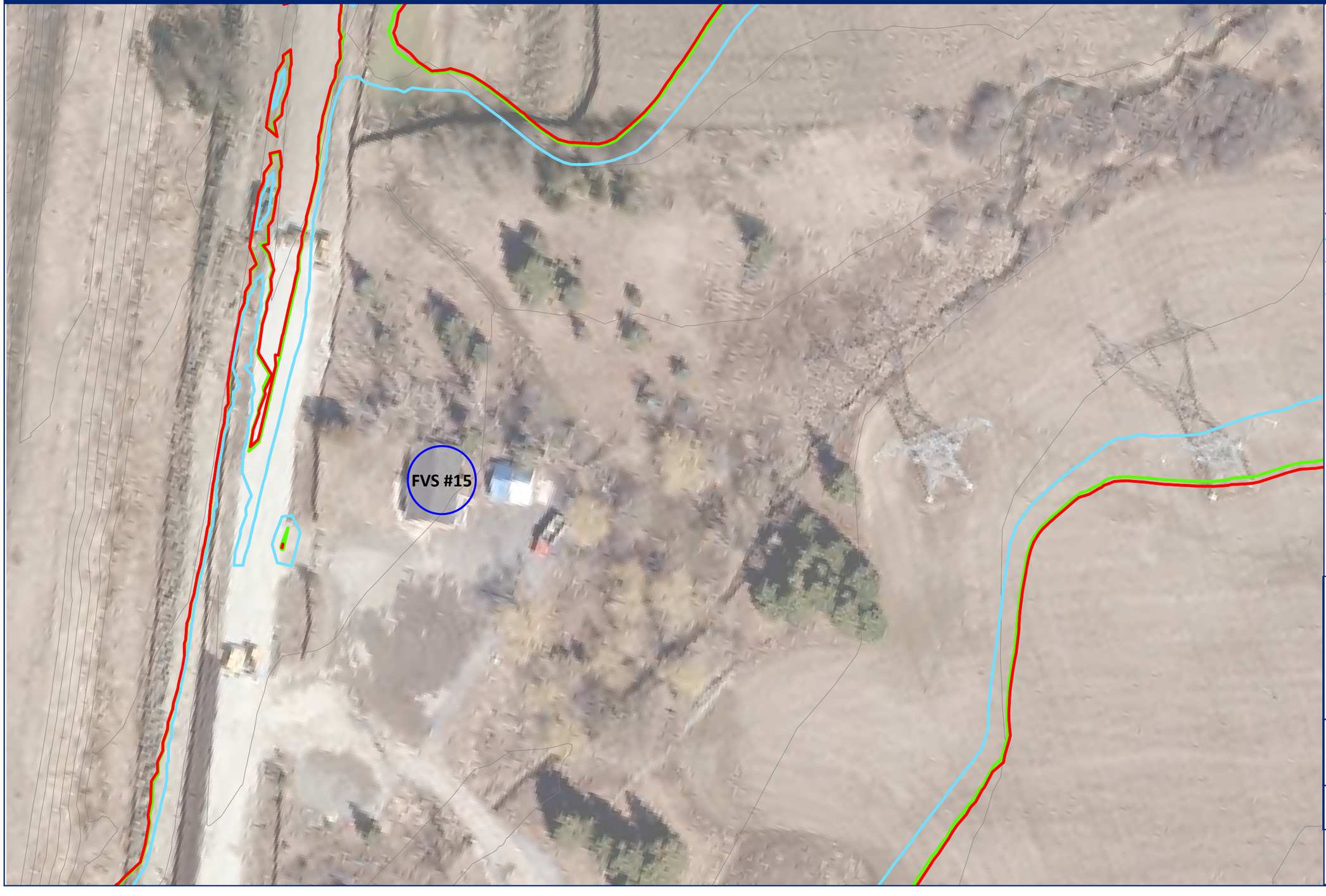
FIGURE
9

Flood Vulnerable Sites



Legend

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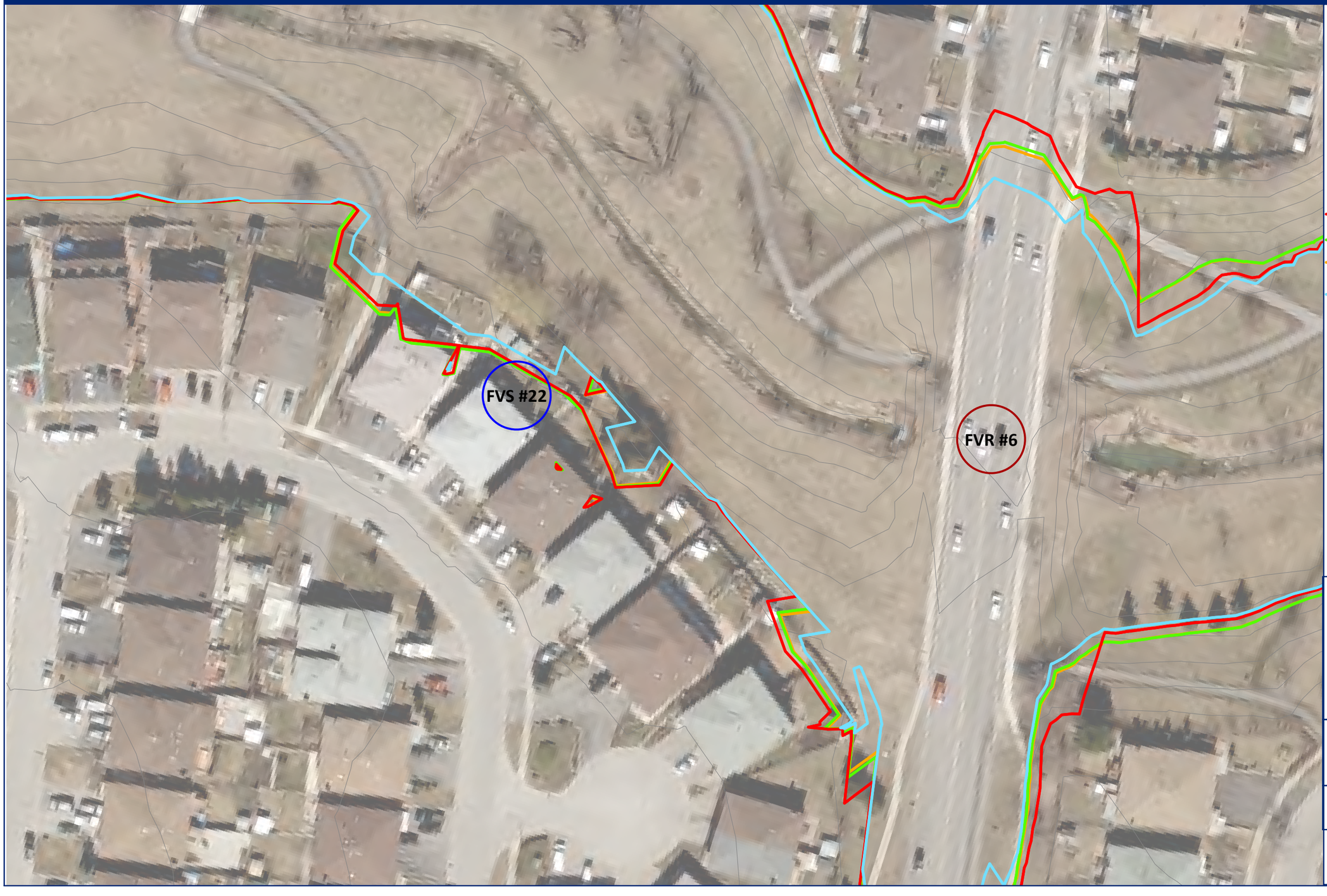
Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Structure 15

SCALE 1:750
0 2.75 5.5 11 16.5 22 Meters

FIGURE
10

Flood Vulnerable Sites



Legend

- FVR #1 — Flood Vulnerable Areas
- FVS #1 — Flood Vulnerable Structures
- FVA #1 — Flood Vulnerable Roads
- Draft 2011 Floodlines (Block 61W Pre-development)
- Draft 2031 Floodlines
- Draft 2051 Floodlines
- TRCA Approved Floodlines (With New Topography)

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Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Structure 22

SCALE 1:750
0 2.75 5.5 11 16.5 22 Meters

FIGURE
11

Flood Vulnerable Sites

Legend

- FVR #1 — Flood Vulnerable Areas
- FVS #1 — Flood Vulnerable Structures
- FVA #1 — Flood Vulnerable Roads
- Draft 2011 Floodlines (Block 61W Pre-development)
- Draft 2031 Floodlines
- Draft 2051 Floodlines
- TRCA Approved Floodlines (With New Topography)

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Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Structure 23

SCALE 1:750
0 2.75 5.5 11 16.5 22 Meters

FIGURE
12

Flood Vulnerable Sites

Legend

- FVR #1 — Flood Vulnerable Areas
- FVS #1 — Flood Vulnerable Structures
- FVA #1 — Flood Vulnerable Roads
- Draft 2011 Floodlines (Block 61W Pre-development)
- Draft 2031 Floodlines
- Draft 2051 Floodlines
- TRCA Approved Floodlines (With New Topography)

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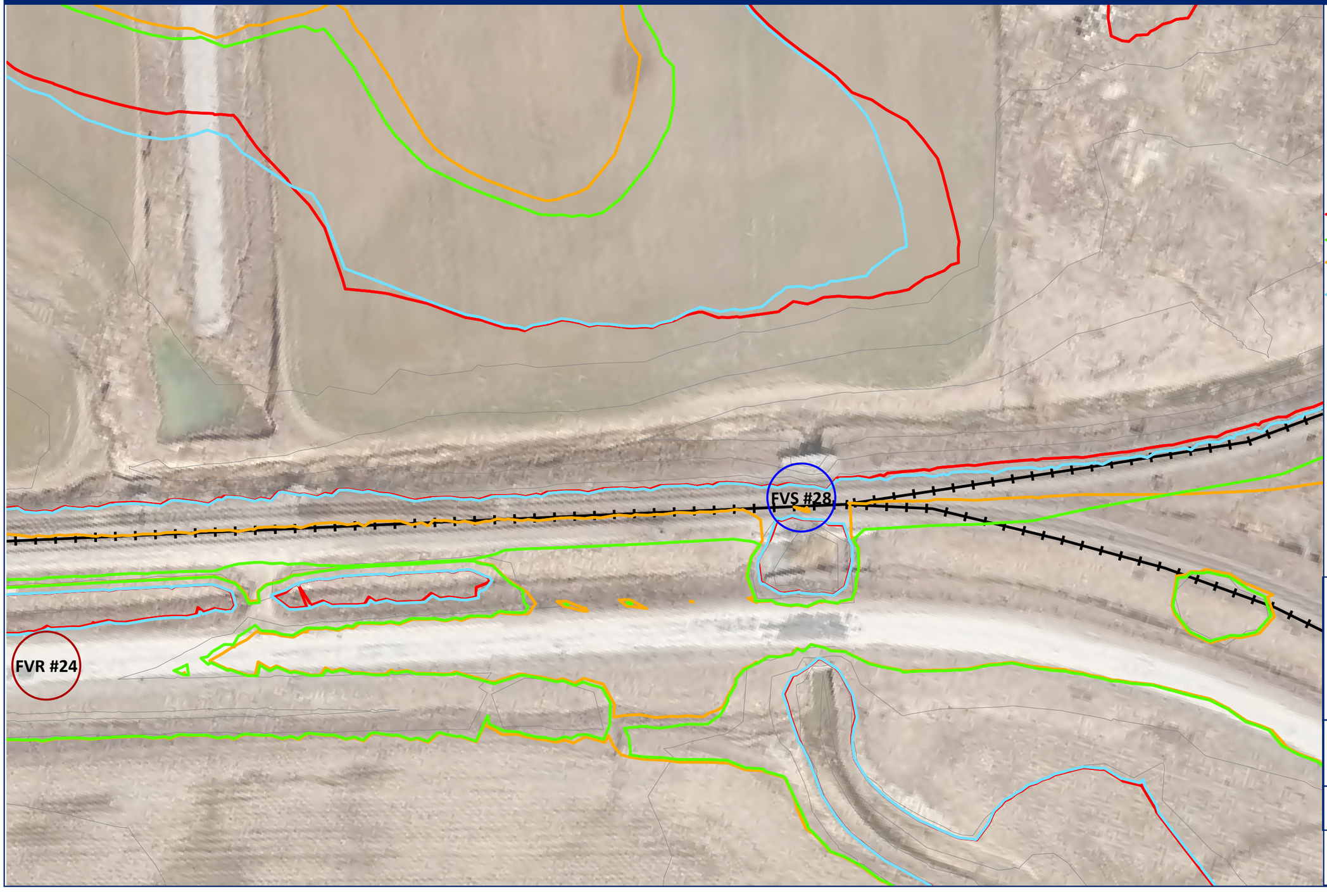
Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Structure 26

SCALE 1:750
0 2.75 5.5 11 16.5 22 Meters

FIGURE
13

Flood Vulnerable Sites



Legend

- FVR #1 — Flood Vulnerable Areas
- FVS #1 — Flood Vulnerable Structures
- FVA #1 — Flood Vulnerable Roads
- Draft 2011 Floodlines (Block 61W Pre-development)
- Draft 2031 Floodlines
- Draft 2051 Floodlines
- TRCA Approved Floodlines (With New Topography)

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Rainbow Creek Subwatershed Update
November 2013

Flood Vulnerable Structure 28

SCALE 1:750
0 2.75 5.5 11 16.5 22 Meters

FIGURE
14

APPENDIX E
Photographs Of Erosion Sites

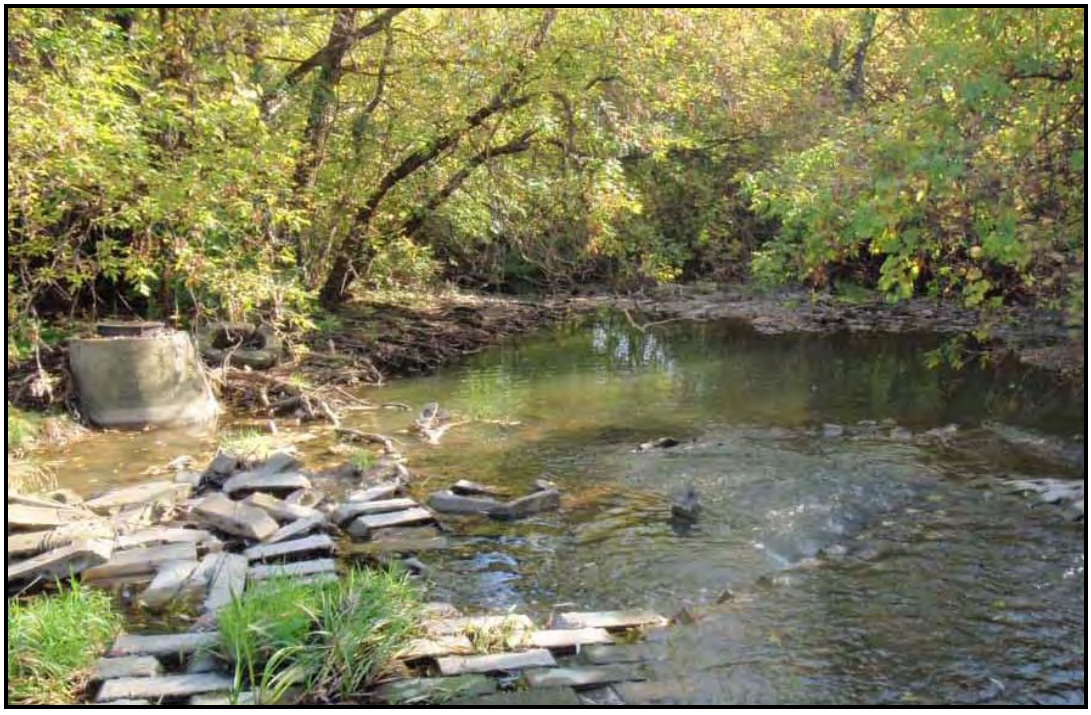
Photograph B1

Photograph B2

Photograph B3

Photograph B4

Photograph B5



Photograph B6

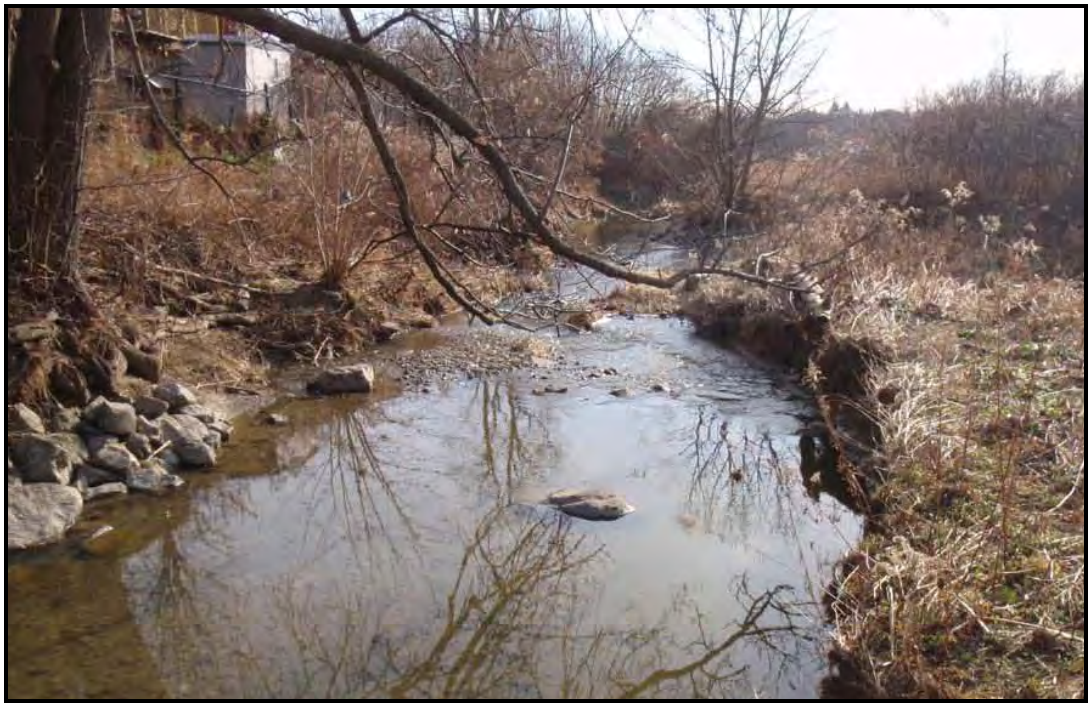
Photograph B7

Photograph B8

Photograph B9

Photograph B10

Photograph B11



Photograph B12

Photograph B13

Photograph B14

Photograph B15

Photograph B16

water's edge
ENVIRONMENTAL SOLUTIONS TEAM LTD.

Rainbow Creek
Vaughan, Ontario

Fluvial Geomorphological and Erosion Assessment Report

December 18, 2012

December 18, 2012
WE 11015

Mr. Mark Bassingthwaite, P. Eng.
Water Resources Engineer, Associate
Cole Engineering Group Ltd.
70 Valleywood Drive,
Markham, Ontario
L3R 4T5

Dear Mr. Bassingthwaite:

RE: Rainbow Creek Fluvial Geomorphological and Erosion Assessment
Vaughan, Ontario

Water's Edge was authorized by Cole Engineering to complete a fluvial and erosion threshold assessment of Rainbow Creek in Vaughan, Ontario.

