

APPENDIX B
PHOTOGRAPHIC RECORD



Photo 1.

Photo taken: October 20, 2006

Bank slump noted along Reach C10.



Photo 2.

Photo taken: October 20, 2006

Looking upstream towards a chute during high flow conditions.



Photo 3.

Photo taken: October 20, 2006

Bank slump along left bank near Old Montreal Road. View looking downstream.



Photo 4.

Photo taken: October 20, 2006

Large knickpoint noted in the channel. Photo looking upstream.

APPENDIX C
DETAILED ASSESSMENT



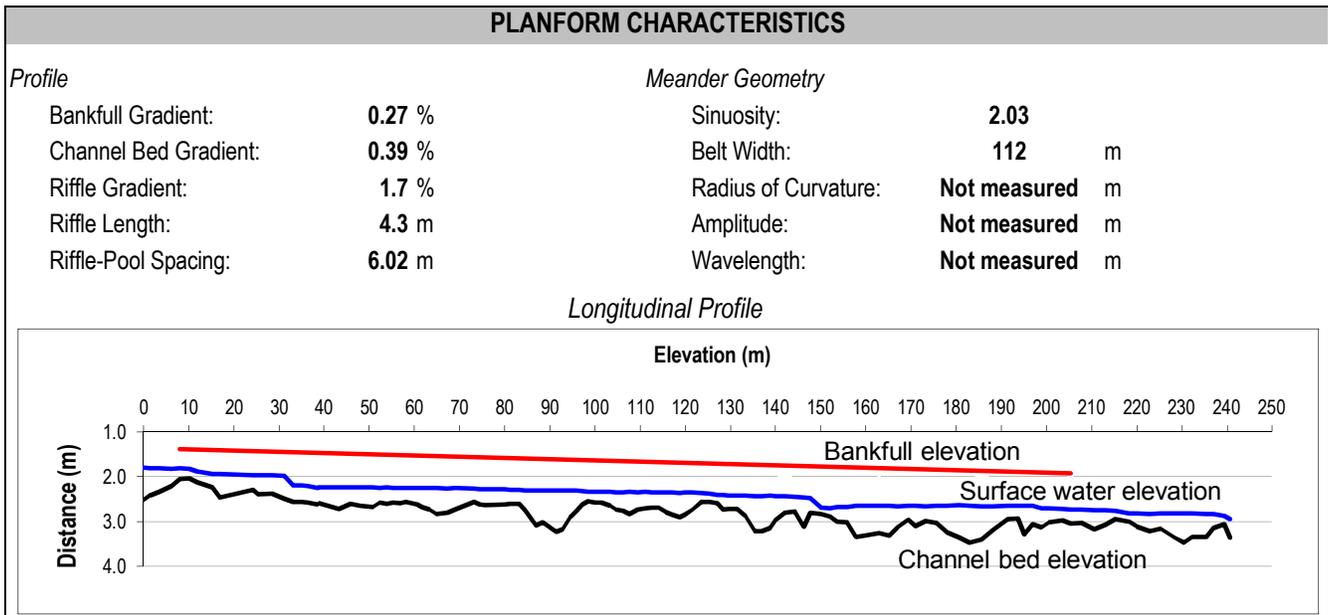
Geomorphic Solutions Fluvial Geomorphology Summary

Cardinal Creek - Reach C10

Location: City of Ottawa	Date: November 24, 2006
Length Surveyed: 240 m	Number of Cross-Sections: 10

GENERAL SITE CHARACTERISTICS	
Drainage Area:	Riparian Vegetation:
Geology/Soils: Marine Clays, Till	Dominant Vegetation Type: Meadow
Surrounding Land Use: Forest, Meadow	Extent of Riparian Buffer Zone: Continuous
Channel Disturbances: None	Width of Riparian Buffer Zone: >15 channel widths
Aquatic Vegetation:	Age Class of Riparian Vegetation: Mature
Dominant Vegetation Type: Rooted macrophytes	Extent of Encroachment into Channel: Minimal
Portion of Reach with Vegetation: 10%	Large Woody Debris: Present in Channel and banks

HYDROLOGY	
Measured Discharge: Not measured m ³ /s	Calculated Bankfull Discharge: #REF! m ³ /s
Modeled 2-year Discharge: Not modeled m ³ /s	Calculated Bankfull Velocity: #REF! m/s
Modeled 2-year Velocity: Not modeled m/s	



