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Draft Memorandum

Date: August 26, 2015

To: Joseph Peterson, Chief of Hydraulics, California Department of Transportation District 4

From: Chris Sewell – WRECO

Subject: Sea Level Rise Impact Study for State Route 1 Bridge Over Lagunitas Creek Replacement Project in Marin County

Introduction

WRECO was retained by the California Department of Transportation (Caltrans) to perform a study to assess the impacts of sea level rise (SLR) to the State Route 1 (SR 1) bridge over Lagunitas Creek and its adjacent approaches (Figure 1). The main objective was to analyze the SLR impact at the bridge site and the adjacent approaches and provide required information for Caltrans' application for a permit from the California Coastal Commission. The 20-mile-long Lagunitas Creek flows under a three-span bridge at SR 1, and when it overflows, the auxiliary reinforced concrete box (RCB) culverts on both sides of the bridge assist in conveying the creek water below SR 1 (Figure 2). Figure 3 shows the location of the SR 1 bridge (BIRIS ID: 27 0023) and the supplementary creek overflow culverts (BIRIS IDs: 27 0022 & 27 0024).

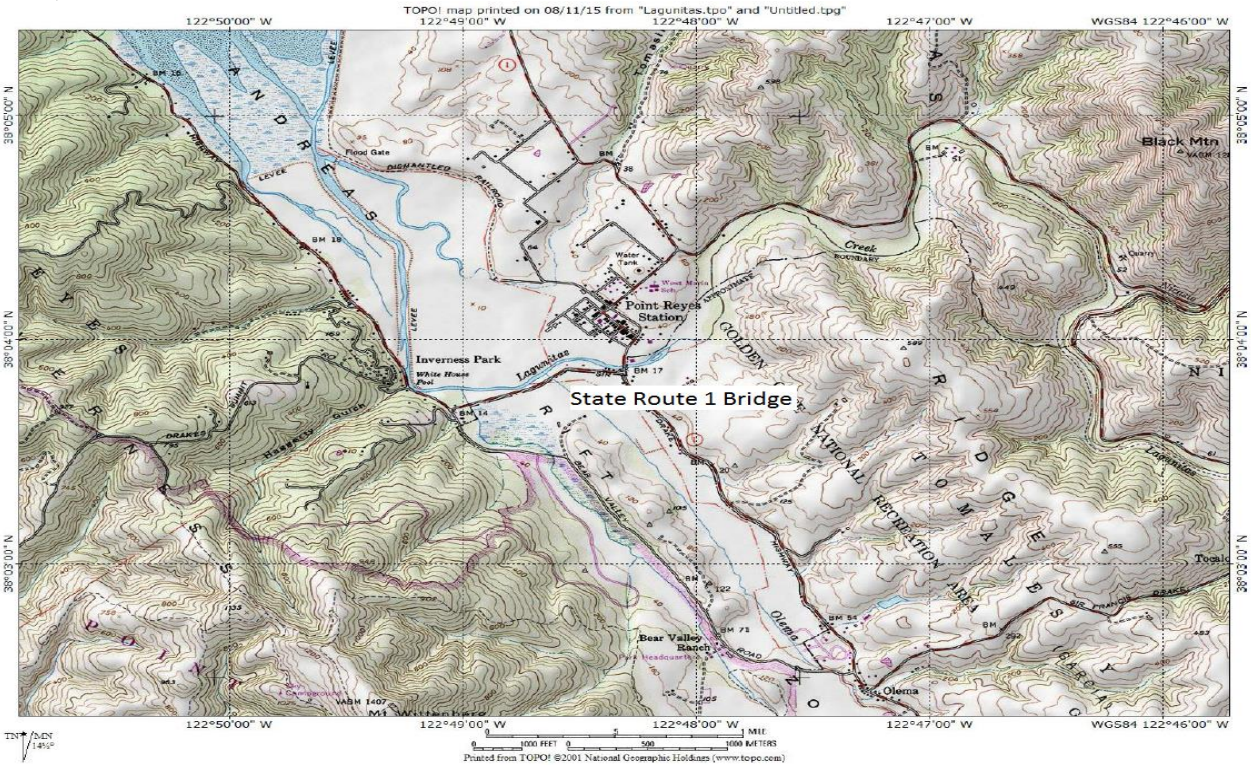

Figure 1. State Route 1 Bridge Location

Source: United States Geological Survey (USGS)

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The SR 1 bridge has a total length of 151.9 ft laid over four piers and a width of 28.87 ft. The bridge lies in a floodway area in Flood Zone AE as shown in the Federal Emergency Management agency (FEMA) Flood Insurance Rate Map (FIRM) (Figure 2). The base flood elevation is approximately 17.5 ft. On each side of the bridge, there are two sets of culverts to help water flow under SR 1 when the creek overflows. Each overflow culvert is a triple reinforced concrete box culvert measuring 10 ft wide by 6 ft high.

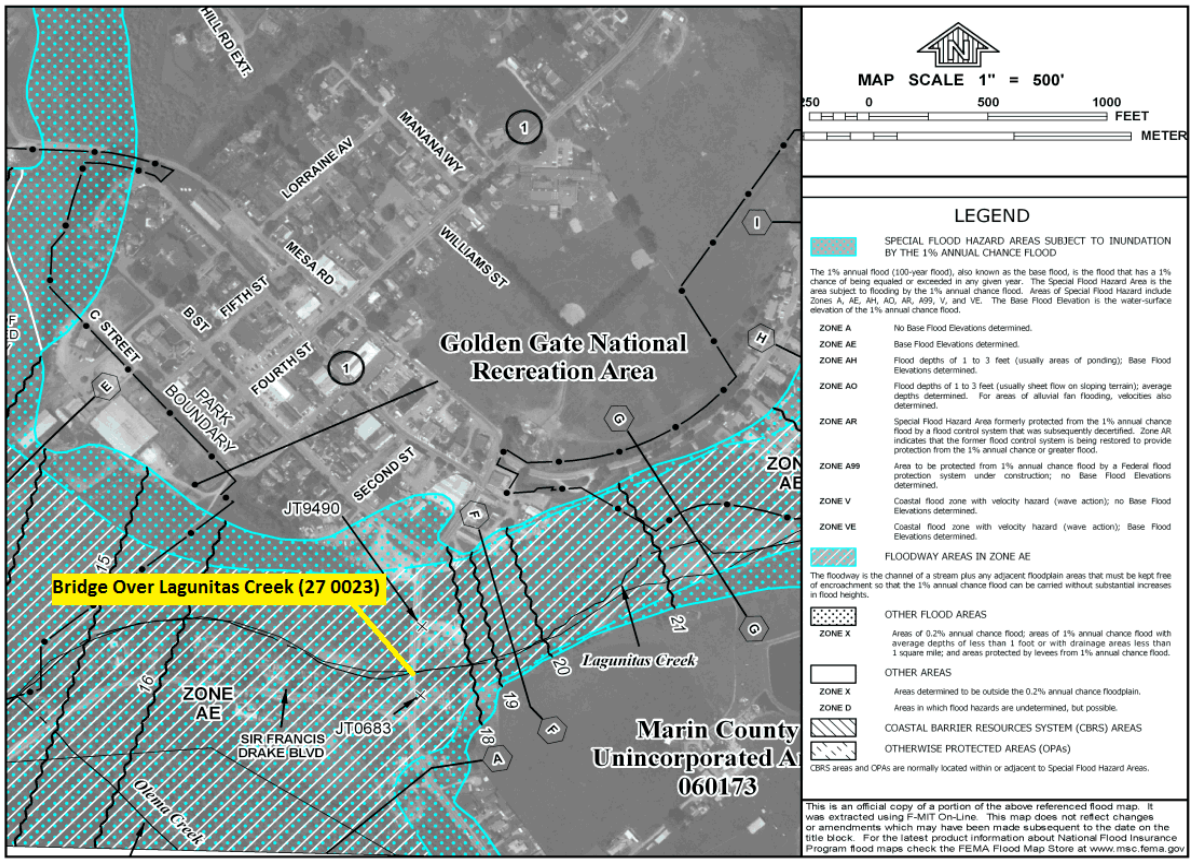

Figure 2. FEMA FIRM Showing Flood Hazard Areas

Source: FEMA

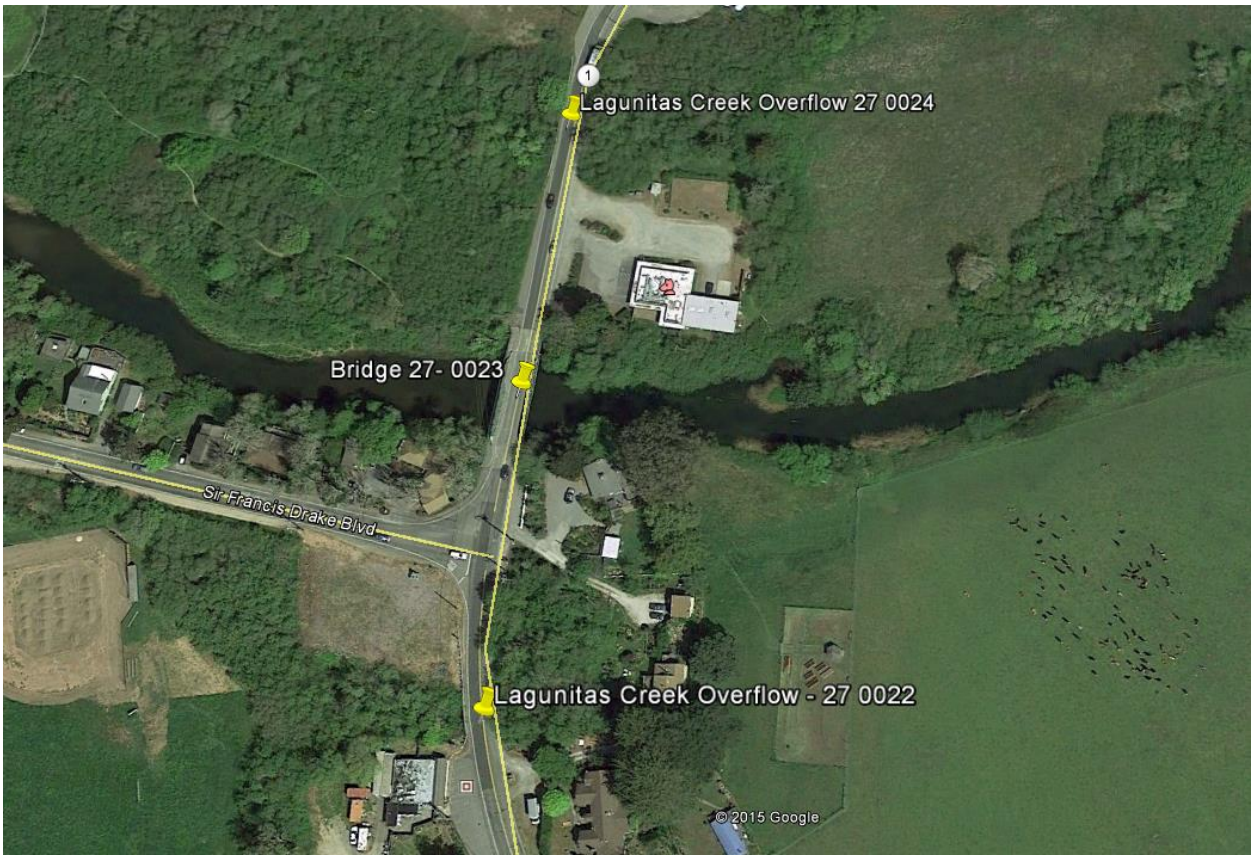

Figure 3. Location of Bridge (ID: 27 0023) and Overflow Culvert Structures (IDs: 27 0022 & 27 0024)
Source: Google Earth

The goal of this report is to evaluate the design hydraulic conditions of Lagunitas Creek at the SR 1 bridge with the effect of the predicted SLR conditions downstream of the bridge. The WRECO study involved reviewing relevant data and project information provided by Caltrans. In addition, WRECO acquired a hard copy of the input and output data of the effective HEC-2 hydraulic model, prepared for Lagunitas Creek through the Project site, from FEMA. The effective model was dated May, 3 1979. A HEC-2 model was reproduced to confirm its ability to match the received output and then to export its input data to a U.S. Army Corps of Engineers' Hydrologic Engineering Centers River Analysis System (HEC-RAS) model. The geometric data of the bridge, overflow culverts, and creek cross sectional data at the Project site were updated for the new HEC-RAS model based on inspection data for these facilities found in the BIRIS inspection files (dated 05/07/2014).

FEMA

The initial step for analysis was to acquire the effective FEMA model output data and digitize it into a working HEC-2 model. This HEC-2 model was run, and the output was compared to what was received. Once the model was confirmed to duplicate the received output, the HEC-2 model was imported to HEC-RAS modeling software. FEMA HEC-2 model input data are included in Appendix A.

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Data in the HEC-2 model that was used for the HEC-RAS model were as follows:

- Creek cross sectional data from 18 cross sections have been imported from HEC-2 (stations 0 to 16957)
- Roughness coefficients at different cross sections
- Expansion/contraction coefficients
- 100-year design storm flow data in Lagunitas Creek
- Bridge geometry

The bridge data in the HEC-RAS model was updated based on channel geometry and deck thickness from the Caltrans BIRIS database. The bridge cross section data from the BIRIS database is shown in Figure 4.

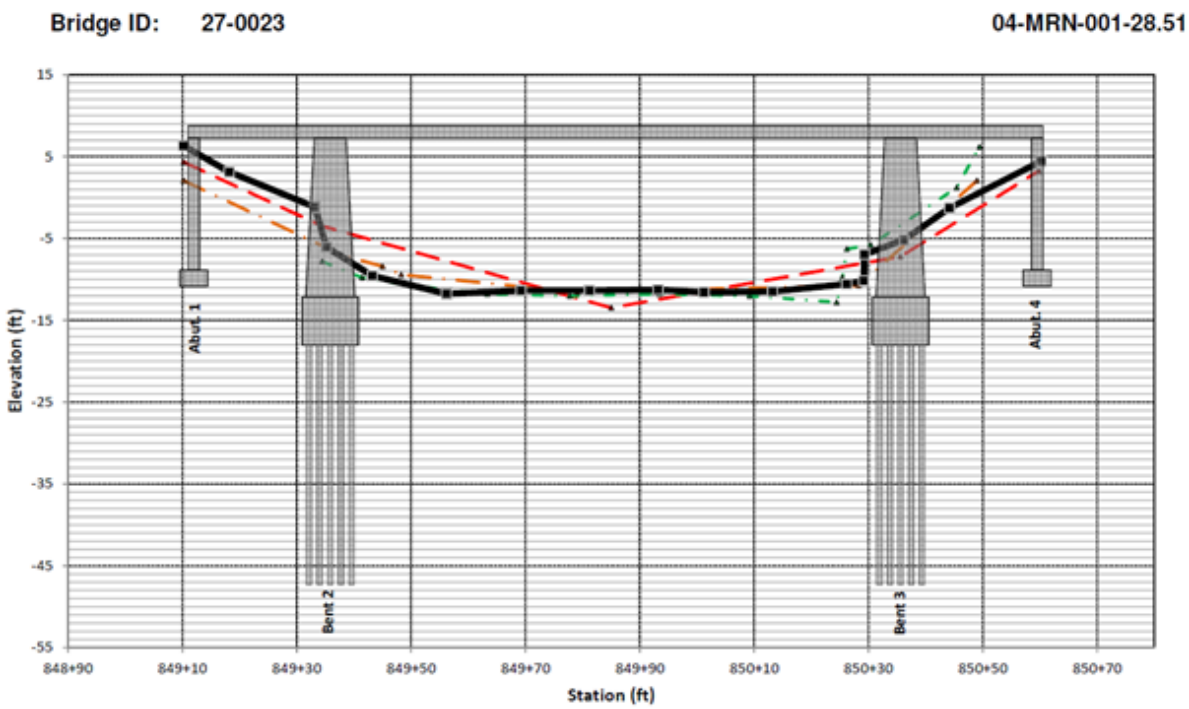

Figure 4. SR1 Bridge from BIRIS database

In addition to updating the bridge data, triple 10 ft by 6 ft RCB culverts were added to the model at each side of the bridge to model the Lagunitas Creek overflow structures (27 0024 & 27 0022). Updated data for bridge, culverts, and cross sections are shown in Figure 5.

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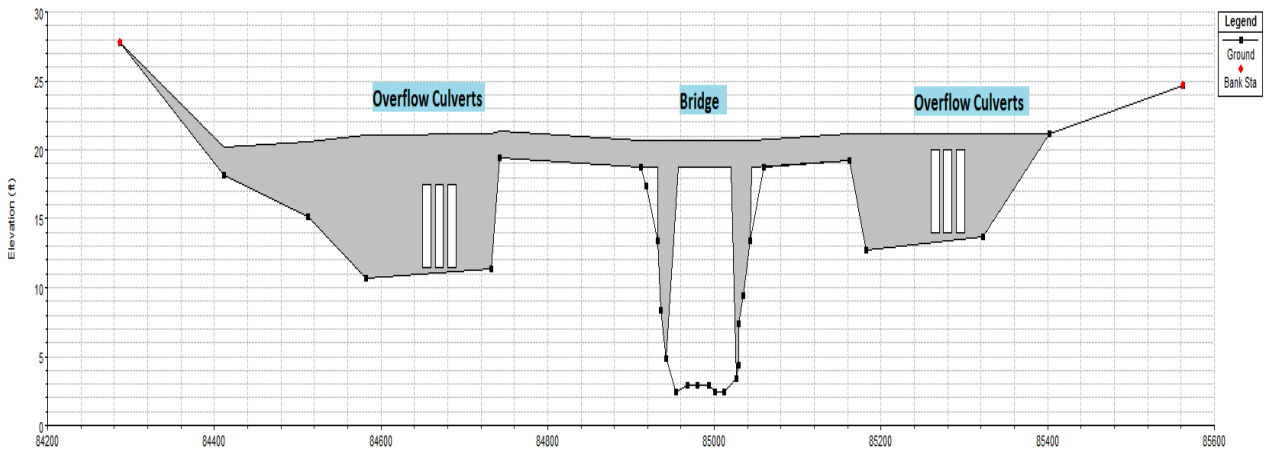

Figure 5. Updated cross section of bridge, culverts, and Lagunitas Creek ground elevation extracted from BIRIS database

Elevations of the creek cross sectional data that were acquired from the FEMA HEC-2 model were based on the National Geodetic Vertical Datum of 1929 (NGVD 29). However, for the HEC-RAS model, the North American Vertical Datum of 1988 (NAVD 88) was adopted; therefore, all imported elevation data from HEC-2 were converted to NAVD 88.

According to the FEMA Flood Insurance Study (FIS), tidal conditions at the Lagunitas Creek downstream edge of the model determined the water surface elevations (WSE) of the creek downstream and thus were used as boundary conditions for the FEMA HEC-2 model. The WSEs from the FIS are shown in Table 1.

Table 1. Downstream WSEs for Lagunitas Creek

Tidal Conditions	Elevation (ft) NAVD 88
500 Year	10.46
100 Year	9.89
50 Year	7.99
10 Year	5.87

The downstream WSEs presented in the FIS were compared to current tidal levels at the National Oceanic and Atmospheric Administration (NOAA) Tide Station 9415020, “Point Reyes, CA,” as shown in Table 2. The purpose of the comparison was to check if the WSE boundary conditions used in FEMA HEC-2 model were still valid and could be used in the new HEC-RAS model.

Table 2. Current Tidal levels at station 9415020 "Point Reyes, CA"

Tidal Conditions	Elevation (ft) NAVD'88
Highest Observed Water Elevation	8.52
Highest Astronomical Tide	7.45
MHHW[1]	5.74
MHW[2]	5.08
MSL[3]	3.08

Note: [1] MHHW = mean higher high water
[2] MHW = mean high water
[3] MSL = mean sea level

As shown in Tables 1 and 2, the WSE used in HEC-2 model were still within the acceptable range of current recorded WSEs of tides. Therefore, the same WSEs used in the HEC-2 model were used as downstream boundary conditions in the new HEC-RAS model for model validation.

Discussions

The purpose of the new HEC-RAS model was to check the possibility that the creek water levels would increase due to SLR plus Q_{100} and thus impact the SR 1 bridge. Hydraulic parameters that were used in the HEC-RAS model are presented hereinafter.

SLR Magnitudes and Downstream Controls

The rise in WSE at the downstream end of Lagunitas Creek will hydraulically affect the design water surface levels in the creek. The SLR magnitudes for years 2050 and 2100 are based on information presented in the report titled *Guidance on Incorporating Sea Level Rise* provided by Caltrans (2011). These SLR magnitudes were reviewed and found to fall within the SLR projections data in the report titled "*Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*" by the National Research Council (2012), and report titled "*California Coastal Commission Seal-Level Rise Policy Guidance*" by California Coastal Commission (2015). Therefore, it is was estimated that in year 2050, there will be a 14 in. rise in sea water level, and in year 2100, there will be 55 in. increase in sea level. Sea level elevations used in new HEC-RAS model for the Q_{100} model are summarized in Table 3.

Table 3. Sea Levels Input to Lagunitas Creek Model for Q_{100}

Run 1	Run 2	Run 3
Base Condition Starting WSE (ft) – NAVD 88 From FEMA	Year 2050 Starting WSE (ft) – NAVD 88 (Base + 14") ft	Year 2100 Starting WSE (ft) – NAVD 88 (Base + 55") ft
9.89	11.06	14.47

The 100-Year Storm Flow in Lagunitas Creek: Q_{100}

The 100-year storm is the storm that has the chance of 1% occurring at the Project area in any year. Q_{100} is the flow in Lagunitas Creek in response to the 100-year storm. In the effective FEMA HEC-2 model, Q_{100}

data input was 20,670 cubic feet per second (cfs), 26,800 cfs, 28,050 cfs at stations 16957, 12316, and 5895, respectively. For the HEC-RAS model, the same settings for Q_{100} were used for the hydraulic analysis.

Channel Roughness

Manning's roughness coefficients (n values) were used in the hydraulic model to estimate energy losses in the flow due to friction. The n values used in the HEC-RAS model were those extracted from the FEMA HEC-2 model, and they ranged from 0.035 to 0.07. Based on observations of the Project site, the overbank n values upstream of the bridge were revised from 0.035 to 0.07.

Expansion and Contraction Coefficients

Expansion and contraction coefficients were used in the hydraulic model to estimate hydraulic losses at transitions between cross sections. The expansion and contraction coefficients used in the channel were 0.3 and 0.2, respectively.

Results

The first runs of HEC-RAS were to confirm its ability to produce the same water levels as HEC-2. The HEC-RAS model produced very similar results to the HEC-2 model at all locations of the creek except near cross sections upstream of the bridge. Some differences were noticed due to computational routine differences between HEC-2 and HEC-RAS, as mentioned in HEC-RAS hydraulic reference manual. HEC-RAS has improved computation capabilities compared with HEC-2. The differences between the two models are in calculating cross section conveyance, critical depth calculations, culvert hydraulic computations, and floodway encroachment calculations.

The HEC-RAS model was confirmed to generate results similar to the FEMA HEC-2 model from the downstream end to the downstream face of the bridge; however, the HEC-RAS model of the bridge resulted in a higher water surface elevation upstream of the bridge.

After checking the accuracy of the model, it was run for three scenarios under a 100-year storm event. The three scenarios were based on base condition WSEs and predicted SLR at years 2050 and 2100. Calculated water surface profiles for Lagunitas Creek under the effect of SLR and Q_{100} are shown in Figure 6. As shown in Figure 6, the 100-year design WSE at the SR 1 bridge was not affected by SLR conditions at the downstream end of the creek. The initial HEC-2 model indicated that the bridge passes the 100-year flow, while the HEC-RAS model indicated that the bridge was overtopped.

