200-YEAR HYDRAULIC ANALYSIS
FOR
CEMEX ROCKFIELD
MODIFICATION PROJECT
QUARRY SITE

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INTRODUCTION

Cemex's Rockfield Modification Project (Project) is located along the east side of the San Joaquin River and west side of North Friant Road in the Friant community of Fresno County. The Project consists of an existing Plant Site at 13475 North Friant Road and an existing Quarry Site approximately 2.0 miles to the north (see Figure 1, Location Map after this report text). Chang Consultants prepared the October 15, 2020 report, *Hydraulic Analyses for Cemex Rockfield Modification Project*. The report determined that the Project complies with the applicable local and federal floodway and floodplain regulations. In addition, the report's hydraulic analysis showed that the San Joaquin River's easterly channel bank contains the 100-year flow, which prevents flow from entering the adjacent Quarry Site, i.e., the easterly channel bank along the Quarry Site is not subject to overtopping during a 100-year event.

The 100-year event is the typical standard used for engineering design and analyses as well as the basis for FEMA's floodplain mapping. This report contains a 200-year hydraulic analysis of the San Joaquin River adjacent to the Quarry Site to assess an even more extreme and rare probability flow event. A 200-year event is a flood that statistically has a 0.5-percent chance of occurring in any given year.

HYDRAULIC ANALYSIS

The US Army Corps of Engineers' HEC-RAS model was used for the 200-year hydraulic analysis. The model is similar to the one from the October 2020 report, but based on the higher flow rate. The input parameters are as follows. The existing condition cross-sections were created from 2-foot contour interval topographic mapping (NAVD 88 vertical datum) flown for the project on November 6, 2018 (see the HEC-RAS Work Map in the map pocket). A site investigation was performed that confirmed the topographic mapping is representative of existing conditions. Cemex recently raised the northerly portion of the berm separating the San Joaquin River and Quarry Site up to approximately 4 feet with compacted fill. The compacted fill was placed over an existing perimeter road from HEC-RAS cross-section 14 to 20 and prevents the 200-year flood from entering the quarry pit. The fill area is delineated on the HEC-RAS Work Map and on relevant HEC-RAS cross-section plots in Appendix A. Topographic mapping from 2026 was prepared to reflect the berm fill in the model. Encroachments were included along some cross-sections to define ineffective flow areas, i.e., to separate active versus inactive flow areas for modeling purposes. The starting downstream water surface elevation was based on normal depth. The normal depth slope was determined by calibrating the 100-year analysis. The normal depth slope was adjusted in the 100-year analysis until the base flood elevation was matched. This slope was used in the 200-year analysis.

The roughness coefficients were assigned based on a site investigation and review of aerial photographs. The roughness coefficients vary from 0.030 to 0.075. A value of 0.030 was used in areas with minimal vegetation and subject to base flow. Higher values were used to represent areas containing low to dense vegetation and trees.

FEMA's January 20, 2016, *Flood Insurance Study, Fresno County, California,* provides the 10-year (10-percent), 50-year (2-percent), 100-year (1-percent), and 500-year (0.2-percent) flow rates

for the San Joaquin River below Friant Dam (attached). The 200-year (0.5-percent) flow rate is not provided, so was estimated from a log-probability plot of the four known flow rates. The log-probability plot is attached after this report text and determined a 200-year flow rate of 95,000 cubic feet per second (cfs).

The existing condition 200-year San Joaquin River HEC-RAS results are included in Appendix A. The 100-year water surface elevations from the October 2020 report and current 200-year water surface elevations are summarized in Table 1. The Quarry Site is from cross-section 2 to 20. The table shows that the 200-year water surface elevations along the Quarry Site are 1.80 to 2.82 feet higher than the 100-year water surface elevations. Appendix A contains graphical plots of each cross-section. The cross-sections are looking downstream, so the Quarry Site is on the left side of the cross-sections. The plots show that the 200-year flow is contained within the easterly channel bank along the entire Quarry Site.

