SANBAG Redlands Passenger Rail Project

Job Name: Hydraulic Impact Analysis – Warm Creek
Job Number: 170063
Client: SANBAG
Consultant: HDR Engineering, Inc.

This report and the analysis and design calculations contained herein have been prepared under the supervision of the following Registered Civil Engineer:

_____ February 2014
Mark Seits, P.E. Date
CA 41103

Table of Contents

1. Purpose 1

2. Background 1

3. Hydrology 4

4. Hydraulic Modeling 5
4.1 Modeling Overview 5
4.2 Model Inputs 5
4.2.1 Existing Condition 5
4.2.2 Proposed Condition Bridge Model 5
4.3 Model Results 6

5. Conclusions 9

6. References 9

List of Attachments

Attachment 1 – CivilDesign Results
Attachment 2 – HEC-RAS Modeling Exhibits
Attachment 3 – Hydraulic Analysis Results
Attachment 4 – Digital Information (CD)

List of Tables

Table 1: Hydraulic Results 6
Table 2: Hydraulic Freeboard Criteria- Offline Alternative 8
Table 3: Hydraulic Freeboard Criteria-In-line Alternative 9

List of Figures

Figure 1: Existing AT&SF Bridge 1.1- Looking Downstream 2
Figure 2: Existing AT&SF Bridge 1.1- Looking Upstream 3
Figure 3: Existing AT&SF Bridge 1.1 3
Figure 4: Profile of Existing Conditions 7
Figure 5: Cross-Section of Existing Conditions Upstream of AT&SF Railroad Bridge 7
Figure 6: Cross-Section of Proposed Conditions Upstream of AT&SF Railroad Bridge 8

List of Exhibits

Exhibit 1: RPRP Project Overview
Exhibit 2: Warm Creek Drainage Area
Exhibit 3 HEC-RAS Model – Cross-Sections
Exhibit 4: FEMA FIRM 06071C Panel 8681H
Exhibit 5: Proposed Bridge Alternative Plans

1. Purpose

The rail from historic Warm Creek (that portion of Warm Creek that was not combined with East Twin Creek and Warm Creek Improvements) to Mill Creek Zanja is proposed to be improved as part of the Redlands Passenger Rail Project (RPRP) (see Exhibit 1). This report covers the hydraulic impact analysis for AT&SF Bridge 1.1 (Bridge 1.1) which crosses over Warm Creek. The improvements are proposed to reconstruct the bridge from its existing freight-only operation to current standards required for regular passenger rail operations. As part of this project, recommendations, including hydraulic analysis, are provided to assist in this process. The purpose of the hydraulic modeling is to evaluate the hydraulic impact of the proposed improvements to Bridge 1.1.

2. Background

The RPRP will design a double track alignment for passenger and freight service from the proposed San Bernardino Transit Center east to the University of Redlands. The Redlands Corridor Strategic Plan (RCSP) was developed by San Bernardino Associated Governments (SANBAG) to address the transportation needs of the Redlands Corridor, assess the capability of transit service and multimodal improvements to meet mobility needs, and describe a course of action to implement transit service in the Redlands Corridor in a cost-effective manner. The first phase of the RCSP calls for the development of a passenger rail service operating between the San Bernardino Transit Center and the University of Redlands, an approximate distance of nine miles.

Bridge 1.1 is a railroad crossing over historic Warm Creek (called simply Warm Creek in the remainder of this report). Exhibit 2 shows the drainage area. Bridge 1.1 is in Federal Emergency Management Agency (FEMA) Zone X (unshaded), which is an area of minimal flood hazard, usually depicted on Flood Insurance Rate Map (FIRM) as above the 500-year flood level (FEMA 2008) as shown on Exhibit 4, FEMA FIRM Panel 06071C8681H. No FEMA hydraulic model or data is available to examine flooding conditions. Therefore, the analysis approach was to calculate the hydrology based on local drainage and perform the hydraulic analysis based on the calculated hydrologic data. A hydraulic model was developed of the project area based on the additional information obtained to model existing and proposed conditions through the bridge and to evaluate the relative changes in water surface for a 100-year flood. The proposed bridge will be designed per structure, constructability, and geotechnical and hydraulic issues.

Bridge 1.1 is located 400 feet south of West Rialto Avenue in the City of San Bernardino, California (Exhibit 2). Warm Creek at this location consists of a rectangular concrete channel constructed in the late 1960s. As discussed in the 1964 USACE Lytle and Warm Creeks report, Warm Creek flows formerly entered the Santa Ana River just downstream from the San Bernardino Freeway bridge. However, construction of the East Twin and Warm Creek improvements by the U.S. Army Corps of Engineers (USACE) in 1960 delivered most of the Warm Creek flows (the flow interception occurs upstream of Bridge 1.1 location) to the Santa Ana River at a point 1.4 miles upstream. Flows in the historic Warm Creek channel upstream from the East Branch of Lytle Creek were then limited to the local drainage from an 18-square-mile area in the City of San Bernardino (USACE 1964). Bridge 1.1 is located within this 18-square mile drainage area. However, because of surface drainage

improvements that have occurred since the 1960's, the contributing drainage area has been further reduced at Bridge 1.1.

Figure 1 shows Warm Creek, looking downstream from Bridge 1.1. Figure 2 shows Warm Creek looking upstream from Bridge 1.1. Figure 3 shows the Bridge 1.1 deck.

Figure 1: Existing AT&SF Bridge 1.1- Looking Downstream

Figure 2: Existing AT&SF Bridge 1.1- Looking Upstream

Figure 3: Existing AT&SF Bridge 1.1

The standard freeboard criteria selected for the bridge (in the following priority) are shown below. For this project, the 50-year flow rate is not available and only the 100-year flow rate was evaluated.

1. 100-year water surface elevation below low chord;
2. 100-year energy grade line (EGL) elevation below top of subgrade and 50-year water surface[hydraulic grade line (HGL)] elevation below low chord;
3. 50-year water surface (HGL) elevation below low chord; and
4. No increase of water surface elevations within project area.

Bridge 1.1 is not in a designated FEMA 100-year floodplain; therefore, the changes to flood levels due to modifications to the bridge are not required to be submitted to FEMA. This report presents analysis results for the drainage; however, it does contain some assumptions and approximations. Prior to 100% design, the assumptions and approximations made within this report should be verified. Primarily, these include the proposed bridge geometry.

3. Hydrology

The contributing watershed to Bridge 1.1 was historically larger than currently exists today. Due to the construction of East Twin Creek, the contributing drainage area of Warm Creek at Bridge 1.1 was reduced. The contributing drainage area to Bridge 1.1 has been further reduced since the 1960's as a result of surface drainage improvements in the area.

The hydrology study was prepared in accordance with the San Bernardino County Flood Control criteria and the San Bernardino County Hydrology Manual (Manual) (1986). The 100-year return period was considered in the analysis. The Unit Hydrograph Method was applicable as the drainage area is greater than 640 acres. Based on 4-foot contour mapping, aerial photographs, and San Bernardino County Redbook and Comprehensive Storm Drain Project (CSDP) 7, the tributary watershed of Warm Creek at Bridge 1.1 was delineated. Exhibit 2 shows the drainage area boundary. The isohyetal maps in the Manual are based on NOAA Atlas 2 and were used in preparation of precipitation data used in Unit Hydrograph analyses. The available isohyetal maps cover 1-hour, 6-hour, and 24-hour durations for 100-year rainfall. The 5-minute, 30-minute, and 3-hour rainfall data were calculated by the program based on the hydrology manual procedures. For the 100-year storm analysis, Antecedent Moisture Condition (AMC) III was used. Soil Group B was defined per the hydrologic soil group map in the Manual. The land use for the study is based on the San Bernardino County GIS data. Engineering software CivilDesign was used to facilitate the hydrology modeling (Bonadiman 2004). CivilDesign calculations are shown in Attachment 1.

The calculated drainage area at Bridge 1.1 is 1,222 acres (1.9 square miles) with a computed 100-year peak flow rate of 2,525 cubic feet per second (cfs). The delineated drainage area is less extensive for Warm Creek compared to what was shown in the USACE 1964 report. The conclusion from the hydrology review is that storm drains and other surface drainage improvements have limited the contributing area to 1.9 square miles at Bridge 1.1. The 1967 Warm Creek channel design plans

(Sheet 1, Drawing No. 3669) show the design storm frequency was 20 years with peak flow rate of 2,900 cfs. The drainage area described on the plan is consistent with the 1964 USACE delineation which, as stated, is larger than the drainage area determined for this report .

4. Hydraulic Modeling

4.1 Modeling Overview

Modeling of the AT&SF railroad bridge was conducted using USACE Hydrologic Engineering Center River Analysis System (HEC-RAS, v4.1) program (USACE 2010). Channel geometry was generated based on the topographic map by using HEC-GeoRAS program (v.4.1.1), an extension for support of HEC-RAS using ArcGIS. The topographic map was based on the 1-foot contour surveyed for RPRP. All reference topography is based on the North American Vertical Datum of 1988 (NAVD 88) datum(National Geodetic Survey 1991).

4.2 Model Inputs

4.2.1 Existing Condition

The existing condition model is based on as-built plan and topographic data. A centerline was laid at the center of the creek utilizing HEC-GeoRAS. Cross-sections were cut perpendicular to the centerline. Due to the limit of the topographic data, a total of five cross-sections were cut in the reach. The total reach length is approximately 560 feet. Cross section locations are shown in Exhibit 3.

Model input data includes:

- Manning's n values, concrete channel: n=0.014.
- Normal depth is used for upstream and downstream boundary conditions.
- The model was run under supercritical flow condition because the channel is concrete.
- Water surface elevations from the channel design plans were added on the profile as "Observed Water Surface" for comparison.

4.2.2 Proposed Condition Bridge Model

Proposed conditions channel geometry and modeling approach are identical to the Existing Condition Bridge Model for all hydraulic cross sections outside of the bridge area. A total of two bridge alternatives were analyzed. The alternatives were taken from the design plans. Bridge alternative plans can be found at Exhibit 5.

The model was modified as follows:

- ***Offline Alternative*** – 30-inch pre-stressed concrete box girder design with supporting piles outside existing channel walls and a total span of 28 feet. Bridge profile was assumed to be the concrete box girder with ties, subgrade, rails and fence.
- ***In-line Alternative*** – 36-inch pre-stressed concrete box girder design with supporting piles outside existing channel walls and a total span of 43 feet. Bridge profile was assumed to be the concrete box girder with ties, subgrade, rails and fence.