HEC-RAS model outputs for several run scenarios (runs 1, 2, and 3) are shown in Appendices B, C, and D respectively.

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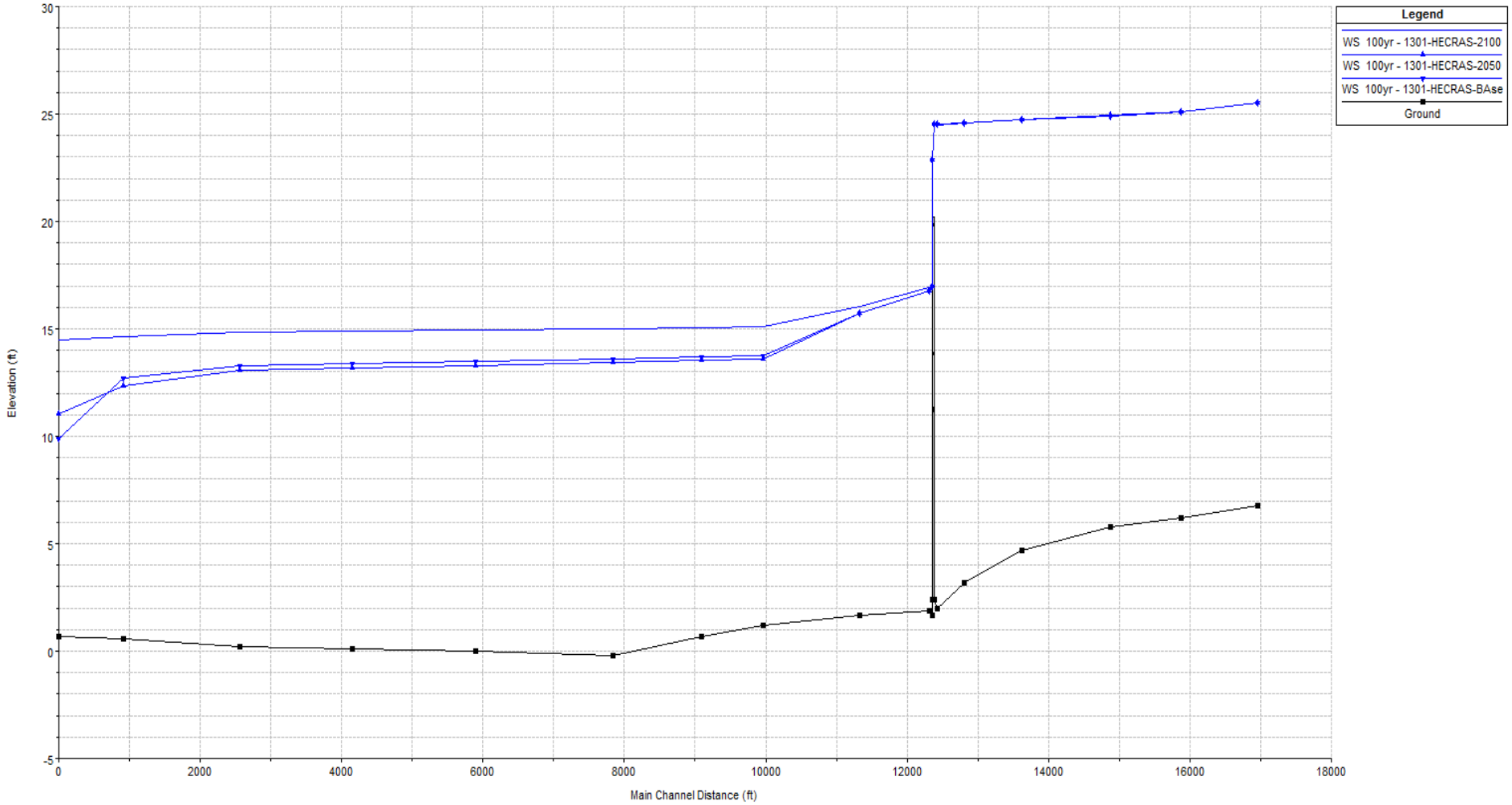

Figure 6. Water surface profiles for Lagunitas Creek affected by downstream tides and conveying flow of a 100-year storm event

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Conclusion

The hydraulic conditions of Lagunitas Creek were evaluated using HEC-RAS Version 4.1.0. under the effect of a 100-year storm plus SLR predicted in the Project area. Geometric data were used from a previously constructed HEC-2 model for the creek. Data for the existing bridge and culverts conveying Lagunitas Creek were updated from the BIRIS database. The model of the 20 mile long creek had 18 cross sections that were used for the hydraulic analyses (Station 0 to 16957). Downstream reach boundary conditions were based on tidal elevations and as reported in published reports (mentioned in a previous section).

SLR does not have an impact on the WSE at the bridge when running the HEC-RAS model. However, the existing bridge is not sufficient to convey the Q_{100} flow without being overtopped.

A more detailed analysis is required to identify improvements to prevent overtopping of the bridge. Such analysis requires a more detailed survey of the creek at several cross sections. Improvements to prevent the overtopping of the bridge include increasing creek cross sectional areas and/or replacement of the bridge with a new one that has a higher soffit level.

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References

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California Department of Transportation. (2014). *Bridge Inspection Report*. Bridge Number: 27 0022. Facility Carried: State route 1. Inspection Date: 05/07/2014.

California Department of Transportation. (2014). *Bridge Inspection Report*. Bridge Number: 27 0024. Facility Carried: State route 1. Inspection Date: 05/07/2014.

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Attachments:

Appendix A: FEMA HEC-2 Input
Appendix B: HEC-RAS Output (Run 1) - Hydraulic Analysis of Lagunitas Creek under Q_{100} and WSE=9.89 ft (base Condition)
Appendix C: HEC-RAS Output (Run 2) - Hydraulic Analysis of Lagunitas Creek under Q_{100} and WSE=11.06 ft (Base Condition + SLR -Year-2050)
Appendix D: HEC-RAS Output (Run 3) - Hydraulic Analysis of Lagunitas Creek under Q_{100} and WSE=14.47 ft (Base Condition + SLR -Year-2100)

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Appendix A: FEMA HEC-2 Input

FEMA Engineering Library
Digitized Data Index

CID:060173

Community:MARIN COUNTY*

County:MARIN COUNTY

State:CALIFORNIA

0269187

Box:

Doc:

Case Number/ Study ID:060173-19820301

Effective Date:3/1/1982

Description:1d. Type 15 Study

Revision Status:

Flooding Source(s):LAGUNITAS CREEK

Contents:09. Engineering Analysis: Hydraulics (riverine, stillwater, LDS)

Notes:

Scanned by:

Scan Date:

QC Staff:

QC Date:

LAGUNITAS

CREEK

Lagunitas Refinement of DS dc Reach.

H&H Copy

THIS RUN EXECUTED 24 MAY 79 16.07.03

(12)

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  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR =  01,02
  MODIFICATION =  50,51,52,53
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T3      BACKWATERS FOR 10, 50, 100, + 500 YEAR FLOOD PEAKS

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GR	6,800	4281,400	7,200	4339,300	8,500	4403,000	8,500	4510,000	7,800	5098,800
GR	7,100	5264,000	6,900	5398,700	6,300	5429,100	6,100	5482,800	7,000	5583,800
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EJ	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.

Lagunitas Cr. DeReach Delineation.

THIS RUN EXECUTED 24 MAY 79 16.07.03

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  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR =  01,02
  MODIFICATION =  50,51,52,53
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NOTE= ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

BACKWATERS FOR 10, 50, 1

SUMMARY PRINTOUT TABLE 110

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225.000	9.10	0.	9.51	2544.33	761.74	20643.68	13434.58	0.	0.	3748.80	4129.30	0.
300.000	6.00	0.	6.69	635.28	0.	14400.96	299.04	0.	0.	3748.80	4129.30	0.
300.000	8.51	0.	8.84	2532.75	331.12	16707.12	7961.76	0.	0.	3748.80	4129.30	0.
300.000	8.75	0.	9.09	2538.38	474.00	17814.04	9761.96	0.	0.	3748.80	4129.30	0.
300.000	9.23	0.	9.60	2545.98	823.96	20130.32	13885.73	0.	0.	3748.80	4129.30	0.
400.000	6.31	0.	6.91	794.57	0.	14201.66	498.34	0.	0.	3748.80	4129.30	0.
400.000	8.64	0.	8.94	2535.97	383.67	16223.39	8392.93	0.	0.	3748.80	4129.30	0.
400.000	8.89	0.	9.20	2541.68	532.33	17306.61	10211.06	0.	0.	3748.80	4129.30	0.
400.000	9.38	0.	9.72	2547.85	891.84	19581.15	14367.01	0.	0.	3748.80	4129.30	0.

SECND	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
500.000	6.57	0.	7.10	1121.54	0.	13944.16	755.84	0.	0.	3748.80	4129.30	0.
500.000	8.76	0.	9.03	2538.72	427.86	15829.41	8742.73	0.	0.	3748.80	4129.30	0.
500.000	9.01	0.	9.30	2543.30	580.93	16891.87	10577.20	0.	0.	3748.80	4129.30	0.
500.000	9.51	0.	9.82	2549.45	948.07	19134.21	14757.72	0.	0.	3748.80	4129.30	0.
650.000	6.90	0.	7.33	1556.01	0.	13501.25	1198.75	0.	0.	3748.80	4129.30	0.
650.000	8.92	0.	9.16	2542.08	483.38	15348.00	9168.62	0.	0.	3748.80	4129.30	0.
650.000	9.17	0.	9.42	2545.26	641.54	16386.26	11022.19	0.	0.	3748.80	4129.30	0.
650.000	9.67	0.	9.95	2551.53	1017.89	18588.59	15233.52	0.	0.	3748.80	4129.30	0.
850.000	7.25	0.	7.58	2052.25	1.06	12807.61	1891.33	0.	0.	3748.80	4129.30	0.
850.000	9.09	0.	9.30	2544.12	540.69	14862.49	9596.81	0.	0.	3748.80	4129.30	0.
850.000	9.35	0.	9.57	2547.36	703.84	15878.93	11467.24	0.	0.	3748.80	4129.30	0.
850.000	9.86	0.	10.11	2553.77	1089.42	18039.54	15711.04	0.	0.	3748.80	4129.30	0.
908.000	7.16	0.	7.73	964.78	0.	13965.19	734.81	0.	0.	3722.10	4126.10	0.
908.000	8.91	0.	9.46	1929.06	0.	19132.53	5867.47	0.	0.	3722.10	4126.10	0.
908.000	9.16	0.	9.73	1931.05	0.	20577.41	7472.59	0.	0.	3722.10	4126.10	0.
908.000	9.65	0.	10.29	1935.03	0.	23531.14	11308.86	0.	0.	3722.10	4126.10	0.

BACKWATERS FOR 10, 50, 1

SUMMARY PRINTOUT TABLE 150

SECND	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
0.	-0.	0.	0.	-2.00	14700.00	3.20	3.18	5.35	110.11	11.76	1250.35	1400.92
0.	-0.	0.	0.	-2.00	25000.00	5.30	5.25	7.93	92.31	13.05	1954.21	2602.02
0.	-0.	0.	0.	-2.00	28050.00	7.20	7.19	8.47	39.34	9.59	3762.24	4472.33
0.	-0.	0.	0.	-2.00	34840.00	7.80	7.80	8.98	36.91	9.73	5143.36	5734.54
25.000	25.00	0.	0.	-2.00	14700.00	4.43	0.	5.70	51.07	9.04	1630.52	2057.07
25.000	25.00	0.	0.	-2.00	25000.00	7.83	5.25	8.43	18.51	6.91	5218.06	5810.90
25.000	25.00	0.	0.	-2.00	28050.00	8.05	0.	8.67	19.12	7.16	5778.76	6414.56
* 25.000	25.00	0.	0.	-2.00	34840.00	8.52	7.80	9.16	19.78	7.57	6948.69	7834.17
50.000	25.00	0.	0.	-2.00	14700.00	4.70	0.	5.85	44.01	8.59	1723.40	2215.74
50.000	25.00	0.	0.	-2.00	25000.00	7.95	0.	8.48	16.43	6.58	5556.04	6168.47
50.000	25.00	0.	0.	-2.00	28050.00	8.17	0.	8.72	17.23	6.87	6077.94	6757.72
50.000	25.00	0.	0.	-2.00	34840.00	8.63	0.	9.22	17.90	7.28	7251.83	8234.76
100.000	50.00	0.	0.	-2.00	14700.00	5.09	0.	6.08	35.62	7.98	1870.39	2463.03
100.000	50.00	0.	0.	-2.00	25000.00	8.11	0.	8.57	14.48	6.26	5915.36	6569.49
100.000	50.00	0.	0.	-2.00	28050.00	8.34	0.	8.82	14.86	6.47	6508.15	7275.47
100.000	50.00	0.	0.	-2.00	34840.00	8.80	0.	9.31	15.57	6.88	7685.84	8830.50
150.000	50.00	0.	0.	-2.00	14700.00	5.38	0.	6.26	30.63	7.56	1986.96	2655.98
150.000	50.00	0.	0.	-2.00	25000.00	8.23	0.	8.65	12.98	5.99	6231.43	6939.21
150.000	50.00	0.	0.	-2.00	28050.00	8.47	0.	8.90	13.34	6.20	6829.81	7680.62
150.000	50.00	0.	0.	-2.00	34840.00	8.94	0.	9.40	14.03	6.60	8016.99	9302.49
225.000	75.00	0.	0.	-2.00	14700.00	5.72	0.	6.49	25.69	7.10	2149.77	2900.25
225.000	75.00	0.	0.	-2.00	25000.00	8.38	0.	8.75	11.39	5.69	6613.22	7406.14
225.000	75.00	0.	0.	-2.00	28050.00	8.62	0.	9.00	11.72	5.88	7220.73	8193.06
225.000	75.00	0.	0.	-2.00	34840.00	9.10	0.	9.51	12.38	6.28	8423.36	9902.72
300.000	75.00	0.	0.	-2.00	14700.00	6.00	0.	6.69	22.15	6.73	2320.31	3123.59
300.000	75.00	0.	0.	-2.00	25000.00	8.51	0.	8.84	10.26	5.45	6926.05	7804.76
300.000	75.00	0.	0.	-2.00	28050.00	8.75	0.	9.09	10.57	5.64	7541.40	8629.37
300.000	75.00	0.	0.	-2.00	34840.00	9.23	0.	9.60	11.19	6.03	8759.04	10414.82
400.000	100.00	0.	0.	-2.00	14700.00	6.31	0.	6.91	18.70	6.32	2537.51	3398.99
400.000	100.00	0.	0.	-2.00	25000.00	8.64	0.	8.94	9.14	5.20	7277.74	8269.59
400.000	100.00	0.	0.	-2.00	28050.00	8.89	0.	9.20	9.42	5.39	7902.58	9137.55
400.000	100.00	0.	0.	-2.00	34840.00	9.38	0.	9.72	10.01	5.77	9139.12	11012.07
500.000	100.00	0.	0.	-2.00	14700.00	6.57	0.	7.10	16.05	5.95	2803.17	3668.78
500.000	100.00	0.	0.	-2.00	25000.00	8.76	0.	9.03	8.29	5.01	7578.50	8680.77
500.000	100.00	0.	0.	-2.00	28050.00	9.01	0.	9.30	8.56	5.19	8212.25	9588.17
500.000	100.00	0.	0.	-2.00	34840.00	9.51	0.	9.82	9.11	5.55	9466.31	11540.75
650.000	150.00	0.	0.	-2.00	14700.00	6.90	0.	7.33	13.09	5.49	3215.70	4062.73
650.000	150.00	0.	0.	-2.00	25000.00	8.92	0.	9.16	7.34	4.77	7965.77	9228.39
650.000	150.00	0.	0.	-2.00	28050.00	9.17	0.	9.42	7.58	4.94	8611.32	10187.68
650.000	150.00	0.	0.	-2.00	34840.00	9.67	0.	9.95	8.10	5.30	9890.09	12245.08
850.000	200.00	0.	0.	-2.00	14700.00	7.25	0.	7.58	10.39	4.95	3861.73	4559.57
850.000	200.00	0.	0.	-2.00	25000.00	9.09	0.	9.30	6.46	4.53	8379.78	9837.30
850.000	200.00	0.	0.	-2.00	28050.00	9.35	0.	9.57	6.68	4.70	9038.93	10852.87
850.000	200.00	0.	0.	-2.00	34840.00	9.86	0.	10.11	7.15	5.04	10346.88	13028.59

SECND	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
908.000	58.00	0.	0.	-2.10	14700.00	7.16	0.	7.73	17.52	6.19	2642.74	3511.86
908.000	58.00	0.	0.	-2.10	25000.00	8.91	0.	9.46	15.80	6.61	3174.07	6289.36
908.000	58.00	0.	0.	-2.10	28050.00	9.16	0.	9.73	16.55	6.89	3653.40	6895.46
908.000	58.00	0.	0.	-2.10	34840.00	9.65	0.	10.29	17.90	7.43	6609.90	8235.41

BACKWATERS FOR 10, 50, 1

SUMMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
0.	14700.00	3.20	0.	0.	0.	290.90	-0.
0.	25000.00	5.30	2.10	0.	0.	413.31	-0.
0.	28050.00	7.20	1.90	0.	0.	1999.93	-0.
0.	34840.00	7.80	.60	0.	0.	2516.39	-0.
25.000	14700.00	4.43	0.	1.23	0.	339.92	25.00
25.000	25000.00	7.83	3.40	2.53	0.	2517.07	25.00
25.000	28050.00	8.05	.22	.85	0.	2522.23	25.00
* 25.000	34840.00	8.52	.46	.72	0.	2532.96	25.00
50.000	14700.00	4.70	0.	.27	0.	360.26	25.00
50.000	25000.00	7.95	3.25	.12	0.	2520.18	25.00
50.000	28050.00	8.17	.22	.12	0.	2524.98	25.00
50.000	34840.00	8.63	.46	.12	0.	2535.73	25.00
100.000	14700.00	5.09	0.	.39	0.	394.39	50.00
100.000	25000.00	8.11	3.01	.15	0.	2523.49	50.00
100.000	28050.00	8.34	.23	.17	0.	2528.93	50.00
100.000	34840.00	8.80	.46	.17	0.	2539.70	50.00
150.000	14700.00	5.38	0.	.29	0.	421.39	50.00
150.000	25000.00	8.23	2.85	.13	0.	2526.39	50.00
150.000	28050.00	8.47	.24	.13	0.	2531.87	50.00
150.000	34840.00	8.94	.47	.13	0.	2542.34	50.00
225.000	14700.00	5.72	0.	.34	0.	580.21	75.00
225.000	25000.00	8.38	2.66	.15	0.	2529.89	75.00
225.000	28050.00	8.62	.24	.15	0.	2535.45	75.00
225.000	34840.00	9.10	.47	.16	0.	2544.33	75.00
300.000	14700.00	6.00	0.	.28	0.	635.28	75.00
300.000	25000.00	8.51	2.51	.12	0.	2532.75	75.00
300.000	28050.00	8.75	.24	.13	0.	2538.38	75.00
300.000	34840.00	9.23	.48	.13	0.	2545.98	75.00
400.000	14700.00	6.31	0.	.31	0.	794.57	100.00
400.000	25000.00	8.64	2.34	.14	0.	2535.97	100.00
400.000	28050.00	8.89	.25	.14	0.	2541.68	100.00
400.000	34840.00	9.38	.49	.15	0.	2547.85	100.00
500.000	14700.00	6.57	0.	.26	0.	1121.54	100.00
500.000	25000.00	8.76	2.19	.12	0.	2538.72	100.00
500.000	28050.00	9.01	.25	.12	0.	2543.30	100.00
500.000	34840.00	9.51	.49	.13	0.	2549.45	100.00
650.000	14700.00	6.90	0.	.33	0.	1556.01	150.00
650.000	25000.00	8.92	2.02	.15	0.	2542.08	150.00
650.000	28050.00	9.17	.25	.16	0.	2545.26	150.00
650.000	34840.00	9.67	.50	.17	0.	2551.53	150.00
850.000	14700.00	7.25	0.	.35	0.	2052.25	200.00
850.000	25000.00	9.09	1.84	.17	0.	2544.12	200.00
850.000	28050.00	9.35	.26	.18	0.	2547.36	200.00
850.000	34840.00	9.86	.51	.19	0.	2553.77	200.00

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
908.000	14700.00	7.16	0.	-.09	0.	964.78	58.00
908.000	25000.00	8.91	1.75	-.17	0.	1929.06	58.00
908.000	28050.00	9.16	.25	-.19	0.	1931.05	58.00
908.000	34840.00	9.65	.49	-.21	0.	1935.03	58.00

