

Hydrology and Hydraulics Report

Perham Salmon Stream Bridge #2739

WIN 023128.00

WIN:	23128.00
Town:	Perham
Route No.:	ME128
Asset ID:	2739
Lat:	46.8459
Long:	-68.1955

Project Name:	
Stream Name:	Salmon Stream
Bridge Name:	Salmon Stream Bridge
Analysis by:	csh
Date:	6/2/2020

Peak Flow Calculations by USGS Regression Equations (Hodgkins, 1999 & Lombard/Hodgkins, 2015)

Enter data in blue cells only!

	km ²	mi ²	ac
A	36.78	14.20	9088.0
W	4.24	1.6	1047.8

Enter data in [mi²]

Watershed Area *DRNAREA*
Wetlands area (by NWI)

P _c	558849	49585192833
County	Aroostook C	

watershed centroid (E, N; UTM 19N; meters)
choose county from drop-down menu
mean annual precipitation (inches; by look-up)

A (km ²)	36.78	Conf Lvl	0.67
W (%)	11.53		

NWI Wetlands % *STORNWI*

References:

Hodgkins, G.A., 1999.
Estimating the magnitude of peak flows for streams
in Maine for selected recurrence intervals
WRIR 99-4008, USGS Augusta, ME

ver. 2020 Feb 07

Worksheet prepared by:

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Environmental Office
Maine Dept. Transportation
Augusta, ME 04333-0016
207-557-1052
Charles.Hebson@maine.gov

Watershed Characteristics for Monthly & Daily Flows

EAVG	767.9
SLOPE	5.8
EMAX	995
WATER	0.58
PRECIP	38.1
SG	0.00
HGA	0
DIST	177.00

mean basin elevation (ft)
mean basin slope (%)
maximum basin elevation (ft)
percent of drainage basin land cover classified as open water
mean annual precipitation
sand & gravel aquifer as decimal fraction of watershed A
mean basin percentage of hydrological soil group A
distance from the coast (mi)

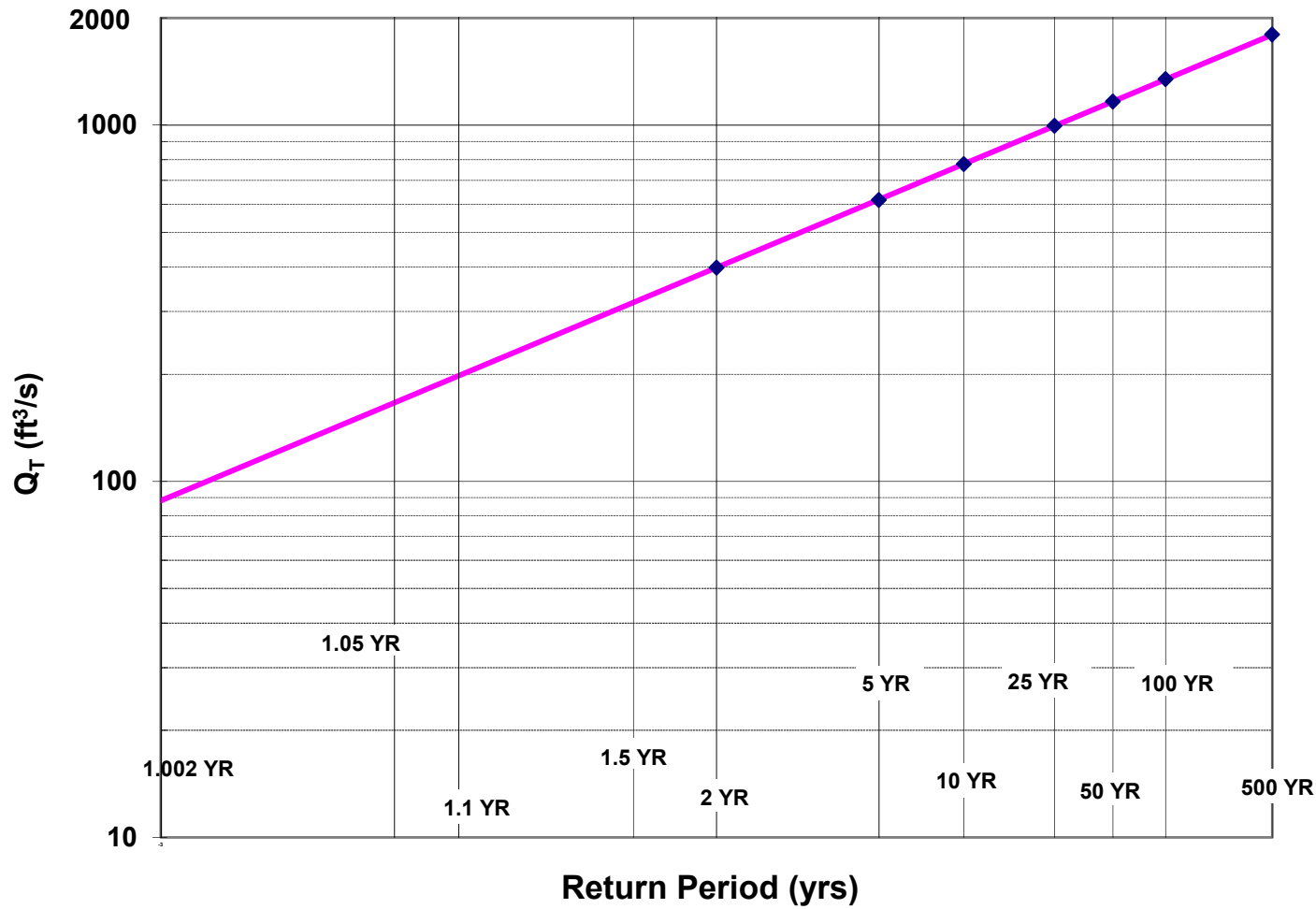
Ret Pd	Peak Flow Estimate		
	T (yr)	Lower	Upper
1.1		5.61	
2		11.28	
5		17.47	
10		22.04	
25		28.18	
50		32.99	
100		38.16	
500		50.89	

Q _T (ft ³ /s)	
198.0	200
398.3	400
616.7	615
778.1	780
995.1	995
1165.0	1165
1347.5	1350
1796.9	1800

Lombard, P.J. & G.A. Hodgkins, 2015.
Peak flow regression equations for small, ungaged streams in
Maine - Comparing map-based to field-based variables
SIR 2015-4059, USGS, Augusta, ME

$$Q_T = b \times A^a \times 10^{-WW}$$

Log-Normal Probability Plot



WIN:	23128.00
Town:	Perham
Route No.:	ME128
Asset ID:	2739
Lat:	46.84590
Long:	-68.19553

Project Name:	0
Stream Name:	Salmon Stream
Bridge Name:	Salmon Stream Bridge
Analysis by:	csh
Date:	6/2/2020

DO NOT ENTER ANY DATA ON THIS PAGE; EVERYTHING IS CALCULATED

MAINE MONTHLY MEDIAN FLOWS and HYDRAULIC GEOMETRY BY USGS REGRESSION EQUATIONS (2004, 2013, 2015)

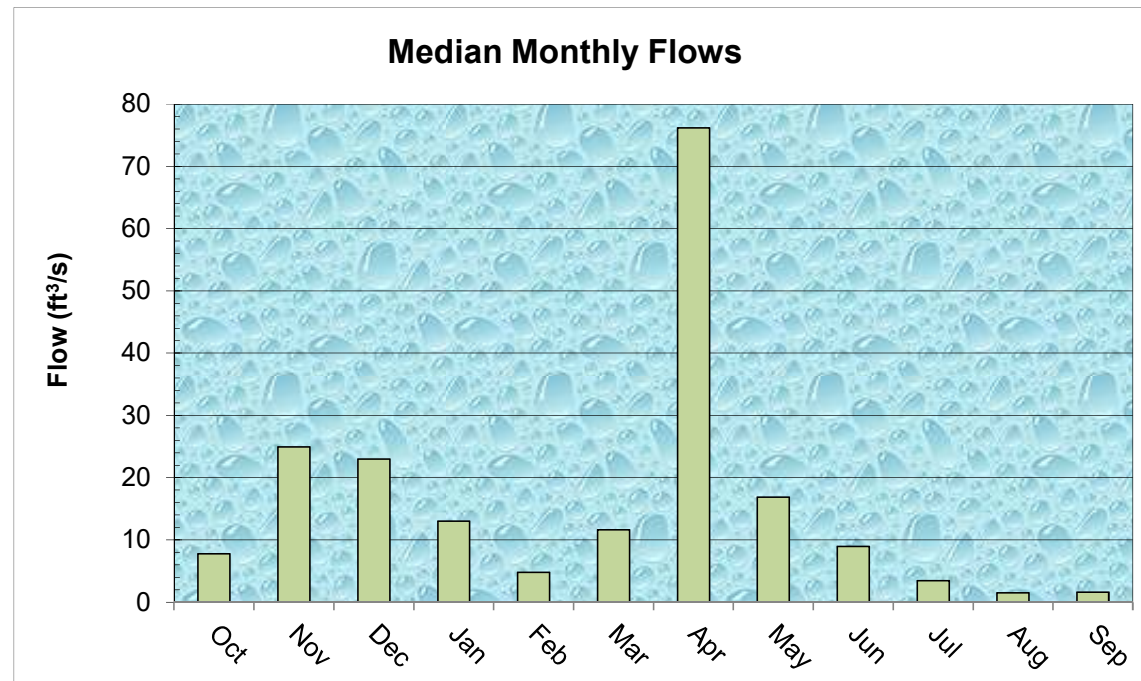
Value	Variable	Explanation
14.20	A	Area (mi ²)
558849.3	P _c	Watershed centroid (E,N; UTM; Zone 19; meters)
177.00	DIST	Distance from Coastal reference line (mi)
38.1	pptA	Mean Annual Precipitation (inches)
0.00	SG	Sand & Gravel Aquifer (decimal fraction of watershed area)

Month	Q _{median} (ft ³ /s)	(m ³ /s)
Jan	13.04	0.3696
Feb	4.83	0.1369
Mar	11.63	0.3296
Apr	76.22	2.1601
May	16.89	0.4787
Jun	8.96	0.2538
Jul	3.48	0.0985
Aug	1.54	0.0437
Sep	1.61	0.0455
Oct	7.81	0.2214
Nov	24.94	0.7067
Dec	23.01	0.6520

Q _{bf}	84.2
ann avg	31.6
ann med	13.5
Q _{1.002}	88.2
Q _{1.01}	117.6
Q _{1.05}	166.2
Q _{bf}	193.9

assume v = 4ft/s

W _{bf}	33.1	estimated bankfull width (ft)
d _{bf}	1.5	estimated bankfull depth (ft)
A _{bf}	44.6	estimated bankfull flow area (ft ²)



References

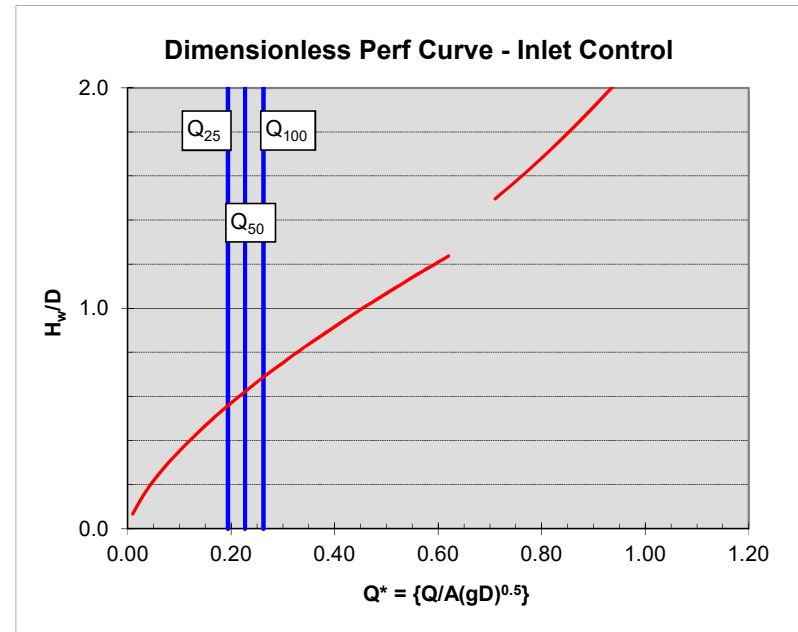
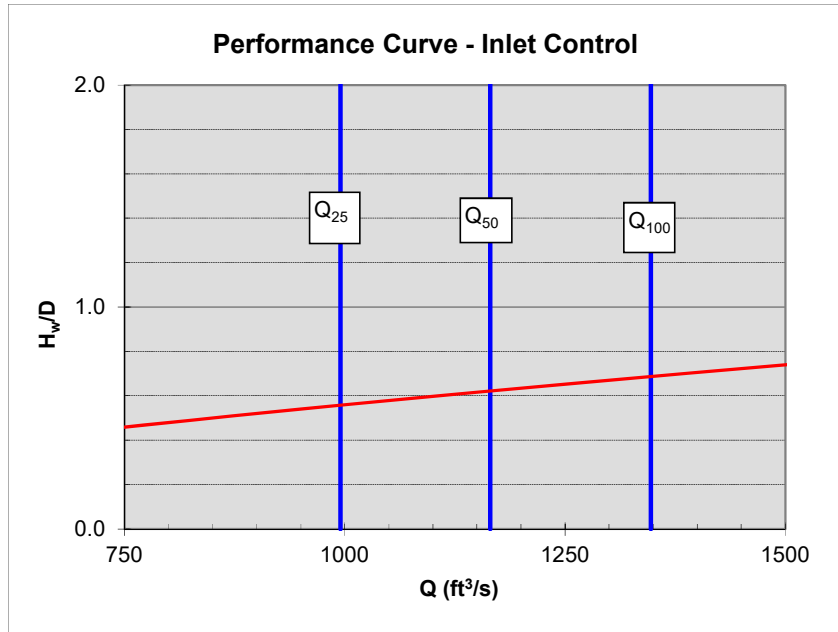
- Dudley, 2013. FY2013 Progress Report - Phase 1 ..., USFWS QRP Project
- Dudley, 2004. Estimating Monthly Streamflows ..., SIR 2004-5026
- Dudley, 2015. Regression Equations for Monthly & Annual Mean..., USGS SIR 2015-5151

NOTE: This page is for preliminary sizing only.
Final design should be done with HY8 or HDS-5

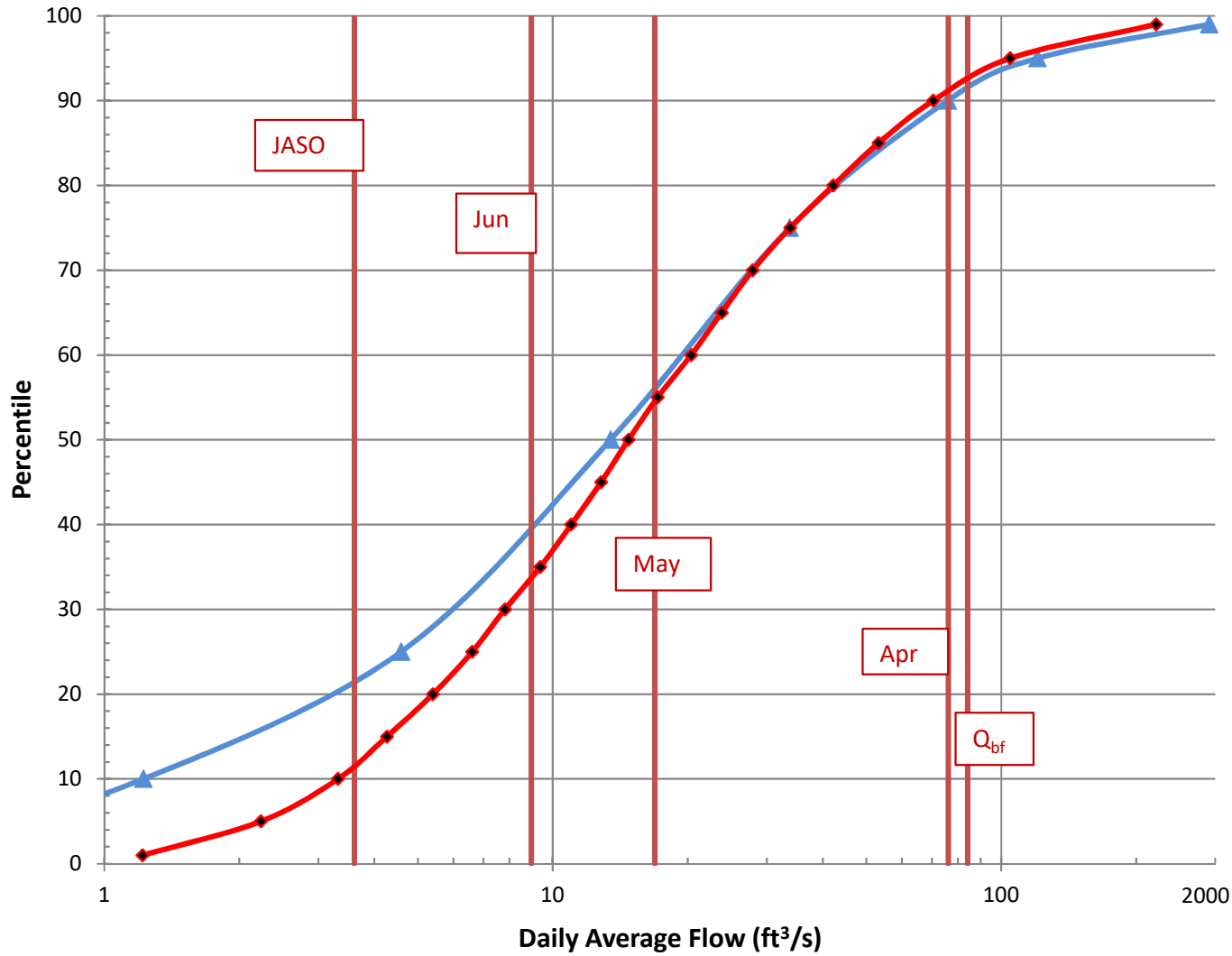
Preliminary Culvert Sizing - Round & Box Culverts