4.3 Model Results

A hydraulic analysis was conducted to generate water surface profiles for the channel and bridge for the 100-year flow rate. The results obtained from 100-year flow rate analysis of Bridge 1.1 are shown in Table 1. Since the flow is contained in the channel and both alternatives only vary outside of the existing channel (different deck size, pile location, etc.), the results are the same for both alternatives. Velocity and Froude Number results vary slightly between existing conditions and the alternatives because the proposed bridge is wider than the existing bridge with the change from one track to two and the variables are being reported at a location further upstream. The differences are small and of no significance. Hydraulic profiles and cross-sections are shown in Attachment 2. Full hydraulic model results are shown in Attachment 3 (Hydraulic Analysis Results). Figure 4 shows the profile for existing conditions for the flow rate of 2,525 cfs (1,222 ac drainage), 2,900 cfs (as-built plan flow rate, Q20) and water surface measured from plans as Observed Water Surface (OWS). Figure 5 shows the existing cross-section of the upstream of the bridge. Figure 6 shows the Offline Alternative bridge upstream cross-section. Cross-sections of In-line Alternative is similar to Offline Alternative.

Table 1: Hydraulic Results

		Existing Bridge	Offline Alternative	In-line Alternative
100-Yr storm event	WSE	1003.41	1003.41	1003.41
	EGL	1011.13	1011.13	1011.13
	VCH	21.99	22.14	22.15
	Froude #	1.53	1.55	1.55
WSE = water surface elevation (ft); EGL = energy grade line elevation (ft); VCH = main channel average velocity (ft/s); All elevations are NAVD 1988				

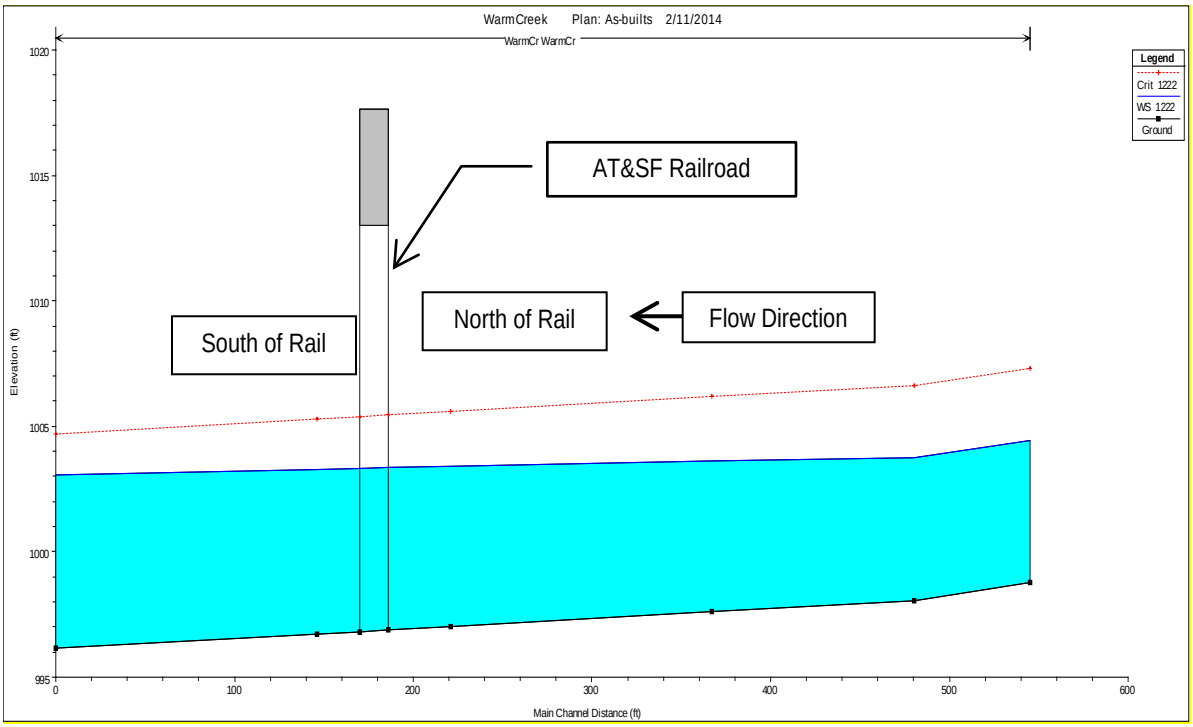


Figure 4: Profile of Existing Conditions

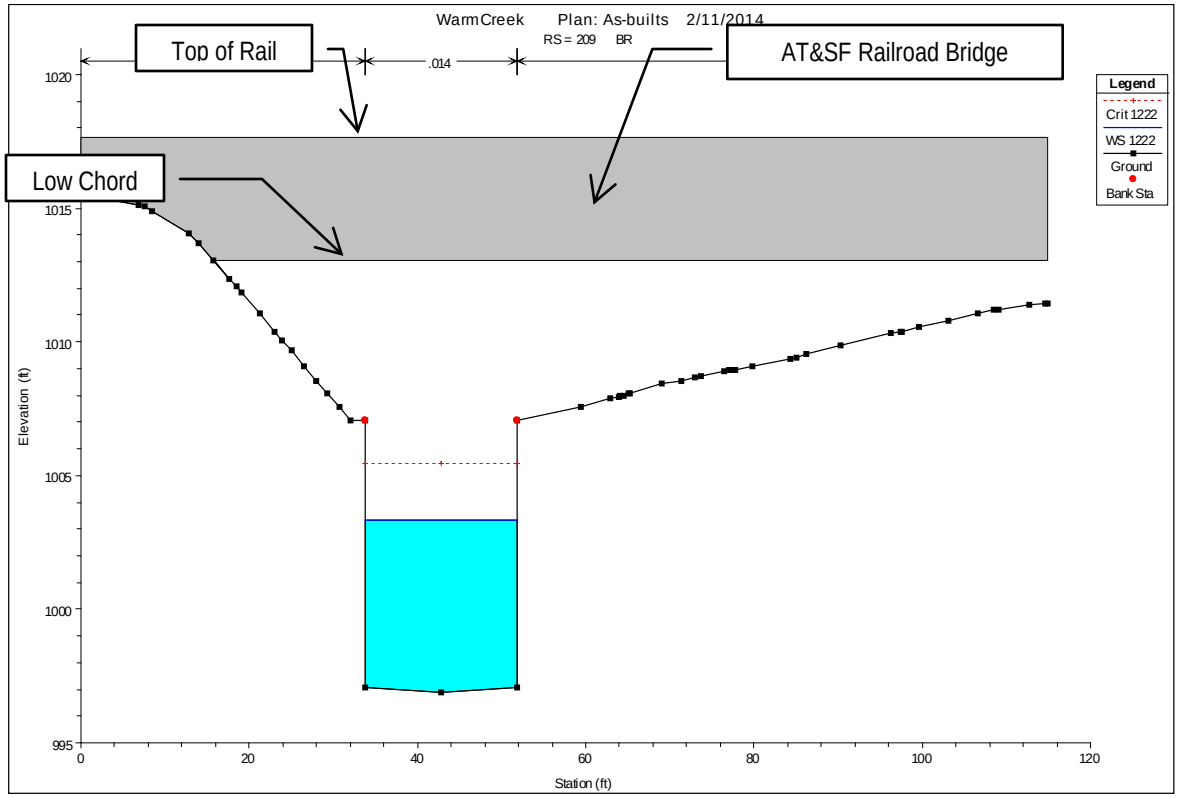


Figure 5: Cross-Section of Existing Conditions Upstream of AT&SF Railroad Bridge

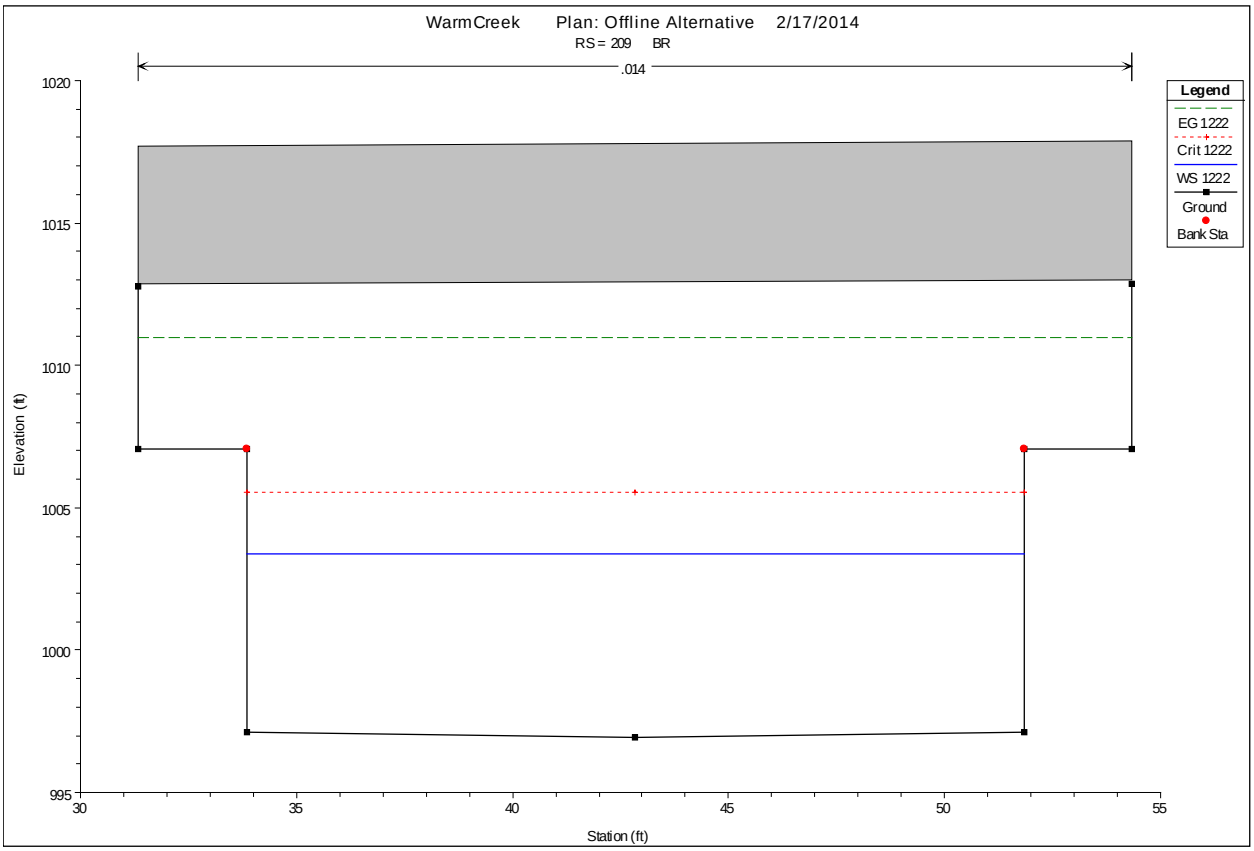


Figure 6: Cross-Section of Proposed Conditions Upstream of AT&SF Railroad Bridge

The 100-year freeboard criteria selected for the bridge (in the following priority) for alternatives are presented below in Tables 2, 3, and 4. The proposed bridges meet all 100-year criteria and therefore, meets 50-year criteria by default.

