TATHAM ENGINEERING

Enhancing our communities

45 Cindy Lane - Adjala-Tosorontio

NATURAL HAZARD ASSESSMENT

2834556 Ontario Inc.

File 423499 | March 21, 2024

Document Control

File:

423499

Date:

March 21, 2024

Prepared by:

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Issue	Date	Description
1	March 21, 2024	Natural Hazard Study

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1 Introduction

Tatham Engineering Limited (Tatham) has been retained by Gagan Singh to complete a natural hazards assessment for 45 Cindy Lane in the Township of Adjala-Tosorontio. The subject property is regulated by the Nottawasaga Conservation Authority (NVCA) for natural hazards associated with a tributary of the Pine River flowing through the subject property. This study has been prepared to establish the flood and erosion hazard limits associated with the tributary in support of an amendment to the Township's Official plan and future development applications for the property. As the NVCA regulates natural hazards, we are seeking approval of this natural hazards assessment and consequently the natural hazard limits defined herein in support of the development application.

1.1 SUBJECT PROPERTY

The subject property is located at 45 Cindy Lane in the Township of Adjala-Tosorontio (see DP-1 enclosed) and is currently within the property limits of the Silver Brooke Golf Club. The entire property is approximately 21.8 ha, with 2.2 ha of that proposed for development, and is designated as open recreation area land use. The proposed development is bound by the tributary of the Pine River to the north, the entrance to Silver Brooke Golf Club to the east, Cindy Lane to the south, and a residential property to the west.

The tributary conveys flow from the west to the east parallel to Cindy Lane approximately 70m to the north of the road and contains one crossing on the subject site where two 600 mm CSP culverts and one 500mm CSP culvert convey flow beneath the entrance to Silver Brooke Golf Club. The tributary then travels northeast where it ultimately joins the main reach of the Pine River approximately 2km downstream of the subject site.

1.2 BACKGROUND REFERENCES

An existing HEC-RAS hydraulic model of the Pine River was provided by the NVCA for the purpose of this study, and the following guidelines, background reports and studies were referenced as part of this Natural Hazard Assessment:

- MNRF Technical Guide – River and Stream Systems: Flooding Hazard Limit (2002);
- MNRF Technical Guide – River and Stream Systems: Erosion Hazard Limit (2002); and
- NVCA Natural Hazards Technical Guide (Nottawasaga Valley Conservation Authority, 2013).

2 Flood Hazard Assessment

To establish the flood hazard limits associated with the tributary of the Pine River across the subject property, hydrologic and hydraulic models were developed using topographic survey data and LiDAR data obtained for the study. The topographic data used in the assessment includes a survey of the subject property and watercourse (Tatham, 2023) and South Central Ontario Orthophotography Project LiDAR data (SCOOP, 2013).

2.1 DATUM COMPARISON

To ensure a consistent datum was used between the various topographic data sources, a datum comparison was performed by comparing the SCOOP elevation data against the topographic survey data along the centerline of Cindy Lane. Through this comparison it was determined that the SCOOP DTM required a vertical adjustment of 0.08 m to be consistent with the topographic survey data (as seen in Figure 1). This correction factor was applied to the SCOOP DTM to vertically align the data with the topographic survey.

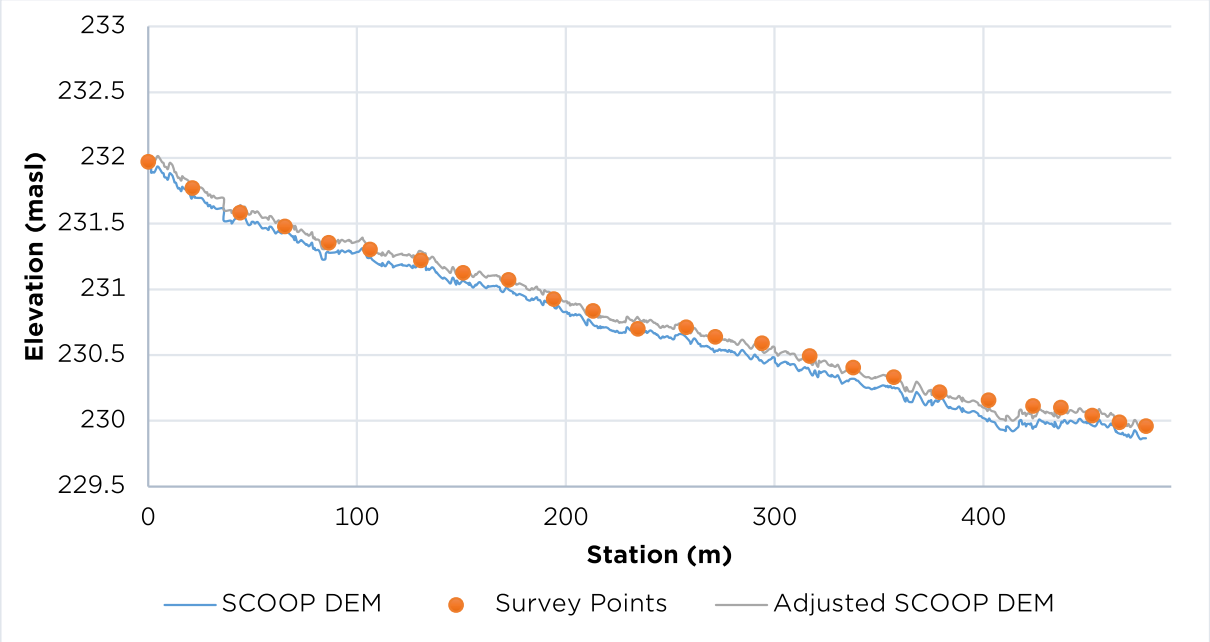


Figure 1: Datum Comparison on Cindy Lane

2.2 HYDROLOGIC ANALYSIS

A review of the aerial imagery and topographic data was completed to delineate the drainage area contributing to the tributary at the subject property. The upstream drainage area was

delineated using SCOOP LiDAR data and is outlined on the External Drainage Plan (Drawing DP-1) enclosed. The catchment soil types were acquired using the Ontario Soil Survey Complex data, and the land use areas were measured using aerial imagery to develop an area-weighting analysis of the catchment characteristics. The time of concentration for the catchment was calculated using the Airport method, which is the preferred method for catchments with a runoff coefficient of less than 0.40. These parameters are summarized in Table 1 below and provided in Appendix A for reference.

Table 1: Hydrologic Parameters Summary

PARAMETER	VALUE
Catchment Area	89.21 ha
Curve Number	56.8
Runoff Coefficient	0.19
Initial Abstraction	7.72 mm
% Imperviousness	3%
Time of Concentration	2.18 hr
Time to Peak	1.46 hr

A Visual OTTHYMO model was created to determine the peak flows for the Regulatory Storm. As per the MNRF Technical Guide – River and Stream Systems: Flooding Hazard Limit (2002), the subject property is in Flood Hazard Criteria Zone 3 which designates the Regulatory Storm to be the greater of the Timmins storm and the 1:100-year design flood frequency storm. The Timmins storm produced a higher peak flow (3.51 m^3/s) than the 1:100-year design storm (2.22 m^3/s) as well as the peak flow in the existing NVCA hydraulic model (2.17 m^3/s). As such, the peak flows generated by the Timmins storm were selected as the Regulatory peak flows for this tributary and have been used for the hydraulic analysis in the following sections.

2.3 HYDRAULIC ANALYSIS

An existing conditions HEC-RAS model was developed using the detailed topographic survey and LiDAR data to predict the Regulatory flood elevations across the subject property. The topographic survey covers the main channel and right overbanks from cross sections 1610.24 to 981, and the left overbanks and remaining cross sections were defined using the SCOOP data. The Manning's roughness coefficients chosen for the various areas are as follows:

- 0.013 - Asphalt;
- 0.016 - Gravel;
- 0.030 - Short grass (golf course);
- 0.040 - Main Channel - Clean, straight, full stage, no rifts or deep pools, with some weeds and stones;
- 0.060 - Overbanks - Light brush and trees.