SUMMARY OF ERRORS

CAUTION SECNO= 25.000 PROFILE= 4 20 TRIALS ATTEMPTED TO BALANCE WSEL

LAGUNITAS Multiple Backwater Record Run

clean (3)

```
                                                                                THIS RUN EXECUTED  03 MAY 79   16.18.46
*************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR = 01,02
  MODIFICATION = 50,51,52,53
*************************************************

T1 MARIN COUNTY - FIS - LAGUNITAS CR.
T2 DETAIL ANALYSIS
T3      BACKWATERS FOR 10, 50, 100, + 500 YEAR FLOOD PEAKS

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

    -0.       2.        -0.       -0.  -0.          -0.       -0.       -0.       2.900     -0.

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

    1.000     -0.       -1.000    -0.       -0.       -0.       -0.       -0.       -0.       -0.

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    110.000   150.000   201.000   -0.       -0.       -0.       -0.       -0.       -0.       -0.

NC        .035      .035      .035      .200      .300      -0.       -0.       -0.       -0.       -0.
QT     -0.       14700.000 25000.000 28050.000 34840.000      -0.       -0.       -0.       -0.       -0.

X1        0.        44.000  3748.800  4129.300     -0.       -0.       -0.       -0.       -0.       -0.
GR     13.100  3510.400     7.800  3526.400     7.200  3539.100     7.100  3570.900     7.600  3592.100
GR      7.600  3696.500     7.200  3748.800     7.100  3756.400    -2.000  3895.000    -2.000  4000.000
GR     -2.000  4085.000     7.200  4123.400     7.800  4129.300     7.000  4190.500     6.800  4244.200
GR      6.300  4427.300     6.400  4587.100     7.300  4668.100     6.100  4673.100     6.100  4690.300
GR      7.200  4694.600     7.600  4867.900     7.100  4929.400     7.500  4973.400     6.400  4978.100
GR      6.300  4998.400     6.900  5006.700     6.800  5115.700     7.100  5326.100     6.800  5511.900
GR      6.400  5537.000     5.300  5544.900     7.000  5552.900     6.900  5579.400     4.800  5601.000
GR      6.800  5609.400     6.100  5655.000     4.000  5767.100     8.900  5786.000     5.600  5808.500
GR      5.600  5921.400     6.300  5981.900     6.100  6038.400    13.900  6112.400     -0.       -0.

X1    908.000    31.000  3722.100  4126.100   908.000   908.000   908.000     -0.       -0.       -0.
GR     40.600  3430.400    35.800  3475.300    13.700  3519.100    11.800  3683.300    14.300  3722.100
GR     12.500  3738.500     7.200  3766.200     7.000  3846.000     4.000  3859.400    -2.100  3910.000
GR     -2.100  4000.000    -2.100  4110.000     6.100  4121.800     8.400  4126.100     6.900  4151.400
GR      6.800  4281.400     7.200  4339.300     8.500  4403.000     8.500  4510.000     7.800  5098.800
GR      7.100  5264.000     6.900  5398.700     6.300  5429.100     6.100  5482.800     7.000  5583.800
GR      5.200  5600.200     5.000  5675.300    15.000  5703.400    14.600  5732.800    15.100  5760.500
GR     78.300  5868.700     -0.       -0.       -0.       -0.       -0.       -0.       -0.       -0.

X1   2562.000    50.000  3803.500  4111.900  1654.000  1654.000  1654.000     -0.       -0.       -0.
GR     13.500  2169.900     4.500  2199.900     2.500  2249.900     1.000  2259.900     1.000  2319.900
GR     10.000  2344.900     3.600  2363.300     4.700  2395.800     2.400  2422.500     2.900  2547.100
GR      1.900  2742.900     0.     2750.100      .900  2822.600     2.400  2830.500     3.500  3030.000
GR      2.800  3382.200     3.600  3652.300     3.600  3792.900     7.700  3803.500     7.600  3824.900
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GR	2.800	3382.200	3.600	3652.300	3.600	3792.900	7.700	3803.500	7.600	3824.900
GR	4.700	3851.200	4.900	3880.700	5.900	3892.100	5.100	3907.500	-2.500	3980.000
GR	-2.500	4000.000	-2.500	4080.000	5.100	4103.100	11.100	4111.900	4.200	4134.300
GR	3.600	4204.600	4.200	4271.600	2.700	4298.100	3.900	4302.700	3.900	4410.300
GR	2.600	4420.500	3.800	4429.500	4.500	4514.100	4.000	4585.400	2.400	4597.600
GR	3.500	4629.500	2.000	4687.300	3.800	4696.500	3.900	4850.400	3.200	5102.900
GR	2.500	5365.300	10.200	5393.900	9.200	5423.900	18.000	5443.900	19.000	5508.900
X1	4151.000	47.000	3825.200	4127.000	1598.000	1589.000	1589.000	-0.	-0.	-0.
GR	12.300	2137.900	4.000	2177.900	3.000	2207.900	1.000	2217.900	.500	2267.900
GR	8.600	2287.900	1.900	2301.500	1.400	2319.300	2.400	2335.200	2.800	2438.300
GR	1.500	2678.900	2.900	2801.900	1.000	2811.600	1.000	2819.200	3.300	2824.500
GR	2.700	2857.600	1.600	2904.600	3.000	2932.800	3.300	3209.500	2.800	3540.400
GR	1.900	3725.000	2.700	3795.100	5.400	3817.100	10.600	3825.200	4.800	3852.200
GR	4.800	3933.300	4.300	3943.400	-2.600	3970.000	-2.600	4000.000	-2.600	4040.000
GR	4.600	4099.700	11.000	4127.000	4.900	4150.200	4.200	4284.900	5.700	4338.500
GR	4.700	4436.300	3.000	4446.600	4.300	4458.100	5.300	4597.500	5.000	4716.200
GR	4.000	4734.800	5.600	5004.800	5.800	5308.100	7.900	5504.000	10.300	5523.700
GR	10.500	5559.900	22.800	5600.000	-0.	-0.	-0.	-0.	-0.	-0.
X1	5895.000	42.000	3883.000	4107.100	1744.000	1744.000	1744.000	-0.	-0.	-0.
GR	23.000	1587.500	20.500	1627.500	12.000	1647.500	12.000	1687.500	1.000	1737.500
GR	8.700	1777.500	3.200	1795.100	3.300	1814.900	-.300	1819.000	-.500	1827.000
GR	2.900	1834.000	3.000	2361.900	2.900	2454.300	4.100	2459.400	3.900	2472.500
GR	2.400	2495.300	2.800	2751.700	2.500	3076.700	1.600	3273.600	-.300	3283.500
GR	-.500	3298.900	2.300	3305.800	2.900	3381.400	1.600	3548.600	3.000	3765.800
GR	3.100	3865.600	10.000	3883.000	3.800	3906.900	-2.700	3940.000	-2.700	4000.000
GR	-2.700	4080.000	3.300	4087.000	9.400	4107.100	4.700	4129.400	6.700	4188.800
GR	4.400	4419.900	5.700	4503.100	4.000	4551.900	7.300	4577.100	8.100	4613.000
GR	5.000	4623.000	72.000	4713.000	-0.	-0.	-0.	-0.	-0.	-0.
NC	.035	.060	.035	-0.	-0.	-0.	-0.	-0.	-0.	-0.
DT	-0.	13960.000	23800.000	26800.000	33310.000	-0.	-0.	-0.	-0.	-0.

Upstream at Rt. Side Stream

X1	7838.000	38.000	3900.900	4158.900	1943.000	1943.000	1943.000	-0.	-0.	-0.
GR	12.200	282.800	5.000	309.400	4.300	652.600	4.300	1095.800	4.700	1547.400
GR	6.700	1553.400	7.700	1566.600	6.000	1576.500	4.900	1902.600	4.700	2320.100
GR	3.800	2495.100	.500	2506.300	3.400	2515.600	3.600	2539.900	.800	2546.900
GR	3.100	2554.200	1.500	2598.900	3.000	2684.700	1.700	2770.900	3.000	2841.600
GR	1.800	2909.100	4.300	2932.200	5.000	3161.200	3.400	3173.600	4.900	3185.300
GR	5.300	3494.700	7.000	3890.200	10.800	3900.900	7.100	3935.500	2.100	3950.500
GR	-2.900	3960.000	-2.900	4000.000	-2.900	4050.000	2.300	4056.000	8.600	4063.900
GR	8.800	4121.800	11.300	4158.900	13.200	4223.900	-0.	-0.	-0.	-0.
X1	9086.000	46.000	3871.600	4052.000	1200.000	1247.000	1247.000	-0.	-0.	-0.
GR	23.000	1572.100	22.800	1661.400	20.000	1724.700	11.800	1759.600	12.300	1813.100
GR	8.500	1833.600	8.300	1932.300	7.800	2242.200	9.600	2251.000	9.700	2262.400
GR	8.100	2273.100	7.500	2559.400	6.300	2977.200	5.400	3261.300	1.900	3290.500
GR	6.200	3322.500	5.500	3351.400	5.000	3380.000	6.800	3539.900	7.800	3737.600
GR	11.000	3871.600	9.900	3902.700	5.000	3919.200	6.400	3943.700	3.000	3961.500
GR	-2.000	3970.000	-2.000	4000.000	-2.000	4040.000	2.600	4042.300	9.900	4052.000
GR	7.500	4112.800	5.700	4249.300	7.400	4300.100	9.600	4315.700	9.700	4351.100
GR	4.600	4366.100	4.100	4490.900	4.100	4700.000	4.200	4905.500	4.100	5118.000
GR	4.300	5327.000	7.000	5537.900	9.900	5571.400	17.800	5594.800	17.500	5636.500
GR	27.900	5659.500	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
NC	-0.	.050	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
X1	9958.000	33.000	3900.400	4104.100	800.000	872.000	872.000	-0.	-0.	-0.
GR	25.100	2126.100	15.800	2162.700	12.000	2368.300	11.800	2408.400	6.400	2444.500

X1	9958.000	33.000	3900.400	4104.100	800.000	872.000	872.000	-0.	-0.	-0.
GR	25.100	2126.100	15.800	2162.700	12.000	2368.300	11.800	2408.400	6.400	2444.500
GR	6.600	2459.800	8.300	2467.900	8.000	2711.700	9.200	2902.000	7.900	2915.900
GR	6.800	2924.900	7.600	3292.400	8.300	3575.500	8.500	3886.000	14.200	3900.400
GR	9.900	3923.100	7.900	3947.200	3.900	3964.300	-1.500	3980.000	-1.500	4000.000
GR	-1.500	4040.000	3.700	4043.900	8.800	4077.500	11.300	4104.100	10.600	4120.500
GR	9.700	4160.900	5.000	4171.700	5.000	4191.500	8.100	4200.300	12.800	4326.200
GR	19.300	4405.400	23.300	4495.300	25.700	4633.300	-0.	-0.	-0.	-0.
NC	-0.	.070	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.

22.

X1	11330.000	38.000	3688.700	4125.900	1300.000	1370.000	1370.000	-0.	-0.	-0.
GR	27.600	3214.900	13.200	3287.600	12.600	3315.000	7.000	3324.500	7.000	3335.900
GR	8.100	3340.300	9.300	3455.300	9.200	3651.500	16.300	3674.500	16.300	3688.700
GR	12.900	3698.800	12.400	3732.400	11.000	3748.100	10.300	3870.100	10.100	3934.800
GR	5.800	3950.400	4.100	3965.600	-1.000	3970.000	-1.000	4000.000	-1.000	4032.000
GR	3.800	4037.200	11.600	4048.000	12.800	4125.900	12.800	4245.300	10.600	4289.800
GR	8.400	4322.800	7.300	4434.300	6.900	4619.600	7.400	4792.600	7.800	4899.800
GR	8.600	4980.000	10.300	5080.400	11.000	5227.200	10.900	5344.400	11.500	5413.000
GR	12.900	5452.400	18.300	5465.700	29.700	5533.600	-0.	-0.	-0.	-0.

X1	12316.000	40.000	3859.300	4154.200	987.000	987.000	987.000	-0.	-0.	-0.
GR	26.400	3302.000	21.900	3329.400	12.900	3367.600	14.600	3383.100	14.700	3418.500
GR	13.300	3434.500	15.400	3488.000	14.600	3615.200	10.700	3635.200	9.100	3718.300
GR	12.800	3859.300	12.100	3928.000	9.600	3945.100	4.000	3963.300	-.800	3970.000
GR	-.800	4000.000	-.800	4040.000	4.100	4047.500	15.400	4063.500	17.400	4154.200
GR	16.000	4175.600	16.900	4208.300	16.500	4264.500	11.200	4291.200	11.700	4384.300
GR	12.500	4499.500	8.800	4638.200	8.500	4762.700	10.000	4941.200	10.900	5133.000
GR	12.300	5264.100	10.600	5278.600	12.100	5296.800	12.700	5392.900	13.100	5616.200
GR	12.100	5660.900	13.900	5849.500	12.800	5898.200	18.300	5948.900	25.700	5976.800
BT	-0.	10140.000	18000.000	20670.000	25890.000	-0.	-0.	-0.	-0.	-0.

Upstream of Br & Olema Cr.

X1	12357.000	14.000	3950.000	4051.000	41.000	41.000	41.000	-0.	-0.	-0.
GR	25.000	3300.000	17.000	3400.000	15.000	3500.000	9.000	3740.000	12.500	3860.000
GR	12.000	3950.000	-1.000	3951.000	-1.000	4050.000	15.000	4051.000	16.500	4160.000
GR	11.000	4300.000	10.000	4900.000	13.000	5900.000	25.000	6100.000	-0.	-0.
SB	-0.	1.137	2.000	-0.	100.000	-0.	1800.000	-0.	-0.	-0.

X1	12388.000	17.000	3950.000	4051.000	31.000	31.000	31.000	-0.	-0.	-0.
X2	-0.	-0.	1.000	15.000	13.000	-0.	-0.	-0.	-0.	-0.
BT	17.000	3275.000	27.700	27.600	3400.000	18.100	18.000	3500.000	18.500	15.000
BT	3570.000	19.000	15.000	3720.000	19.100	15.000	3730.000	19.300	19.200	3900.000
BT	18.600	18.500	3950.000	18.200	14.000	3951.000	18.000	14.100	4050.000	18.000
BT	14.900	4051.000	18.200	15.000	4070.000	18.600	18.500	4150.000	17.100	17.000
BT	4170.000	13.000	12.500	4310.000	14.000	13.500	4390.000	21.100	21.000	4550.000
BT	24.600	24.500	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
GR	27.600	3275.000	18.000	3400.000	15.000	3500.000	10.500	3570.000	11.200	3720.000
GR	19.200	3730.000	18.500	3900.000	14.000	3950.000	-1.000	3951.000	-1.000	4050.000
GR	15.000	4051.000	18.500	4070.000	17.000	4150.000	12.500	4170.000	13.500	4310.000
GR	21.000	4390.000	24.500	4550.000	-0.	-0.	-0.	-0.	-0.	-0.

X1	12428.000	28.000	3901.900	4073.500	40.000	40.000	40.000	-0.	-0.	-0.
GR	28.400	3275.200	22.500	3356.800	15.000	3433.900	16.100	3452.400	15.400	3502.900
GR	12.600	3522.300	13.700	3535.600	13.500	3558.900	10.300	3574.400	11.300	3717.600
GR	19.300	3733.400	18.100	3806.400	18.500	3901.900	12.400	3934.300	3.700	3962.500
GR	-.700	3970.000	-.700	4000.000	-.700	4025.000	3.900	4044.800	18.700	4073.500
GR	16.900	4148.000	12.600	4171.200	12.900	4240.300	14.100	4314.900	16.500	4364.300

X1	12428.000	28.000	3901.900	4073.500	40.000	40.000	40.000	-0.	-0.	-0.