We have completed our assessment of the creek in accordance with the approved project Terms of Reference. Data sources for the analysis include:

- Aerial photograph of the study area (Google Imagery);
- Physiography of Southern Ontario by Chapman & Putnam (digital data from Ministry of Northern Development and Mines (MNDM));
- Site Inspections and Surveys; and,
- Discussions with Cole Engineering staff.

1.0 EXISTING CONDITIONS

1.1 Channel Geomorphology

The Rainbow Creek watershed is largely located in the City of Vaughan. The creek is a tributary of the East Humber River. The Rainbow Creek watershed consists of various tributaries that originate in mainly agricultural areas above the site and continue through the site before joining the Humber River further to the southeast. The majority of the channel in the Study Area runs through agricultural lands.

Figure 1 presents a 2007 aerial photograph of the site, and the breakdown of reaches, based on imagery obtained from the Toronto & Region Conservation Authority.

Water's Edge inspected the various reaches of Rainbow Creek during various site inspections during Winter and Spring 2012. Each reach was examined using current and historic aerial photographs and by undertaking selective site walks with the intent of identifying critical zones. Subsequently, stream profiles and stream cross sections were surveyed in selected reaches where stormwater management facilities were being considered. At these locations, bankfull characteristics were generally noted along the profile. See Figure 1 for the location of each reach as well as Figure 2 for the location of Threshold analysis cross section locations.

Substrate sampling was also completed at each of the selected cross sections. The substrates are likely sourced from the clay plains which are characteristic of the physiography and Peel Clay soils in this part of York County (see Figure 3). The riffle substrate sizes are noted in Table 1.

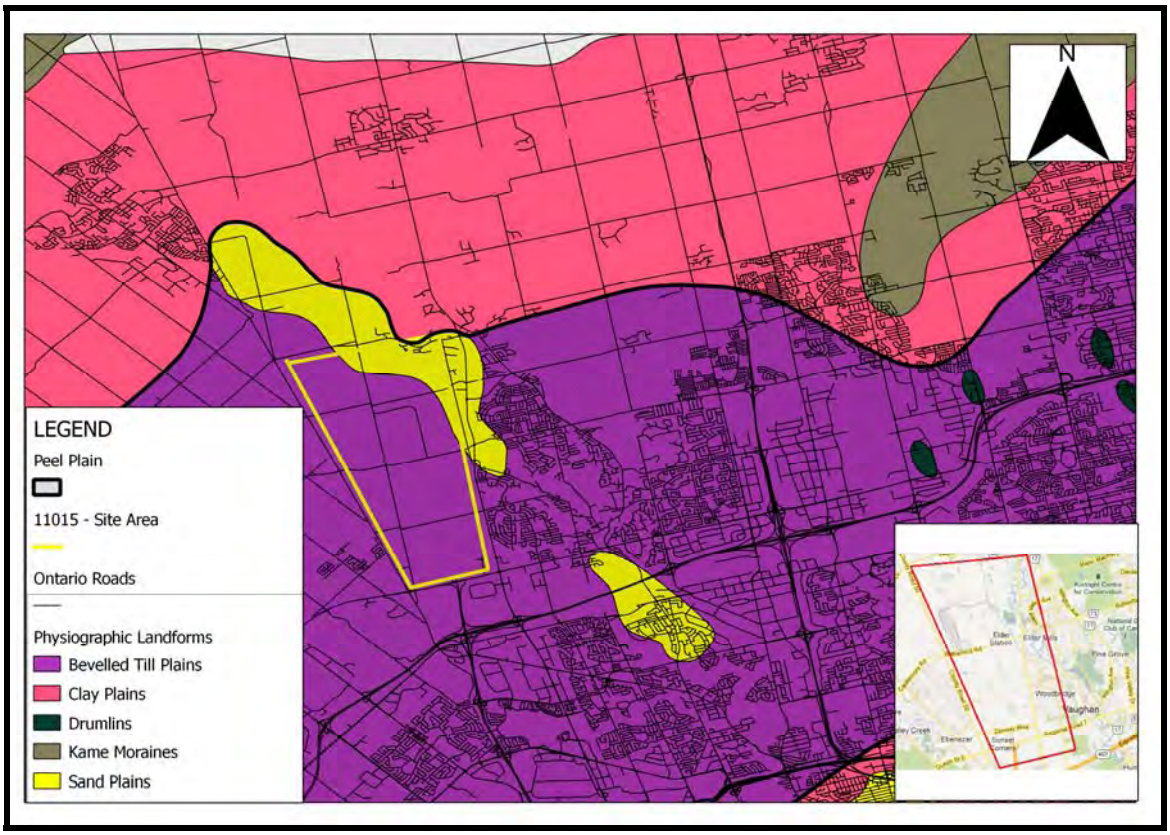


Figure 3: Local Physiography (data from MNDM)

Rapid assessments (Rapid Geomorphic Assessment – RGA and Rapid Stream Assessment Technique- RSAT) were also completed on the various reaches and are discussed in Section 2 and summarized in Table 4.

We have acquired and examined 1954, 1983 and 2007 aerial photography. In general, the channel has had little change to its planform from an aerial perspective. The few changes that have occurred have been due to anthropogenic influences and are not considered in the analysis. The lack of large scale movement or changes in the creeks points to the largely well vegetated banks as well as to the large substrate size in most areas.

Based on our field reconnaissance, desktop analysis and geomorphic survey, various geomorphic parameters were determined for the various reaches present within the study area.

Main Stem Reaches

Main 1, the final reach of Rainbow Creek, is located between the confluence of the East Humber River and Highway 407. The reach is generally well vegetated and it has a sinuosity of 1.21. Photograph A1 details typical reach conditions.

Erosion Issues: This reach has several erosion locations. Erosion is occurring under the Highway 407 Bridge (Photograph B1) where geotextile is causing additional erosion. Bridge transitional flow is likely also the cause of bank erosion immediately downstream of the bridge (Photograph B2). Erosion is also occurring adjacent to the Highway 407 embankment (Photograph B3).

Main 2 is located downstream of Regional Road 7 and upstream of Highway 407. The majority of the reach is within floodplain open space with some residential backing onto the creek (Photograph A2). This reach is well vegetated throughout and it has a high sinuosity of 1.80.

Erosion Issues: This reach has ongoing erosion locations at many outside bends (Photograph B4 is typical). Since these are located within a broad floodplain, the impact of this erosion is minimal. Existing toe protection behind residential units appears to be stable but should be monitored over time (Photograph B5). Downstream of the toe protection is a sanitary crossing. The terrafix protection has failed and is causing ongoing erosion issues (Photograph B6).

Main 3 is upstream of Regional Road 7 and runs through parkland surrounded by residential areas. The entire reach has a terrafix channel and there is little to no vegetation in the riparian zone (Photograph A3). The reach has a low sinuosity of 1.05. There are no erosion issues within this reach.

Main Stem Tributary Reaches

Main Tributary 1 is located south of Highway 407. The reach is a well vegetated and sinuous channel. It is a remnant of the channel upstream of Highway 407 that was previously diverted. It joins directly into the main branch. It has a sinuosity of 1.24. There are no immediate erosion concerns within this reach.

Main Tributary 2 runs along the north side of Highway 407 and is riprap lined channel with a low sinuosity of 1.01. The channel runs from near York Regional Road 27 to the confluence with the main branch just above Highway 407. There are no immediate erosion concerns within this reach.

Main Tributary 3 begins at a large stormwater management pond on the west side of Regional Road 27 and continues to where the riprap begins for MT2. Reach MT3 is a somewhat natural channel with grasses and shrubs in the riparian zone and has a sinuosity of 1.09. There are no immediate erosion concerns within this reach.

Main Tributary 4 extends from Martin Grove Road to Reach MT2 on the north side of Highway 407. MT4 is a natural channel that is well vegetated with an average sinuosity of 1.19. There are no immediate erosion concerns within this reach.

Main Tributary 5 is in an industrial area and runs under Martin Grove Road. It is a highly impacted area and has two online ponds in it. MT5 has a sinuosity of 1.15. There are no immediate erosion concerns within this reach.

West Branch Reaches

West 1 (W1) is a relatively long reach located between Langstaff Road and the upper end of Reach Main 3 (Photograph A4). It flows under Regional Road 27 (Photograph A5). It is generally a well vegetated natural channel that has a high sinuosity at 1.71.

Erosion Issues: This reach is relatively stable. One erosion concerns exists immediately upstream of Highway 27 (Photograph B7) where a high eroding bank contributes excess sediment to the stream. Low bank erosion is also occurring downstream of Langstaff Road but is relatively minor (Photograph B8).

West 2 is located north of Langstaff Road and continues north to the forest block. The reach contains a single thread, sinuous channel. Four riffle cross-sections were surveyed at this site. The channel here is very slightly entrenched and the Width/Depth ratio is very low. The

bankfull slope is relatively low at approximately 0.004 m/m. The general bankfull width is approximately 3.98 m. The channel sinuosity is 1.21. The channel was predominantly covered by gravels and cobbles with a very small percentage of sands. For the purposes of communicating the characteristics of the stream, the reach can be considered a Rosgen E4. Photograph A6 shows typical channel conditions within Reach West 2.

> ***Erosion Issues:*** Bank erosion is occurring at the upper end (Photograph B9), immediately downstream of the old beaver dam (Photograph B10). The channel is actively migrating and causing the bank erosion. The old beaver dam is also causing local erosion at the banks.

West 3 continues northerly from Reach W2 and is a single thread, sinuous channel. Two riffle cross-sections were surveyed at this site. The channel here is moderately entrenched and the Width/Depth ratio is also moderate. The bankfull slope is relatively low at approximately 0.002 m/m. The general bankfull is 4.47 m. The channel sinuosity is 1.21. The channel was predominantly covered by fines such as sands, silt and clay. However, there is a sizeable percentage of gravel. For the purposes of communicating the characteristics of the stream, the reach can be considered a Rosgen B5c. Photograph A7 shows typical channel conditions within Reach West 3.

> ***Erosion Issues:*** Erosion is occurring at various locations within the reach, primarily at outside bends (Photograph B11). Erosion is largely due to moderate channel entrenchment.

West 4 (W4) continues upstream from Reach West 4 and is a single thread, sinuous channel. The channel has been historically straightened but is slowly naturalizing over time. Three riffle and three pool cross-sections were surveyed at this site. The channel here is very slightly entrenched and the Width/Depth ratio is very low. The bankfull slope is relatively low at approximately 0.004 m/m. The general bankfull width ranges from 1.98 m to 2.15 m. The channel sinuosity is 1.21. The channel was predominantly covered by sand and gravel with a small percentage of silts and clay. For the purposes of communicating the characteristics of the stream, the reach can be considered a Rosgen E5. Photograph A8 shows typical channel conditions within Reach West 4. This reach is relatively stable and there are no erosion areas of concern.

West 5 (W5) is located upstream of Reach West 4 to the easterly limits of the existing transfer yard. The entire reach is a cattail wetland area with numerous wetland channels. It is a well vegetated, natural channel that has a sinuosity of 1.11. Typical channel conditions can be seen in Photograph A9. There are no erosion areas of concern.

West 6 (W6) is a drainage channel that runs through a train yard between Major Mackenzie Drive and Huntington Road.

West 7 (W7) begins at County Road 50 and continues downstream to Major Mackenzie Drive (W6). It is a highly altered channel that mostly flows through agricultural fields that offer little or no riparian buffer (Photograph A10). From two cross sections that were surveyed on this reach the following information was noted. The bankfull slope of the channel is 0.0041 m/m. The channel has an average bankfull width of 6 metres and also has a low Width/Depth ratio while not being entrenched. It has a low sinuosity of 1.04 because it has generally been straightened for agricultural purposes. This reach has a particle size D50 of 0.21 mm. and can be classified as a Rosgen C5. No areas of erosional concern are present within this reach.

West Branch Tributary Reaches

West Tributary 1 branches north off of Reach M3. The channel is highly urbanized and is surrounded by residential on all sides. The majority of the channel is lined with terrafix. It has a sinuosity of 1.05. There are no areas of immediate erosion concern.

West Tributary 2 (WT2) continues east from Huntington Road before it joins into Reach West 2. The reach is a single thread channel with a sinuosity of 1.08. The reach is well vegetated and has similar channel characteristics as Reach West 2. There are no areas of erosion concern. See Photograph A11.

West Tributary 3 (WT3) is located east of County Road 50 to Huntingdon Road within an area that is being actively developed (see Photograph A12 and A13). The reach contains several online ponds but the creek is generally well vegetated with a sinuosity of 1.04. There are no areas of immediate erosion concern.

East Branch Reaches

East 1 (E1) is located between Langstaff Road and Reach M3 (just upstream of the confluence with the West Branch). It is a well vegetated reach with an average sinuosity of 1.26. It is surrounded by residential and industrial areas (Photograph A14). The channel appears to be moderately entrenched at times.

Erosion Issues: This reach has several erosion locations, primarily at outside bends along the reach (Photographs B12 and B13). This is partly due to the relatively narrow corridor at times but also to moderate channel entrenchment and local pedestrian traffic. Bank erosion is also occurring at the old weir located downstream of Woodbridge Ave.

East 2 (E2) starts at York Regional Road 27 and continues until it reaches reach E1 at Langstaff Road (Photographs A15 and A16). Reach East 2 is generally a natural channel with a good riparian buffer. Reach sinuosity is 1.50. No areas of immediate erosion concern were noted within this reach.

East 3 is a single thread, sinuous channel that continues upstream from York Regional Road 27. The reach had a pond built on it prior to 1983 that has since been bypassed. The channel here is slightly entrenched and the Width/Depth ratio is low. The bankfull slope is relatively low at approximately 0.006 m/m. The general bankfull width is 3.26 m. The channel sinuosity is 1.19. The channel was predominantly covered by gravel and cobbles and some sand. For the purposes of communicating the characteristics of the stream, the reach can be considered a Rosgen E4. Photograph A17 shows typical channel conditions within Reach East 3.

There are no immediate erosion concerns within this reach.

East 4 is a single thread, sinuous channel. The channel here is slightly entrenched and the Width/Depth ratio is low. The bankfull slope is relatively low at approximately 0.006 m/m. The general bankfull width is 5.29 m. The channel sinuosity is 1.19. The channel was predominantly covered by gravel and cobbles and some sand. For the purposes of communicating the characteristics of the stream, the reach can be considered a Rosgen E4. Photograph A18 shows typical channel conditions within Reach East 4.

Erosion Issues: This reach has several erosion locations, primarily at outside bends along the reach (Photograph B14).

East 5 extends upstream from Reach E4 under Rutherford Road to just west of McGillivray Road. The average bankfull width for this reach is 1.44 metres and the average depth is 0.20 metres. The channel is only slightly entrenched. The sinuosity is normal at 1.09 and the bankfull slope is relatively low at 0.0064 m/m. The riparian zone for this reach is generally well vegetated with large trees and grasses. The particle distribution for reach east 3 is sand and gravel. This reach is classified as a Rosgen E4 channel. Photograph A19 shows typical channel conditions within Reach East 5.

> ***Erosion Issues:*** This reach is relatively stable and has only a few minor erosion locations, primarily at outside bends along the reach (Photograph B15).

East 6 is located west of McGillivray Road. It is a short reach that is generally vegetated and has a sinuosity of 1.26. However, this reach has several on-line ponds.

East 7 passes through a forested area between McGillivray and Huntington Road. It has a sinuosity of 1.15.

East 8 begins east of Huntington Road and continues downstream to the forest area of Reach E7. There is a large online pond in the reach but the majority of it is a highly sinuous channel that is sparsely vegetated (Photograph A20). The area has been actively grazed over time.

> ***Erosion Issues:*** This reach is has had extensive cattle grazing over time which has caused bank instability (Photograph B16). The pond and its outlet have also created some erosion problems (Photograph B17).

East 9 extends from Major Mackenzie Drive to Huntington Road. It also passes underneath a railway track just south of Major Mackenzie Drive. It is natural channel that has a good riparian buffer and has a sinuosity of 1.39. There are no immediate erosion concerns within this reach.

East 10 is located north of Major Mackenzie Drive. Reach E10 is a relatively natural channel with a thin riparian buffer of large trees. It has a sinuosity of 1.16. There are no immediate erosion concerns within this reach.

East 11 is located within a large forested area and is a natural channel (Photograph A21). One cross section was surveyed in this reach and the following was noted. The entrenchment ratio is low while the Width/Depth ratio is high. The bankfull width is 8.24 m. and the bankfull slope is 0.0032 m/m. This reach has a sinuosity of 1.39. Erosion Threshold cross section 3 is located in this reach. The channel substrate in this reach was a D50 of 23.9 mm which is a predominantly gravel bed stream. This data classifies this reach as a Rosgen C4.

East 12 extends south of Nashville Road to Reach E11. It is a natural channel with a sinuosity of 1.27 (Photograph A22). The reach is well vegetated with good riparian buffers. Two cross sections were surveyed in this reach and the following was noted. The channel is not entrenched within the floodplain and the Width/Depth ratio is very low. The bankfull slope for the reach is 0.0046 m/m while the bankfull width of the channel is approximately 2.5 m. Channel substrate was mostly sands with some silts and gravels as well. This channel is classified as a Rosgen E5. This reach contains Erosion Threshold cross section 1.

East 13 is located north of Nashville Road and generally flows through agricultural fields. It has been straightened in its past and has little riparian vegetation. Reach E13 has a sinuosity of 1.23. There are no immediate erosion concerns within this reach.

East 14 starts at Cold Creek Road and continues until it joins into reach E13. It has a high sinuosity at 1.40. The reach has a good riparian zone vegetated with grasses and shrubs. There are no immediate erosion concerns within this reach.

East Branch Tributary Reaches

East Tributary 1 (ET1) originates from a pond that was created sometime between 1954 and 1983. This reach is a small single thread channel that is completely covered by grasses (Photograph A23). The channel joins into the East branch at reach E3. One cross section was surveyed in this reach and the following was noted. The channel here is slightly entrenched and the Width/Depth ratio is low. The bankfull slope is relatively low at approximately 0.008 m/m. The general bankfull width is 1.55 m. The channel sinuosity is 1.11. The channel substrate was predominantly covered by fines (sand, silt and clay). For the purposes of communicating the characteristics of the stream, the reach can be considered a Rosgen E5. Photograph 7 shows typical channel conditions within Reach East Tributary 1 (see Appendix A).

East Tributary 2 (ET2) is a single thread, sinuous channel. This channel joins into Reach East 3 approximately 140 metres south of Rutherford Road. Two riffle cross-sections were surveyed at this site. The channel here is slightly entrenched and the Width/Depth ratio is low. The bankfull slope is relatively low at approximately 0.008 m/m. The general bankfull width ranges from 1.55 m to 3.49 m. The channel sinuosity is 1.11. The channel was predominantly covered by fines (sand, silt and clay). For the purposes of communicating the characteristics of the stream, the reach can be considered a Rosgen E6. Photograph 8 shows typical channel conditions within Reach East Tributary 2.

East Tributary 3 is located east of McGillivray Road. The reach passes through agricultural land as well as crossing the railway tracks on two occasions (Photograph A24). Five cross sections were surveyed in this reach. The reach has a bankfull slope of 0.0031 m/m and a bankfull width of approximately 4 metres. The channel has a mean bankfull depth of 0.30 m. The channel in this reach has a high Width/Depth ratio at 15 and the channel is not entrenched. It has a sinuosity of 1.05. There are no immediate erosion concerns within this reach.

East Tributary 4 is a drainage ditch that flows alongside the railway tracks on the east side of McGillivray Road. It has a low sinuosity. There are no immediate erosion concerns within this reach.

East Tributary 5 is located in a culvert that passes under McGillivray Road and outlets downstream of the railroad tracks. Erosion is not an issue in this reach.