The hydraulic model results indicate that the tributary has insufficient capacity to convey the Regulatory storm for the majority of the length of the subject property. Backwater conditions from the entrance culverts of Silver Brooke Golf Club cause the floodplain to extend southward to Cindy Lane between cross sections 1115.65 and 1097.90. The flood limit also extends up to 25m southward into the proposed development between cross sections 1495.37 and 1353.29. The flood elevation varies across the site from 231.86 masl at the upstream end to 229.84 masl at the downstream end, and the flood extents are available on the Natural Hazard Plan NH-1 enclosed. The HEC-RAS results and cross section plots are available in Appendix B for reference.

3 Erosion Hazard Assessment

The erosion hazard limit for the tributary of the Pine River through the subject property at 45 Cindy Lane was established following the erosion hazard guidelines defined in the MNRF Technical Guide – River and Stream Systems: Erosion Hazard Limit.

The tributary of the Pine River crossing 45 Cindy Lane is considered a confined watercourse having an erosion hazard limit defined as the sum of the toe erosion allowance, stable slope allowance and erosion access allowance. A site visit was not conducted to investigate the soil type, but the Ontario Soils Complex Maps show this location has Alliston Sandy Loam. The channel through this area is generally straight with no evidence of active erosion or meandering, therefore a toe erosion allowance of 5 m has been applied. A stable slope allowance equal to a 3:1 slope from the toe erosion allowance to existing grade has been selected in the absence of a detailed geotechnical investigation. Finally, a 6 m erosion access allowance has been added to define the erosion hazard limit.

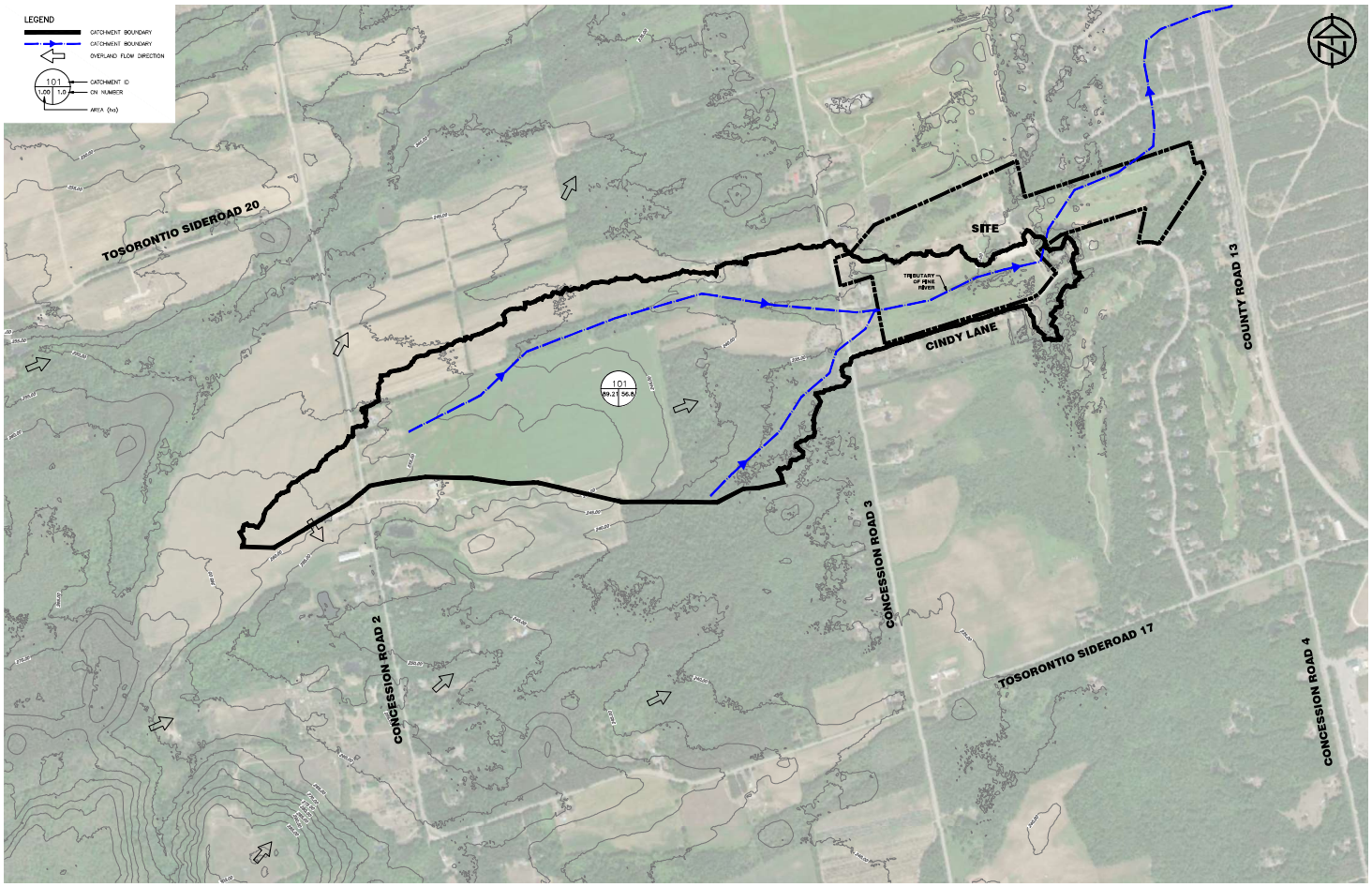
The erosion hazard limit is illustrated on the Natural Hazard Plan (Drawing NH-1) enclosed.

4 Summary

The natural hazard limits associated with the tributary of the Pine River within the subject lands at 45 Cindy Lane have been established in accordance with the MNRF Technical Guide - River and Stream Systems: Flood and Erosion Hazard Limit.

The flood hazard limit has been established for the Regulatory (greater of the 1:100-year and Regional storm) storm through the development of a HEC-RAS model using the detailed topographic data available. The erosion hazard limit for this confined tributary of the Pine River has been defined as the sum of the toe erosion allowance (5 m), stable slope allowance (3:1 slope) and erosion access allowance (6 m). The flood an erosion hazard limits are illustrated on the Natural Hazards Plan (Drawing NH-1) enclosed. The natural hazards limit is defined as the greater of the flood and erosion hazard limit.

As the NVCA regulates natural hazards, we are seeking approval of this natural hazards assessment and consequently the natural hazards limits delineated herein support of the amendment of the Township's Official Plan and development applications for the property.



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CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME, ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