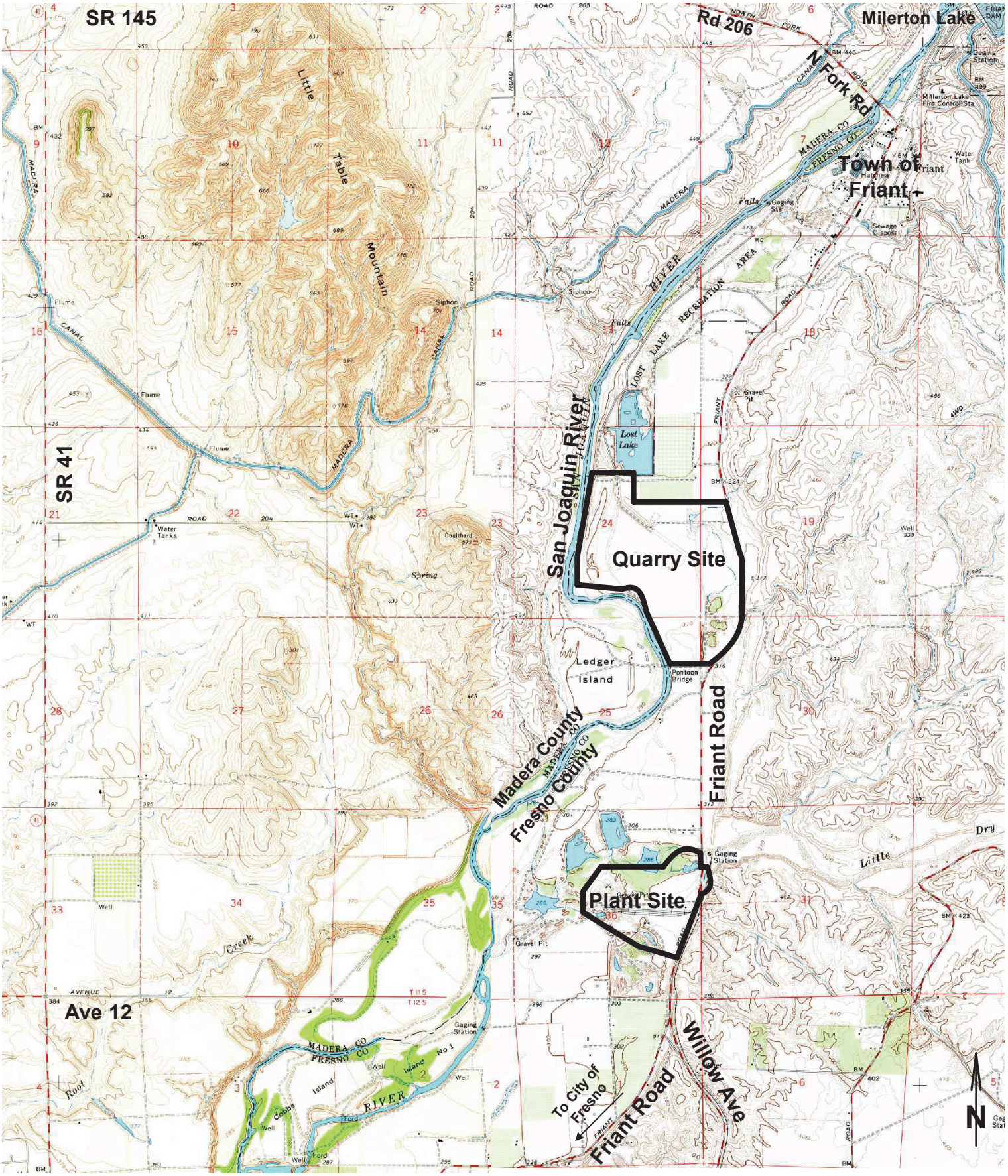
Cross-Section	100-Year WSE, ft	200-Year WSE, ft	200- minus 100-Year WSE, ft
22	313.36	316.18	2.82
21	311.29	313.43	2.14
20	311.37	313.78	2.41
19	310.91	313.11	2.20
18	310.15	312.25	2.10
17	310.01	312.13	2.12
16	309.60	311.87	2.27
15	308.99	311.19	2.20
14	308.74	310.84	2.10
13	308.41	310.43	2.02
12	307.72	309.60	1.88
11	307.08	308.88	1.80
10	306.41	308.48	2.07
9	306.07	308.12	2.05
8	305.23	307.39	2.16
7	305.31	307.47	2.16
6	305.27	307.43	2.16
5	305.24	307.40	2.16
4	305.19	307.34	2.15
3	305.14	307.30	2.16
2	305.02	307.19	2.17
1	305.00	307.17	2.17

Table 1. 100- and 200-Year Water Surface Elevations

CONCLUSION

The October 15, 2020 report, *Hydraulic Analyses for Cemex Rockfield Modification Project,* provided a 100-year San Joaquin River hydraulic analysis for the Quarry Site. The 100-year event

is the typical standard for engineering design, analyses, and FEMA floodplain mapping. The report showed that the 100-year flow will not enter the Quarry Site. This report contains a 200-year