BANK CHARACTERISTICS							
	<i>Minimum</i>	<i>Maximum</i>	<i>Average</i>		<i>Minimum</i>	<i>Maximum</i>	<i>Average</i>
Bank Height (m):	0.6	8.0	1.5				
Bank Angle (degrees):	30.0	85.0	65.0	Torvane Value* (kg/cm ²):	0.05	0.35	0.2
Root Depth (m):	0.3	1.0	0.5	Penetrometer Value* (kg/cm ³):	Not Available		
Root Density (kg/m ²):	10	100.0	70.0	Bank Material (range):	Clay to Gravel		
Depth of Undercut (m):	0.10	0.25	0.15	* Mechanic shear stress/ failure as measured from instruments is NOT equivalent to a threshold or entrainment shear stress			

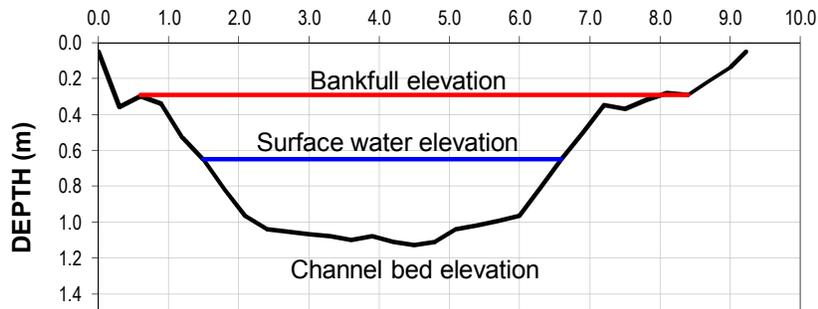
CROSS-SECTIONAL CHARACTERISTICS

	<i>Minimum</i>	<i>Maximum</i>	<i>Average</i>
Bankfull Width (m):	5.70	10.10	7.47
Average Bankfull Depth (m):	0.40	0.91	0.69
Bankfull Width/Depth:	11.42	34.24	19.86
Wetted Width (m):	3.90	8.70	5.59
Water Depth (m):	0.09	0.37	0.25
Wetted Width/Depth:	13.62	98.85	29.25
Entrenchment (m):	14	22	17.6
Entrenchment Ratio:	1.49	3.17	2.43
Maximum Depth (m):	0.45	1.1	0.8
Manning's n:	0.035		

Representative Cross-Section

CROSS-SECTION 4

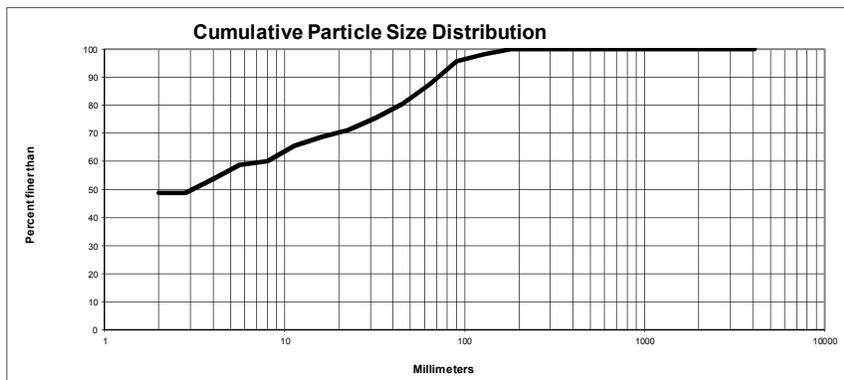
DISTANCE (m)



SUBSTRATE CHARACTERISTICS

<p><i>Particle size</i></p> <p>D₁₀ N/A mm</p> <p>D₅₀ 3.0 mm</p> <p>D₉₀ 70.0 mm</p>	<p>Subpavement: Marine deposits (consolidated clay)</p> <p>Particle shape: Sub-angular to sub-rounded</p> <p>Embeddedness (%): 20</p> <p>Particle range (riffle): Sand to Cobble</p> <p>Particle Range (pool): Clay to Gravel</p>
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Grain Size Distribution



CHANNEL THRESHOLDS

Flow Competency (non-cohesive sediments):	Tractive Force at Bankfull:	27.1 N/m²
for D ₅₀ : 0.33 m/s	Tractive Force at 2-year flow:	N/A N/m²
for D ₈₄ : 1.23 m/s	Critical Shear Stress (Bed):	2.2 N/m²
Unit Stream Power at Bankfull: 38.19 W/m²	Critical Shear Stress (Bank):	3.6 N/m²