Shape:	Box			
Type:	Box 0 ww	Q ₂₅	995.1	
D or R (ft)	8	Q ₅₀	1165.0	trial D / R = 13.9
w (ft)	40 box width	Q ₁₀₀	1347.5	trial w: BFW = 33.1
Slope (ft/ft)	0.02			
A (ft ²)	320.00			
g (ft/s ²)	32.2			

Note:
culvert dimensions are for open flow area; adjust for lost capacity due to embedding / backfilling (min {2' / 25% rise} embedment)



Daily Average Flow Distribution



Daily Avg Flow Dist

$A_{ws} = (mi^2)$ 14.2

Q (ft³/s)

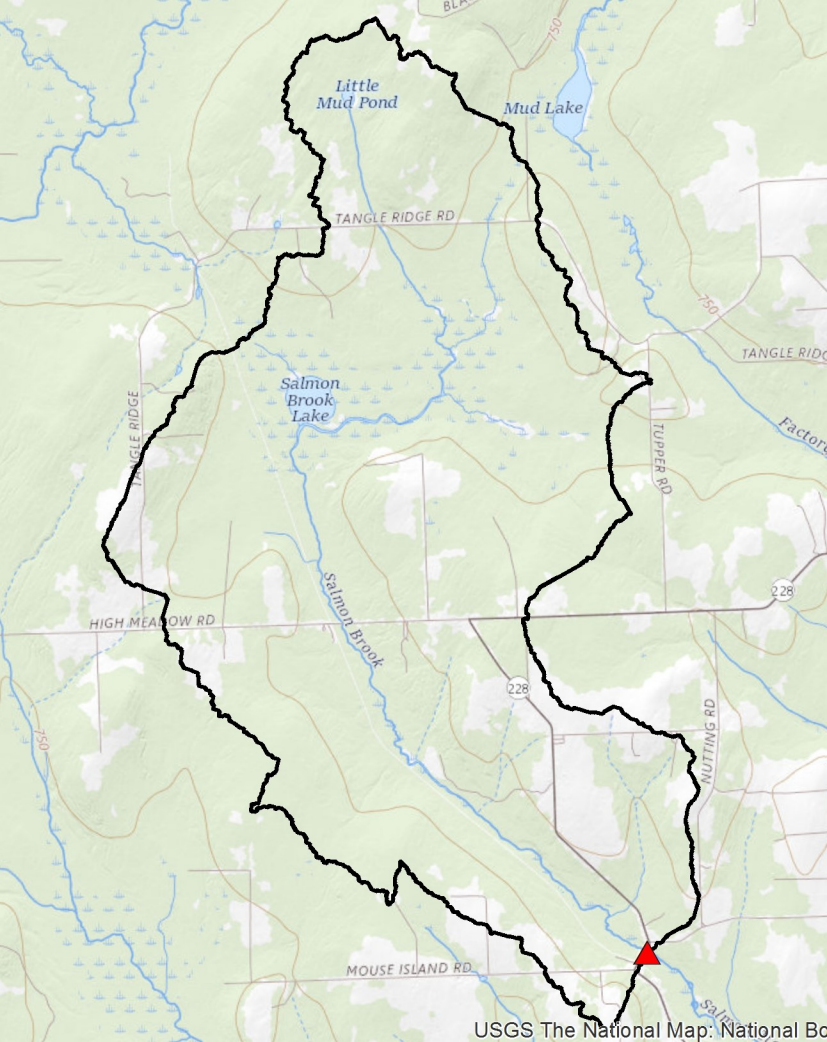
Pctl	Median	84 th pctl
1	1.22	2.16
5	2.24	3.60
10	3.32	4.99
15	4.27	6.23
20	5.40	7.56
25	6.61	8.86
30	7.82	10.09
35	9.37	11.53
40	10.99	13.26
45	12.81	15.00
50	14.75	17.71
55	17.13	20.61
60	20.34	24.19
65	23.80	28.18
70	27.92	32.88
75	33.84	39.54
80	42.21	47.21
85	53.25	60.50
90	70.54	81.24
95	104.69	126.33
99	221.39	291.47