HEC-RAS hydraulic analysis in order to assess a more extreme and rare probability flow event. The results show that the 200-year flow is also contained within river's east bank and will not enter the Quarry Site.



USGS Friant 7.5' Quad

CEMEX
Rockfield Modification Project
Friant Road, Fresno County
Figure 1
Location Map

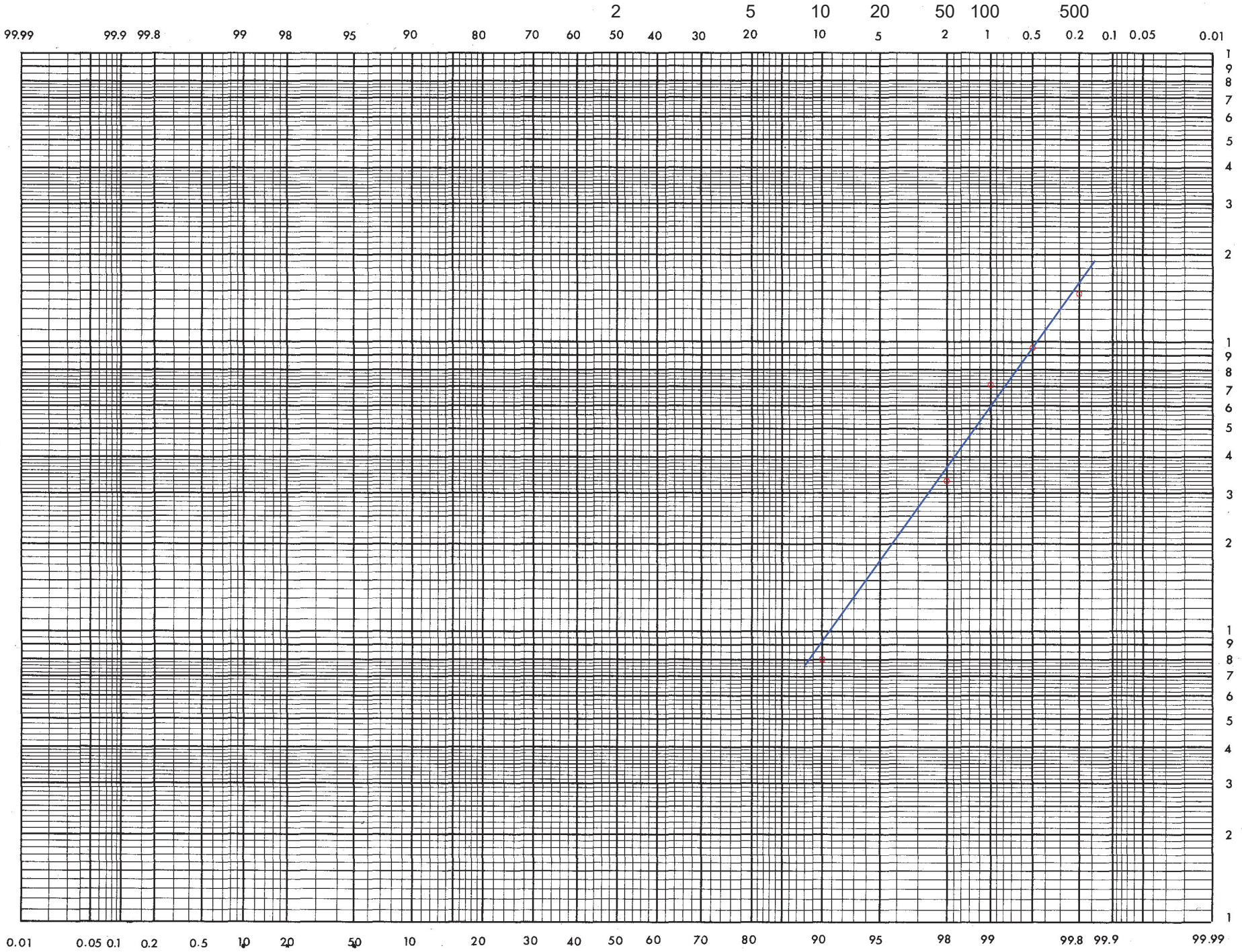
Table 6: Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-percent	2-percent	1-percent	0.2-percent
SAN JOAQUIN RIVER (continued)					
[redacted]	1,676	8,000	[redacted]	[redacted]	146,000
SPRR DRAINAGE					
At North Avenue	0.99	30	70	160	300
TIVY VALLEY CREEK					
At Piedra Avenue	2.2	70	210[1]	265[1]	320[1]
At Weldon Avenue	2.0	70	550	1,100	1,660
WARTHAN CREEK					
At confluence with Los Ganos Creek	116.0	2,300	6,400	8,900	17,100
WELDON CREEK					
At Piedra Road	1.1	60	260	520	820
WOOTEN CREEK					
At Alta Main Canal	15.9	150[1]	170[1]	175[1]	175[1]
At AT&SF Railway	12.7	350	690[1]	995[1]	1,340[1]
Downstream of Friant-Kern Canal	11.7	345	800	1,115	1,360