Table 2: Hydraulic Freeboard Criteria- Offline Alternative

Criterion	Standard	Proposed Model Results	Criterion Met?
1. 100-yr WSE < Low Chord	Low Chord = 1012.87	100-yr WSE = 1003.41	Yes
2. 100-yr EGL < Top of SBGD	Top of SBGD = 1014.78	100-yr EGL = 1011.13	Yes
3. Proposed WSE ≤ Existing WSE	Existing 100-yr WSE = 1003.41	Proposed 100-yr WSE = Existing 100-yr WSE	Yes
WSE = water surface elevation (ft); EGL = energy grade line elevation (ft); SBGD = subgrade. All elevations are NAVD 1988.			

HDR ONE COMPANY Many Solutions℠

Table 3: Hydraulic Freeboard Criteria-In-line Alternative

Criterion	Standard	Proposed Model Results	Criterion Met?
1. 100-yr WSE < Low Chord	Low Chord = 1012.32	100-yr WSE = 1003.41	Yes
2. 100-yr EGL < Top of SBGD	Top of SBGD = 1014.74	100-yr EGL = 1011.13	Yes
3. Proposed WSE ≤ Existing WSE	Existing 100-yr WSE = 1003.41	Proposed 100-yr WSE = Existing 100-yr WSE	Yes
WSE = water surface elevation (ft); EGL = energy grade line elevation (ft); SBGD = subgrade. All elevations are NGVD 1988.			

5. Conclusions

Using the data and resources available, the hydraulic conditions were modeled for Bridge 1.1 for both existing and proposed conditions. The 100-year flow is contained within the channel for both existing and proposed alternatives. The results of the modeling indicate that the proposed bridge improvements result in the same 100-year water surface and energy grade elevations as the existing condition; therefore, the proposed bridge alternatives will meet the freeboard criteria.

6. References

City of San Bernardino. 1968. Warm Creek Channel Plans.

County of San Bernardino. 1986. San Bernardino County Hydrology Manual.

Federal Emergency Management Agency (FEMA). 2008. Flood Insurance Study, San Bernardino County, California.

Joseph E. Bonadiman and Associates, Inc. 2004. CivilDesign Manual.

National Geodetic Survey. 1991. North American Vertical Datum (NAVD) 88.

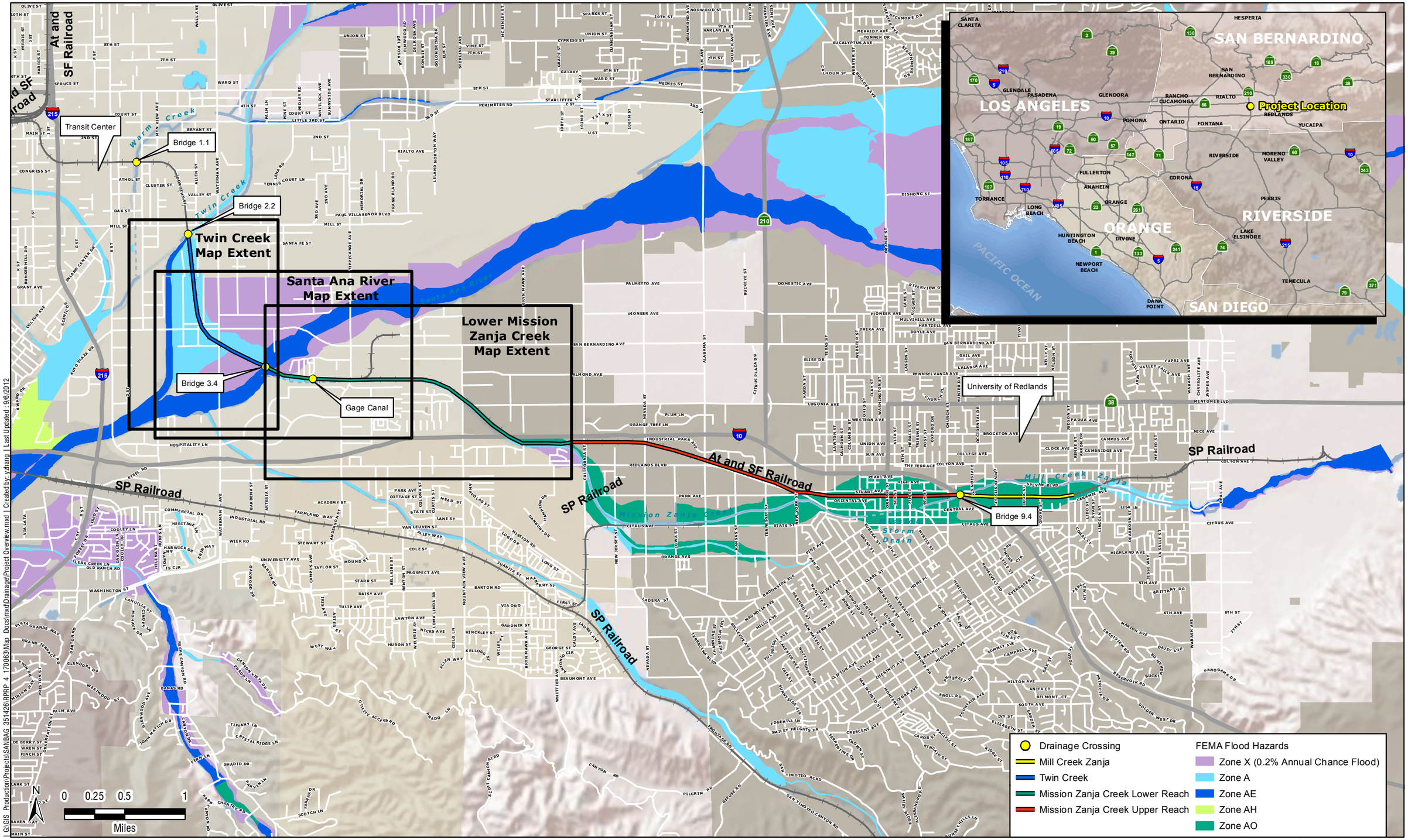
San Bernardino County Flood Control District. 1982. Comprehensive Storm Drain Project No.7 (CSDP 7).

U.S. Army Corps of Engineers (USACE). 2010. HEC-RAS v.4.1 User's Manual and Technical Reference Manual.

U.S. Army Corps of Engineers. 2004. Corpscon 6.0.1.

U.S. Army Corps of Engineers. 1964. Lytle and Warm Creeks.

Exhibit 1: RPRP Project Overview



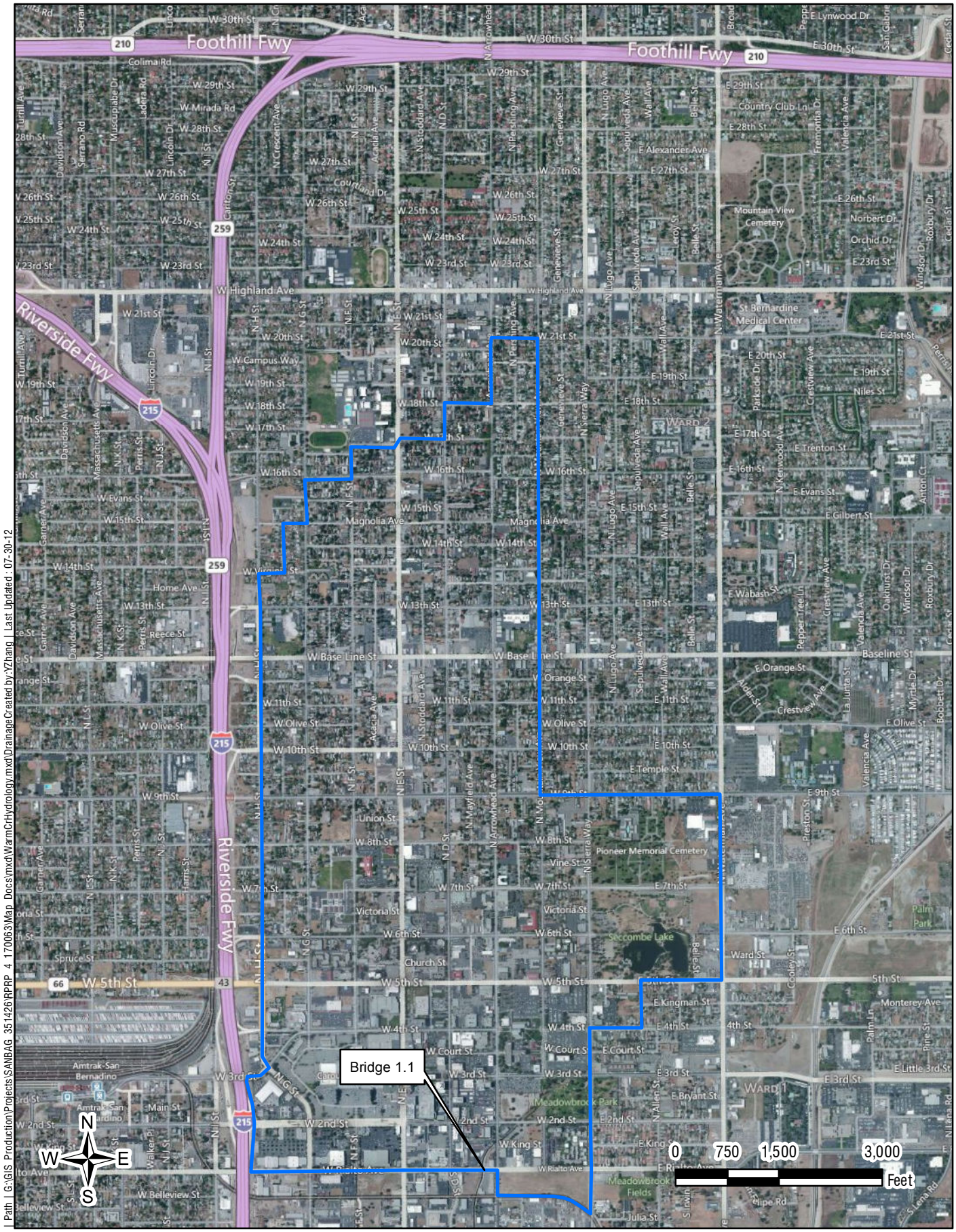
HDR
ONE COMPANY | *Many Solutions*℠

Project Overview

EXHIBIT 1

SANBAG | Redlands Passenger Rail Project | Hydraulic Impact Report

Exhibit 2: Warm Creek Drainage Area



| Path | G:\GIS_Production\Projects\SANBAG_351426\RPRP_4_170063\Map_Docs\mxd\WarmCrHydrology.mxd\DrainageCreated by:YZhang | Last Updated : 07-30-12

