

OCTOBER 3, 2025

11 CRAIGLEITH COURT HYDROLOGY AND HYDRAULICS REPORT

TOWN OF COLLINGWOOD
PROJECT No. 2024-056



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Introduction

CAPES Engineering Ltd. has been retained by Owner to prepare a Hydrology and Hydraulic Report for their property at 11 Craigleith Court in the Town of Collingwood. The intent of this report is to demonstrate the extent of the potential flooding on the property to satisfy the Nottawasaga Valley Conservation Authority (NVCA) with respect to the proposed severance (through consent) of a lot from the existing parcel and the eventual construction of a new single-family residence.

The NVCA has mapped the entirety of property as within a regulated area due to the potential for flooding from Silver Creek. The Creek is not located within the subject property but is located as close as 300 m east of the site on an adjacent property.

The intent of this study is to demonstrate the extent of the flooding in the area and to demonstrate that the proposed severed lot and future house location are not within the flood affected areas and that safe access and egress for the site can be achieved.

Existing Study Area Conditions

Our description of the existing study area is based on review of aerial imagery (1954-2024 data) obtained from Simcoe County (<https://opengis.simcoe.ca/public/>), LiDAR information from Land Information Ontario, review of the DTM information obtained from the NVCA, review of previous reports for the area (MacLaren Study and Collingwood SWM Master Model), review of the topographic survey of the Site (2024) as well as site visits conducted by CAPES Engineering staff in July 2024.

The 11 Craigleith Court site is a 0.40 ha parcel located on the south side of Craigleith Court on the north side of the Georgian Trail in the Town of Collingwood.

The lot currently has a single-family residence on it, located on the east side of the lot with the remainder of the lot (west side) being covered in trees. An EIS has been completed (by others) for the site which documents the natural features. There are residential homes to the east and west of the site.

The entirety of site is within a regulated area by the NVCA due to the proximity to a watercourse and potential for flooding. Silver Creek flows through adjacent properties 300 m to the east but does not actually flow through the subject property.

Silver Creek starts at the west edge of the NVCA regulated area on the Niagara Escarpment at Castle Glen Estates. The various branches of the Creek cross under Grey Rd. 19 and combine into a single watercourse approximately 900 m south of the site. The creek flow is then transmitted under the Georgian Trail via a 10 m long x 4 m bridge. There are also two other culverts (300 mm and 750 mm dia) that appear to allow standing water from the south side of the Georgian Trail to flow to the north side immediately south of 11 Craigleith Court.

The creek continues for another 700 m north from the Georgian Trail crossing to Hwy. 26 where it crosses under the highway and then continues to flow north to Georgian Bay.

In the vicinity of the site (and at the time of inspection June/July 2024) the watercourse channel in this varies from 5-7 m wide with a water depth between 0.3 m and 0.5 m deep. The channel bottom was a mix of fine sediment (mud) and small rocks with no weeds or vegetation. The bank slopes were generally flat with heavy vegetation on either side of the channel beyond the top of bank.

For the purposes of this report the study area will extend over an area 120 m in a north-south direction and 800 m wide centered on Silver Creek. The study area extends approximately 50 m south of the Georgian Trail.

Please refer to **Figure 1** for the extent of the study area and location of the watercourse for this report and to **Appendix B** for select photos of key locations.

Background Information Review

It appears that two previous hydrology and hydraulic reports exist specifically for this area or this part of Silver Creek.

Watershed Hydrology Study for Nottawasaga, Pretty and Batteaux Rivers, Black Ash, Silver and Sturgeon Creeks - 1988

MacLaren Plansearch prepared a study in 1988 titled “Watershed Hydrology Study for Nottawasaga, Pretty and Batteaux Rivers, Black Ash, Silver and Sturgeon Creeks”. This study was provided by the NVCA as relevant background information for the study area. We reviewed the information and have found that Silver Creek is mentioned specifically and Figure 2.1 of the study shows the watershed boundaries and it appears that Catchments 900 & 901A-901E representing 26.3 sq. km of drainage area discharges to the “CNR” crossing, which is now the Georgian Trail.

The MacLaren Study indicates that the Regional peak flow for the discharge point of catchment 901E is equal to 109.0 cms.

The annotated MacLaren catchment map along with the peak flow summary has been included in **Appendix A**.

NVCA Generic Regulations Model

The NVCA have also provided a copy of their generic regulation HEC RAS model for Silver Creek. This model was built using the NVCA DEM which has known errors ranging from +/- 1.0 m. The HEC RAS model shows 4 cross sections (Reach 1, STA 2413.307 to 2221.361) for the Creek study area, none of which cross into the subject property.

The NVCA flows in the Creek are noted as 273.577 cms at the upper end of the Creek within the model. There is no indication in the information provided by the NVCA where these flow values were obtained from as they do not match anything in the MacLaren study.

The model shows flood elevations for the area between 187.09 and 184.64 and surface elevations along the Georgian Trail which vary from 186.00 to 186.97 at the Silver Creek Bridge crossing. The model also shows elevations of the Silver Creek bottom at 185.13 and a bridge opening 10 m wide by 1.30 m high.

The site-specific topographic survey and new LiDAR information we obtained shows an elevation of 187.15 for the Georgian Trail at the Silver Creek crossing and a channel bottom of 185.24. The

elevations of the Georgian Trail adjacent to the 11 Craigleith Court range from 187.04 to 187.08 south of the 11 Craigleith Court site. It appears that the NVCA model elevations and bridge crossing parameters are not significantly different than the most current topographic information available.

We have included the results for the relevant sections of the NVCA model in **Appendix A**, however we do not believe that the model outputs are reliable as the flow data is incorrect and the cross sections do not extend far enough west to include the subject site. In addition, the mannings n values used in the HEC RAS model are overly conservative (0.08) and the boundary conditions are set to a “Known WS”; 195.00 upstream and 176.82 at the downstream end. There is no information on where these values come from.

Collingwood Stormwater Management Master Model - 2022

The Town of Collingwood retained Greenland International Consulting Ltd. to complete a comprehensive stormwater model for the Town including Silver Creek. They produced a report titled “Collingwood Stormwater Management Master Model” in January 2022. We understand that from the NVCA point of view this study currently does not have official status and it is unknown when, or if, the study will be formally adopted.

Greenland adjusted the watershed boundaries and updated the peak flows. Greenland determined a Regional flow of 93.49 cms to the outlet or 90.49 cms to the south side of the Georgian Trail.

The portion of the HEC RAS model that deals with the study area extends from cross section 1870.80 (south of the Georgian Trail) to 1636.9 north of the Trail. With floodplain elevations ranging from 187.42 to 184.65.

They identified a number of spill locations from Silver Creek including a 14.80 cms spill over the Georgian Trail west of 11 Craigleith Court, a 3.81 cms spill west on the south side of the Georgian Trail west of 11 Craigleith Court, a 1.43 cms spill east of Silvery Creek on the north side of the Georgian Trail and three other spills between the Georgian Trail and Hwy 26 north of our study area.

Greenland determined that flows above elevation 187.00 would continue west on the south side of the Georgian Trail and would flow over the Georgian Trail at elevation 187.04. They concluded that flow going over the Georgian Trail would flow to Craigleith Court or to Silver Creek.

Their study did not have detailed topo survey for the private residences on Craigleith Court, and did not delineate the flood path of the spill going over the trail leaving some uncertainty in the report as to which lots may be flooded. The Report also does not include the input parameters used or sufficient detail to allow for a comparison of the topographic elevations used to the current LiDAR and Topo survey.

We understand however that the report was reviewed and commented on by the NVCA as well as Town of Collingwood staff and ultimately the final report was prepared and submitted, but has not ultimately been adopted by the NVCA.

Based on the available existing modelling we propose that a new hydraulic model be developed that represents the expanded topography by extending the cross sections west to 11 Craigleith Court, uses the flows from McLaren study (109.00 cms) and input characteristics of the study area.

Existing Condition Hydraulic Modelling

We have utilized the background information and hydrology results obtained from the background studies to develop a new hydraulic HEC-RAS floodplain model. Civil 3D has been used to produce a digital terrain model for the subject area using LiDAR information obtained from Land Information Ontario and site specific topographic survey information.

The LiDAR was adjusted globally by 0.17 m to match into the site-specific topographic information. The centerline of the Georgian Trail and Craigleith Court was used as the main common element between the two for calibration. Please refer to **Drawing C2** which demonstrates the alterations to the LiDAR completed by comparing three cross sections through the study area.

The HEC-RAS import and export tools within Civil 3D allow the watercourse alignments, cross sections and profiles created from AutoCAD Tin surfaces to be exported as GIS entities, into the HEC-RAS environment. Working within the Civil 3D environment facilitates generation of geo-referenced cross sections and floodlines and tends to avoid errors associated with traditional approaches that rely on manual input.

HEC-RAS Version 6.5, developed by the U.S. Army Corps of Engineers, has been utilized in accordance with NVCA Hydraulic Standards. This model estimates the change in water surface elevation between selected valley cross sections and runs embedded computational routines to account for local increases in water levels due to bridges and/or other flow obstructions. The model is intended for utilization in the analysis of water surface profiles of steady state, gradually varied, one-dimensional flow, in natural and man-made channels.

A number of considerations are required in the selection of data and parameters to be used in the application of the HEC-RAS model to the floodplains of the study area, including the location of cross-sections and hydraulic structures, hydraulic input parameters and boundary conditions.

Cross Sections

Floodplain boundaries and the lateral extension of flows along a natural stream are typically controlled by the topographic relief and conveyance structures within the stream corridor. This relief is quantified in terms of ground surface elevations and/or contours. For utilization in the HEC-RAS program the topographic relief is represented by cross sections of the stream corridor taken perpendicular to the direction of flow.

Cross sections need to be taken at small enough spacing to accurately represent the channel geometry and to ensure sudden changes in cross section or slope are accounted for in the model. The total distance between the first and last cross sections required to represent the valley system is referred to as the reach length. Please refer to the defined reaches in **Table 1**.

Table 1 – River Reaches

Reach	Upstream Cross Section	Downstream Cross Section
EX-SILVER CR	RS 139.93	RS 19.93

The digitized cross sections were initially taken looking from left to right in the upstream direction, which is opposite to the orientation required in HEC RAS. Once the cross sections were imported to HEC RAS they need to be reversed to have the proper orientation (left to right looking downstream).

Cross sections have been cut perpendicular to the anticipated major system flow path through the site and watercourses, and at key locations as follows:

- Changes in channel and/or valley cross-sectional shape.
- Rapid changes in channel or valley slope.
- Significant changes in channel or valley roughness.
- Upstream and downstream of bridges.
- At all defined control points.
- Upstream and downstream of all channel confluences.

Following the initial evaluation of the cross-section selections as noted above, additional sections were added to the model when calculations indicated any of the following conditions:

- Where energy slope decreased or increased significantly.
- When significant changes in the conveyance of adjacent sections were observed.
- Where topographic representation of flow between cross sections indicated unrealistic transition.

Upon using this set of criteria to select the cross sections, these were then reviewed, and edits were made where necessary in the HEC-RAS software. HEC-RAS input geometry files were re-cut from the topographic survey data and iterated through a visual examination of plotted cross sections and model-generated warnings until the number of warnings generated by the software were minimize, eliminated or deemed to not have any impact on the generated floodplain extents.

Hydraulic Structures

Hydraulic structure information was based on review of previous work completed and confirmed with site investigation. This data included the location, orientation, elevation, width and height, composition, inlet/outlet characteristics.

Hydraulic structures in the model are limited to the two culverts and at the Georgian Trail. The closest downstream structure is located at Hwy 26 at almost 700 m north of the Georgian Trail and has little potential to change the flood elevation for the reach due to the distance downstream and relative elevation changes.

We have assumed that the bridge crossing and the Georgian Trail itself will be the primary features controlling the flood elevation. The bridge is a wooden platform 10 m long and 4 m wide with a railing

on top with open pickets to allow flow over the bridge top. It is supported by concrete and wood supports at each end and one wooden support at mid span. The width between the outer two supports is 7 m and the flow depth at the time of the site visit was 0.30 m.

We have inserted two lateral weirs into the model. The first is located upstream of the Georgian Trail at STA 139.50 extending north to the Georgian Trail. This weir assumes that flow spills from the system west at elevation 186.00. The flow model has been optimized to reduce the main channel flow by the amount of the spill west from the system.

The second lateral weir is located downstream of the Georgian Trail at STA 39.50 and allows flow to spill east out of the system. Flow escapes the system at between elevations 184.71 and 185.08 and the flow is optimized in the model.

Please refer to **Table 2** below for a list of the structure characteristics for information only.

Table 2 – HEC RAS Hydraulic Structures

Flow Location	Type	Dimensions	Inv. (Up)	Inv. (Down)
Georgian Trail – STA 116.92	Wooden Bridge	10 m long x 4 m wide	185.18 (Stream Bed)	185.18 (Stream Bed)
Georgian Trail – STA 116.92	CSP Culvert	750 mm	185.98	185.98
Georgian Trail – STA 116.92	CSP Culvert	300 mm	186.22	186.12
Upstream of Georgian Trail – STA 139.50	Lateral Weir	10 m wide x 30.5 m long	186.00	186.00
Downstream of Georgian Trail – STA 39.50	Lateral Weir	10 m wide x 18 m long	184.71	185.08

The two culverts, located between the site and the bridge crossing on the Georgian Trail did not have active flow, but there was standing water on either side of the trail adjacent to the culverts.

In the model we tested the fully open condition for the bridge and the 50% blocked condition for the bridge (as per NVCA Guidelines). We believe the culverts provide little or no impact on the overall model due to their small size relative to the flow, but we included them in the model regardless. The sensitivity review of the input parameters is discussed further below.

Hydraulic Parameters

HEC RAS requires the input of various hydraulic parameters have been referenced from the HEC-RAS User Manual and Design Chart 2.01 from the 1997 MTO Drainage Management Manual as follows:

Manning's 'n' values are used to compute flow friction losses and have been summarized in the HEC-RAS description editor.

The Silver Creek channel typically has flat banks, slightly meanders and has a mud, gravel bottom with cobbles and small boulders. The banks are typically heavily vegetated with trees and shrubs through the study area.

Please refer to **Table 3** below for the Mannings n values for the reaches used in the HEC RAS Model.

Table 3 – Manning's n values Channel & Overbank Areas

Reach	Left Of Bank Manning n	Channel Manning n	Right Of Bank Manning n
EXST-SILVER CR	0.10 – Medium to dense vegetation, Summer	0.045 – Irregular section, slight channel meander, bottom mud, gravel and rock	0.10 – Medium to dense vegetation, Summer

Levees and Ineffective Flow Areas

There is a localized elevated area that extends from the upstream section of the model to the Georgian Trail, east of the Silver Creek watercourse. The ridge continues on the downstream side of the Georgian Trail but ends approximately 45 m north of the end of the model. We assumed ineffective flow area for any regions that have flow cut off from the main channel due to a ridge or raised ground surface (ie. Flow in the cross section disconnected from the main channel flow is due to flow from an upstream cross section). We set levees and ineffective flow areas at the following sections and stations (see **Table 4**) to reflect this ridge.

Table 4 – HEC RAS Levees & Ineffective Flow Areas

HEC RAS X-SECT	Levee Left of Channel		Levee Right of Channel		Ineffective Flow Areas (Left/Right of Channel)	
	Station	Elevation	Station	Elevation	Station	Elevation
139.93			634.32	188.03		
123.82			676.69	188.17		
110.02					405.83/426.95	186.29/186.41
100			728.17	187.17	267.92	186.31
79.98			651.28	186.87	332.5	185.87
59.93			653.41	185.67	411.21	185.60
39.93					/450.69	/185.29
					/563.65	/185.15

Boundary Conditions

We have made the assumption that the reach is flowing under normal (uniform) flow conditions at the upstream and downstream ends of the study area. We have measured the bed slope of the channel at the boundary using information obtained from the LiDAR survey and utilized that as the energy slope for the normal boundary condition 0.5% slope for the upstream end and 0.8% for the downstream end (end of study area to Hwy 26)

A summary of boundary condition parameters used has been outlined in **Table 5** below.

Table 5 – Reach Boundary Conditions

Reach	Upstream Boundary Condition	Downstream Boundary Condition
EXST-SILVER CR	Normal Depth = 0.005	Normal Depth = 0.008

Existing Condition Hydraulic Modelling Results

The floodplain results for the Regional storm event has been plotted on **Drawing C1** and the summary table results have been provided in **Appendix C**.

The resulting floodplain, based on the fully open culvert condition at the bridge at the Georgian Trail, varies in elevation from 187.21 at the upstream end of the model to 185.19 at the downstream end.

South of the Georgian Trail the flood spills west, consistent with the Greenland model. The optimized flow indicates that the spill is 21.74 cms west. The flood level over the Georgian Trail is 187.21 at the upstream side and 187.10 by the time it reaches the north side of the trail, which is slightly higher than what Greenland determined (187.04).

Based on the site investigation, model results and topographic survey the flow that breaches the Georgian Trail south of 11 Craigleith Court, enters a low lying area/ditch on the north side and continues to flow west past the site along the north side of the Georgian Trail. The flow does enter the 11 Craigleith Court property but the extent of the flooded area is limited.

As per section 3.2.6 of the NVCA Natural Hazards Technical Guide (2013) we tested the model with a 50% blockage at the bridge, a 20% increase in the peak flow and tested the Mannings roughness coefficients by adjusted them by 20%.

The sensitivity alterations are listed below in **Table 6**.

Table 6 – HEC RAS Model Sensitivity Analysis

Model Factor	Sensitivity Factor	Value Used	Impact to Floodplain	General Result
Bridge Blockage	50% Blockage	n/a	None	No Change
Mannings n	20% Increase	0.12 overbank, 0.054 channel	Max 6 cm increase (XSECT 79.98)	No Change to Floodplain
Peak Flow	20% Increase	130.8 cms	Max 7 cm increase (XSECT 79.98)	No Change to Floodplain

The model shows that the bridge opening blockage of 50%, a peak flow increase of 20% and Mannings n increase by 20% have little to no significant impact on the floodplain.