East Tributary 6 is located in an agricultural field and begins at McGillivray Road and continues northerly to the confluence of Reaches ET7 and ET8 (Photograph A25). Six cross sections were surveyed in this reach and the following was noted. The bankfull slope is 0.005 m/m and the general bankfull width is 4.13 m. The Width/Depth ratio for the reach is 35.1. The reach's particle size D50 is 0.26 mm. There is no riparian zone and it is a highly eroding reach with a sinuosity of 1.15. This reach is classified as a C5. Reach ET6 contains Erosion Threshold cross section 6. There are no immediate erosion concerns within this reach.

East Tributary 7 is located north of McGillivray Road and starts at the confluence with Reach ET8. The creek travels northeasterly and passes under Major Mackenzie Road. The reach is located mainly in agricultural fields that have little in the way of vegetation and riparian buffer. The channel has been largely straightened over time. Reach E7 has a sinuosity of 1.09. There are no immediate erosion concerns within this reach.

East Tributary 8 characteristics are similar to that of Reach ET7. The reach begins at the confluence with ET7 and continues northwesterly through agricultural fields and passes under Huntington Road and Major Mackenzie Drive. The entire reach is in agricultural fields which provide no vegetation. The sinuosity is 1.09. There are no immediate erosion concerns within this reach.

East Tributary 9 is located in a forested valley and begins at the confluence with E11. The reach is well vegetated and has a sinuosity of 1.04. The upper end of the reach is a large driveway culvert. There are no immediate erosion concerns within this reach.

East Tributary 10 is located in a forested valley and is north of ET9 (Photograph A26). There were 2 cross sections that were surveyed in this reach and the following was noted. The reach has an average bankfull of 2.99 m. and an average bankfull depth of 0.39 m. while the bankfull slope is .0047 m/m. The reach is only slightly entrenched and it has a sinuosity of 1.13. The Width/Depth ratio is 8.49. This reach's channel is classified as an E5. There are no immediate erosion concerns within this reach. This reach contains Erosion Threshold cross section 2.

East Tributary 11 extends from Nashville Road, flowing through agricultural fields, to Reach ET9. There is very little vegetation on this reach and it has a low sinuosity of 1.06. There are no immediate erosion concerns within this reach.

East Tributary 12 is at the north end of this branch of Rainbow Creek and is on the north side of Nashville Road. It flows through an agricultural field and has a predominantly grassed riparian zone with minimal width. It has a sinuosity of 1.02. There are no immediate erosion concerns within this reach.

East Tributary 13 begins east of County Road 50 and continues until its confluence with Reach ET11. It flows through an agricultural field which offers no structure or riparian buffer. It has a sinuosity of 1.07. There are no immediate erosion concerns within this reach.

East Tributary 14 begins on the east side of Cold Creek Road and flows through agricultural fields, with little riparian buffer, until it ends at Reach E14. It has a low sinuosity of 1.09. There are no immediate erosion concerns within this reach.

Figures 1C to 10C detail the partial longitudinal profiles of each reach. Figures 1D to 10D detail the representative cross sections from each reach (see respective appendices for figures). Table 1 presents a summary of the field work results and our analyses where detailed fieldwork was undertaken in Rainbow Creek reaches.

Table 1A: Summary of Geomorphic Parameters

Reach/Parameter	West 2	West 3	West 4	West 7	East 3	East 4	East 5
Bankfull Width (m)	3.98	4.47	1.98	6.12	3.26	5.29	1.44
Bankfull Depth (m)	0.56	0.28	0.32	0.12	0.41	0.24	0.20
Width-Depth Ratio	4.46	17.5	7.23	52.11	10.60	22.04	6.94
Entrenchment Ratio	5.41	1.73	4.04	4.12	3.47	1.81	7.16
Bankfull Slope (m/m)	0.0041	0.0022	0.0038	0.0041	0.0058	0.0061	0.0064
Sinuosity	1.21	1.21	1.21	1.04	1.19	1.19	1.09
Substrate D_{16} (mm)	6.76	0.05	0.11	0.06	8.97	5.7	0.43
Substrate D_{50} (mm)	64.00	0.21	1.28	0.21	43.43	21.28	14.38
Substrate D_{84} (mm)	199.74	2.74	9.73	2.74	79.18	84.43	54.3
Rosgen Classification	E4	B5c	E5	C5	E4	B4c	E4

Table 1B: Summary of Geomorphic Parameters

Reach/Parameter	East 11	East 12	East T1	East T2	East T3	East T6	East T10
Bankfull Width (m)	8.24	2.52	1.55	2.52	4.39	4.13	2.99
Bankfull Depth (m)	0.34	0.65	0.55	0.24	0.30	0.20	0.39
Width-Depth Ratio	24.24	3.51	6.94	10.40	15	35.1	8.49
Entrenchment Ratio	5.12	15.16	7.23	4.50	7.51	8.35	3.43
Bankfull Slope (m/m)	0.0032	0.0046	0.0081	0.0076	0.0031	0.0057	0.0047
Sinuosity	1.39	1.27	1.11	1.11	1.05	1.15	1.13
Substrate D_{16} (mm)	0.42	0.06	0.02	0.01	0.02	0.06	0.07
Substrate D_{50} (mm)	23.9	0.25	0.11	0.04	0.09	0.26	0.9
Substrate D_{84} (mm)	52.88	3.18	1.3	0.22	0.83	0.54	3.75
Rosgen Classification	C4	E5	E5	E6	C5	C5	E5

2.0 RAPID FIELD ASSESSMENTS

2.1 Rapid Stream Assessment Technique

One of the most complete multi-parameter measures of stream conditions and field-tested is the Rapid Stream Assessment Technique, developed by John Galli and other staff of the Metropolitan Washington (DC) Council of Governments (Galli and others, 1996). The RSAT systematically focuses on conditions reflecting aquatic-system response to watershed urbanization. It groups those responses into six categories, presumed to adequately evaluate the conditions of the stream system at the time of measurement on a reach-by-reach basis. The six categories are:

1. Channel stability;
2. Channel scouring and sediment deposition;
3. Physical in-stream habitat;
4. Water quality;
5. Riparian habitat conditions; and
6. Biological conditions.

Stream channel stability and cross-sectional characterization is a critical component of RSAT. While normally a 30 metre long channel reach is surveyed at each transect, the RSAT is representative of the entire reach for this study. Signs of instability (such as bank sloughing, recently exposed non-woody tree roots, general absence of vegetation within bottom 1/3 of the bank, recent tree falls, etc.) and channel degradation or downcutting (such as high banks in small headwater streams and erosion around man-made structures) are noted and cross-section measurements are made.

An assessment of soil conditions along the stream banks is also conducted to determine soil texture and potential erodibility of the stream bank. Qualitative water quality measurements are also made (temperature, turbidity, colour and odour) along with an indication of substrate fouling.

The RSAT stream work also typically involves a qualitative sampling and evaluation of benthic organisms. While no formal evaluation of benthic organisms has been conducted, the site is evaluated through observations and the moving of substrate to expose possible species. A comparative scroe is then given for each reach.

Each category is assigned a value which is then summed to provide an overall score and ranking. Table 2 details the range of scores and rankings with a higher score suggesting a healthier system.

Table 2: RSAT Scores with Associated Rankings

RSAT Score	Ranking
41-50	Excellent
31-40	Good
21-30	Fair
11-20	Poor
0-10	Degraded

Within these broad categories, our assessment technique evaluated the stream reach. The results of the RSAT evaluation are presented in Table 4.

2.2 Rapid Geomorphic Assessment

Stream stability has also been assessed using a Rapid Geomorphic Assessment (MOE, 2004). The RGA assessment focuses entirely on the geomorphic component of a stream system. The RGA method consists of four factors that summarize various components of channel adjustment, specifically: aggradation, degradation, channel widening and plan form adjustment. Each factor is

assessed separately and the total score indicates the overall stability of the system. This methodology has been applied to numerous streams and the following table details the ranking criteria (see Table 3).

The results of the Rapid Geomorphic Assessment have been presented in Table 4.

Table 3: Interpretation of RGA Score

Stability Index (SI) Value	Classification	Interpretation
SI ≤ 0.20	In Regime	The channel morphology is within a range of variance for rivers of similar hydrographic characteristics and evidence of instability is isolated or associated with normal river meander processes.
0.21 ≤ SI ≤0.40	Transitional/Stressed	Channel morphology is within a range of variance for rivers of similar hydrographic characteristics but the evidence of instability is frequent.
SI ≥ 0.40	In Adjustment	Channel morphology is not within the range of variance and evidence of instability is wide spread.

Table 4A: Summary of Rapid Stream Assessments

Rapid Field Assessment Method	Reach West 2	Reach West 3	Reach West 4	Reach West 7	Reach East 3	Reach East 4	Reach East 5
RSAT	34	32	25	3	35	37	27
	Good	Good	Fair	V. Poor	Good	Good	Fair
RGA	0.28	0.41	0.35	0.34	0.45	0.19	0.31
	Transitional	In Adjustment	Transitional	Transitional	In Adjustment	In regime	Transitional

Table 4B: Summary of Rapid Stream Assessments

Rapid Field Assessment Method	Reach East 11	Reach East 12	Reach East T1	Reach East T2	Reach East T3	Reach East T6	Reach East T10
RSAT	33	26	16	27	28	5	27
	Good	Fair	Poor	Fair	Fair	V. Poor	Fair
RGA	0.22	0.28	0.29	0.39	0.28	0.38	0.34
	Transitional	Transitional	Transitional	Transitional	Transitional	Transitional	Transitional

3.0 EROSION THRESHOLD DEVELOPMENT

The geomorphic assessment included measurements of channel, bank and bankfull flow characteristics. The survey also provided a measure of the local energy gradient. Detailed information was collected in order to determine erosion thresholds, shear stress and critical discharge values. Erosion thresholds indicate the point at which sustained flows will tend to entrain and transport sediment, specifically the D_{50} of the substrate material.

Using the data collected during the field investigations, related hydraulic parameters were determined. Bed shear stress and critical shear stress were determined at each cross section.

Sand is classified as bed particles that range in size from 0.062 mm to 2 mm. Gravel is classified as substrate that is between 2 mm to 64 mm. These particle distributions are generally what are in the Rainbow Creek Study Area. Boundary shear stresses under bankfull conditions ranged from 4.08 to 11.97 Pa. These values were calculated based on existing site and reach conditions at each threshold location. Critical particle shear stresses were determined to range from 0.95 to 80.49 Pa based on the existing D_{50} particle size present at each threshold location.

Table 5 presents a summary of the threshold analyses. These threshold values are recommended for use in the hydrologic stormwater management modelling.

Table 5: Summary of Erosion Threshold Parameters

SWM Facility # / Parameter	SWM 1	SWM 2	SWM 3	SWM 4/5	SWM 6	SWM 8	SWM 9
Relative Roughness	113.9	68.4	5.9	48.9	436.5	2.9	751.0
Average Bankfull Velocity (m/s)	1.84	1.45	0.77	0.77	1.61	0.53	1.95
Average Shear Velocity u* (m/s)	0.13	0.11	0.11	0.06	0.09	0.10	0.10
Bankfull Flow (m^3/s)	1.98	1.54	2.15	0.68	1.62	0.15	0.64
Froude Number	0.74	0.84	0.42	0.65	0.99	0.38	1.36
Stream Power (W/m)	88.4	72.2	77.6	19.4	56.4	9.1	40.1
Unit Stream Power (W/m^2)	52.6	20.4	9.4	3.1	15.2	6.3	25.9
Average Shear Stress (Pa)	16.2	12.0	11.3	3.8	8.2	9.4	10.4
Critical Shear Stress (Pa)	2.3	2.7	17.4	2.0	0.4	39.6	0.2
Critical Flow (m^3/s)	0.022	0.038	1.522	0.101	0.004	0.150	0.640

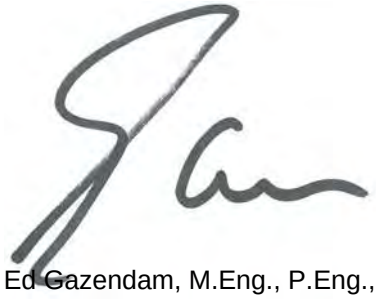
4.0 SUMMARY

Rainbow Creek, a tributary of East Humber River, flows through the Peel Plain physiographic region. The study reaches are located in Vaughan, Ontario.

In order to carry out a fluvial assessment, a geomorphic survey of various stream reaches in the area of interest was carried out. As such, most of the study reaches were determined to show characteristics of a Rosgen E or C channels. Two different assessment tools, viz., RSAT and RGA, were used to assess stream condition. RSAT scores that assess the stream's response to urbanization show that the reaches are mostly in a good or a fair state except for Reaches East Tributary 1 (poor state), West 7 and East Tributary 6 (very poor state). RGA scores indicate that most of the stream reaches, like most urban streams are in a transitional state, i.e., the stream is trying to achieve the state of quasi-equilibrium.

Erosion thresholds flows (see Table 5) were developed for all proposed stormwater management facilities and range from 0.004 to 1.52 m^3/s. It is recommended that these values be used to assist in determining release rates from the proposed stormwater management facilities.

Respectfully submitted,



Ed Gazendam, M.Eng., P.Eng.,
President, Sr. Geomorphologist

Christina Bright, B.A.Sc. (Eng), EIT,
Fluvial Geomorphologist

ATTACHMENTS:

Figure 1:	**Reach Delineation**
Figure 2:	**Site Locations and Erosion Threshold Points**
Appendix A:	**Representative Reach Photographs**
Appendix B:	**Representative Erosion Site Photographs**
Appendix C:	**Profiles of Channel Reaches**
Appendix D:	**Cross Sections of Channel Reaches**

0 250 500 1,000 1,500

Meters

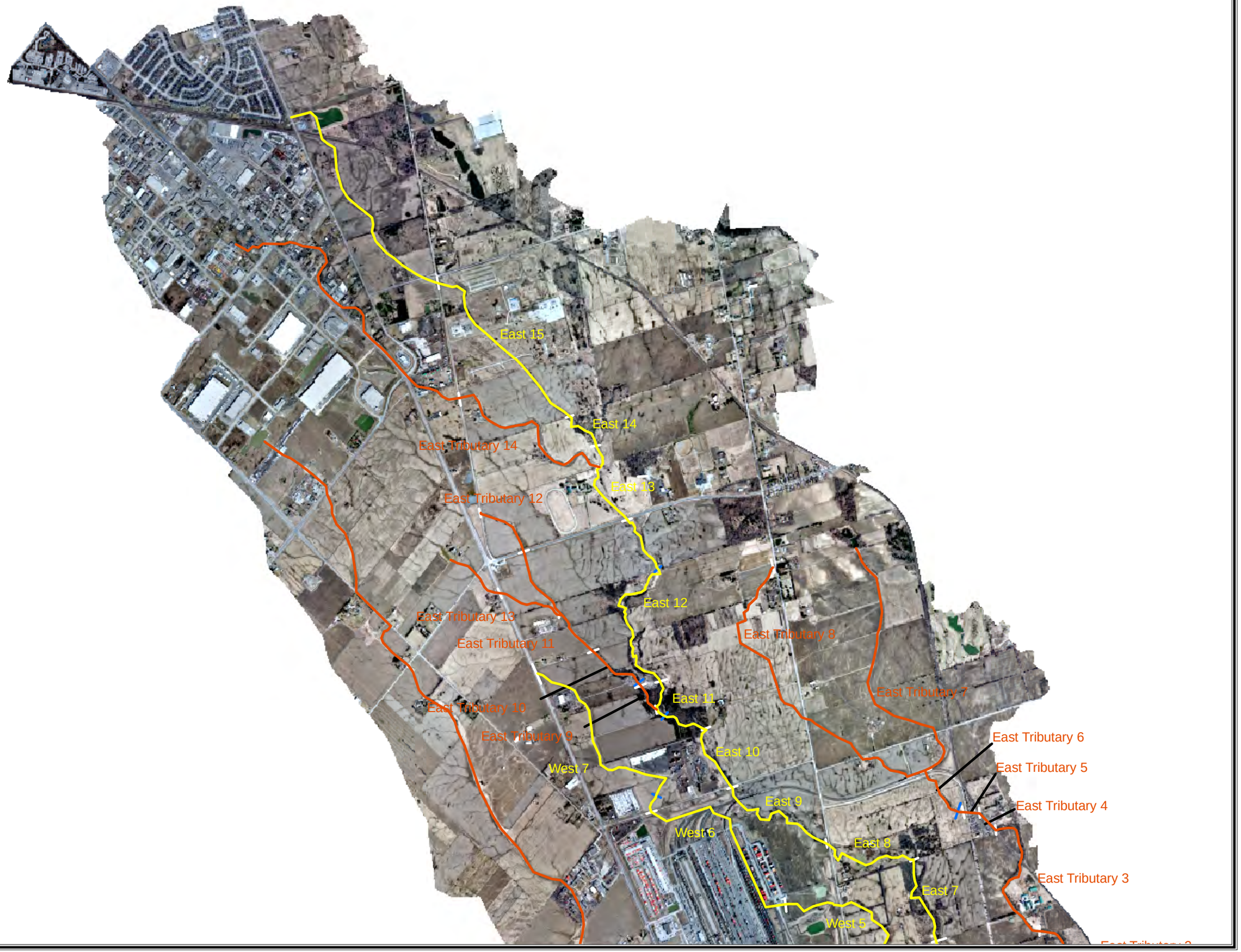
Rainbow Creek

Fluvial Geomorphology Component

Erosion Threshold Cross Section Locations

Checked By:	Figure No.:
EG	1A
Date: August 14, 2012	**Drawn By:** NG

water's edge ENVIRONMENTAL SOLUTIONS TEAM LTD.



0 250 500 1,000 1,500

Meters

Rainbow Creek

Fluvial Geomorphology Component

Erosion Threshold Cross Section Locations

Checked By:	Figure No.:
EG	1B
Date:	**Drawn By:**
August 14, 2012	NG

water's edge ENVIRONMENTAL SOLUTIONS TEAM LTD.