[1] Decrease due to excessive overbank losses upstream

Log-Probability

probability x 3 log cycles



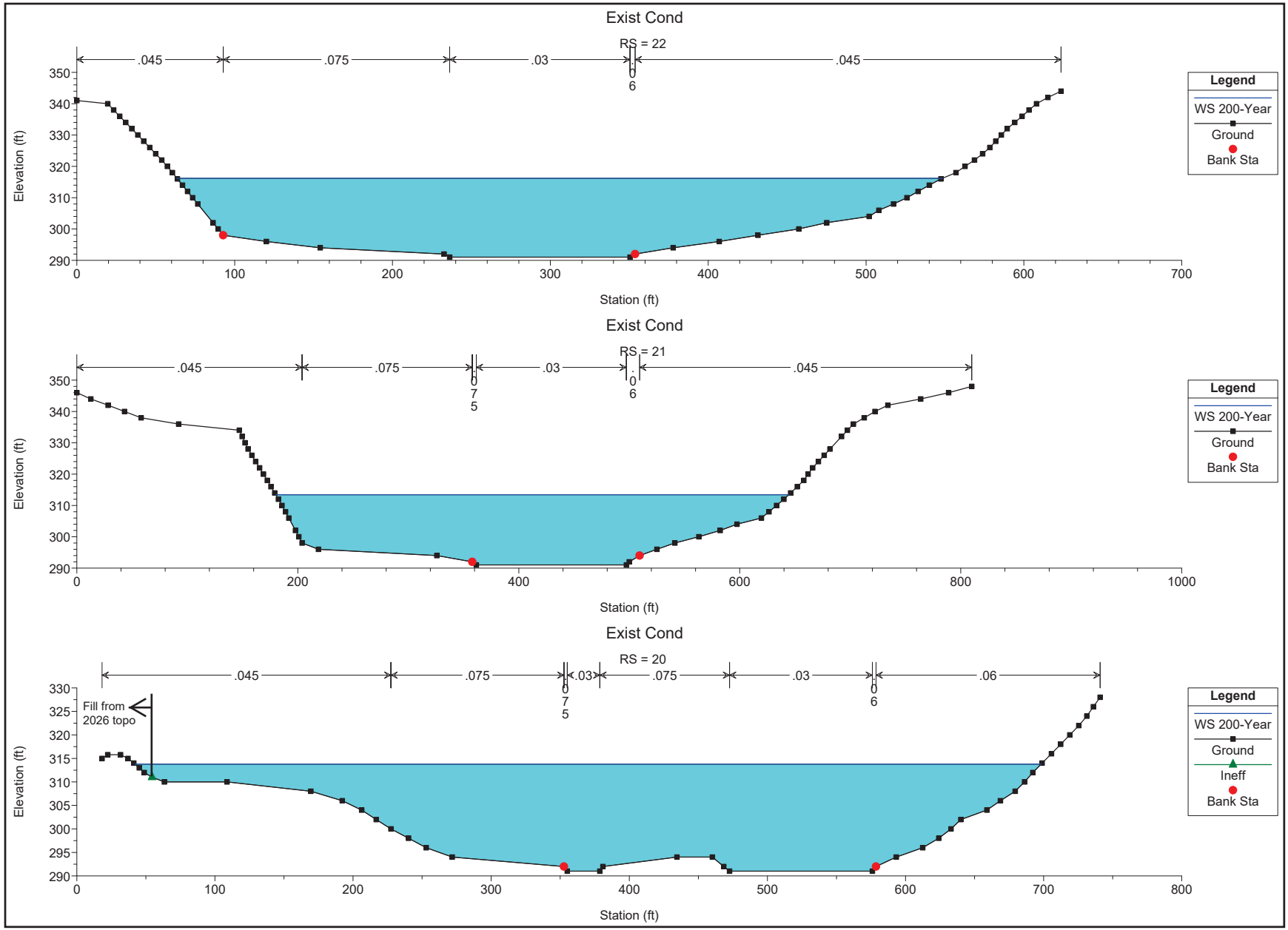
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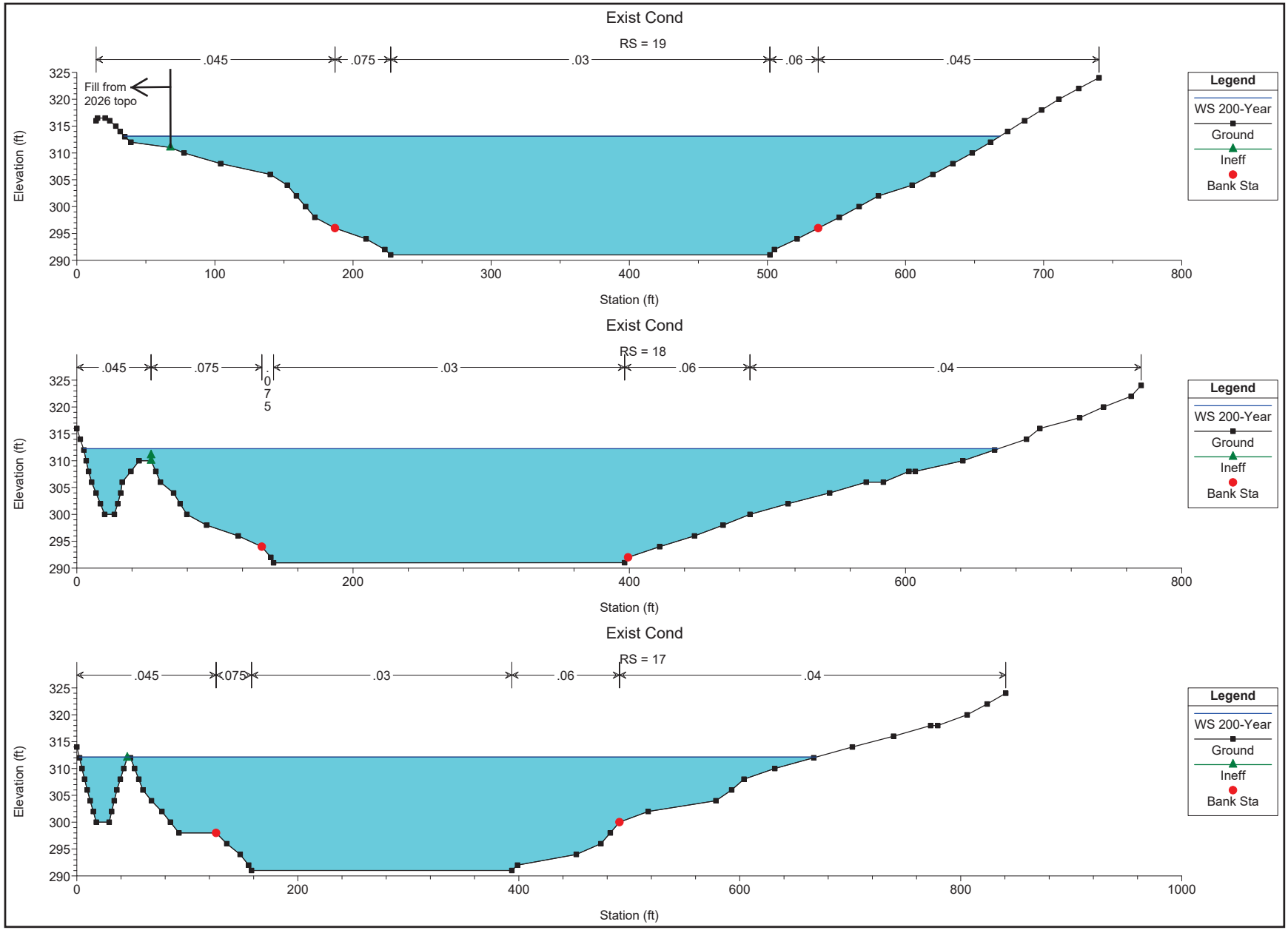
APPENDIX A