Conclusions & Recommendations

We have undertaken a review of the previous hydrology and hydraulic work completed for Silver Creek and the study area adjacent to 11 Craigleith Court which generally extends from 50 m south of the Georgian trail to approximately 100 m north of the trail and for several hundred meters in an east-west direction.

Silver Creek does not actually flow across 11 Craigleith Court and is generally a well defined shallow watercourse feature 5-7 m wide, which travels through wooded and wetland areas in the study area.

The drainage area and peak flows for the Creek is quite large, on the order of 26 sq. km and produces 109.00 cms of flow and was determined by the MacLaren Study in 1988.

It is proposed to sever the west part of 11 Craigleith Court and construct a new single-family residence. It has been anticipated that in order to support the proposed severance that the NVCA will require a flood study to be completed to demonstrate that the proposed lot and home location would not be within the floodplain and that safe access and egress can be provided.

The model we have developed for the study demonstrates that flood flows travel west on both the north and south side of the Georgian Trail and overtops the trail but only partially enters the 11 Craigleith Court property. Flows continue to spill west past the property outside of the study area. The maximum flood depth on the property is 185.90 during the regional storm event.

We have no issue with the proposed lot severance or the construction of a new home on the lot.

Our recommendations for the site are as follows:

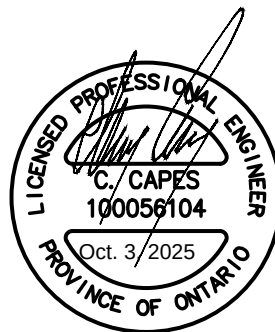
1. That the future home has a minimum opening elevation set 0.30 m above 185.90 (ie. 186.20) as per NVCA standards.

Report Prepared By:



Clayton Capes, MSc. P.Eng.

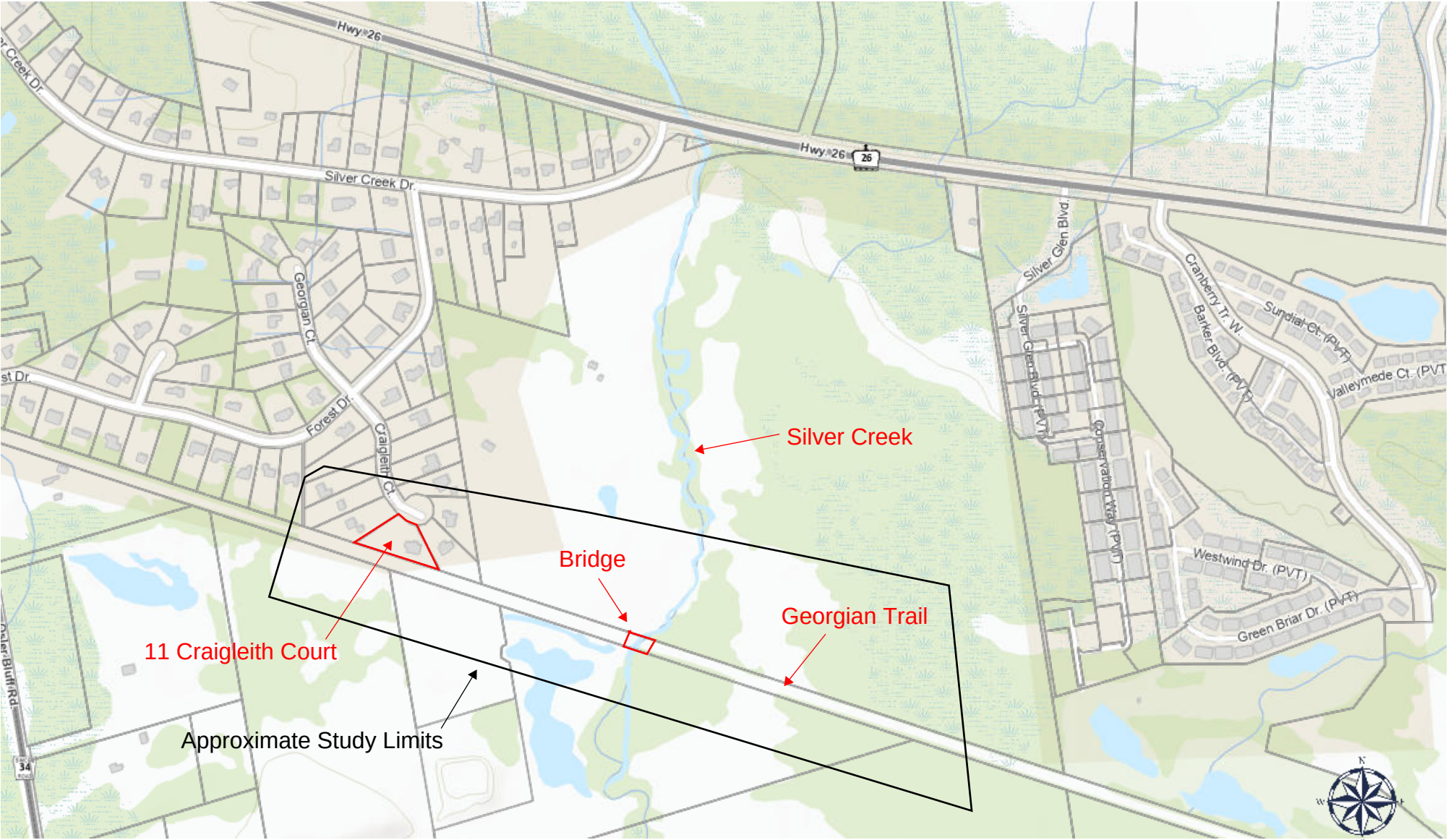
CAPES Engineering Ltd.



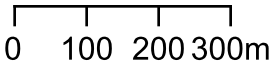
Figures

Figure 1 - Study Area

County of Simcoe - Web Map



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Drawings

Appendices

Appendix A – Background Information

MacLaren Study Flows

DESIGN FLOWS:

REF. NO.	DESCRIPTION	TRIBUTARY DEVELOPMENT		DISCHARGE (M3/S)					
		AREA (KM2)	CONDITION	5-YR	10-YR	20-YR	50-YR	100-YR	REGIONAL STORM
SILVER CREEK									
900	Outlet from sub-catchment 900	20.3	Present	13.4	17.8	22.1	29.5	35.4	80.8
			Future	13.4	17.8	22.1	29.5	35.4	80.8
90	Total flow at outlet of sub-catchment 901A	22.6	Present	15.6	20.6	25.7	34.4	40.6	81.1
			Future	15.6	20.6	25.7	34.4	40.6	81.1
9012	Outlet of sub-catchment no. 901B	1.65	Present	2.5	3.2	4.0	5.2	6.2	14.5
			Future	2.5	3.2	4.0	5.2	6.2	14.5
9013	Outlet of sub-catchment 901C	0.85	Present	1.4	1.8	2.2	3.0	3.5	8.2
			Future	1.4	1.8	2.2	3.0	3.5	8.2
930	Confluence sub-catchments 901B and 901C	2.5	Present	3.9	5.1	6.2	8.2	9.7	22.7
			Future	3.9	5.1	6.2	8.2	9.7	22.7
91	Outlet of sub-catchment no 901D	2.8	Present	4.2	5.4	6.6	8.7	10.3	22.2
			Future	4.2	5.4	6.6	8.7	10.3	22.2
94	Confluence of Silver Creek and tributary	25.4	Present	18.6	24.0	30.0	39.6	46.9	105.7
			Future	18.6	24.0	30.0	39.6	46.9	105.7
92	At CNR crossing	26.3	Present	19.5	25.0	31.0	40.7	49.6	109.0
			Future	19.5	25.0	31.0	40.7	49.6	109.0
93	At Highway No. 26	26.6	Present	20.2	25.5	31.3	40.8	50.1	113.7
			Future	20.2	25.5	31.3	40.8	50.1	113.7
95	Outlet of Silver Creek	26.8	Present	19.1	24.0	29.7	38.7	47.7	105.1
			Future	19.1	24.0	29.7	38.7	47.7	105.1
9018	Catchment 901H only	0.38	Present	0.22	0.30	0.37	0.46	0.51	1.52
			Future	0.72	0.87	1.03	1.24	1.39	2.27
9019	Catchment 901I only	0.67	Present	0.45	0.58	0.78	1.02	1.21	3.16
			Future	1.21	1.49	1.79	2.17	2.44	4.18

A map of the Silver Creek area. A blue line outlines the 900 block. A blue arrow points to the intersection of 901B and 901C. The map shows streets 901A, 901B, 901C, and 901D. It also shows Silver Creek and Black Creek.

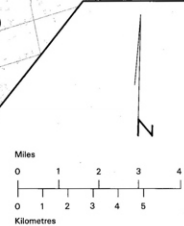
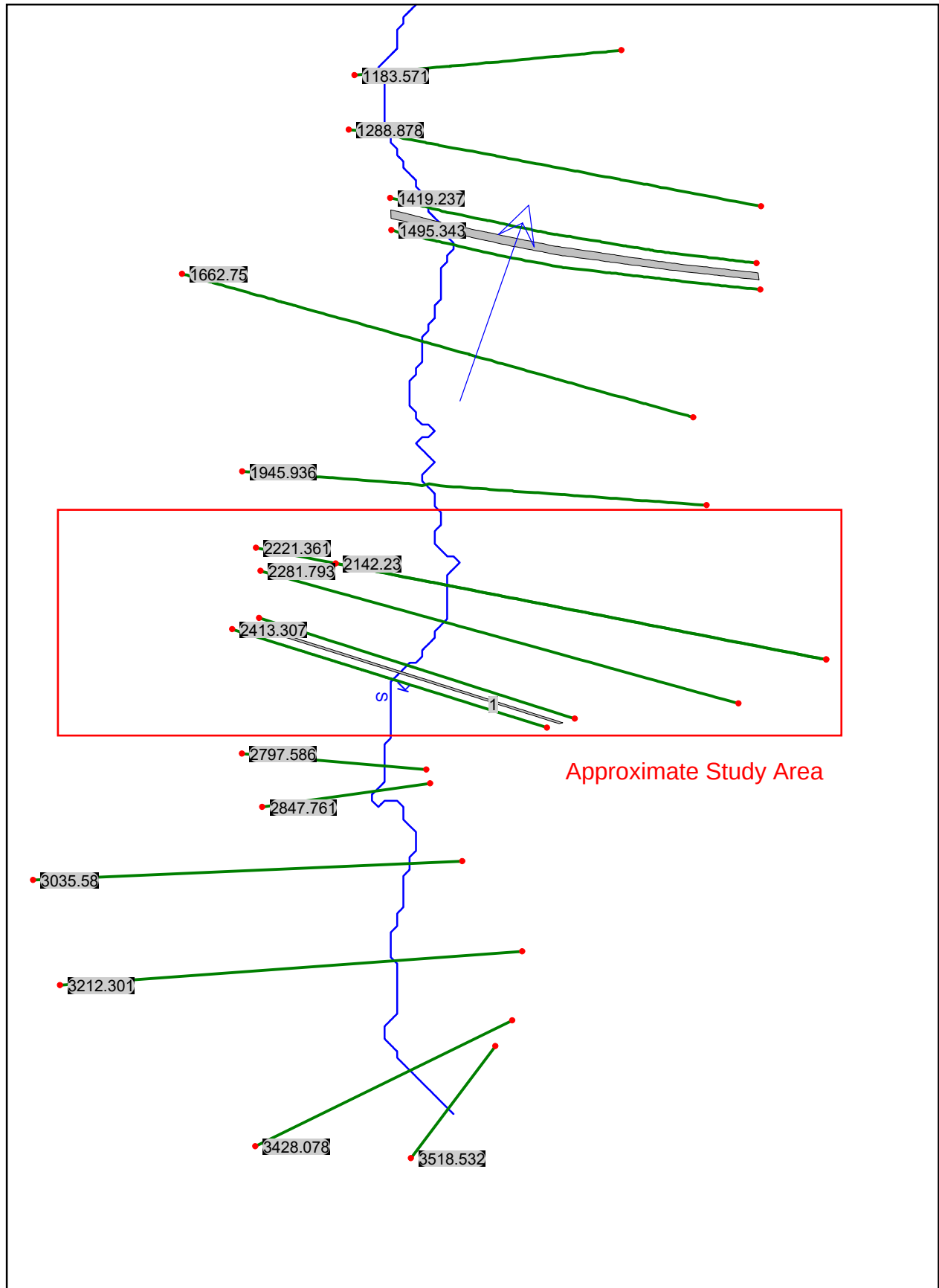


Figure 2-1
**Location of Surveyed
Waterway Cross-Sections
and Representative
Stream Reaches**

NVCA Generic Model



Silver_Final Plan: Silver_Final 2024-06-21
RS = 2413.307

Legend

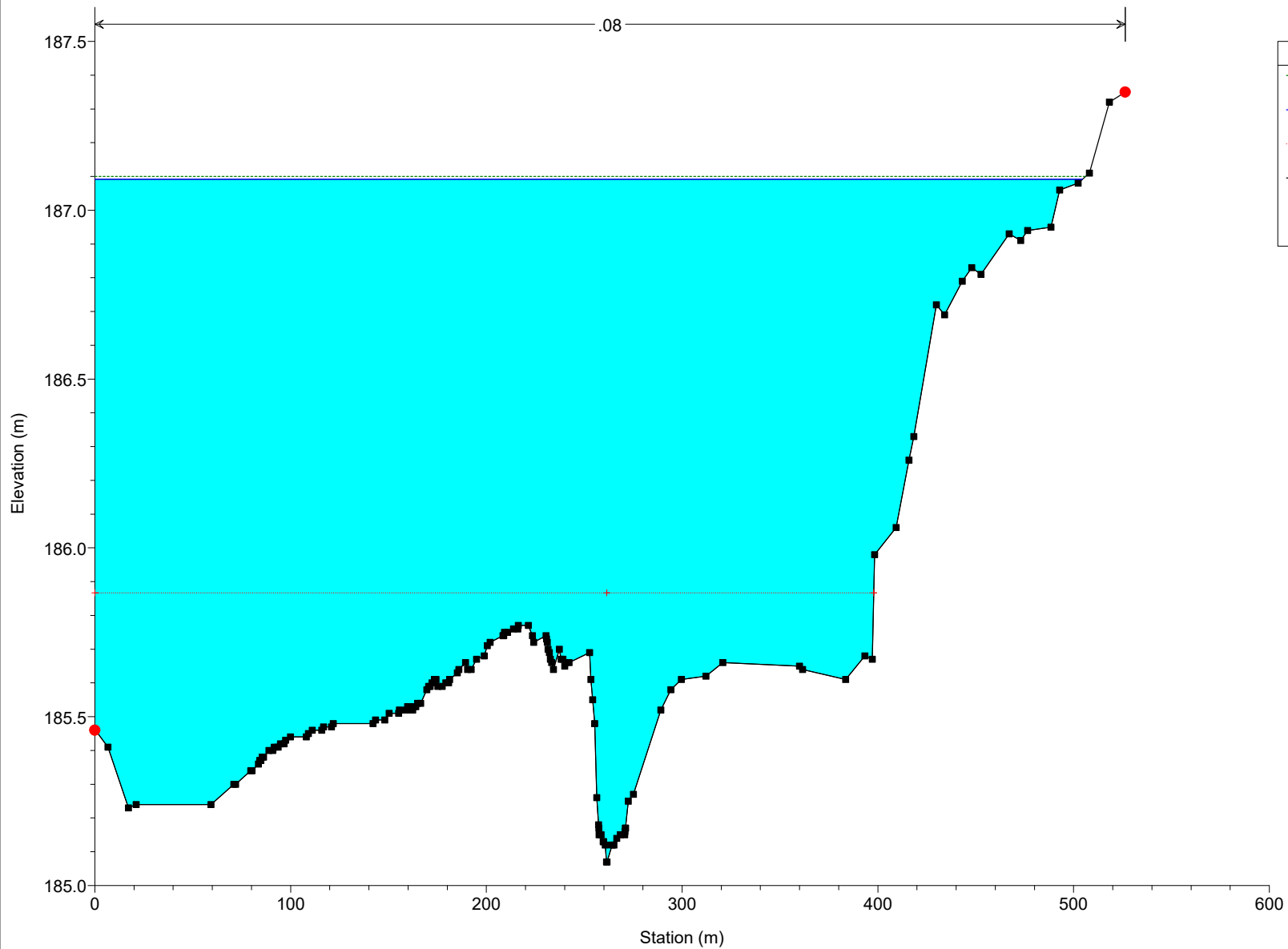
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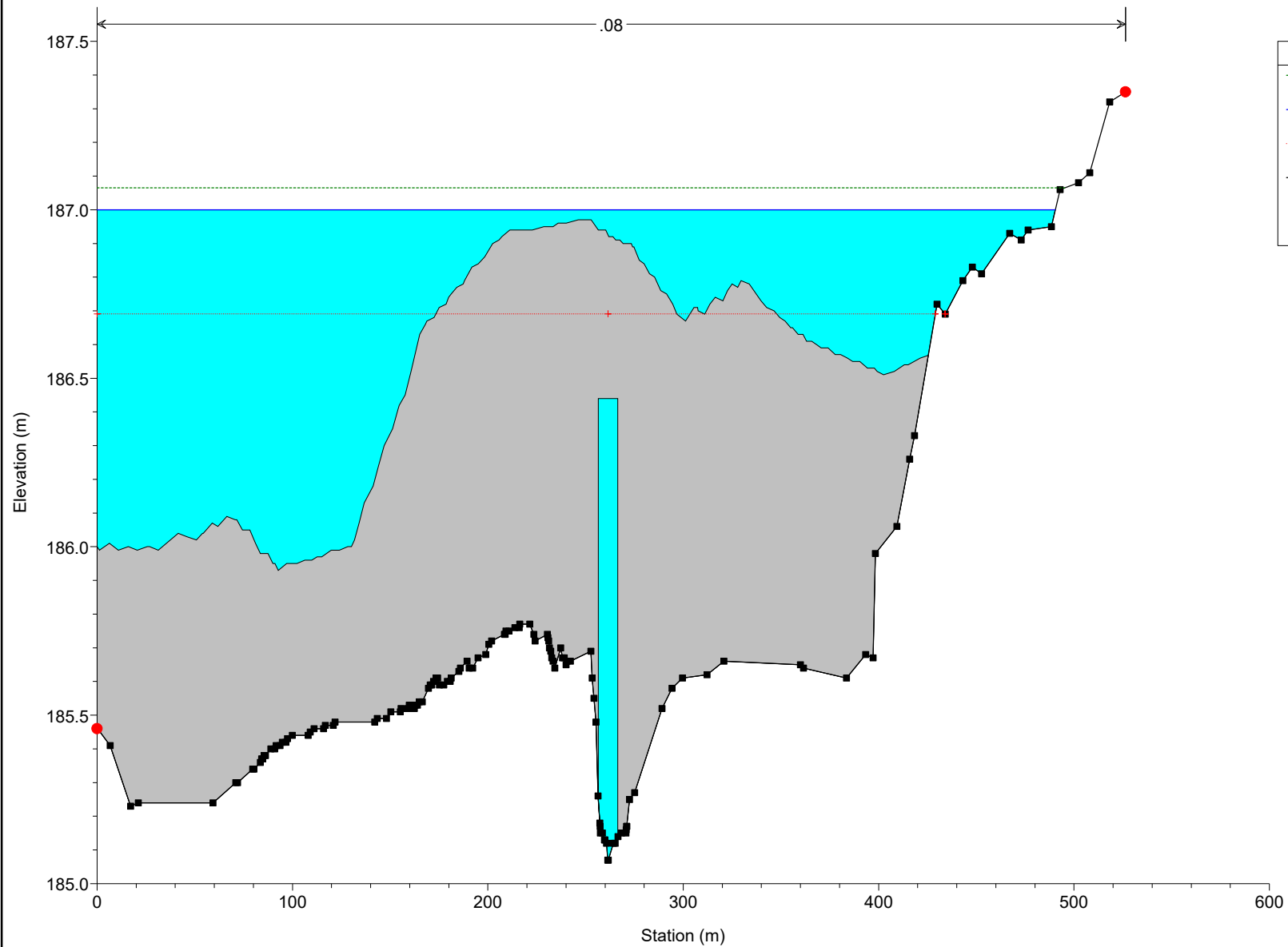
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Ground