0 50 100 200 300 400

Meters

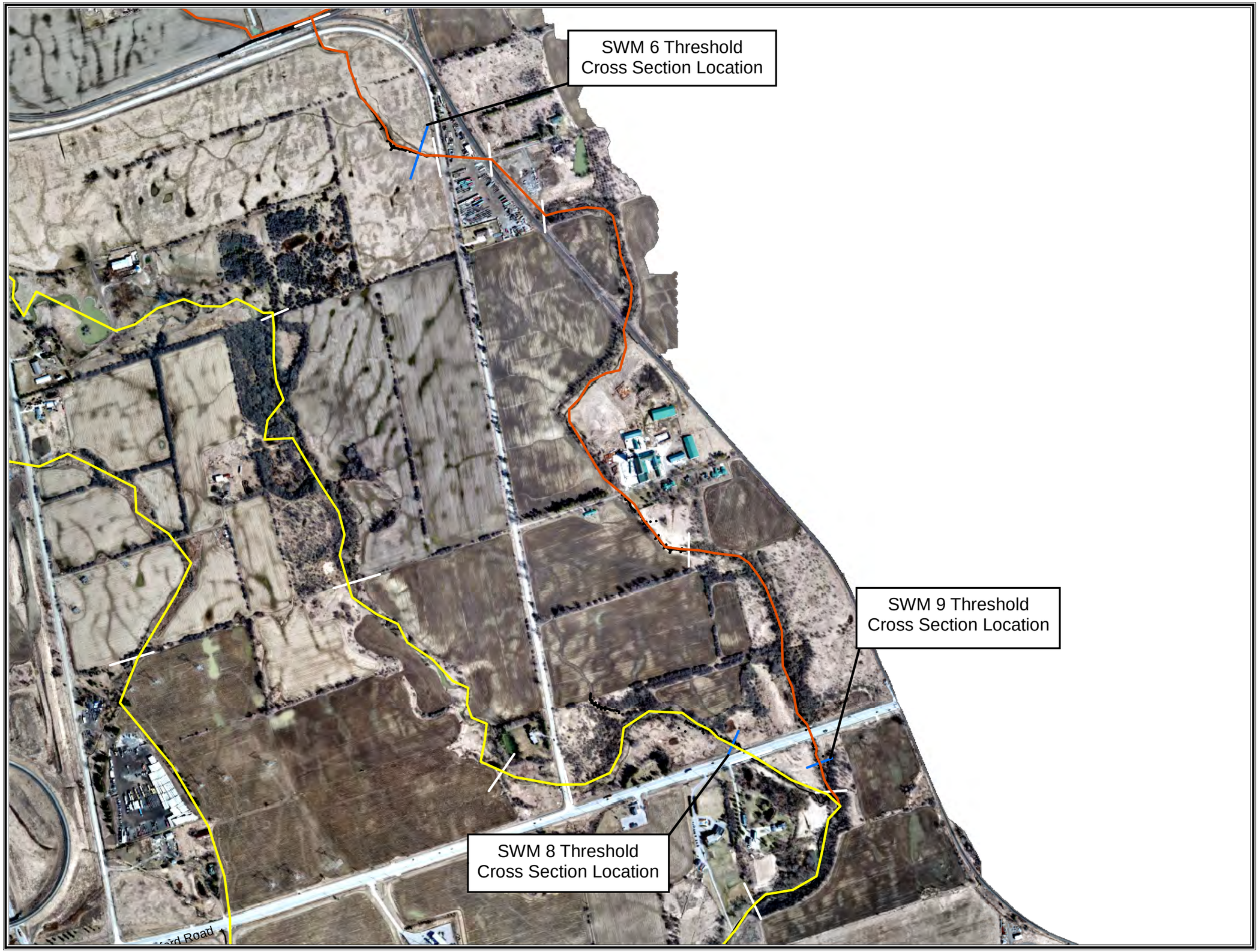
Rainbow Creek

Fluvial Geomorphology Component

Erosion Threshold Cross Section Locations

Checked By: EG	Figure No.: 2A
Date: August 14, 2012	Drawn By: NG

water's edge
ENVIRONMENTAL SOLUTIONS TEAM LTD.



0 50100 200 300 400

Meters

Rainbow Creek

Fluvial Geomorphology Component

Erosion Threshold Cross Section Locations

Checked By: EG	Figure No.: 2B
Date: August 14, 2012	Drawn By: NG

water's edge
ENVIRONMENTAL SOLUTIONS TEAM LTD.

APPENDIX A:

Representative Reach Photographs

Rainbow Creek, City of Vaughan

PHOTOGRAPH NO.: A1
FROM:
LOOKING:
COMMENT: Reach Main 1

PHOTOGRAPH NO.: A2
FROM:
LOOKING:
COMMENT: Reach Main 2

PHOTOGRAPH NO.: A3
FROM:
LOOKING:
COMMENT: Reach Main 3

PHOTOGRAPH NO.: A4
FROM:
LOOKING:
COMMENT: Reach West 1

PHOTOGRAPH NO.: A5
FROM:
LOOKING:
COMMENT: Reach West 1

PHOTOGRAPH NO.: A6
FROM:
LOOKING:
COMMENT: Reach West 2

PHOTOGRAPH NO.: A7
FROM:
LOOKING:
COMMENT: Reach West 3

PHOTOGRAPH NO.: A8
FROM:
LOOKING:
COMMENT: Reach West 4

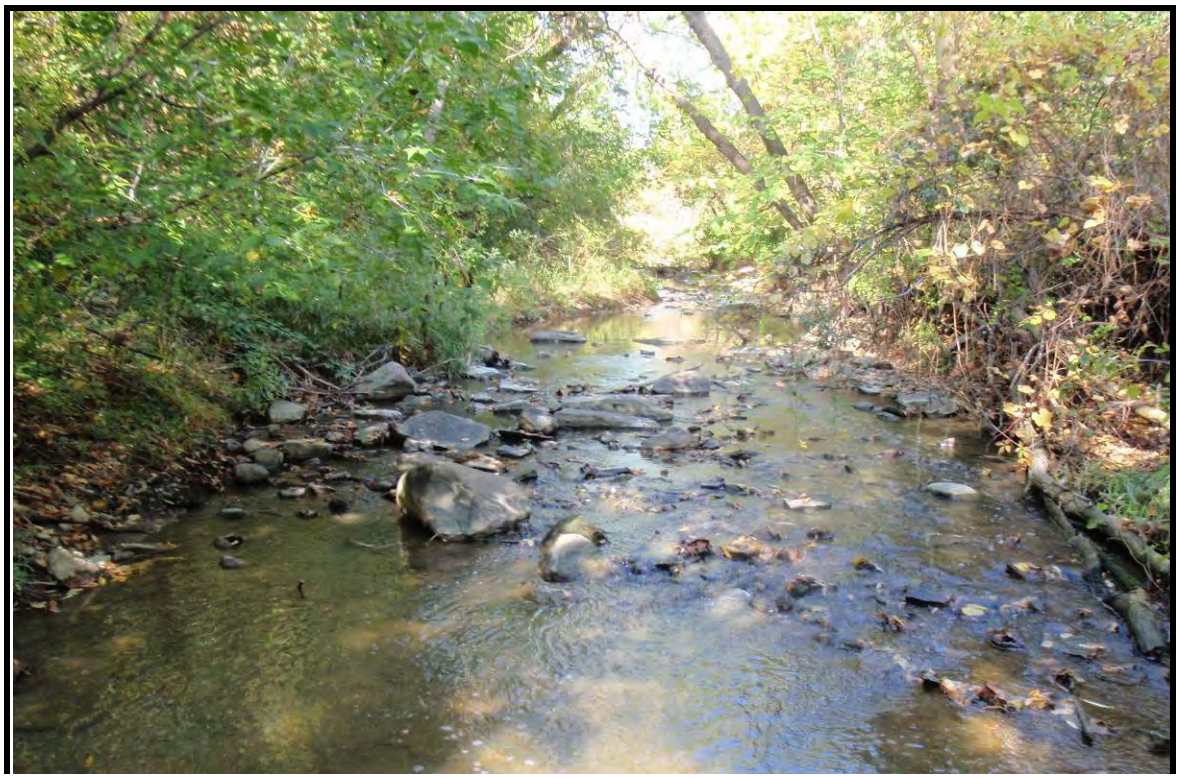
PHOTOGRAPH NO.: A9
FROM:
LOOKING:
COMMENT: Reach West 5

PHOTOGRAPH NO.: A10
FROM:
LOOKING:
COMMENT: Reach West 7

PHOTOGRAPH NO.: A11
FROM:
LOOKING:
COMMENT: Reach West Tributary 2

PHOTOGRAPH NO.: A12
FROM:
LOOKING:
COMMENT: Reach West Tributary 3

PHOTOGRAPH NO.: A13
FROM:
LOOKING:
COMMENT: Reach West Tributary 3



PHOTOGRAPH NO.: A14
FROM:
LOOKING:
COMMENT: Reach East 1

PHOTOGRAPH NO.: A15
FROM:
LOOKING:
COMMENT: Reach East 2

PHOTOGRAPH NO.: A16
FROM:
LOOKING:
COMMENT: Reach East 2

PHOTOGRAPH NO.: A17
FROM:
LOOKING:
COMMENT: Reach East 3

PHOTOGRAPH NO.: A18
FROM:
LOOKING:
COMMENT: Reach East 4

PHOTOGRAPH NO.: A19
FROM:
LOOKING:
COMMENT: Reach East 5

PHOTOGRAPH NO.: A20
FROM:
LOOKING:
COMMENT: Reach East 8

PHOTOGRAPH NO.: A21
FROM:
LOOKING:
COMMENT: Reach East 11

PHOTOGRAPH NO.: A22
FROM:
LOOKING:
COMMENT: Reach East 12

PHOTOGRAPH NO.: A23
FROM:
LOOKING:
COMMENT: Reach East Tributary 1

PHOTOGRAPH NO.: A24
FROM:
LOOKING:
COMMENT: Reach East Tributary 3

PHOTOGRAPH NO.: A25
FROM:
LOOKING:
COMMENT: Reach East Tributary 6

PHOTOGRAPH NO.: A26
FROM:
LOOKING:
COMMENT: Reach East Tributary 10

APPENDIX B:

Representative Erosion Sites Photographs

Rainbow Creek, City of Vaughan

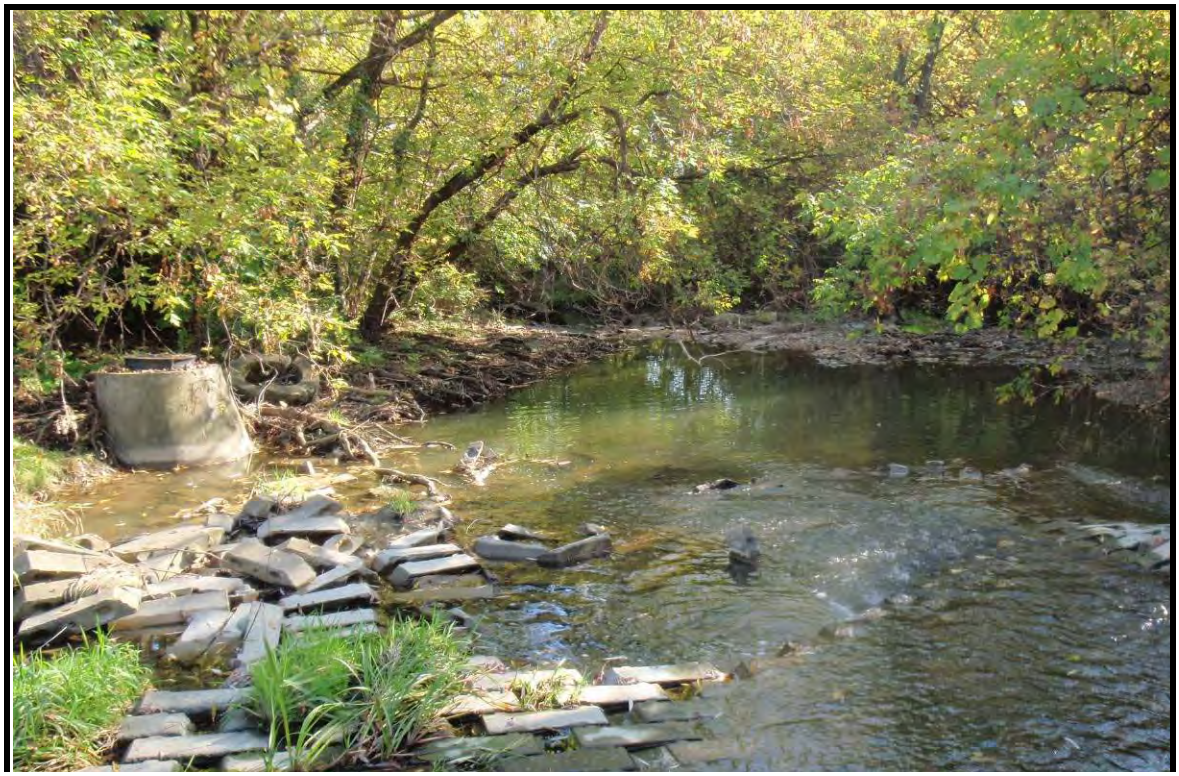
PHOTOGRAPH NO.: B1
FROM:
LOOKING:
COMMENT: Reach Main 1 – Under Hwy 407 Bridge

PHOTOGRAPH NO.: B2
FROM:
LOOKING: Downstream
COMMENT: Reach Main 1 – Downstream of Hwy 407 bridge

PHOTOGRAPH NO.: B3
FROM:
LOOKING: Downstream
COMMENT: Reach Main 1 – South side of 407

PHOTOGRAPH NO.: B4
FROM:
LOOKING: Downstream
COMMENT: Reach Main 2

PHOTOGRAPH NO.: B5
FROM: Channel
LOOKING: Upstream
COMMENT: Reach Main 2 – Note toe protection along east bank of slope



PHOTOGRAPH NO.: B6
FROM: Channel
LOOKING: Downstream
COMMENT: Reach Main 2 – Note terrafix in poor condition at sanitary crossing

PHOTOGRAPH NO.: B7
FROM: Channel
LOOKING: Upstream at eroding west bank
COMMENT: Reach West 1

PHOTOGRAPH NO.: B8
FROM:
LOOKING:
COMMENT: Reach West 1 Bank erosion

PHOTOGRAPH NO.: B9
FROM: Channel
LOOKING: Upstream
COMMENT: Reach West 2 Bank Erosion

PHOTOGRAPH NO.: B10
FROM:
LOOKING: Upstream
COMMENT: Reach West 2 – Note old beaver dam and bank erosion

File #: 11015

PHOTOGRAPH NO.: B11
FROM:
LOOKING: Upstream
COMMENT: Reach West 3 bank erosion

PHOTOGRAPH NO.: B12
FROM:
LOOKING:
COMMENT: Reach East 1

PHOTOGRAPH NO.: B13
FROM: West bank
LOOKING: Downstream
COMMENT: Reach East 1

PHOTOGRAPH NO.: B14
FROM:
LOOKING:
COMMENT: Reach East 4 – Note localized bank erosion at outside bends

PHOTOGRAPH NO.: B15
FROM:
LOOKING:
COMMENT: Reach East 5

PHOTOGRAPH NO.: B16
FROM: Crossing
LOOKING: Upstream
COMMENT: Reach East 8

PHOTOGRAPH NO.: B17
FROM: Downstream of dam
LOOKING: Upstream at dam
COMMENT: Reach East 8

APPENDIX C:

Longitudinal Profiles

Rainbow Creek, City of Vaughan

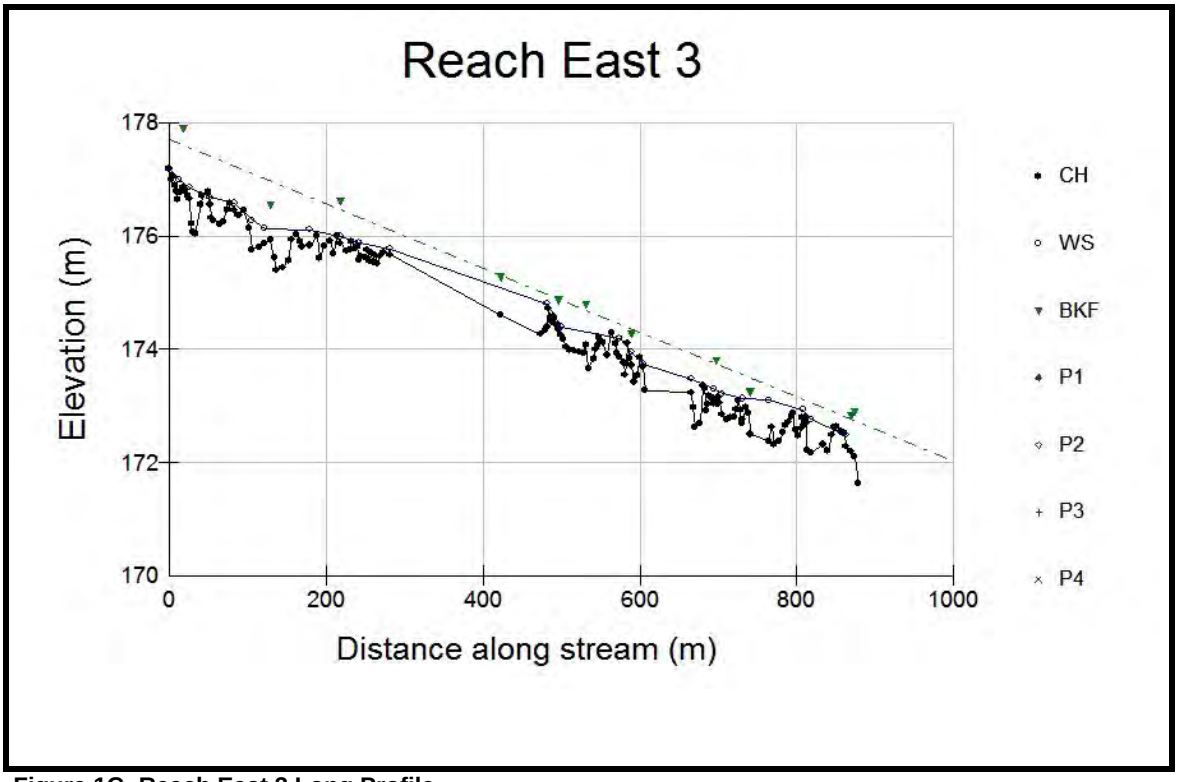


Figure 1C: Reach East 3 Long Profile

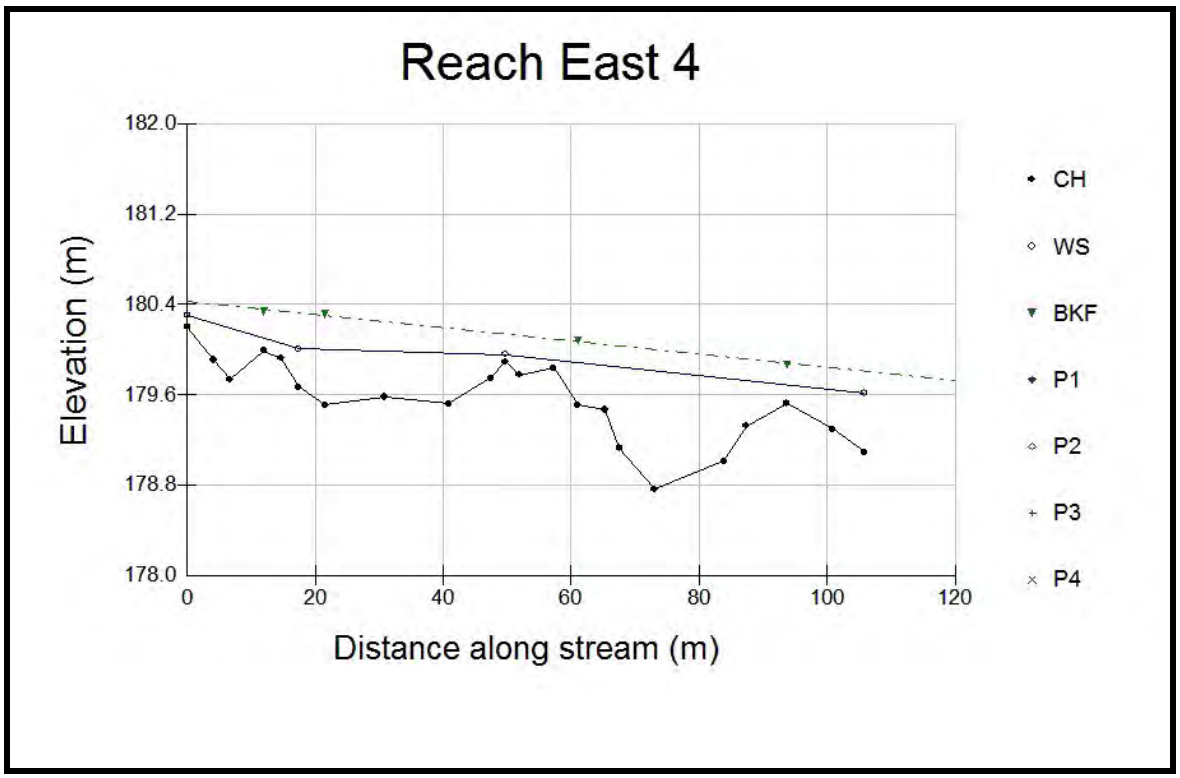


Figure 2C: Reach East 4 Long Profile

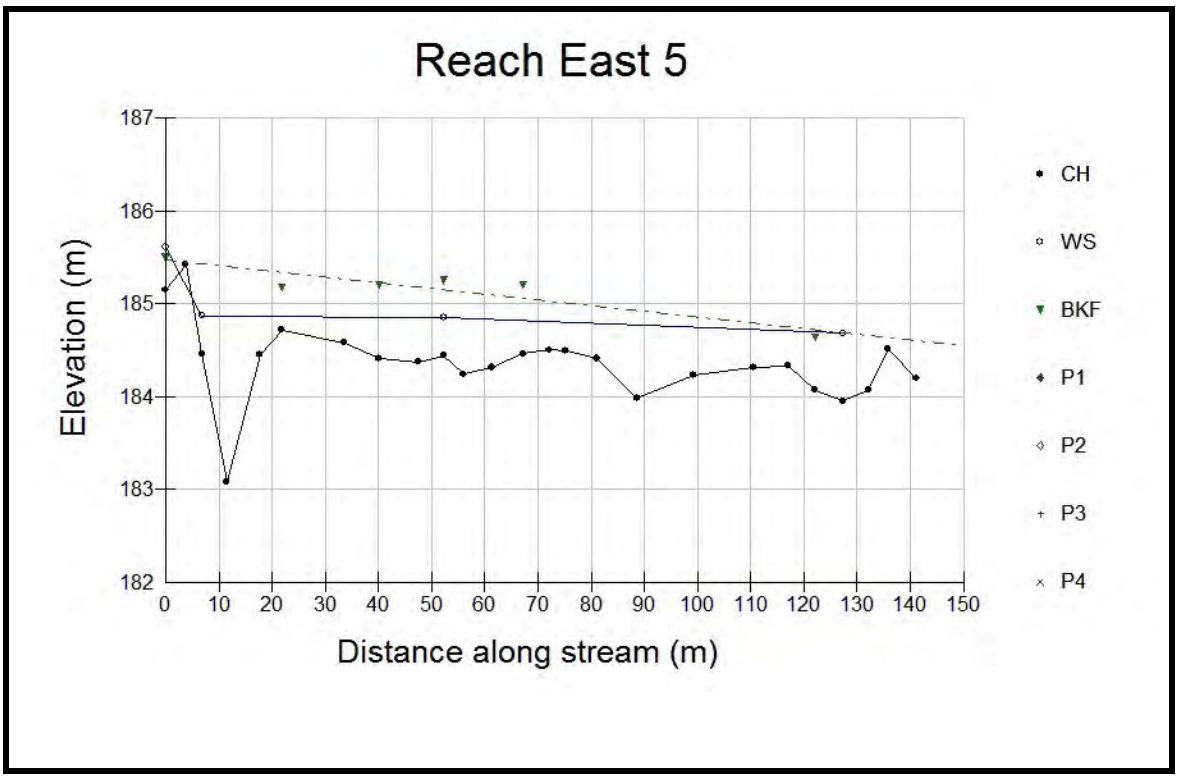


Figure 3C: Reach East 5 Long Profile

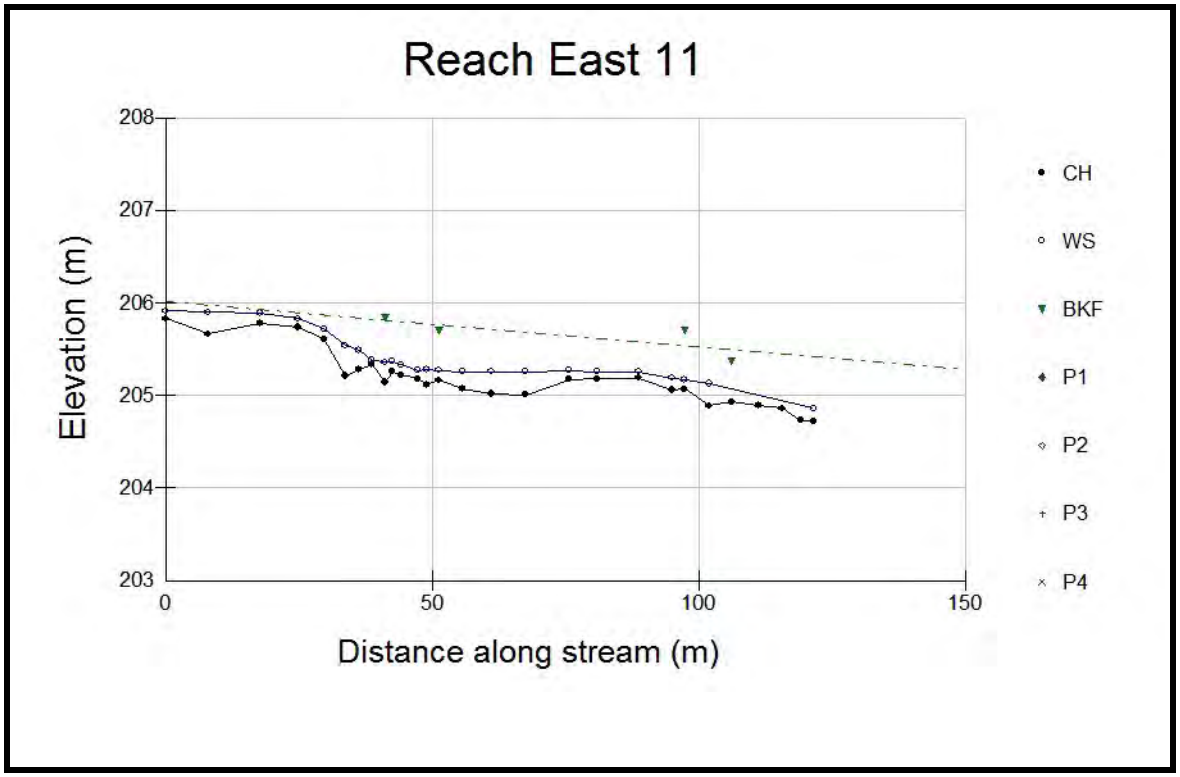


Figure 4C: Reach East 11 Long Profile

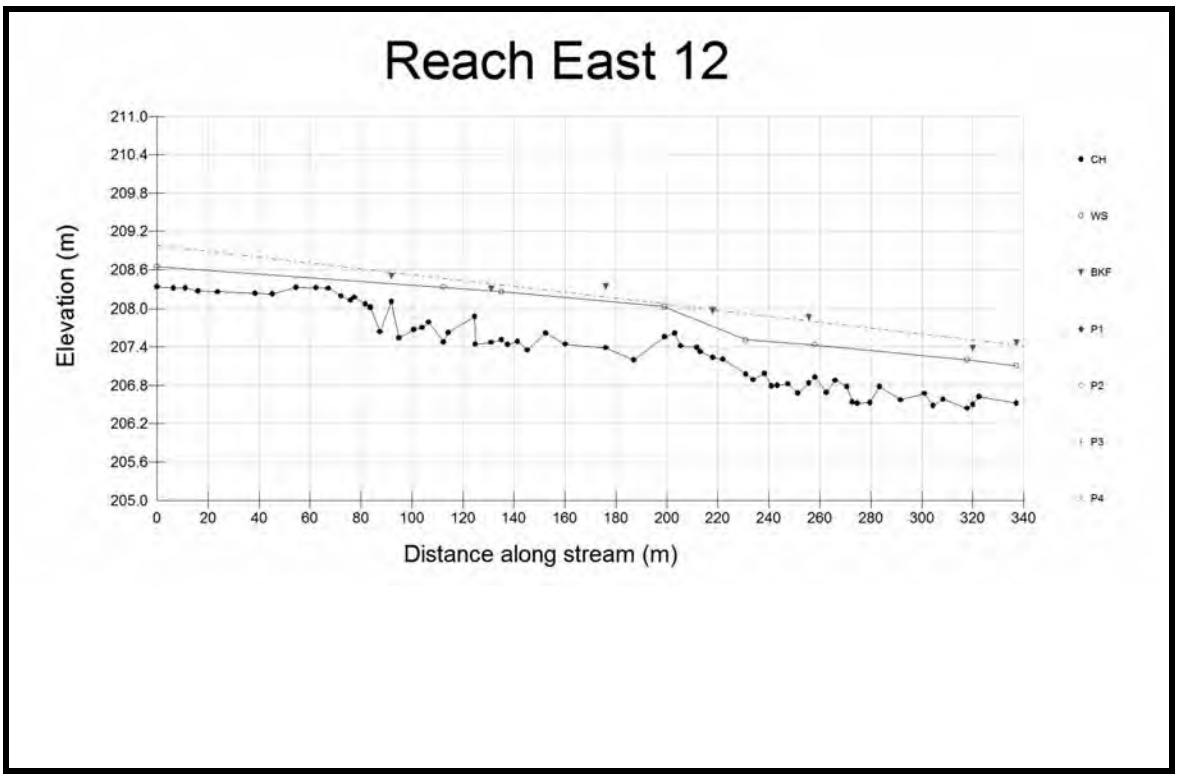


Figure 5C: Reach East 11 Long Profile

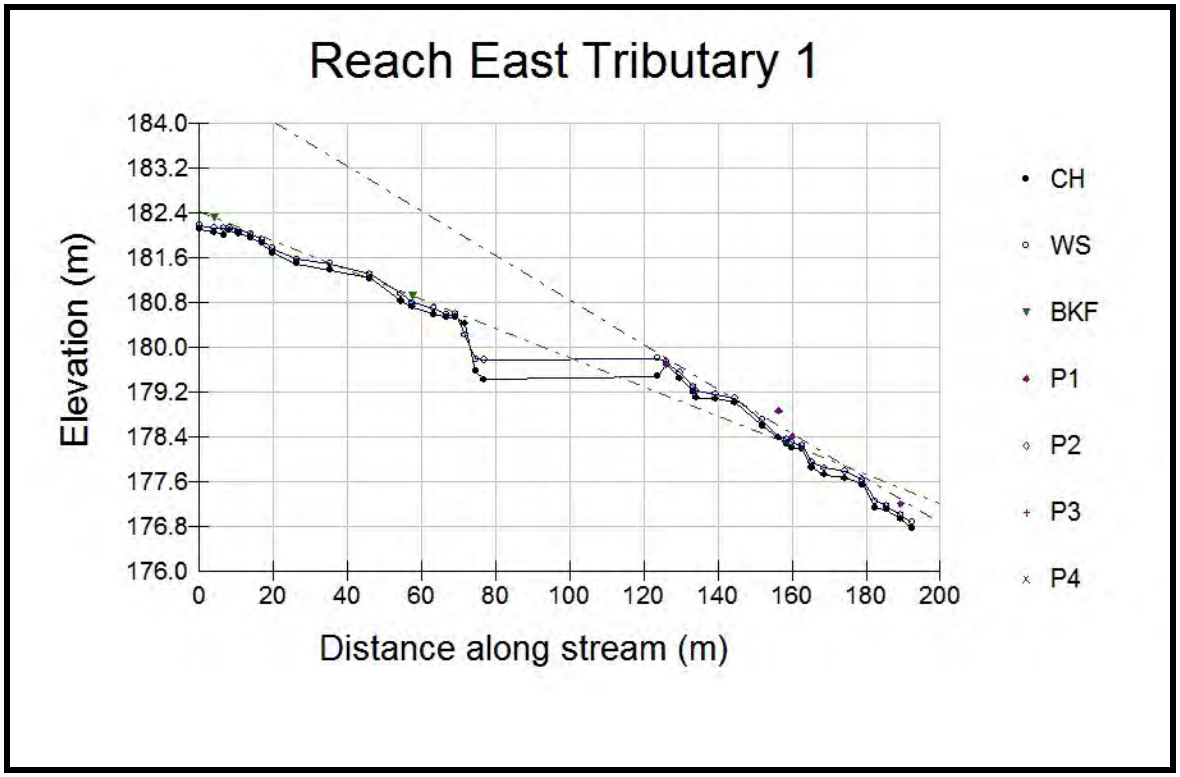


Figure 6C: Reach East Tributary 1 Long Profile

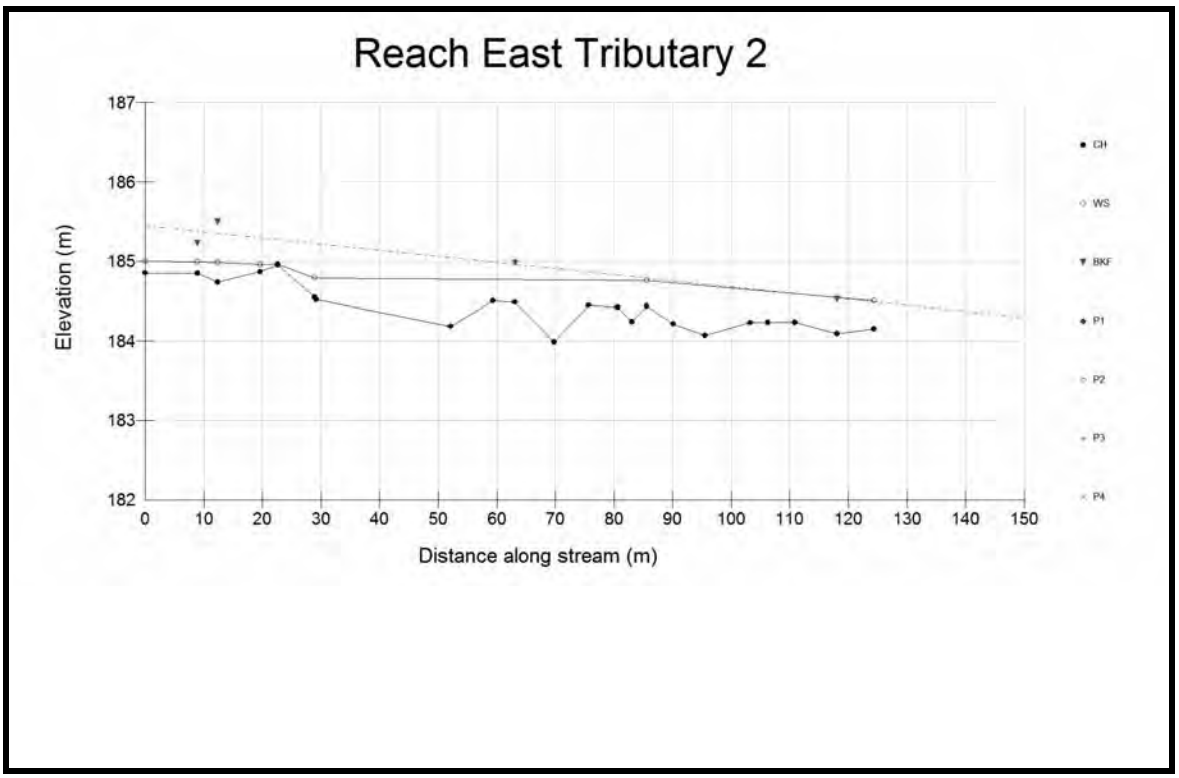


Figure 7C: Reach East Tributary 2 Long Profile