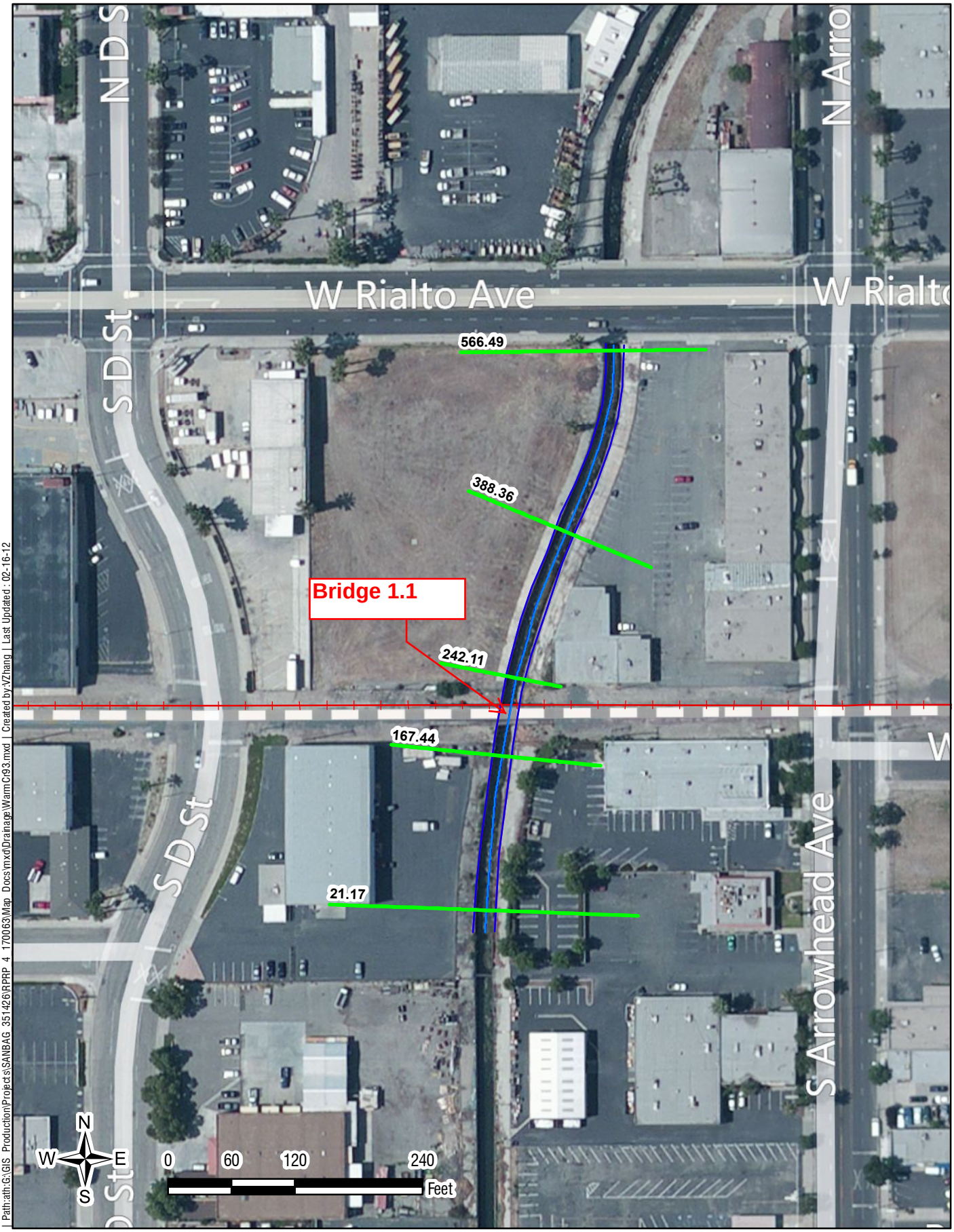
HDR
ONE COMPANY | *Many Solutions*℠

Warm Creek Drainage Area

EXHIBIT 2

SANBAG | Redlands Passenger Rail Project | Warm Creek Report

Exhibit 3: HEC-RAS Model – Cross-Sections



| Path:ath:G:\GIS_Production\Projects\SANBAG_351426\RPRP_4_170063\Map_Docs\mxd\Drainage\WarmCr93.mxd | Created by:VZhang | Last Updated : 02-16-12

HEC-RAS Model - Cross Sections

EXHIBIT 3

SANBAG | Redlands Passenger Rail Project | Warm Creek Report

HDR
ONE COMPANY | *Many Solutions*℠

Exhibit 4: FEMA FIRM 06071C Panel 8681H

MAP SCALE 1" = 500'

50 0 500 1000 FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 8681H

FIRM

FLOOD INSURANCE RATE MAP

SAN BERNARDINO COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 8681 OF 9400

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SAN BERNARDINO, CITY OF	060281	8681	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

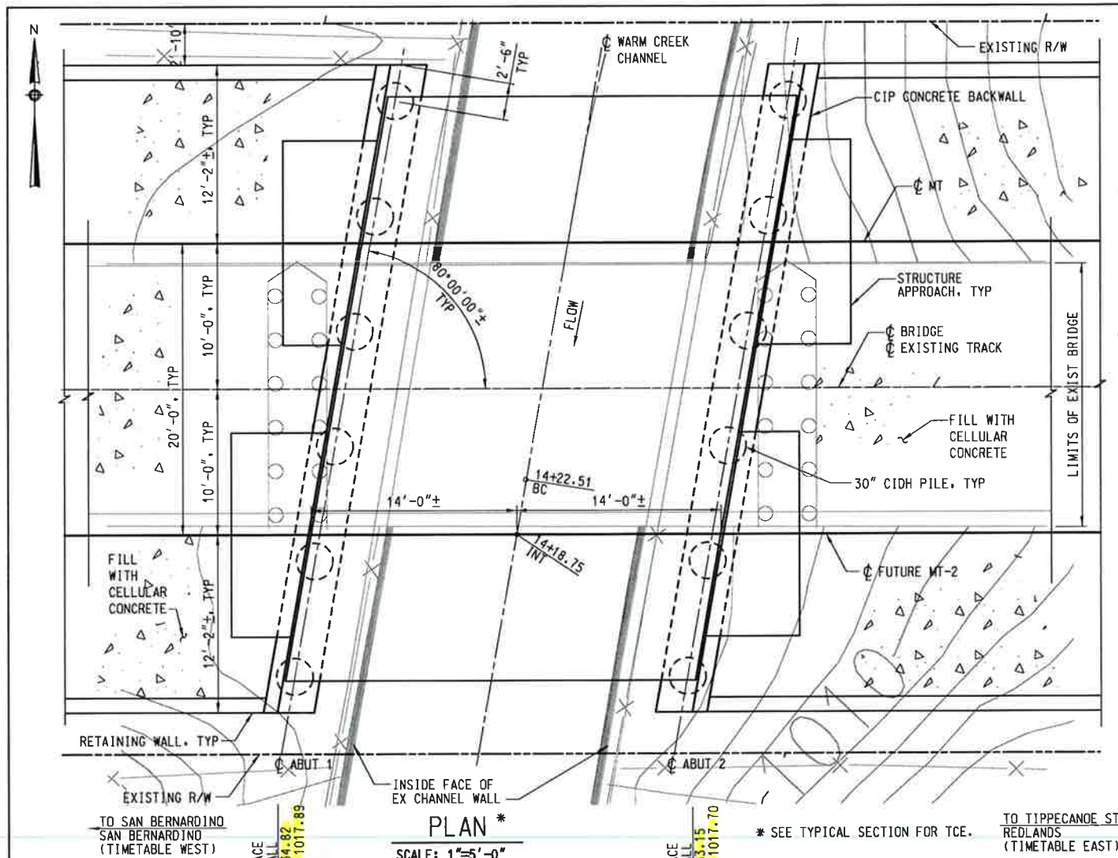
MAP NUMBER
06071C8681H

MAP REVISED
AUGUST 28, 2008

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

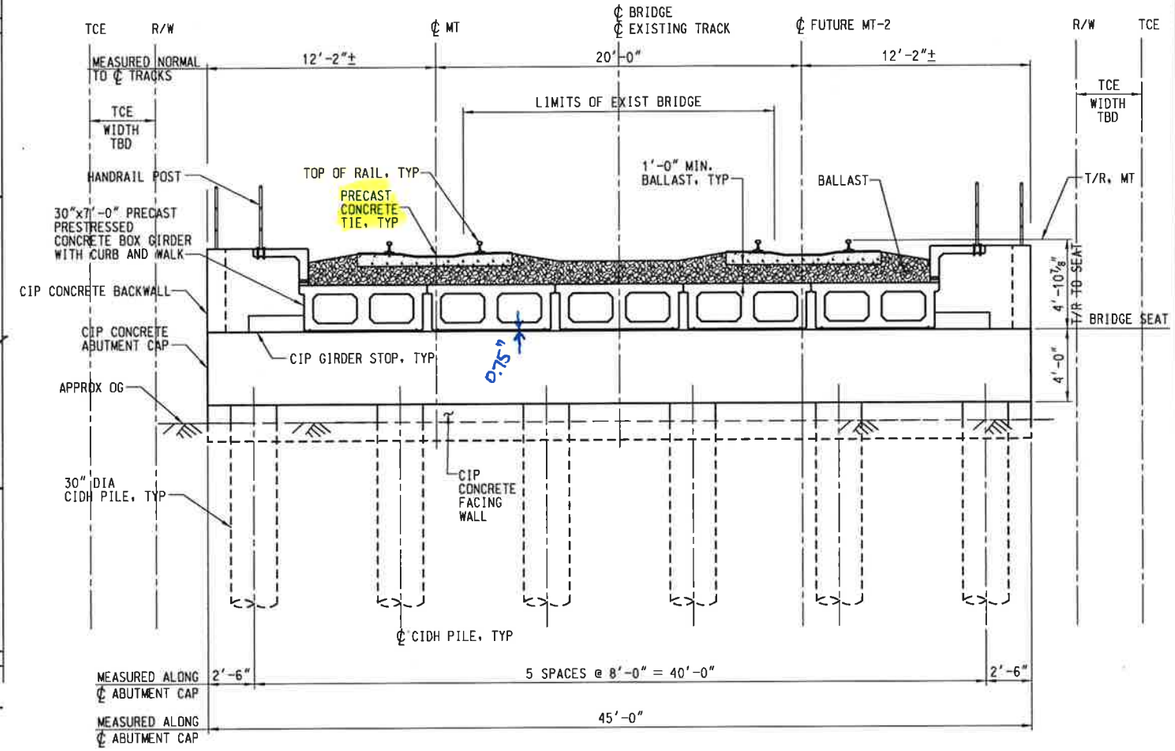
Exhibit 5: Proposed Bridge Alternative Plans