Q_{bf} 84.2

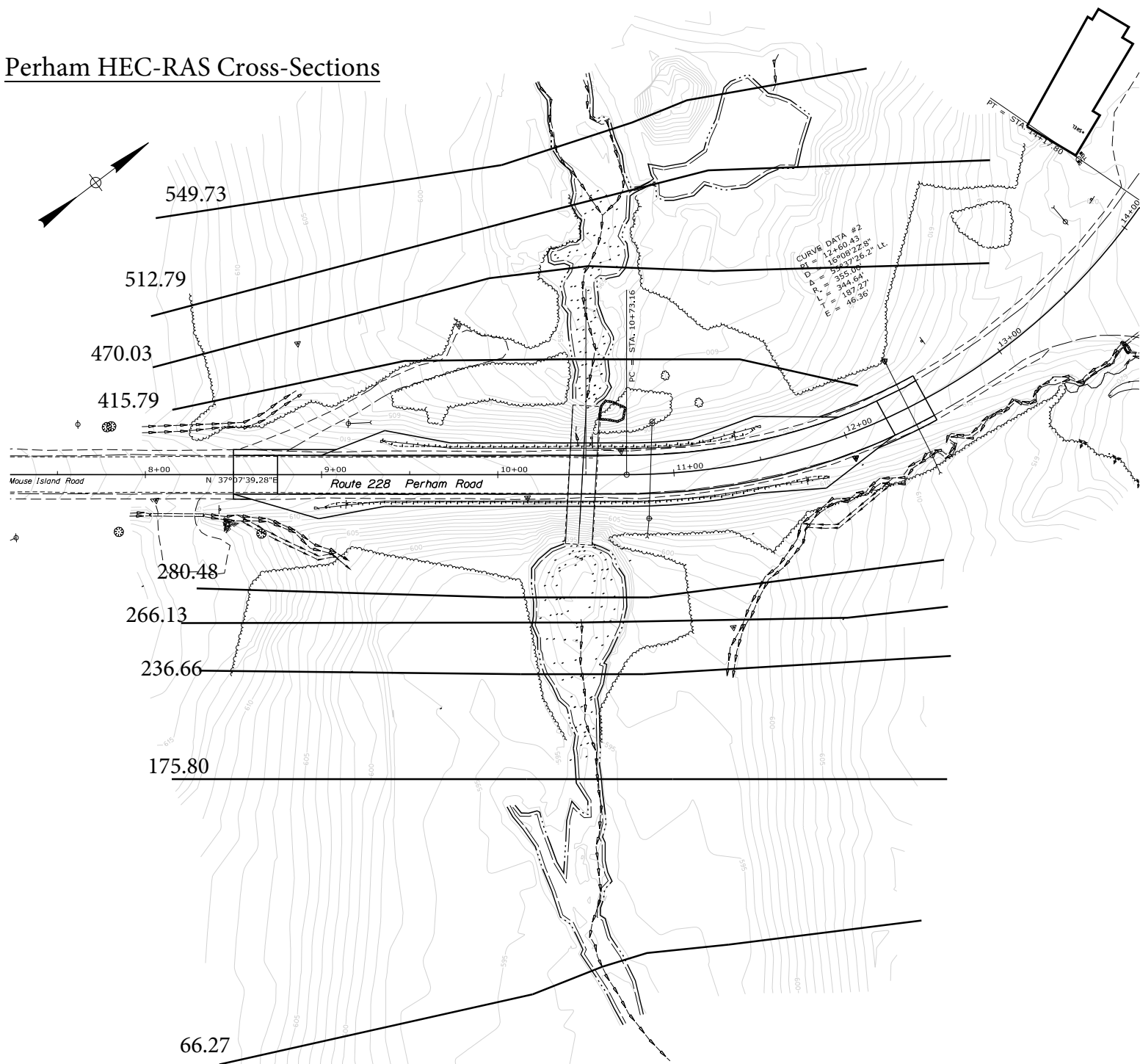
Q_{1.002} 88.2

Q_{1.1} 198.0

Q₂ 398.3

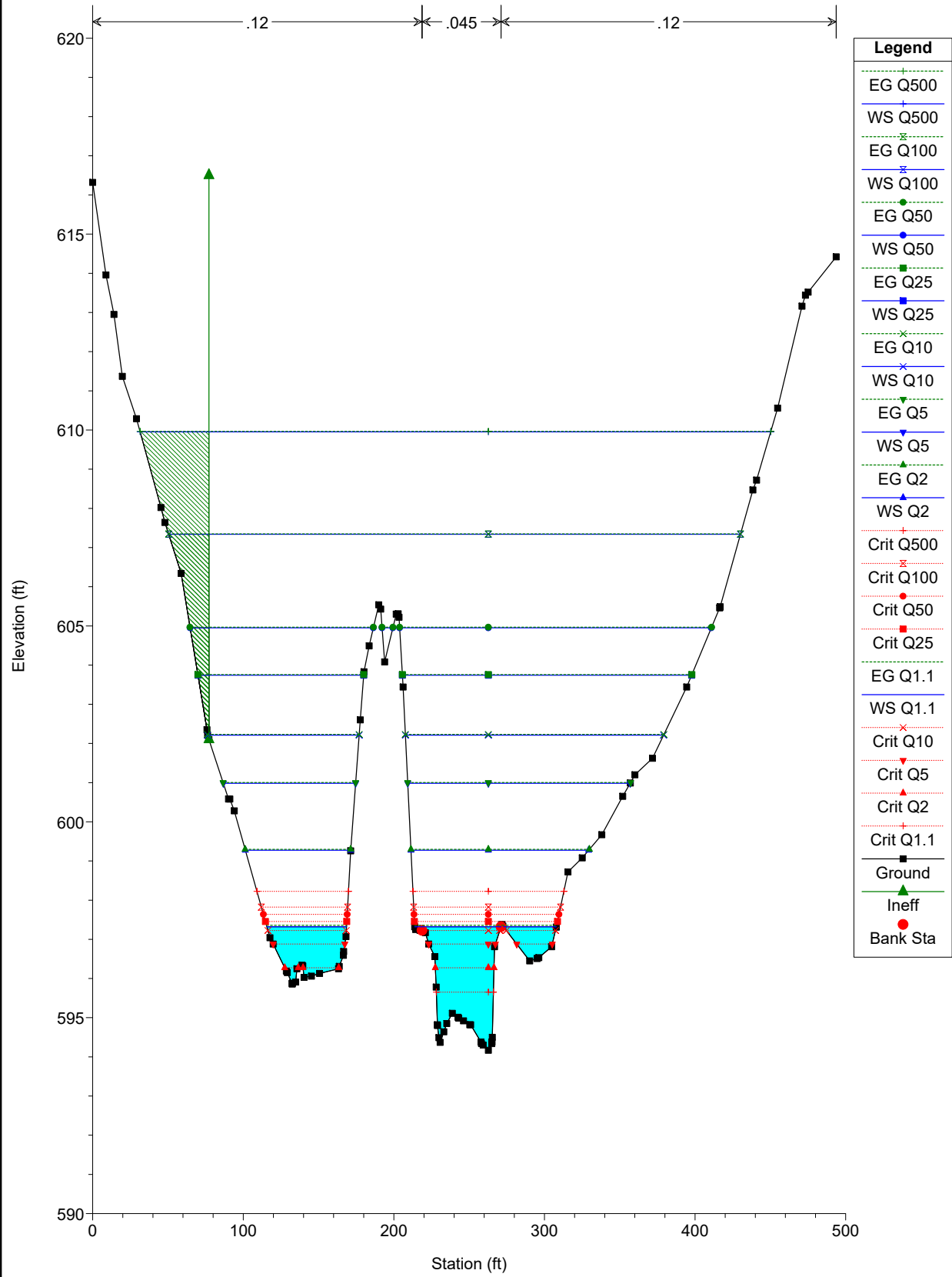


Perham HEC-RAS Cross-Sections

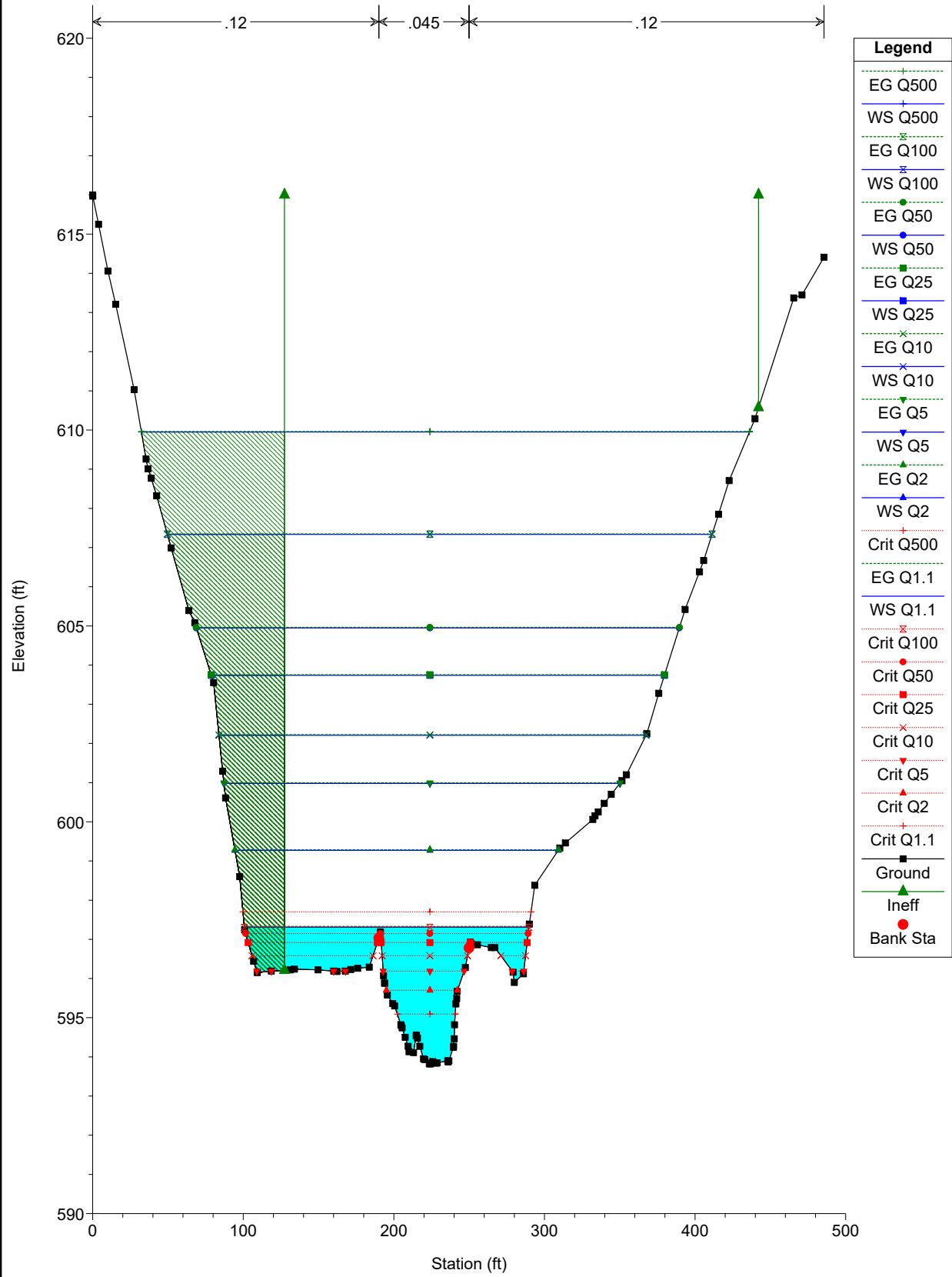


Existing Bridge

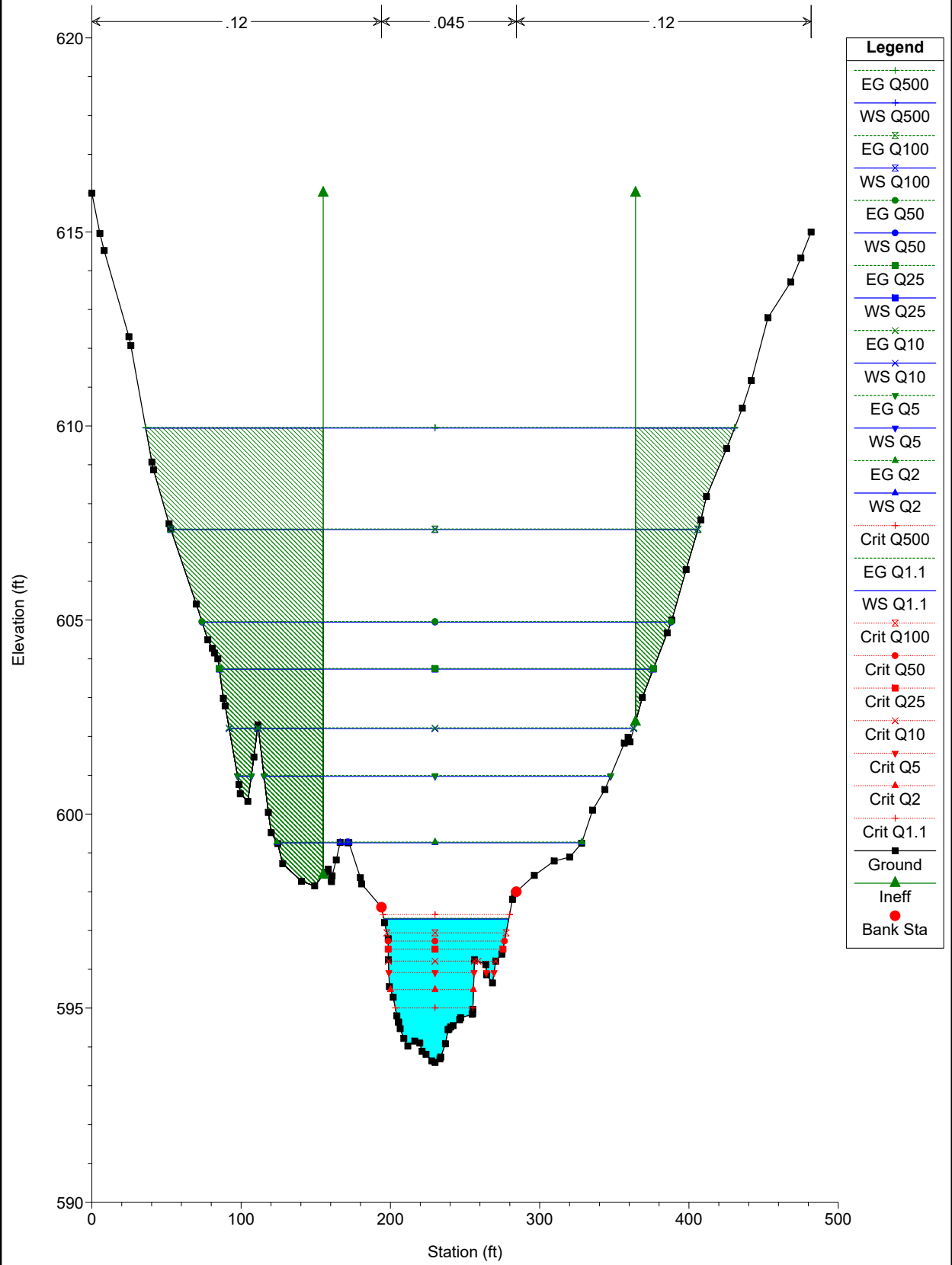
Perham Existing Plan: PerhamExisting3 2/8/2022



Perham Existing Plan: PerhamExisting3 2/8/2022

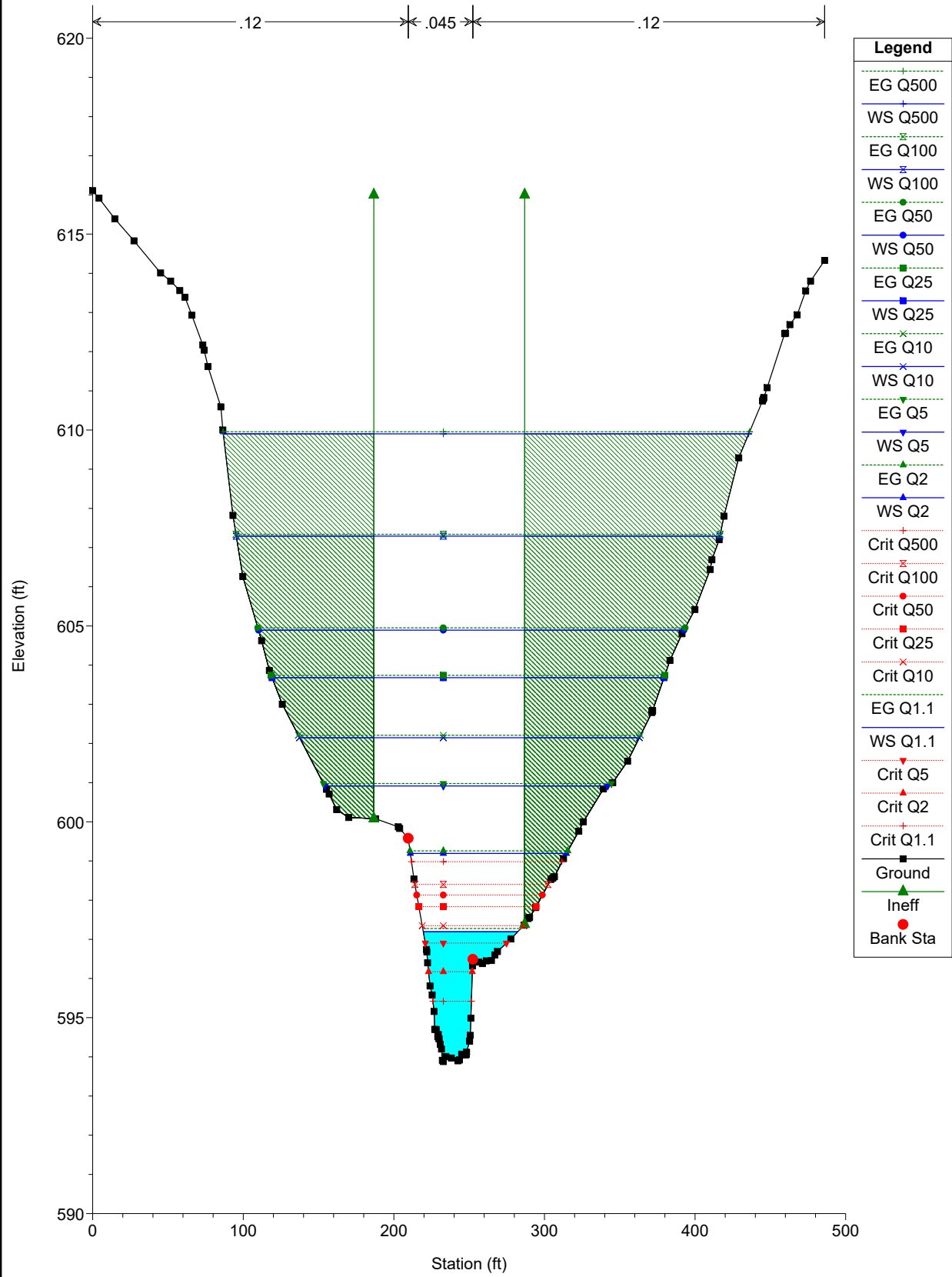


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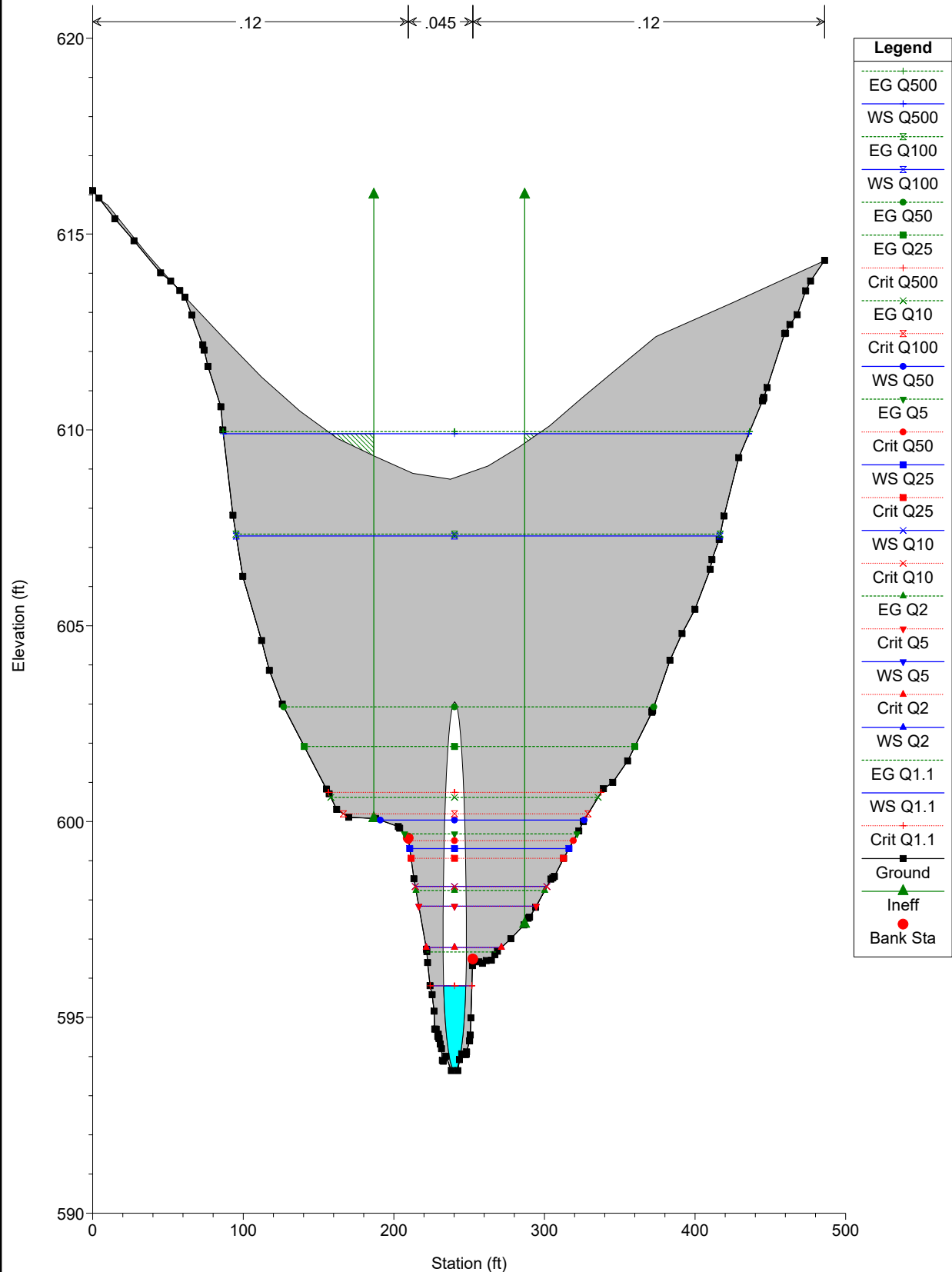


Legend	
EG Q500	+
WS Q500	—
EG Q100	x
WS Q100	—
EG Q50	•
WS Q50	—
EG Q25	■
WS Q25	—
EG Q10	x
WS Q10	—
EG Q5	▼
WS Q5	—
EG Q2	▲
WS Q2	—
Crit Q500	+
EG Q1.1	—
WS Q1.1	—
Crit Q100	x
Crit Q50	•
Crit Q25	■
Crit Q10	x
Crit Q5	▼
Crit Q2	▲
Crit Q1.1	+
Ground	■
Ineff	▲
Bank Sta	•