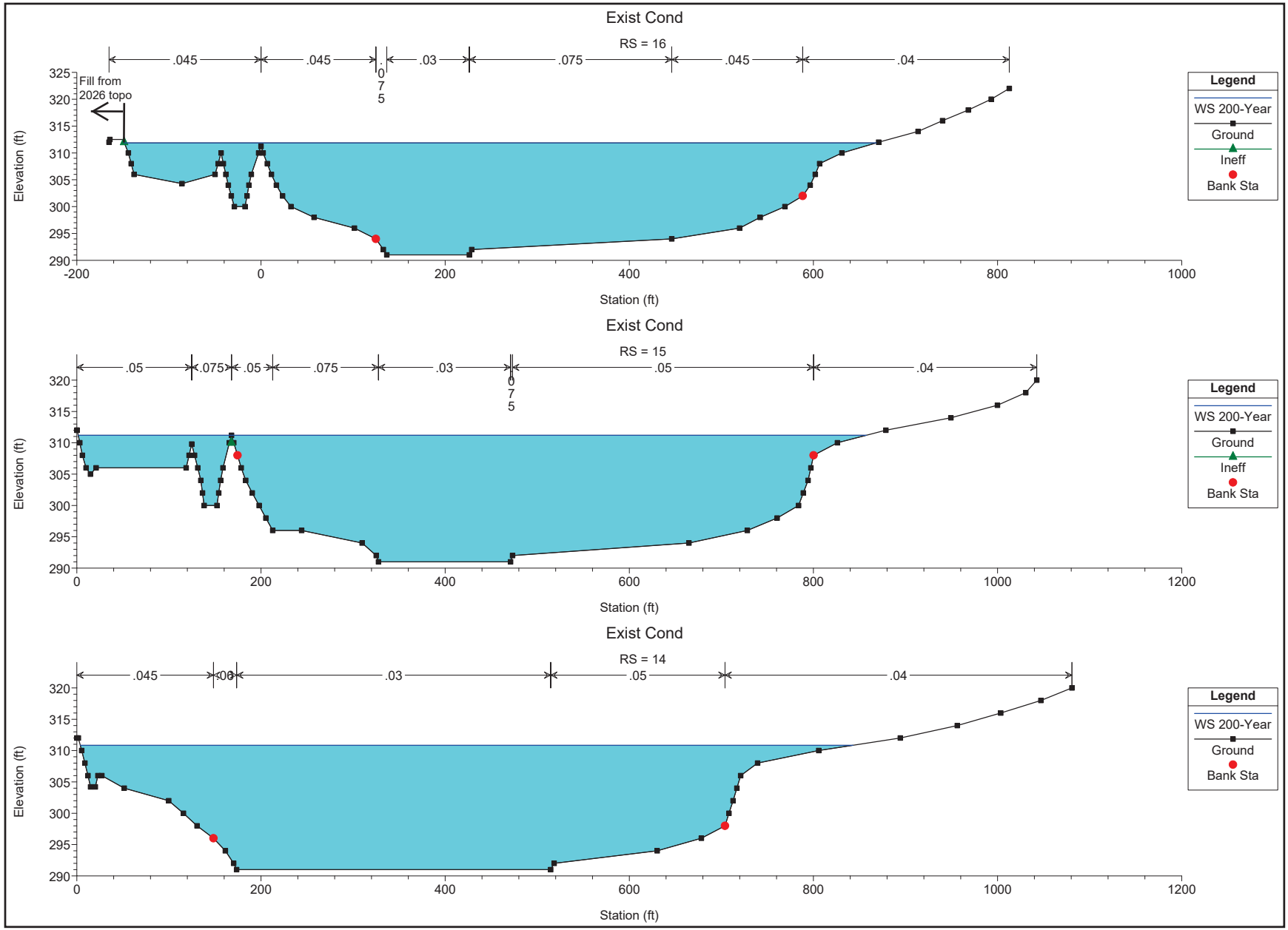
200-YEAR HEC-RAS ANALYSIS

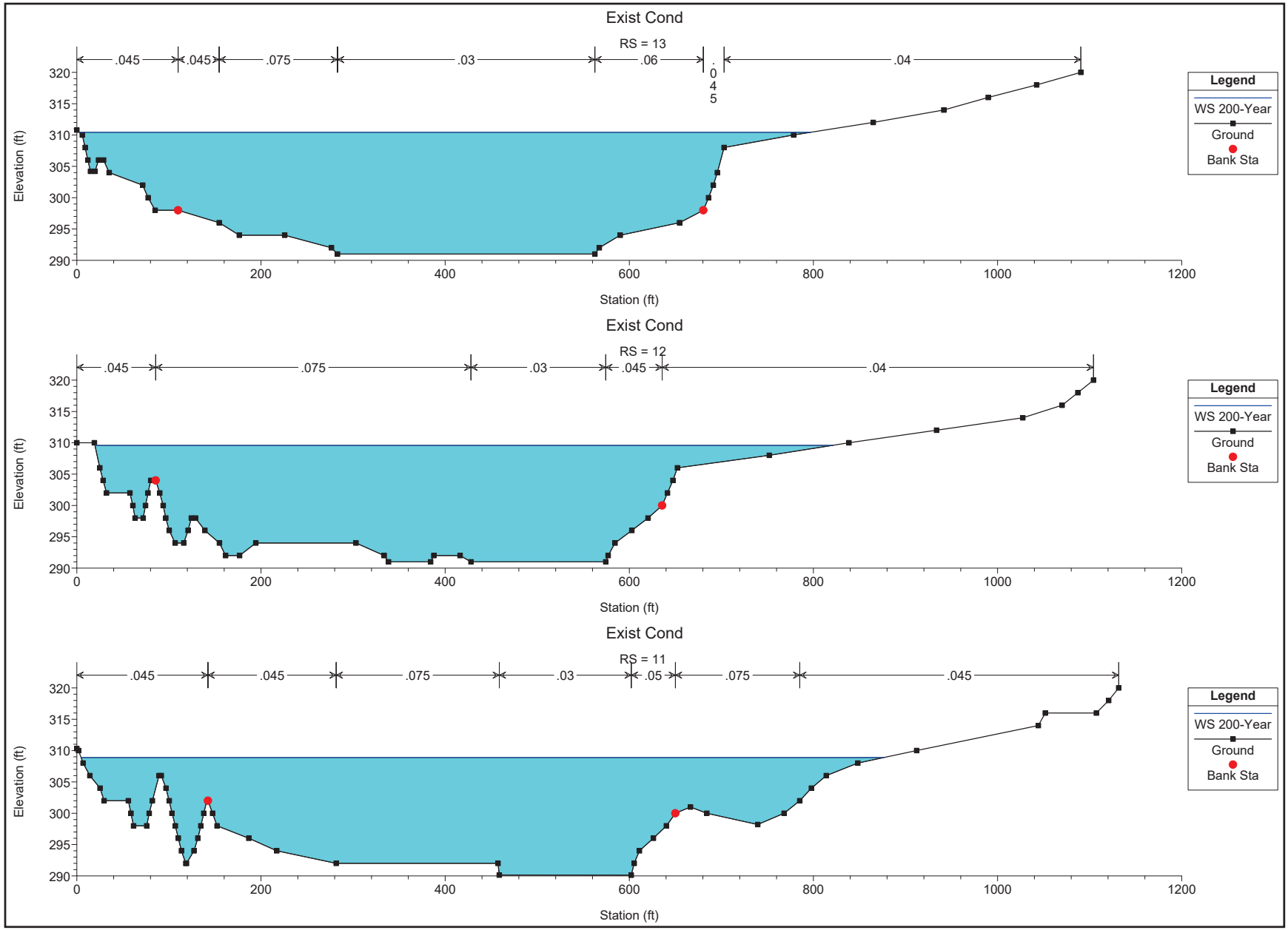
HEC-RAS Plan: Exist Cond River: RIVER-1 Reach: Reach-1 Profile: 200-Year