PLAN *

SCALE: 1"=5'-0"

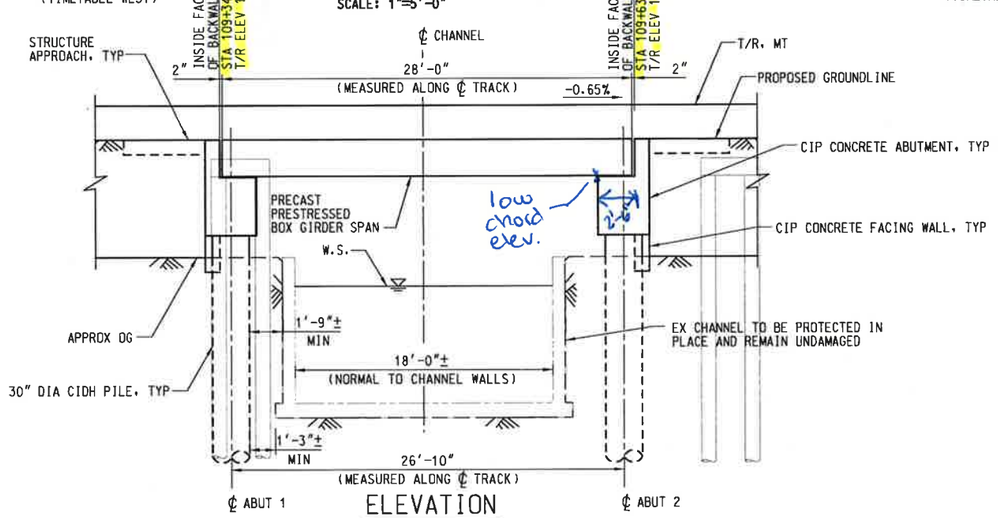
* SEE TYPICAL SECTION FOR TCE.



TYPICAL SECTION

(LOOKING TIMETABLE EAST)

SCALE: 1/4"=1'-0"



ELEVATION

SCALE: 1"=5'-0"

low chord elevation = (1017.70 + 0.65/100 × 2.5) − (4'-10 7/8" − 0.75")

= 1017.716 − 4.844

= 1012.87'

LEGEND

EXISTING STRUCTURE

NEW STRUCTURE

REV.	DATE		BY	SUB.	APP.

DESIGNED BY J. HEREDIA
DRAWN BY R. ZHAO
CHECKED BY B. REZNIKOV
APPROVED BY M. BORAKS
DATE FEB 2013

Governments SANBAG Working Together — SAN BERNARDINO ASSOCIATED GOVERNMENTS

HDR ONE COMPANY Many Solutions — HDR Engineering, Inc.

SUBMITTED: PROJECT MANAGER

APPROVED:

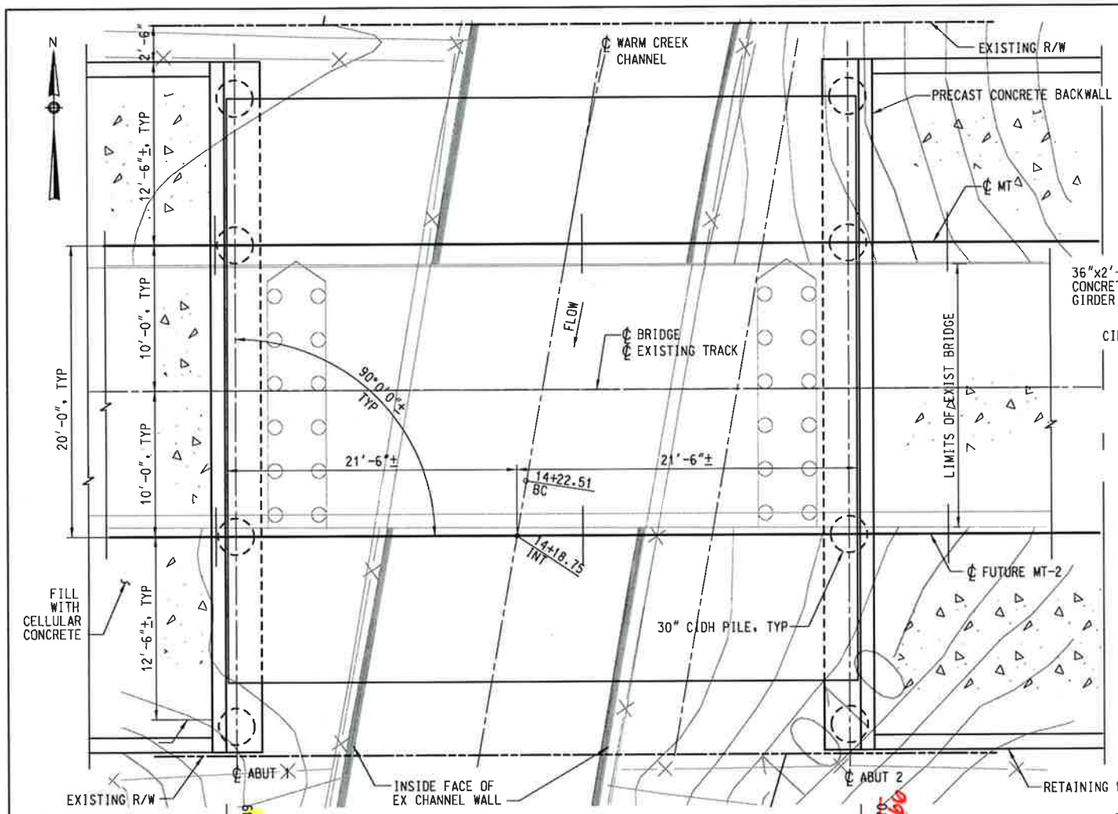
30% SUBMITTAL
NOT FOR CONSTRUCTION

REDLANDS PASSENGER RAIL PROJECT

OFFLINE ALTERNATIVE
BRIDGE 1.1
GENERAL PLAN

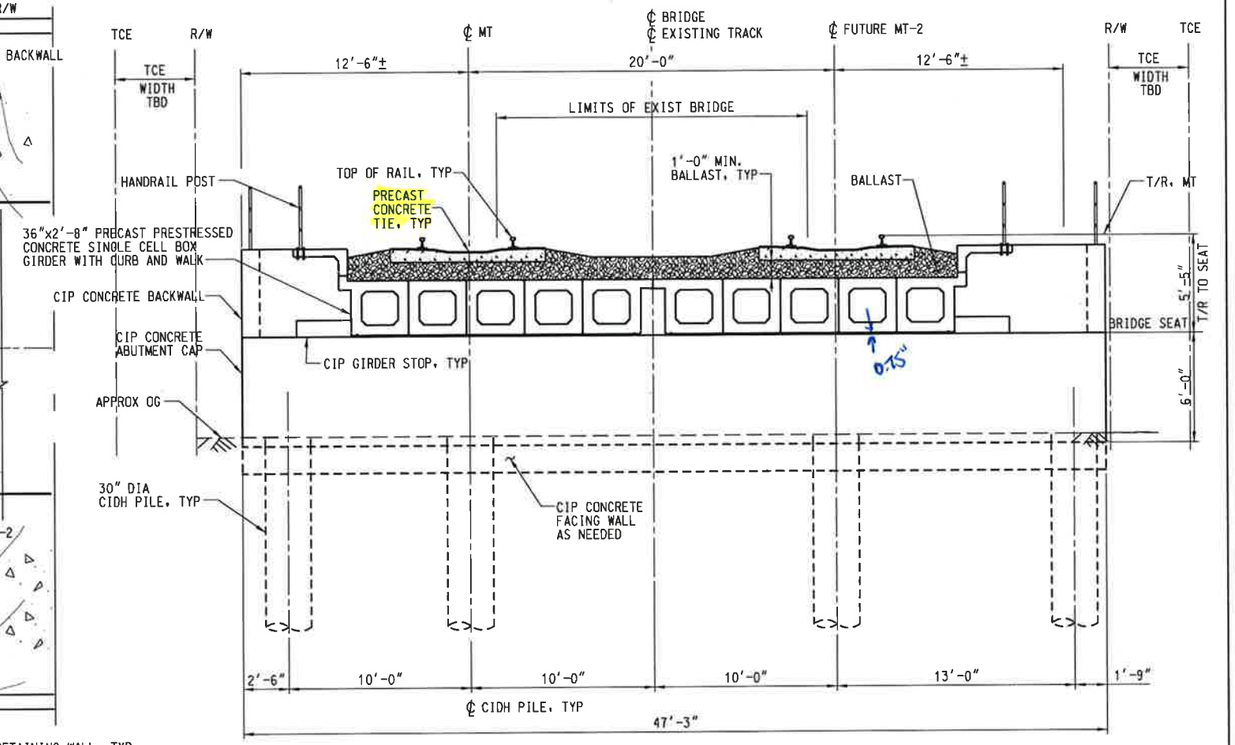
CONTRACT NO.
DRAWING NO. SB-06101
REVISION
SHEET NO.
SCALE AS NOTED

2/5/2014 5:37:30 PM mgranado
pw:\\PWAPPSACO1:California_Sacramento\Documents\351426\CON0052776\00000000170063\13.00_CAD\13.02_Contract_Files\Sheet_Files\07_Structures\Bridge 1.1\170063-S-06101.dgn
pw:\\PWAPPSACO1:California_Sacramento\Documents\351426\CON0052776\00000000170063\13.00_CAD\13.02_Contract_Files_PLOTDRV\SANBAG_BW.tbl
c:\pwworking\sac\d0301512\SANBAG-11x17bw_pdf.pltcfg