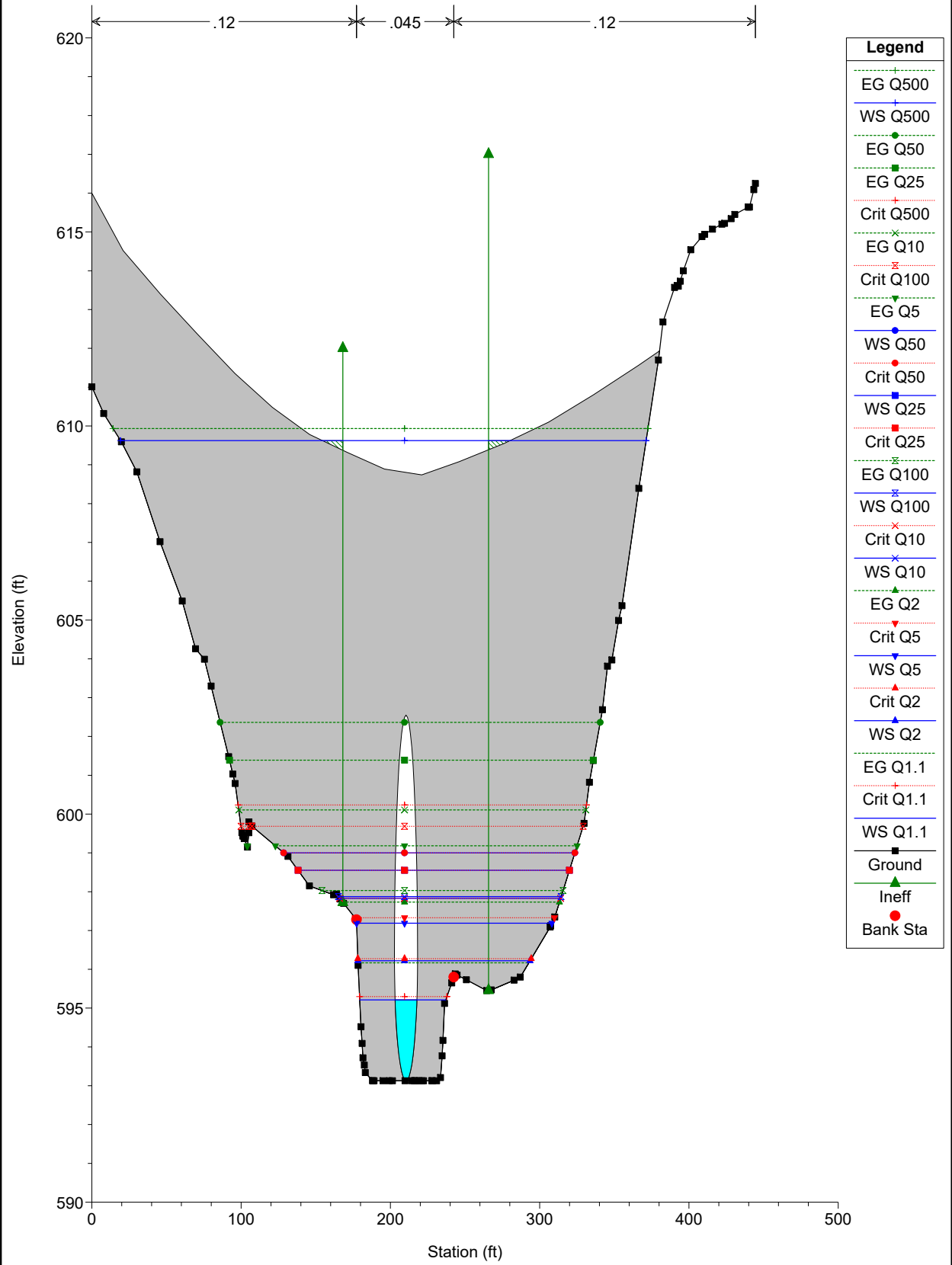
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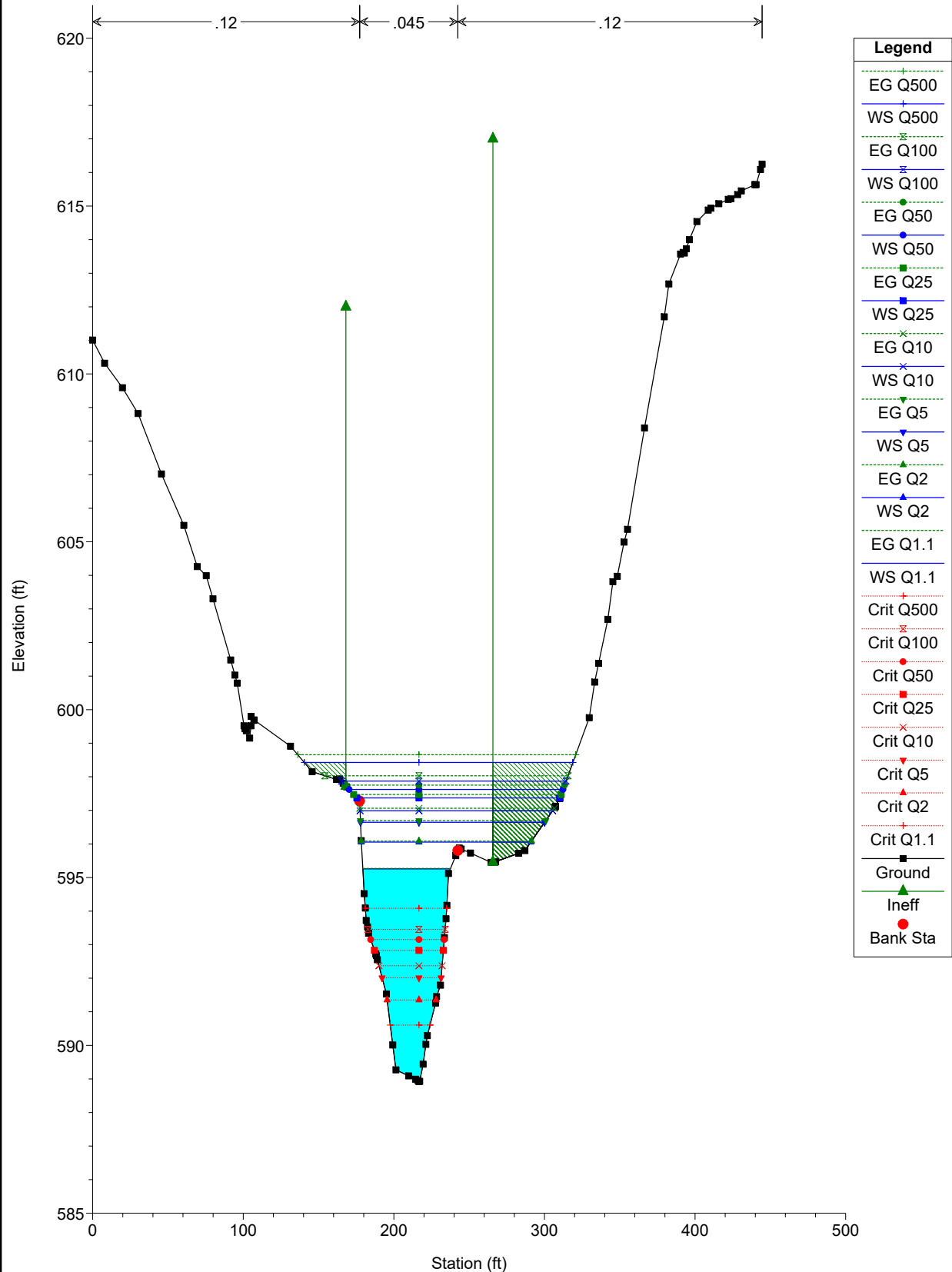
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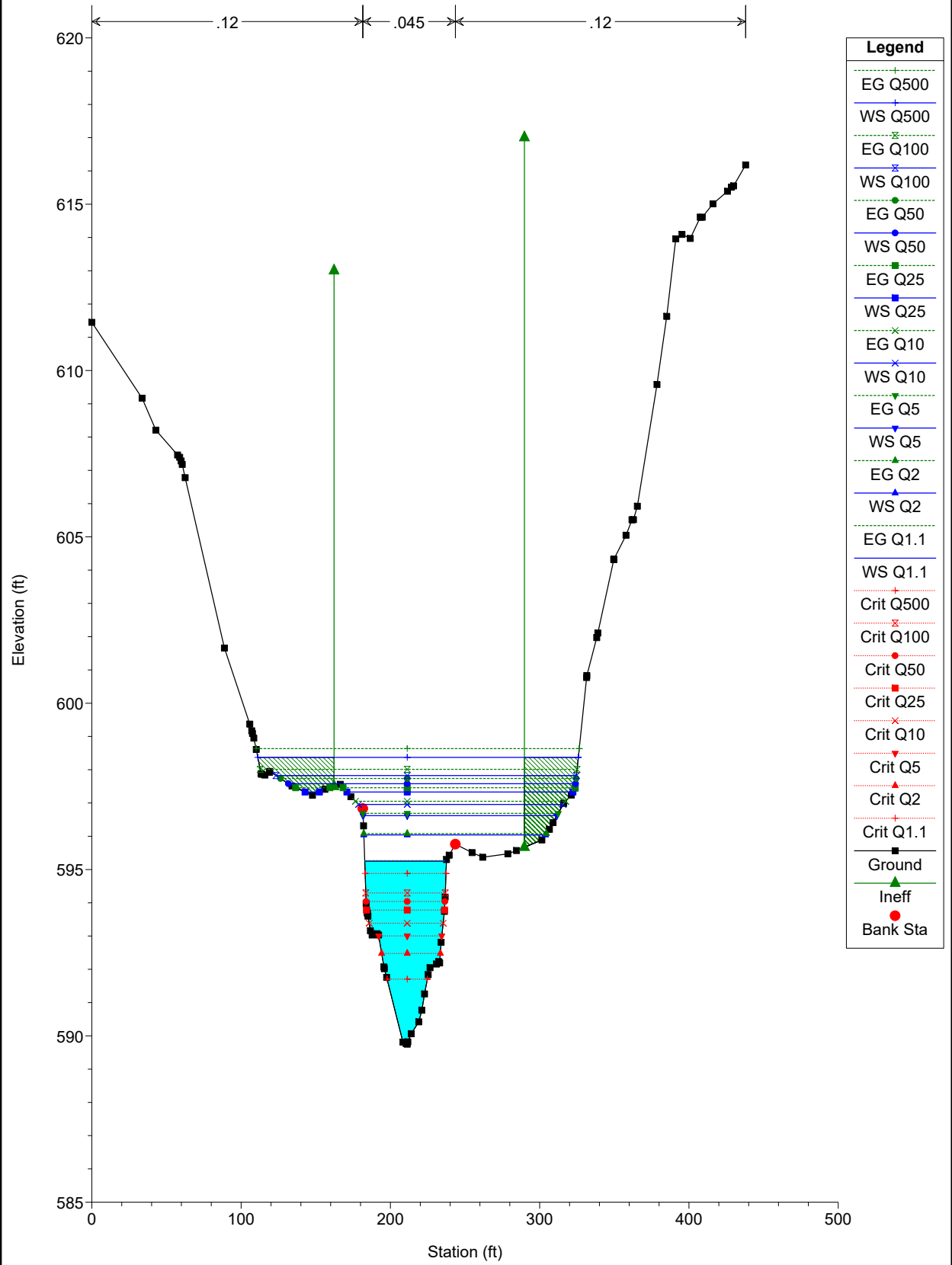
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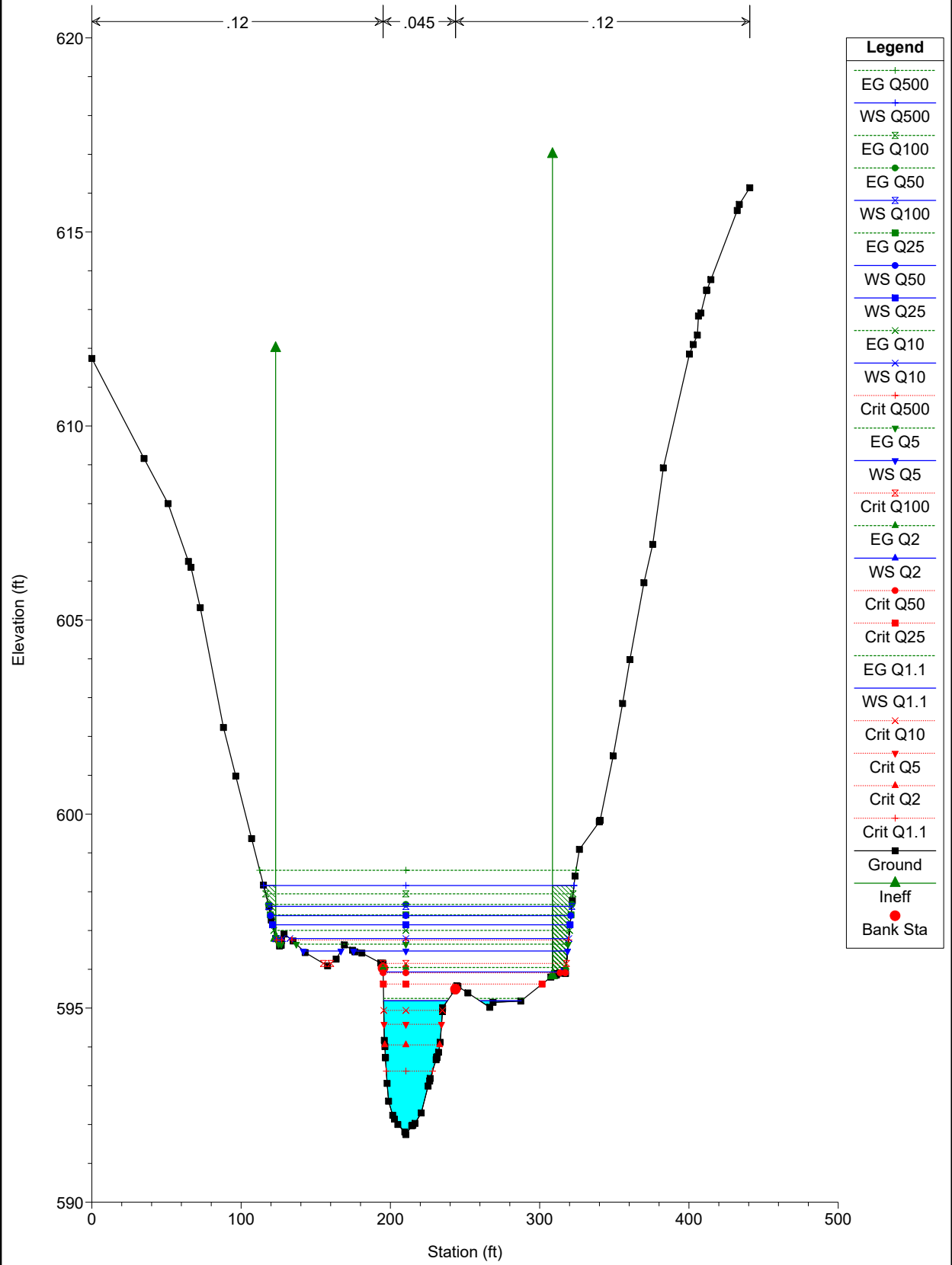
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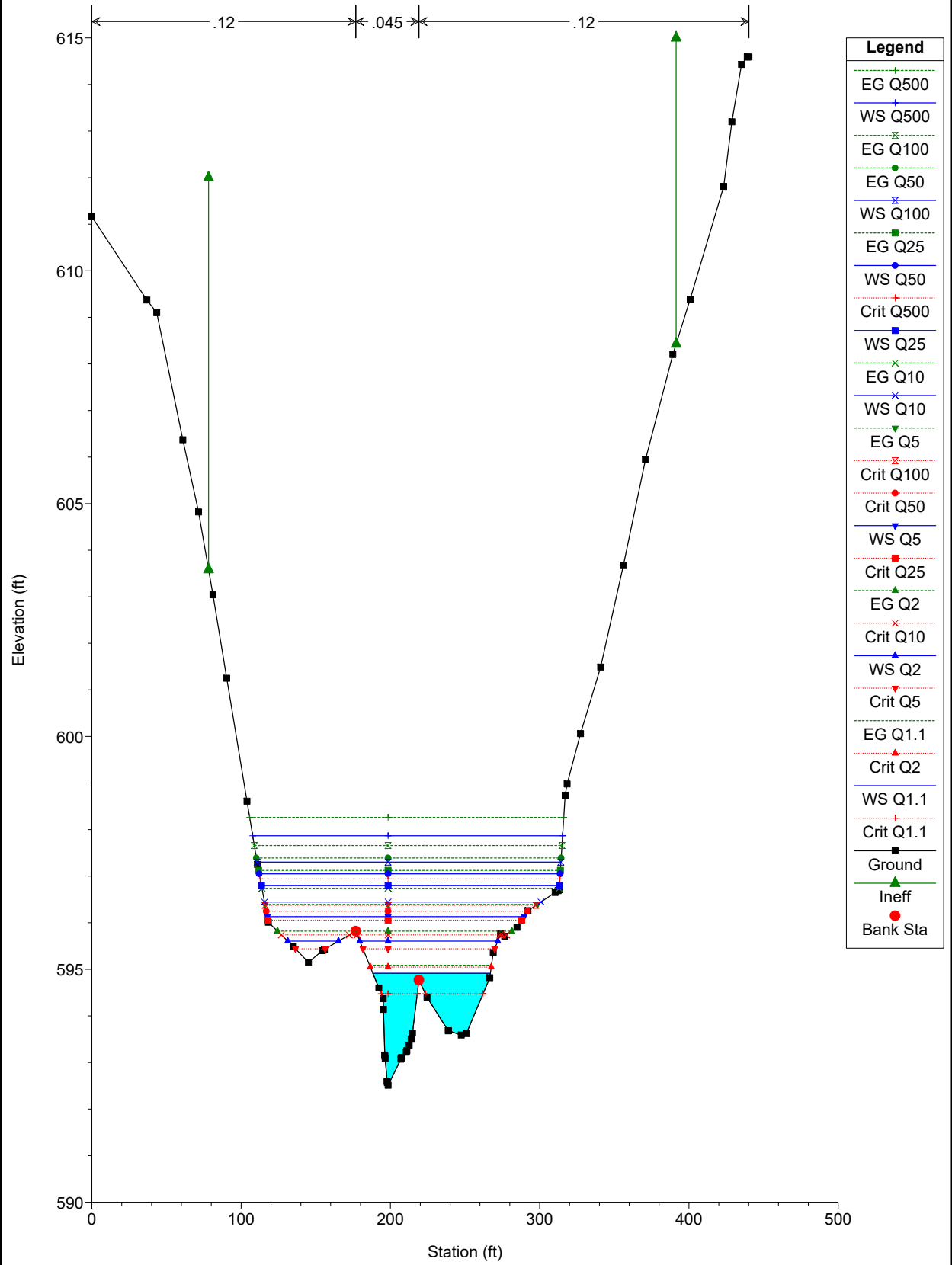
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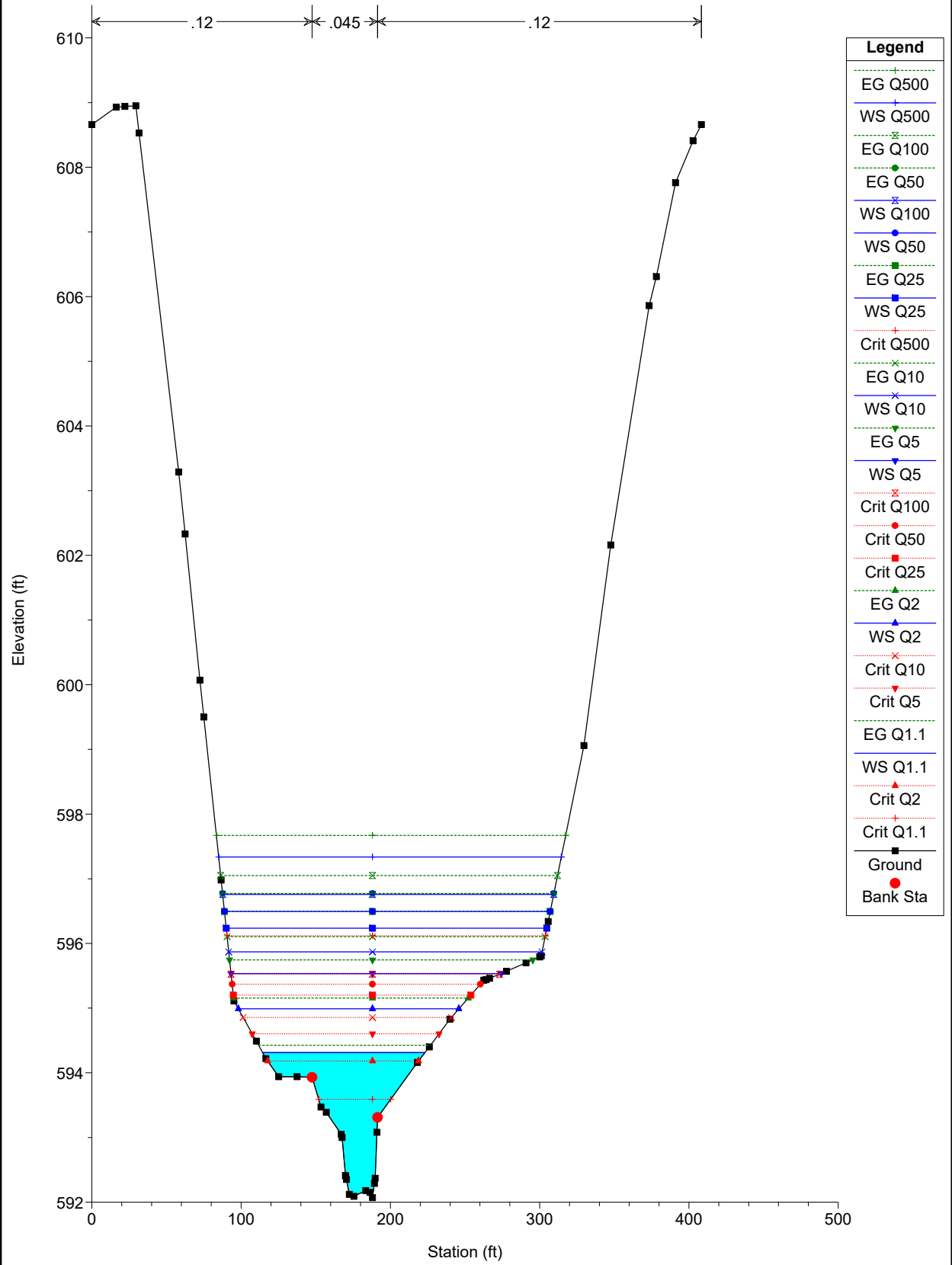
Perham Existing Plan: PerhamExisting3 2/8/2022