GR	28.400	3275.200	22.500	3356.800	15.000	3433.900	16.100	3452.400	15.400	3502.900
GR	12.600	3522.300	13.700	3535.600	13.500	3558.900	10.300	3574.400	11.300	3717.600
GR	19.300	3733.400	18.100	3806.400	18.500	3901.900	12.400	3934.300	3.700	3962.500
GR	-.700	3970.000	-.700	4000.000	-.700	4025.000	3.900	4044.800	18.700	4073.500
GR	16.900	4148.000	12.600	4171.200	12.900	4240.300	14.100	4314.900	16.500	4364.300
GR	21.000	4394.700	22.500	4447.200	24.600	4546.000	-0.	-0.	-0.	-0.
NC	.060	.060	.045	-0.	-0.	-0.	-0.	-0.	-0.	-0.
X1	12809.000	21.000	3919.100	4072.000	381.000	381.000	381.000	-0.	-0.	-0.
GR	24.300	3305.600	22.500	3396.700	15.700	3450.600	11.100	3474.900	11.600	3540.300
GR	10.500	3550.500	12.100	3597.900	12.600	3710.100	12.500	3834.100	13.300	3919.100
GR	11.800	3948.500	3.800	3968.200	1.000	3972.000	.500	4000.000	1.000	4033.000
GR	3.800	4037.200	12.600	4053.900	12.500	4072.000	18.400	4117.700	23.800	4207.100
GR	25.000	4385.000	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
X1	13624.000	25.000	3768.400	4139.400	815.000	815.000	815.000	-0.	-0.	-0.
GR	36.000	3456.500	27.400	3479.700	26.800	3497.300	17.000	3519.200	16.000	3568.300
GR	11.000	3645.200	13.100	3683.200	14.400	3768.400	2.100	3800.700	2.100	3821.700
GR	13.800	3853.800	13.700	3944.400	9.800	3960.600	3.900	3973.700	2.000	4000.000
GR	2.000	4034.000	3.600	4036.800	7.500	4045.100	8.500	4094.800	10.600	4139.400
GR	21.600	4221.600	29.000	4308.500	34.200	4457.900	34.100	4599.400	35.900	4648.000
NC	.060	.070	.045	-0.	-0.	-0.	-0.	-0.	-0.	-0.
X1	14885.000	25.000	3885.900	4051.600	1259.000	1259.000	1259.000	-0.	-0.	-0.
GR	76.600	2878.200	65.200	3010.600	38.900	3167.700	31.800	3273.900	31.800	3344.200
GR	29.000	3542.700	11.300	3682.300	12.400	3720.700	12.900	3767.300	8.400	3799.000
GR	10.000	3842.500	4.600	3873.200	10.800	3885.900	5.300	3938.700	3.500	3977.600
GR	3.100	4000.000	3.100	4032.100	16.000	4051.600	19.400	4117.700	15.600	4197.100
GR	16.700	4242.700	23.100	4254.100	47.900	4350.400	74.300	4465.200	90.700	4543.000
NC	.070	.070	.060	-0.	-0.	-0.	-0.	-0.	-0.	-0.
X1	15876.000	20.000	3966.600	4116.800	991.000	991.000	991.000	-0.	-0.	-0.
GR	63.500	3582.700	42.900	3688.800	35.200	3753.800	35.000	3772.500	17.300	3814.000
GR	14.400	3882.800	14.100	3966.600	6.600	3981.400	3.500	4000.000	6.300	4017.900
GR	8.100	4062.000	7.200	4100.400	13.000	4116.800	8.000	4129.000	8.400	4153.000
GR	17.800	4230.200	26.400	4256.200	26.300	4271.700	30.500	4276.500	57.900	4377.200
X1	16957.000	16.000	3928.000	4110.400	1080.000	1080.000	1080.000	-0.	-0.	-0.
GR	87.700	3553.100	73.800	3635.400	63.100	3707.400	41.300	3728.600	41.700	3760.600
GR	25.600	3790.500	15.400	3879.200	14.500	3928.000	4.600	3963.500	4.100	4006.000
GR	4.700	4038.900	13.500	4091.000	18.000	4110.400	19.500	4240.200	60.000	4349.000
GR	82.800	4449.500	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
EJ	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.

follows Det comps: Lagunitas Cr. Mult. Bkwtr. Summary

THIS RUN EXECUTED 03 MAY 79 16.18.48

Lagunitas Mult Bkwtr.

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  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR =  01,02
  MODIFICATION =  50,51,52,53
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

BACKWATERS FOR 10, 50, 1

SUMMARY PRINTOUT TABLE 110

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	0.	3.18	.28	5.35	290.47	0.	14700.00	0.	0.	0.	3748.80	4129.30	0.
*	0.	5.30	2.40	7.93	413.73	0.	24848.12	151.88	0.	0.	3748.80	4129.30	0.
*	0.	7.20	4.30	8.47	1998.05	.61	24651.82	3397.56	0.	0.	3748.80	4129.30	0.
*	0.	7.77	4.87	8.99	2512.91	95.75	27359.06	7385.19	0.	0.	3748.80	4129.30	0.
	908.000	7.79	0.	8.19	1178.68	0.	13165.18	1534.82	0.	0.	3722.10	4126.10	0.
	908.000	9.85	0.	10.14	1936.61	0.	16360.34	8639.66	0.	0.	3722.10	4126.10	0.
	908.000	9.89	0.	10.25	1936.92	0.	18244.32	9805.68	0.	0.	3722.10	4126.10	0.
	908.000	10.41	0.	10.81	1941.12	0.	20944.71	13895.29	0.	0.	3722.10	4126.10	0.
	2562.000	8.45	0.	8.46	3179.59	7753.71	2010.54	4935.75	0.	0.	3803.50	4111.90	0.
	2562.000	10.37	0.	10.39	3242.81	13054.68	3132.20	8813.12	0.	0.	3803.50	4111.90	0.
	2562.000	10.52	0.	10.54	3244.35	14638.15	3495.48	9916.37	0.	0.	3803.50	4111.90	0.
	2562.000	11.13	0.	11.16	3250.49	18137.72	4255.51	12446.77	0.	0.	3803.50	4111.90	0.
	4151.000	8.52	0.	8.54	3319.73	9748.90	1959.04	2992.06	0.	0.	3825.20	4127.00	0.
	4151.000	10.44	0.	10.46	3397.43	15612.37	2931.72	6455.91	0.	0.	3825.20	4127.00	0.
	4151.000	10.61	0.	10.63	3411.04	17445.09	3262.66	7342.25	0.	0.	3825.20	4127.00	0.
	4151.000	11.23	0.	11.27	3419.25	21334.94	3966.43	9538.63	0.	0.	3825.20	4127.00	0.
	5895.000	8.60	0.	8.62	2908.84	11454.13	2362.05	883.82	0.	0.	3883.00	4107.10	0.
	5895.000	10.53	0.	10.55	2936.24	19478.38	3394.26	2127.35	0.	0.	3883.00	4107.10	0.
	5895.000	10.71	0.	10.73	2937.30	21843.59	3767.82	2438.59	0.	0.	3883.00	4107.10	0.
	5895.000	11.35	0.	11.38	2941.08	27082.09	4517.32	3240.59	0.	0.	3883.00	4107.10	0.
	7838.000	8.70	0.	8.71	3770.07	12417.55	1542.45	0.	0.	0.	3900.90	4158.90	0.
	7838.000	10.63	0.	10.65	3858.18	21944.54	1855.46	0.	0.	0.	3900.90	4158.90	0.
	7838.000	10.83	0.	10.84	3863.90	24744.33	2055.67	0.	0.	0.	3900.90	4158.90	0.
	7838.000	11.49	0.	11.51	3879.72	30829.13	2480.85	.02	0.	0.	3900.90	4158.90	0.
	9086.000	8.81	0.	8.86	3507.16	4639.70	2871.50	6448.80	0.	0.	3871.60	4052.00	0.
	9086.000	10.73	0.	10.76	3733.09	10929.57	3082.26	9788.16	0.	0.	3871.60	4052.00	0.
	9086.000	10.93	0.	10.98	3749.43	12558.27	3321.57	10920.16	0.	0.	3871.60	4052.00	0.
	9086.000	11.61	0.	11.65	3759.60	16373.86	3826.17	13109.96	0.	0.	3871.60	4052.00	0.
*	9958.000	9.12	0.	9.85	1661.71	5284.29	8164.47	511.24	0.	0.	3900.40	4104.10	0.
	9958.000	10.90	0.	11.21	1821.54	15343.31	7594.84	861.85	0.	0.	3900.40	4104.10	0.
	9958.000	11.13	0.	11.47	1838.74	17718.23	8093.17	988.60	0.	0.	3900.40	4104.10	0.

THIS RUN EXECUTED 03 MAY 79 16.18.48

Laguna Mull Bkwtr.

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*****************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR =  01,02
  MODIFICATION =  50,51,52,53
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

BACKWATERS FOR 10, 50, 1

SUMMARY PRINTOUT TABLE 110

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	0.	3.18	.28	5.35	290.47	0.	14700.00	0.	0.	0.	3748.80	4129.30	0.
*	0.	5.30	2.40	7.93	413.73	0.	24848.12	151.88	0.	0.	3748.80	4129.30	0.
*	0.	7.20	4.30	8.47	1998.05	.61	24651.82	3397.56	0.	0.	3748.80	4129.30	0.
*	0.	7.77	4.87	8.99	2512.91	95.75	27359.06	7385.19	0.	0.	3748.80	4129.30	0.
	908.000	7.79	0.	8.19	1178.68	0.	13165.18	1534.82	0.	0.	3722.10	4126.10	0.
	908.000	9.85	0.	10.14	1936.61	0.	16360.34	8639.66	0.	0.	3722.10	4126.10	0.
	908.000	9.89	0.	10.25	1936.92	0.	18244.32	9805.68	0.	0.	3722.10	4126.10	0.
	908.000	10.41	0.	10.81	1941.12	0.	20944.71	13895.29	0.	0.	3722.10	4126.10	0.
	2562.000	8.45	0.	8.46	3179.59	7753.71	2010.54	4935.75	0.	0.	3803.50	4111.90	0.
	2562.000	10.37	0.	10.39	3242.81	13054.68	3132.20	8813.12	0.	0.	3803.50	4111.90	0.
	2562.000	10.52	0.	10.54	3244.35	14638.15	3495.48	9916.37	0.	0.	3803.50	4111.90	0.
	2562.000	11.13	0.	11.16	3250.49	18137.72	4255.51	12446.77	0.	0.	3803.50	4111.90	0.
	4151.000	8.52	0.	8.54	3319.73	9748.90	1959.04	2992.06	0.	0.	3825.20	4127.00	0.
	4151.000	10.44	0.	10.46	3397.43	15612.37	2931.72	6455.91	0.	0.	3825.20	4127.00	0.
	4151.000	10.61	0.	10.63	3411.04	17445.09	3262.66	7342.25	0.	0.	3825.20	4127.00	0.
	4151.000	11.23	0.	11.27	3419.25	21334.94	3966.43	9538.63	0.	0.	3825.20	4127.00	0.
	5895.000	8.60	0.	8.62	2908.84	11454.13	2362.05	883.82	0.	0.	3883.00	4107.10	0.
	5895.000	10.53	0.	10.55	2936.24	19478.38	3394.26	2127.35	0.	0.	3883.00	4107.10	0.
	5895.000	10.71	0.	10.73	2937.30	21843.59	3767.82	2438.59	0.	0.	3883.00	4107.10	0.
	5895.000	11.35	0.	11.38	2941.08	27082.09	4517.32	3240.59	0.	0.	3883.00	4107.10	0.
	7838.000	8.70	0.	8.71	3770.07	12417.55	1542.45	0.	0.	0.	3900.90	4158.90	0.
	7838.000	10.63	0.	10.65	3858.18	21944.54	1855.46	0.	0.	0.	3900.90	4158.90	0.
	7838.000	10.83	0.	10.84	3863.90	24744.33	2055.67	0.	0.	0.	3900.90	4158.90	0.
	7838.000	11.49	0.	11.51	3879.72	30829.13	2480.85	.02	0.	0.	3900.90	4158.90	0.
	9086.000	8.81	0.	8.86	3507.16	4639.70	2871.50	6448.80	0.	0.	3871.60	4052.00	0.
	9086.000	10.73	0.	10.76	3733.09	10929.57	3082.26	9788.16	0.	0.	3871.60	4052.00	0.
	9086.000	10.93	0.	10.98	3749.43	12558.27	3321.57	10920.16	0.	0.	3871.60	4052.00	0.
	9086.000	11.61	0.	11.65	3759.60	16373.86	3826.17	13109.96	0.	0.	3871.60	4052.00	0.
*	9958.000	9.12	0.	9.85	1661.71	5284.29	8164.47	511.24	0.	0.	3900.40	4104.10	0.
	9958.000	10.90	0.	11.21	1821.54	15343.31	7594.84	861.85	0.	0.	3900.40	4104.10	0.
	9958.000	11.13	0.	11.47	1838.74	17718.23	8093.17	988.60	0.	0.	3900.40	4104.10	0.
	9958.000	11.79	0.	12.14	1871.86	23144.97	8860.02	1305.01	0.	0.	3900.40	4104.10	0.

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
Prof Xsec 10	11330.000	12.07	0.	12.17	1857.02	2930.89	4802.45	6226.66	0.	0.	3688.70	4125.90	0.
	11330.000	13.05	0.	13.21	2123.68	5515.37	7346.47	10938.15	0.	0.	3688.70	4125.90	0.
	11330.000	13.34	0.	13.53	2134.02	6261.00	8278.43	12260.56	0.	0.	3688.70	4125.90	0.
	11330.000	13.92	0.	14.14	2141.95	7886.12	10279.05	15144.83	0.	0.	3688.70	4125.90	0.
11 Trans	12316.000	13.06	0.	13.37	1901.07	1717.42	7884.06	4358.51	0.	0.	3859.30	4154.20	0.
	12316.000	14.34	0.	14.71	2139.74	3607.50	10866.94	9325.56	0.	0.	3859.30	4154.20	0.
	12316.000	14.66	0.	15.04	2190.34	4201.51	11669.48	10929.01	0.	0.	3859.30	4154.20	0.
	12316.000	15.29	0.	15.70	2336.35	5592.07	13279.19	14438.74	0.	0.	3859.30	4154.20	0.
DSBr.	12357.000	13.22	0.	13.43	2139.55	1095.06	6464.63	2580.31	0.	0.	3950.00	4051.00	0.
	12357.000	14.53	0.	14.77	2247.22	2774.96	8593.32	6631.72	0.	0.	3950.00	4051.00	0.
	12357.000	14.85	0.	15.11	2273.63	3375.39	9256.30	8038.31	0.	0.	3950.00	4051.00	0.
	12357.000	15.50	0.	15.77	2368.47	4725.70	10248.86	10915.45	0.	0.	3950.00	4051.00	0.
DSBr.	12388.000	12.92	0.	13.58	351.85	763.73	9376.27	0.	0.	0.	3950.00	4051.00	0.
	12388.000	13.52	0.	15.25	445.69	1910.32	16072.57	17.11	0.	0.	3950.00	4051.00	0.
	12388.000	13.44	0.	15.77	436.38	2110.19	18545.41	14.40	0.	0.	3950.00	4051.00	0.
*	12388.000	14.94	0.	16.93	501.18	6339.54	19084.53	465.92	0.	0.	3950.00	4051.00	0.
12	12428.000	12.89	0.	13.66	364.60	842.32	9295.33	2.35	0.	0.	3901.90	4073.50	0.
	12428.000	13.51	0.	15.43	429.29	2067.16	15867.25	65.60	0.	0.	3901.90	4073.50	0.
	12428.000	13.40	0.	16.04	416.40	2254.46	18358.16	57.38	0.	0.	3901.90	4073.50	0.
	12428.000	14.99	0.	17.20	539.90	4905.22	20388.39	596.39	0.	0.	3901.90	4073.50	0.
13	12809.000	13.76	0.	14.51	620.96	1510.36	8622.87	6.77	0.	0.	3919.10	4072.00	0.
	12809.000	16.20	0.	16.88	654.09	5989.39	11907.56	103.04	0.	0.	3919.10	4072.00	0.
	12809.000	17.09	0.	17.72	667.85	7764.38	12736.75	168.87	0.	0.	3919.10	4072.00	0.
	12809.000	17.99	0.	18.71	682.09	10642.06	14966.76	281.17	0.	0.	3919.10	4072.00	0.
14	13624.000	15.67	0.	15.85	603.95	615.33	9399.35	125.32	0.	0.	3768.40	4139.40	0.
	13624.000	17.90	0.	18.17	676.65	1974.93	15672.33	352.74	0.	0.	3768.40	4139.40	0.
	13624.000	18.62	0.	18.92	683.78	2562.70	17654.00	453.29	0.	0.	3768.40	4139.40	0.
	13624.000	19.64	0.	20.01	693.63	3658.95	21580.88	650.17	0.	0.	3768.40	4139.40	0.
15	14885.000	16.56	0.	16.76	481.82	2937.98	7191.75	10.27	0.	0.	3885.90	4051.60	0.
	14885.000	18.99	0.	19.32	608.43	5931.94	11725.59	342.46	0.	0.	3885.90	4051.60	0.
	14885.000	19.72	0.	20.09	632.19	6975.67	13116.50	577.82	0.	0.	3885.90	4051.60	0.
	14885.000	20.85	0.	21.30	643.13	8982.20	15780.43	1127.37	0.	0.	3885.90	4051.60	0.
	15876.000	17.50	0.	17.80	414.15	688.18	7433.66	2018.16	0.	0.	3966.60	4116.80	0.
	15876.000	20.18	0.	20.63	430.15	2362.44	11721.81	3915.74	0.	0.	3966.60	4116.80	0.
	15876.000	20.96	0.	21.45	434.32	3010.54	13082.67	4576.79	0.	0.	3966.60	4116.80	0.
	15876.000	22.21	0.	22.80	441.03	4291.77	15729.90	5868.33	0.	0.	3966.60	4116.80	0.