PLAN

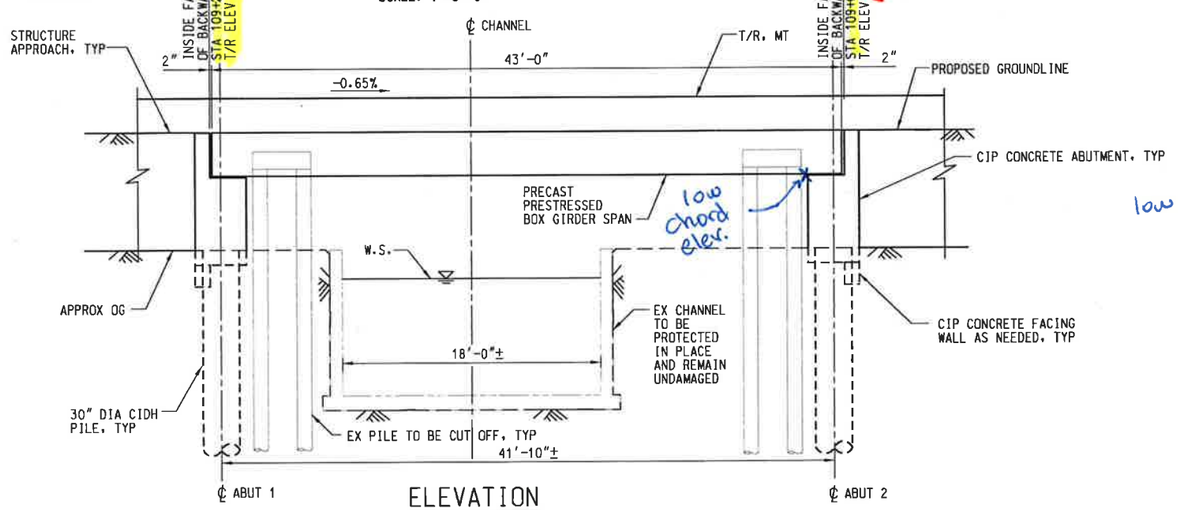
SCALE: 1"=5'-0"



TYPICAL SECTION

(LOOKING TIMETABLE EAST)

SCALE: 1/4"=1'-0"



* SEE TYPICAL SECTION FOR TCE.

ELEVATION

SCALE: 1"=5'-0"

low chord elevation = (1017.66' + 0.65/100 x 2.5') - (5'-5" - 0.75")
= 1017.676 - 5.354
= 1012.32'

LEGEND

EXISTING STRUCTURE

NEW STRUCTURE

REV.	DATE		BY	SUB.	APP.

DESIGNED BY J. HEREDIA
DRAWN BY R. ZHAO
CHECKED BY B. REZNIKOV
APPROVED BY M. BORAKS
DATE FEB 2013

Governments SANBAG Working Together — SAN BERNARDINO ASSOCIATED GOVERNMENTS

HDR — ONE COMPANY Many Solutions — HDR Engineering, Inc.

SUBMITTED: _____ PROJECT MANAGER

APPROVED: _____

30% SUBMITTAL
NOT FOR CONSTRUCTION

REDLANDS PASSENGER RAIL PROJECT

IN-LINE ALTERNATIVE
BRIDGE 1.1
GENERAL PLAN

CONTRACT NO.
DRAWING NO. SB-06104
REVISION | SHEET NO.
SCALE AS NOTED

2/5/2014 5:38:26 PM mgranado
pw:\\PWAPPSAC01:California_Sacramento\Documents\351426\CON00527776\0000000001700063\13.00_CADV13.02_Contract_Files\
pw:\\PWAPPSAC01:California_Sacramento\Documents\351426\CON00527776\0000000001700063\13.00_CADV13.02_Contract_Files\
c:\pwworking\sac\d0301512\SANBAG_18x18w_pdf.pltcfg
Project: 1:\170063-S-06104.dgn
Bridge 1:\170063-S-06104.dgn
SANBAG_BW.tbl

Attachment 1 – CivilDesign Results

U n i t H y d r o g r a p h A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004, Version 7.0

Study date 05/09/12

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 4055

Warm Creek, 1222ac

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
1222.00	1	1.47
Rainfall data for year 100		
1222.00	6	3.09
Rainfall data for year 100		
1222.00	24	5.79

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
56.0	75.8	1222.00	1.000	0.440	0.265	0.117

Area-averaged adjusted loss rate Fm (In/Hr) = 0.117

********* Area-Averaged low loss rate fraction, Yb **********

Area	Area	SCS CN	SCS CN	S	Pervious

(Ac.)	Fract	(AMC2)	(AMC3)		Yield Fr
323.83	0.265	56.0	75.8	3.19	0.549
898.17	0.735	98.0	98.0	0.20	0.959

Area-averaged catchment yield fraction, Y = 0.850
Area-averaged low loss fraction, Yb = 0.150
++
Watercourse length = 12171.00(Ft.)
Length from concentration point to centroid = 4974.00(Ft.)
Elevation difference along watercourse = 144.00(Ft.)
Mannings friction factor along watercourse = 0.025
Watershed area = 1222.00(Ac.)
Catchment Lag time = 0.367 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 22.6921
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.117(In/Hr)
Average low loss rate fraction (Yb) = 0.150 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.544(In)
Computed peak 30-minute rainfall = 1.114(In)
Specified peak 1-hour rainfall = 1.470(In)
Computed peak 3-hour rainfall = 2.316(In)
Specified peak 6-hour rainfall = 3.086(In)
Specified peak 24-hour rainfall = 5.785(In)

Rainfall depth area reduction factors:
Using a total area of 1222.00(Ac.) (Ref: fig. E-4)

5-minute factor = 0.943 Adjusted rainfall = 0.513(In)
30-minute factor = 0.943 Adjusted rainfall = 1.050(In)
1-hour factor = 0.943 Adjusted rainfall = 1.386(In)
3-hour factor = 0.993 Adjusted rainfall = 2.300(In)
6-hour factor = 0.996 Adjusted rainfall = 3.074(In)
24-hour factor = 0.998 Adjusted rainfall = 5.776(In)

U n i t H y d r o g r a p h
++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 14778.56 (CFS))	
1	1.377	203.561
2	6.244	719.193
3	17.339	1639.664
4	32.345	2217.723
5	51.349	2808.557
6	70.297	2800.198
7	81.330	1630.465
8	89.304	1178.548
9	93.622	638.053
10	96.428	414.658
11	97.947	224.476
12	98.497	81.386
13	98.906	60.370
14	99.314	60.349
15	99.722	60.299
16	100.000	41.061

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.5129	0.5129
2	0.6768	0.1639

3	0.7959	0.1192
4	0.8930	0.0971
5	0.9764	0.0834
6	1.0502	0.0739
7	1.1170	0.0668
8	1.1783	0.0613
9	1.2352	0.0568
10	1.2883	0.0532
11	1.3384	0.0501
12	1.3858	0.0474
13	1.4379	0.0521
14	1.4879	0.0500
15	1.5359	0.0481
16	1.5823	0.0464
17	1.6272	0.0448
18	1.6706	0.0434
19	1.7128	0.0422
20	1.7537	0.0410
21	1.7936	0.0399
22	1.8325	0.0389
23	1.8704	0.0379
24	1.9075	0.0371
25	1.9437	0.0362
26	1.9792	0.0355
27	2.0139	0.0347
28	2.0480	0.0340
29	2.0814	0.0334
30	2.1142	0.0328
31	2.1464	0.0322
32	2.1780	0.0316
33	2.2091	0.0311
34	2.2397	0.0306
35	2.2698	0.0301
36	2.2995	0.0297
37	2.3261	0.0265
38	2.3522	0.0261
39	2.3779	0.0257
40	2.4033	0.0254
41	2.4283	0.0250
42	2.4529	0.0246
43	2.4772	0.0243
44	2.5012	0.0240
45	2.5248	0.0237
46	2.5482	0.0234
47	2.5712	0.0231
48	2.5940	0.0228
49	2.6165	0.0225
50	2.6387	0.0222
51	2.6607	0.0220
52	2.6825	0.0217
53	2.7039	0.0215
54	2.7252	0.0213
55	2.7462	0.0210
56	2.7670	0.0208
57	2.7876	0.0206
58	2.8080	0.0204
59	2.8282	0.0202
60	2.8482	0.0200
61	2.8680	0.0198
62	2.8876	0.0196
63	2.9070	0.0194
64	2.9262	0.0192
65	2.9453	0.0191
66	2.9642	0.0189
67	2.9829	0.0187
68	3.0015	0.0186

69	3.0199	0.0184
70	3.0382	0.0183
71	3.0563	0.0181
72	3.0742	0.0180
73	3.0936	0.0194
74	3.1128	0.0192
75	3.1318	0.0191
76	3.1508	0.0189
77	3.1696	0.0188
78	3.1882	0.0187
79	3.2068	0.0185
80	3.2252	0.0184
81	3.2434	0.0183
82	3.2616	0.0182
83	3.2796	0.0180
84	3.2976	0.0179
85	3.3154	0.0178
86	3.3330	0.0177
87	3.3506	0.0176
88	3.3681	0.0175
89	3.3854	0.0174
90	3.4027	0.0173
91	3.4198	0.0171
92	3.4369	0.0170
93	3.4538	0.0169
94	3.4707	0.0168
95	3.4874	0.0167
96	3.5041	0.0167
97	3.5206	0.0166
98	3.5371	0.0165
99	3.5535	0.0164
100	3.5698	0.0163
101	3.5860	0.0162
102	3.6021	0.0161
103	3.6181	0.0160
104	3.6340	0.0159
105	3.6499	0.0159
106	3.6657	0.0158
107	3.6814	0.0157
108	3.6970	0.0156
109	3.7125	0.0155
110	3.7280	0.0155
111	3.7433	0.0154
112	3.7587	0.0153
113	3.7739	0.0152
114	3.7890	0.0152
115	3.8041	0.0151
116	3.8191	0.0150
117	3.8341	0.0149
118	3.8490	0.0149
119	3.8638	0.0148
120	3.8785	0.0147
121	3.8932	0.0147
122	3.9078	0.0146
123	3.9223	0.0145
124	3.9368	0.0145
125	3.9512	0.0144
126	3.9656	0.0143
127	3.9798	0.0143
128	3.9941	0.0142
129	4.0082	0.0142
130	4.0223	0.0141
131	4.0364	0.0140
132	4.0504	0.0140
133	4.0643	0.0139
134	4.0782	0.0139