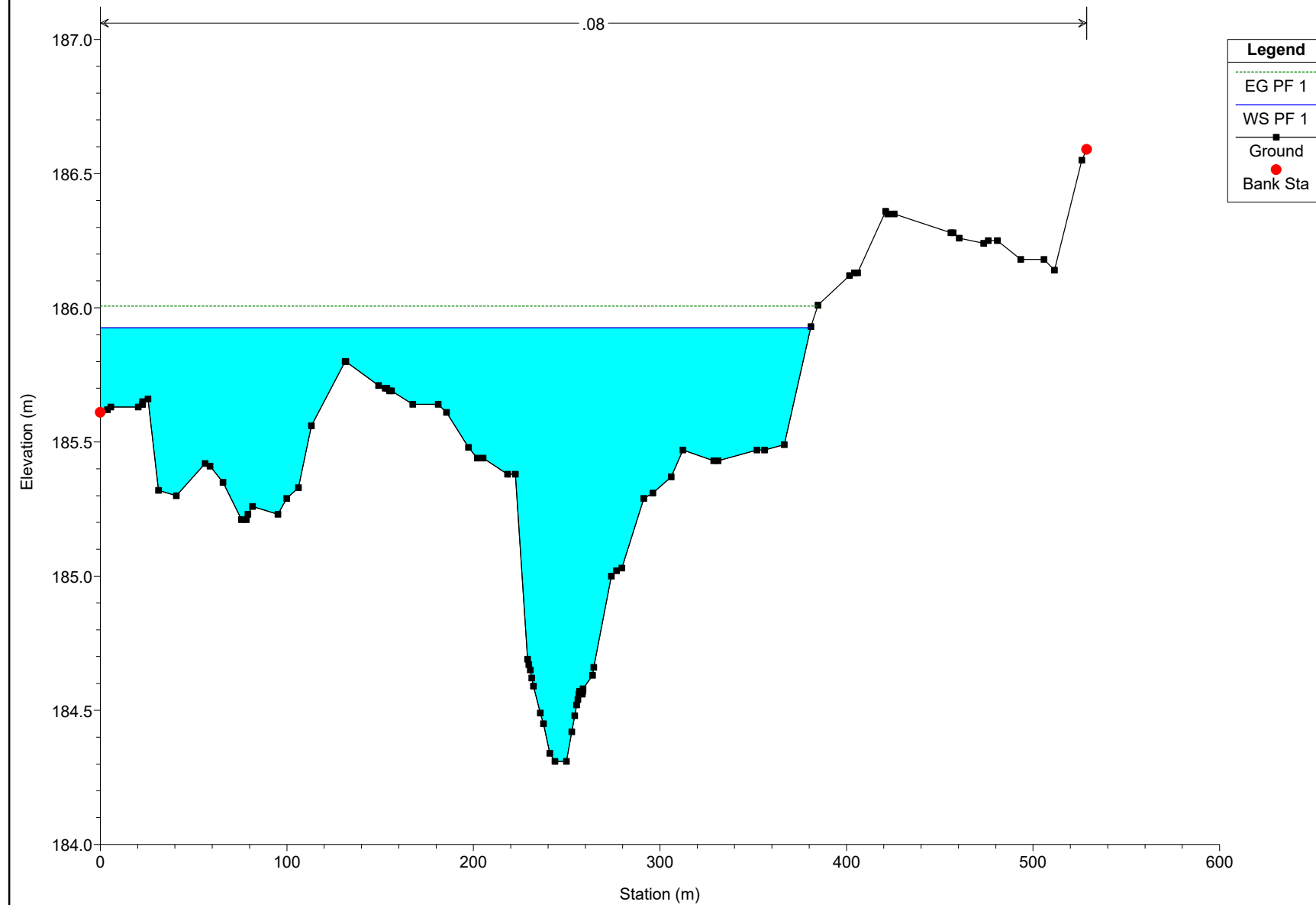
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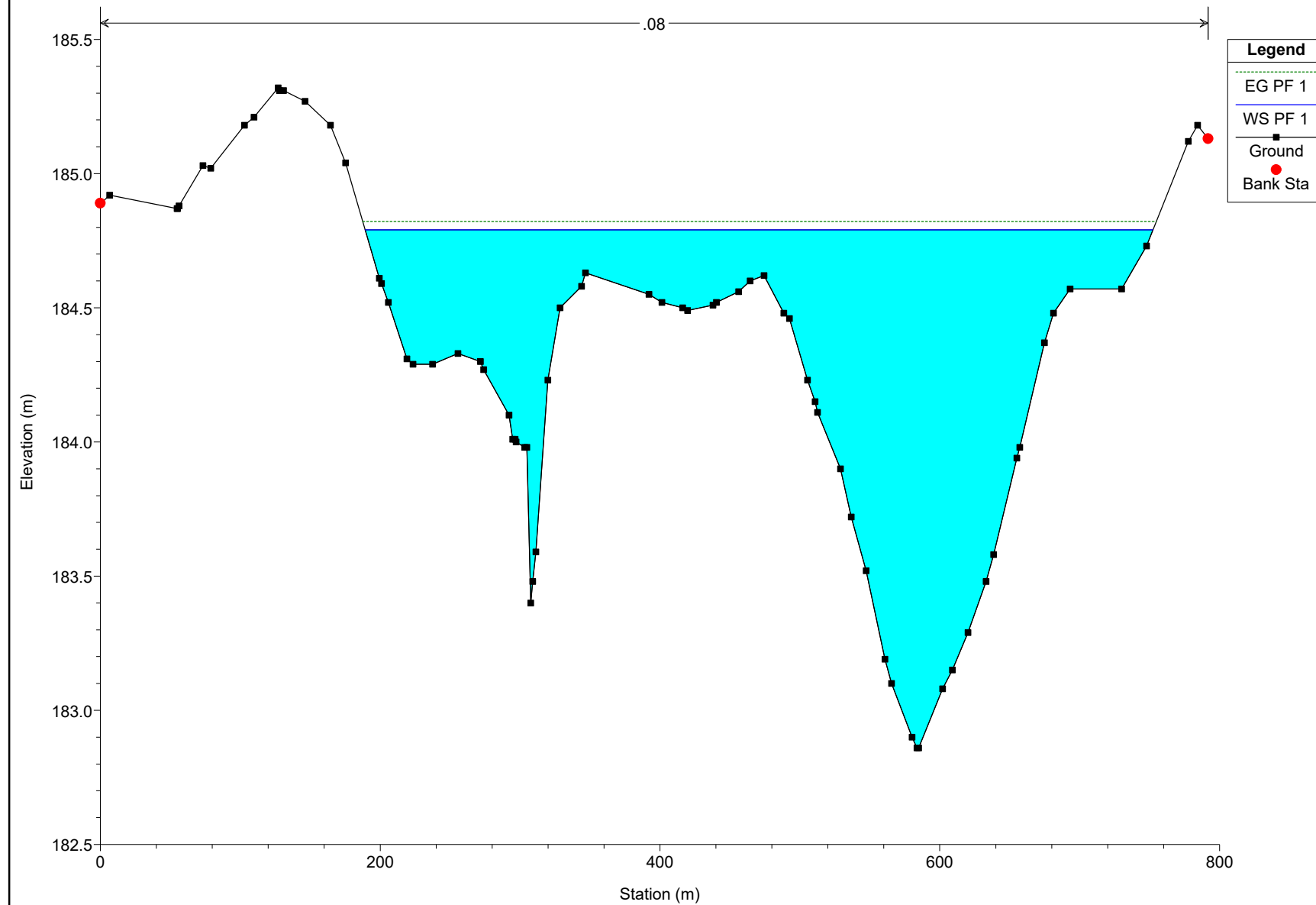
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RS = 2399.675 BR



Silver_Final Plan: Silver_Final 2024-06-21
RS = 2381.221



Silver_Final Plan: Silver_Final 2024-06-21
RS = 2281.793



Silver_Final Plan: Silver_Final 2024-06-21
RS = 2221.361

.08

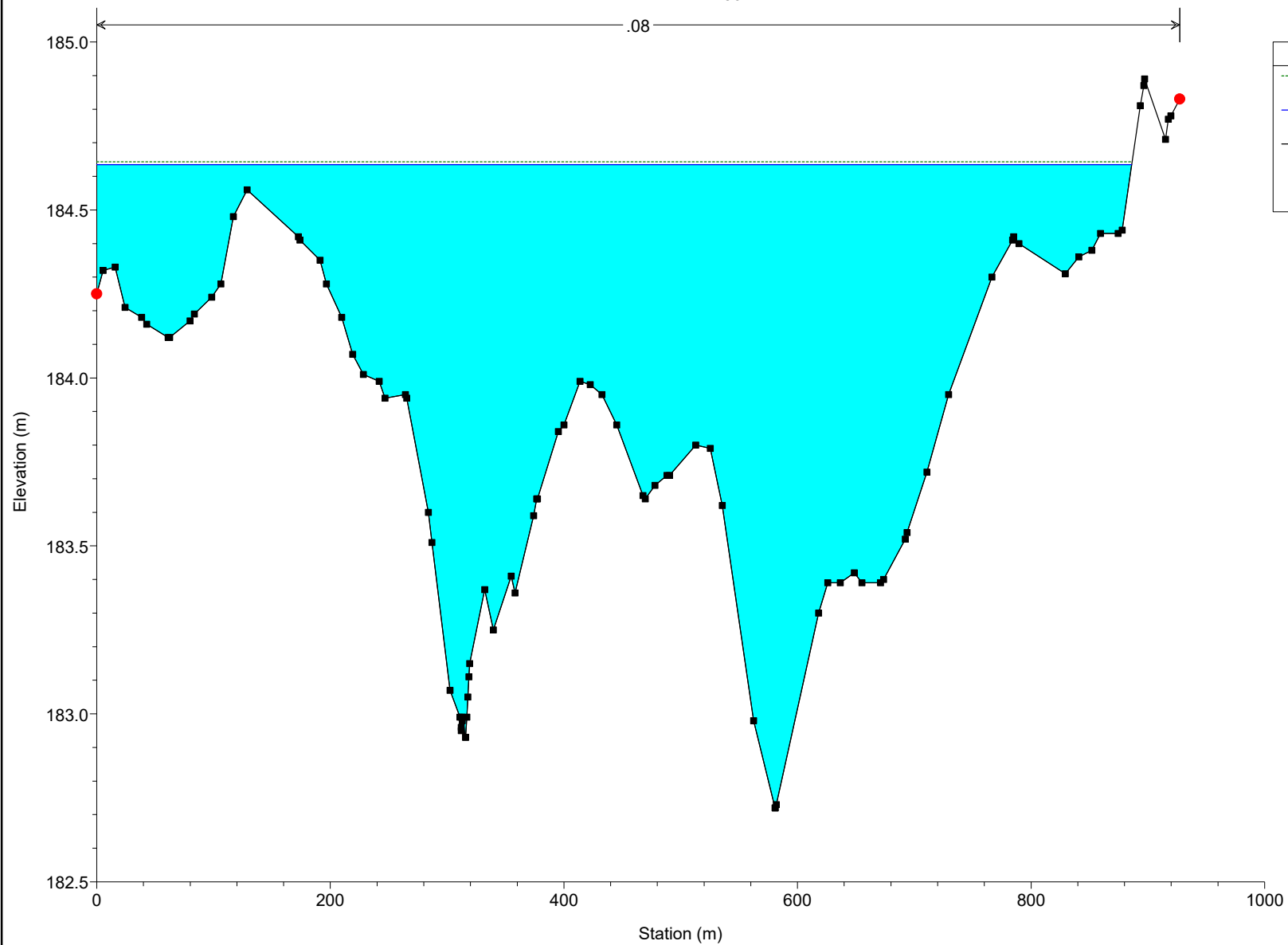
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assigned. As there was no existing field hydraulic information for the creek, field survey data was collected for two (2) of the bridge crossings within the Town of Collingwood: the Georgian Trail crossing and Highway 26. The data was then incorporated into the HEC-RAS model. The final HEC-RAS model schematic is depicted in **Figure 5-3**.

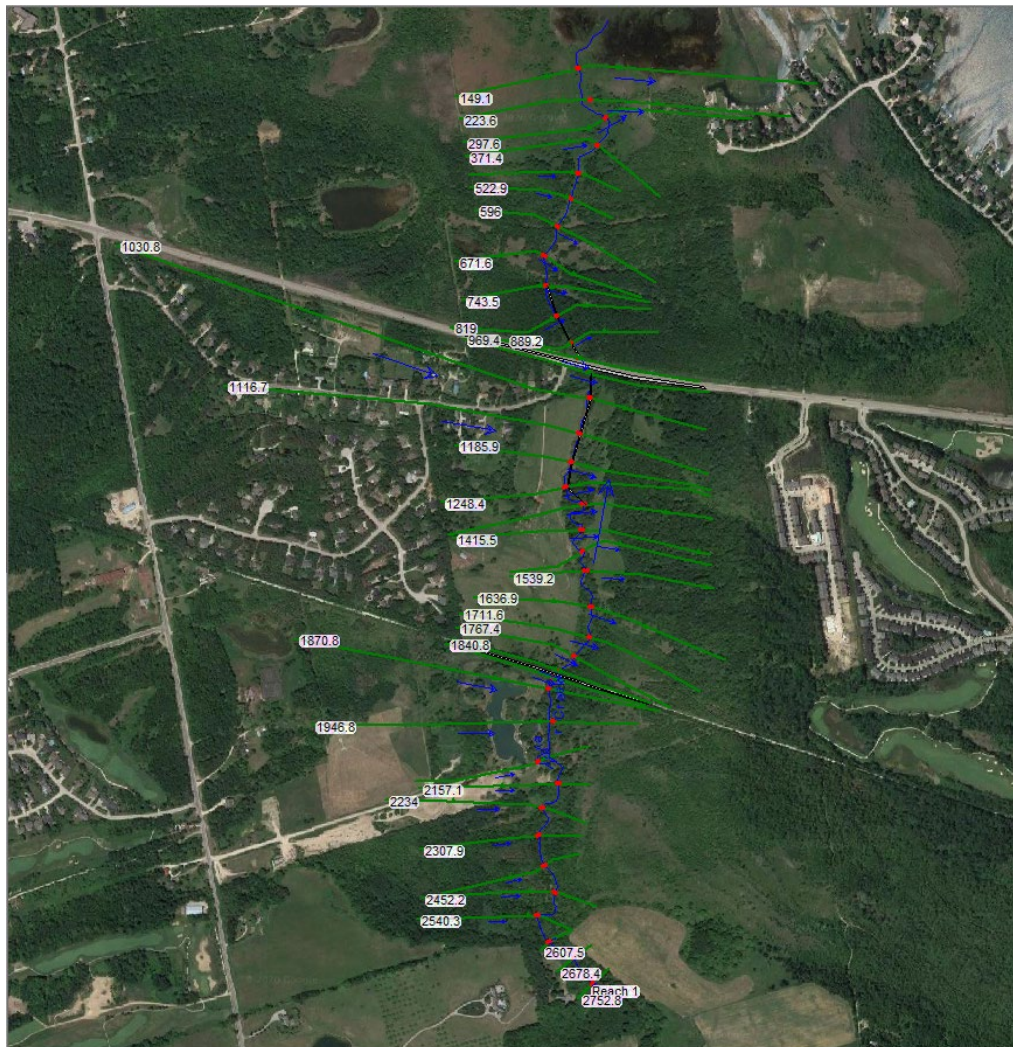


Figure 5-3 Silver Creek HEC-RAS Model Layout

5.4 Townline Creek

The Townline Creek hydraulic model is based on the HEC-RAS model created for Watercourse 1 in the recent NDMP work prepared by Greenland for the GSCA and the Town of the Blue Mountains. It had to be adjusted for use within the Town of Collingwood. Since the Town has all its infrastructure tied to the older CGVD28 geodetic datum, the LiDAR data for Collingwood and Camperdown has a 0.37 m difference. The surveyed culvert elevation in the original HEC-RAS model matched the Camperdown LiDAR which is