	16957.000	19.23	0.	19.55	370.77	518.62	9583.64	37.74	0.	0.	3928.00	4110.40	0.
	16957.000	22.19	0.	22.69	427.31	1560.71	15532.96	906.33	0.	0.	3928.00	4110.40	0.
	16957.000	23.03	0.	23.57	436.81	1969.42	17370.94	1329.64	0.	0.	3928.00	4110.40	0.
	16957.000	24.44	0.	25.07	452.83	2812.85	20849.01	2228.13	0.	0.	3928.00	4110.40	0.

BACKWATERS FOR 10, 50, 1

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
*	0.	-0.	0.	0.	-2.00	14700.00	3.18	3.18	5.35	111.79	11.82	1243.92	1390.30
*	0.	-0.	0.	0.	-2.00	25000.00	5.30	5.30	7.93	92.11	13.04	1955.92	2604.84
*	0.	-0.	0.	0.	-2.00	28050.00	7.20	7.20	8.47	39.38	9.60	3757.94	4469.63
*	0.	-0.	0.	0.	-2.00	34840.00	7.77	7.77	8.99	37.79	9.82	5074.87	5667.62
	908.000	908.00	0.	0.	-2.10	14700.00	7.79	0.	8.19	12.09	5.30	3326.42	4227.72
	908.000	908.00	0.	0.	-2.10	25000.00	9.85	0.	10.14	8.05	5.05	6990.63	8814.05
	908.000	908.00	0.	0.	-2.10	28050.00	9.89	0.	10.25	9.86	5.60	7065.72	8931.09
	908.000	908.00	0.	0.	-2.10	34840.00	10.41	0.	10.81	10.80	6.07	8078.34	10599.75
	2562.000	1654.00	0.	0.	-2.50	14700.00	8.45	0.	8.46	.42	.98	17106.10	22646.20
	2562.000	1654.00	0.	0.	-2.50	25000.00	10.37	0.	10.39	.45	1.19	23237.89	37253.03
	2562.000	1654.00	0.	0.	-2.50	28050.00	10.52	0.	10.54	.53	1.30	23723.64	38526.77
	2562.000	1654.00	0.	0.	-2.50	34840.00	11.13	0.	11.16	.63	1.48	25701.83	43891.05
	4151.000	1589.00	0.	0.	-2.60	14700.00	8.52	0.	8.54	.52	1.07	15919.64	20361.13
	4151.000	1589.00	0.	0.	-2.60	25000.00	10.44	0.	10.46	.52	1.22	22353.51	34569.51
	4151.000	1589.00	0.	0.	-2.60	28050.00	10.61	0.	10.63	.61	1.33	24914.04	35936.52
	4151.000	1589.00	0.	0.	-2.60	34840.00	11.23	0.	11.27	.71	1.51	25048.96	41393.79
	5895.000	1744.00	0.	0.	-2.70	14700.00	8.60	0.	8.62	.41	1.18	18351.11	22965.86
	5895.000	1744.00	0.	0.	-2.70	25000.00	10.53	0.	10.55	.47	1.40	21980.21	36603.99
	5895.000	1744.00	0.	0.	-2.70	28050.00	10.71	0.	10.73	.54	1.53	24507.38	38026.57
	5895.000	1744.00	0.	0.	-2.70	34840.00	11.35	0.	11.38	.65	1.73	24395.74	43304.27
	7838.000	1943.00	0.	0.	-2.90	13960.00	8.70	0.	8.71	.57	1.20	15963.31	18486.68
	7838.000	1943.00	0.	0.	-2.90	23800.00	10.63	0.	10.65	.51	1.08	23355.53	33418.68
	7838.000	1943.00	0.	0.	-2.90	26800.00	10.83	0.	10.84	.58	1.17	24108.80	35165.23
	7838.000	1943.00	0.	0.	-2.90	33310.00	11.49	0.	11.51	.65	1.28	26670.76	41431.70
	9086.000	1247.00	0.	0.	-2.00	13960.00	8.81	0.	8.86	3.17	2.74	10156.64	7844.76
	9086.000	1247.00	0.	0.	-2.00	23800.00	10.73	0.	10.76	2.03	2.30	17097.41	16710.96
	9086.000	1247.00	0.	0.	-2.00	26800.00	10.93	0.	10.98	2.25	2.41	17876.83	17876.59
	9086.000	1247.00	0.	0.	-2.00	33310.00	11.61	0.	11.65	2.28	2.56	20394.69	22049.07
*	9958.000	872.00	0.	0.	-1.50	13960.00	9.12	9.12	9.85	35.36	8.56	2792.00	2347.79
	9958.000	872.00	0.	0.	-1.50	23800.00	10.90	0.	11.21	16.19	6.07	5895.34	5914.20
	9958.000	872.00	0.	0.	-1.50	26800.00	11.13	0.	11.47	16.91	6.26	6313.13	6517.99
	9958.000	872.00	0.	0.	-1.50	33310.00	11.79	0.	12.14	15.46	6.25	7541.22	8471.44
	11330.000	1370.00	0.	0.	-1.00	13960.00	12.07	0.	12.17	9.34	3.33	6309.66	4568.95
	11330.000	1370.00	0.	0.	-1.00	23800.00	13.05	0.	13.21	13.44	4.04	8213.00	6492.76
	11330.000	1370.00	0.	0.	-1.00	26800.00	13.34	0.	13.53	13.68	4.26	8842.52	7247.03
	11330.000	1370.00	0.	0.	-1.00	33310.00	13.92	0.	14.14	14.21	4.69	10078.52	8836.97
	12316.000	987.00	0.	0.	-.80	13960.00	13.06	0.	13.37	14.46	5.71	4688.51	3671.08
	12316.000	987.00	0.	0.	-.80	23800.00	14.34	0.	14.71	15.71	6.63	7325.16	6005.45
	12316.000	987.00	0.	0.	-.80	26800.00	14.66	0.	15.04	15.96	6.84	8016.07	6707.58
	12316.000	987.00	0.	0.	-.80	33310.00	15.29	0.	15.70	16.31	7.24	9458.57	8246.81
	12357.000	41.00	0.	0.	-1.00	10140.00	13.22	0.	13.43	4.55	4.55	3568.55	4754.75
	12357.000	41.00	0.	0.	-1.00	18000.00	14.53	0.	14.77	6.06	5.53	6442.19	7313.69
	12357.000	41.00	0.	0.	-1.00	20670.00	14.85	0.	15.11	6.58	5.84	9168.70	8056.81
	12357.000	41.00	0.	0.	-1.00	25890.00	15.50	0.	15.77	7.06	6.20	10678.56	9745.64

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
	12388.000	31.00	13.00	15.00	-1.00	10140.00	12.92	0.	13.58	10.35	6.74	1749.55	3151.60
	12388.000	31.00	13.00	15.00	-1.00	18000.00	13.52	0.	15.25	26.71	11.07	1965.66	3482.58
	12388.000	31.00	13.00	15.00	-1.00	20670.00	13.44	12.03	15.77	36.16	12.85	1934.74	3437.31
*	12388.000	31.00	13.00	15.00	-1.00	25890.00	14.94	14.94	16.93	66.06	12.31	2543.02	3165.29
	12428.000	40.00	0.	0.	-.70	10140.00	12.89	0.	13.66	14.99	7.30	1602.41	2619.40
	12428.000	40.00	0.	0.	-.70	18000.00	13.51	0.	15.43	37.09	11.71	1847.88	2955.75
*	12428.000	40.00	0.	0.	-.70	20670.00	13.40	13.40	16.04	51.13	13.70	1800.21	2890.74
	12428.000	40.00	0.	0.	-.70	25890.00	14.99	0.	17.20	42.18	13.05	2590.46	3986.49
	12809.000	381.00	0.	0.	.50	10140.00	13.76	0.	14.51	36.39	7.48	1862.75	1681.00
	12809.000	381.00	0.	0.	.50	18000.00	16.20	0.	16.88	27.25	7.80	3417.09	3448.10
	12809.000	381.00	0.	0.	.50	20670.00	17.09	0.	17.72	23.54	7.67	3997.38	4260.31
	12809.000	381.00	0.	0.	.50	25890.00	17.99	0.	18.71	24.87	8.32	4610.69	5192.02
	13624.000	815.00	0.	0.	2.00	10140.00	15.67	0.	15.85	8.11	3.48	3263.39	3560.37
	13624.000	815.00	0.	0.	2.00	18000.00	17.90	0.	18.17	9.29	4.45	4700.15	5906.06
	13624.000	815.00	0.	0.	2.00	20670.00	18.62	0.	18.92	9.19	4.65	5199.65	6817.20
	13624.000	815.00	0.	0.	2.00	25890.00	19.64	0.	20.01	10.02	5.18	5898.35	8178.14
	14885.000	1259.00	0.	0.	3.10	10140.00	16.56	0.	16.76	6.42	4.02	3197.98	4000.52
	14885.000	1259.00	0.	0.	3.10	18000.00	18.99	0.	19.32	8.69	5.35	4525.23	6104.51
	14885.000	1259.00	0.	0.	3.10	20670.00	19.72	0.	20.09	9.09	5.67	4982.85	6856.83
	14885.000	1259.00	0.	0.	3.10	25890.00	20.85	0.	21.30	10.14	6.31	5704.52	8129.65
	15876.000	991.00	0.	0.	3.50	10140.00	17.50	0.	17.80	18.50	4.90	2549.34	2357.75
	15876.000	991.00	0.	0.	3.50	18000.00	20.18	0.	20.63	20.95	6.11	3685.00	3932.91
	15876.000	991.00	0.	0.	3.50	20670.00	20.96	0.	21.45	21.43	6.43	4020.75	4464.71
	15876.000	991.00	0.	0.	3.50	25890.00	22.21	0.	22.80	23.09	7.07	4567.87	5387.69
	16957.000	1080.00	0.	0.	4.10	10140.00	19.23	0.	19.55	14.22	4.65	2396.67	2689.45
	16957.000	1080.00	0.	0.	4.10	18000.00	22.19	0.	22.69	17.16	5.97	3610.66	4345.23
	16957.000	1080.00	0.	0.	4.10	20670.00	23.03	0.	23.57	17.76	6.31	3970.99	4905.38
	16957.000	1080.00	0.	0.	4.10	25890.00	24.44	0.	25.07	19.00	6.93	4597.27	5939.95

BACKWATERS FOR 10, 50, 1

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	0.	14700.00	3.18	0.	0.	.28	290.47	-0.
*	0.	25000.00	5.30	2.13	0.	2.40	413.73	-0.
*	0.	28050.00	7.20	1.89	0.	4.30	1998.05	-0.
*	0.	34840.00	7.77	.57	0.	4.87	2512.91	-0.
	908.000	14700.00	7.79	0.	4.61	0.	1178.68	908.00
	908.000	25000.00	9.85	2.06	4.55	0.	1936.61	908.00
	908.000	28050.00	9.89	.04	2.69	0.	1936.92	908.00
	908.000	34840.00	10.41	.52	2.64	0.	1941.12	908.00
	2562.000	14700.00	8.45	0.	.66	0.	3179.59	1654.00
	2562.000	25000.00	10.37	1.92	.52	0.	3242.81	1654.00
	2562.000	28050.00	10.52	.15	.63	0.	3244.35	1654.00
	2562.000	34840.00	11.13	.61	.72	0.	3250.49	1654.00
	4151.000	14700.00	8.52	0.	.07	0.	3319.73	1589.00
	4151.000	25000.00	10.44	1.92	.08	0.	3397.43	1589.00
	4151.000	28050.00	10.61	.17	.09	0.	3411.04	1589.00
	4151.000	34840.00	11.23	.63	.10	0.	3419.25	1589.00
	5895.000	14700.00	8.60	0.	.08	0.	2908.84	1744.00
	5895.000	25000.00	10.53	1.93	.09	0.	2936.24	1744.00
	5895.000	28050.00	10.71	.18	.10	0.	2937.30	1744.00
	5895.000	34840.00	11.35	.64	.12	0.	2941.08	1744.00
	7838.000	13960.00	8.70	0.	.09	0.	3770.07	1943.00
	7838.000	23800.00	10.63	1.93	.10	0.	3858.18	1943.00
	7838.000	26800.00	10.83	.20	.12	0.	3863.90	1943.00
	7838.000	33310.00	11.49	.66	.14	0.	3879.72	1943.00
	9086.000	13960.00	8.81	0.	.12	0.	3507.16	1247.00
	9086.000	23800.00	10.73	1.91	.10	0.	3733.09	1247.00
	9086.000	26800.00	10.93	.21	.11	0.	3749.43	1247.00
	9086.000	33310.00	11.61	.67	.12	0.	3759.60	1247.00
*	9958.000	13960.00	9.12	0.	.31	0.	1661.71	872.00
	9958.000	23800.00	10.90	1.78	.17	0.	1821.54	872.00
	9958.000	26800.00	11.13	.23	.19	0.	1838.74	872.00
	9958.000	33310.00	11.79	.66	.18	0.	1871.86	872.00
	11330.000	13960.00	12.07	0.	2.95	0.	1857.02	1370.00
	11330.000	23800.00	13.05	.97	2.14	0.	2123.68	1370.00
	11330.000	26800.00	13.34	.29	2.21	0.	2134.02	1370.00
	11330.000	33310.00	13.92	.58	2.13	0.	2141.95	1370.00
	12316.000	13960.00	13.06	0.	.98	0.	1901.07	987.00
	12316.000	23800.00	14.34	1.28	1.29	0.	2139.74	987.00
	12316.000	26800.00	14.66	.32	1.32	0.	2190.34	987.00
	12316.000	33310.00	15.29	.64	1.37	0.	2336.35	987.00
	12357.000	10140.00	13.22	0.	.16	0.	2139.55	41.00
	12357.000	18000.00	14.53	1.31	.19	0.	2247.22	41.00
	12357.000	20670.00	14.85	.32	.19	0.	2273.63	41.00
	12357.000	25890.00	15.50	.65	.21	0.	2368.47	41.00

BACKWATERS FOR 10, 50, 1

SUMMARY PRINTOUT TABLE 150

	SECND	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	0.	14700.00	3.18	0.	0.	.28	290.47	-0.
*	0.	25000.00	5.30	2.13	0.	2.40	413.73	-0.
*	0.	28050.00	7.20	1.89	0.	4.30	1998.05	-0.
*	0.	34840.00	7.77	.57	0.	4.87	2512.91	-0.
	908.000	14700.00	7.79	0.	4.61	0.	1178.68	908.00
	908.000	25000.00	9.85	2.06	4.55	0.	1936.61	908.00
	908.000	28050.00	9.89	.04	2.69	0.	1936.92	908.00
	908.000	34840.00	10.41	.52	2.64	0.	1941.12	908.00
	2562.000	14700.00	8.45	0.	.66	0.	3179.59	1654.00
	2562.000	25000.00	10.37	1.92	.52	0.	3242.81	1654.00
	2562.000	28050.00	10.52	.15	.63	0.	3244.35	1654.00
	2562.000	34840.00	11.13	.61	.72	0.	3250.49	1654.00
	4151.000	14700.00	8.52	0.	.07	0.	3319.73	1589.00
	4151.000	25000.00	10.44	1.92	.08	0.	3397.43	1589.00
	4151.000	28050.00	10.61	.17	.09	0.	3411.04	1589.00
	4151.000	34840.00	11.23	.63	.10	0.	3419.25	1589.00
	5895.000	14700.00	8.60	0.	.08	0.	2908.84	1744.00
	5895.000	25000.00	10.53	1.93	.09	0.	2936.24	1744.00
	5895.000	28050.00	10.71	.18	.10	0.	2937.30	1744.00
	5895.000	34840.00	11.35	.64	.12	0.	2941.08	1744.00
	7838.000	13960.00	8.70	0.	.09	0.	3770.07	1943.00
	7838.000	23800.00	10.63	1.93	.10	0.	3858.18	1943.00
	7838.000	26800.00	10.83	.20	.12	0.	3863.90	1943.00
	7838.000	33310.00	11.49	.66	.14	0.	3879.72	1943.00
	9086.000	13960.00	8.81	0.	.12	0.	3507.16	1247.00
	9086.000	23800.00	10.73	1.91	.10	0.	3733.09	1247.00
	9086.000	26800.00	10.93	.21	.11	0.	3749.43	1247.00
	9086.000	33310.00	11.61	.67	.12	0.	3759.60	1247.00
*	9958.000	13960.00	9.12	0.	.31	0.	1661.71	872.00
	9958.000	23800.00	10.90	1.78	.17	0.	1821.54	872.00
	9958.000	26800.00	11.13	.23	.19	0.	1838.74	872.00
	9958.000	33310.00	11.79	.66	.18	0.	1871.86	872.00
	11330.000	13960.00	12.07	0.	2.95	0.	1857.02	1370.00
	11330.000	23800.00	13.05	.97	2.14	0.	2123.68	1370.00
	11330.000	26800.00	13.34	.29	2.21	0.	2134.02	1370.00
	11330.000	33310.00	13.92	.58	2.13	0.	2141.95	1370.00
	12316.000	13960.00	13.06	0.	.98	0.	1901.07	987.00
	12316.000	23800.00	14.34	1.28	1.29	0.	2139.74	987.00
	12316.000	26800.00	14.66	.32	1.32	0.	2190.34	987.00
	12316.000	33310.00	15.29	.64	1.37	0.	2336.35	987.00
	12357.000	10140.00	13.22	0.	.16	0.	2139.55	41.00
	12357.000	18000.00	14.53	1.31	.19	0.	2247.22	41.00
	12357.000	20670.00	14.85	.32	.19	0.	2273.63	41.00
	12357.000	25890.00	15.50	.65	.21	0.	2368.47	41.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	12388.000	10140.00	12.92	0.	-.29	0.	351.85	31.00
	12388.000	18000.00	13.52	.60	-1.00	0.	445.69	31.00
	12388.000	20670.00	13.44	-.09	-1.41	0.	436.38	31.00
*	12388.000	25890.00	14.94	1.50	-.56	0.	501.18	31.00
	12428.000	10140.00	12.89	0.	-.03	0.	364.60	40.00
	12428.000	18000.00	13.51	.62	-.01	0.	429.29	40.00
*	12428.000	20670.00	13.40	-.11	-.04	0.	416.40	40.00
	12428.000	25890.00	14.99	1.59	.05	0.	539.90	40.00
	12809.000	10140.00	13.76	0.	.87	0.	620.96	381.00
	12809.000	18000.00	16.20	2.44	2.69	0.	654.09	381.00
	12809.000	20670.00	17.09	.88	3.68	0.	667.85	381.00
	12809.000	25890.00	17.99	.91	3.00	0.	682.09	381.00
	13624.000	10140.00	15.67	0.	1.91	0.	603.95	815.00
	13624.000	18000.00	17.90	2.22	1.69	0.	676.65	815.00
	13624.000	20670.00	18.62	.73	1.54	0.	683.78	815.00
	13624.000	25890.00	19.64	1.02	1.65	0.	693.63	815.00