135	4.0920	0.0138
136	4.1058	0.0138
137	4.1195	0.0137
138	4.1331	0.0137
139	4.1467	0.0136
140	4.1603	0.0135
141	4.1738	0.0135
142	4.1872	0.0134
143	4.2006	0.0134
144	4.2139	0.0133
145	4.2272	0.0133
146	4.2405	0.0132
147	4.2536	0.0132
148	4.2668	0.0131
149	4.2799	0.0131
150	4.2929	0.0130
151	4.3059	0.0130
152	4.3189	0.0129
153	4.3318	0.0129
154	4.3446	0.0129
155	4.3574	0.0128
156	4.3702	0.0128
157	4.3829	0.0127
158	4.3956	0.0127
159	4.4082	0.0126
160	4.4208	0.0126
161	4.4334	0.0125
162	4.4459	0.0125
163	4.4584	0.0125
164	4.4708	0.0124
165	4.4832	0.0124
166	4.4955	0.0123
167	4.5078	0.0123
168	4.5201	0.0123
169	4.5323	0.0122
170	4.5445	0.0122
171	4.5566	0.0121
172	4.5687	0.0121
173	4.5808	0.0121
174	4.5928	0.0120
175	4.6048	0.0120
176	4.6167	0.0120
177	4.6287	0.0119
178	4.6405	0.0119
179	4.6524	0.0118
180	4.6642	0.0118
181	4.6760	0.0118
182	4.6877	0.0117
183	4.6994	0.0117
184	4.7111	0.0117
185	4.7227	0.0116
186	4.7343	0.0116
187	4.7458	0.0116
188	4.7574	0.0115
189	4.7689	0.0115
190	4.7803	0.0115
191	4.7918	0.0114
192	4.8032	0.0114
193	4.8145	0.0114
194	4.8259	0.0113
195	4.8372	0.0113
196	4.8484	0.0113
197	4.8597	0.0112
198	4.8709	0.0112
199	4.8821	0.0112
200	4.8932	0.0111

201	4.9043	0.0111
202	4.9154	0.0111
203	4.9265	0.0111
204	4.9375	0.0110
205	4.9485	0.0110
206	4.9594	0.0110
207	4.9704	0.0109
208	4.9813	0.0109
209	4.9922	0.0109
210	5.0030	0.0109
211	5.0139	0.0108
212	5.0246	0.0108
213	5.0354	0.0108
214	5.0462	0.0107
215	5.0569	0.0107
216	5.0676	0.0107
217	5.0782	0.0107
218	5.0889	0.0106
219	5.0995	0.0106
220	5.1100	0.0106
221	5.1206	0.0106
222	5.1311	0.0105
223	5.1416	0.0105
224	5.1521	0.0105
225	5.1626	0.0105
226	5.1730	0.0104
227	5.1834	0.0104
228	5.1938	0.0104
229	5.2041	0.0104
230	5.2144	0.0103
231	5.2247	0.0103
232	5.2350	0.0103
233	5.2453	0.0103
234	5.2555	0.0102
235	5.2657	0.0102
236	5.2759	0.0102
237	5.2860	0.0102
238	5.2962	0.0101
239	5.3063	0.0101
240	5.3164	0.0101
241	5.3264	0.0101
242	5.3365	0.0100
243	5.3465	0.0100
244	5.3565	0.0100
245	5.3665	0.0100
246	5.3764	0.0100
247	5.3864	0.0099
248	5.3963	0.0099
249	5.4062	0.0099
250	5.4160	0.0099
251	5.4259	0.0098
252	5.4357	0.0098
253	5.4455	0.0098
254	5.4553	0.0098
255	5.4651	0.0098
256	5.4748	0.0097
257	5.4845	0.0097
258	5.4942	0.0097
259	5.5039	0.0097
260	5.5135	0.0097
261	5.5232	0.0096
262	5.5328	0.0096
263	5.5424	0.0096
264	5.5520	0.0096
265	5.5615	0.0096
266	5.5711	0.0095

267	5.5806	0.0095
268	5.5901	0.0095
269	5.5996	0.0095
270	5.6090	0.0095
271	5.6185	0.0094
272	5.6279	0.0094
273	5.6373	0.0094
274	5.6467	0.0094
275	5.6561	0.0094
276	5.6654	0.0093
277	5.6747	0.0093
278	5.6840	0.0093
279	5.6933	0.0093
280	5.7026	0.0093
281	5.7119	0.0093
282	5.7211	0.0092
283	5.7303	0.0092
284	5.7395	0.0092
285	5.7487	0.0092
286	5.7579	0.0092
287	5.7670	0.0092
288	5.7762	0.0091

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0091	0.0014	0.0078
2	0.0092	0.0014	0.0078
3	0.0092	0.0014	0.0078
4	0.0092	0.0014	0.0078
5	0.0092	0.0014	0.0079
6	0.0093	0.0014	0.0079
7	0.0093	0.0014	0.0079
8	0.0093	0.0014	0.0079
9	0.0093	0.0014	0.0079
10	0.0094	0.0014	0.0080
11	0.0094	0.0014	0.0080
12	0.0094	0.0014	0.0080
13	0.0095	0.0014	0.0080
14	0.0095	0.0014	0.0081
15	0.0095	0.0014	0.0081
16	0.0095	0.0014	0.0081
17	0.0096	0.0014	0.0081
18	0.0096	0.0014	0.0082
19	0.0096	0.0014	0.0082
20	0.0097	0.0014	0.0082
21	0.0097	0.0015	0.0082
22	0.0097	0.0015	0.0083
23	0.0098	0.0015	0.0083
24	0.0098	0.0015	0.0083
25	0.0098	0.0015	0.0084
26	0.0098	0.0015	0.0084
27	0.0099	0.0015	0.0084
28	0.0099	0.0015	0.0084
29	0.0100	0.0015	0.0085
30	0.0100	0.0015	0.0085
31	0.0100	0.0015	0.0085
32	0.0100	0.0015	0.0085
33	0.0101	0.0015	0.0086
34	0.0101	0.0015	0.0086
35	0.0102	0.0015	0.0086
36	0.0102	0.0015	0.0087
37	0.0102	0.0015	0.0087
38	0.0103	0.0015	0.0087
39	0.0103	0.0015	0.0088

40	0.0103	0.0015	0.0088
41	0.0104	0.0016	0.0088
42	0.0104	0.0016	0.0088
43	0.0105	0.0016	0.0089
44	0.0105	0.0016	0.0089
45	0.0105	0.0016	0.0090
46	0.0106	0.0016	0.0090
47	0.0106	0.0016	0.0090
48	0.0106	0.0016	0.0090
49	0.0107	0.0016	0.0091
50	0.0107	0.0016	0.0091
51	0.0108	0.0016	0.0092
52	0.0108	0.0016	0.0092
53	0.0109	0.0016	0.0092
54	0.0109	0.0016	0.0093
55	0.0109	0.0016	0.0093
56	0.0110	0.0016	0.0093
57	0.0110	0.0017	0.0094
58	0.0111	0.0017	0.0094
59	0.0111	0.0017	0.0095
60	0.0111	0.0017	0.0095
61	0.0112	0.0017	0.0095
62	0.0112	0.0017	0.0096
63	0.0113	0.0017	0.0096
64	0.0113	0.0017	0.0096
65	0.0114	0.0017	0.0097
66	0.0114	0.0017	0.0097
67	0.0115	0.0017	0.0098
68	0.0115	0.0017	0.0098
69	0.0116	0.0017	0.0099
70	0.0116	0.0017	0.0099
71	0.0117	0.0018	0.0099
72	0.0117	0.0018	0.0100
73	0.0118	0.0018	0.0100
74	0.0118	0.0018	0.0101
75	0.0119	0.0018	0.0101
76	0.0120	0.0018	0.0102
77	0.0120	0.0018	0.0102
78	0.0121	0.0018	0.0103
79	0.0121	0.0018	0.0103
80	0.0122	0.0018	0.0104
81	0.0123	0.0018	0.0104
82	0.0123	0.0018	0.0105
83	0.0124	0.0019	0.0105
84	0.0124	0.0019	0.0106
85	0.0125	0.0019	0.0106
86	0.0125	0.0019	0.0107
87	0.0126	0.0019	0.0107
88	0.0127	0.0019	0.0108
89	0.0128	0.0019	0.0109
90	0.0128	0.0019	0.0109
91	0.0129	0.0019	0.0110
92	0.0129	0.0019	0.0110
93	0.0130	0.0020	0.0111
94	0.0131	0.0020	0.0111
95	0.0132	0.0020	0.0112
96	0.0132	0.0020	0.0113
97	0.0133	0.0020	0.0113
98	0.0134	0.0020	0.0114
99	0.0135	0.0020	0.0115
100	0.0135	0.0020	0.0115
101	0.0137	0.0020	0.0116
102	0.0137	0.0021	0.0117
103	0.0138	0.0021	0.0117
104	0.0139	0.0021	0.0118
105	0.0140	0.0021	0.0119