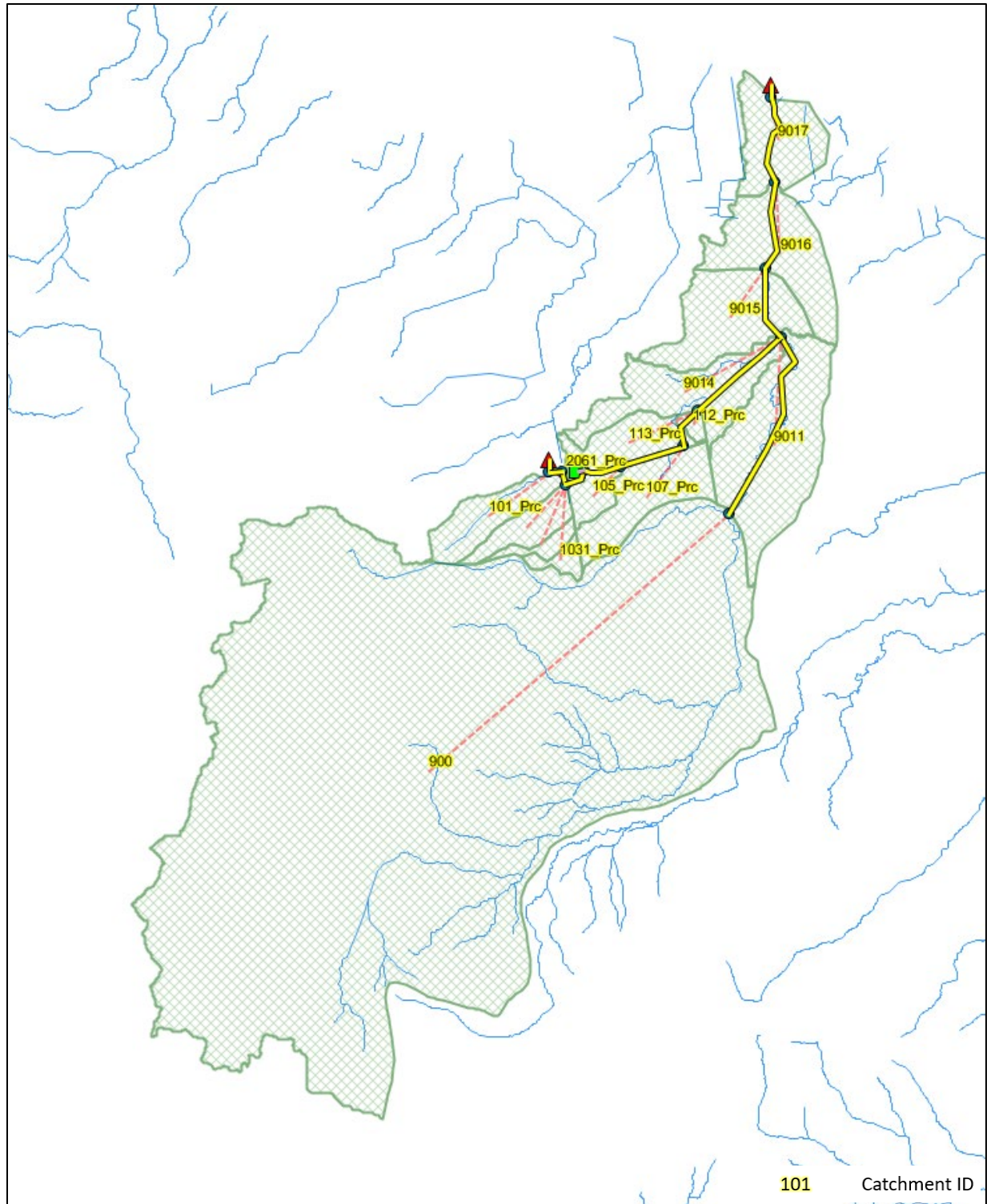


Figure 4-5 Silver Creek Watershed in PCSWMM

The length to width ratio in the updated project model remains unchanged from the MacLaren Study. With the adjusted parameters, the PCSWMM model was run for the Timmins Storm (areally reduced to

Table A5- 7 Windfall Matched Flow and Adjusted Parameters - Original Catchment (100yr 24 SCS)

Name	PCSWMM					VO2 Catchment	
	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Peak Runoff (m ³ /s)	NHYD	Peak Flow
101_Prc	47	1469	320	18	3.91	101	3.847
102_Prc	28	933	300	18	2.86	102	2.866
1031_Prc	9.8	576	170	18	1.36	1031	1.358
1032_Prc	10.2	408	250	18	1.16	1032	1.093
105_Prc	16.9	845	200	5	1.95	105	1.919
107_Prc	61.8	1236	500	10	2.68	107	2.666
112_Prc	5.3	353	150	5	0.41	112	0.396
113_Prc	42.3	1410	300	7	1.87	113	1.823
2061_Prc	0.9	150	60	2	0.09	2061	0.087
2062_Prc	2	200	100	3	0.47	2062	0.45
Outlet	224.2				11.75		11.53

Table A5- 8 Silver Creek Updated Model Flow - (Timmins 90%)

Name	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Peak Runoff (m ³ /s)
101_Prc	43.90	1372.0	320	18	3.85
102_Prc	28.03	934.5	300	18	2.55
1031_Prc	9.85	579.1	170	18	0.93
1032_Prc	10.16	406.6	250	18	0.94
105_Prc	16.87	843.7	200	5	1.61
107_Prc	61.86	1237.1	500	10	4.68
112_Prc	5.26	350.6	150	5	0.46
113_Prc	42.30	1410.0	300	7	3.28
2061_Prc	0.98	163.6	60	2	0.08
2062_Prc	2.00	199.7	100	3	0.21
900	2018.6	6728.6	3000	5	71.25
9011	136.84	1052.6	1350	1.5	6.57
9014	81.48	905.3	900	2	3.88
9015	84.08	934.3	900	1	3.41
9016	39.9	399.0	1000	0.5	1.04
9017	42.02	700.3	600	1	1.96
Outlet	2624.1				93.49

3. Silver Creek

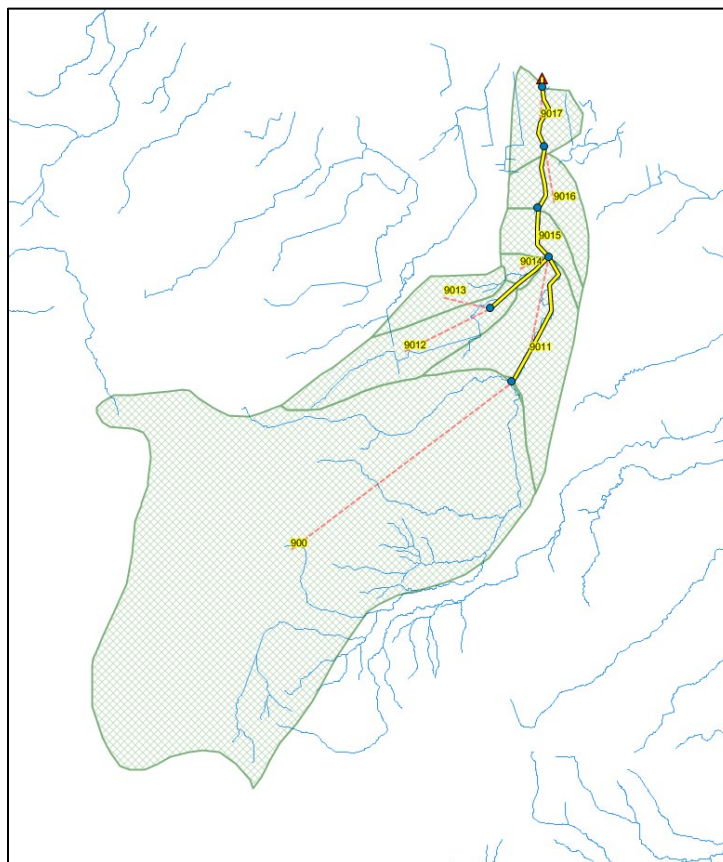


Figure A5- 2 Silver Creek PCSWMM Model –MacLaren Catchment

Table A5- 5 Silver Creek QUALHYMO Parameters

SubWatershed ID	SMAX	SMIN	API	SK	S*	CN condition I	CN condition II	Area
900	2100	61	27	0.11	165.6	60.5	78	2032
9011	881	22	27	0.11	66.1	79.4	90	227
9012	1202	30	27	0.11	90.1	73.8	87	165
9013	766	20	27	0.11	58.3	81.3	92	85
9014	1910	43	27	0.11	138.8	64.7	81	30
9015	2174	70	27	0.11	177.9	58.8	77	88
9016	3339	121	27	0.11	286.1	47.0	67	35.2
9017	2032	54	27	0.11	155.5	62.0	79	16
9018	3339	121	27	0.11	286.1	47.0	67	38
9019	2032	54	27	0.11	155.5	62.0	79	67

Table A5- 6 Silver Creek Matched Flow and Adjusted Parameters (Timmins 94%)

Name	PCSWMM					QUALHYMO	
	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Peak Runoff (m ³ /s)	ISER	Peak Flow
900	2032	6773	3000	5	77.24	900	77.206
9011	227	1335	1700	1.5	10.58	9011	10.732
9012	165	1833	900	15	13.69	9012	13.284
9013	85	1063	800	15	7.79	9013	7.616
9014	30	545	550	2	1.84	9014	1.779
9015	88	880	1000	1	3.69	9015	3.595
9016	35.2	352	1000	0.5	1.01	9016	0.921
9017	16	457	350	1	0.98	9017	0.921
Outlet	2678.2				105.75	97	110.26

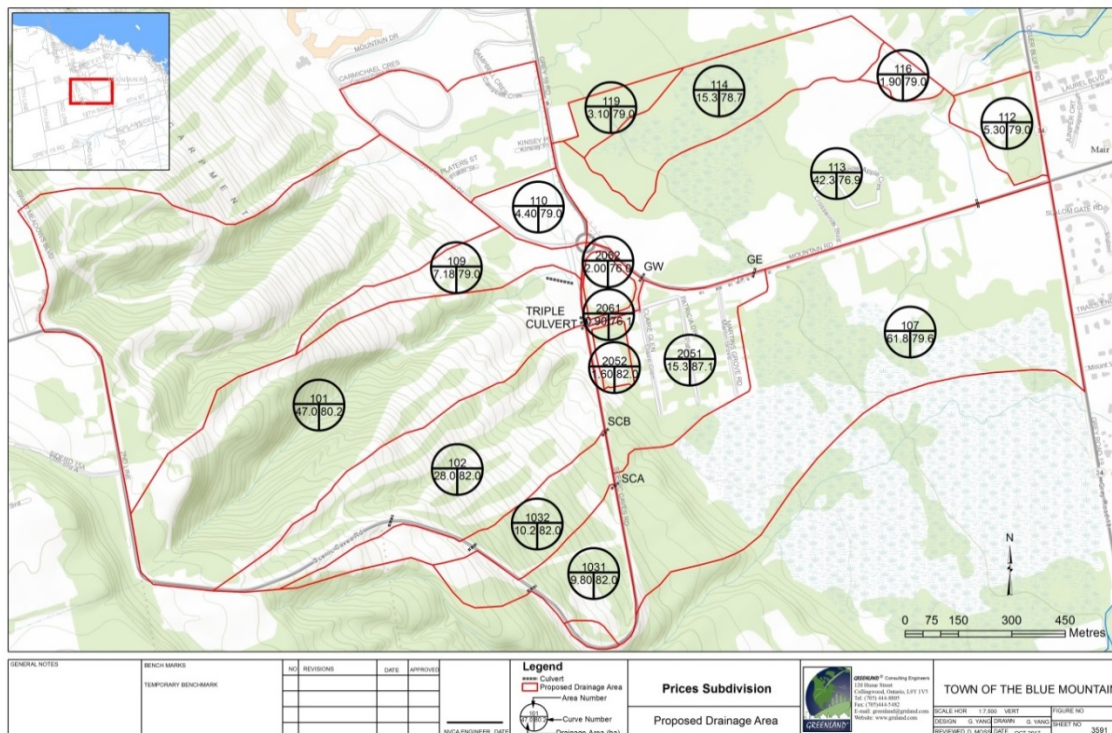


Figure A5- 3 Windfall Catchment - Original Catchment

Table A5- 7 Windfall Matched Flow and Adjusted Parameters - Original Catchment (100yr 24 SCS)

Name	PCSWMM					VO2 Catchment	
	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Peak Runoff (m ³ /s)	NHYD	Peak Flow
101_Prc	47	1469	320	18	3.91	101	3.847
102_Prc	28	933	300	18	2.86	102	2.866
1031_Prc	9.8	576	170	18	1.36	1031	1.358
1032_Prc	10.2	408	250	18	1.16	1032	1.093
105_Prc	16.9	845	200	5	1.95	105	1.919
107_Prc	61.8	1236	500	10	2.68	107	2.666
112_Prc	5.3	353	150	5	0.41	112	0.396
113_Prc	42.3	1410	300	7	1.87	113	1.823
2061_Prc	0.9	150	60	2	0.09	2061	0.087
2062_Prc	2	200	100	3	0.47	2062	0.45
Outlet	224.2				11.75		11.53

Table A5- 8 Silver Creek Updated Model Flow - (Timmins 90%)

Name	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Peak Runoff (m ³ /s)
101_Prc	43.90	1372.0	320	18	3.85
102_Prc	28.03	934.5	300	18	2.55
1031_Prc	9.85	579.1	170	18	0.93
1032_Prc	10.16	406.6	250	18	0.94
105_Prc	16.87	843.7	200	5	1.61
107_Prc	61.86	1237.1	500	10	4.68
112_Prc	5.26	350.6	150	5	0.46
113_Prc	42.30	1410.0	300	7	3.28
2061_Prc	0.98	163.6	60	2	0.08
2062_Prc	2.00	199.7	100	3	0.21
900	2018.6	6728.6	3000	5	71.25
9011	136.84	1052.6	1350	1.5	6.57
9014	81.48	905.3	900	2	3.88
9015	84.08	934.3	900	1	3.41
9016	39.9	399.0	1000	0.5	1.04
9017	42.02	700.3	600	1	1.96
Outlet	2624.1				93.49

4. Batteaux Creek

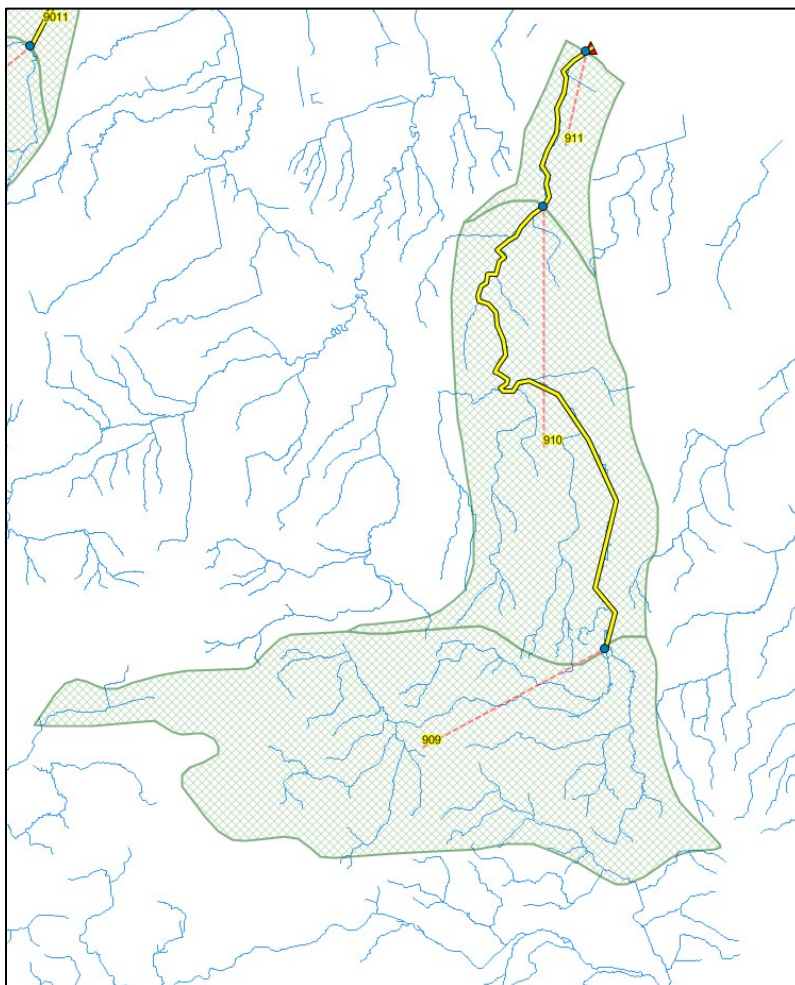
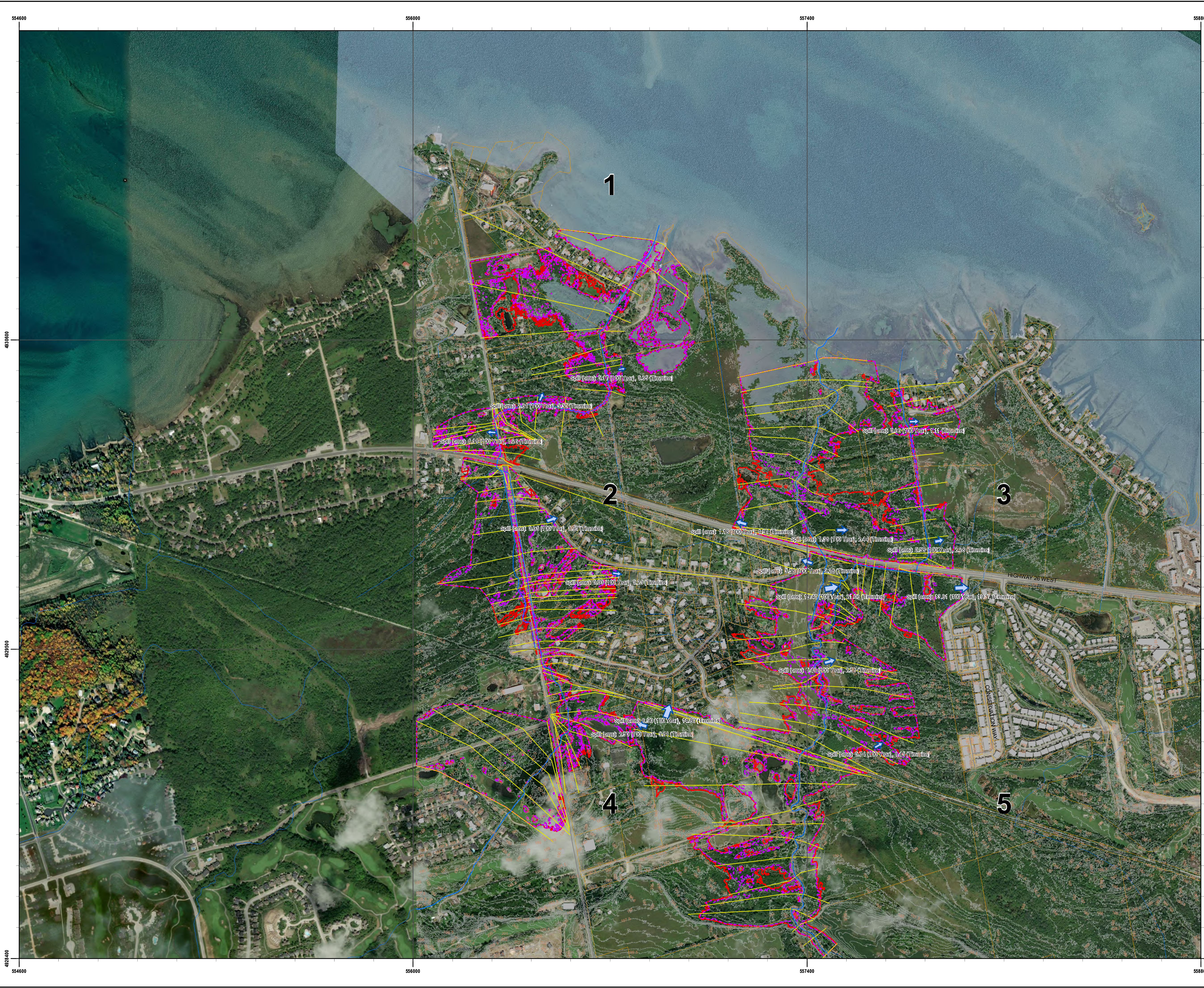