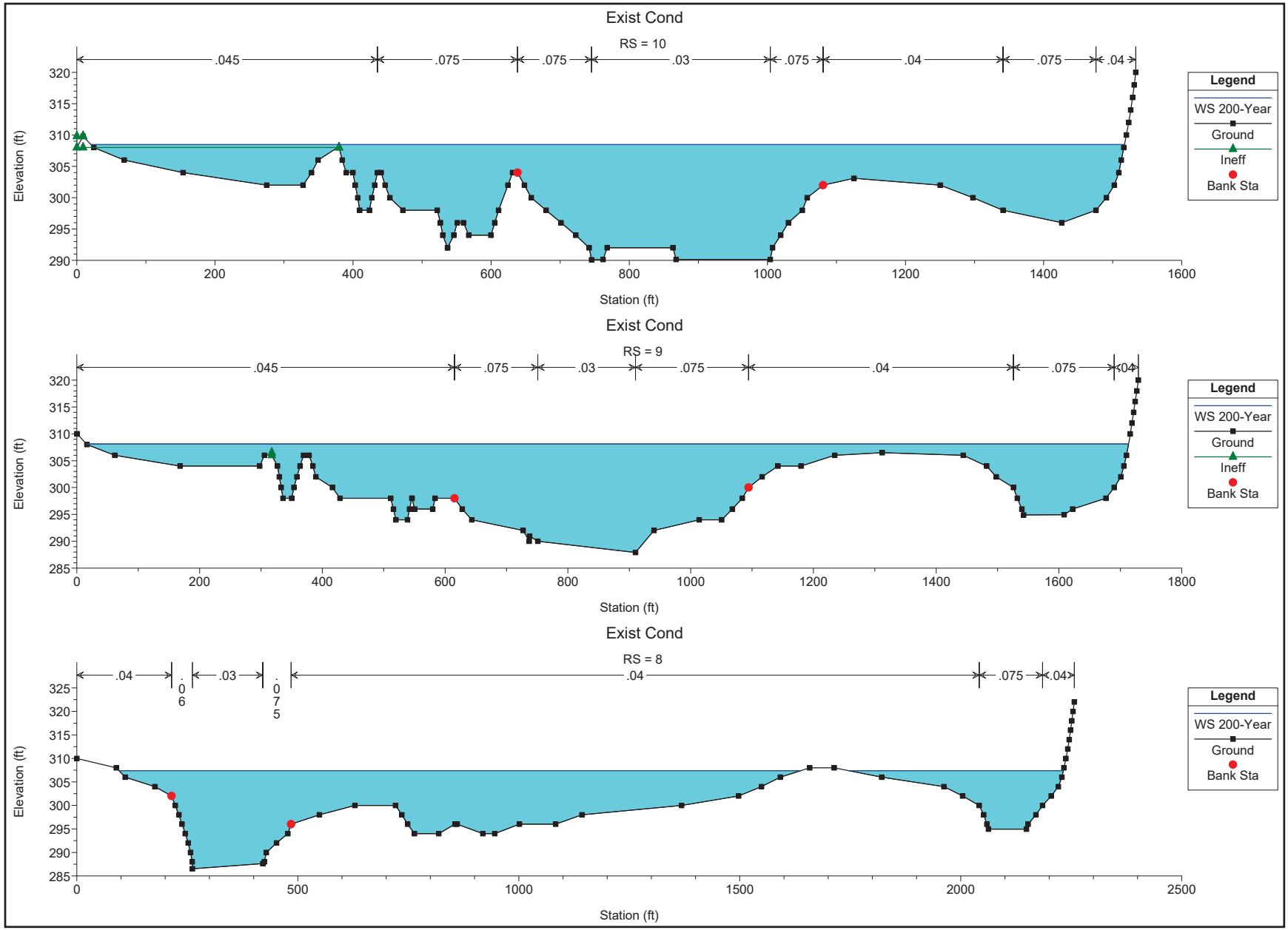
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	22	200-Year	95000.00	291.01	316.18		317.80	0.002409	10.38	9374.04	484.89	0.38
Reach-1	21	200-Year	95000.00	291.01	313.43		316.85	0.002689	17.74	7973.41	464.27	0.66
Reach-1	20	200-Year	95000.00	291.00	313.78		315.49	0.002934	12.06	9915.68	656.07	0.45
Reach-1	19	200-Year	95000.00	291.01	313.11		314.97	0.001095	11.43	9661.94	634.12	0.43
Reach-1	18	200-Year	95000.00	291.00	312.25	306.18	314.55	0.001459	13.42	9530.03	662.63	0.51
Reach-1	17	200-Year	95000.00	291.01	312.13	305.26	313.87	0.001999	11.16	9580.89	667.06	0.44
Reach-1	16	200-Year	95000.00	291.01	311.87		313.02	0.002565	8.83	11203.45	816.71	0.37
Reach-1	15	200-Year	95000.00	291.00	311.19	303.09	312.32	0.002073	8.66	11570.14	855.85	0.37
Reach-1	14	200-Year	95000.00	291.01	310.84		311.95	0.000814	8.64	11941.46	839.16	0.35
Reach-1	13	200-Year	95000.00	291.00	310.43		311.64	0.001189	9.01	11167.63	794.42	0.38
Reach-1	12	200-Year	95000.00	291.01	309.60		311.11	0.002577	10.02	9960.06	801.63	0.44
Reach-1	11	200-Year	95000.00	290.12	308.88		310.22	0.003003	9.75	10837.14	871.89	0.43
Reach-1	10	200-Year	95000.00	290.10	308.48	304.23	309.56	0.001392	9.73	14355.90	1499.07	0.44
Reach-1	9	200-Year	95000.00	287.90	308.12	302.16	308.96	0.001592	8.43	14964.34	1697.86	0.37
Reach-1	8	200-Year	95000.00	286.50	307.39		307.88	0.001106	6.89	17891.57	2028.32	0.29
Reach-1	7	200-Year	95000.00	286.50	307.47		307.57	0.000191	2.00	38388.85	2756.68	0.09
Reach-1	6	200-Year	95000.00	287.61	307.43		307.50	0.000119	2.10	44283.95	3028.92	0.09
Reach-1	5	200-Year	95000.00	287.61	307.40		307.47	0.000113	2.40	46011.38	3258.41	0.10
Reach-1	4	200-Year	95000.00	287.61	307.34		307.43	0.000119	2.70	40300.45	2906.28	0.11
Reach-1	3	200-Year	95000.00	287.60	307.30		307.38	0.000197	2.63	40102.77	3396.53	0.11
Reach-1	2	200-Year	95000.00	287.60	307.19		307.31	0.000237	3.79	36273.89	3376.12	0.16
Reach-1	1	200-Year	95000.00	286.77	307.17	295.72	307.24	0.000119	3.06	45581.13	3585.52	0.12