BENCHMARKS

TBM1 – ELEVATION 231.010 m
SET ON N.E. CORNER OF CONCRETE TRANSFORMER

TBM2 – ELEVATION 230.430 m
SET ON N.E. CORNER OF CONCRETE TRANSFORMER

TBM3 – ELEVATION 230.15 m
SET ON N.E. CORNER OF CONCRETE TRANSFORMER

NOTES

TOPOGRAPHIC INFORMATION SHOWN BASED ON SURVEY COMPLETED BY TATHAM ENGINEERING LIMITED, DATED

No.	REVISION DESCRIPTION	DATE
1.	ISSUED FOR CLIENT REVIEW	DEC 11/23

ENGINEER STAMP

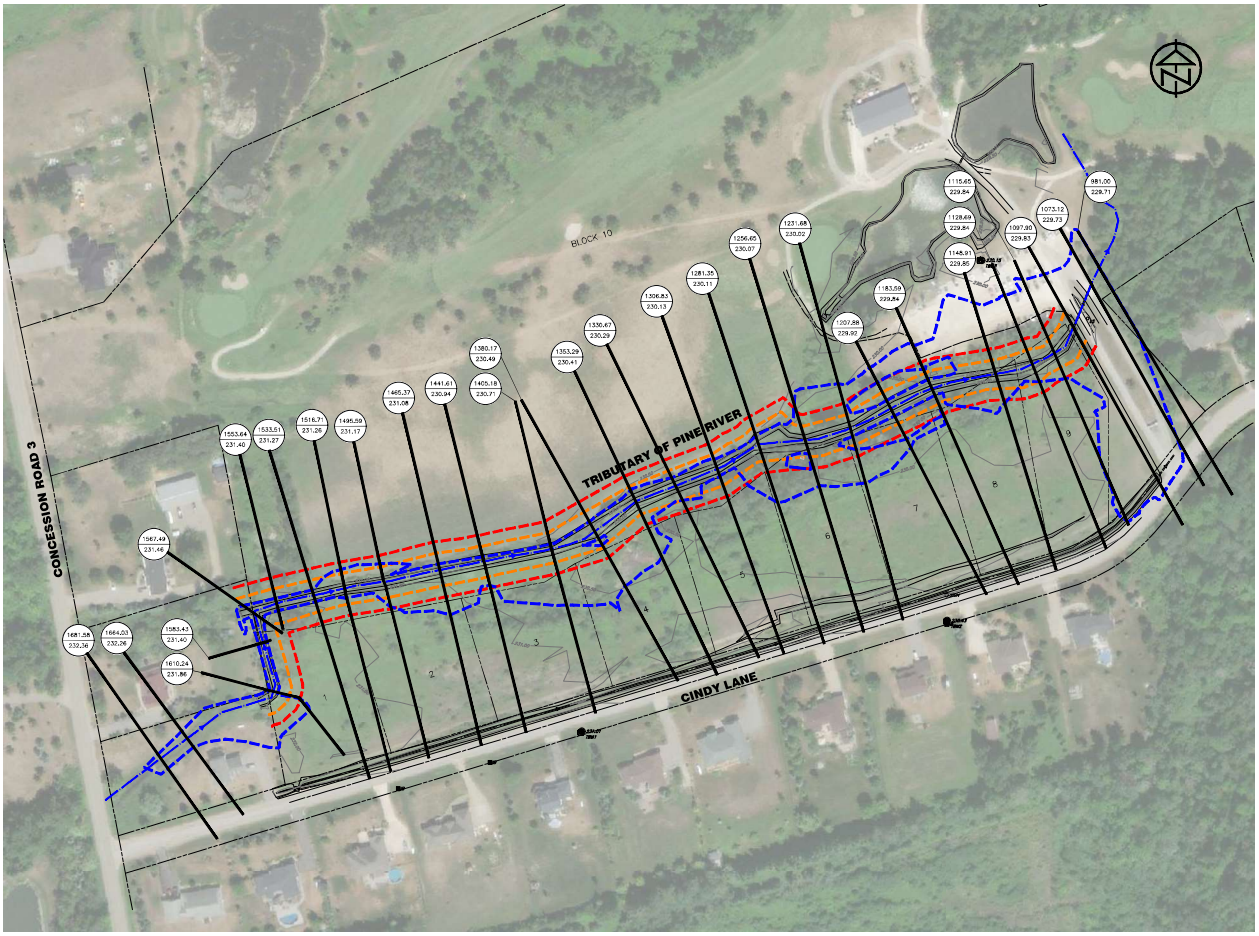
45 CINDY LANE
TOWNSHIP OF ADJALA-TOSORONTIO

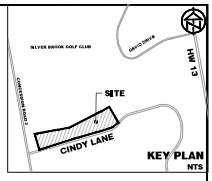
EXTERNAL DRAINAGE PLAN

TATHAM ENGINEERING

DESIGN: JG	FILE: 423499	DWG:	DP-1
DRAWN: LG	DATE: NOVEMBER 2023		
CHECK: DRT	SCALE: 1:5000		

Drawing Name: 423499-DP01.dwg, Plotted: Mar 05, 2024





LEGEND

- 260.00 — EXISTING CONTOUR
- REGIONAL FLOOD LIMIT
- EROSION HAZARD LIMIT
- STABLE SLOPE ALLOWANCE
- CREEK
- HEC-RAS CROSS SECTION
- 981.00 / 229.82 — HEC-RAS CROSS-SECTION
- REGIONAL (TIMMINS) STORM FLOOD ELEVATION

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TBM3 – ELEVATION 230.15 m
SET ON N.E. CORNER OF CONCRETE TRANSFORMER

NOTES

TOPOGRAPHIC INFORMATION SHOWN BASED ON SURVEY COMPLETED BY TATHAM ENGINEERING LIMITED, DATED

No.	REVISION DESCRIPTION	DATE
1.	ISSUED FOR CLIENT REVIEW	DEC 11/23

ENGINEER STAMP

DRAFT

45 CINDY LANE
TOWNSHIP OF ADJALA-TOSORONTIO

NATURAL HAZARD PLAN

TATHAM ENGINEERING

DESIGN: JG	FILE: 423499	DWG:	NH-1
DRAWN: LG	DATE: NOVEMBER 2023		
CHECK: DRT	SCALE: 1:1000		

Drawing Name: 423499-NH01.dwg, Plotted: Mar 05, 2024

Appendix A:
Hydrologic Analysis

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Visual OTTHYMO Model Parameter Calculations (NasHYD)

Project Details

45 Cindy Lane	423499

Prepared By

John Gore	03/01/2024

Data Sources

Detailed Soil Survey Reports for Ontario, NVCA Stormwater Technical Guide (2013), MTO Drainage Management Manual (1997)

Pre-Development Condition

Watershed:	NVCA
Catchment ID:	101
Catchment Area (ha):	89.21
Impervious %:	3%

Average Curve Number (CN), Runoff Coefficient (C) and Initial Abstraction (IA)

Soil Symbol		**Tisl**			**Ans**								
Soil Series		Tioga			Alliston								
Hydrologic Soils Group		A			AB								
Soil Texture		Sand Loam			Sand Loam								
Runoff Coefficient Type		1			1								
Area (ha)		74.61			14.60								
Percentage of Catchment		84%			16%								
Land Cover Category	**IA**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**
Impervious	2	1.32	100	0.95		100	0.95						
Gravel	3		89	0.09		89	0.09						
Woodland	10	7.10	32	0.08	14.60	46	0.08						
Pasture/Lawns	5		49	0.10		59	0.10						
Meadows	8	2.50	38	0.09		51	0.09						
Cultivated	7	63.11	62	0.22		68	0.22						
Waterbody	12	0.58	50	0.05		50	0.05						
Average CN		58.92			46.00								
Average C		0.21			0.08								
Average IA		7.27			10.00								

Time to Peak Calculations

Max. Catchment Elev. (m):	262.92
Min. Catchment Elev. (m):	229.31
Catchment Length (m):	2428
Catchment Slope (%):	1.38%
Method: Airport Method	
Time of Concentration (mins):	131.02