Figure A5- 4 Batteaux Creek PCSWMM Model – MaLaren's Catchment

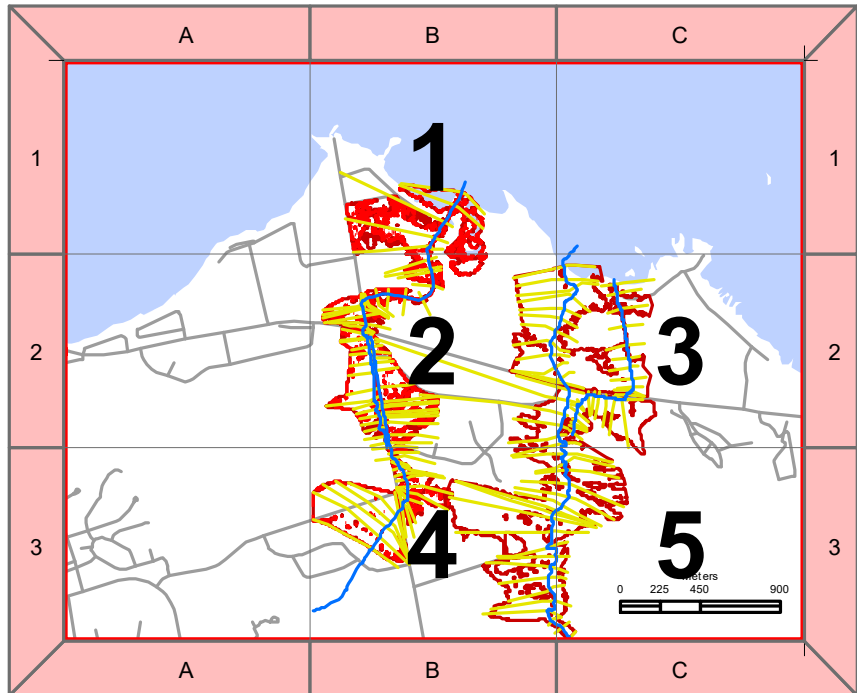
Table A5- 9 Batteaux Creek QUALHYMO Parameters

SubWatershed ID	SMAX	SMIN	API	SK	S*	CN condition I	CN condition II	Area
909	1735	43.4	27	0.11	130.2	66.1	82	3021
910	1735	43.4	27	0.11	130.2	66.1	82	2118
911	1344	33.7	27	0.11	100.9	71.6	86	372



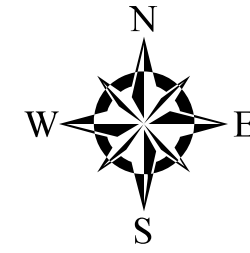
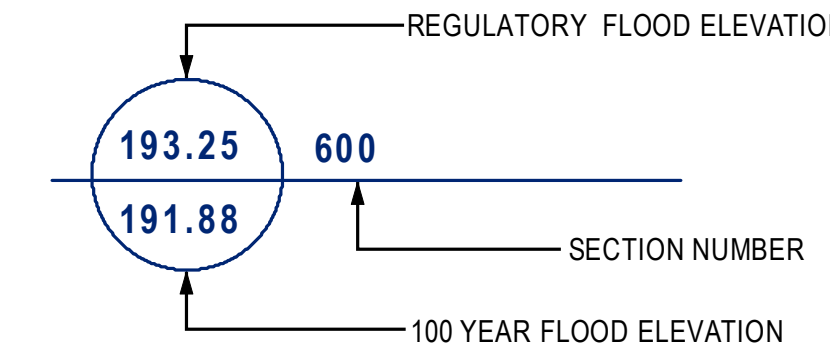
Collingwood

Floodlines - Silver and Townline Creek
(Existing Condition)



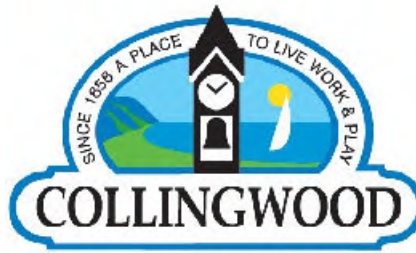
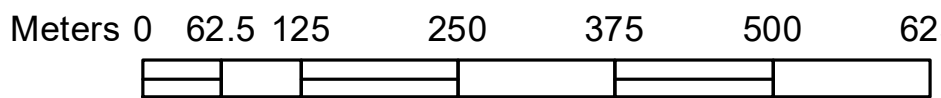
Legend

- Rivers
- Road
- Contour
- Cross Sections
- Building Footprint
- 100 Year Floodline
- Timmins Floodline
- Property Parcels
- Lake Level



Sheet: Index

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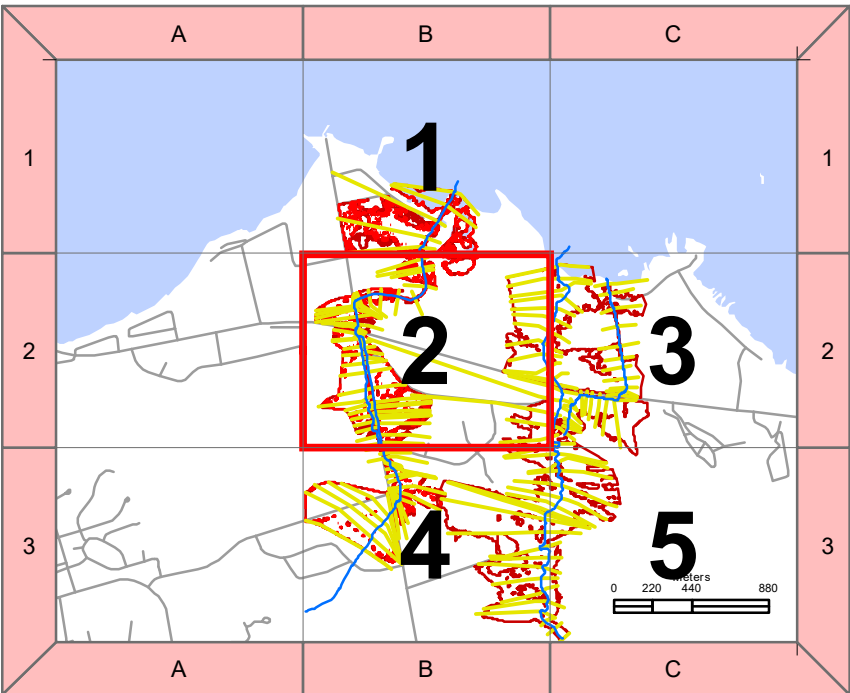
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Horizontal Datum: North American Datum 1983 (NAD 83)
Projection: Universal Transverse Mercator
Zone: 17
Central Meridian: 81° West
Grid Spacing: 100 Meters

NOTES:
1. Floodlines were generated using a DEM derived from a LiDAR survey.
2. Where a discrepancy between the contours and the Floodlines is evident, the Floodline shall take precedence.
3. An additional topographic survey and professional expertise may be used to more precisely locate the Floodline on specific properties.

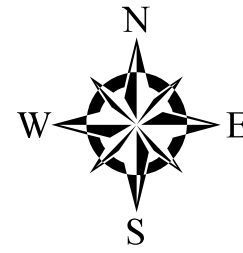
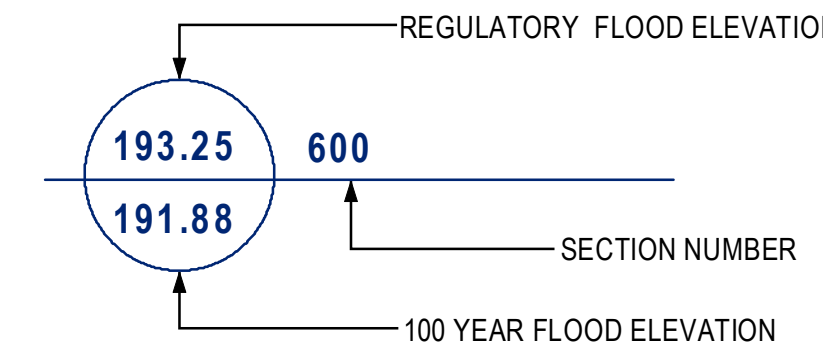
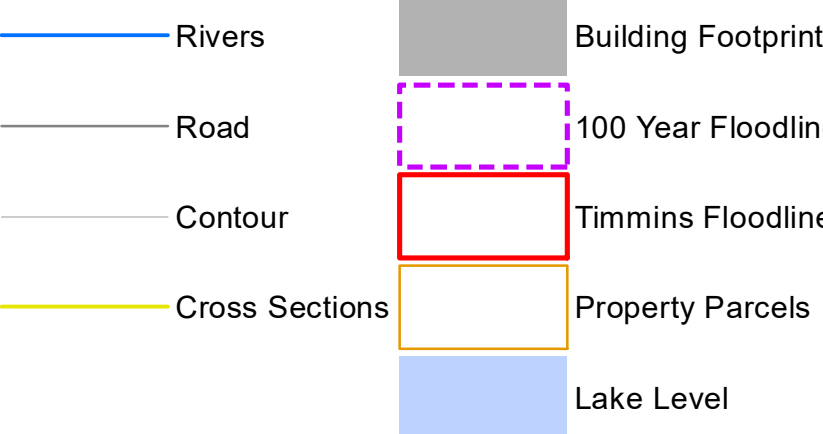


Collingwood

Floodlines - Silver and Townline Creek (Existing Condition)

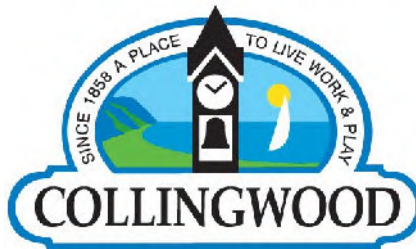
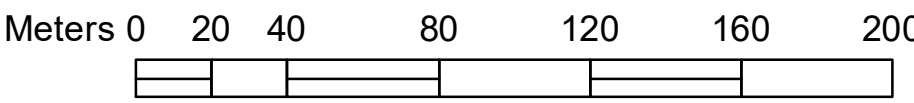


Legend



Sheet: 2

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Projection: Universal Transverse Mercator
Zone: 17
Central Meridian: 81° West
Grid Spacing: 100 Meters

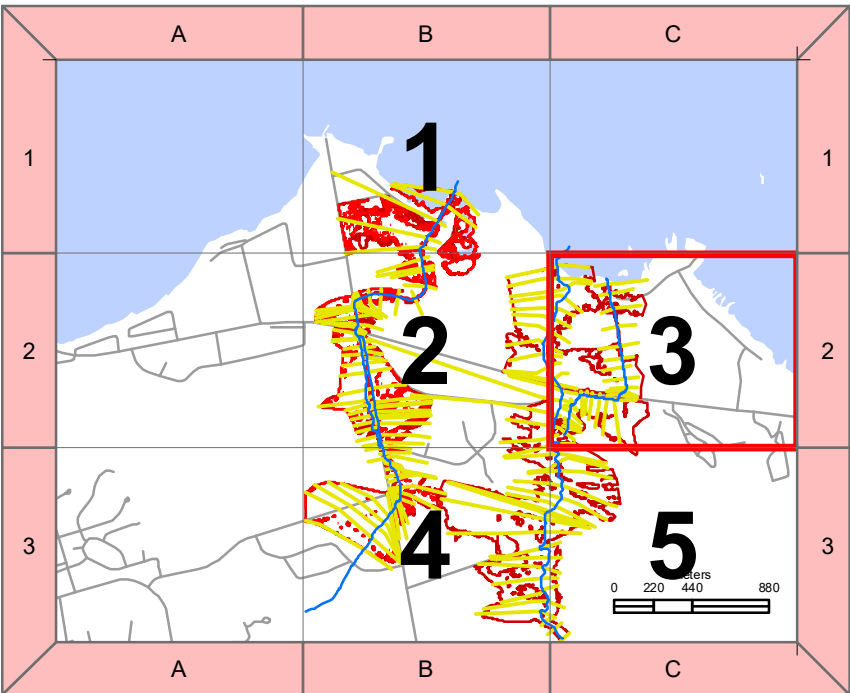
NOTES:
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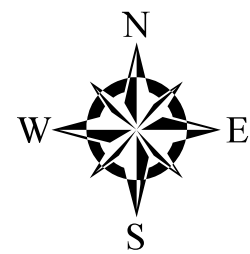
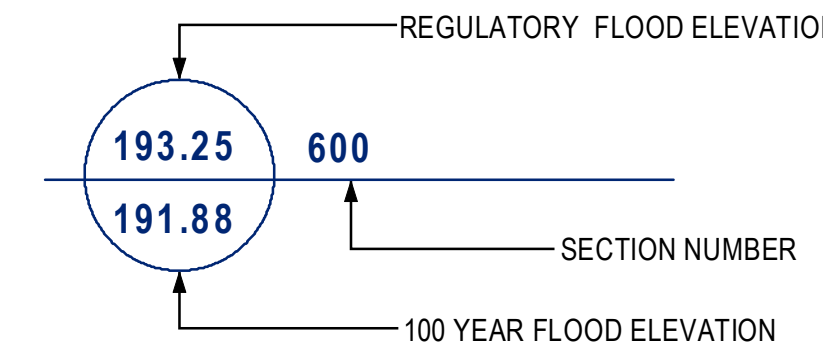
Collingwood

Floodlines - Silver and Townline Creek (Existing Condition)



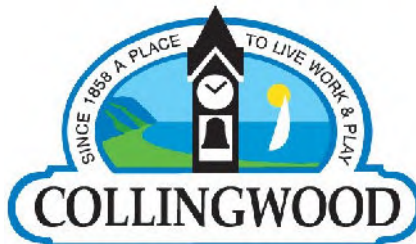
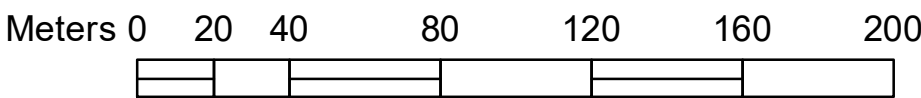
Legend

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- Contour
- Cross Sections
- Building Footprint
- 100 Year Floodline
- Timmins Floodline
- Property Parcels
- Lake Level



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1:2,000



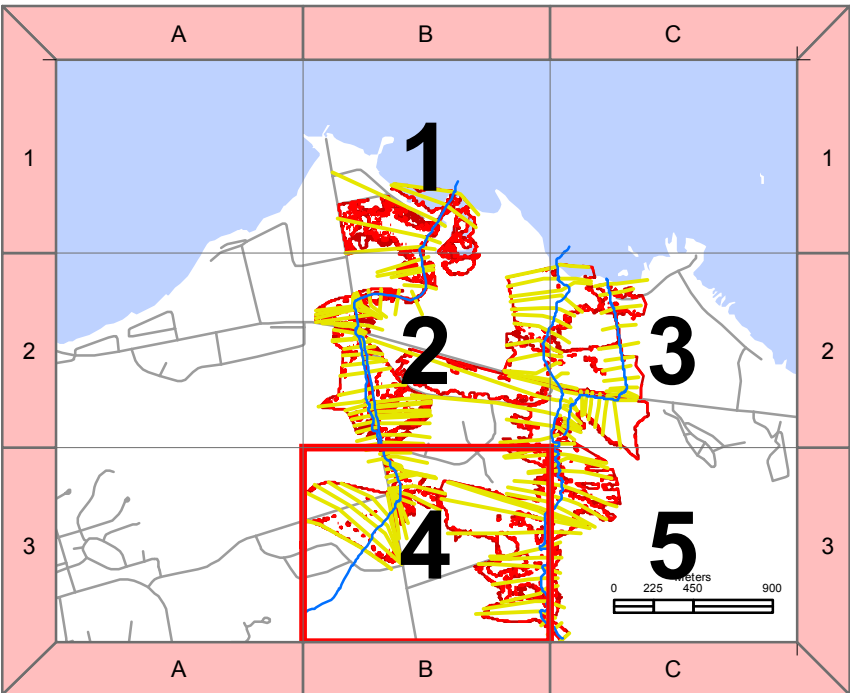
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Horizontal Datum: North American Datum 1983 (NAD 83)
Projection: Universal Transverse Mercator
Zone: 17
Central Meridian: 81° West
Grid Spacing: 100 Meters

NOTES:
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2. Where a discrepancy between the contours and the Floodline is evident, the Floodline shall take precedence.
3. An additional topographic survey and professional expertise may be used to more precisely locate the Floodline on specific properties.