Perham Existing Plan: PerhamExisting3 2/8/2022



Perham Existing Plan: PerhamExisting3 2/8/2022



Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach	549.7325	Q1.1	198.00	594.17	597.32	595.65	597.36	0.001015	1.63	177.92	145.41	0.20
Reach	549.7325	Q2	398.30	594.17	599.27	596.27	599.30	0.000308	1.41	497.48	187.89	0.12
Reach	549.7325	Q5	616.70	594.17	600.98	596.88	601.00	0.000187	1.40	860.36	235.53	0.10
Reach	549.7325	Q10	778.10	594.17	602.21	597.23	602.23	0.000138	1.37	1173.40	272.11	0.09
Reach	549.7325	Q25	995.10	594.17	603.74	597.46	603.76	0.000099	1.33	1606.69	302.08	0.08
Reach	549.7325	Q50	1165.00	594.17	604.95	597.64	604.97	0.000080	1.30	1979.23	335.81	0.07
Reach	549.7325	Q100	1347.50	594.17	607.34	597.82	607.35	0.000043	1.11	2797.39	379.68	0.06
Reach	549.7325	Q500	1796.90	594.17	609.95	598.22	609.96	0.000034	1.12	3746.57	418.76	0.05
Reach	512.7847	Q1.1	198.00	593.82	597.31	595.09	597.33	0.000373	1.17	245.70	189.02	0.13
Reach	512.7847	Q2	398.30	593.82	599.27	595.70	599.29	0.000165	1.14	576.13	214.65	0.09
Reach	512.7847	Q5	616.70	593.82	600.98	596.19	601.00	0.000117	1.19	924.93	262.87	0.08
Reach	512.7847	Q10	778.10	593.82	602.21	596.58	602.22	0.000092	1.19	1209.89	283.55	0.08
Reach	512.7847	Q25	995.10	593.82	603.74	596.92	603.75	0.000072	1.20	1586.57	300.84	0.07
Reach	512.7847	Q50	1165.00	593.82	604.95	597.15	604.96	0.000061	1.19	1897.92	320.71	0.07
Reach	512.7847	Q100	1347.50	593.82	607.34	597.31	607.35	0.000036	1.06	2549.90	361.70	0.05
Reach	512.7847	Q500	1796.90	593.82	609.95	597.70	609.96	0.000031	1.12	3322.35	403.71	0.05
Reach	470.0250	Q1.1	198.00	593.60	597.30	595.00	597.31	0.000316	1.02	194.83	83.73	0.12
Reach	470.0250	Q2	398.30	593.60	599.26	595.47	599.28	0.000161	1.06	426.54	198.81	0.09
Reach	470.0250	Q5	616.70	593.60	600.97	595.91	600.99	0.000107	1.09	738.31	241.23	0.08
Reach	470.0250	Q10	778.10	593.60	602.20	596.21	602.22	0.000084	1.09	983.84	270.38	0.07
Reach	470.0250	Q25	995.10	593.60	603.73	596.52	603.75	0.000065	1.10	1304.07	290.76	0.07
Reach	470.0250	Q50	1165.00	593.60	604.95	596.73	604.96	0.000054	1.10	1557.45	314.19	0.06
Reach	470.0250	Q100	1347.50	593.60	607.33	596.94	607.35	0.000032	0.98	2057.19	353.14	0.05
Reach	470.0250	Q500	1796.90	593.60	609.95	597.41	609.96	0.000028	1.04	2604.20	394.50	0.05
Reach	415.7876	Q1.1	198.00	593.88	597.19	595.42	597.28	0.001508	2.31	98.88	62.74	0.26
Reach	415.7876	Q2	398.30	593.88	599.19	596.17	599.26	0.000778	2.18	241.91	103.62	0.20
Reach	415.7876	Q5	616.70	593.88	600.91	596.90	600.98	0.000493	2.19	397.63	187.90	0.17
Reach	415.7876	Q10	778.10	593.88	602.15	597.35	602.21	0.000370	2.18	521.19	225.54	0.15
Reach	415.7876	Q25	995.10	593.88	603.68	597.83	603.74	0.000285	2.20	674.68	260.29	0.14
Reach	415.7876	Q50	1165.00	593.88	604.89	598.13	604.95	0.000237	2.20	796.08	282.54	0.13
Reach	415.7876	Q100	1347.50	593.88	607.29	598.40	607.34	0.000141	1.97	1036.41	321.17	0.10
Reach	415.7876	Q500	1796.90	593.88	609.90	598.98	609.95	0.000124	2.11	1297.69	348.90	0.10
Reach	350.18		Culvert									
Reach	280.4748	Q1.1	198.00	588.92	595.26	590.60	595.27	0.000098	0.82	241.29	58.14	0.07
Reach	280.4748	Q2	398.30	588.92	596.06	591.35	596.09	0.000241	1.37	299.89	112.58	0.11
Reach	280.4748	Q5	616.70	588.92	596.64	592.01	596.70	0.000385	1.86	351.51	122.25	0.15
Reach	280.4748	Q10	778.10	588.92	596.99	592.37	597.06	0.000493	2.19	381.81	127.89	0.17
Reach	280.4748	Q25	995.10	588.92	597.37	592.83	597.47	0.000641	2.60	415.58	134.86	0.19
Reach	280.4748	Q50	1165.00	588.92	597.62	593.15	597.75	0.000756	2.91	439.11	142.12	0.21
Reach	280.4748	Q100	1347.50	588.92	597.87	593.46	598.03	0.000877	3.22	463.51	149.17	0.23
Reach	280.4748	Q500	1796.90	588.92	598.42	594.08	598.66	0.001160	3.92	517.32	178.33	0.26
Reach	266.1282	Q1.1	198.00	589.75	595.25	591.70	595.27	0.000181	1.01	196.01	54.73	0.09
Reach	266.1282	Q2	398.30	589.75	596.04	592.48	596.08	0.000412	1.63	266.90	121.60	0.14
Reach	266.1282	Q5	616.70	589.75	596.62	593.01	596.69	0.000613	2.16	329.48	129.84	0.18
Reach	266.1282	Q10	778.10	589.75	596.96	593.39	597.05	0.000754	2.50	366.29	137.03	0.20
Reach	266.1282	Q25	995.10	589.75	597.33	593.78	597.46	0.000940	2.94	409.39	161.21	0.23
Reach	266.1282	Q50	1165.00	589.75	597.58	594.04	597.74	0.001086	3.26	439.72	192.40	0.25
Reach	266.1282	Q100	1347.50	589.75	597.83	594.30	598.01	0.001234	3.58	471.17	201.32	0.26
Reach	266.1282	Q500	1796.90	589.75	598.37	594.88	598.63	0.001564	4.28	540.51	214.72	0.30
Reach	236.6616	Q1.1	198.00	591.74	595.19	593.38	595.25	0.001177	1.96	102.23	70.71	0.23
Reach	236.6616	Q2	398.30	591.74	595.93	594.05	596.05	0.001949	2.82	175.14	119.97	0.30
Reach	236.6616	Q5	616.70	591.74	596.47	594.58	596.65	0.002362	3.49	245.07	168.51	0.34
Reach	236.6616	Q10	778.10	591.74	596.79	594.94	597.00	0.002601	3.89	299.46	191.15	0.36
Reach	236.6616	Q25	995.10	591.74	597.15	595.62	597.40	0.002889	4.36	365.05	199.41	0.38
Reach	236.6616	Q50	1165.00	591.74	597.38	595.91	597.67	0.003107	4.70	408.87	201.26	0.40
Reach	236.6616	Q100	1347.50	591.74	597.62	596.15	597.94	0.003300	5.02	453.02	202.92	0.42
Reach	236.6616	Q500	1796.90	591.74	598.16	596.75	598.55	0.003644	5.69	552.46	207.95	0.45
Reach	175.8002	Q1.1	198.00	592.51	594.91	594.48	595.09	0.008745	3.71	82.69	78.75	0.56
Reach	175.8002	Q2	398.30	592.51	595.61	595.05	595.82	0.008808	4.30	148.67	126.37	0.59
Reach	175.8002	Q5	616.70	592.51	596.13	595.44	596.39	0.008340	4.85	230.40	171.99	0.59
Reach	175.8002	Q10	778.10	592.51	596.45	595.74	596.74	0.007877	5.18	286.54	185.21	0.59
Reach	175.8002	Q25	995.10	592.51	596.80	596.06	597.13	0.007638	5.58	354.41	199.60	0.59
Reach	175.8002	Q50	1165.00	592.51	597.05	596.25	597.39	0.007269	5.78	405.06	201.59	0.59
Reach	175.8002	Q100	1347.50	592.51	597.30	596.38	597.66	0.006976	5.97	456.42	203.55	0.58
Reach	175.8002	Q500	1796.90	592.51	597.87	596.94	598.26	0.006508	6.42	572.69	207.59	0.58
Reach	66.2684	Q1.1	198.00	592.07	594.31	593.59	594.43	0.004005	2.76	93.72	108.77	0.39
Reach	66.2684	Q2	398.30	592.07	594.99	594.18	595.16	0.004005	3.53	180.10	147.74	0.42
Reach	66.2684	Q5	616.70	592.07	595.53	594.60	595.74	0.004002	4.08	268.69	180.92	0.43
Reach	66.2684	Q10	778.10	592.07	595.87	594.86	596.10	0.004001	4.41	334.97	209.86	0.44
Reach	66.2684	Q25	995.10	592.07	596.24	595.20	596.49	0.004006	4.75	412.56	214.73	0.45

HEC-RAS Plan: ex3 River: Stream Reach: Reach (Continued)

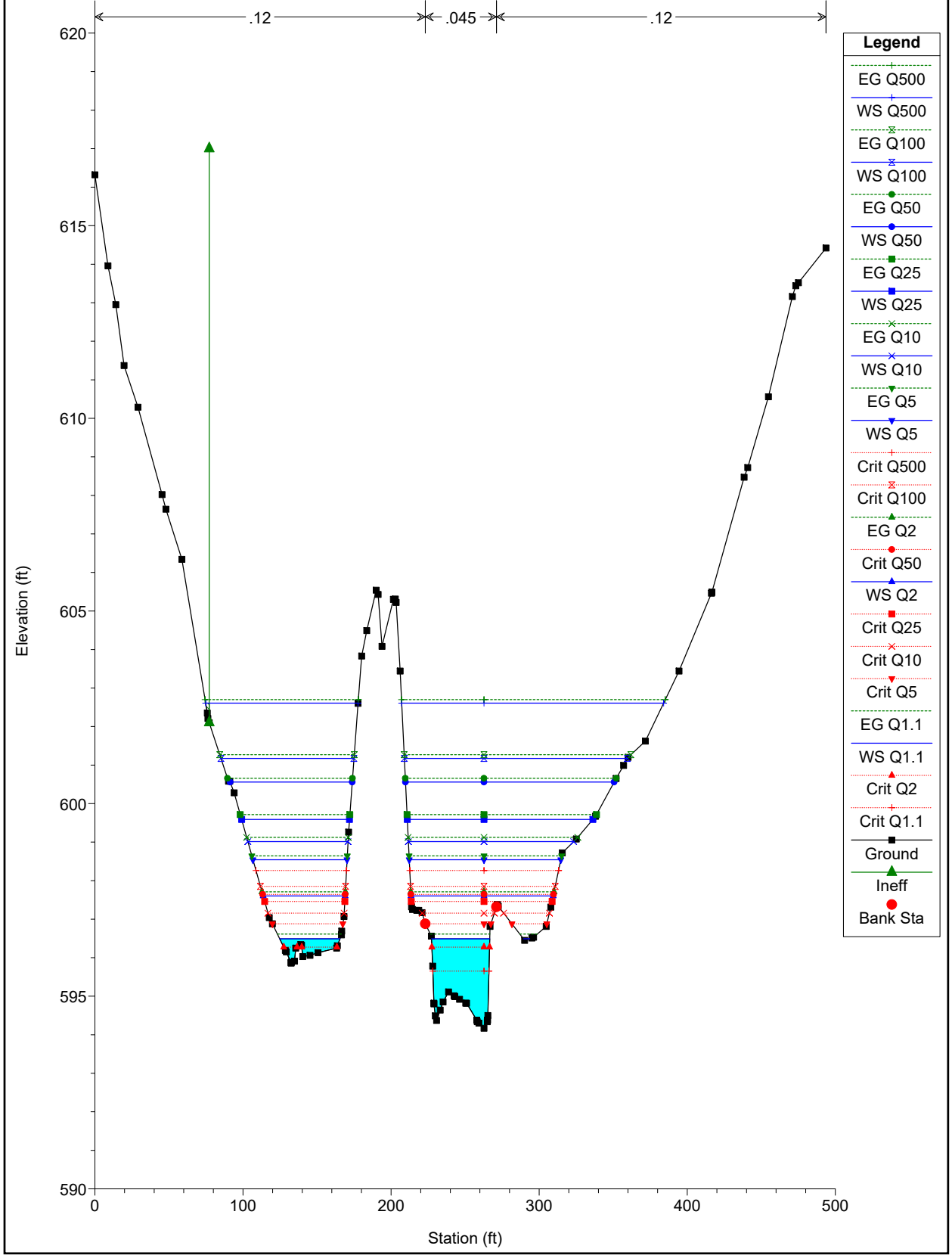
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach	66.2684	Q50	1165.00	592.07	596.50	595.37	596.77	0.004003	4.98	469.08	218.23	0.46
Reach	66.2684	Q100	1347.50	592.07	596.76	595.52	597.05	0.004001	5.21	526.48	221.73	0.46
Reach	66.2684	Q500	1796.90	592.07	597.34	596.12	597.67	0.004000	5.71	657.22	229.51	0.47