Summary

Catchment CN:	56.8
Catchment C:	0.19
Catchment IA (mm):	7.72
Time of Concentration (hrs):	2.18
Catchment Time to Peak (hrs):	1.46
Catchment Time Step (mins):	17.47

```
************************************************
** SIMULATION:100yr 24hr 15min SCS Type II (MTO) **
************************************************
--------------------
| CALIB          |
| NASHYD   (  0102)|  Area    (ha)=  89.21   Curve Number   (CN)= 56.8
|ID= 1 DT= 5.0 min |  Ia      (mm)=   7.72   # of Linear Res.(N)= 3.00
--------------------  U.H. Tp(hrs)=   1.46

      NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	6.167	1.94	12.250	148.78	18.33	2.19
0.167	0.00	6.250	1.94	12.333	17.52	18.42	2.19
0.250	0.00	6.333	2.19	12.417	17.50	18.50	2.19
0.333	1.34	6.417	2.19	12.500	17.50	18.58	2.19
0.417	1.34	6.500	2.19	12.583	17.50	18.67	2.19
0.500	1.34	6.583	2.19	12.667	17.50	18.75	2.19
0.583	1.34	6.667	2.19	12.750	17.50	18.83	2.19
0.667	1.34	6.750	2.19	12.833	9.00	18.92	2.19
0.750	1.34	6.833	2.19	12.917	8.99	19.00	2.19
0.833	1.34	6.917	2.19	13.000	8.99	19.08	2.19
0.917	1.34	7.000	2.19	13.083	8.99	19.17	2.19
1.000	1.34	7.083	2.19	13.167	8.99	19.25	2.19
1.083	1.34	7.167	2.19	13.250	8.99	19.33	2.19
1.167	1.34	7.250	2.19	13.333	6.56	19.42	2.19
1.250	1.34	7.333	2.67	13.417	6.56	19.50	2.19
1.333	1.34	7.417	2.67	13.500	6.56	19.58	2.19
1.417	1.34	7.500	2.67	13.583	6.56	19.67	2.19
1.500	1.34	7.583	2.67	13.667	6.56	19.75	2.19
1.583	1.34	7.667	2.67	13.750	6.56	19.83	2.19
1.667	1.34	7.750	2.67	13.833	5.11	19.92	2.19
1.750	1.34	7.833	2.67	13.917	5.11	20.00	2.19
1.833	1.34	7.917	2.67	14.000	5.11	20.08	2.19
1.917	1.34	8.000	2.67	14.083	5.11	20.17	2.19
2.000	1.34	8.083	2.67	14.167	5.11	20.25	2.19
2.083	1.34	8.167	2.67	14.250	5.11	20.33	1.46
2.167	1.34	8.250	2.67	14.333	3.65	20.42	1.46
2.250	1.34	8.333	3.16	14.417	3.65	20.50	1.46
2.333	1.58	8.417	3.16	14.500	3.65	20.58	1.46
2.417	1.58	8.500	3.16	14.583	3.65	20.67	1.46
2.500	1.58	8.583	3.16	14.667	3.65	20.75	1.46
2.583	1.58	8.667	3.16	14.750	3.65	20.83	1.46
2.667	1.58	8.750	3.16	14.833	3.65	20.92	1.46
2.750	1.58	8.833	3.40	14.917	3.65	21.00	1.46

2.833	1.58	8.917	3.40	15.000	3.65	21.08	1.46
2.917	1.58	9.000	3.40	15.083	3.65	21.17	1.46
3.000	1.58	9.083	3.40	15.167	3.65	21.25	1.46
3.083	1.58	9.167	3.40	15.250	3.65	21.33	1.46
3.167	1.58	9.250	3.40	15.333	3.65	21.42	1.46
3.250	1.58	9.333	3.89	15.417	3.65	21.50	1.46
3.333	1.58	9.417	3.89	15.500	3.65	21.58	1.46