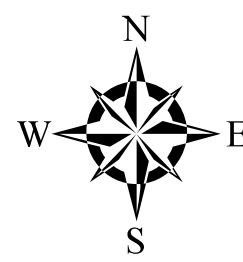
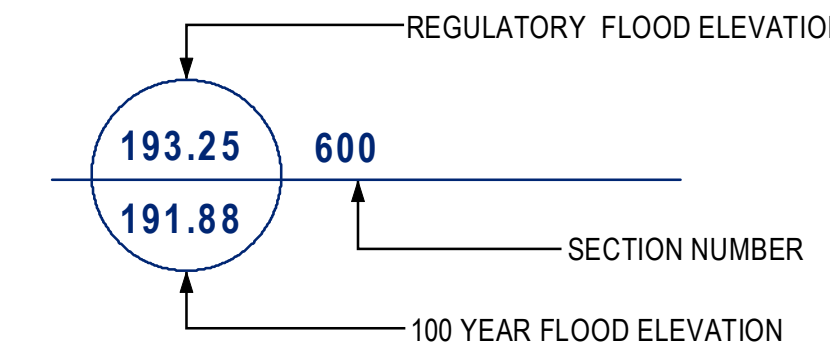
Collingwood

Floodlines - Silver and Townline Creek (Existing Condition)



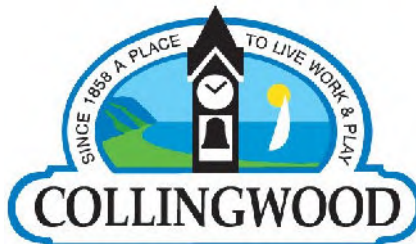
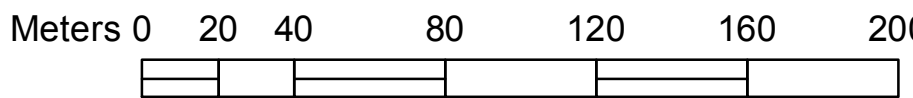
Legend

- Rivers
- Road
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- Cross Sections
- Building Footprint
- 100 Year Floodline
- Timmins Floodline
- Property Parcels
- Lake Level



Sheet: 4

1:2,000



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Central Meridian: 81° West
Grid Spacing: 100 Meters

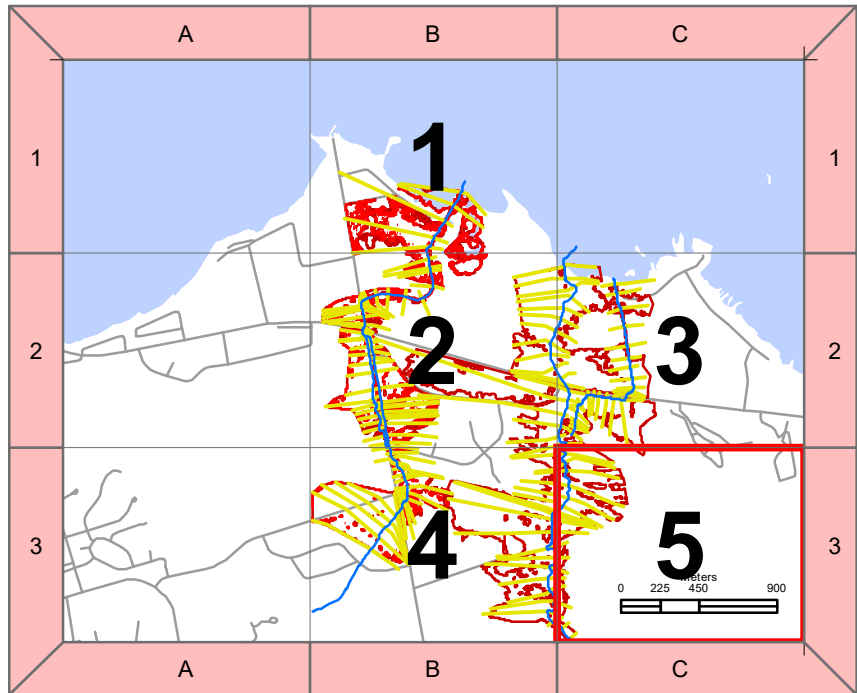
NOTES:
1. Floodlines were generated using a DEM derived from a LiDAR survey.
2. Where a discrepancy between the contours and the Floodlines is evident, the Floodline shall take precedence.
3. An additional topographic survey and professional expertise may be used to more precisely locate the Floodline on specific properties.

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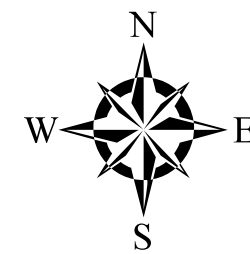
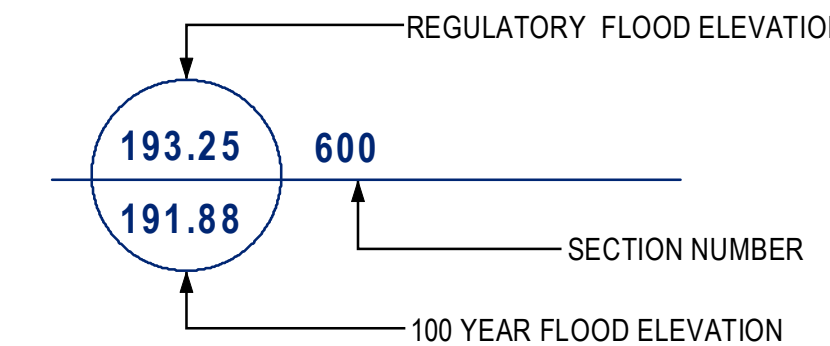
Collingwood

Floodlines - Silver and Townline Creek (Existing Condition)



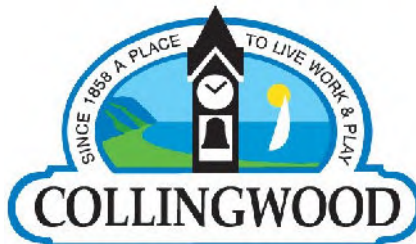
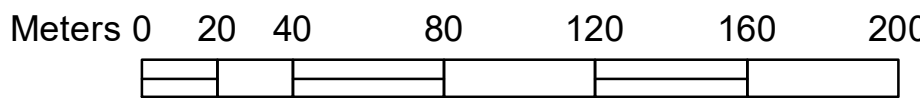
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- Rivers
- Road
- Contour
- Cross Sections
- Building Footprint
- 100 Year Floodline
- Timmins Floodline
- Property Parcels
- Lake Level



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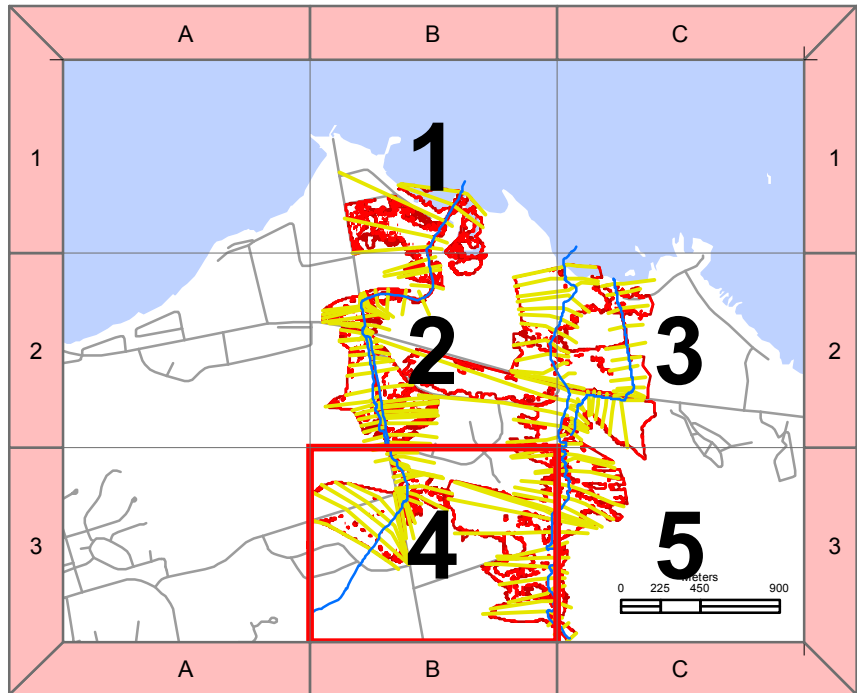
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Horizontal Datum: North American Datum 1983 (NAD 83)
Projection: Universal Transverse Mercator
Zone: 17
Central Meridian: 81° West
Grid Spacing: 100 Meters

NOTES:
1. Floodlines were generated using a DEM derived from a LiDAR survey.
2. Where a discrepancy between the contours and the Floodline is evident, the Floodline shall take precedence.
3. An additional topographic survey and professional expertise may be used to more precisely locate the Floodline on specific properties.



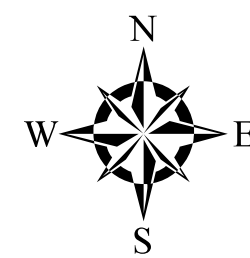
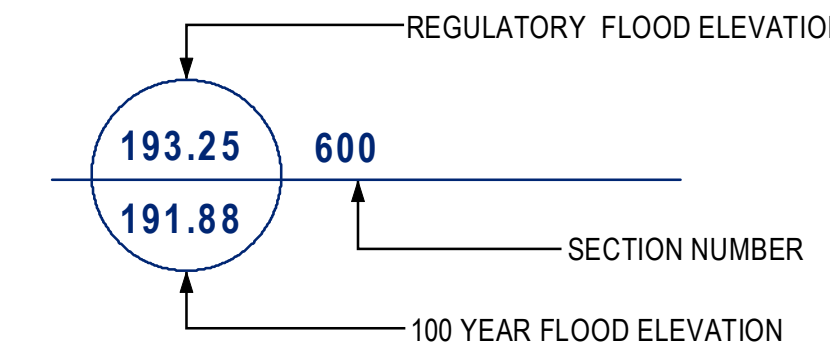
Collingwood

Floodlines - Silver and Townline Creek (Existing Condition)



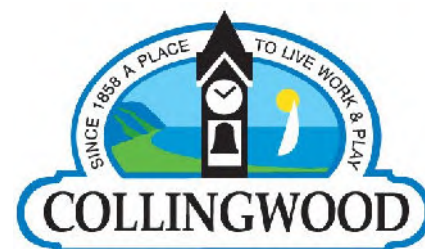
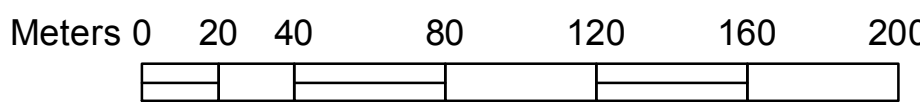
Legend

- Rivers
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- Property Parcels
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Sheet: 4

1:2,000



Scale: 1 : 2,000
1 cm on the map represents 20 m on the ground
All measurements are in Metric.
Vertical Datum: Mean Sea Level (G.S.C.)
Horizontal Datum: North American Datum 1983 (NAD 83)
Projection: Universal Transverse Mercator
Zone: 17
Central Meridian: 81° West
Grid Spacing: 100 Meters

NOTES:
1. Floodlines were generated using a DEM derived from a LiDAR survey.
2. Where a discrepancy between the contours and the Floodlines is evident, the Floodline shall take precedence.
3. An additional topographic survey and professional expertise may be used to more precisely locate the Floodline on specific properties.

Appendix B – Study Area Photos



Photos (Left) – Silver Creek south of Georgian Trail

Photo (Right) – Silver Creek north of Georgian Trail



Photo (Top) – Silver Creek Bridge
Crossing at Georgian Trail looking north
at south side of crossing.

Photo (Bottom) – Silver Creek Bridge
looking east from west of Bridge.

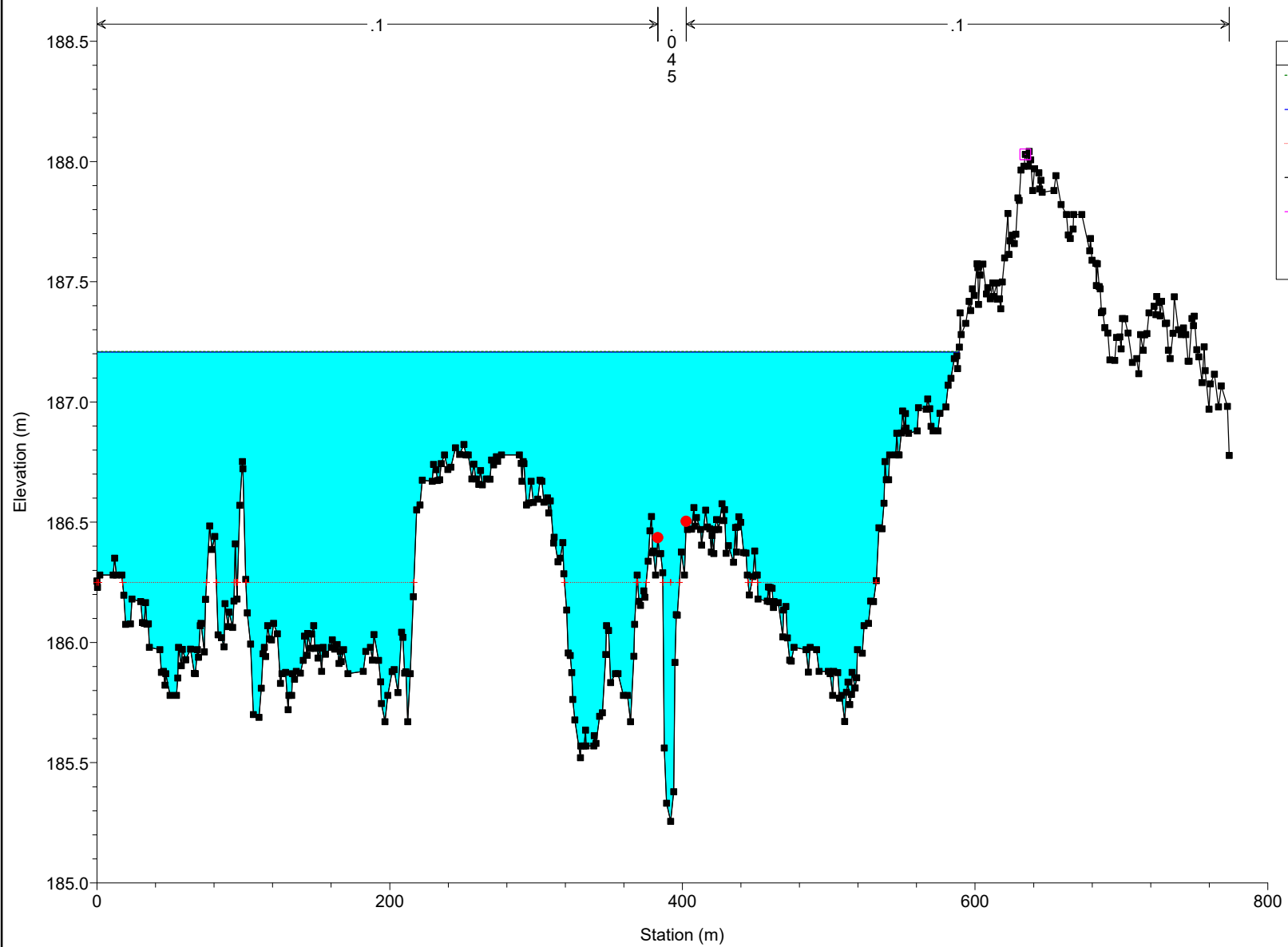
Appendix C – Existing Condition HEC RAS Results