HEC-RAS Plan: ex3 River: Stream Reach: Reach

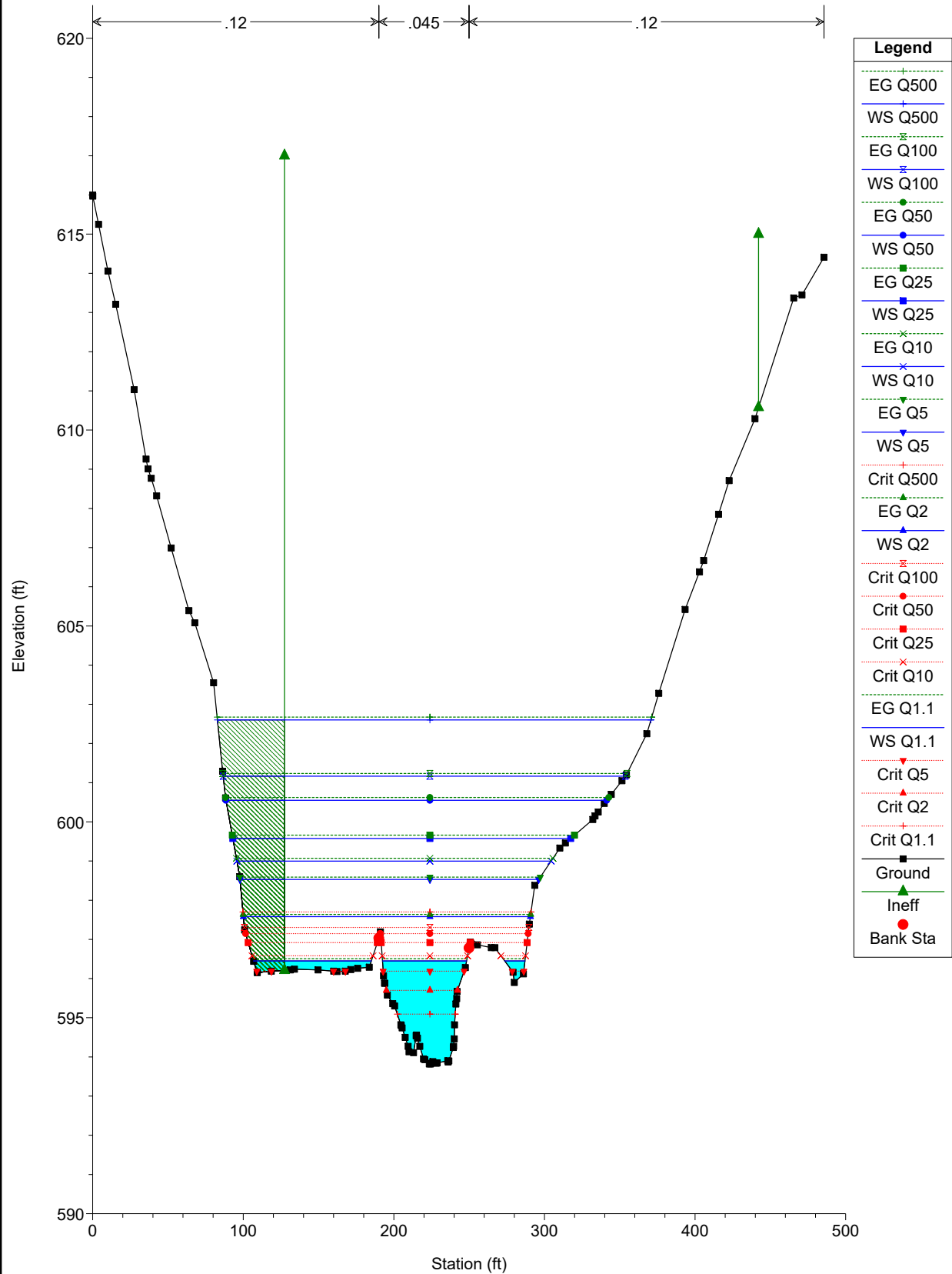
Reach	River Sta	Profile	E.G. US. (ft)	W.S. US. (ft)	E.G. IC (ft)	E.G. OC (ft)	Min El Weir Flow (ft)	Q Culv Group (cfs)	Q Weir (cfs)	Delta WS (ft)	Culv Vel US (ft/s)	Culv Vel DS (ft/s)	Culv WS Inlet (ft)
Reach	350.18 Culvert #1	Q1.1	597.28	597.19	596.88	597.28	608.75	198.00		1.94	7.46	7.84	595.81
Reach	350.18 Culvert #1	Q2	599.26	599.19	598.61	599.26	608.75	398.30		3.14	9.68	9.86	596.79
Reach	350.18 Culvert #1	Q5	600.98	600.91	600.24	600.98	608.75	616.70		4.27	10.90	11.33	597.84
Reach	350.18 Culvert #1	Q10	602.21	602.15	601.31	602.21	608.75	778.10		5.16	12.09	12.11	598.35
Reach	350.18 Culvert #1	Q25	603.74	603.68	602.77	603.74	608.75	995.10		6.31	12.95	13.51	599.31
Reach	350.18 Culvert #1	Q50	604.95	604.89	603.88	604.95	608.75	1165.00		7.27	13.64	14.70	600.04
Reach	350.18 Culvert #1	Q100	607.34	607.29	607.34	606.27	608.75	1347.50		9.42	14.42	15.43	600.77
Reach	350.18 Culvert #1	Q500	609.95	609.90	609.95	607.85	608.75	1565.85	231.05	11.48	14.10	22.50	603.06

Proposed Bridge

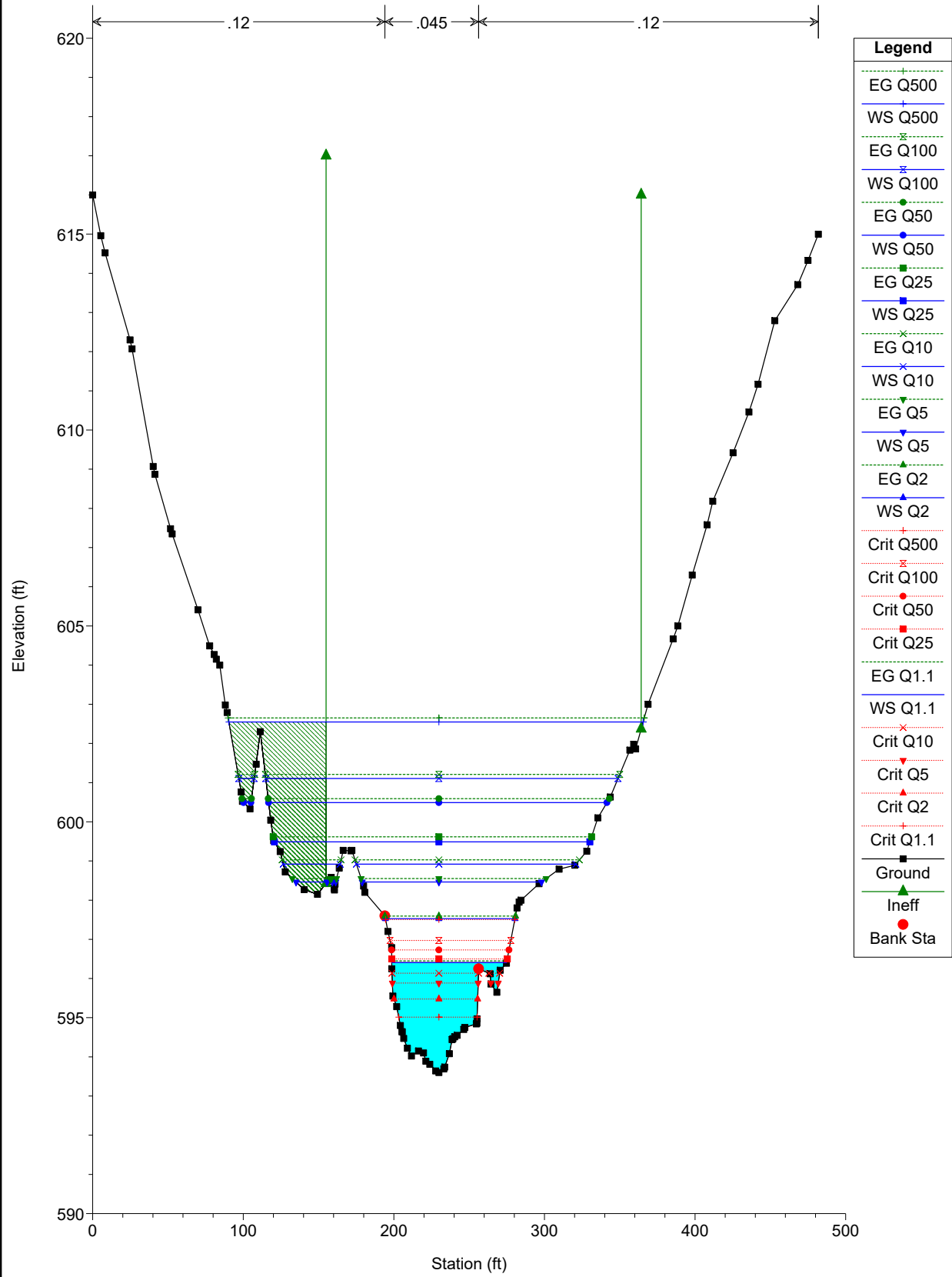
Perham Proposed Box Plan: Perham Proposed Box 3/7/2022



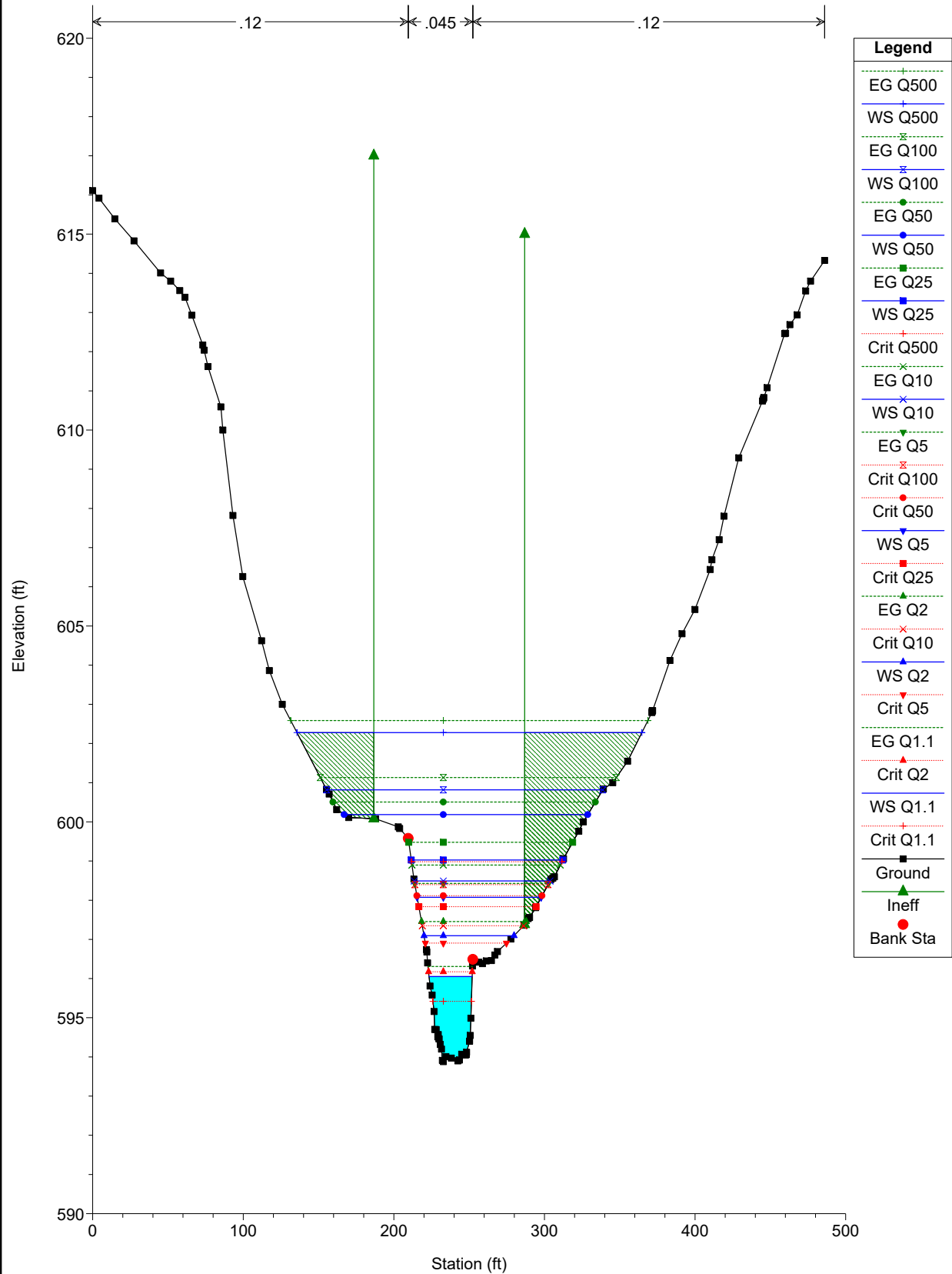
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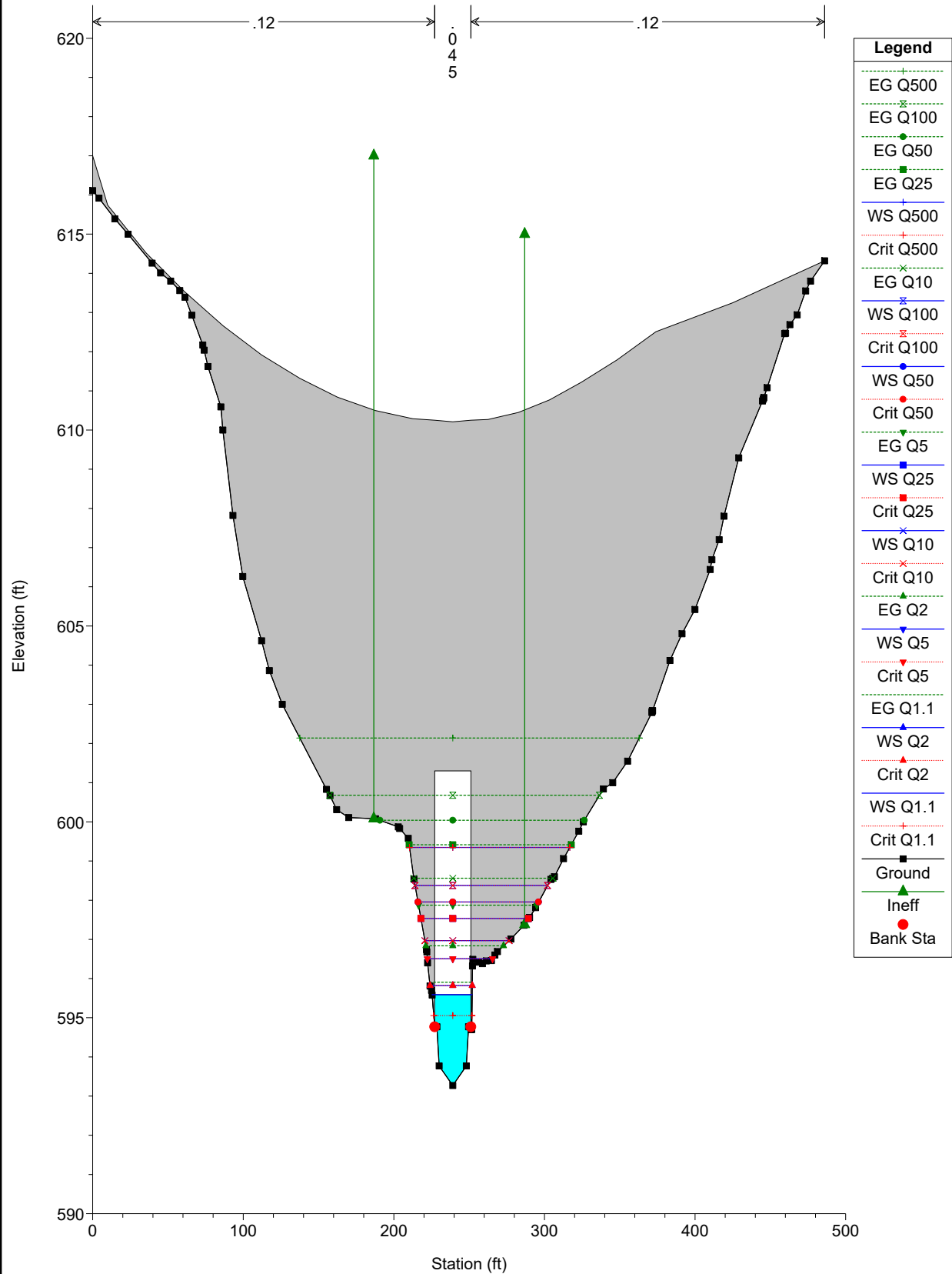
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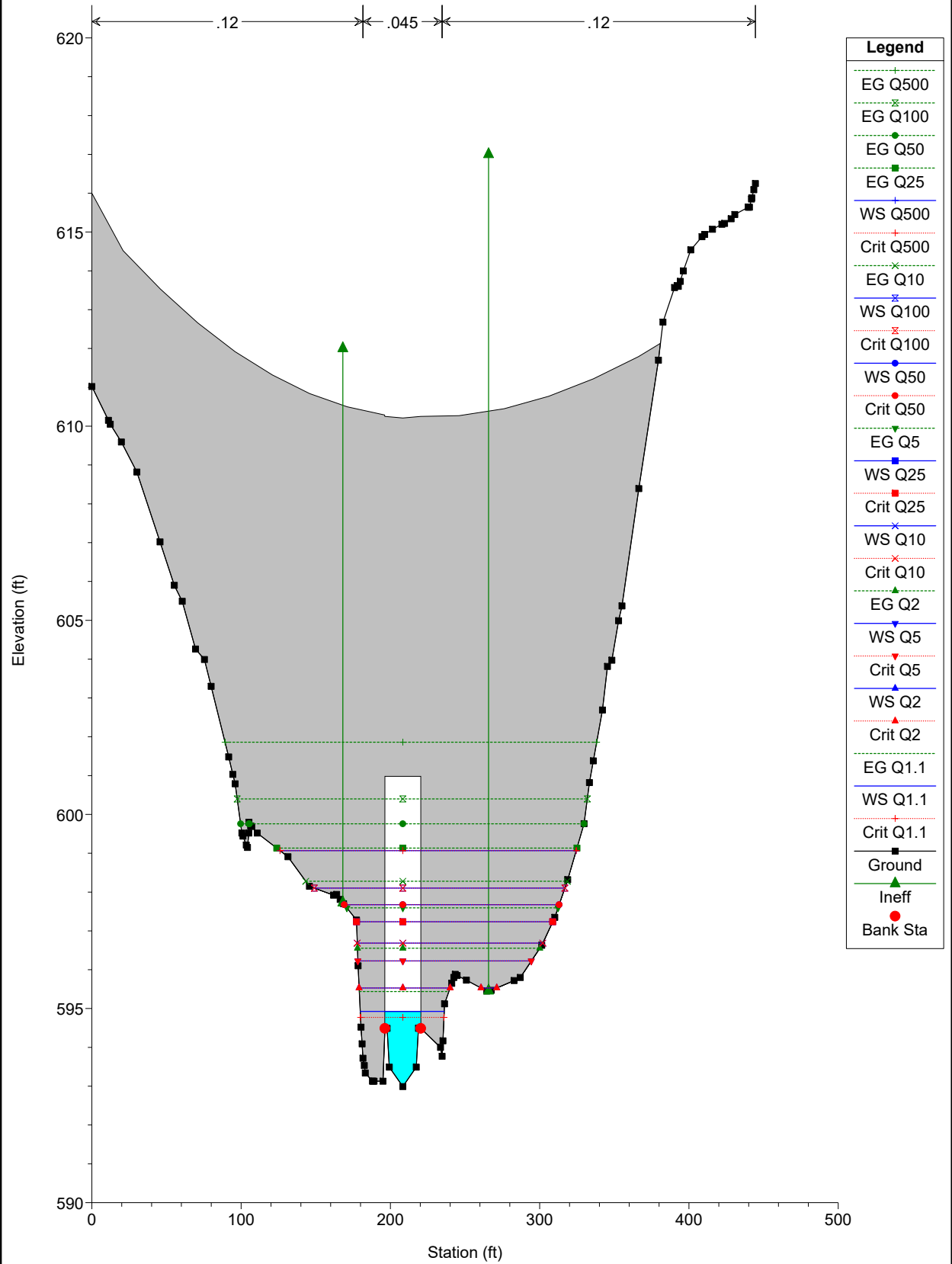
Perham Proposed Box Plan: Perham Proposed Box 3/7/2022