GENERAL FIELD OBSERVATIONS

- Formation of islands at the downstream section of the reach
- Large wood debris scattered in and around stream
- Valley wall contact along downstream extent of survey
- Steep banks
- Substrate - Consolidated clay and clay aggradations (clay balls - gravel sized)

Erosion Pin Installation

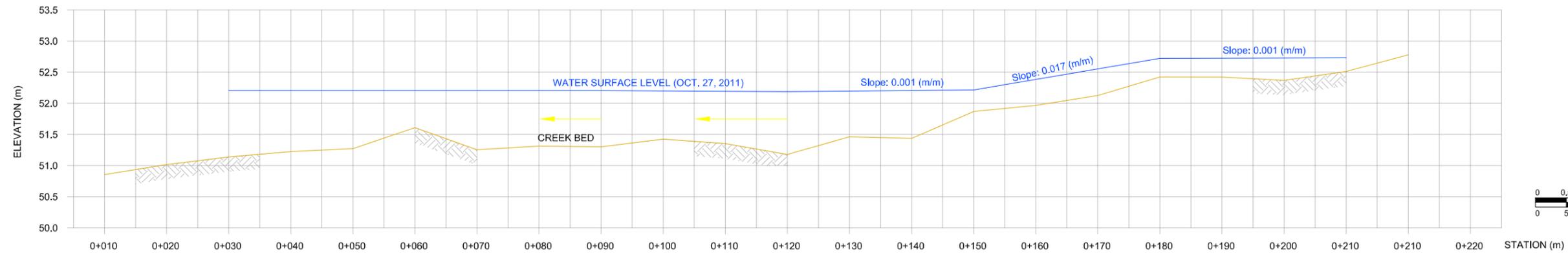
Cross-section # 5; GPS Coordinates: 462906.0211, 5038248.874 NAD 83 ZONE 18N
 Erosion pin (left bank - upper) = 10.5 cm; (left bank - lower) = 8.5 cm; Erosion pin (right bank) = 12.0 cm
 Scour pin (at 2.9 m mark on tape) = 5.2 cm; Scour pin (at 6.0 m mark on tape) = 3.5 cm

Representative Photo - Cross Section 6, downstream view





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Cross-Section Locations
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Vert: 1:75
Horz: 1:750