Existing Condition HEC RAS Results

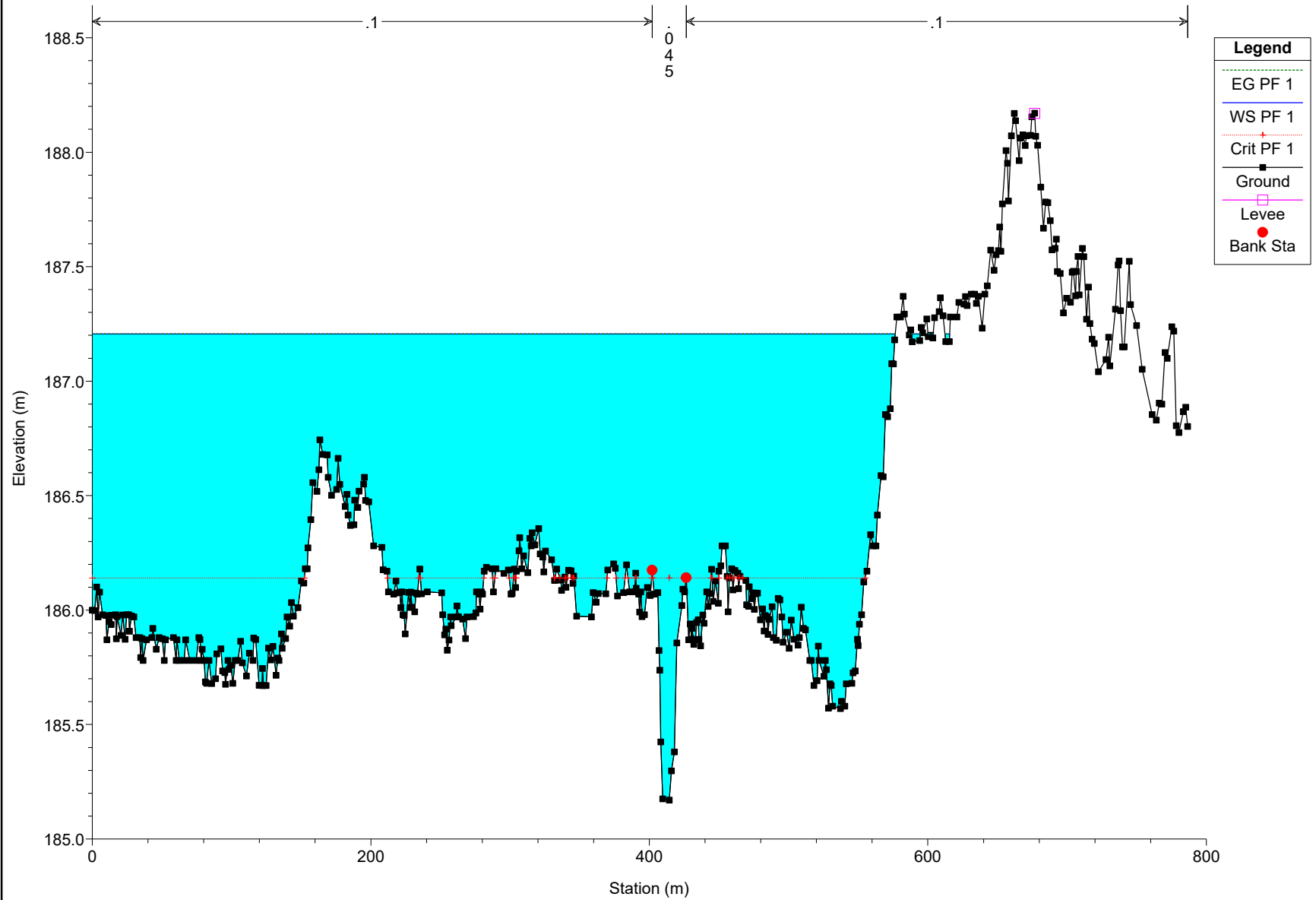
HEC-RAS Plan: Plan 05 River: EXST - SILVER CR Reach: EXST - SILVER CR Profile: PF 1

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
EXST - SILVER CR	139.93	PF 1	109.00	185.26	187.21	186.25	187.21	0.000319	0.46	579.48	588.96	0.13
EXST - SILVER CR	139.50		Lat Struct									
EXST - SILVER CR	123.82	PF 1	86.36	185.17	187.21	186.14	187.21	0.000111	0.31	679.92	590.64	0.08
EXST - SILVER CR	116.92		Culvert									
EXST - SILVER CR	110.02	PF 1	86.36	185.18	186.29	186.29	186.33	0.012152	1.61	128.17	482.90	0.70
EXST - SILVER CR	100	PF 1	86.19	184.97	186.08	185.86	186.12	0.007126	1.47	132.00	426.00	0.56
EXST - SILVER CR	79.98	PF 1	86.19	184.51	185.90	185.79	185.97	0.007143	1.99	132.02	329.92	0.60
EXST - SILVER CR	59.93	PF 1	86.19	184.38	185.56	185.56	185.72	0.026849	2.78	77.26	295.19	1.08
EXST - SILVER CR	39.93	PF 1	86.19	184.08	185.32	185.29	185.34	0.005786	1.35	180.58	442.39	0.50
EXST - SILVER CR	39.50		Lat Struct									
EXST - SILVER CR	19.93	PF 1	81.64	184.18	185.19	185.15	185.20	0.008001	1.37	168.89	474.55	0.57

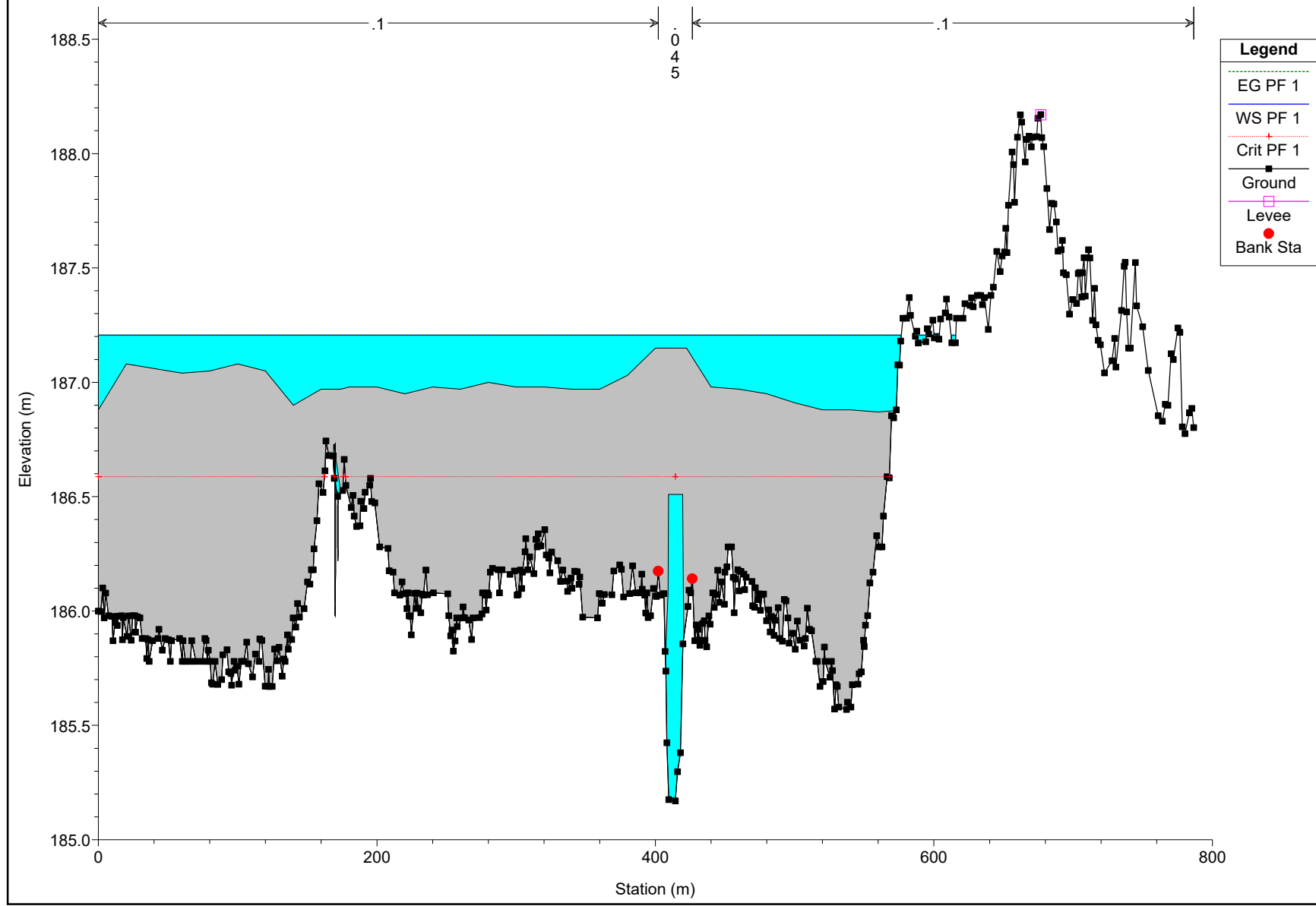
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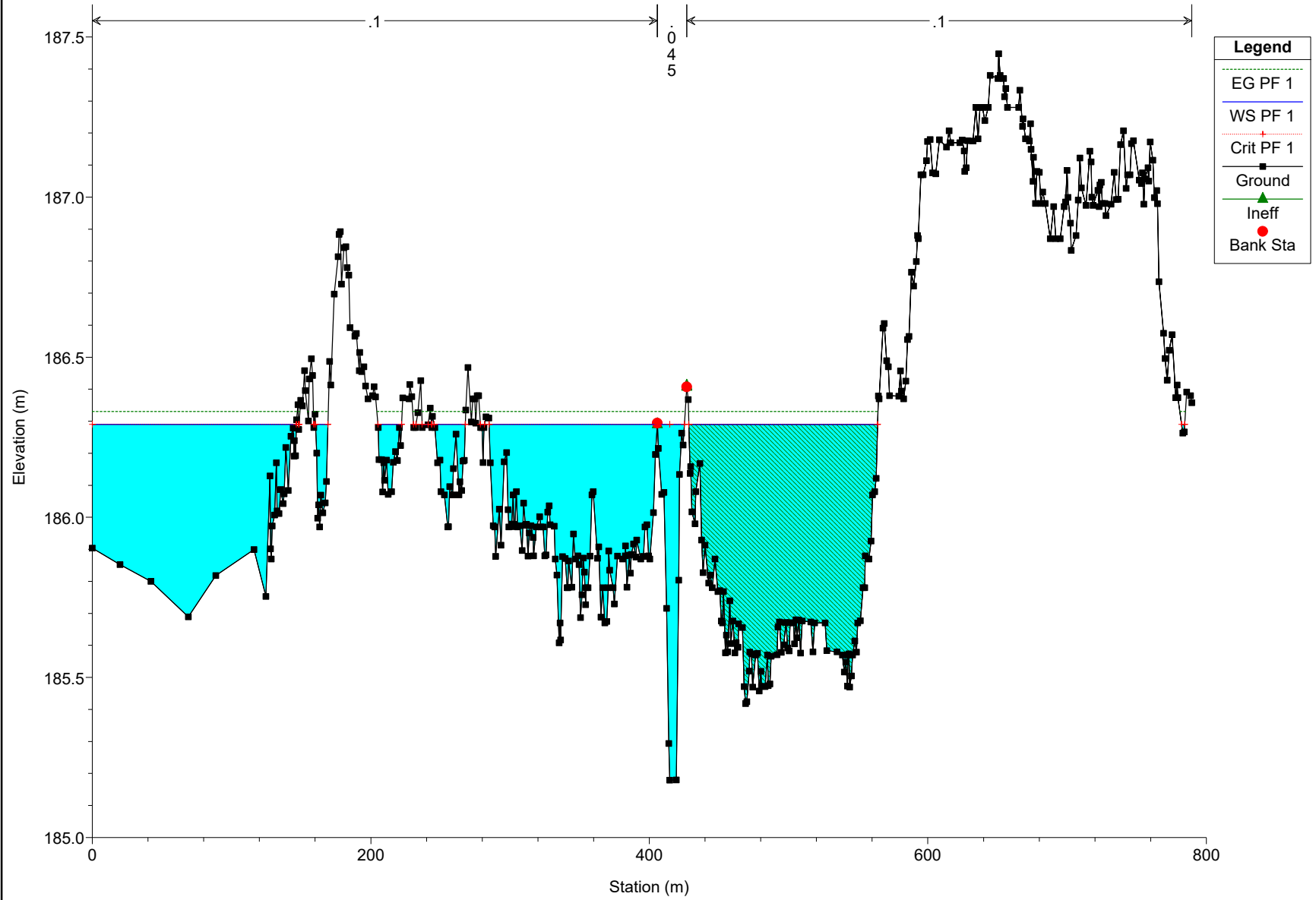
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River = EXST - SILVER CR Reach = EXST - SILVER CR RS = 123.82



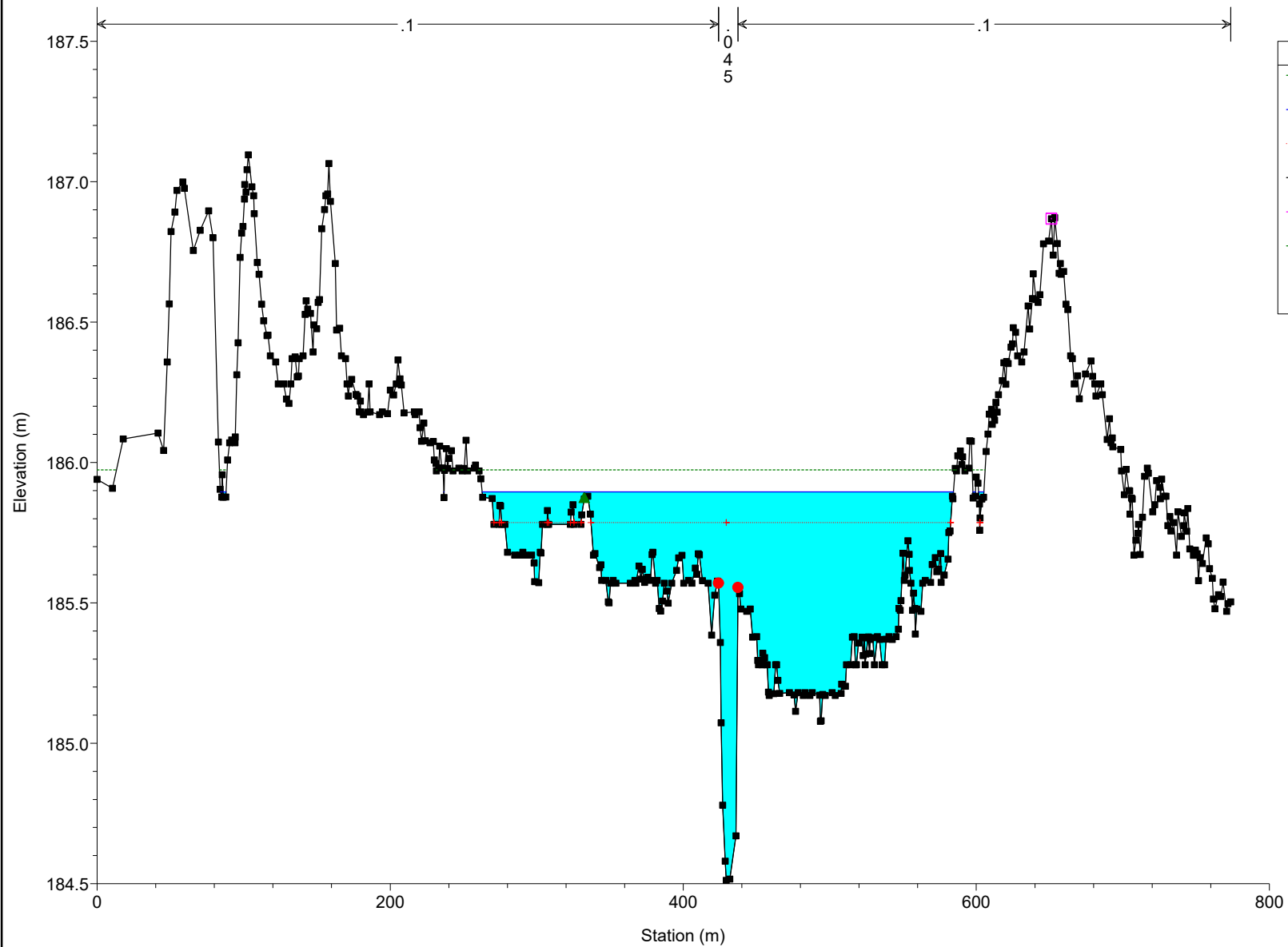
2024-056 11 Craigleith Exist Plan: Plan 05 2025-10-01
River = EXST - SILVER CR Reach = EXST - SILVER CR RS = 116.92 Culv



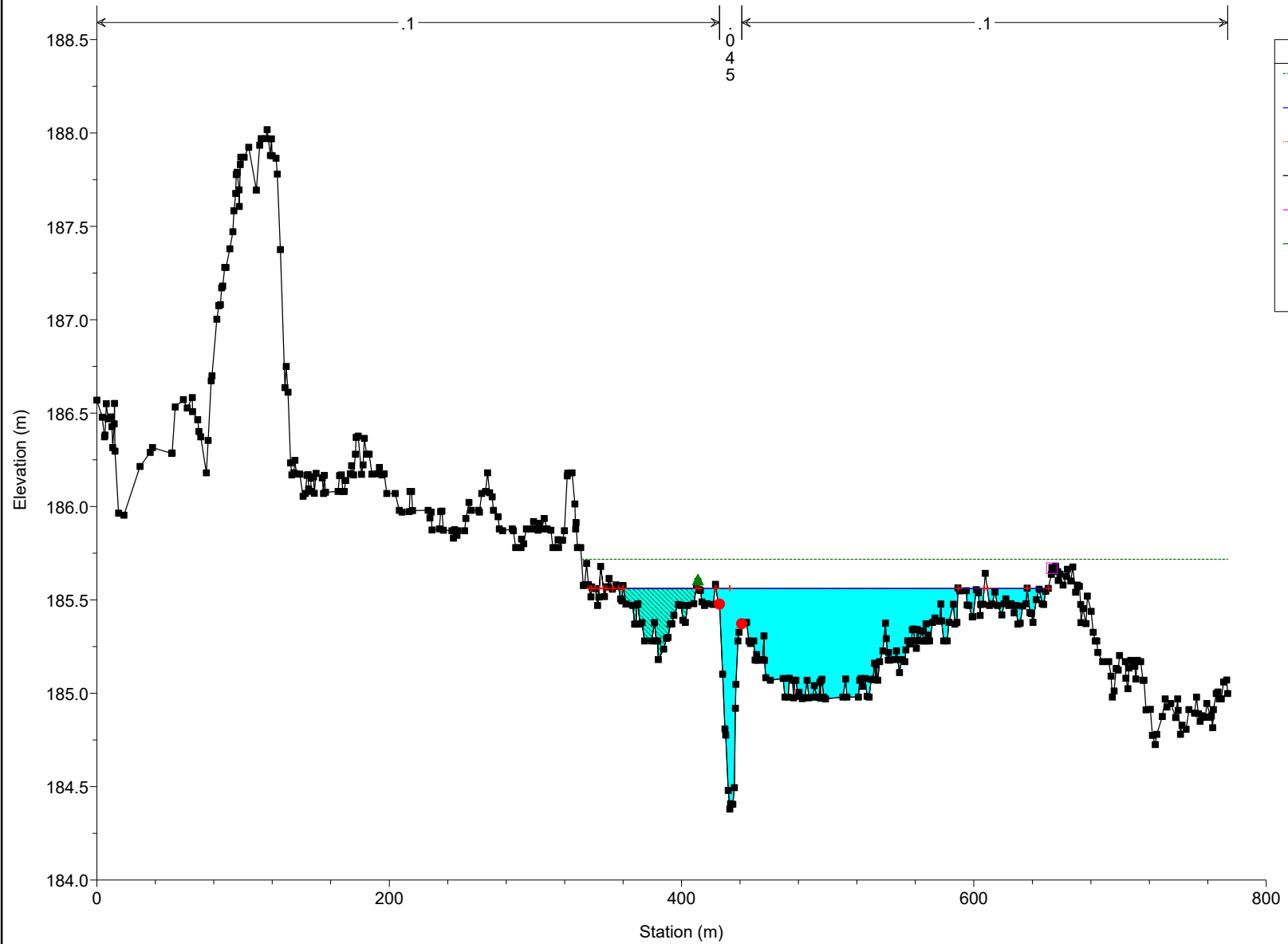
2024-056 11 Craigleith Exist Plan: Plan 05 2025-10-01
River = EXST - SILVER CR Reach = EXST - SILVER CR RS = 110.02