3.417	1.58	9.500	3.89	15.583	3.65	21.67	1.46
3.500	1.58	9.583	3.89	15.667	3.65	21.75	1.46
3.583	1.58	9.667	3.89	15.750	3.65	21.83	1.46
3.667	1.58	9.750	3.89	15.833	3.65	21.92	1.46
3.750	1.58	9.833	4.38	15.917	3.65	22.00	1.46
3.833	1.58	9.917	4.38	16.000	3.65	22.08	1.46
3.917	1.58	10.000	4.38	16.083	3.65	22.17	1.46
4.000	1.58	10.083	4.38	16.167	3.65	22.25	1.46
4.083	1.58	10.167	4.38	16.250	3.65	22.33	1.46
4.167	1.58	10.250	4.38	16.333	2.19	22.42	1.46
4.250	1.58	10.333	5.59	16.417	2.19	22.50	1.46
4.333	1.94	10.417	5.59	16.500	2.19	22.58	1.46
4.417	1.94	10.500	5.59	16.583	2.19	22.67	1.46
4.500	1.94	10.583	5.59	16.667	2.19	22.75	1.46
4.583	1.94	10.667	5.59	16.750	2.19	22.83	1.46
4.667	1.94	10.750	5.59	16.833	2.19	22.92	1.46
4.750	1.94	10.833	7.54	16.917	2.19	23.00	1.46
4.833	1.94	10.917	7.54	17.000	2.19	23.08	1.46
4.917	1.94	11.000	7.54	17.083	2.19	23.17	1.46
5.000	1.94	11.083	7.54	17.167	2.19	23.25	1.46
5.083	1.94	11.167	7.54	17.250	2.19	23.33	1.46
5.167	1.94	11.250	7.54	17.333	2.19	23.42	1.46
5.250	1.94	11.333	11.67	17.417	2.19	23.50	1.46
5.333	1.94	11.417	11.67	17.500	2.19	23.58	1.46
5.417	1.94	11.500	11.67	17.583	2.19	23.67	1.46
5.500	1.94	11.583	11.67	17.667	2.19	23.75	1.46
5.583	1.94	11.667	11.67	17.750	2.19	23.83	1.46
5.667	1.94	11.750	11.67	17.833	2.19	23.92	1.46
5.750	1.94	11.833	35.98	17.917	2.19	24.00	1.46
5.833	1.94	11.917	35.98	18.000	2.19	24.08	1.46
5.917	1.94	12.000	35.98	18.083	2.19	24.17	1.46
6.000	1.94	12.083	148.76	18.167	2.19	24.25	1.46
6.083	1.94	12.167	148.78	18.250	2.19		

Unit Hyd Qpeak (cms)= 2.334

PEAK FLOW (cms)= 2.217 (i)
TIME TO PEAK (hrs)= 13.750
RUNOFF VOLUME (mm)= 42.204
TOTAL RAINFALL (mm)= 121.550
RUNOFF COEFFICIENT = 0.347

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

****
** SIMULATION:Timmins **
****

| CALIB |
| NASHYD (0102)| Area (ha)= 89.21 Curve Number (CN)= 56.8
|ID= 1 DT= 5.0 min | Ia (mm)= 7.72 # of Linear Res.(N)= 3.00
--- U.H. Tp(hrs)= 1.46

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.00	3.333	10.00	6.583	20.00	9.83	23.00
0.167	0.00	3.417	10.00	6.667	20.00	9.92	23.00
0.250	0.00	3.500	10.00	6.750	20.00	10.00	23.00
0.333	0.00	3.583	10.00	6.833	20.00	10.08	13.00
0.417	0.00	3.667	10.00	6.917	20.00	10.17	13.00
0.500	0.00	3.750	10.00	7.000	20.00	10.25	13.00
0.583	0.00	3.833	10.00	7.083	43.00	10.33	13.00
0.667	0.00	3.917	10.00	7.167	43.00	10.42	13.00
0.750	0.00	4.000	10.00	7.250	43.00	10.50	13.00