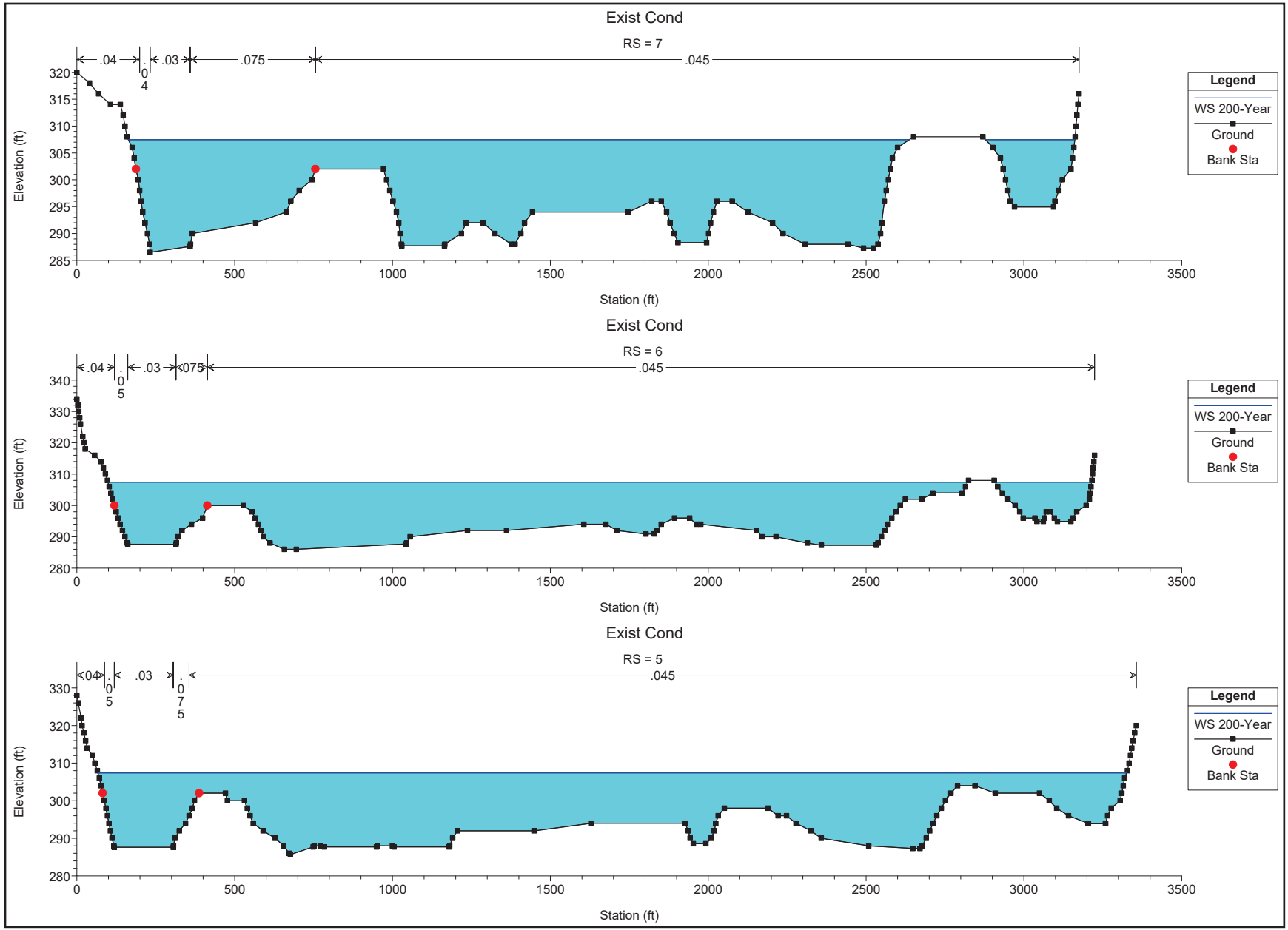

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Station (ft)
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Ground
Bank Sta
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0.06
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Station (ft)
Legend
WS 200-Year
Ground
Bank Sta
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0.075
.03
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Fill from
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Station (ft)
Legend
WS 200-Year
Ground
Ineff
Bank Sta