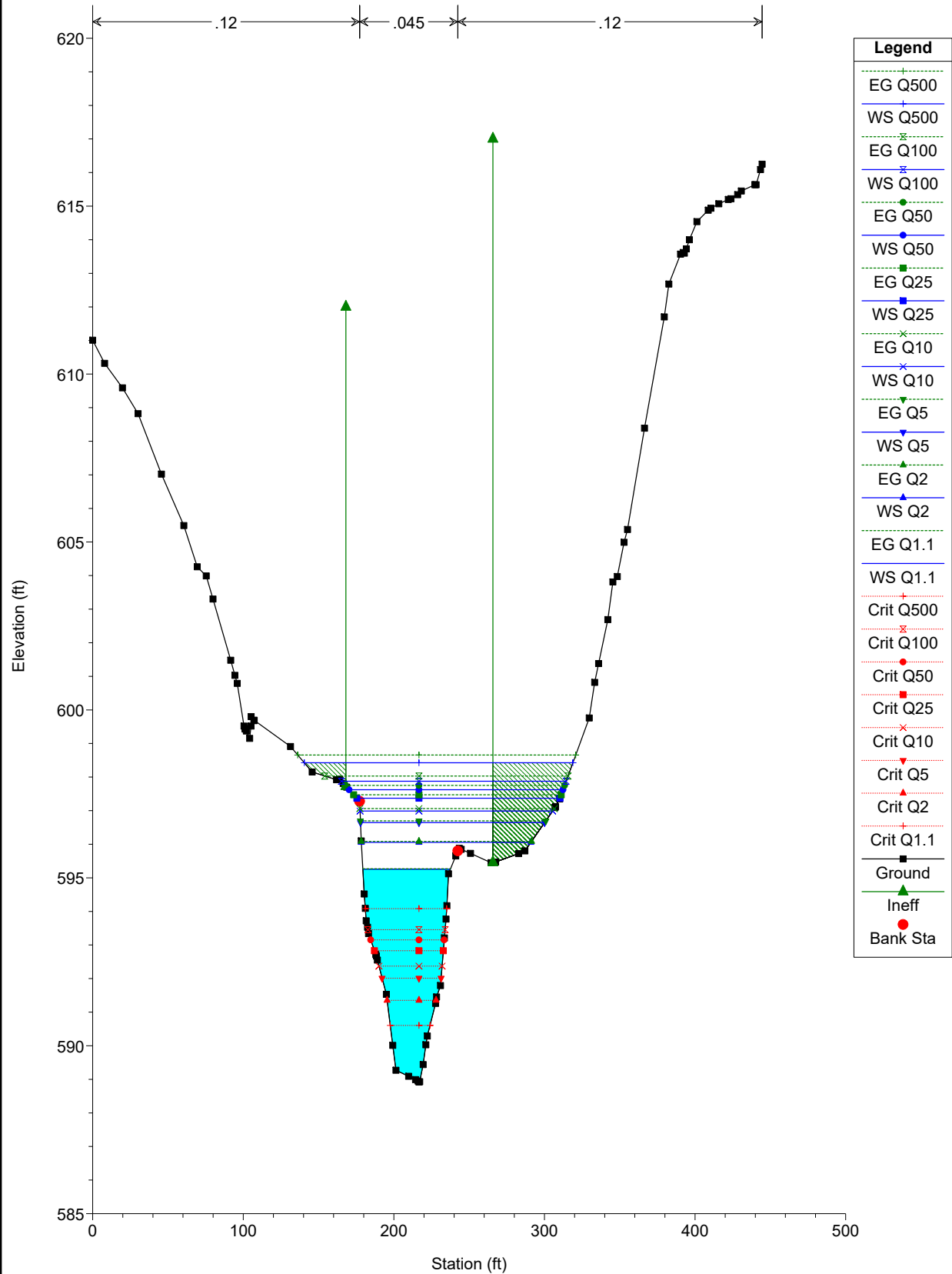
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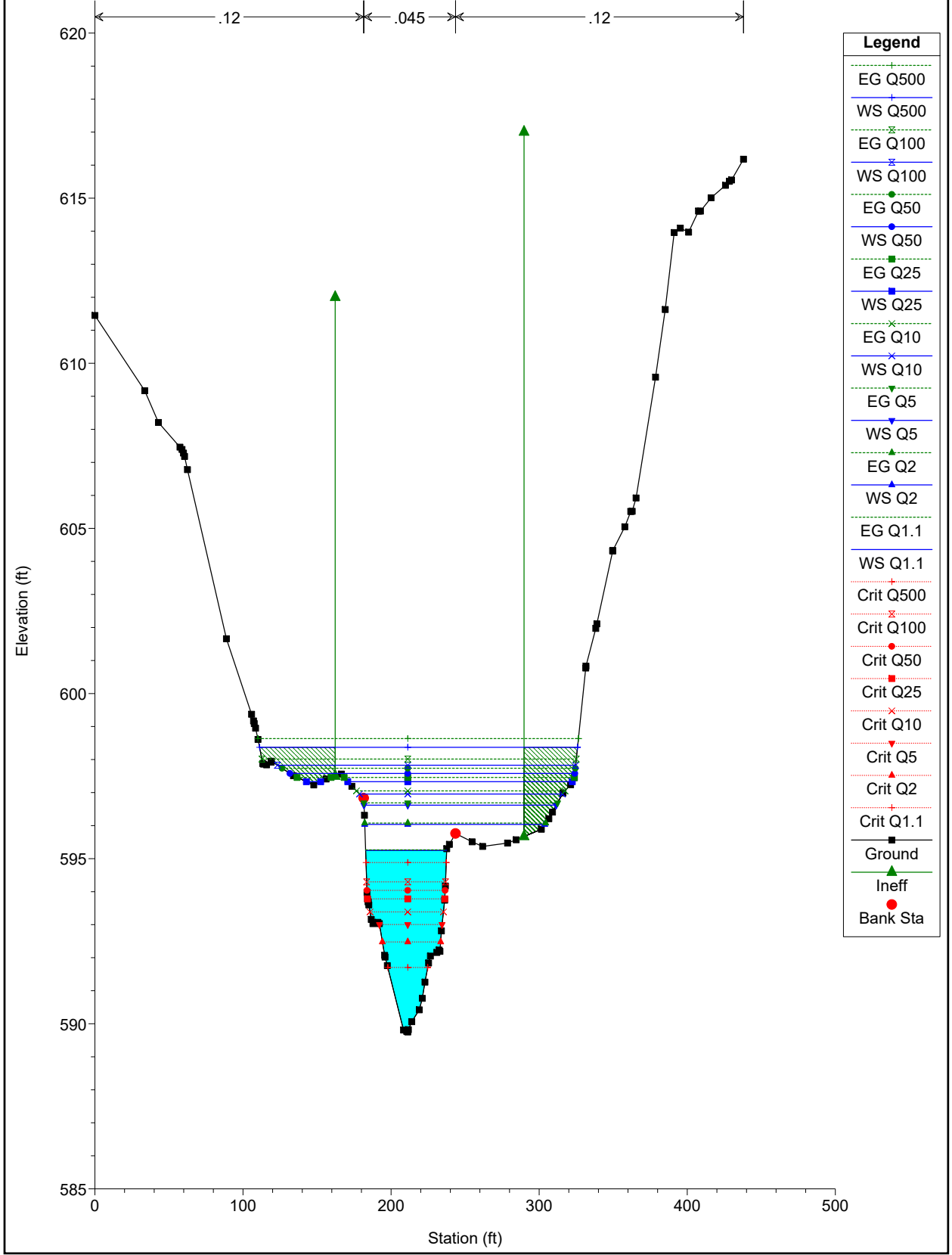
Perham Proposed Box Plan: Perham Proposed Box 3/7/2022



Perham Proposed Box Plan: Perham Proposed Box 3/7/2022

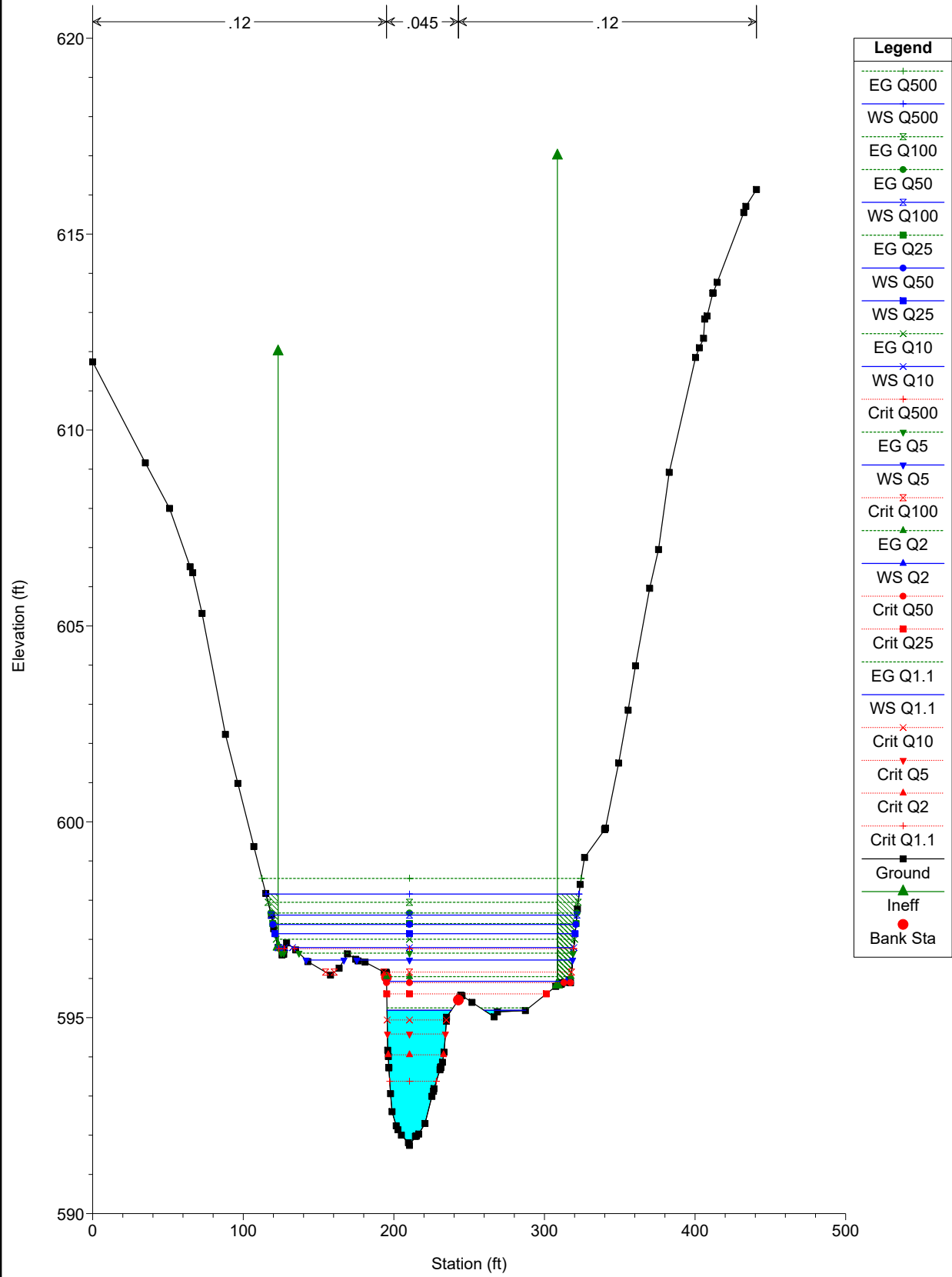


Perham Proposed Box Plan: Perham Proposed Box 3/7/2022

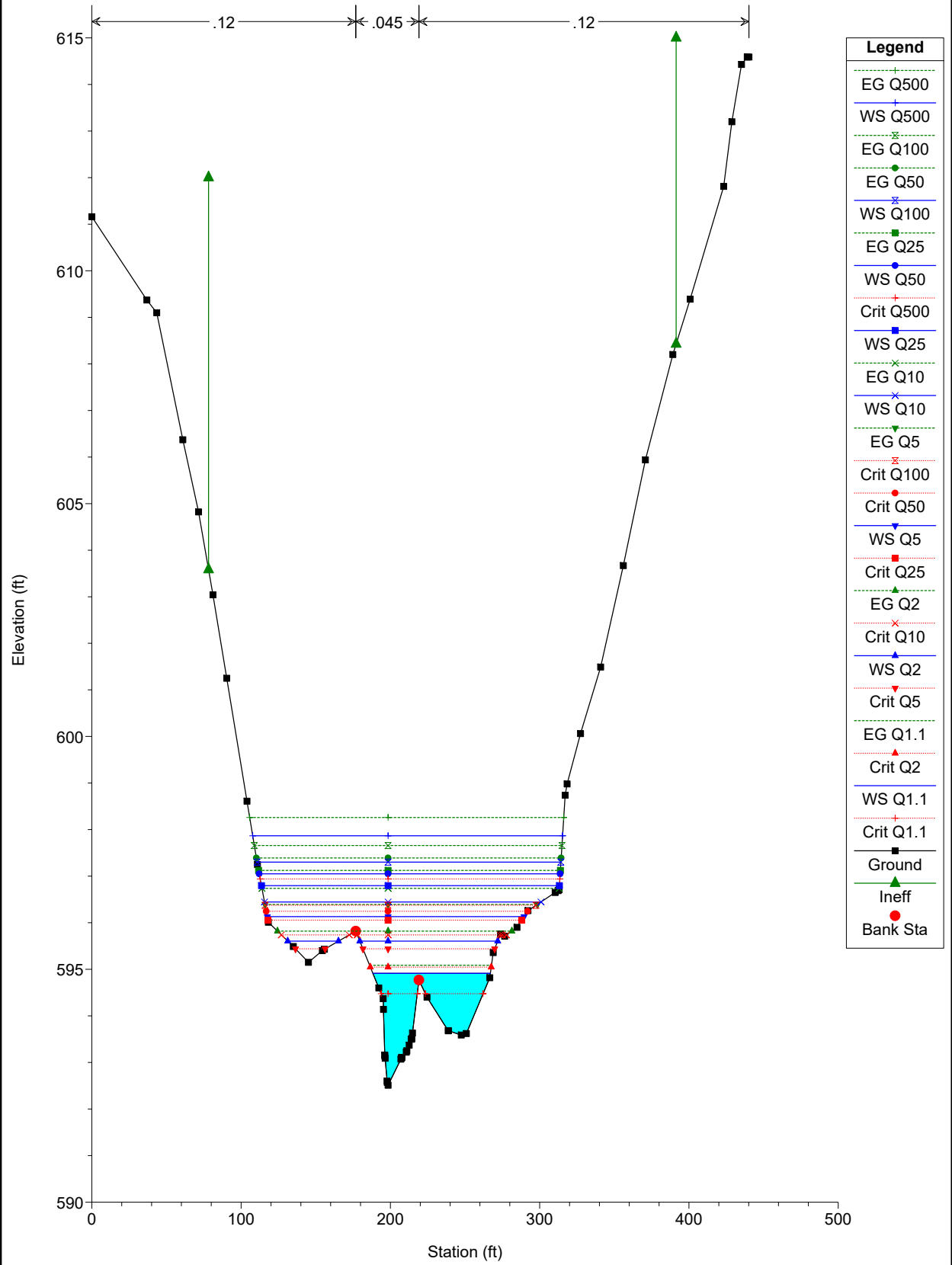


Legend	
EG Q500	+
WS Q500	—
EG Q100	x
WS Q100	—
EG Q50	•
WS Q50	—
EG Q25	■
WS Q25	—
EG Q10	x
WS Q10	—
EG Q5	▼
WS Q5	—
EG Q2	▲
WS Q2	—
EG Q1.1	+
WS Q1.1	—
Crit Q500	x
Crit Q100	•
Crit Q50	■
Crit Q25	x
Crit Q10	▼
Crit Q5	▲
Crit Q2	+
Crit Q1.1	—
Ground	■
Ineff	▲
Bank Sta	•