0.833	0.00	4.083	3.00	7.333	43.00	10.58	13.00
0.917	0.00	4.167	3.00	7.417	43.00	10.67	13.00
1.000	0.00	4.250	3.00	7.500	43.00	10.75	13.00
1.083	15.00	4.333	3.00	7.583	43.00	10.83	13.00
1.167	15.00	4.417	3.00	7.667	43.00	10.92	13.00
1.250	15.00	4.500	3.00	7.750	43.00	11.00	13.00
1.333	15.00	4.583	3.00	7.833	43.00	11.08	13.00
1.417	15.00	4.667	3.00	7.917	43.00	11.17	13.00
1.500	15.00	4.750	3.00	8.000	43.00	11.25	13.00
1.583	15.00	4.833	3.00	8.083	20.00	11.33	13.00
1.667	15.00	4.917	3.00	8.167	20.00	11.42	13.00
1.750	15.00	5.000	3.00	8.250	20.00	11.50	13.00
1.833	15.00	5.083	5.00	8.333	20.00	11.58	13.00
1.917	15.00	5.167	5.00	8.417	20.00	11.67	13.00
2.000	15.00	5.250	5.00	8.500	20.00	11.75	13.00
2.083	20.00	5.333	5.00	8.583	20.00	11.83	13.00
2.167	20.00	5.417	5.00	8.667	20.00	11.92	13.00
2.250	20.00	5.500	5.00	8.750	20.00	12.00	13.00
2.333	20.00	5.583	5.00	8.833	20.00	12.08	8.00
2.417	20.00	5.667	5.00	8.917	20.00	12.17	8.00

2.500	20.00	5.750	5.00	9.000	20.00	12.25	8.00
2.583	20.00	5.833	5.00	9.083	23.00	12.33	8.00
2.667	20.00	5.917	5.00	9.167	23.00	12.42	8.00
2.750	20.00	6.000	5.00	9.250	23.00	12.50	8.00
2.833	20.00	6.083	20.00	9.333	23.00	12.58	8.00
2.917	20.00	6.167	20.00	9.417	23.00	12.67	8.00
3.000	20.00	6.250	20.00	9.500	23.00	12.75	8.00
3.083	10.00	6.333	20.00	9.583	23.00	12.83	8.00
3.167	10.00	6.417	20.00	9.667	23.00	12.92	8.00
3.250	10.00	6.500	20.00	9.750	23.00	13.00	8.00

Unit Hyd Qpeak (cms)= 2.334

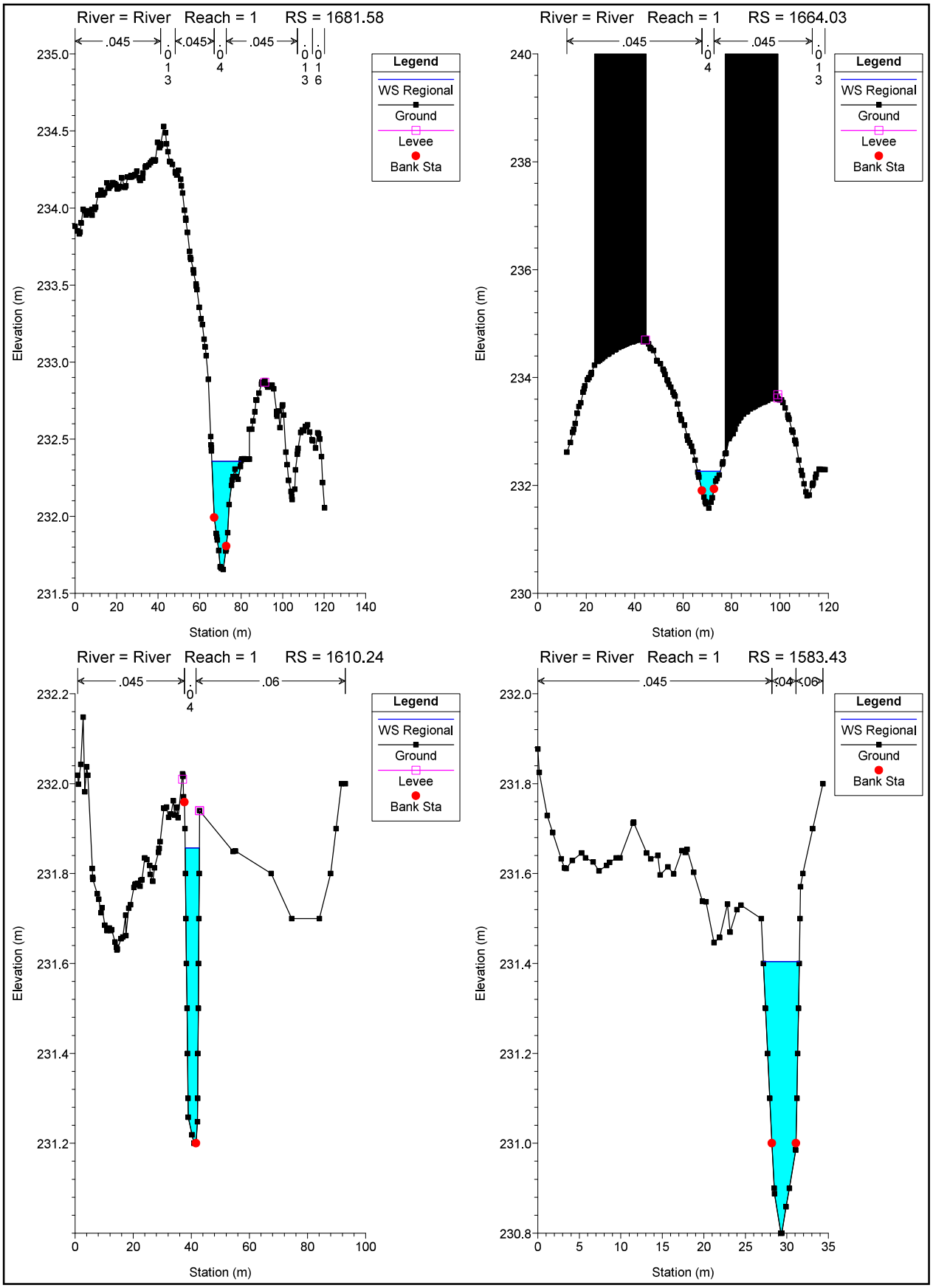
PEAK FLOW (cms)= 3.505 (i)
TIME TO PEAK (hrs)= 10.333
RUNOFF VOLUME (mm)= 90.705
TOTAL RAINFALL (mm)= 193.000
RUNOFF COEFFICIENT = 0.470

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

Appendix B:
HEC-RAS Results

HEC-RAS Plan: Default Scenario River: River Reach: 1 Profile: Regional

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	1681.58	Regional	3.51	231.66	232.36	232.09	232.39	0.002493	0.88	4.87	14.06	0.36
1	1664.03	Regional	3.51	231.58	232.26	232.10	232.33	0.005195	1.18	3.38	9.37	0.52
1	1610.24	Regional	3.51	231.20	231.86	231.70	231.96	0.008914	1.52	2.55	4.91	0.66
1	1583.43	Regional	3.51	230.80	231.40	231.40	231.63	0.017882	2.15	1.81	4.35	0.95
1	1567.49	Regional	3.51	230.60	231.46		231.47	0.000928	0.67	7.68	14.54	0.24
1	1553.64	Regional	3.51	230.53	231.40	231.06	231.45	0.002709	1.17	3.97	6.67	0.40
1	1533.51	Regional	3.51	230.50	231.27	231.12	231.37	0.004930	1.33	2.85	6.45	0.52