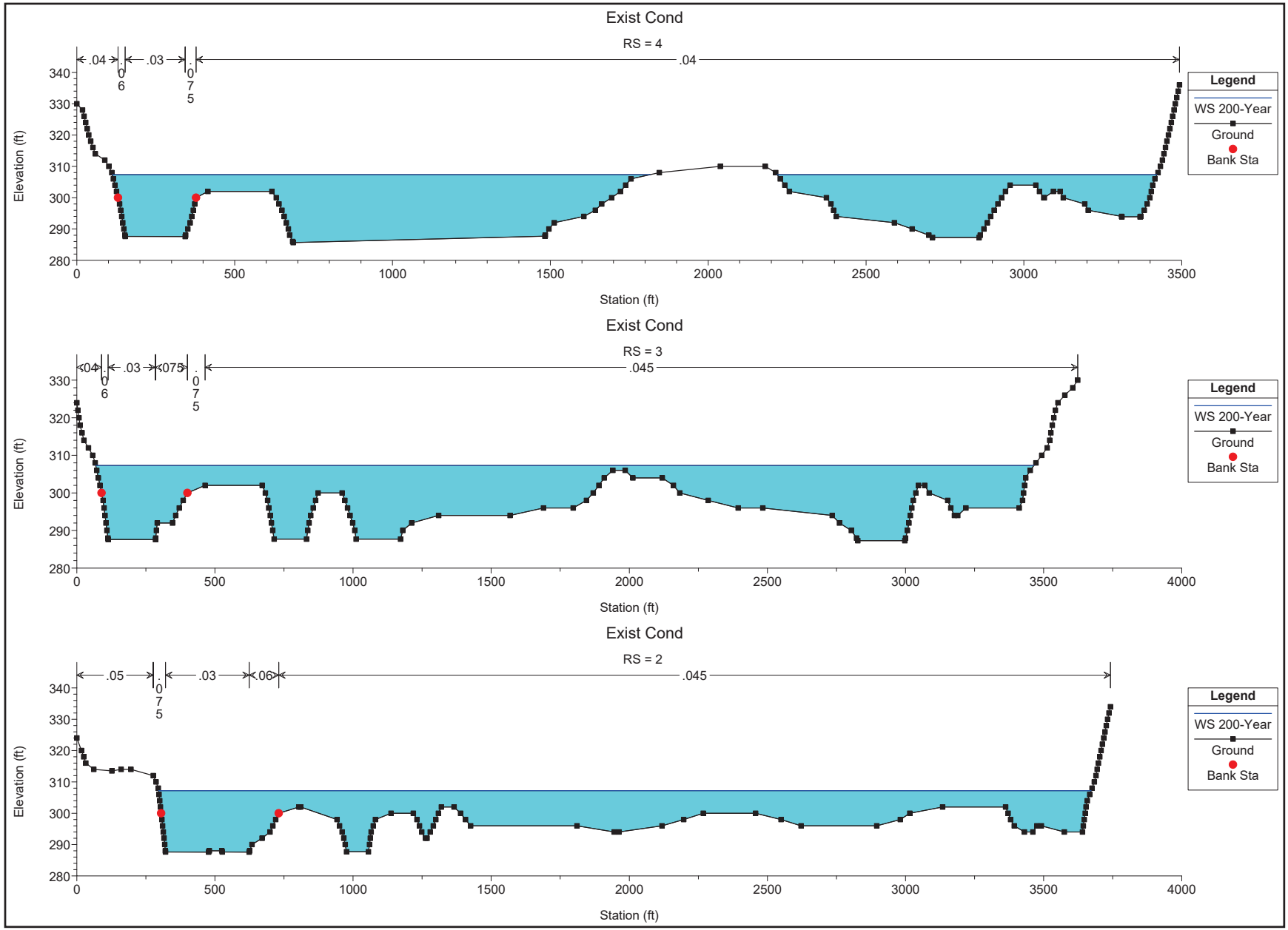

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Ground
Ineff
Bank Sta
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Elevation (ft)
Station (ft)
Legend
WS 200-Year
Ground
Ineff
Bank Sta
Exist Cond
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Elevation (ft)
Station (ft)
Legend
WS 200-Year
Ground
Ineff
Bank Sta

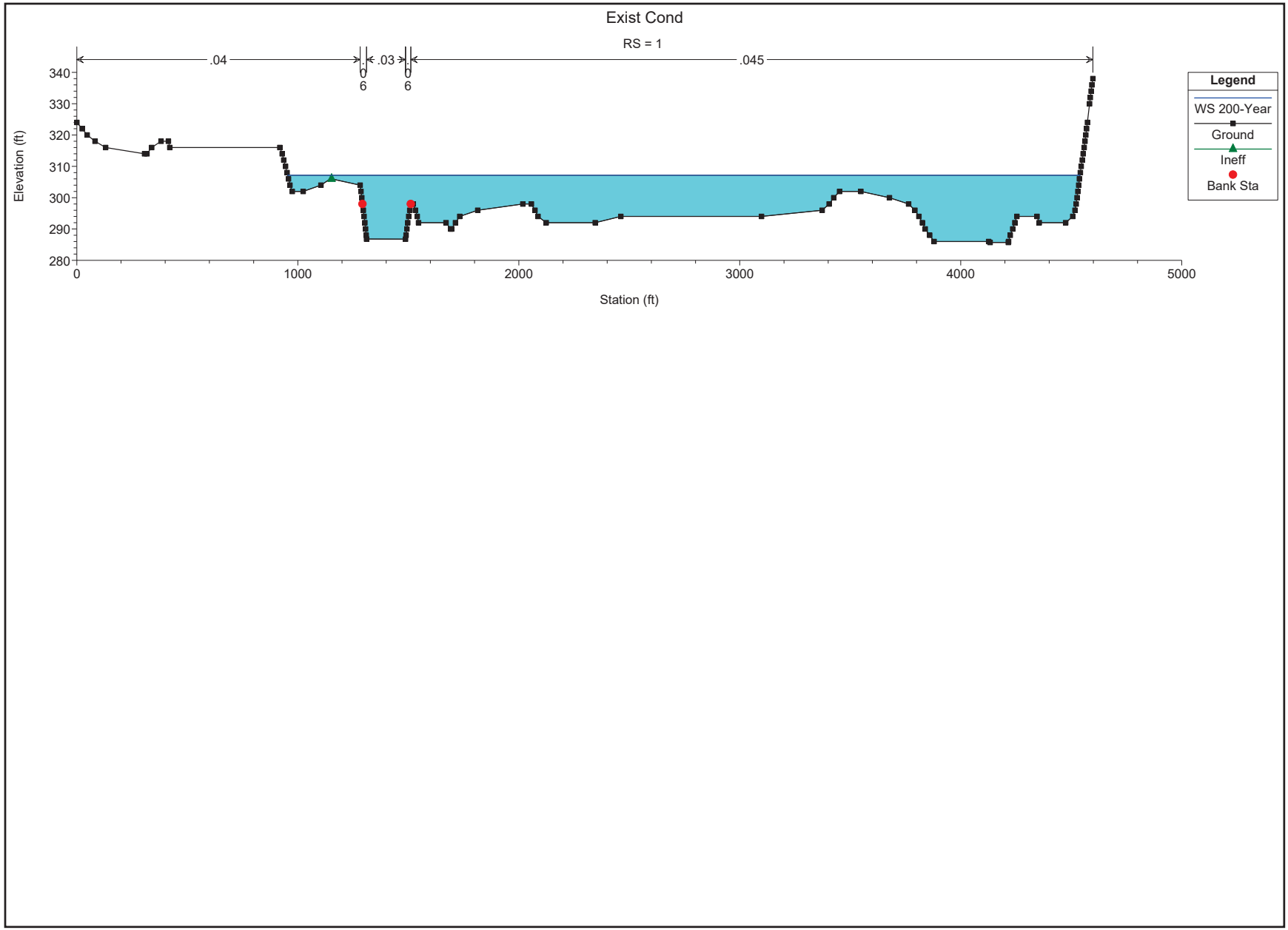

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Station (ft)
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Bank Sta
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Station (ft)


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Ground
Bank Sta
Elevation (ft)
Station (ft)


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800
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Station (ft)
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WS 200-Year
Ground
Ineff
Bank Sta
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Elevation (ft)
Station (ft)
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WS 200-Year
Ground
Bank Sta


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WS 200-Year
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Bank Sta
Elevation (ft)
Station (ft)


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300
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2000
3000
4000
5000
Station (ft)
Legend
WS 200-Year
Ground
Ineff
Bank Sta

MAP POCKET

GRAPHIC SCALE

200 0 100 200 400

1 INCH = 200 FEET

LEGEND:

PERMIT BOUNDARY

HEC–RAS CROSS–SECTION

LIMIT OF COMPACTED FILL PLACED ON BERM IN 2026

QUARRY SITE

HEC–RAS WORK MAP