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Legend



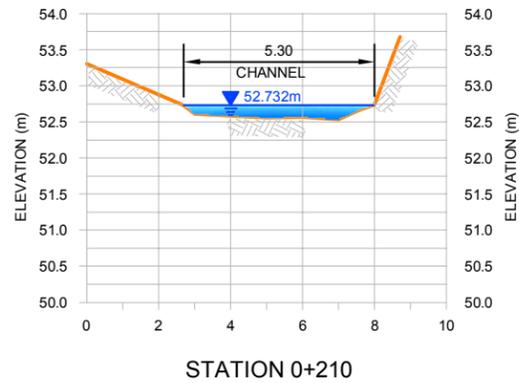
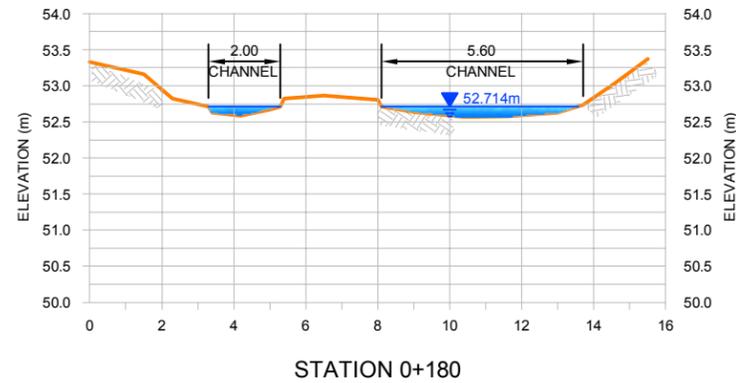
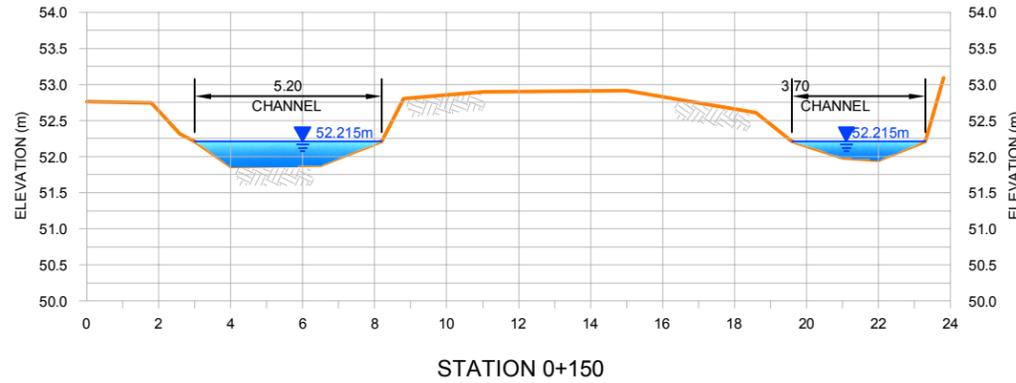
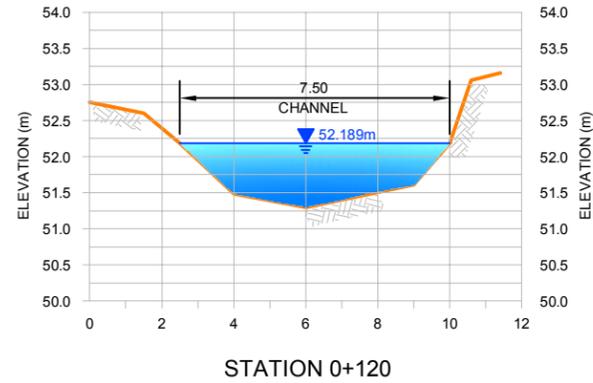
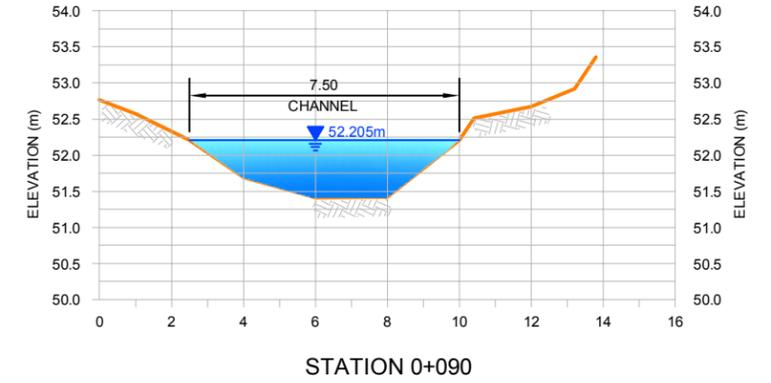
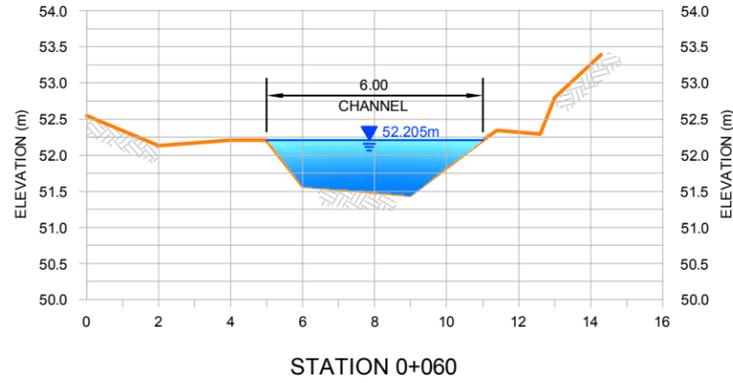
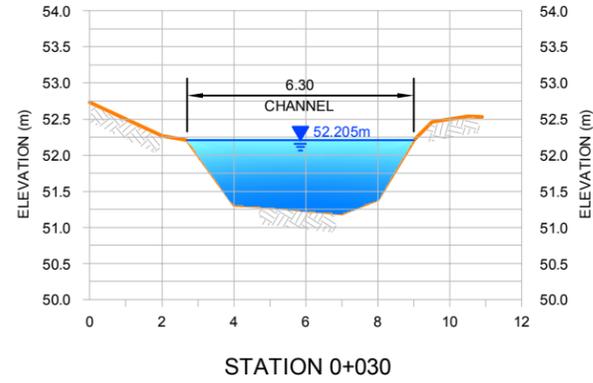
City of Ottawa
Cardinal Creek Subwatershed Study

Plan and Profile

PROJECT NUMBER
60189560

DATE
May, 2013

FIGURE
1



NOTES:
1. ALL CROSS SECTIONS SHOWN ARE LOOKING TOWARDS UPSTREAM.



Legend

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City of Ottawa
Cardinal Creek Subwatershed Study

Cross Sections

PROJECT NUMBER 60189560	DATE May, 2013	FIGURE 2
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