1	1516.71	Regional	3.51	230.53	231.26	231.10	231.29	0.002620	0.95	5.03	19.11	0.38
1	1495.59	Regional	3.51	230.36	231.17	230.89	231.23	0.003168	1.13	4.32	29.48	0.42
1	1465.37	Regional	3.51	230.30	231.08	230.81	231.13	0.003101	1.12	5.01	30.77	0.42
1	1441.61	Regional	3.51	230.28	230.94	230.81	231.03	0.006528	1.42	3.36	19.94	0.59
1	1405.18	Regional	3.51	230.04	230.71	230.71	230.78	0.006727	1.45	4.84	32.99	0.60
1	1380.17	Regional	3.51	229.96	230.49	230.28	230.52	0.002865	0.84	5.68	33.20	0.38
1	1353.29	Regional	3.51	229.68	230.41	230.25	230.44	0.003085	1.06	7.56	39.93	0.41
1	1330.67	Regional	3.51	229.71	230.29	230.13	230.35	0.005209	1.11	3.58	12.25	0.51
1	1306.83	Regional	3.51	229.51	230.13	230.00	230.21	0.006479	1.32	3.18	9.54	0.58
1	1281.35	Regional	3.51	229.26	230.11	229.73	230.13	0.001312	0.73	7.19	36.60	0.27
1	1256.65	Regional	3.51	229.15	230.07	229.62	230.10	0.001221	0.79	8.16	47.95	0.27
1	1231.68	Regional	3.51	229.20	230.02	229.75	230.05	0.003010	1.19	7.17	28.86	0.42
1	1207.88	Regional	3.51	229.11	229.92	229.67	229.97	0.003389	1.18	4.31	9.15	0.44
1	1183.59	Regional	3.51	228.98	229.84	229.57	229.89	0.003331	1.21	4.28	8.98	0.44
1	1148.91	Regional	3.51	229.03	229.85	229.59	229.85	0.000266	0.35	15.77	71.99	0.12
1	1128.69	Regional	3.51	228.88	229.84	229.37	229.85	0.000319	0.41	12.65	58.14	0.14
1	1115.65	Regional	3.51	228.88	229.84	229.59	229.84	0.000564	0.50	12.46	74.03	0.18
1	1097.9	Regional	3.51	228.78	229.83	229.43	229.84	0.000181	0.34	25.87	155.38	0.11
1	1086.07		Culvert									
1	1073.12	Regional	3.51	228.78	229.73	229.35	229.77	0.002578	0.98	4.86	85.50	0.34
1	981	Regional	3.51	228.70	229.71	229.59	229.73	0.002761	0.83	5.92	26.82	0.35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Legend
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Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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.045
.04
.013
Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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Legend
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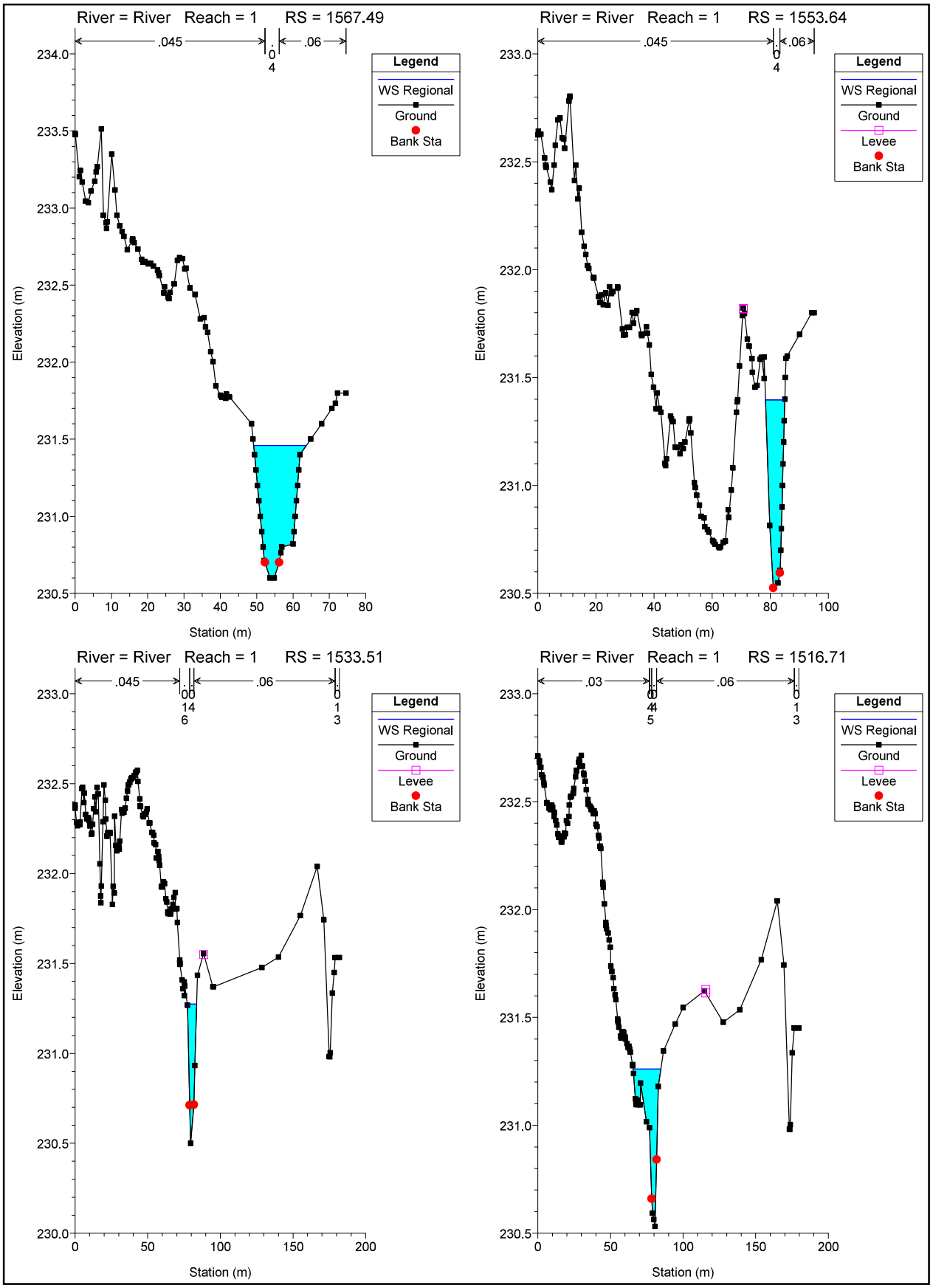
Ground
Bank Sta
Elevation (m)
Station (m)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Ground
Bank Sta
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.06
Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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.06
Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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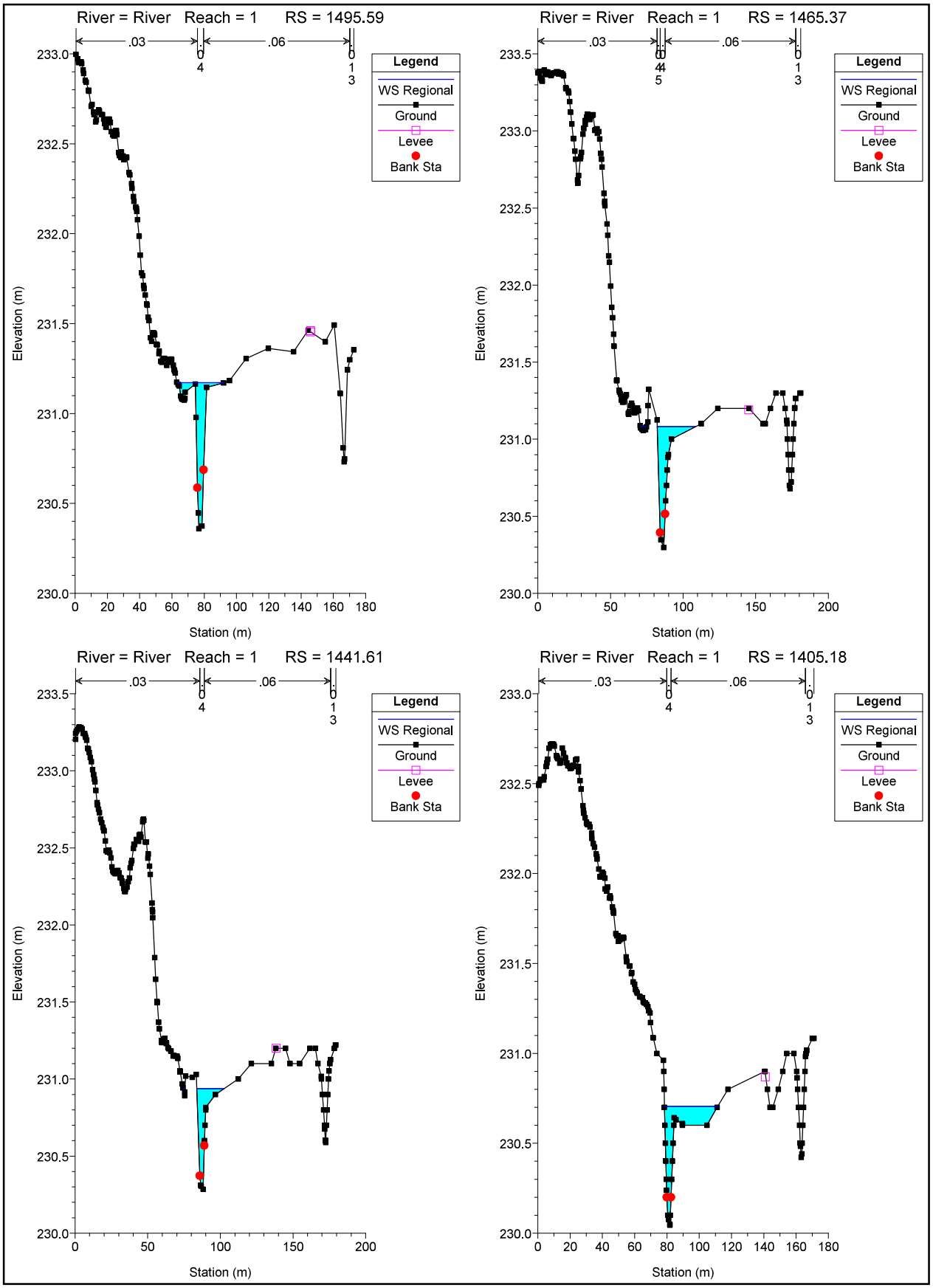
Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)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Legend
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Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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.06
Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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.06
Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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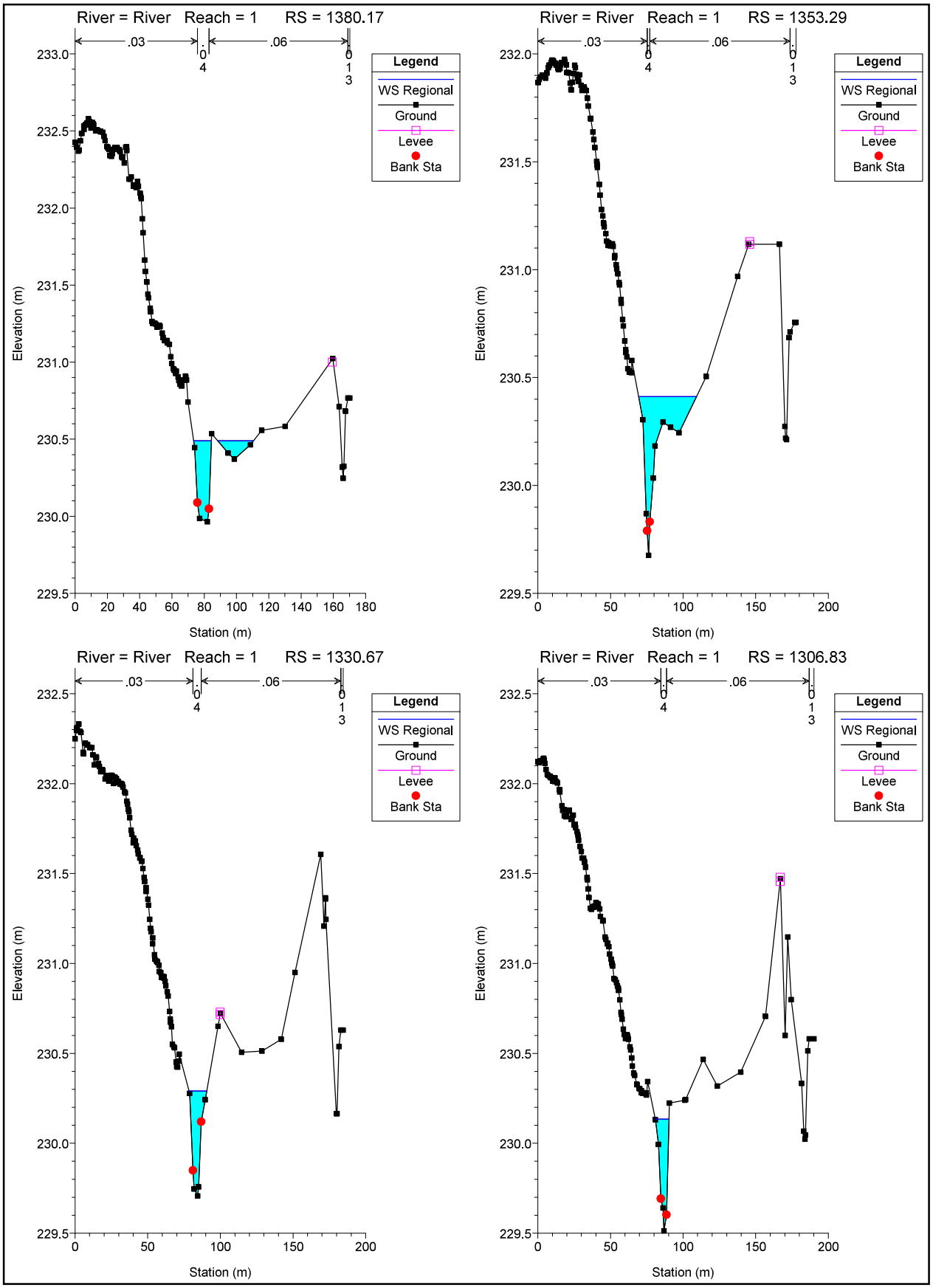
Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)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WS Regional
Ground
Levee
Bank Sta
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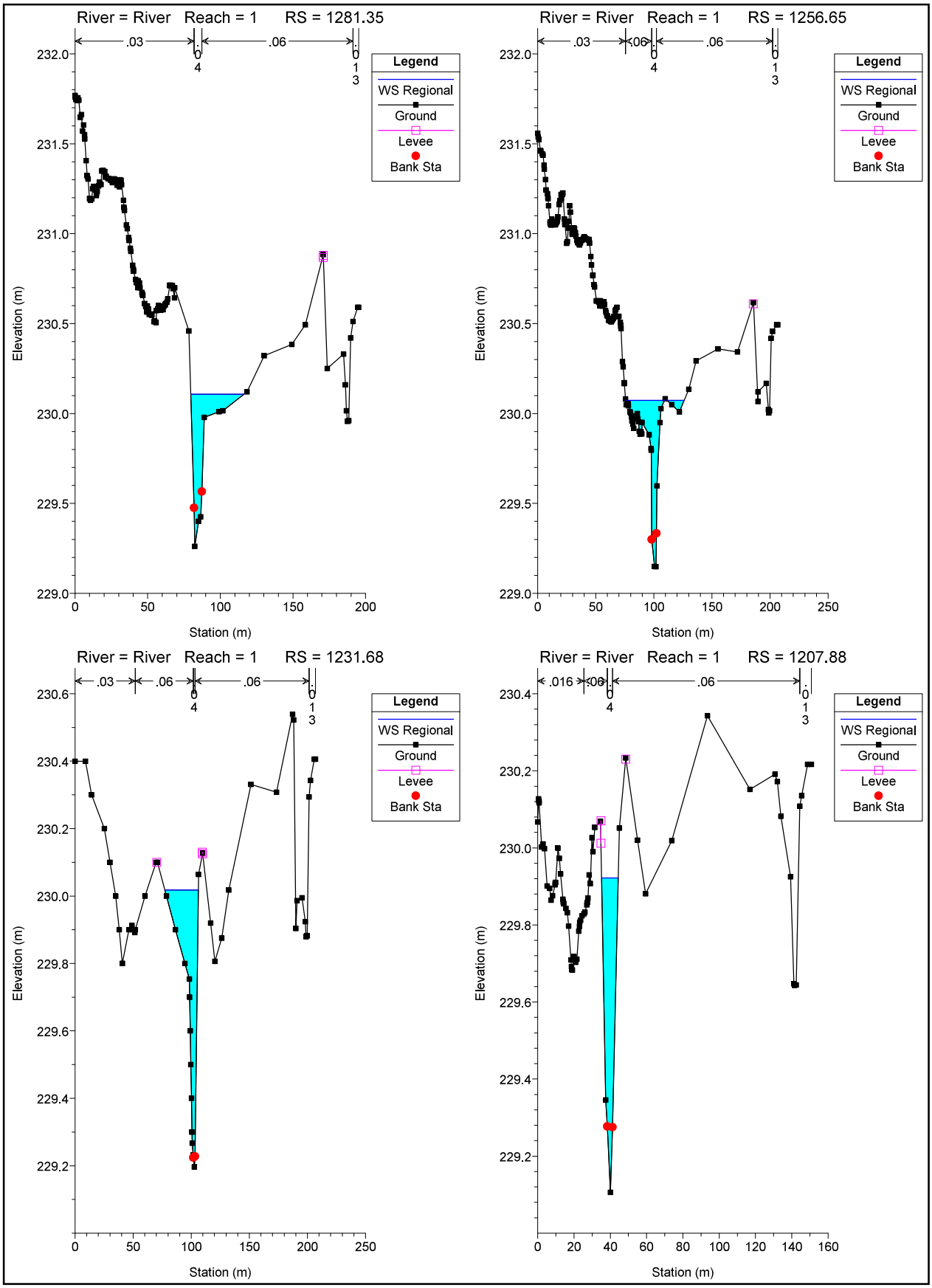
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Ground
Levee
Bank Sta
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0.13
Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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.06
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0.04
0.13
Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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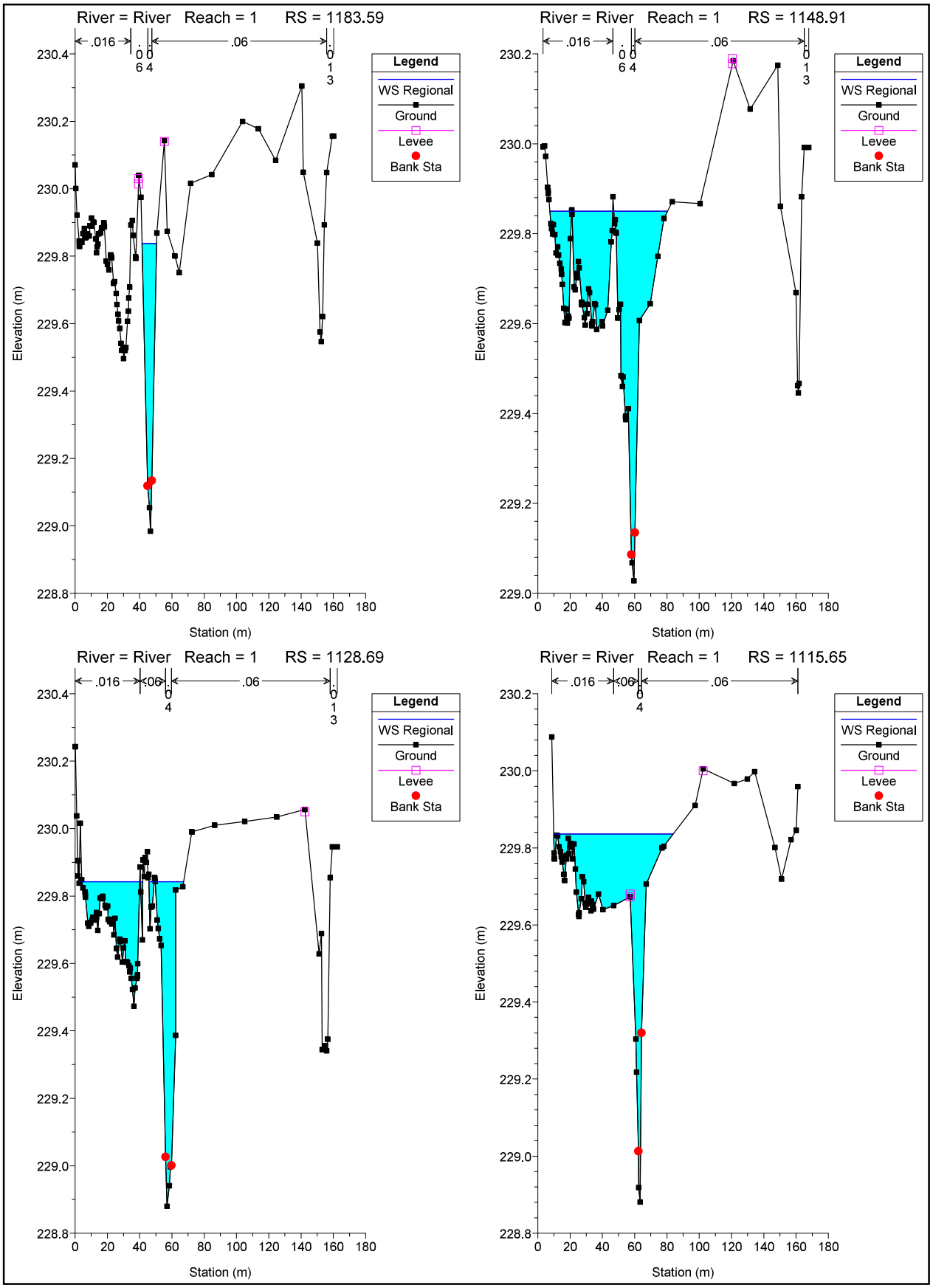
Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)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Legend
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Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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Legend
WS Regional
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
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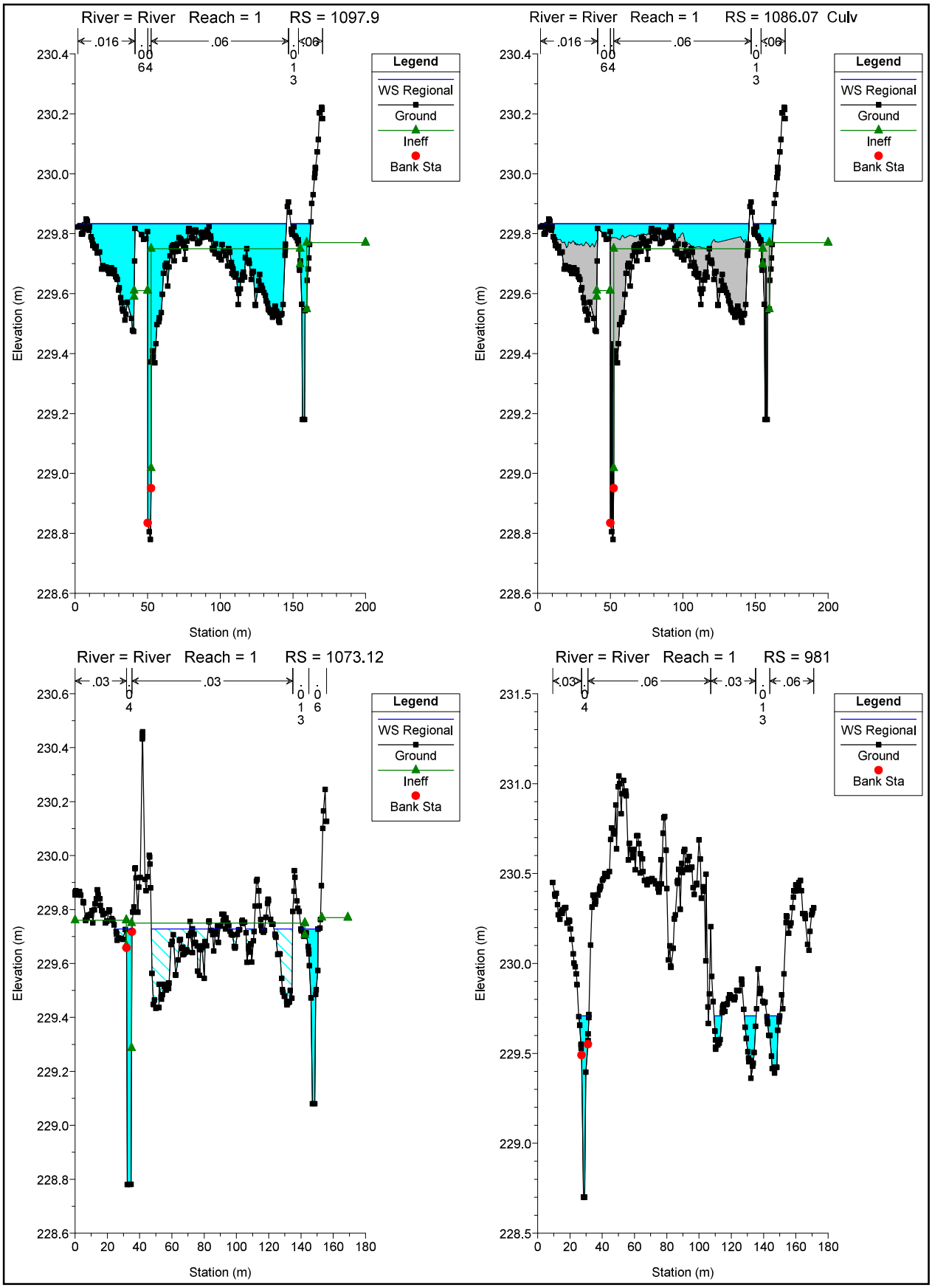
Levee
Bank Sta
Elevation (m)
Station (m)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Legend
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Ground
Ineff
Bank Sta
Elevation (m)
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.06
Legend
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Ground
Ineff
Bank Sta
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Legend
WS Regional
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
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.03
.06
.03
.06
Legend
WS Regional
Ground
Bank Sta
Elevation (m)
Station (m)