	14885.000	10140.00	16.56	0.	.89	0.	481.82	1259.00
	14885.000	18000.00	18.99	2.42	1.09	0.	608.43	1259.00
	14885.000	20670.00	19.72	.74	1.10	0.	632.19	1259.00
	14885.000	25890.00	20.85	1.13	1.21	0.	643.13	1259.00
	15876.000	10140.00	17.50	0.	.93	0.	414.15	991.00
	15876.000	18000.00	20.18	2.69	1.19	0.	430.15	991.00
	15876.000	20670.00	20.96	.78	1.24	0.	434.32	991.00
	15876.000	25890.00	22.21	1.25	1.35	0.	441.03	991.00
	16957.000	10140.00	19.23	0.	1.73	0.	370.77	1080.00
	16957.000	18000.00	22.19	2.97	2.01	0.	427.31	1080.00
	16957.000	20670.00	23.03	.83	2.07	0.	436.81	1080.00
	16957.000	25890.00	24.44	1.41	2.23	0.	452.83	1080.00

SUMMARY OF ERRORS

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CAUTION  SECNO=     0.      PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=     0.      PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=     0.      PROFILE= 3  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=     0.      PROFILE= 4  CRITICAL DEPTH ASSUMED

CAUTION  SECNO= 9958.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO= 9958.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO= 9958.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO=12388.000  PROFILE= 4  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=12388.000  PROFILE= 4  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=12388.000  PROFILE= 4  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO=12428.000  PROFILE= 3  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=12428.000  PROFILE= 3  MINIMUM SPECIFIC ENERGY
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Lagunitas Fldwy & Tbl E

THIS RUN EXECUTED 14 MAY 79 08.29.48

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*************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR =  01,02
  MODIFICATION =  50,51,52,53
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

BACKWATERS FOR 10, 50, 1

SUMMARY PRINTOUT TABLE 110

SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
908.000	9.89	0.	10.21	1936.90	0.	17438.05	9361.95	0.	0.	3722.10	4126.10	0.
908.000	10.89	1.00	11.07	1940.00	0.	15114.57	11685.43	1940.00	3750.00	3722.10	4126.10	5690.00
2562.000	10.47	0.	10.49	3243.75	13989.22	3346.64	9464.13	0.	0.	3803.50	4111.90	0.
2562.000	11.29	.82	11.31	2600.00	10481.49	4142.24	12176.28	2600.00	2800.00	3803.50	4111.90	5400.00
4151.000	10.55	0.	10.57	3409.80	16691.65	3125.93	6982.42	0.	0.	3825.20	4127.00	0.
4151.000	11.38	.83	11.41	2700.00	12935.63	4050.97	9813.40	2700.00	2800.00	3825.20	4127.00	5500.00
5895.000	10.65	0.	10.67	2936.92	20873.97	3613.52	2312.51	0.	0.	3883.00	4107.10	0.
5895.000	11.49	.84	11.51	2500.00	20022.57	3966.88	2810.54	2500.00	2100.00	3883.00	4107.10	4600.00
7838.000	10.76	0.	10.78	3861.99	25886.67	2163.33	0.	0.	0.	3900.90	4158.90	0.
7838.000	11.60	.84	11.63	2900.00	25172.32	2877.68	0.	2900.00	1200.00	3900.90	4158.90	4100.00
9086.000	10.88	0.	10.93	3745.47	13082.25	3512.75	11455.00	0.	0.	3871.60	4052.00	0.
9086.000	11.73	.84	11.82	2480.00	21583.49	4950.46	1516.05	2480.00	1820.00	3871.60	4052.00	4300.00
9958.000	11.11	0.	11.48	1837.06	18502.30	8514.96	1032.73	0.	0.	3900.40	4104.10	0.
9958.000	12.09	.98	12.30	1883.50	19797.38	7111.58	1141.04	1900.00	2400.00	3900.40	4104.10	4300.00
11330.000	13.47	0.	13.66	2135.68	6573.09	8664.48	12812.43	0.	0.	3688.70	4125.90	0.
11330.000	13.75	.28	14.00	1750.00	0.	11354.71	16695.29	1750.00	3700.00	3688.70	4125.90	5450.00
12316.000	14.79	0.	15.18	2233.84	4460.22	11981.61	11608.16	0.	0.	3859.30	4154.20	0.
12316.000	15.40	.61	16.05	1093.45	6128.44	14862.64	7058.92	1300.00	3500.00	3859.30	4154.20	4800.00
12809.000	15.23	0.	16.38	640.09	6888.34	13739.90	41.75	0.	0.	3919.10	4072.00	0.
12809.000	16.20	.97	17.03	600.67	7656.75	12938.72	74.53	620.00	3500.00	3919.10	4072.00	4120.00
13624.000	17.35	0.	17.75	671.42	2639.11	17791.13	239.75	0.	0.	3768.40	4139.40	0.
13624.000	17.71	.36	18.17	500.00	2885.02	17784.98	0.	500.00	3600.00	3768.40	4139.40	4100.00
14885.000	18.62	0.	19.11	590.26	6716.35	13637.20	316.46	0.	0.	3885.90	4051.60	0.
14885.000	19.05	.42	19.57	435.72	6235.81	14335.84	98.35	450.00	3700.00	3885.90	4051.60	4150.00
15876.000	20.33	0.	20.90	430.95	2772.45	13384.68	4512.87	0.	0.	3966.60	4116.80	0.

BACKWATERS FOR 10, 50, 1

SUMMARY PRINTOUT TABLE 150

SECND	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
908.000	-0.	0.	0.	-2.10	26800.00	9.89	0.	10.21	9.02	5.36	7060.95	8923.63
908.000	-0.	0.	0.	-2.10	26800.00	10.89	0.	11.07	4.75	4.16	9000.34	12290.93
2562.000	1654.00	0.	0.	-2.50	26800.00	10.47	0.	10.49	.50	1.25	23534.33	38028.31
2562.000	1654.00	0.	0.	-2.50	26800.00	11.29	0.	11.31	.57	1.42	20877.67	35651.29
4151.000	1589.00	0.	0.	-2.60	26800.00	10.55	0.	10.57	.57	1.29	22717.40	35455.67
4151.000	1589.00	0.	0.	-2.60	26800.00	11.38	0.	11.41	.70	1.51	17687.97	32074.88
5895.000	1744.00	0.	0.	-2.70	26800.00	10.65	0.	10.67	.51	1.47	22319.28	37516.40
5895.000	1744.00	0.	0.	-2.70	26800.00	11.49	0.	11.51	.48	1.50	21425.73	38707.77
7838.000	1943.00	0.	0.	-2.90	28050.00	10.76	0.	10.78	.66	1.24	23834.62	34524.46
7838.000	1943.00	0.	0.	-2.90	28050.00	11.60	0.	11.63	.74	1.56	20555.51	32605.29
9086.000	1247.00	0.	0.	-2.00	28050.00	10.88	0.	10.93	2.54	2.57	17687.46	17590.03
9086.000	1247.00	0.	0.	-2.00	28050.00	11.73	0.	11.82	3.64	3.26	12002.59	14698.86
9958.000	872.00	0.	0.	-1.50	28050.00	11.11	0.	11.48	18.87	6.61	6272.09	6457.59
9958.000	872.00	0.	0.	-1.50	28050.00	12.09	0.	12.30	8.83	4.82	8099.19	9438.62
11330.000	1370.00	0.	0.	-1.00	28050.00	13.47	0.	13.66	13.74	4.34	9100.44	7567.06
11330.000	1370.00	0.	0.	-1.00	28050.00	13.75	0.	14.00	19.35	5.37	8036.07	6377.38
12316.000	987.00	0.	0.	-.80	28050.00	14.79	0.	15.18	15.99	6.92	6312.53	7014.93
12316.000	987.00	0.	0.	-.80	28050.00	15.40	0.	16.05	19.67	8.01	5588.10	6324.97
12809.000	473.00	0.	0.	.50	20670.00	15.23	0.	16.38	30.89	9.98	2788.33	3719.17
12809.000	473.00	0.	0.	.50	20670.00	16.20	0.	17.03	19.48	8.48	3220.56	4682.97
13624.000	815.00	0.	0.	2.00	20670.00	17.35	0.	17.75	8.80	5.36	4336.73	6967.83
13624.000	815.00	0.	0.	2.00	20670.00	17.71	0.	18.17	9.49	5.67	3928.79	6711.36
14885.000	1259.00	0.	0.	3.10	20670.00	18.62	0.	19.11	12.91	6.40	4307.51	5753.82
14885.000	1259.00	0.	0.	3.10	20670.00	19.05	0.	19.57	12.80	6.52	3946.06	5776.67
15876.000	991.00	0.	0.	3.50	20670.00	20.33	0.	20.90	26.28	6.89	3749.05	4032.24
15876.000	991.00	0.	0.	3.50	20670.00	20.77	0.	21.57	32.55	7.85	3130.56	3622.96
16957.000	1080.00	0.	0.	4.10	20670.00	22.74	0.	23.32	19.26	6.49	3847.25	4709.97
16957.000	1080.00	0.	0.	4.10	20670.00	23.54	0.	24.11	17.21	6.35	3663.74	4982.59

SECND	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
16957.000	22.74	0.	23.32	433.57	1910.24	17526.96	1232.81	0.	0.	3928.00	4110.40	0.
16957.000	23.54	.80	24.11	300.00	2067.60	18082.08	520.32	300.00	3850.00	3928.00	4110.40	4150.00

BACKWATERS FOR 10, 50, 1

SUMMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
908.000	26800.00	9.89	0.	0.	0.	1936.90	-0.
908.000	26800.00	10.89	1.00	0.	1.00	1940.00	-0.
2562.000	26800.00	10.47	0.	.58	0.	3243.75	1654.00
2562.000	26800.00	11.29	.82	.40	.82	2600.00	1654.00
4151.000	26800.00	10.55	0.	.08	0.	3409.80	1589.00
4151.000	26800.00	11.38	.83	.10	.83	2700.00	1589.00
5895.000	26800.00	10.65	0.	.09	0.	2936.92	1744.00
5895.000	26800.00	11.49	.84	.11	.84	2500.00	1744.00
7838.000	28050.00	10.76	0.	.11	0.	3861.99	1943.00
7838.000	28050.00	11.60	.84	.11	.84	2900.00	1943.00
9086.000	28050.00	10.88	0.	.12	0.	3745.47	1247.00
9086.000	28050.00	11.73	.84	.12	.84	2480.00	1247.00
9958.000	28050.00	11.11	0.	.22	0.	1837.06	872.00
9958.000	28050.00	12.09	.98	.36	.98	1883.50	872.00
11330.000	28050.00	13.47	0.	2.36	0.	2135.68	1370.00
11330.000	28050.00	13.75	.28	1.66	.28	1750.00	1370.00
12316.000	28050.00	14.79	0.	1.32	0.	2233.84	987.00
12316.000	28050.00	15.40	.61	1.65	.61	1093.45	987.00
12809.000	20670.00	15.23	0.	.44	0.	640.09	473.00
12809.000	20670.00	16.20	.97	.80	.97	600.67	473.00
13624.000	20670.00	17.35	0.	2.12	0.	671.42	815.00
13624.000	20670.00	17.71	.36	1.51	.36	500.00	815.00
14885.000	20670.00	18.62	0.	1.27	0.	590.26	1259.00
14885.000	20670.00	19.05	.42	1.33	.42	435.72	1259.00
15876.000	20670.00	20.33	0.	1.71	0.	430.95	991.00
15876.000	20670.00	20.77	.44	1.72	.44	300.00	991.00
16957.000	20670.00	22.74	0.	2.41	0.	433.57	1080.00
16957.000	20670.00	23.54	.80	2.77	.80	300.00	1080.00

SUMMARY OF ERRORS

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Appendix B: HEC-RAS Output (Run 1) - Hydraulic Analysis of Lagunitas Creek under Q_{100} and WSE=9.89 ft (base Condition) - (Run 1)

HEC-RAS Plan: Biris-current-TD River: RIVER-1 Reach: Reach-1

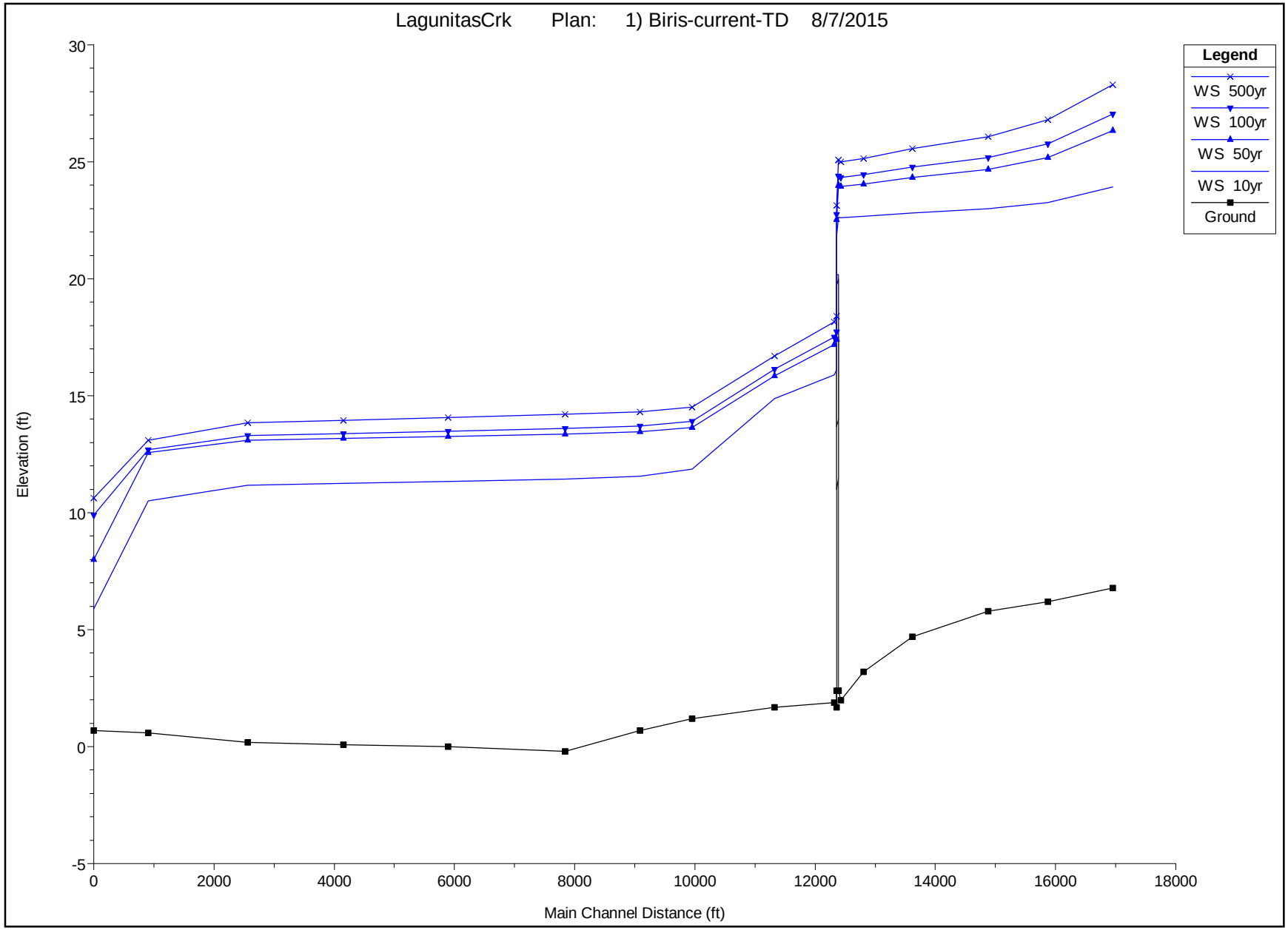
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	16957	10yr	10140.00	6.79	23.94		24.13	0.000737	3.74	3211.23	416.54	0.18
Reach-1	16957	50yr	18000.00	6.79	26.33		26.69	0.001157	5.23	4239.34	443.74	0.23
Reach-1	16957	100yr	20670.00	6.79	27.04		27.45	0.001264	5.63	4556.76	451.81	0.25
Reach-1	16957	500yr	25890.00	6.79	28.30		28.81	0.001446	6.33	5135.28	466.12	0.27
Reach-1	15876	10yr	10140.00	6.19	23.26		23.40	0.000604	3.35	3854.16	432.26	0.16
Reach-1	15876	50yr	18000.00	6.19	25.19		25.47	0.001069	4.87	4696.71	442.60	0.22
Reach-1	15876	100yr	20670.00	6.19	25.77		26.09	0.001204	5.31	4953.86	445.70	0.24
Reach-1	15876	500yr	25890.00	6.19	26.80		27.22	0.001452	6.08	5414.77	451.22	0.26
Reach-1	14885	10yr	10140.00	5.79	22.99		23.07	0.000191	2.67	5350.68	637.79	0.12
Reach-1	14885	50yr	18000.00	5.79	24.67		24.85	0.000373	4.02	6439.30	654.08	0.18
Reach-1	14885	100yr	20670.00	5.79	25.18		25.39	0.000431	4.41	6771.50	658.98	0.19
Reach-1	14885	500yr	25890.00	5.79	26.07		26.35	0.000540	5.11	7363.33	668.20	0.21
Reach-1	13624	10yr	10140.00	4.69	22.81		22.86	0.000132	1.93	6255.65	702.45	0.10
Reach-1	13624	50yr	18000.00	4.69	24.33		24.44	0.000261	2.94	7332.73	719.70	0.14
Reach-1	13624	100yr	20670.00	4.69	24.78		24.92	0.000302	3.24	7659.10	725.62	0.15
Reach-1	13624	500yr	25890.00	4.69	25.57		25.76	0.000383	3.79	8234.55	735.93	0.18
Reach-1	12809	10yr	10140.00	3.19	22.67		22.73	0.000185	2.52	6010.01	727.20	0.12
Reach-1	12809	50yr	18000.00	3.19	24.04		24.18	0.000376	3.83	7030.46	760.78	0.17
Reach-1	12809	100yr	20670.00	3.19	24.45		24.62	0.000440	4.21	7339.76	770.67	0.19
Reach-1	12809	500yr	25890.00	3.19	25.14		25.37	0.000566	4.91	7879.97	787.64	0.22
Reach-1	12428	10yr	10140.00	1.99	22.61		22.68	0.000112	2.51	6400.20	1004.14	0.12
Reach-1	12428	50yr	18000.00	1.99	23.94		24.08	0.000211	3.66	7750.68	1033.90	0.17
Reach-1	12428	100yr	20670.00	1.99	24.33		24.49	0.000243	4.00	8157.74	1051.58	0.18
Reach-1	12428	500yr	25890.00	1.99	25.00		25.21	0.000305	4.61	8870.00	1081.81	0.20
Reach-1	12388	10yr	10140.00	2.38	22.64	10.39	22.66	0.000056	1.21	8402.00	1114.27	0.08
Reach-1	12388	50yr	18000.00	2.38	24.00	13.87	24.05	0.000109	1.81	9965.69	1193.84	0.11
Reach-1	12388	100yr	20670.00	2.38	24.40	14.24	24.46	0.000126	1.98	10447.45	1217.31	0.12
Reach-1	12388	500yr	25890.00	2.38	25.08	14.93	25.16	0.000156	2.29	11293.50	1239.73	0.13
Reach-1	12372.5		Culvert									
Reach-1	12357	10yr	10140.00	1.69	16.11		16.29	0.000406	4.33	6006.01	2156.29	0.20
Reach-1	12357	50yr	18000.00	1.69	17.41		17.63	0.000553	5.32	8870.84	2262.84	0.24

HEC-RAS Plan: Biris-current-TD River: RIVER-1 Reach: Reach-1 (Continued)

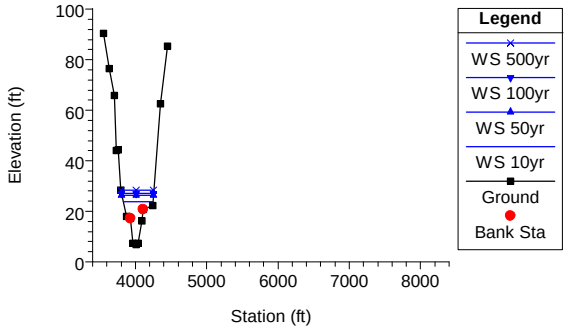
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	12357	100yr	20670.00	1.69	17.73		17.97	0.000603	5.63	9605.76	2292.61	0.25
Reach-1	12357	500yr	25890.00	1.69	18.39		18.65	0.000655	6.02	11167.00	2402.21	0.26
Reach-1	12316	10yr	13960.00	1.89	15.89		16.23	0.001495	5.88	4969.69	1957.59	0.39
Reach-1	12316	50yr	23800.00	1.89	17.18		17.56	0.001556	6.67	7657.24	2150.74	0.41
Reach-1	12316	100yr	26800.00	1.89	17.50		17.90	0.001610	6.95	8359.93	2238.17	0.42
Reach-1	12316	500yr	33310.00	1.89	18.15		18.57	0.001722	7.46	9852.11	2362.36	0.44