2024-056 11 Craigleith Exist Plan: Plan 05 2025-10-01
River = EXST - SILVER CR Reach = EXST - SILVER CR RS = 79.98



2024-056 11 Craigleith Exist Plan: Plan 05 2025-10-01
River = EXST - SILVER CR Reach = EXST - SILVER CR RS = 59.93



2024-056 11 Craigleith Exist Plan: Plan 05 2025-10-01
River = EXST - SILVER CR Reach = EXST - SILVER CR RS = 39.93

Legend

EG PF 1

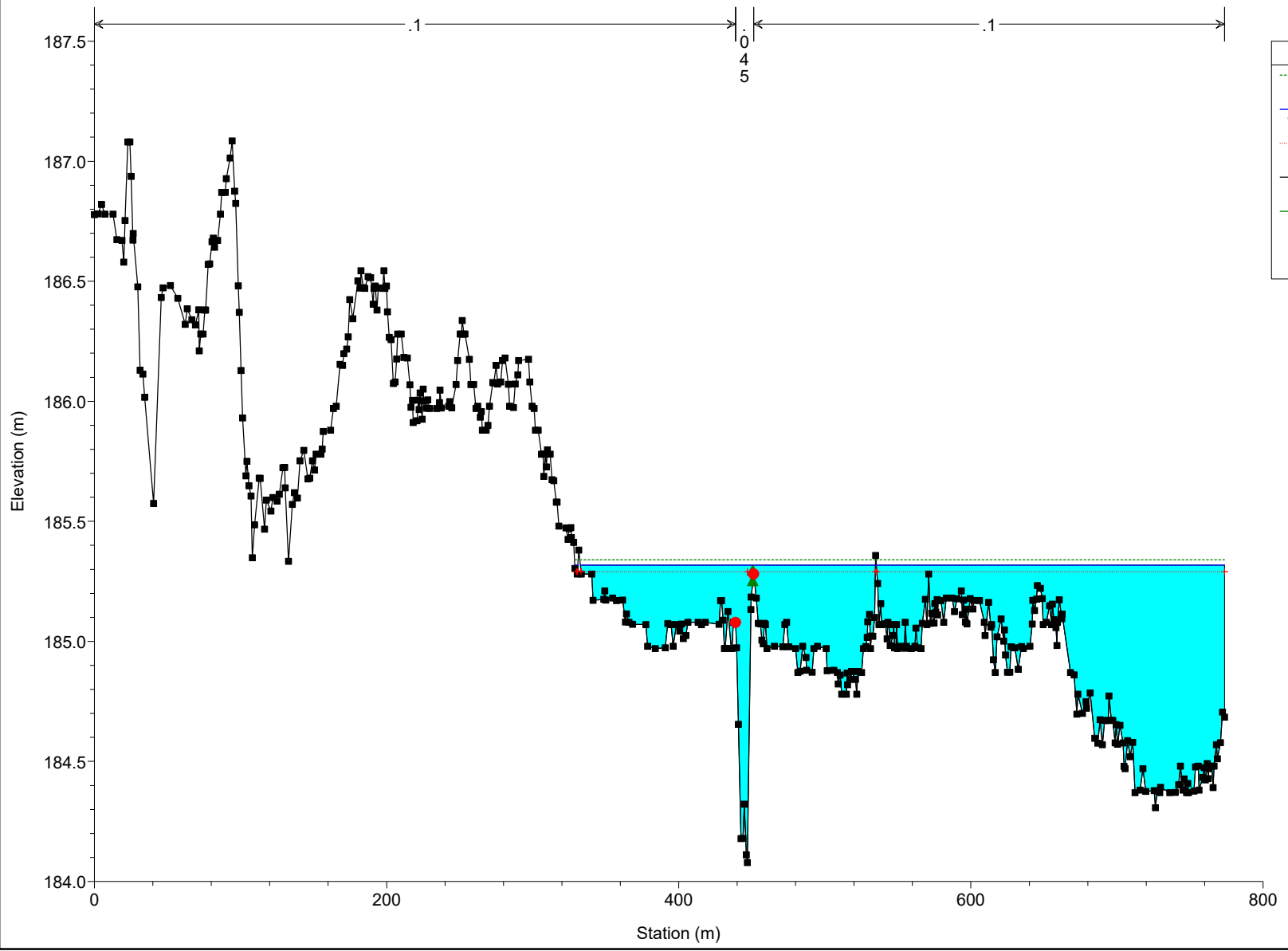
WS PF 1

Crit PF 1

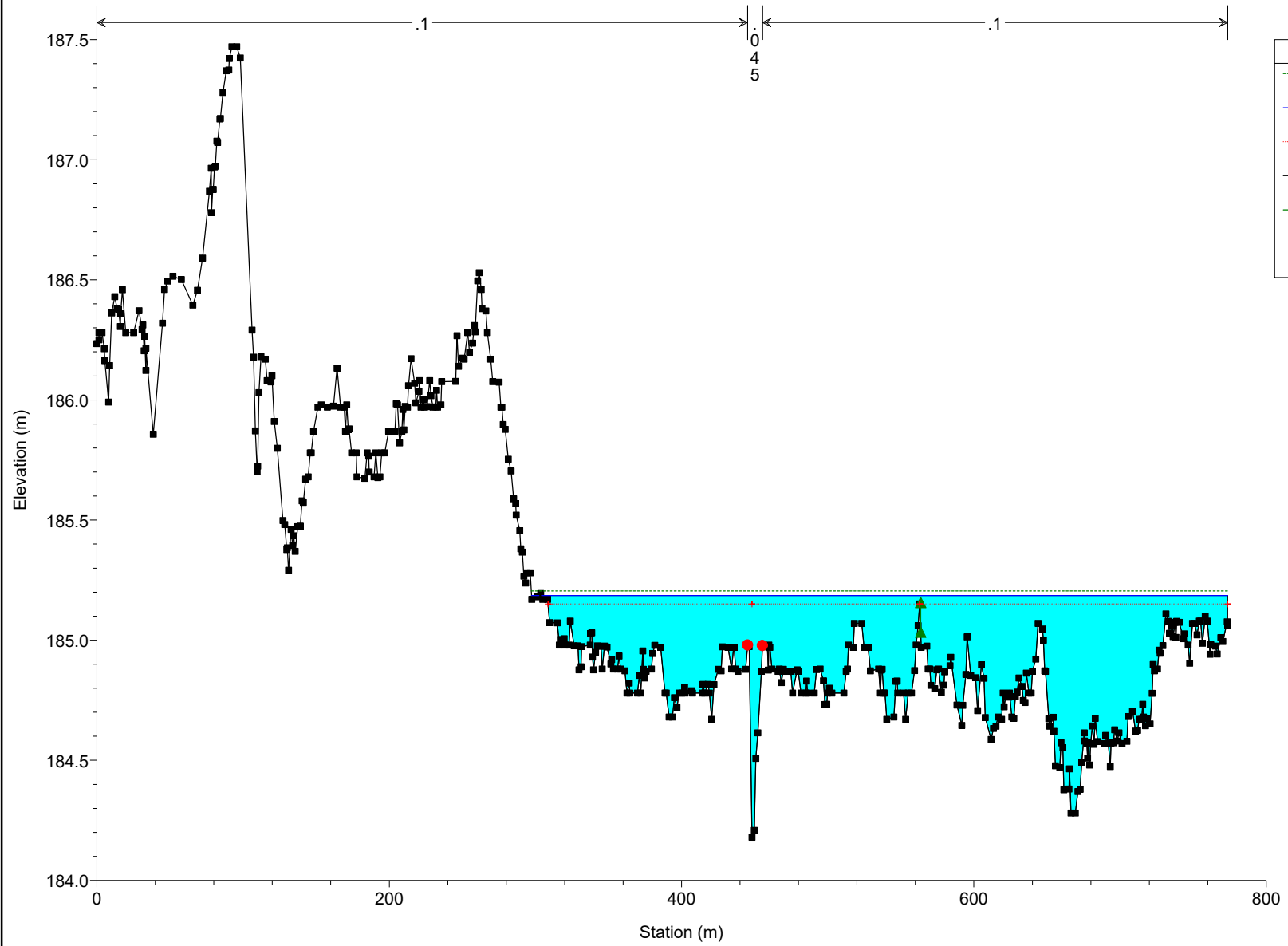
Ground

Ineff

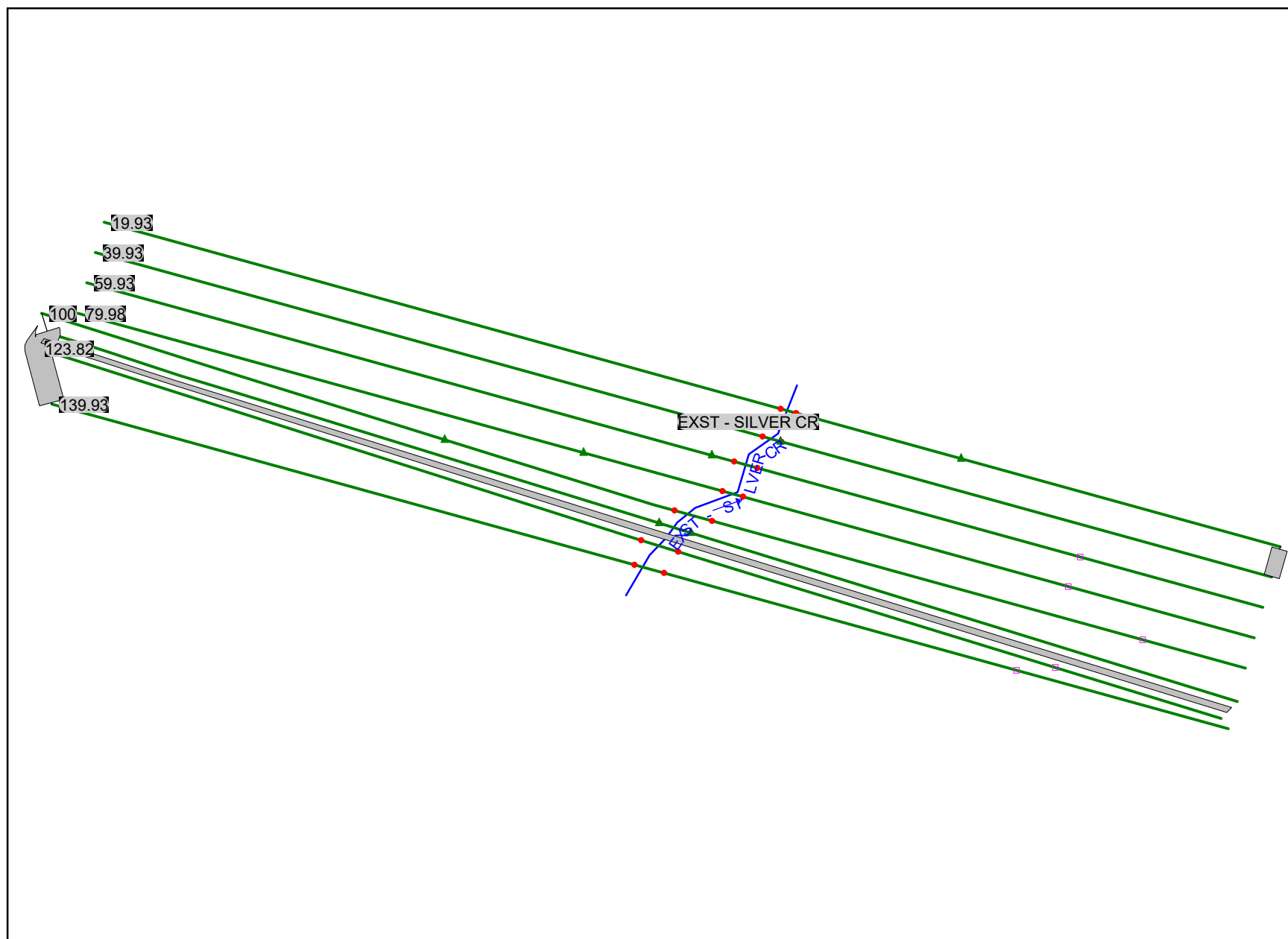
Bank Sta



2024-056 11 Craigleith Exist Plan: Plan 05 2025-10-01
River = EXST - SILVER CR Reach = EXST - SILVER CR RS = 19.93



Legend	
EG PF 1	
WS PF 1	
Crit PF 1	
Ground	
Ineff	
Bank Sta	



HEC RAS Results 20% Increase in Flow

HEC-RAS Plan: Plan 08 River: EXST - SILVER CR Reach: EXST - SILVER CR Profile: PF 1

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
EXST - SILVER CR	139.93	PF 1	130.80	185.26	187.24	186.31	187.25	0.000408	0.53	600.99	589.29	0.15
EXST - SILVER CR	139.50		Lat Struct									
EXST - SILVER CR	123.82	PF 1	107.17	185.17	187.24	186.17	187.24	0.000156	0.37	701.16	599.03	0.09
EXST - SILVER CR	116.92		Culvert									
EXST - SILVER CR	110.02	PF 1	107.17	185.18	186.29	186.29	186.35	0.018714	2.00	128.17	482.90	0.87
EXST - SILVER CR	100	PF 1	107.00	184.97	186.15	185.89	186.20	0.007479	1.60	152.14	444.68	0.59
EXST - SILVER CR	79.98	PF 1	107.00	184.51	185.95	185.84	186.04	0.007965	2.17	150.58	349.81	0.64
EXST - SILVER CR	59.93	PF 1	107.00	184.38	185.61	185.61	185.77	0.026221	2.88	102.54	315.60	1.08
EXST - SILVER CR	39.93	PF 1	107.00	184.08	185.37	185.29	185.40	0.006079	1.46	205.58	446.17	0.52
EXST - SILVER CR	39.50		Lat Struct									
EXST - SILVER CR	19.93	PF 1	101.46	184.18	185.24	185.15	185.26	0.008008	1.45	194.02	476.82	0.58

HEC RAS Results 20% Increase in n Values

HEC-RAS Plan: Plan 07 River: EXST - SILVER CR Reach: EXST - SILVER CR Profile: PF 1

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
EXST - SILVER CR	139.93	PF 1	109.00	185.26	187.21	186.25	187.21	0.000457	0.46	580.28	588.98	0.13
EXST - SILVER CR	139.50		Lat Struct									
EXST - SILVER CR	123.82	PF 1	86.36	185.17	187.21	186.14	187.21	0.000160	0.31	679.95	590.65	0.08
EXST - SILVER CR	116.92		Culvert									
EXST - SILVER CR	110.02	PF 1	86.36	185.18	186.29	186.29	186.33	0.017501	1.61	128.17	482.90	0.70
EXST - SILVER CR	100	PF 1	86.20	184.97	186.13	185.86	186.16	0.007751	1.34	146.56	439.92	0.49
EXST - SILVER CR	79.98	PF 1	86.20	184.51	185.95	185.79	186.01	0.007270	1.73	152.03	350.47	0.51
EXST - SILVER CR	59.93	PF 1	86.20	184.38	185.56	185.56	185.72	0.038884	2.78	77.09	294.56	1.08
EXST - SILVER CR	39.93	PF 1	86.20	184.08	185.36	185.29	185.38	0.006088	1.20	201.00	445.46	0.43
EXST - SILVER CR	39.50		Lat Struct									
EXST - SILVER CR	19.93	PF 1	80.84	184.18	185.23	185.15	185.24	0.008014	1.19	188.65	476.69	0.48

HEC RAS Results 50% Bridge Blockage

HEC-RAS Plan: Plan 06 River: EXST - SILVER CR Reach: EXST - SILVER CR Profile: PF 1

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
EXST - SILVER CR	139.93	PF 1	109.00	185.26	187.21	186.25	187.21	0.000319	0.46	579.48	588.96	0.13
EXST - SILVER CR	139.50		Lat Struct									
EXST - SILVER CR	123.82	PF 1	86.36	185.17	187.21	186.14	187.21	0.000111	0.31	679.92	590.64	0.08
EXST - SILVER CR	116.92		Culvert									
EXST - SILVER CR	110.02	PF 1	86.36	185.18	186.29	186.29	186.33	0.012152	1.61	128.17	482.90	0.70
EXST - SILVER CR	100	PF 1	86.19	184.97	186.08	185.86	186.12	0.007126	1.47	132.00	426.00	0.56
EXST - SILVER CR	79.98	PF 1	86.19	184.51	185.90	185.79	185.97	0.007143	1.99	132.02	329.92	0.60
EXST - SILVER CR	59.93	PF 1	86.19	184.38	185.56	185.56	185.72	0.026849	2.78	77.26	295.19	1.08
EXST - SILVER CR	39.93	PF 1	86.19	184.08	185.32	185.29	185.34	0.005786	1.35	180.58	442.39	0.50
EXST - SILVER CR	39.50		Lat Struct									
EXST - SILVER CR	19.93	PF 1	81.64	184.18	185.19	185.15	185.20	0.008001	1.37	168.89	474.55	0.57