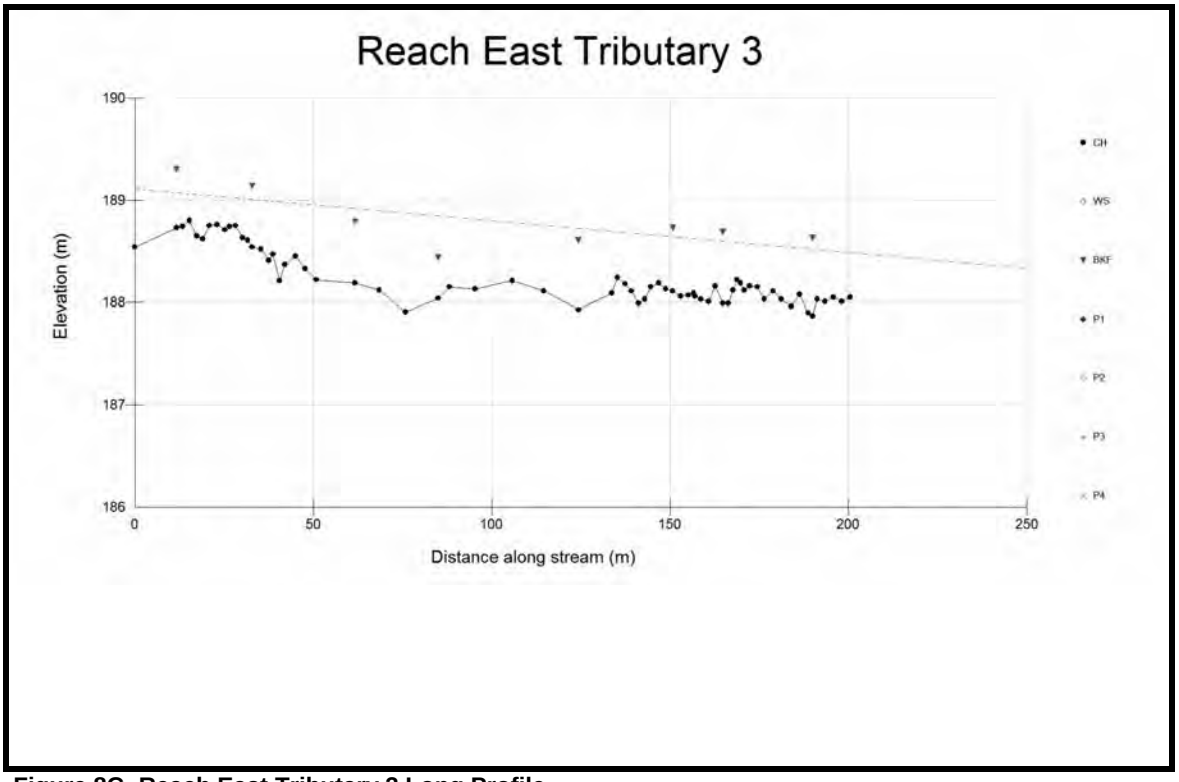


Figure 8C: Reach East Tributary 3 Long Profile

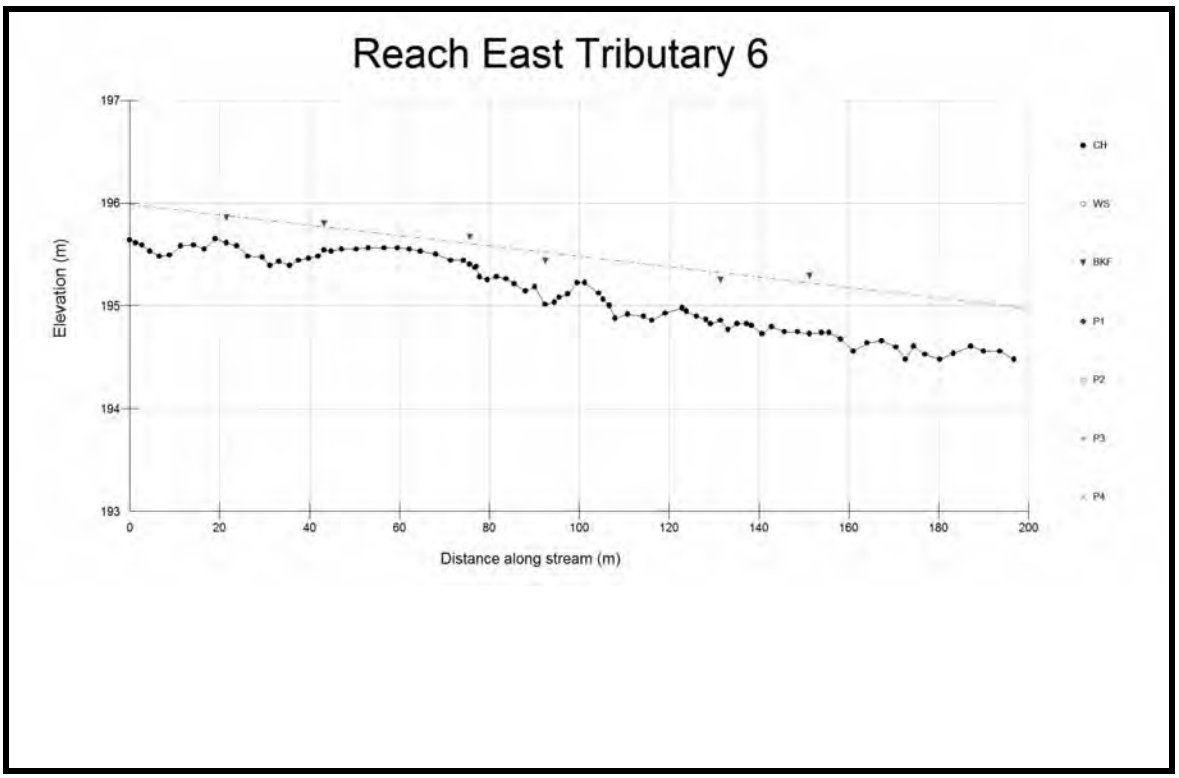


Figure 7C: Reach East Tributary 2 Long Profile

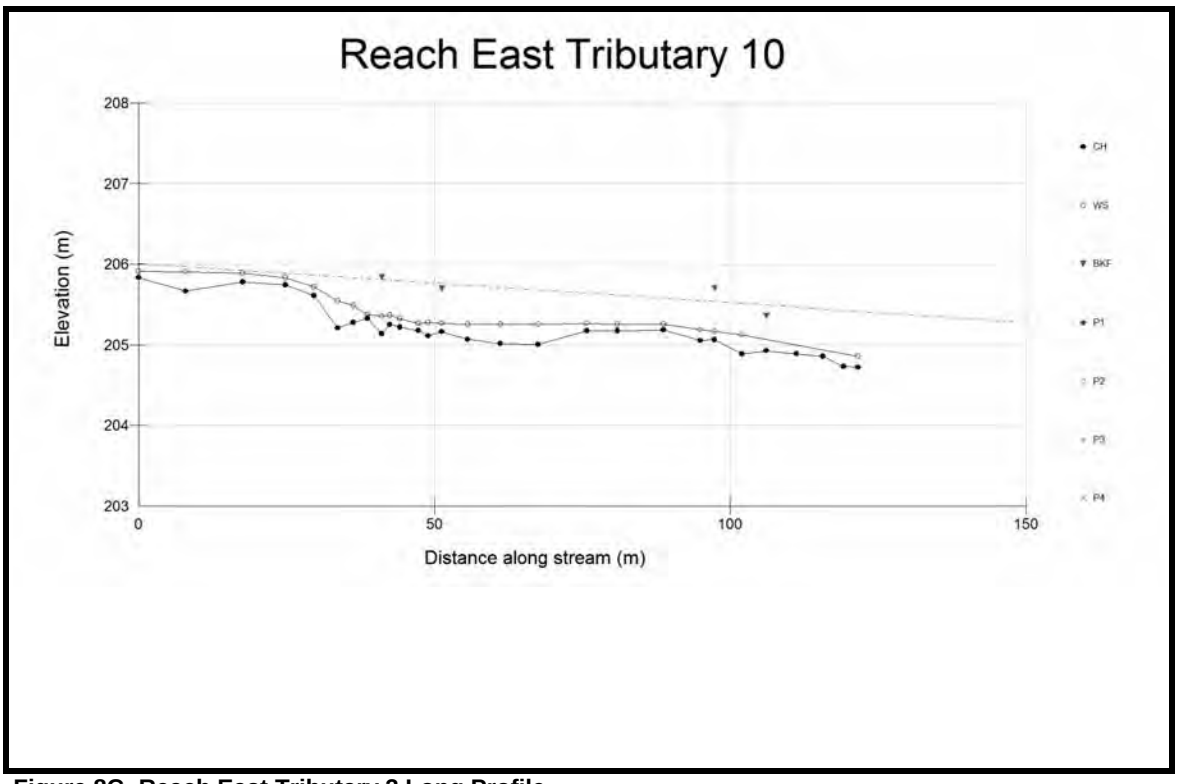


Figure 8C: Reach East Tributary 3 Long Profile

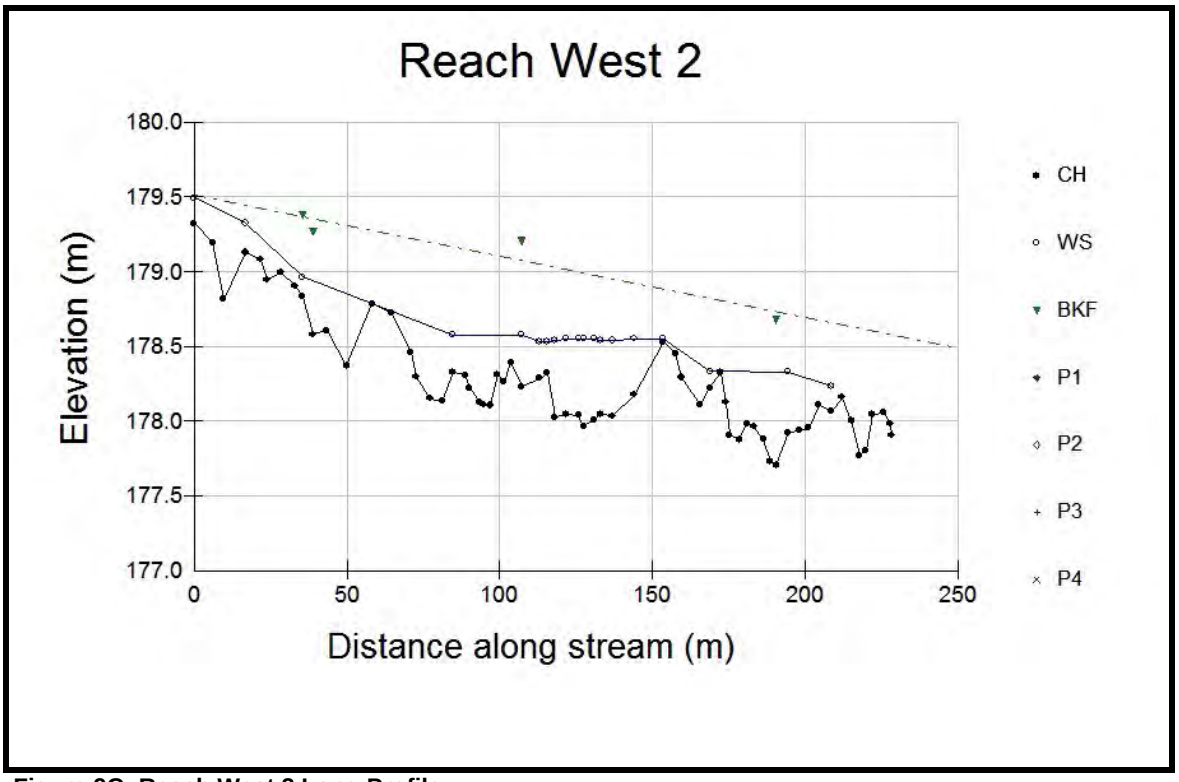


Figure 9C: Reach West 2 Long Profile

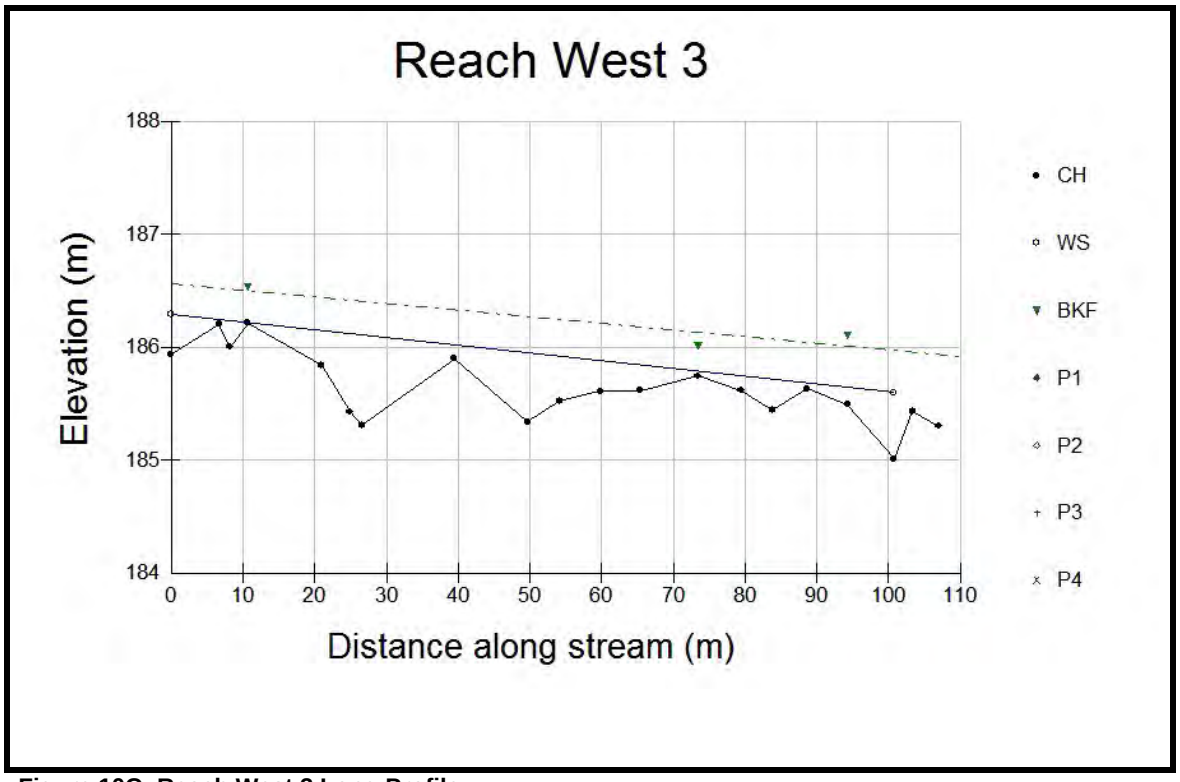


Figure 10C: Reach West 3 Long Profile

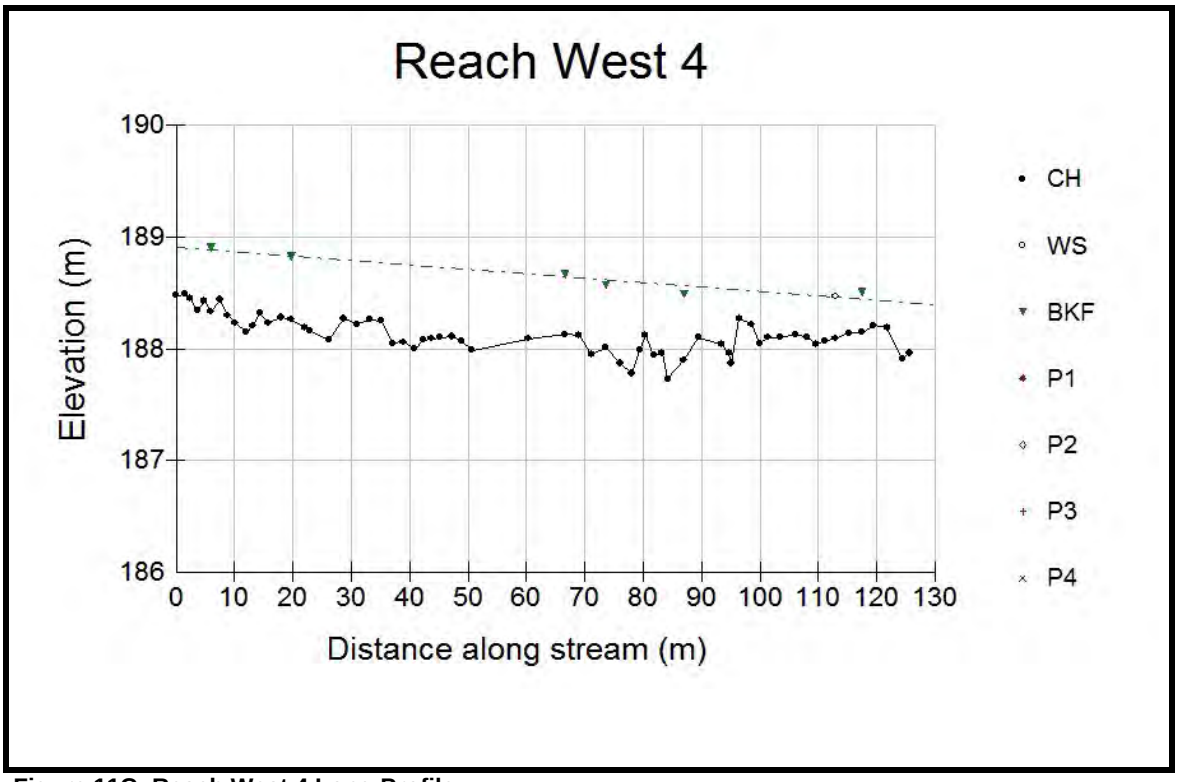


Figure 11C: Reach West 4 Long Profile

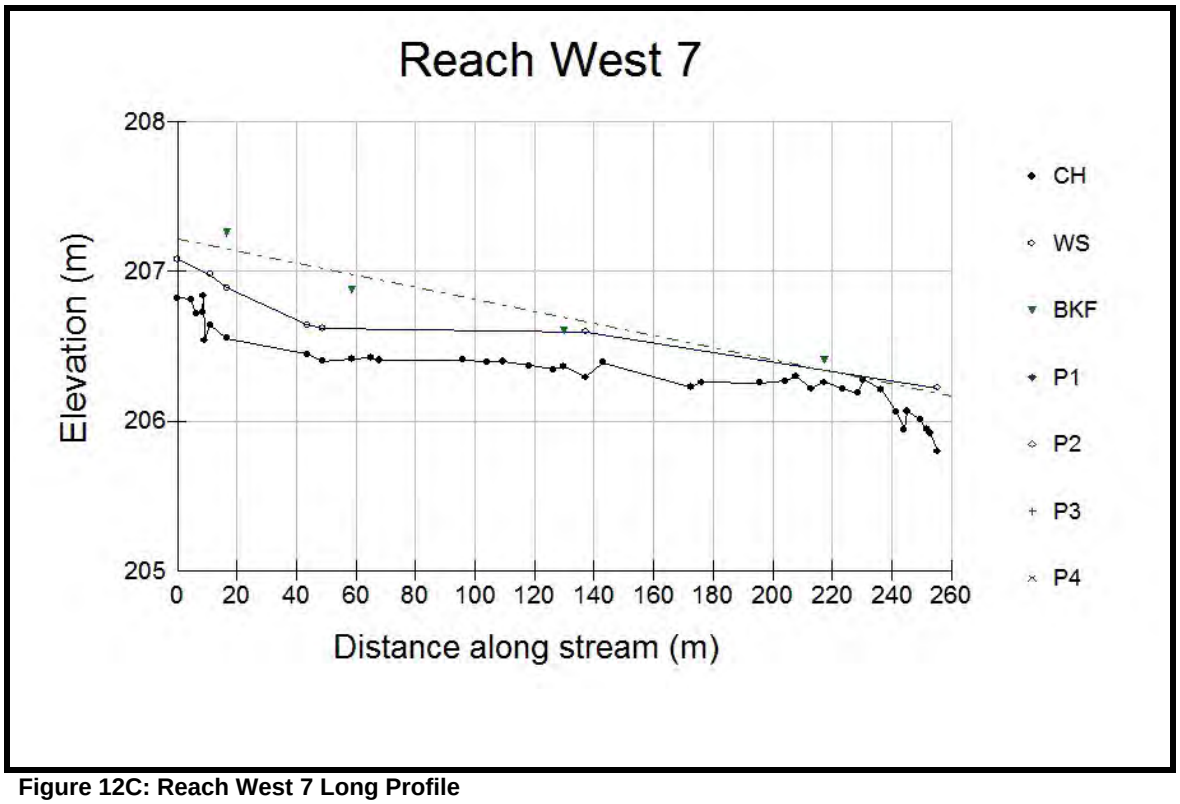


Figure 12C: Reach West 7 Long Profile

APPENDIX D:

Cross Sections

Rainbow Creek, City of Vaughan

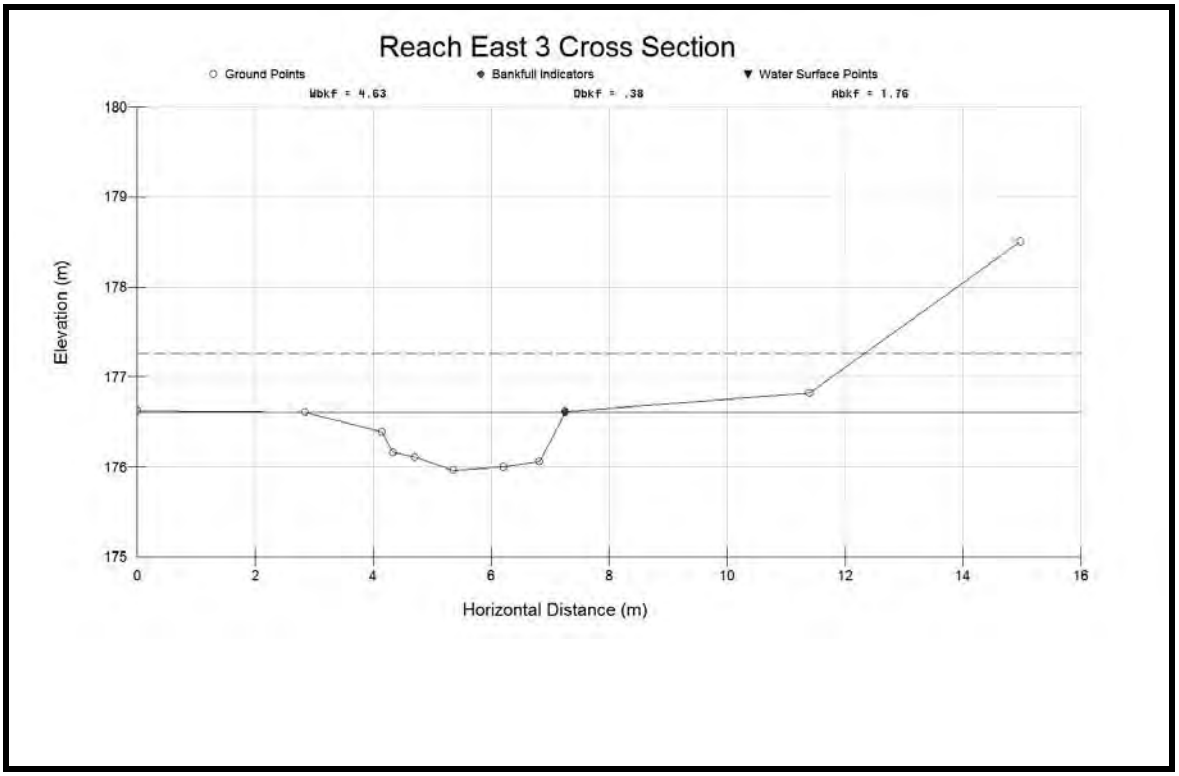


Figure 1D: Reach East 3 Cross Section

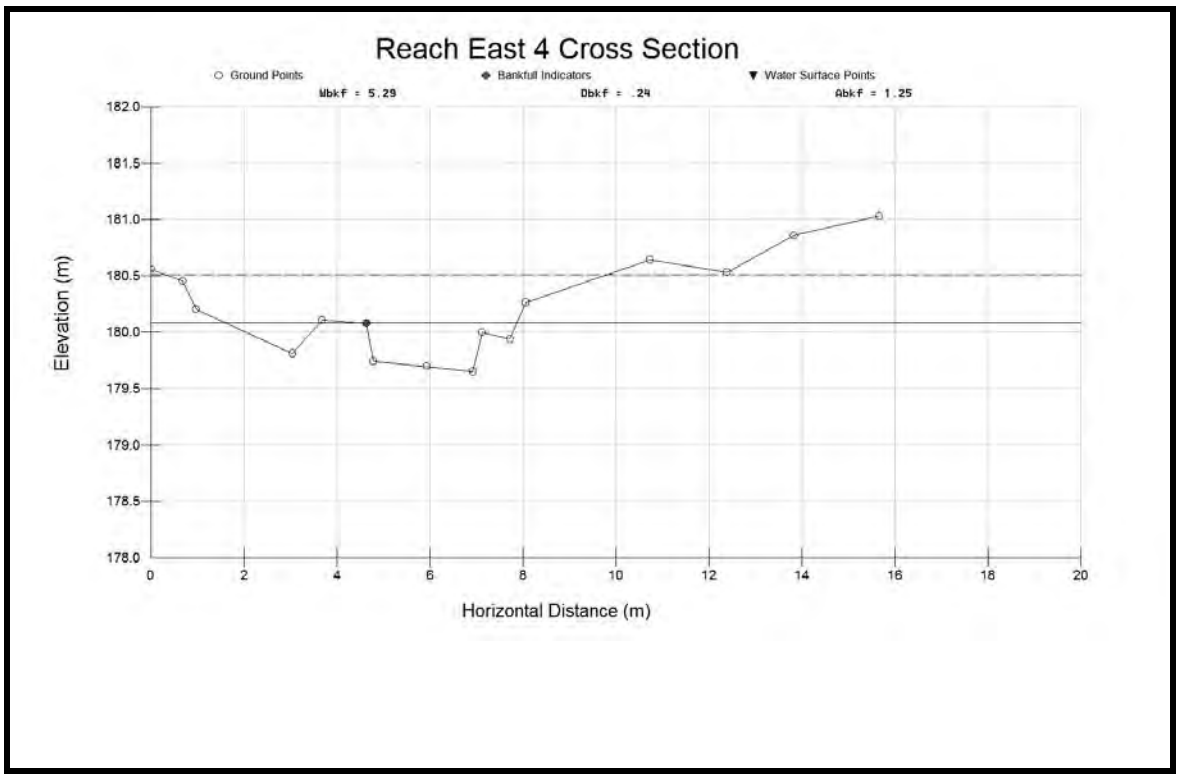


Figure 2D: Reach East 4 Cross Section

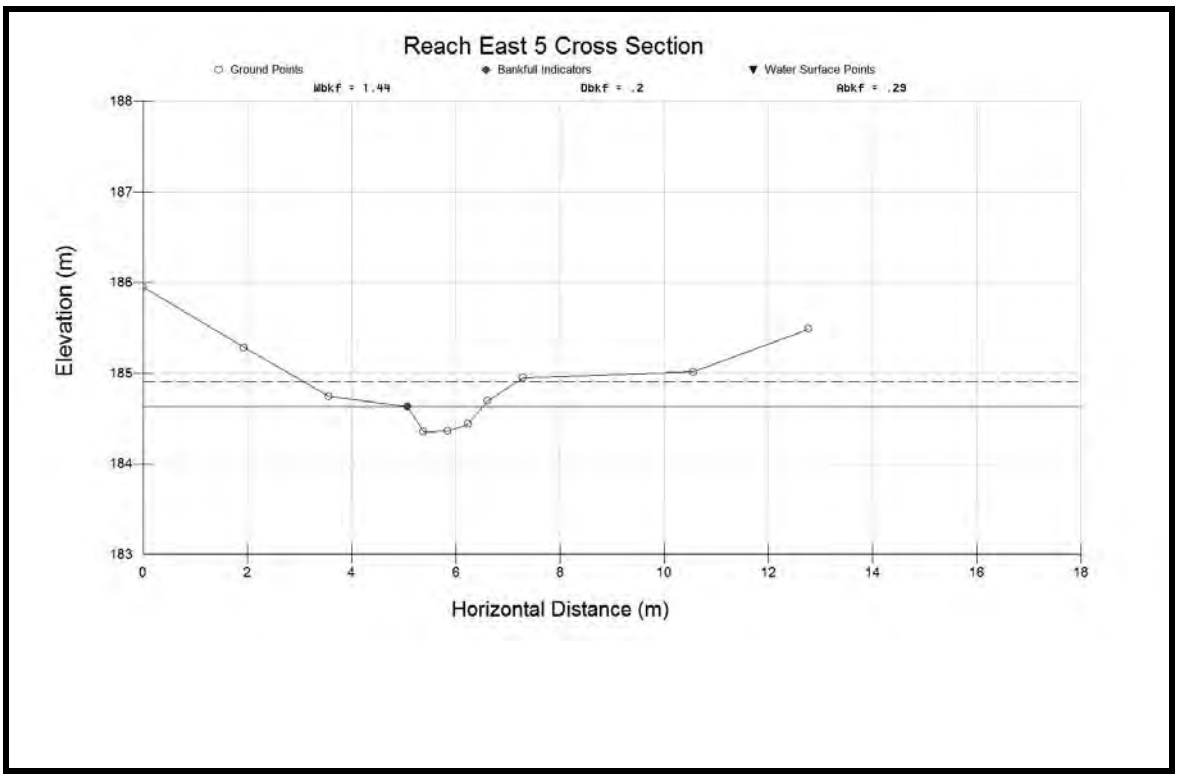


Figure 3D: Reach East 5 Cross Section

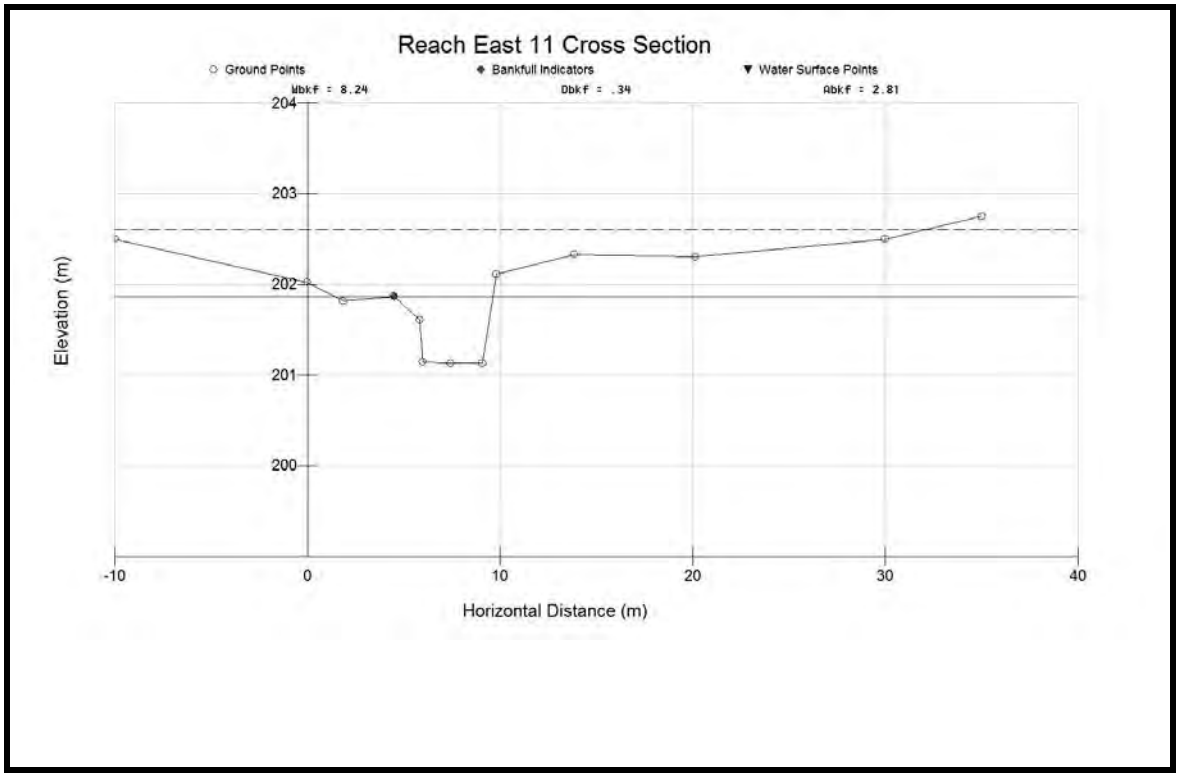


Figure 4D: Reach East 10 Cross Section

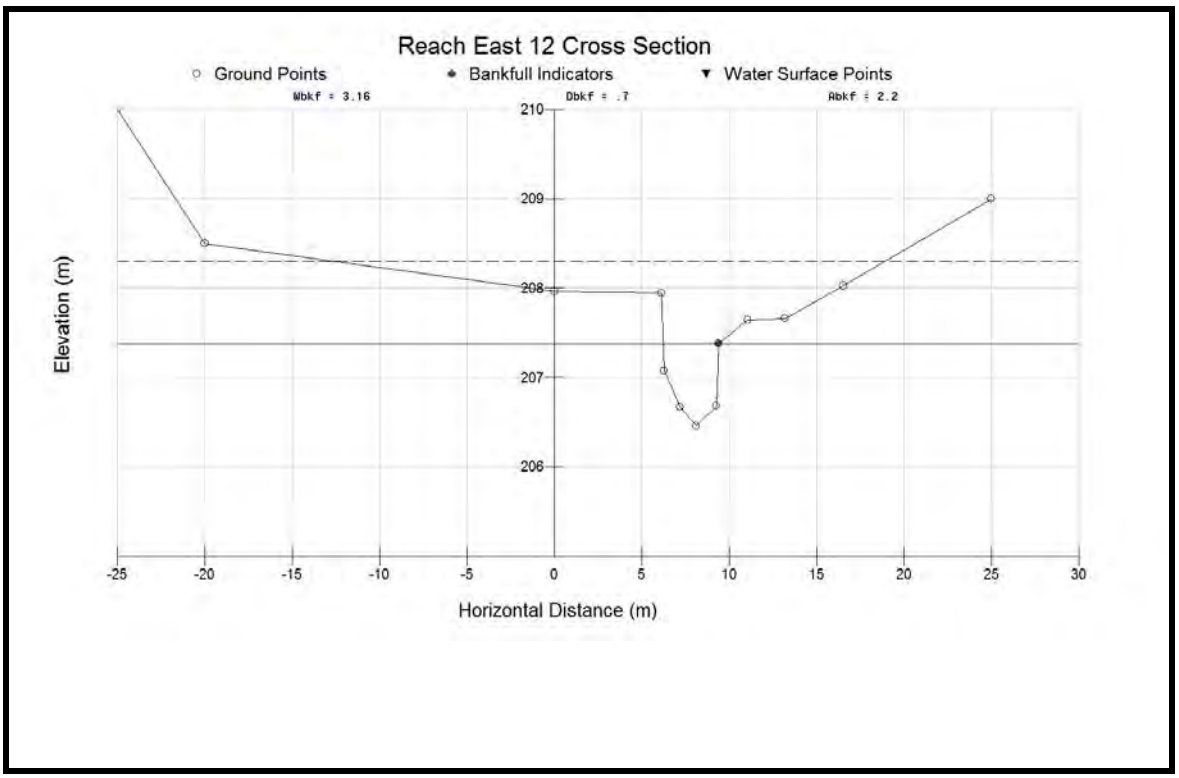


Figure 5D: Reach East 11 Cross Section

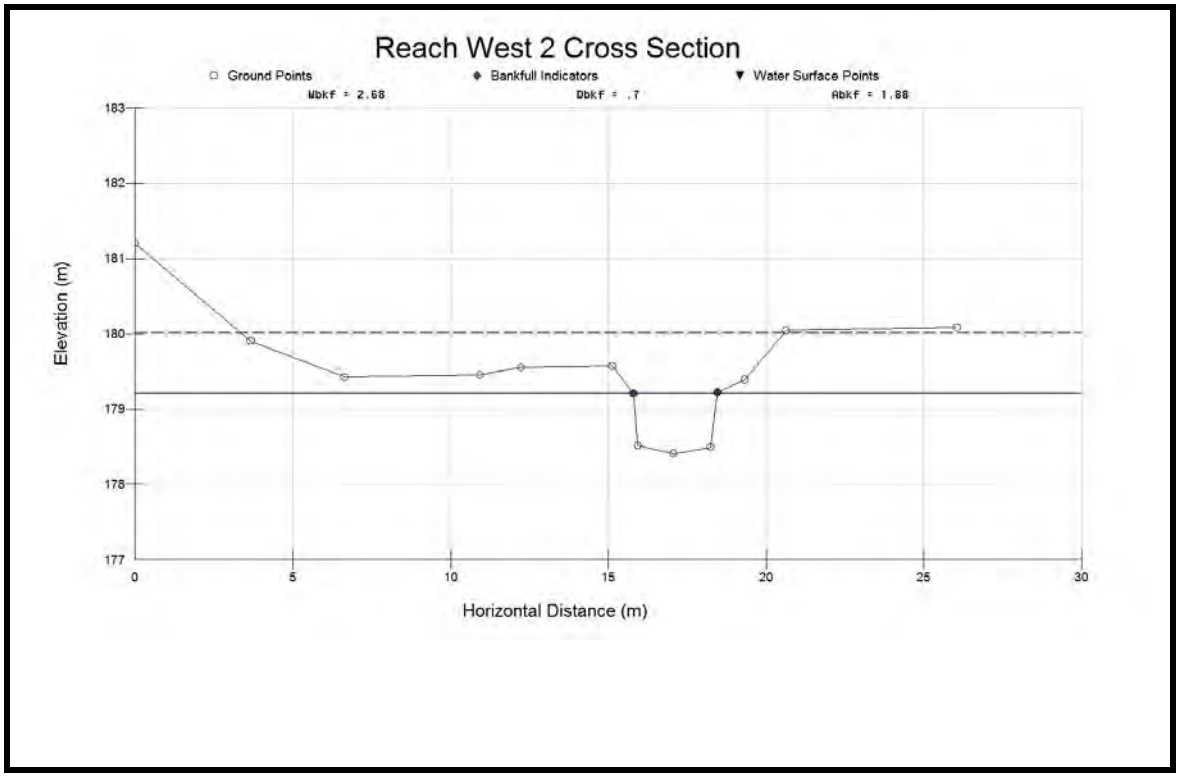


Figure 6D: Reach East Tributary 1 Cross Section

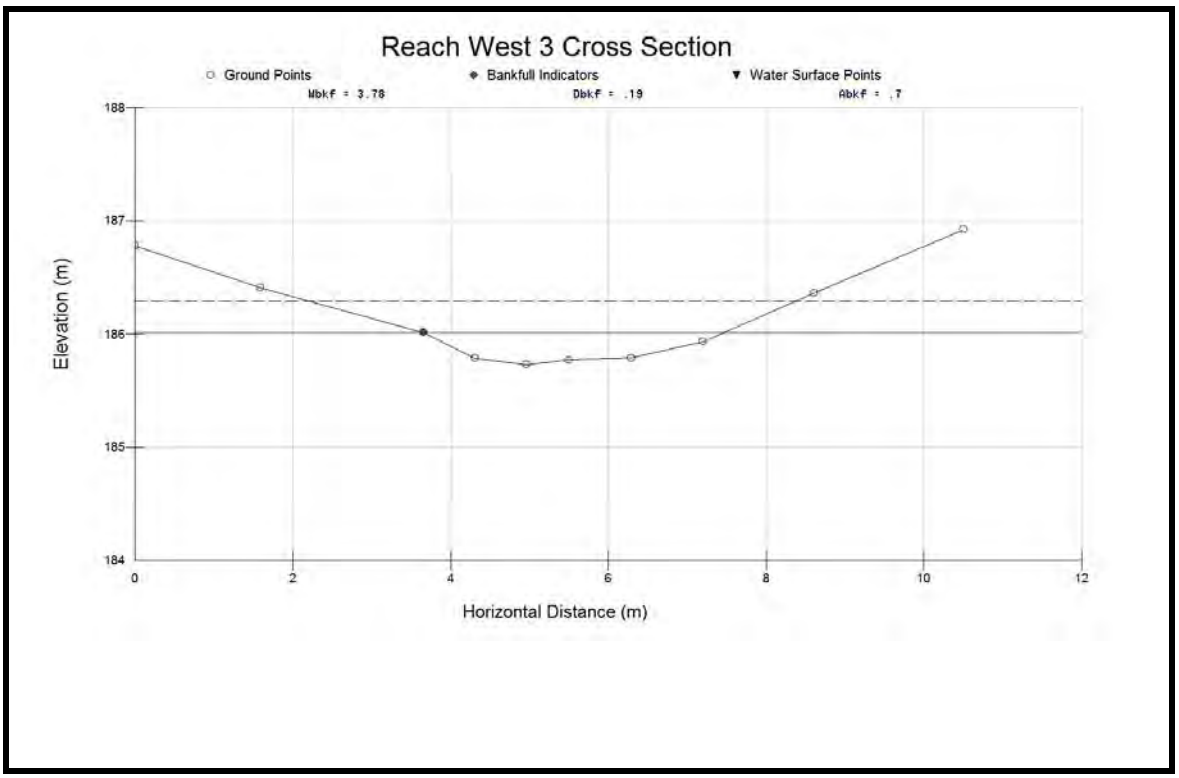