Reach-1	11330	10yr	13960.00	1.69	14.89		14.99	0.000960	3.38	6532.33	1872.47	0.29
Reach-1	11330	50yr	23800.00	1.69	15.85		16.02	0.001439	4.25	8446.61	2129.65	0.36
Reach-1	11330	100yr	26800.00	1.69	16.13		16.32	0.001460	4.46	9050.90	2135.36	0.36
Reach-1	11330	500yr	33310.00	1.69	16.70		16.93	0.001494	4.86	10273.94	2143.20	0.38
Reach-1	9958	10yr	13960.00	1.19	11.86	11.86	12.61	0.003633	8.68	2867.26	1672.11	0.60
Reach-1	9958	50yr	23800.00	1.19	13.65		13.96	0.001603	6.06	6009.15	1826.24	0.41
Reach-1	9958	100yr	26800.00	1.19	13.92		14.24	0.001625	6.16	6491.72	1846.04	0.41
Reach-1	9958	500yr	33310.00	1.19	14.52		14.87	0.001555	6.29	7618.57	1879.61	0.41
Reach-1	9086	10yr	13960.00	0.69	11.55		11.60	0.000330	2.81	10326.57	3512.51	0.18
Reach-1	9086	50yr	23800.00	0.69	13.46		13.50	0.000215	2.37	17264.61	3736.60	0.15
Reach-1	9086	100yr	26800.00	0.69	13.71		13.75	0.000231	2.45	18199.20	3754.72	0.16
Reach-1	9086	500yr	33310.00	0.69	14.32		14.37	0.000240	2.63	20493.92	3759.82	0.16
Reach-1	7838	10yr	13960.00	-0.21	11.43		11.44	0.000059	1.17	16143.87	3784.67	0.08
Reach-1	7838	50yr	23800.00	-0.21	13.36		13.38	0.000051	1.09	23534.08	3859.60	0.07
Reach-1	7838	100yr	26800.00	-0.21	13.60		13.62	0.000057	1.16	24456.93	3865.57	0.08
Reach-1	7838	500yr	33310.00	-0.21	14.20		14.22	0.000065	1.30	26777.11	3880.76	0.08
Reach-1	5895	10yr	14700.00	-0.01	11.34		11.35	0.000041	1.18	16472.58	2910.04	0.07
Reach-1	5895	50yr	25000.00	-0.01	13.26		13.28	0.000046	1.40	22105.90	2936.50	0.07
Reach-1	5895	100yr	28050.00	-0.01	13.49		13.51	0.000053	1.52	22767.21	2937.82	0.08
Reach-1	5895	500yr	34840.00	-0.01	14.06		14.10	0.000065	1.74	24460.96	2941.21	0.09
Reach-1	4151	10yr	14700.00	0.09	11.26		11.27	0.000052	1.07	16068.64	3321.16	0.07
Reach-1	4151	50yr	25000.00	0.09	13.18		13.20	0.000053	1.23	22498.16	3405.94	0.08
Reach-1	4151	100yr	28050.00	0.09	13.39		13.41	0.000060	1.33	23224.94	3412.51	0.08
Reach-1	4151	500yr	34840.00	0.09	13.95		13.98	0.000072	1.52	25124.32	3419.43	0.09
Reach-1	2562	10yr	14700.00	0.19	11.18		11.20	0.000042	0.98	17212.27	3180.18	0.07

HEC-RAS Plan: Biris-current-TD River: RIVER-1 Reach: Reach-1 (Continued)

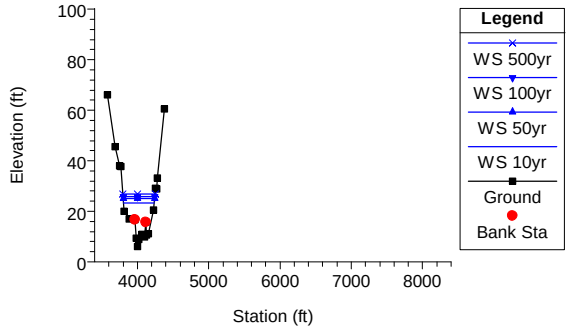
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2562	50yr	25000.00	0.19	13.10		13.12	0.000046	1.20	23360.16	3243.20	0.07
Reach-1	2562	100yr	28050.00	0.19	13.30		13.32	0.000052	1.30	24015.38	3245.28	0.08
Reach-1	2562	500yr	34840.00	0.19	13.84		13.87	0.000064	1.50	25759.78	3250.59	0.09
Reach-1	908	10yr	14700.00	0.59	10.50	5.85	10.92	0.001242	5.38	3343.35	1191.61	0.36
Reach-1	908	50yr	25000.00	0.59	12.57	8.13	12.86	0.000828	5.13	7035.50	1936.79	0.31
Reach-1	908	100yr	28050.00	0.59	12.68	8.91	13.03	0.000961	5.57	7260.96	1937.73	0.33
Reach-1	908	500yr	34840.00	0.59	13.10		13.51	0.001123	6.18	8066.20	1941.07	0.36
Reach-1	0	10yr	14700.00	0.69	5.88	5.88	8.04	0.011057	11.77	1248.65	290.79	1.00
Reach-1	0	50yr	25000.00	0.69	8.00	8.00	10.62	0.009203	13.04	1956.80	413.95	0.96
Reach-1	0	100yr	28050.00	0.69	9.89	8.99	11.24	0.004118	9.81	3762.24	1999.93	0.66
Reach-1	0	500yr	34840.00	0.69	10.64	10.64	11.74	0.003382	9.43	5513.35	2519.79	0.61


LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Elevation (ft)
Main Channel Distance (ft)
30
25
20
15
10
5
0
-5
0
2000
4000
6000
8000
10000
12000
14000
16000
18000

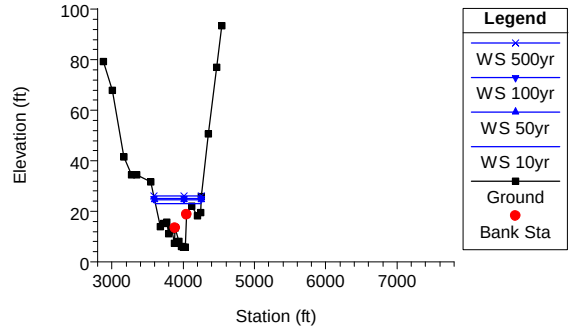
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 16957



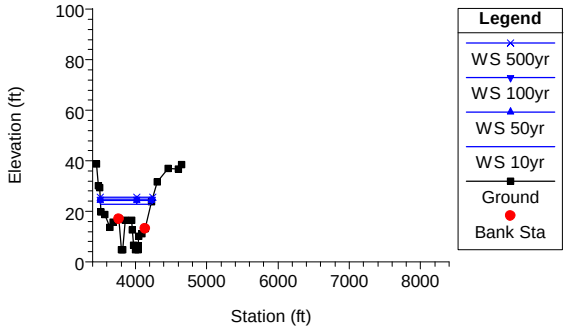
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 15876



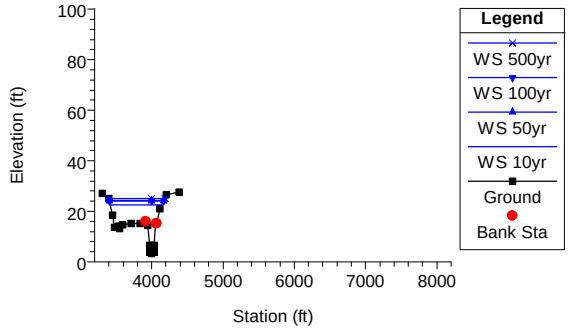
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 14885



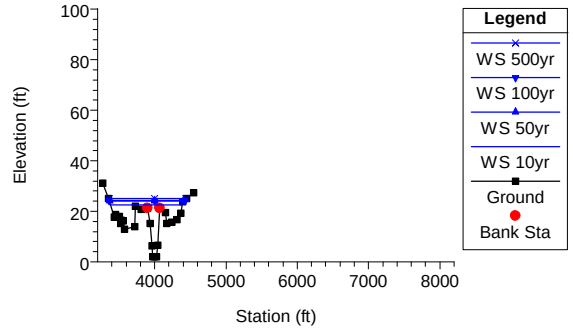
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 13624



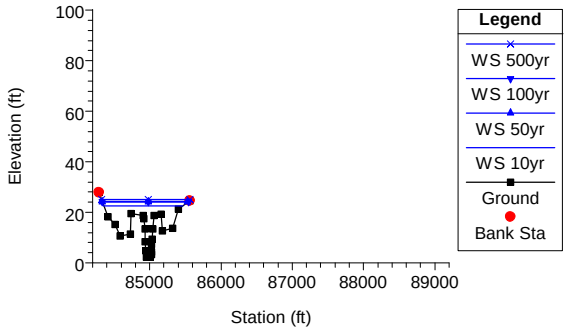
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12809



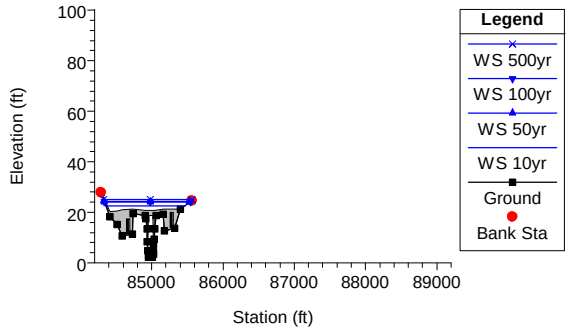
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12428



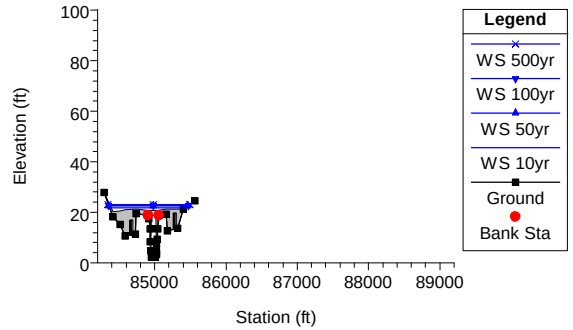
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12388



LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12372.5 Culv Bridge #1

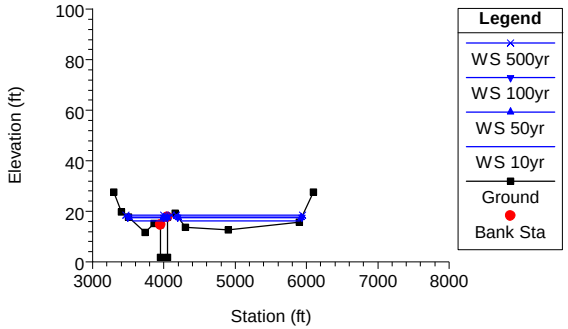


LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12372.5 Culv Bridge #1

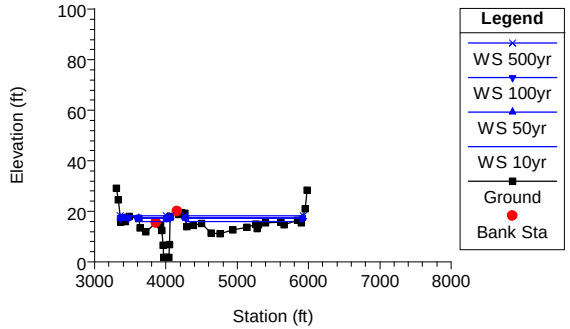


1 in Horiz. = 2693 ft 1 in Vert. = 76 ft

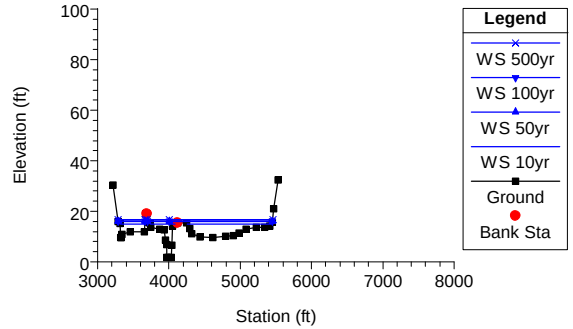
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12357



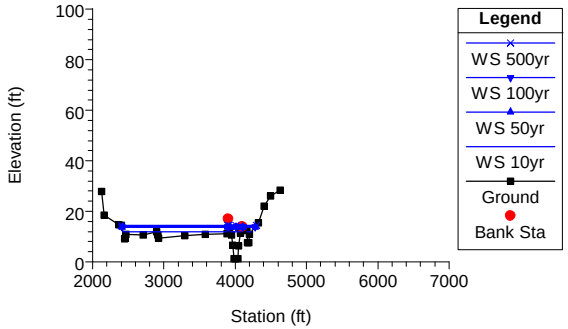
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12316



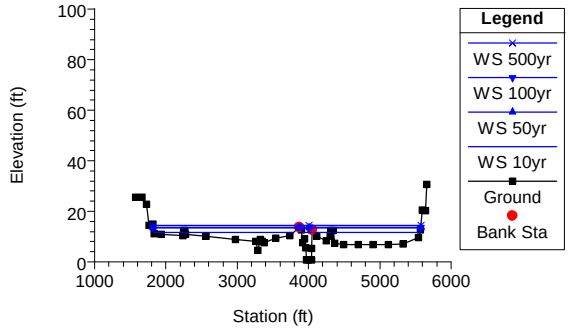
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 11330



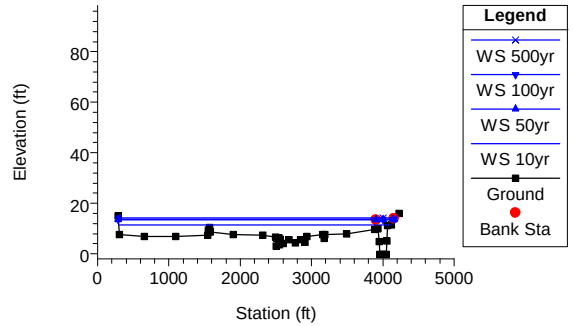
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 9958



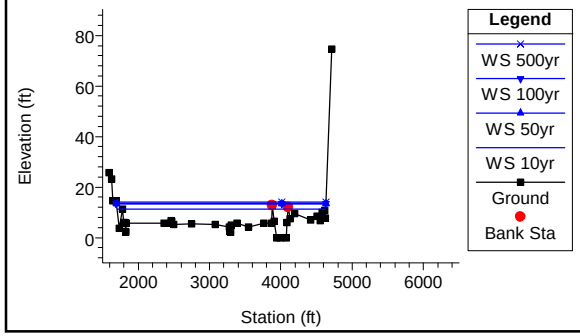
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 9086



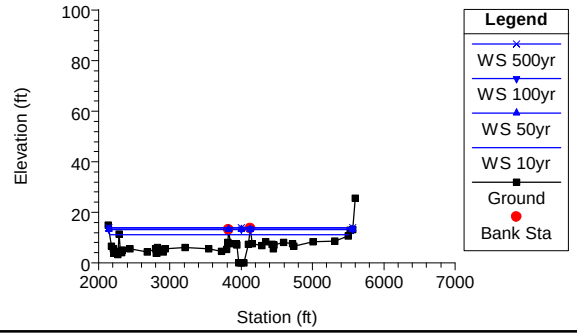
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 7838



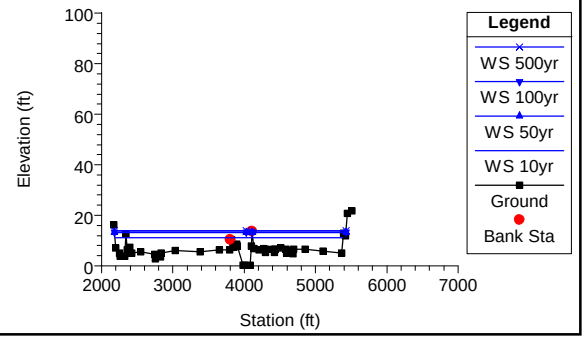
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 5895



LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 4151



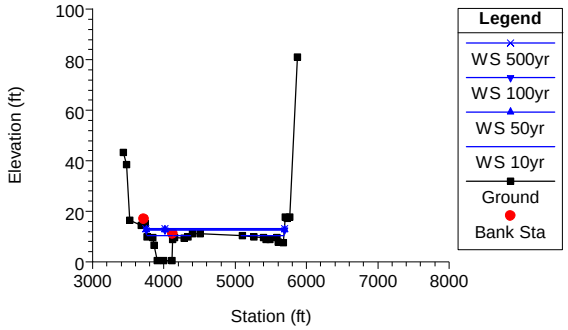
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 2562



1 in Horiz. = 2693 ft 1 in Vert. = 76 ft

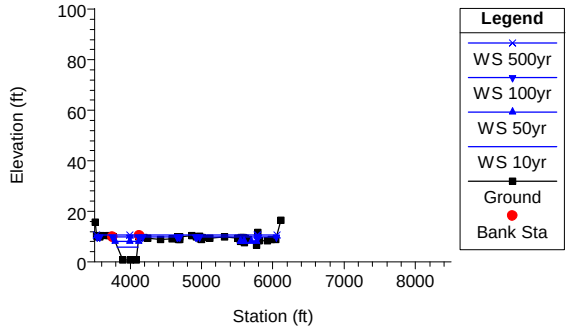
LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015

River = RIVER-1 Reach = Reach-1 RS = 908



LagunitasCrk Plan: 1) Biris-current-TD 8/7/2015

River = RIVER-1 Reach = Reach-1 RS = 0



1 in Horiz. = 2693 ft 1 in Vert. = 76 ft

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Appendix C: HEC-RAS Output (Run 2) - Hydraulic Analysis of Lagunitas Creek under Q_{100} and WSE=11.06 ft (Base Condition + SLR -Year-2050) - (Run 2)

HEC-RAS Plan: Biris 14 tidal River: RIVER-1 Reach: Reach-1

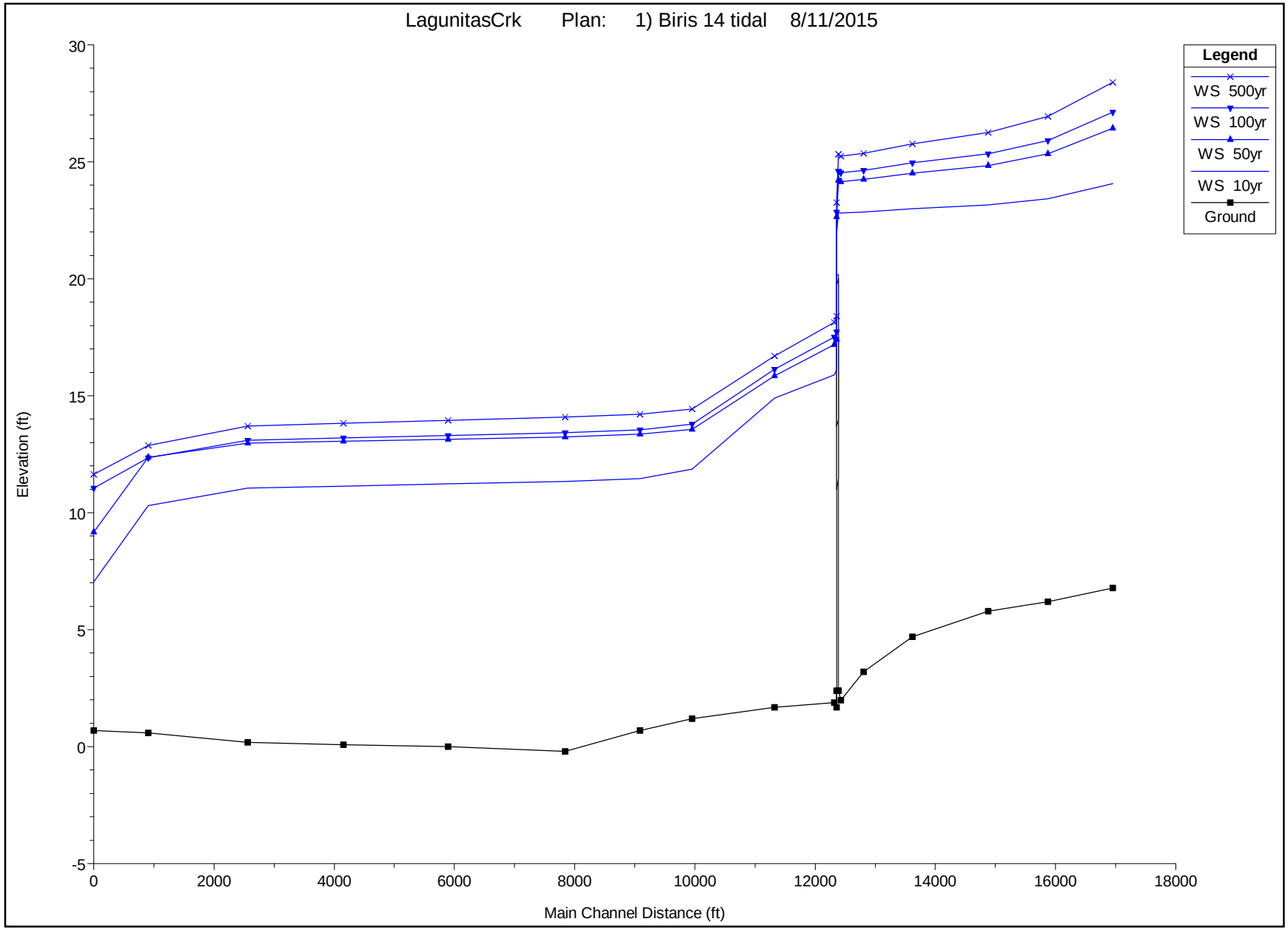
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	16957	10yr	10140.00	6.79	21.98		22.30	0.001401	4.64	2420.61	376.87	0.24
Reach-1	16957	50yr	18000.00	6.79	24.96		25.45	0.001701	5.97	3644.40	428.21	0.28
Reach-1	16957	100yr	20670.00	6.79	25.79		26.33	0.001769	6.32	4001.96	437.61	0.29
Reach-1	16957	500yr	25890.00	6.79	27.24		27.87	0.001883	6.93	4647.88	454.10	0.30
Reach-1	15876	10yr	10140.00	6.19	20.26		20.57	0.001849	4.93	2580.28	414.94	0.27
Reach-1	15876	50yr	18000.00	6.19	22.95		23.40	0.002111	6.15	3718.35	430.57	0.30
Reach-1	15876	100yr	20670.00	6.19	23.70		24.20	0.002186	6.50	4042.62	434.59	0.31
Reach-1	15876	500yr	25890.00	6.19	25.01		25.60	0.002324	7.13	4617.57	441.64	0.33
Reach-1	14885	10yr	10140.00	5.79	19.31		19.51	0.000658	4.08	3225.12	486.85	0.22
Reach-1	14885	50yr	18000.00	5.79	21.72		22.07	0.000893	5.44	4554.32	610.81	0.26
Reach-1	14885	100yr	20670.00	5.79	22.41		22.80	0.000948	5.80	4984.47	632.21	0.27
Reach-1	14885	500yr	25890.00	5.79	23.63		24.09	0.001031	6.39	5763.57	644.02	0.29
Reach-1	13624	10yr	10140.00	4.69	18.43		18.60	0.000787	3.45	3308.34	607.65	0.22
Reach-1	13624	50yr	18000.00	4.69	20.63		20.91	0.000922	4.45	4746.52	680.32	0.25
Reach-1	13624	100yr	20670.00	4.69	21.28		21.58	0.000941	4.70	5191.17	686.91	0.26
Reach-1	13624	500yr	25890.00	4.69	22.44		22.80	0.000972	5.13	5996.80	698.70	0.27
Reach-1	12809	10yr	10140.00	3.19	16.68		17.35	0.003196	7.15	2002.96	623.90	0.45
Reach-1	12809	50yr	18000.00	3.19	18.96		19.63	0.002666	7.75	3462.75	655.18	0.43
Reach-1	12809	100yr	20670.00	3.19	19.66		20.33	0.002522	7.88	3920.01	666.03	0.42
Reach-1	12809	500yr	25890.00	3.19	20.87		21.56	0.002348	8.17	4737.76	685.00	0.42
Reach-1	12428	10yr	10140.00	1.99	15.93		16.61	0.001315	6.91	1734.78	400.27	0.39
Reach-1	12428	50yr	18000.00	1.99	16.78	15.22	18.37	0.003035	10.78	2120.64	501.47	0.59
Reach-1	12428	100yr	20670.00	1.99	16.90	15.93	18.90	0.003808	12.12	2181.54	506.98	0.66
Reach-1	12428	500yr	25890.00	1.99	17.45	17.45	19.96	0.004777	13.79	2465.67	530.07	0.75
Reach-1	12388	10yr	10140.00	2.38	16.23	10.36	16.42	0.000819	3.53	2871.64	568.18	0.28
Reach-1	12388	50yr	18000.00	2.38	17.55	13.88	17.93	0.001335	4.90	3672.25	640.98	0.36
Reach-1	12388	100yr	20670.00	2.38	17.90	14.24	18.33	0.001503	5.31	3895.74	660.20	0.38
Reach-1	12388	500yr	25890.00	2.38	18.59	14.93	19.14	0.001715	5.93	4365.03	690.84	0.42
Reach-1	12372.5		Bridge									
Reach-1	12357	10yr	10140.00	1.69	16.11		16.30	0.000405	4.33	6008.70	2156.39	0.20
Reach-1	12357	50yr	18000.00	1.69	17.41		17.63	0.000552	5.32	8875.41	2263.01	0.24

HEC-RAS Plan: Biris 14 tidal River: RIVER-1 Reach: Reach-1 (Continued)

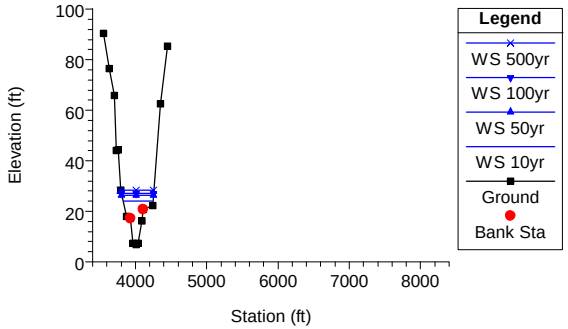
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	12357	100yr	20670.00	1.69	17.73		17.97	0.000602	5.62	9611.70	2293.04	0.25
Reach-1	12357	500yr	25890.00	1.69	18.39		18.65	0.000655	6.03	11165.87	2402.14	0.26
Reach-1	12316	10yr	13960.00	1.89	15.89		16.23	0.001493	5.88	4972.89	1957.89	0.39
Reach-1	12316	50yr	23800.00	1.89	17.18		17.56	0.001553	6.67	7662.59	2150.92	0.41
Reach-1	12316	100yr	26800.00	1.89	17.50		17.90	0.001608	6.95	8366.74	2238.80	0.42
Reach-1	12316	500yr	33310.00	1.89	18.15		18.57	0.001723	7.46	9850.49	2362.31	0.44
Reach-1	11330	10yr	13960.00	1.69	14.89		15.00	0.000957	3.38	6541.27	1873.09	0.29
Reach-1	11330	50yr	23800.00	1.69	15.85		16.03	0.001429	4.24	8466.10	2130.15	0.36
Reach-1	11330	100yr	26800.00	1.69	16.14		16.33	0.001448	4.45	9075.34	2135.52	0.36
Reach-1	11330	500yr	33310.00	1.69	16.70		16.93	0.001496	4.86	10269.39	2143.18	0.38
Reach-1	9958	10yr	13960.00	1.19	11.86	11.86	12.61	0.003614	8.65	2874.59	1673.12	0.60
Reach-1	9958	50yr	23800.00	1.19	13.56		13.89	0.001743	6.29	5835.81	1819.07	0.42
Reach-1	9958	100yr	26800.00	1.19	13.78		14.14	0.001824	6.49	6238.47	1835.68	0.43
Reach-1	9958	500yr	33310.00	1.19	14.43		14.80	0.001657	6.45	7452.64	1869.91	0.42
Reach-1	9086	10yr	13960.00	0.69	11.45		11.50	0.000363	2.93	9979.72	3501.59	0.19
Reach-1	9086	50yr	23800.00	0.69	13.35		13.39	0.000232	2.47	16846.74	3727.82	0.16
Reach-1	9086	100yr	26800.00	0.69	13.55		13.59	0.000258	2.59	17581.32	3743.24	0.16
Reach-1	9086	500yr	33310.00	0.69	14.22		14.27	0.000256	2.69	20097.26	3758.94	0.17
Reach-1	7838	10yr	13960.00	-0.21	11.33		11.34	0.000062	1.34	15740.98	3752.02	0.08
Reach-1	7838	50yr	23800.00	-0.21	13.24		13.26	0.000054	1.12	23075.74	3855.95	0.07
Reach-1	7838	100yr	26800.00	-0.21	13.43		13.45	0.000063	1.21	23777.06	3861.53	0.08
Reach-1	7838	500yr	33310.00	-0.21	14.09		14.11	0.000069	1.32	26339.04	3876.48	0.09
Reach-1	5895	10yr	14700.00	-0.01	11.23		11.24	0.000043	1.21	16147.38	2906.84	0.07
Reach-1	5895	50yr	25000.00	-0.01	13.14		13.16	0.000049	1.43	21739.95	2935.76	0.08
Reach-1	5895	100yr	28050.00	-0.01	13.30		13.33	0.000058	1.56	22221.86	2936.73	0.08
Reach-1	5895	500yr	34840.00	-0.01	13.94		13.98	0.000068	1.77	24108.73	2940.51	0.09
Reach-1	4151	10yr	14700.00	0.09	11.14		11.15	0.000056	1.10	15678.07	3317.42	0.08
Reach-1	4151	50yr	25000.00	0.09	13.05		13.07	0.000056	1.26	22058.46	3380.01	0.08
Reach-1	4151	100yr	28050.00	0.09	13.19		13.22	0.000066	1.38	22561.32	3408.78	0.09
Reach-1	4151	500yr	34840.00	0.09	13.82		13.85	0.000076	1.55	24693.02	3418.41	0.09
Reach-1	2562	10yr	14700.00	0.19	11.06		11.07	0.000046	1.01	16819.97	3178.03	0.07

HEC-RAS Plan: Biris 14 tidal River: RIVER-1 Reach: Reach-1 (Continued)

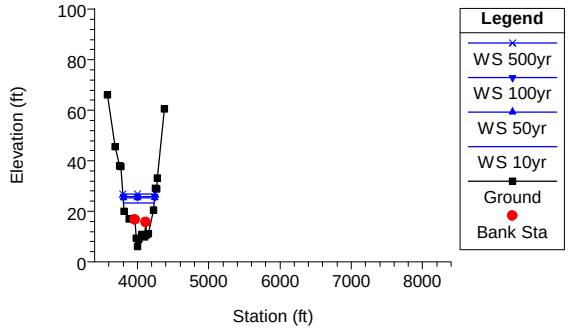
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2562	50yr	25000.00	0.19	12.97		12.98	0.000048	1.22	22924.61	3241.81	0.07
Reach-1	2562	100yr	28050.00	0.19	13.10		13.12	0.000057	1.34	23356.83	3243.19	0.08
Reach-1	2562	500yr	34840.00	0.19	13.71		13.74	0.000068	1.52	25329.96	3249.46	0.09
Reach-1	908	10yr	14700.00	0.59	10.31		10.77	0.001412	5.64	3115.15	1121.40	0.38
Reach-1	908	50yr	25000.00	0.59	12.37		12.71	0.000955	5.43	6646.72	1935.18	0.33
Reach-1	908	100yr	28050.00	0.59	12.35		12.78	0.001217	6.13	6613.42	1935.04	0.37
Reach-1	908	500yr	34840.00	0.59	12.87		13.35	0.001303	6.56	7630.70	1939.26	0.39