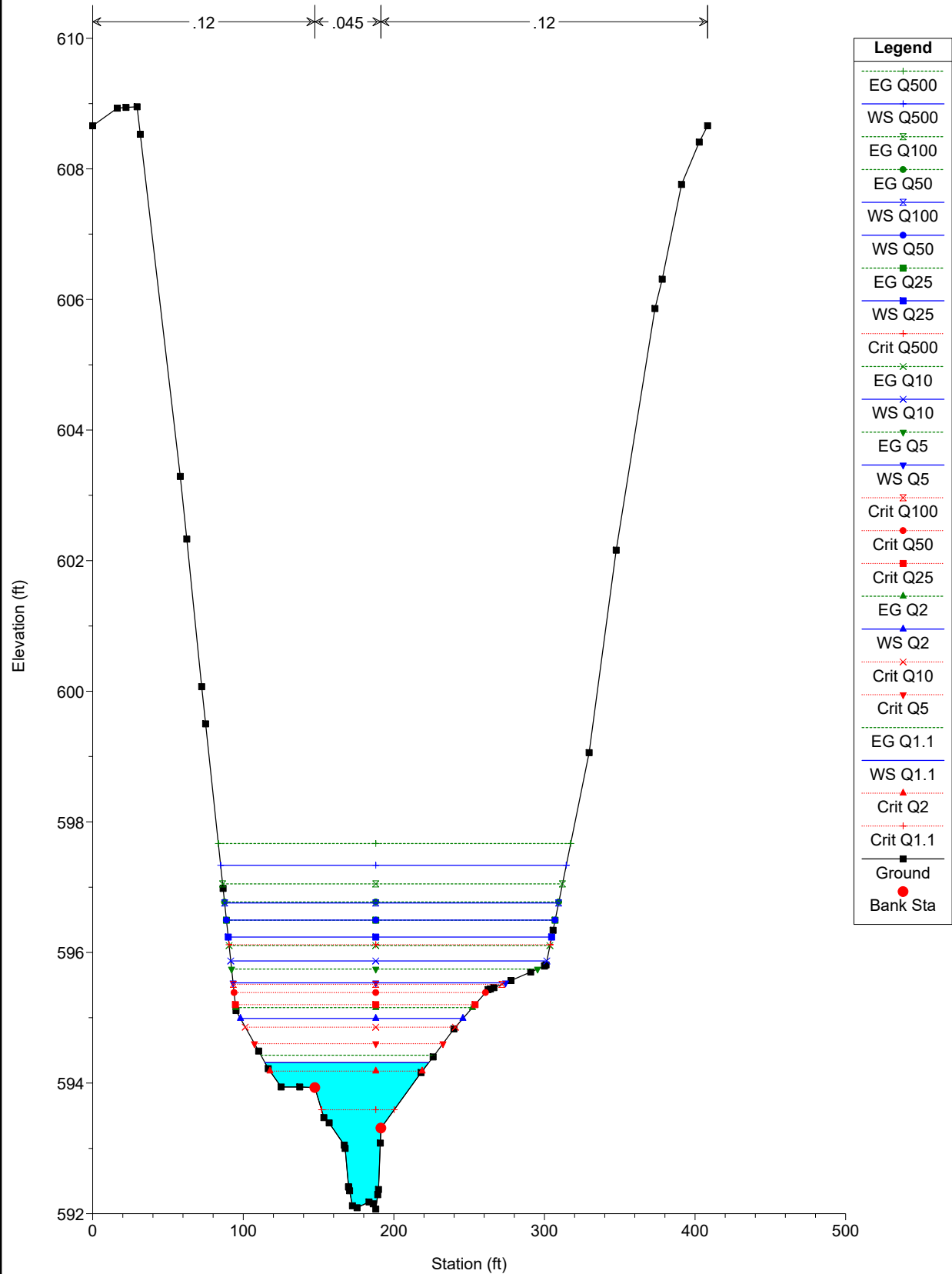
Perham Proposed Box Plan: Perham Proposed Box 3/7/2022



Perham Proposed Box Plan: Perham Proposed Box 3/7/2022



Perham Proposed Box Plan: Perham Proposed Box 3/7/2022



HEC-RAS Plan: Box River: Stream Reach: Reach

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach	549.7325	Q1.1	198.00	594.17	596.49	595.65	596.61	0.003754	2.83	81.85	84.35	0.38
Reach	549.7325	Q2	398.30	594.17	597.60	596.27	597.71	0.002356	2.84	220.00	151.37	0.32
Reach	549.7325	Q5	616.70	594.17	598.54	596.88	598.64	0.001573	2.87	369.22	165.93	0.27
Reach	549.7325	Q10	778.10	594.17	599.01	597.16	599.12	0.001529	3.09	449.62	179.25	0.28
Reach	549.7325	Q25	995.10	594.17	599.59	597.46	599.71	0.001468	3.32	558.42	198.17	0.28
Reach	549.7325	Q50	1165.00	594.17	600.56	597.64	600.66	0.000927	3.01	763.02	223.39	0.23
Reach	549.7325	Q100	1347.50	594.17	601.17	597.85	601.27	0.000814	3.03	905.45	240.48	0.22
Reach	549.7325	Q500	1796.90	594.17	602.61	598.26	602.70	0.000610	3.02	1282.51	279.87	0.20
Reach	512.7847	Q1.1	198.00	593.82	596.45	595.09	596.51	0.001581	1.93	117.88	147.62	0.25
Reach	512.7847	Q2	398.30	593.82	597.58	595.70	597.64	0.001011	2.06	289.65	190.60	0.22
Reach	512.7847	Q5	616.70	593.82	598.53	596.19	598.59	0.000782	2.20	446.28	198.35	0.20
Reach	512.7847	Q10	778.10	593.82	599.00	596.58	599.07	0.000797	2.40	527.58	208.64	0.21
Reach	512.7847	Q25	995.10	593.82	599.58	596.92	599.66	0.000807	2.63	632.99	224.31	0.21
Reach	512.7847	Q50	1165.00	593.82	600.55	597.15	600.62	0.000549	2.46	831.15	252.84	0.18
Reach	512.7847	Q100	1347.50	593.82	601.16	597.31	601.24	0.000498	2.50	966.30	267.04	0.17
Reach	512.7847	Q500	1796.90	593.82	602.60	597.70	602.67	0.000401	2.57	1304.81	287.82	0.16
Reach	470.0250	Q1.1	198.00	593.60	596.41	595.01	596.45	0.001009	1.67	124.09	76.27	0.21
Reach	470.0250	Q2	398.30	593.60	597.53	595.48	597.59	0.000964	2.09	214.46	86.05	0.21
Reach	470.0250	Q5	616.70	593.60	598.46	595.88	598.55	0.000908	2.42	308.71	141.71	0.22
Reach	470.0250	Q10	778.10	593.60	598.92	596.13	599.03	0.000982	2.71	371.55	183.50	0.23
Reach	470.0250	Q25	995.10	593.60	599.49	596.50	599.62	0.001008	2.98	466.26	209.50	0.24
Reach	470.0250	Q50	1165.00	593.60	600.49	596.73	600.59	0.000669	2.75	646.22	229.50	0.20
Reach	470.0250	Q100	1347.50	593.60	601.11	596.97	601.21	0.000605	2.79	763.76	244.13	0.19
Reach	470.0250	Q500	1796.90	593.60	602.55	597.51	602.65	0.000489	2.87	1055.85	275.08	0.18
Reach	415.7876	Q1.1	198.00	593.88	596.05	595.42	596.31	0.007931	4.07	48.63	28.61	0.55
Reach	415.7876	Q2	398.30	593.88	597.09	596.17	597.46	0.006901	4.86	92.80	59.79	0.54
Reach	415.7876	Q5	616.70	593.88	598.07	596.90	598.43	0.005333	4.97	159.41	82.31	0.50
Reach	415.7876	Q10	778.10	593.88	598.49	597.35	598.90	0.005599	5.37	189.61	90.12	0.52
Reach	415.7876	Q25	995.10	593.88	599.03	597.83	599.48	0.005598	5.74	229.36	100.66	0.53
Reach	415.7876	Q50	1165.00	593.88	600.19	598.12	600.51	0.002973	4.89	324.87	161.83	0.40
Reach	415.7876	Q100	1347.50	593.88	600.82	598.40	601.13	0.002512	4.89	388.02	183.35	0.37
Reach	415.7876	Q500	1796.90	593.88	602.28	598.98	602.59	0.001839	4.92	534.35	229.02	0.33
Reach	350.18	Bridge										
Reach	280.4748	Q1.1	198.00	588.92	595.26	590.60	595.27	0.000098	0.82	241.29	58.14	0.07
Reach	280.4748	Q2	398.30	588.92	596.05	591.35	596.08	0.000241	1.37	299.78	112.56	0.11
Reach	280.4748	Q5	616.70	588.92	596.64	592.01	596.70	0.000385	1.86	351.46	122.24	0.15
Reach	280.4748	Q10	778.10	588.92	596.99	592.37	597.06	0.000493	2.19	381.81	127.89	0.17
Reach	280.4748	Q25	995.10	588.92	597.37	592.83	597.47	0.000641	2.60	415.62	134.87	0.19
Reach	280.4748	Q50	1165.00	588.92	597.62	593.15	597.75	0.000756	2.91	439.13	142.13	0.21
Reach	280.4748	Q100	1347.50	588.92	597.87	593.46	598.03	0.000877	3.22	463.62	149.20	0.23
Reach	280.4748	Q500	1796.90	588.92	598.43	594.08	598.66	0.001159	3.91	517.54	178.39	0.26
Reach	266.1282	Q1.1	198.00	589.75	595.25	591.70	595.27	0.000181	1.01	196.01	54.73	0.09
Reach	266.1282	Q2	398.30	589.75	596.04	592.48	596.08	0.000413	1.63	266.76	121.58	0.14
Reach	266.1282	Q5	616.70	589.75	596.62	593.01	596.69	0.000613	2.16	329.43	129.83	0.18
Reach	266.1282	Q10	778.10	589.75	596.96	593.39	597.05	0.000754	2.50	366.29	137.03	0.20
Reach	266.1282	Q25	995.10	589.75	597.33	593.78	597.46	0.000939	2.94	409.44	161.27	0.23
Reach	266.1282	Q50	1165.00	589.75	597.58	594.04	597.74	0.001086	3.26	439.74	192.41	0.25
Reach	266.1282	Q100	1347.50	589.75	597.83	594.30	598.01	0.001233	3.57	471.32	201.36	0.26
Reach	266.1282	Q500	1796.90	589.75	598.37	594.88	598.64	0.001562	4.28	540.81	214.74	0.30
Reach	236.6616	Q1.1	198.00	591.74	595.19	593.38	595.25	0.001177	1.96	102.23	70.71	0.23
Reach	236.6616	Q2	398.30	591.74	595.93	594.05	596.05	0.001932	2.83	174.89	119.84	0.30
Reach	236.6616	Q5	616.70	591.74	596.47	594.58	596.65	0.002356	3.51	244.70	168.32	0.34
Reach	236.6616	Q10	778.10	591.74	596.79	594.94	597.00	0.002601	3.91	299.01	191.02	0.36
Reach	236.6616	Q25	995.10	591.74	597.14	595.61	597.40	0.002895	4.39	364.52	199.38	0.38
Reach	236.6616	Q50	1165.00	591.74	597.38	595.90	597.67	0.003119	4.73	408.18	201.24	0.40
Reach	236.6616	Q100	1347.50	591.74	597.62	596.16	597.94	0.003313	5.05	452.44	202.89	0.42
Reach	236.6616	Q500	1796.90	591.74	598.16	596.76	598.55	0.003663	5.73	551.92	207.92	0.45
Reach	175.8002	Q1.1	198.00	592.51	594.91	594.48	595.09	0.008745	3.71	82.69	78.75	0.56
Reach	175.8002	Q2	398.30	592.51	595.61	595.05	595.82	0.008808	4.30	148.67	126.37	0.59
Reach	175.8002	Q5	616.70	592.51	596.13	595.44	596.39	0.008340	4.85	230.40	171.99	0.59
Reach	175.8002	Q10	778.10	592.51	596.45	595.74	596.74	0.007877	5.18	286.54	185.21	0.59
Reach	175.8002	Q25	995.10	592.51	596.80	596.06	597.13	0.007638	5.58	354.41	199.60	0.59
Reach	175.8002	Q50	1165.00	592.51	597.05	596.25	597.39	0.007269	5.78	405.06	201.59	0.59
Reach	175.8002	Q100	1347.50	592.51	597.30	596.38	597.66	0.006976	5.97	456.42	203.55	0.58
Reach	175.8002	Q500	1796.90	592.51	597.87	596.94	598.26	0.006515	6.42	572.48	207.58	0.58
Reach	66.2684	Q1.1	198.00	592.07	594.31	593.59	594.43	0.004005	2.76	93.72	108.77	0.39
Reach	66.2684	Q2	398.30	592.07	594.99	594.18	595.16	0.004005	3.53	180.10	147.74	0.42
Reach	66.2684	Q5	616.70	592.07	595.53	594.60	595.74	0.004002	4.08	268.69	180.92	0.43
Reach	66.2684	Q10	778.10	592.07	595.87	594.86	596.10	0.004001	4.41	334.97	209.86	0.44
Reach	66.2684	Q25	995.10	592.07	596.24	595.20	596.49	0.004006	4.75	412.56	214.73	0.45

HEC-RAS Plan: Box River: Stream Reach: Reach (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach	66.2684	Q50	1165.00	592.07	596.50	595.39	596.77	0.004003	4.98	469.07	218.23	0.46
Reach	66.2684	Q100	1347.50	592.07	596.76	595.51	597.05	0.004001	5.21	526.48	221.73	0.46
Reach	66.2684	Q500	1796.90	592.07	597.33	596.12	597.67	0.004008	5.71	656.75	229.48	0.47

HEC-RAS Plan: Box River: Stream Reach: Reach

Reach	River Sta	Profile	E.G. US. (ft)	Min El Prs (ft)	BR Open Area (sq ft)	Q Total (cfs)	Min El Weir Flow (ft)	Delta EG (ft)	BR Open Vel (ft/s)	W.S. US. (ft)	W.S. Elev (ft)
Reach	350.18	Q1.1	596.31	601.30	180.35	198.00	610.22	1.04	5.73	596.05	596.05
Reach	350.18	Q2	597.46	601.30	180.35	398.30	610.22	1.37	8.11	597.09	597.09
Reach	350.18	Q5	598.43	601.30	180.35	616.70	610.22	1.73	9.35	598.07	598.07
Reach	350.18	Q10	598.90	601.30	180.35	778.10	610.22	1.83	10.11	598.49	598.49
Reach	350.18	Q25	599.48	601.30	180.35	995.10	610.22	2.01	11.03	599.03	599.03
Reach	350.18	Q50	600.51	601.30	180.35	1165.00	610.22	2.75	11.56	600.19	600.19
Reach	350.18	Q100	601.13	601.30	180.35	1347.50	610.22	3.10	12.14	600.82	600.82
Reach	350.18	Q500	602.59	601.30	180.35	1796.90	610.22	3.93	13.37	602.28	602.28