Figure 7D: Reach East Tributary 2 Cross Section

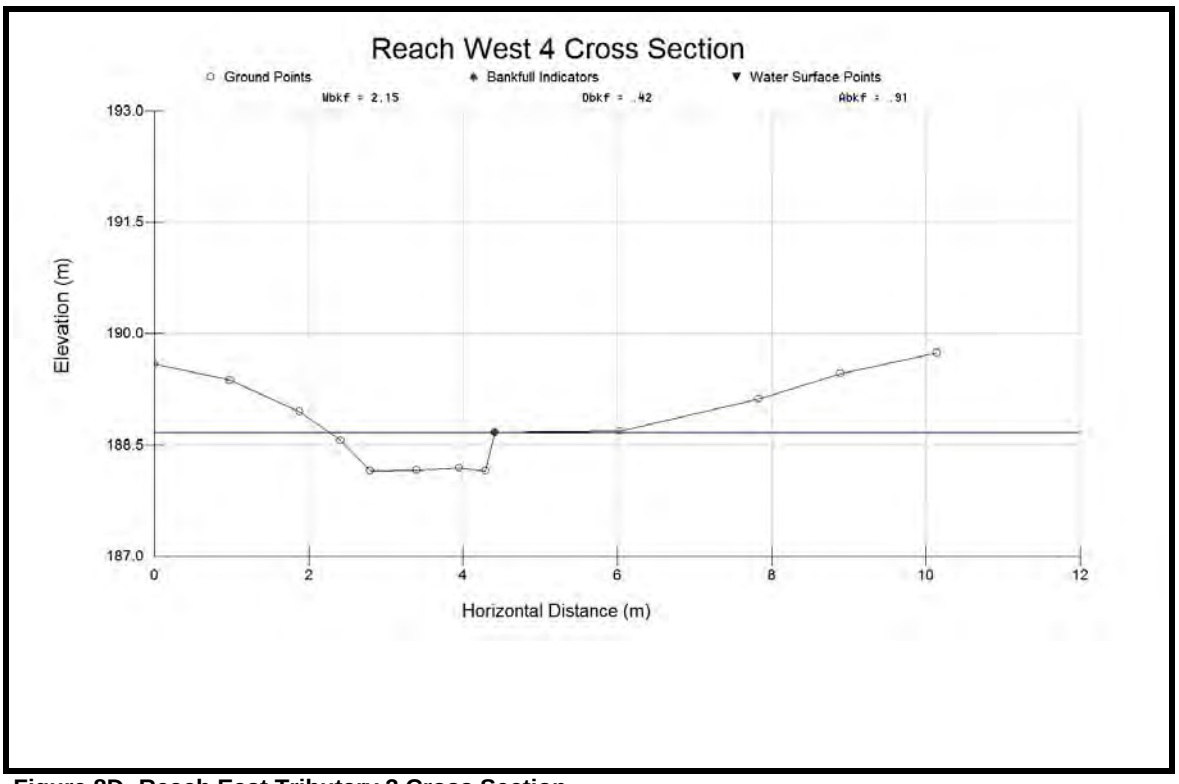


Figure 8D: Reach East Tributary 3 Cross Section

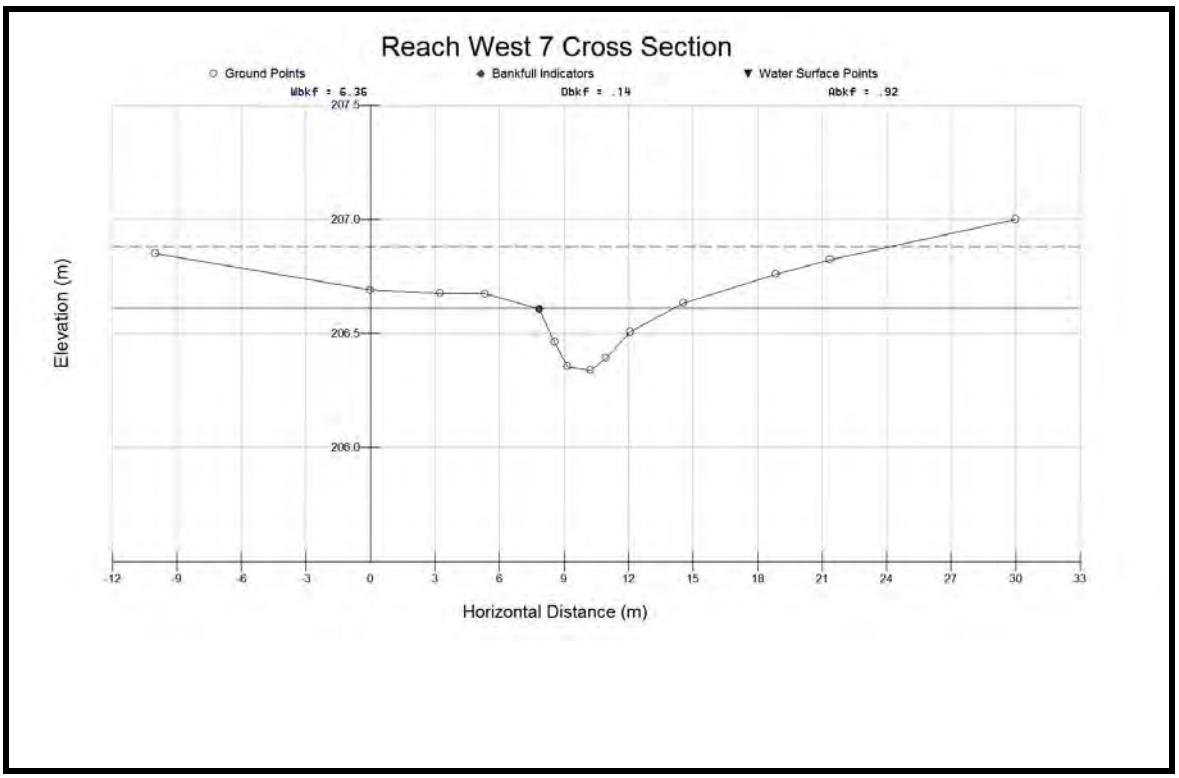


Figure 9D: Reach West 2 Cross Section

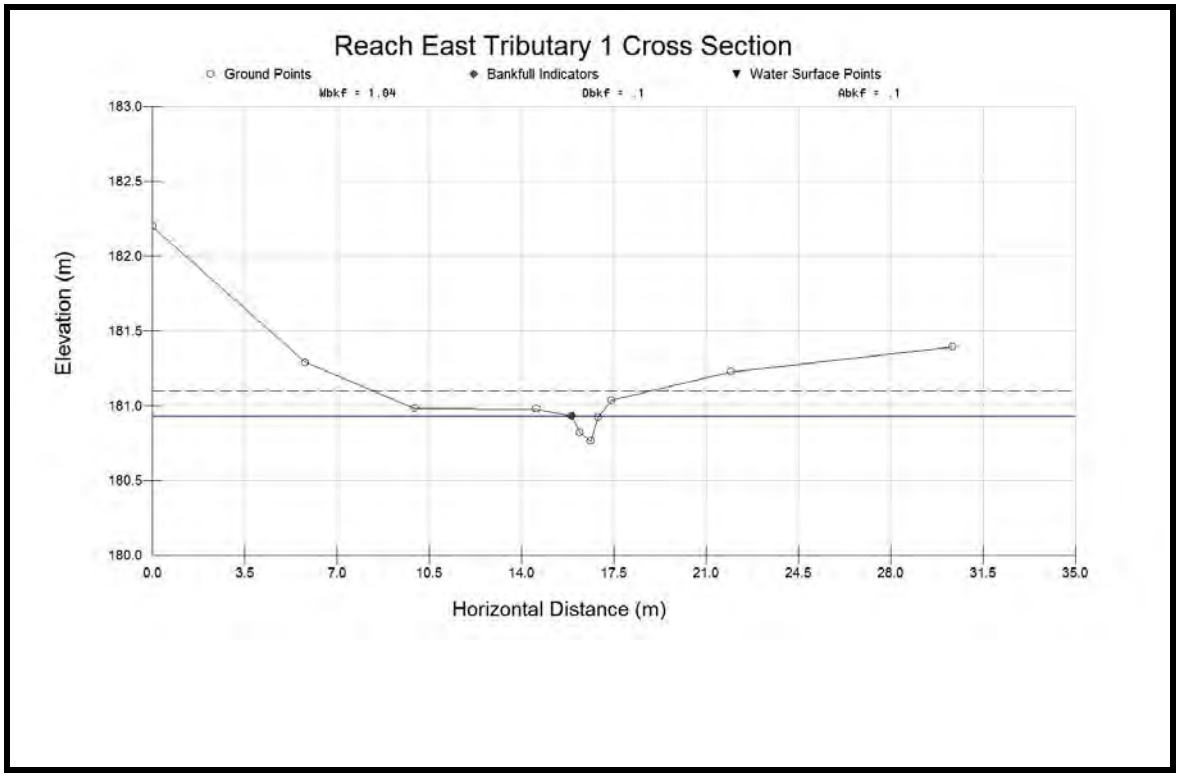


Figure 10D: Reach West 3 Cross Section

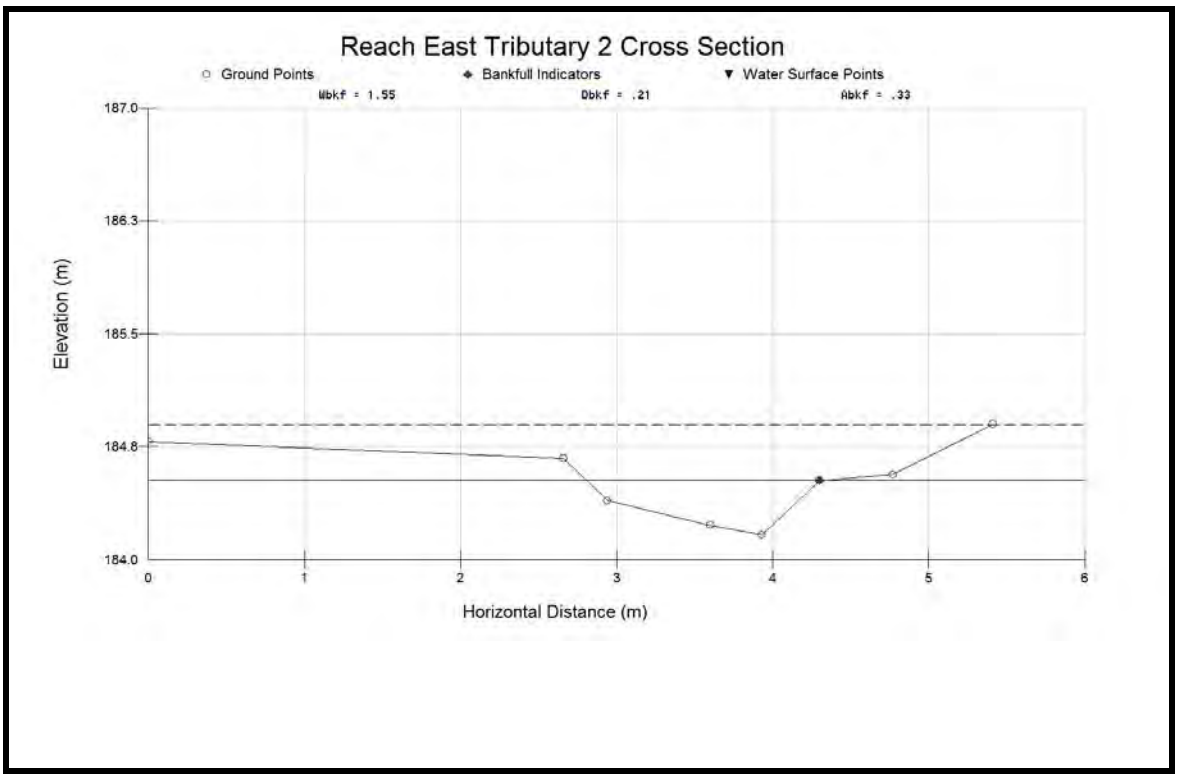


Figure 11D: Reach West 4 Cross Section

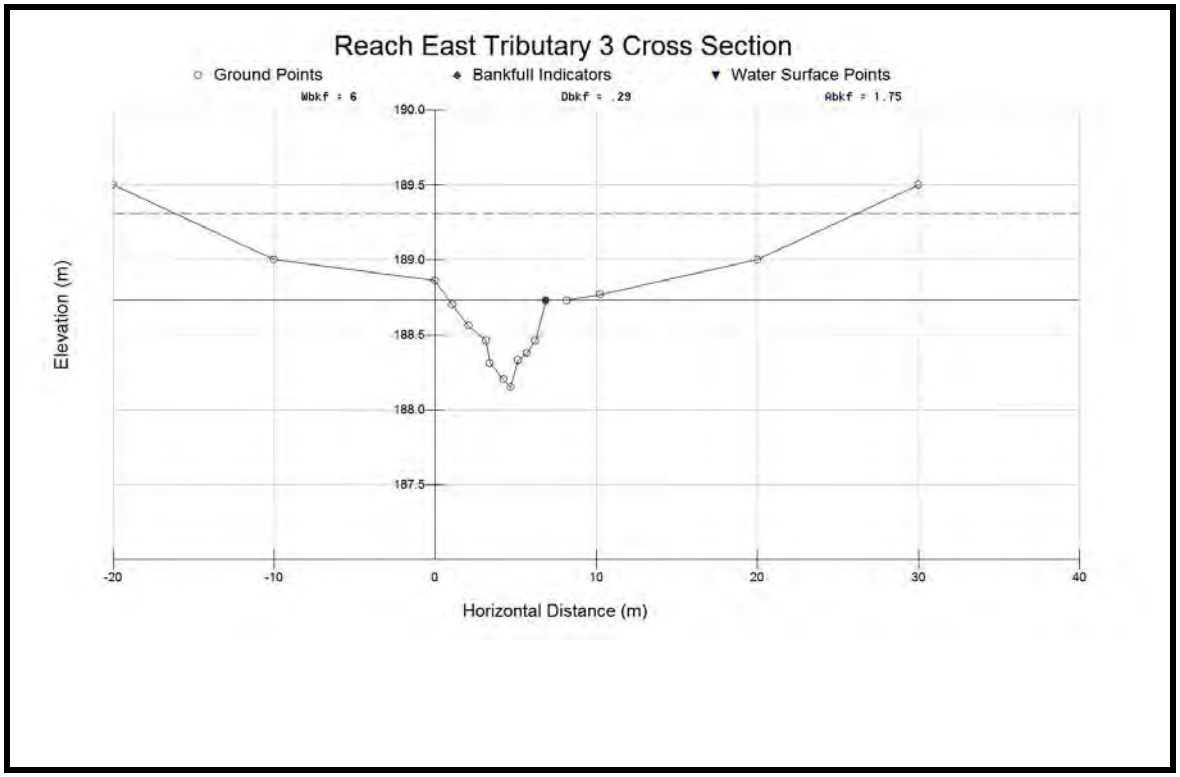


Figure 12D: Reach West 7 Cross Section

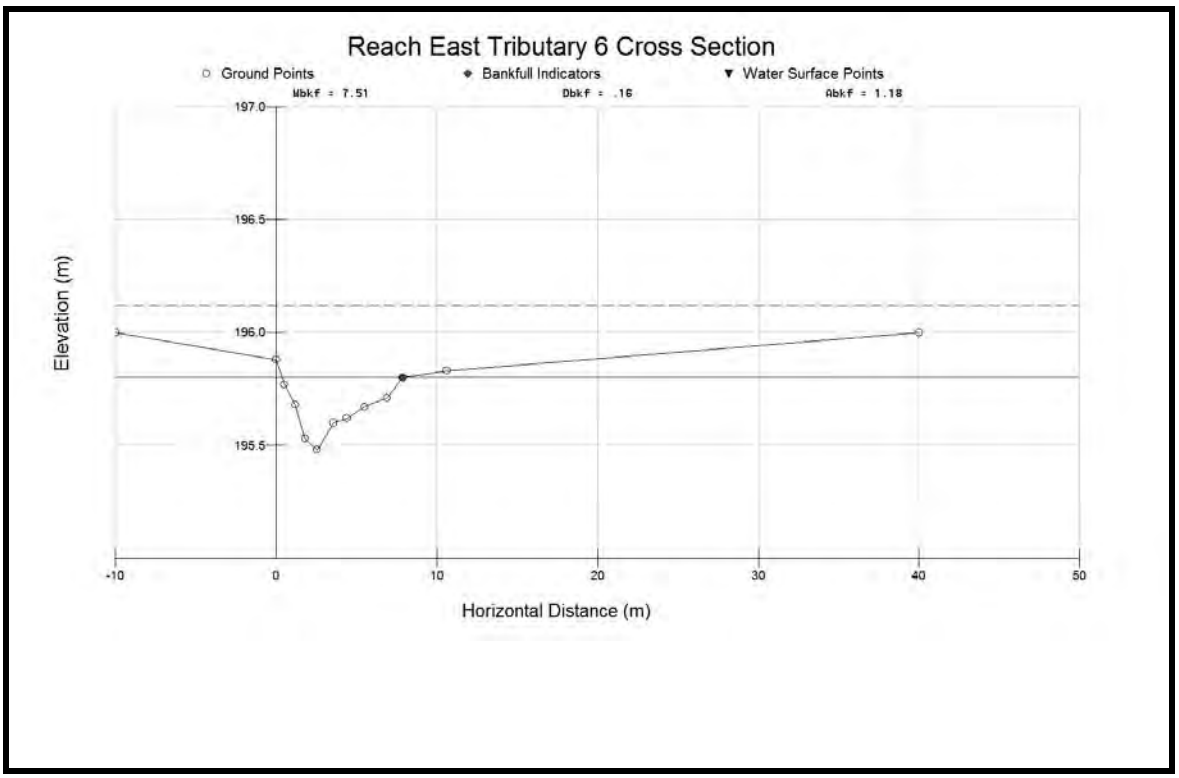


Figure 13D: Reach West 12 Cross Section

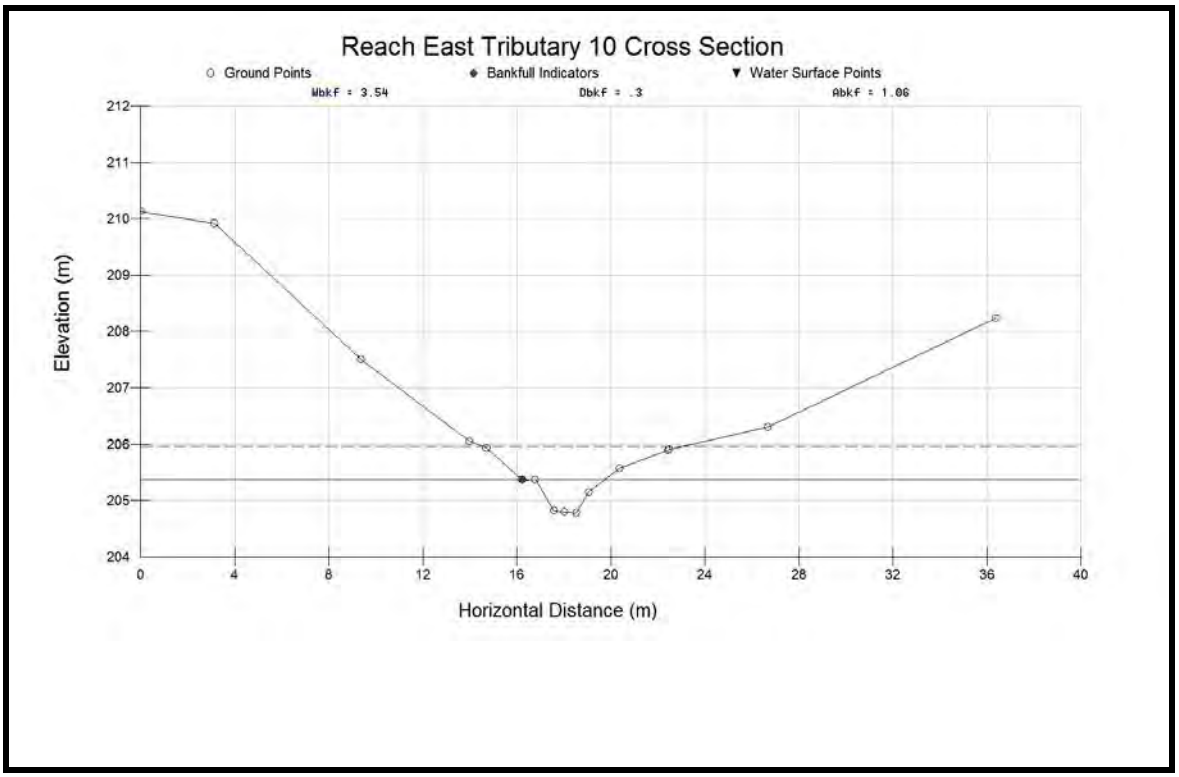


Figure 13D: Reach West 12 Cross Section