Reach-1	0	10yr	14700.00	0.69	7.04	5.88	8.35	0.005368	9.20	1601.23	333.25	0.72
Reach-1	0	50yr	25000.00	0.69	9.16	8.00	10.78	0.004970	10.41	2691.65	1052.91	0.72
Reach-1	0	100yr	28050.00	0.69	11.06	9.00	11.55	0.001500	6.52	6581.47	2529.60	0.41
Reach-1	0	500yr	34840.00	0.69	11.63	10.63	12.11	0.001440	6.69	8027.10	2542.39	0.40


LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Elevation (ft)
Main Channel Distance (ft)
30
25
20
15
10
5
0
-5
0
2000
4000
6000
8000
10000
12000
14000
16000
18000

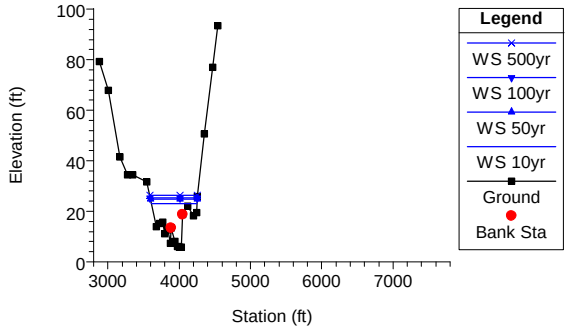
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 16957



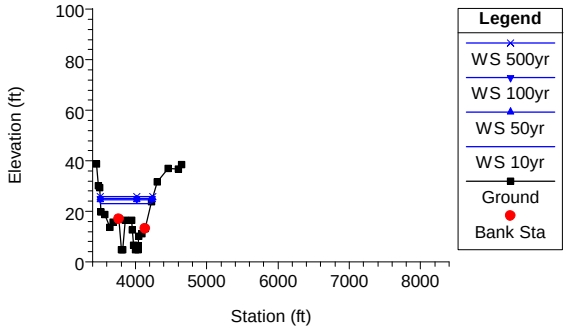
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 15876



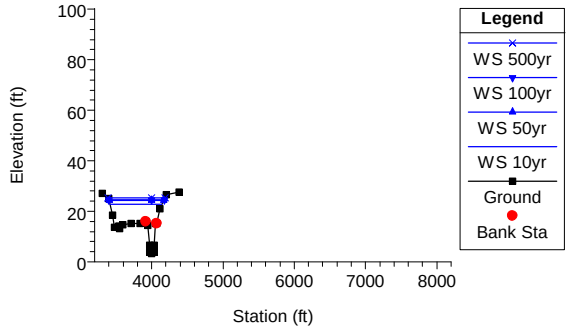
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 14885



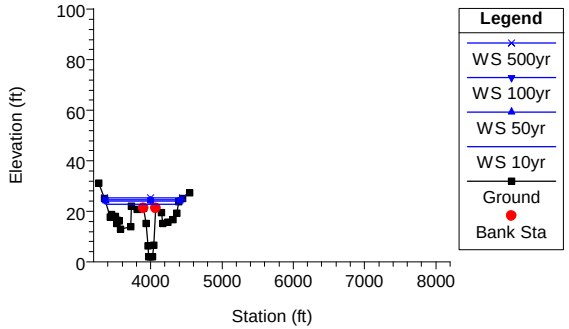
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 13624



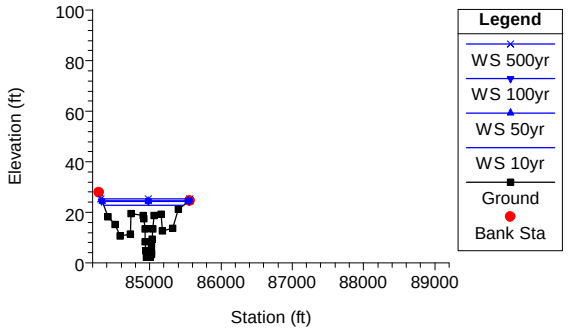
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 12809



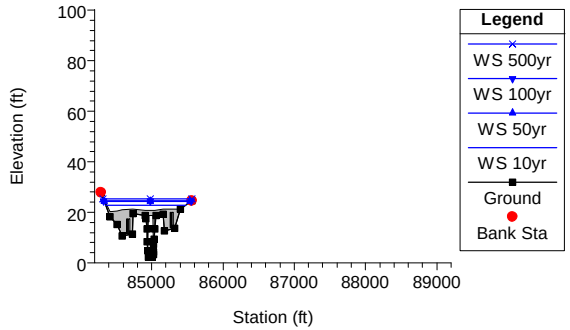
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 12428



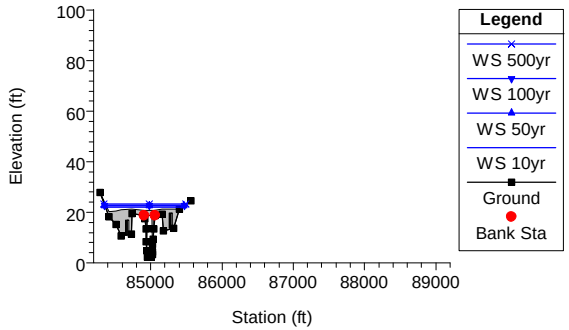
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 12388



LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 12372.5 Culv Bridge #1

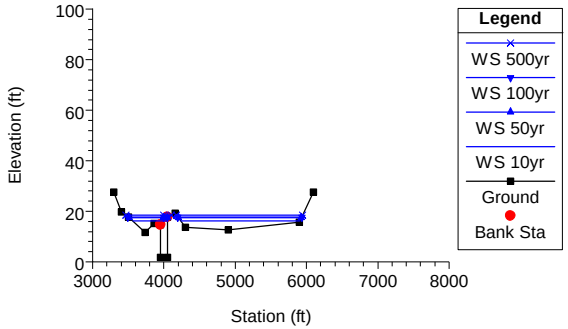


LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 12372.5 Culv Bridge #1

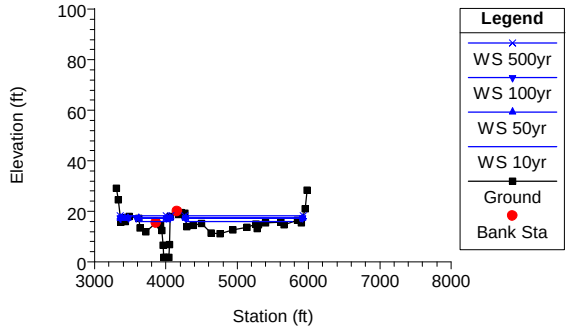


1 in Horiz. = 2693 ft 1 in Vert. = 76 ft

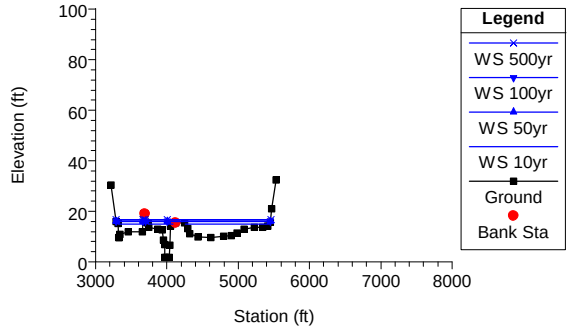
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 12357



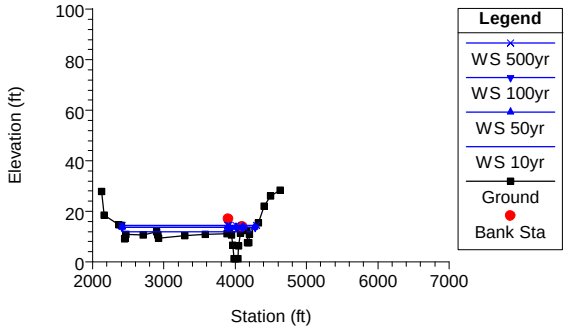
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 12316



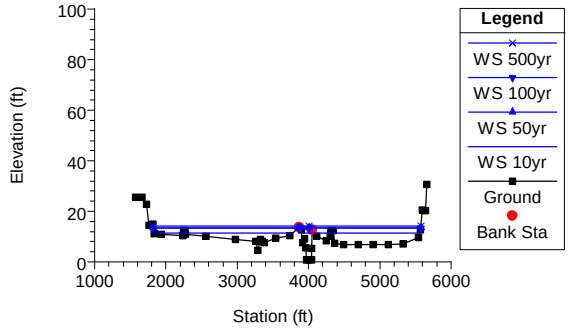
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 11330



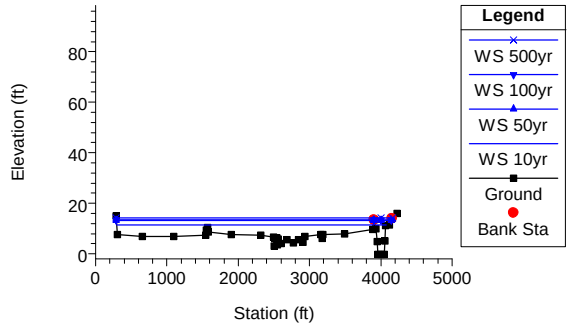
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 9958



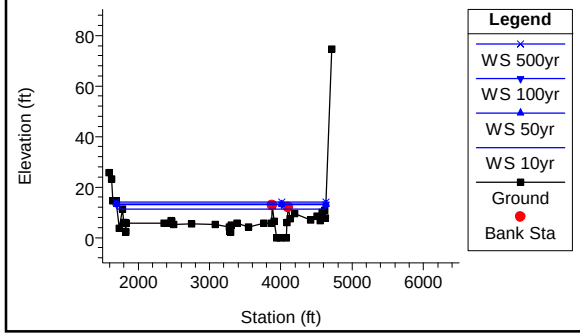
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 9086



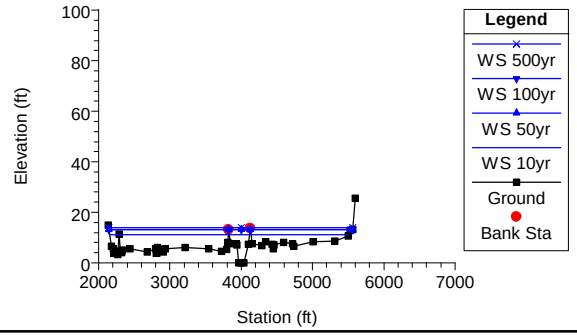
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 7838



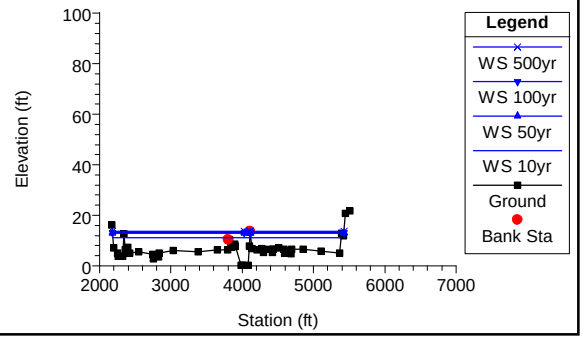
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 5895



LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 4151



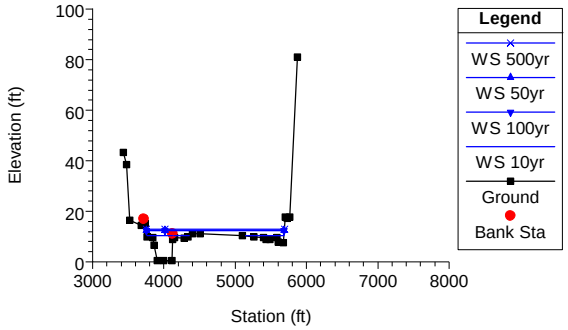
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015
River = RIVER-1 Reach = Reach-1 RS = 2562



1 in Horiz. = 2693 ft 1 in Vert. = 76 ft

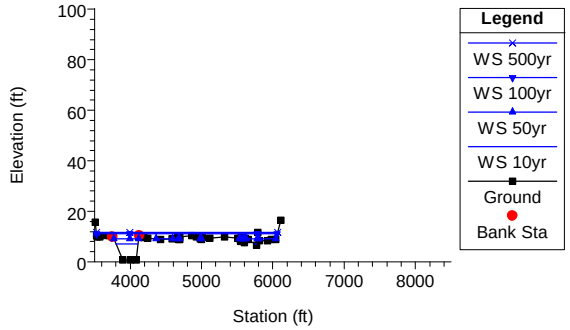
LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015

River = RIVER-1 Reach = Reach-1 RS = 908



LagunitasCrk Plan: 1) Biris 14 tidal 8/11/2015

River = RIVER-1 Reach = Reach-1 RS = 0



1 in Horiz. = 2693 ft 1 in Vert. = 76 ft

1243 Alpine Road, Suite 108
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Appendix D: HEC-RAS Output (Run 3) - Hydraulic Analysis of Lagunitas Creek under Q_{100} and WSE=14.47 ft (Base Condition + SLR – Year 2100) - (Run 3)

HEC-RAS Plan: Biris-55-tidal River: RIVER-1 Reach: Reach-1

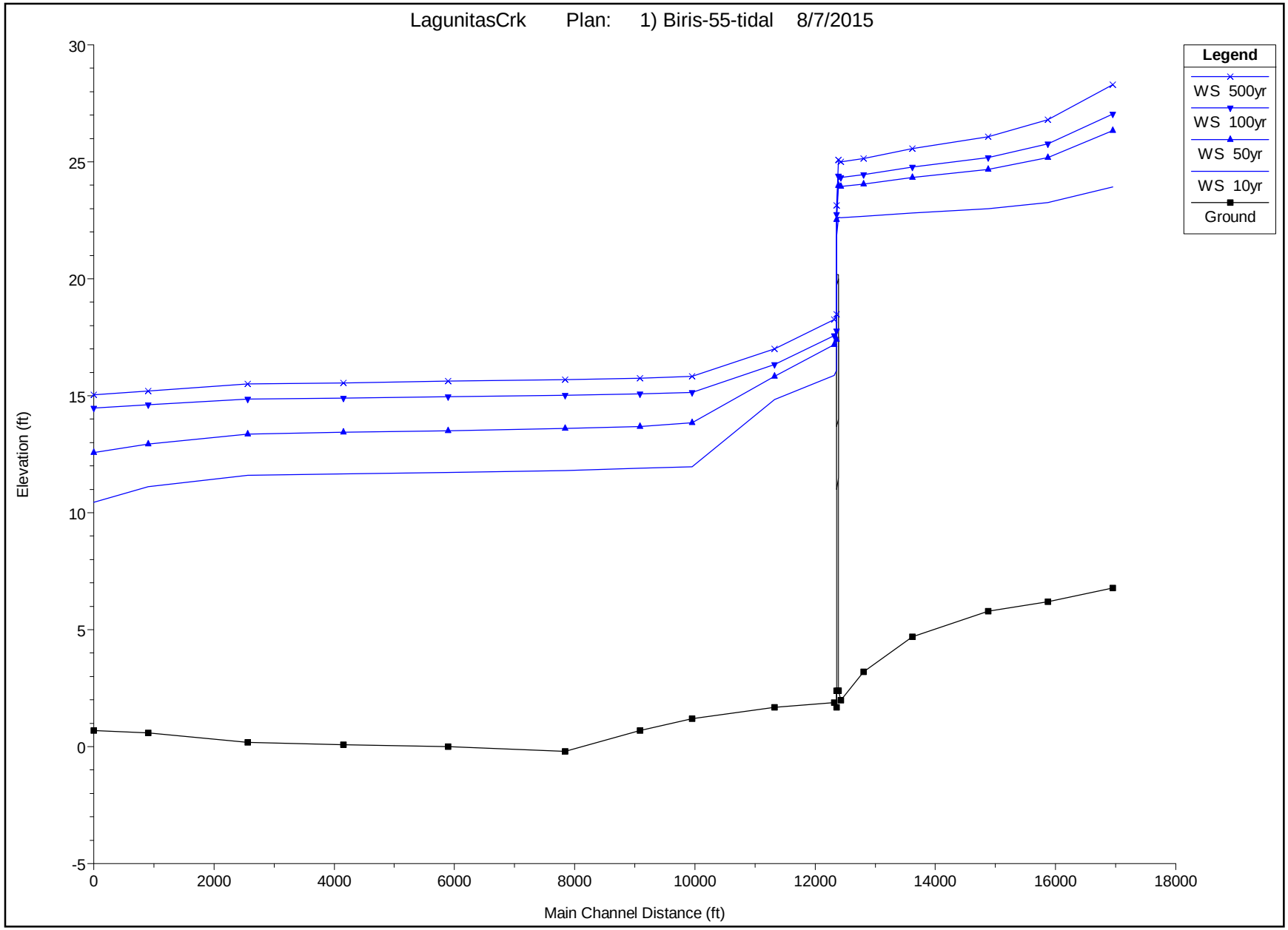
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	16957	10yr	10140.00	6.79	23.94		24.13	0.000737	3.74	3211.23	416.54	0.18
Reach-1	16957	50yr	18000.00	6.79	26.33		26.69	0.001157	5.23	4239.34	443.74	0.23
Reach-1	16957	100yr	20670.00	6.79	27.04		27.45	0.001264	5.63	4556.76	451.81	0.25
Reach-1	16957	500yr	25890.00	6.79	28.30		28.81	0.001446	6.33	5135.28	466.12	0.27
Reach-1	15876	10yr	10140.00	6.19	23.26		23.40	0.000604	3.35	3854.16	432.26	0.16
Reach-1	15876	50yr	18000.00	6.19	25.19		25.47	0.001069	4.87	4696.71	442.60	0.22
Reach-1	15876	100yr	20670.00	6.19	25.77		26.09	0.001204	5.31	4953.86	445.70	0.24
Reach-1	15876	500yr	25890.00	6.19	26.80		27.22	0.001452	6.08	5414.77	451.22	0.26
Reach-1	14885	10yr	10140.00	5.79	22.99		23.07	0.000191	2.67	5350.68	637.79	0.12
Reach-1	14885	50yr	18000.00	5.79	24.67		24.85	0.000373	4.02	6439.30	654.08	0.18
Reach-1	14885	100yr	20670.00	5.79	25.18		25.39	0.000431	4.41	6771.50	658.98	0.19
Reach-1	14885	500yr	25890.00	5.79	26.07		26.35	0.000540	5.11	7363.33	668.20	0.21
Reach-1	13624	10yr	10140.00	4.69	22.81		22.86	0.000132	1.93	6255.64	702.45	0.10
Reach-1	13624	50yr	18000.00	4.69	24.33		24.44	0.000261	2.94	7332.73	719.70	0.14
Reach-1	13624	100yr	20670.00	4.69	24.78		24.92	0.000302	3.24	7659.10	725.62	0.15
Reach-1	13624	500yr	25890.00	4.69	25.57		25.76	0.000383	3.79	8234.55	735.93	0.18
Reach-1	12809	10yr	10140.00	3.19	22.67		22.73	0.000185	2.52	6010.01	727.20	0.12
Reach-1	12809	50yr	18000.00	3.19	24.04		24.18	0.000376	3.83	7030.46	760.78	0.17
Reach-1	12809	100yr	20670.00	3.19	24.45		24.62	0.000440	4.21	7339.76	770.67	0.19
Reach-1	12809	500yr	25890.00	3.19	25.14		25.37	0.000566	4.91	7879.97	787.64	0.22
Reach-1	12428	10yr	10140.00	1.99	22.61		22.68	0.000112	2.51	6400.20	1004.14	0.12
Reach-1	12428	50yr	18000.00	1.99	23.94		24.08	0.000211	3.66	7750.68	1033.90	0.17
Reach-1	12428	100yr	20670.00	1.99	24.33		24.49	0.000243	4.00	8157.74	1051.58	0.18
Reach-1	12428	500yr	25890.00	1.99	25.00		25.21	0.000305	4.61	8870.00	1081.81	0.20
Reach-1	12388	10yr	10140.00	2.38	22.64	10.35	22.66	0.000056	1.21	8402.00	1114.27	0.08
Reach-1	12388	50yr	18000.00	2.38	24.00	13.88	24.05	0.000109	1.81	9965.69	1193.84	0.11
Reach-1	12388	100yr	20670.00	2.38	24.40	14.24	24.46	0.000126	1.98	10447.45	1217.31	0.12
Reach-1	12388	500yr	25890.00	2.38	25.08	14.93	25.16	0.000156	2.29	11293.50	1239.73	0.13
Reach-1	12372.5		Culvert									
Reach-1	12357	10yr	10140.00	1.69	16.10		16.28	0.000409	4.35	5977.83	2155.21	0.20
Reach-1	12357	50yr	18000.00	1.69	17.40		17.63	0.000554	5.32	8864.81	2262.62	0.24

HEC-RAS Plan: Biris-55-tidal River: RIVER-1 Reach: Reach-1 (Continued)

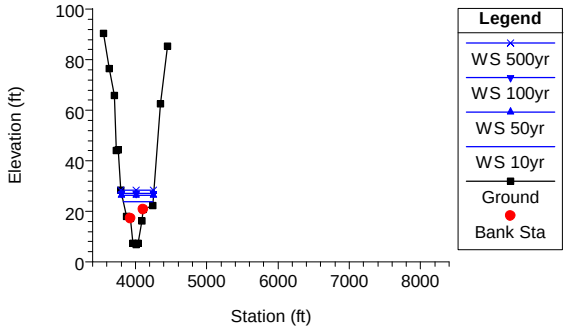
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	12357	100yr	20670.00	1.69	17.78		18.01	0.000585	5.56	9724.14	2301.11	0.25
Reach-1	12357	500yr	25890.00	1.69	18.47		18.71	0.000628	5.92	11356.00	2415.14	0.26
Reach-1	12316	10yr	13960.00	1.89	15.87		16.22	0.001518	5.92	4936.05	1954.43	0.39
Reach-1	12316	50yr	23800.00	1.89	17.18		17.56	0.001560	6.68	7650.18	2150.51	0.41
Reach-1	12316	100yr	26800.00	1.89	17.56		17.94	0.001553	6.86	8495.60	2250.53	0.41
Reach-1	12316	500yr	33310.00	1.89	18.26		18.64	0.001618	7.18	10112.47	2369.39	0.42
Reach-1	11330	10yr	13960.00	1.69	14.83		14.94	0.001001	3.45	6435.54	1865.77	0.30
Reach-1	11330	50yr	23800.00	1.69	15.84		16.01	0.001450	4.26	8426.74	2129.15	0.36
Reach-1	11330	100yr	26800.00	1.69	16.33		16.51	0.001256	4.25	9481.53	2138.13	0.34
Reach-1	11330	500yr	33310.00	1.69	17.00		17.21	0.001223	4.56	10926.27	2147.38	0.34
Reach-1	9958	10yr	13960.00	1.19	11.97		12.61	0.003202	8.15	3058.02	1684.78	0.57
Reach-1	9958	50yr	23800.00	1.19	13.85		14.12	0.001356	5.61	6366.69	1840.93	0.37
Reach-1	9958	100yr	26800.00	1.19	15.15		15.31	0.000663	4.29	8830.08	1960.03	0.27
Reach-1	9958	500yr	33310.00	1.19	15.83		16.02	0.000672	4.51	10186.48	2015.54	0.27
Reach-1	9086	10yr	13960.00	0.69	11.90		11.93	0.000239	2.44	11542.93	3550.53	0.16
Reach-1	9086	50yr	23800.00	0.69	13.69		13.72	0.000185	2.19	18104.37	3754.19	0.14
Reach-1	9086	100yr	26800.00	0.69	15.07		15.10	0.000102	1.82	23341.12	3821.64	0.11
Reach-1	9086	500yr	33310.00	0.69	15.76		15.79	0.000111	1.98	25952.65	3826.57	0.11
Reach-1	7838	10yr	13960.00	-0.21	11.81		11.82	0.000045	0.98	17564.03	3811.81	0.07
Reach-1	7838	50yr	23800.00	-0.21	13.60		13.61	0.000045	1.03	24446.92	3865.53	0.07
Reach-1	7838	100yr	26800.00	-0.21	15.02		15.03	0.000029	0.93	29971.92	3911.36	0.06
Reach-1	7838	500yr	33310.00	-0.21	15.70		15.71	0.000034	1.06	32623.95	3934.49	0.06
Reach-1	5895	10yr	14700.00	-0.01	11.73		11.74	0.000033	1.08	17615.50	2918.45	0.06
Reach-1	5895	50yr	25000.00	-0.01	13.51		13.53	0.000042	1.35	22830.48	2937.95	0.07
Reach-1	5895	100yr	28050.00	-0.01	14.96		14.97	0.000031	1.26	27100.91	2985.89	0.06
Reach-1	5895	500yr	34840.00	-0.01	15.62		15.64	0.000038	1.44	29079.10	2988.34	0.07
Reach-1	4151	10yr	14700.00	0.09	11.67		11.68	0.000041	0.97	17429.14	3332.48	0.07
Reach-1	4151	50yr	25000.00	0.09	13.43		13.45	0.000047	1.18	23371.29	3413.20	0.07
Reach-1	4151	100yr	28050.00	0.09	14.90		14.92	0.000031	1.08	28404.64	3427.17	0.06
Reach-1	4151	500yr	34840.00	0.09	15.55		15.58	0.000038	1.23	30636.91	3429.71	0.07
Reach-1	2562	10yr	14700.00	0.19	11.61		11.62	0.000033	0.90	18565.61	3187.58	0.06

HEC-RAS Plan: Biris-55-tidal River: RIVER-1 Reach: Reach-1 (Continued)

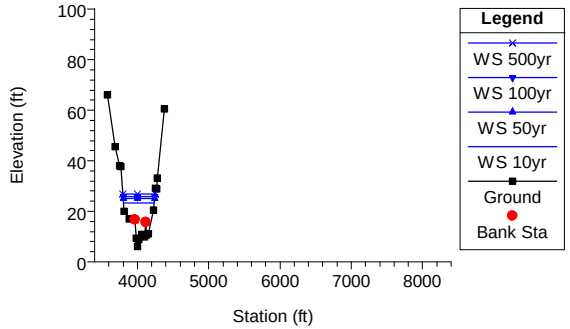
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2562	50yr	25000.00	0.19	13.36		13.38	0.000040	1.15	24218.68	3245.93	0.07
Reach-1	2562	100yr	28050.00	0.19	14.86		14.87	0.000028	1.06	29073.34	3256.30	0.06
Reach-1	2562	500yr	34840.00	0.19	15.50		15.52	0.000034	1.22	31161.46	3259.89	0.06
Reach-1	908	10yr	14700.00	0.59	11.11		11.41	0.000852	4.67	4237.67	1748.86	0.30
Reach-1	908	50yr	25000.00	0.59	12.93		13.17	0.000646	4.64	7738.20	1939.71	0.27
Reach-1	908	100yr	28050.00	0.59	14.61		14.74	0.000301	3.50	11018.85	1965.93	0.19
Reach-1	908	500yr	34840.00	0.59	15.21		15.36	0.000346	3.87	12201.03	2031.05	0.21
Reach-1	0	10yr	14700.00	0.69	10.45	5.88	10.68	0.000714	4.26	5042.81	2511.28	0.28
Reach-1	0	50yr	25000.00	0.69	12.57	8.00	12.70	0.000368	3.63	10422.46	2554.14	0.21
Reach-1	0	100yr	28050.00	0.69	14.47	8.99	14.53	0.000151	2.62	15297.90	2577.90	0.14
Reach-1	0	500yr	34840.00	0.69	15.04	10.64	15.12	0.000175	2.92	16769.34	2585.03	0.15


LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Elevation (ft)
Main Channel Distance (ft)
30
25
20
15
10
5
0
-5
0
2000
4000
6000
8000
10000
12000
14000
16000
18000

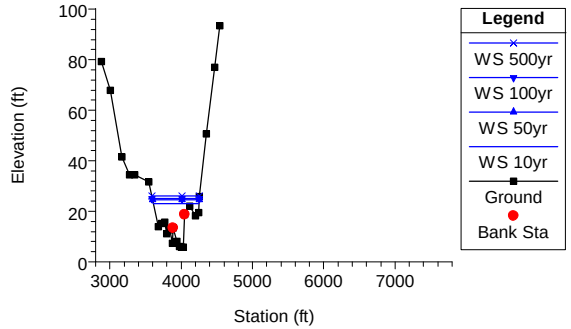
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 16957



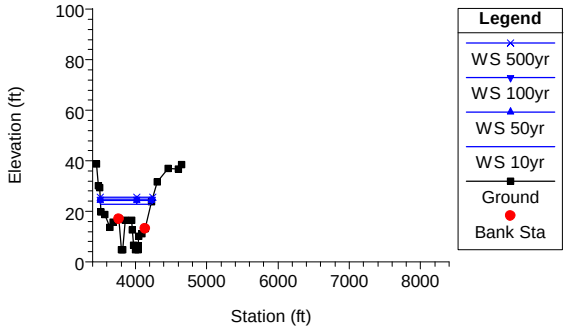
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 15876



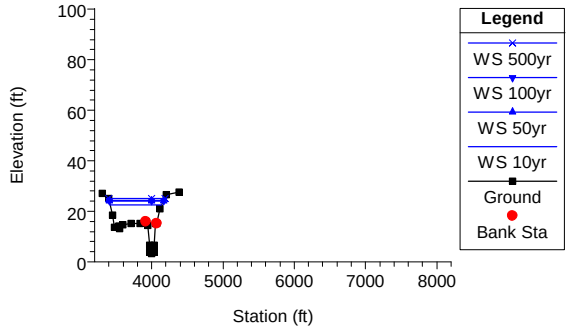
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 14885



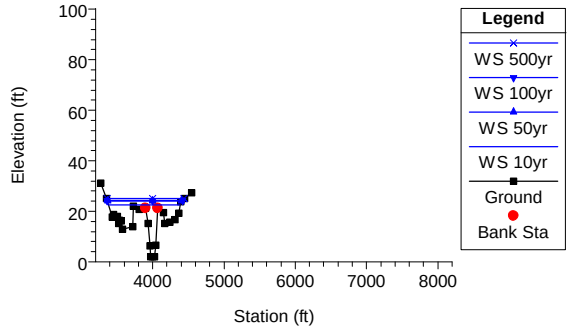
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 13624



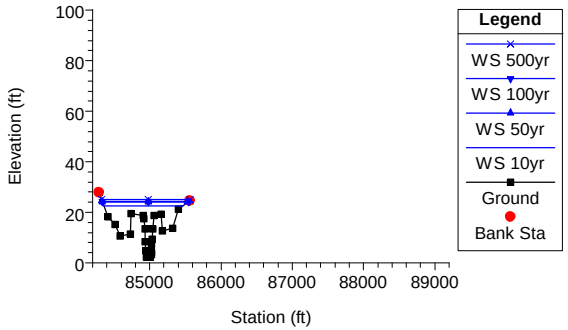
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12809



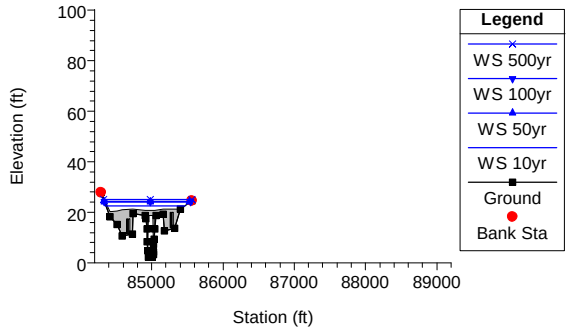
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12428



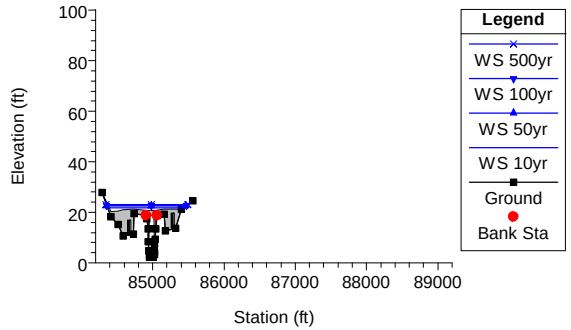
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12388



LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12372.5 Culv Bridge #1

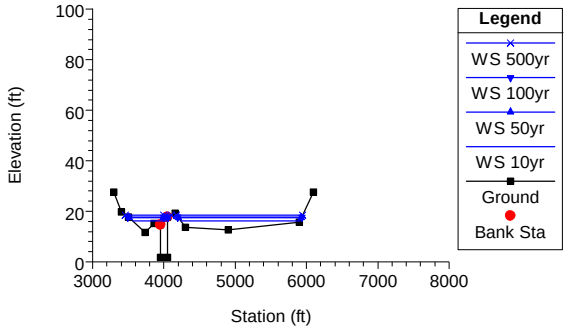


LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12372.5 Culv Bridge #1

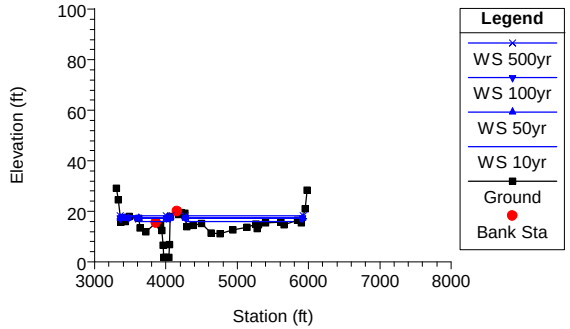


1 in Horiz. = 2693 ft 1 in Vert. = 76 ft

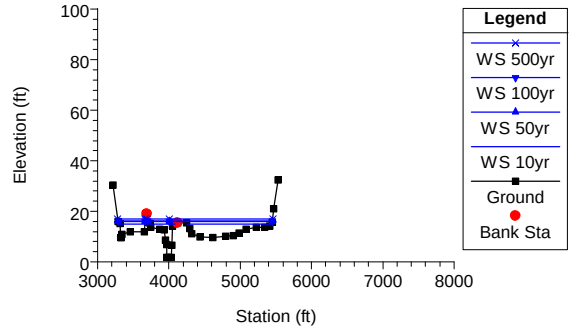
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12357



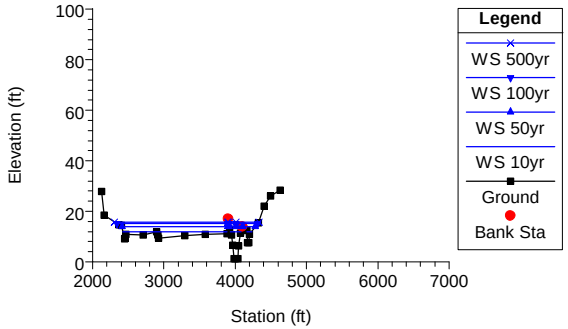
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 12316



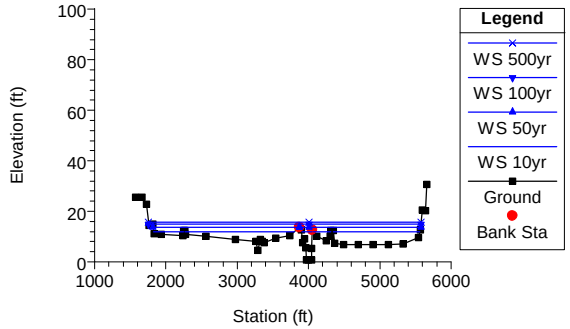
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 11330



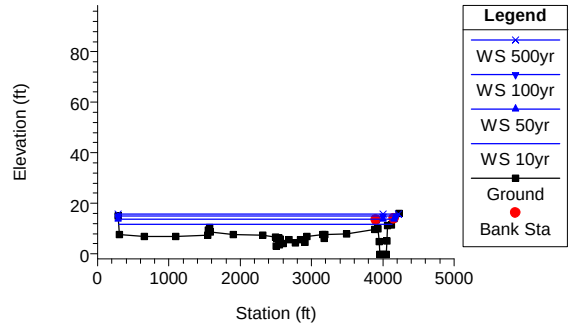
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 9958



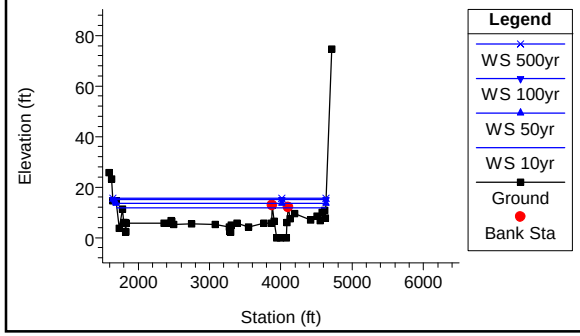
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 9086



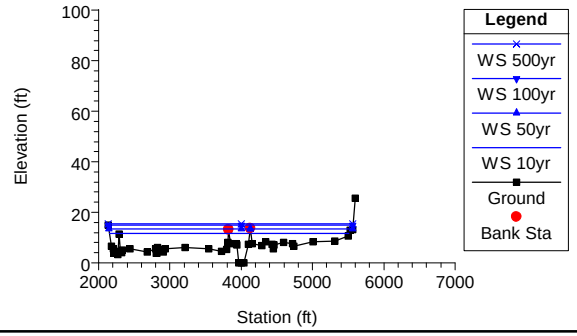
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 7838



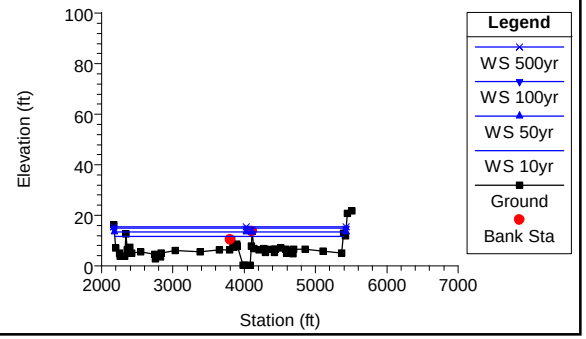
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 5895



LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 4151



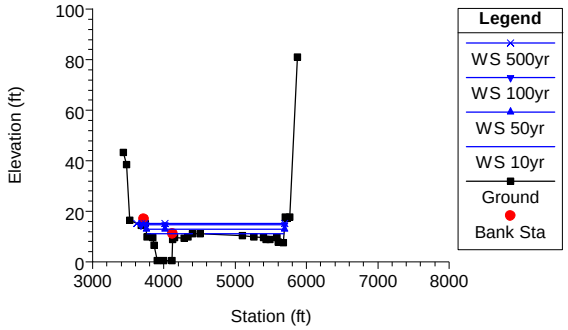
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015
River = RIVER-1 Reach = Reach-1 RS = 2562



1 in Horiz. = 2693 ft 1 in Vert. = 76 ft

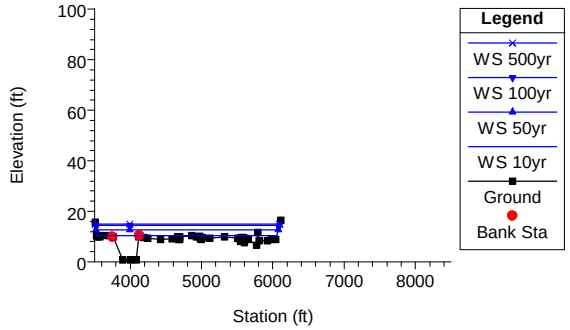
LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015

River = RIVER-1 Reach = Reach-1 RS = 908



LagunitasCrk Plan: 1) Biris-55-tidal 8/7/2015

River = RIVER-1 Reach = Reach-1 RS = 0



1 in Horiz. = 2693 ft 1 in Vert. = 76 ft