106	0.0140	0.0021	0.0119
107	0.0142	0.0021	0.0120
108	0.0142	0.0021	0.0121
109	0.0143	0.0021	0.0122
110	0.0144	0.0022	0.0123
111	0.0145	0.0022	0.0124
112	0.0146	0.0022	0.0124
113	0.0147	0.0022	0.0125
114	0.0148	0.0022	0.0126
115	0.0149	0.0022	0.0127
116	0.0150	0.0022	0.0128
117	0.0152	0.0023	0.0129
118	0.0152	0.0023	0.0130
119	0.0154	0.0023	0.0131
120	0.0155	0.0023	0.0131
121	0.0156	0.0023	0.0133
122	0.0157	0.0023	0.0133
123	0.0159	0.0024	0.0135
124	0.0159	0.0024	0.0136
125	0.0161	0.0024	0.0137
126	0.0162	0.0024	0.0138
127	0.0164	0.0025	0.0139
128	0.0165	0.0025	0.0140
129	0.0167	0.0025	0.0142
130	0.0167	0.0025	0.0142
131	0.0169	0.0025	0.0144
132	0.0170	0.0026	0.0145
133	0.0173	0.0026	0.0147
134	0.0174	0.0026	0.0148
135	0.0176	0.0026	0.0149
136	0.0177	0.0026	0.0150
137	0.0179	0.0027	0.0152
138	0.0180	0.0027	0.0153
139	0.0183	0.0027	0.0155
140	0.0184	0.0028	0.0156
141	0.0187	0.0028	0.0159
142	0.0188	0.0028	0.0160
143	0.0191	0.0029	0.0162
144	0.0192	0.0029	0.0163
145	0.0180	0.0027	0.0153
146	0.0181	0.0027	0.0154
147	0.0184	0.0028	0.0157
148	0.0186	0.0028	0.0158
149	0.0189	0.0028	0.0161
150	0.0191	0.0029	0.0162
151	0.0194	0.0029	0.0165
152	0.0196	0.0029	0.0167
153	0.0200	0.0030	0.0170
154	0.0202	0.0030	0.0172
155	0.0206	0.0031	0.0175
156	0.0208	0.0031	0.0177
157	0.0213	0.0032	0.0181
158	0.0215	0.0032	0.0183
159	0.0220	0.0033	0.0187
160	0.0222	0.0033	0.0189
161	0.0228	0.0034	0.0194
162	0.0231	0.0035	0.0196
163	0.0237	0.0035	0.0201
164	0.0240	0.0036	0.0204
165	0.0246	0.0037	0.0209
166	0.0250	0.0037	0.0212
167	0.0257	0.0039	0.0219
168	0.0261	0.0039	0.0222
169	0.0297	0.0044	0.0252
170	0.0301	0.0045	0.0256
171	0.0311	0.0047	0.0265

172	0.0316	0.0047	0.0269
173	0.0328	0.0049	0.0279
174	0.0334	0.0050	0.0284
175	0.0347	0.0052	0.0295
176	0.0355	0.0053	0.0302
177	0.0371	0.0055	0.0315
178	0.0379	0.0057	0.0323
179	0.0399	0.0060	0.0339
180	0.0410	0.0061	0.0348
181	0.0434	0.0065	0.0369
182	0.0448	0.0067	0.0381
183	0.0481	0.0072	0.0409
184	0.0500	0.0075	0.0425
185	0.0474	0.0071	0.0403
186	0.0501	0.0075	0.0426
187	0.0568	0.0085	0.0483
188	0.0613	0.0092	0.0521
189	0.0739	0.0097	0.0642
190	0.0834	0.0097	0.0737
191	0.1192	0.0097	0.1094
192	0.1639	0.0097	0.1542
193	0.5129	0.0097	0.5032
194	0.0971	0.0097	0.0874
195	0.0668	0.0097	0.0571
196	0.0532	0.0080	0.0452
197	0.0521	0.0078	0.0443
198	0.0464	0.0069	0.0394
199	0.0422	0.0063	0.0358
200	0.0389	0.0058	0.0331
201	0.0362	0.0054	0.0308
202	0.0340	0.0051	0.0289
203	0.0322	0.0048	0.0274
204	0.0306	0.0046	0.0260
205	0.0265	0.0040	0.0226
206	0.0254	0.0038	0.0216
207	0.0243	0.0036	0.0207
208	0.0234	0.0035	0.0199
209	0.0225	0.0034	0.0191
210	0.0217	0.0033	0.0185
211	0.0210	0.0031	0.0179
212	0.0204	0.0031	0.0173
213	0.0198	0.0030	0.0168
214	0.0192	0.0029	0.0164
215	0.0187	0.0028	0.0159
216	0.0183	0.0027	0.0155
217	0.0194	0.0029	0.0165
218	0.0189	0.0028	0.0161
219	0.0185	0.0028	0.0158
220	0.0182	0.0027	0.0154
221	0.0178	0.0027	0.0151
222	0.0175	0.0026	0.0149
223	0.0171	0.0026	0.0146
224	0.0168	0.0025	0.0143
225	0.0166	0.0025	0.0141
226	0.0163	0.0024	0.0138
227	0.0160	0.0024	0.0136
228	0.0158	0.0024	0.0134
229	0.0155	0.0023	0.0132
230	0.0153	0.0023	0.0130
231	0.0151	0.0023	0.0128
232	0.0149	0.0022	0.0126
233	0.0147	0.0022	0.0125
234	0.0145	0.0022	0.0123
235	0.0143	0.0021	0.0121
236	0.0141	0.0021	0.0120
237	0.0139	0.0021	0.0118

238	0.0138	0.0021	0.0117
239	0.0136	0.0020	0.0116
240	0.0134	0.0020	0.0114
241	0.0133	0.0020	0.0113
242	0.0131	0.0020	0.0112
243	0.0130	0.0019	0.0111
244	0.0129	0.0019	0.0109
245	0.0127	0.0019	0.0108
246	0.0126	0.0019	0.0107
247	0.0125	0.0019	0.0106
248	0.0123	0.0018	0.0105
249	0.0122	0.0018	0.0104
250	0.0121	0.0018	0.0103
251	0.0120	0.0018	0.0102
252	0.0119	0.0018	0.0101
253	0.0118	0.0018	0.0100
254	0.0117	0.0017	0.0099
255	0.0116	0.0017	0.0098
256	0.0115	0.0017	0.0097
257	0.0114	0.0017	0.0097
258	0.0113	0.0017	0.0096
259	0.0112	0.0017	0.0095
260	0.0111	0.0017	0.0094
261	0.0110	0.0016	0.0094
262	0.0109	0.0016	0.0093
263	0.0108	0.0016	0.0092
264	0.0107	0.0016	0.0091
265	0.0107	0.0016	0.0091
266	0.0106	0.0016	0.0090
267	0.0105	0.0016	0.0089
268	0.0104	0.0016	0.0089
269	0.0104	0.0015	0.0088
270	0.0103	0.0015	0.0087
271	0.0102	0.0015	0.0087
272	0.0101	0.0015	0.0086
273	0.0101	0.0015	0.0086
274	0.0100	0.0015	0.0085
275	0.0099	0.0015	0.0084
276	0.0099	0.0015	0.0084
277	0.0098	0.0015	0.0083
278	0.0097	0.0015	0.0083
279	0.0097	0.0014	0.0082
280	0.0096	0.0014	0.0082
281	0.0096	0.0014	0.0081
282	0.0095	0.0014	0.0081
283	0.0094	0.0014	0.0080
284	0.0094	0.0014	0.0080
285	0.0093	0.0014	0.0079
286	0.0093	0.0014	0.0079
287	0.0092	0.0014	0.0078
288	0.0092	0.0014	0.0078

Total soil rain loss = 0.77(In)
Total effective rainfall = 5.01(In)
Peak flow rate in flood hydrograph = 2524.87(CFS)

++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

```
Time(h+m) Volume Ac.Ft   Q(CFS)  0      650.0    1300.0    1950.0    2600.0
-----------------------------------------------------------------------
```

```
0+ 5       0.0109      1.58  Q          |          |          |          |
0+10       0.0603      7.17  Q          |          |          |          |
0+15       0.1974     19.92  Q          |          |          |          |
0+20       0.4536     37.19  Q          |          |          |          |
0+25       0.8606     59.10  Q          |          |          |          |
0+30       1.4184     81.00  VQ         |          |          |          |
0+35       2.0650     93.89  VQ         |          |          |          |
0+40       2.7765    103.31  VQ         |          |          |          |
0+45       3.5241    108.55  VQ         |          |          |          |
0+50       4.2961    112.09  VQ         |          |          |          |
0+55       5.0823    114.16  VQ         |          |          |          |
1+ 0       5.8752    115.13  VQ         |          |          |          |
1+ 5       6.6736    115.93  VQ         |          |          |          |
1+10       7.4777    116.75  VQ         |          |          |          |
1+15       8.2874    117.56  VQ         |          |          |          |
1+20       9.1017    118.24  VQ         |          |          |          |
1+25       9.9184    118.59  VQ         |          |          |          |
1+30      10.7376    118.95  VQ         |          |          |          |
1+35      11.5594    119.31  VQ         |          |          |          |
1+40      12.3836    119.68  VQ         |          |          |          |
1+45      13.2104    120.05  |Q         |          |          |          |
1+50      14.0398    120.42  |Q         |          |          |          |
1+55      14.8717    120.80  |Q         |          |          |          |
2+ 0      15.7063    121.18  |Q         |          |          |          |
2+ 5      16.5435    121.56  |Q         |          |          |          |
2+10      17.3833    121.95  |Q         |          |          |          |
2+15      18.2259    122.33  |Q         |          |          |          |
2+20      19.0711    122.73  |Q         |          |          |          |
2+25      19.9191    123.12  |Q         |          |          |          |
2+30      20.7698    123.53  |Q         |          |          |          |
2+35      21.6233    123.93  |Q         |          |          |          |
2+40      22.4796    124.34  |Q         |          |          |          |
2+45      23.3388    124.75  |Q         |          |          |          |
2+50      24.2008    125.17  |Q         |          |          |          |
2+55      25.0657    125.58  |Q         |          |          |          |
3+ 0      25.9335    126.01  |QV        |          |          |          |
3+ 5      26.8043    126.43  |QV        |          |          |          |
3+10      27.6780    126.87  |QV        |          |          |          |
3+15      28.5547    127.30  |QV        |          |          |          |
3+20      29.4345    127.74  |QV        |          |          |          |
3+25      30.3173    128.19  |QV        |          |          |          |
3+30      31.2033    128.64  |QV        |          |          |          |
3+35      32.0923    129.09  |QV        |          |          |          |
3+40      32.9845    129.55  |QV        |          |          |          |
3+45      33.8799    130.01  | Q        |          |          |          |
3+50      34.7785    130.48  | Q        |          |          |          |
3+55      35.6803    130.95  | Q        |          |          |          |
4+ 0      36.5854    131.43  | Q        |          |          |          |
4+ 5      37.4939    131.91  | Q        |          |          |          |
4+10      38.4057    132.40  | QV       |          |          |          |
4+15      39.3209    132.88  | QV       |          |          |          |
4+20      40.2395    133.38  | QV       |          |          |          |
4+25      41.1616    133.88  | QV       |          |          |          |
4+30      42.0872    134.40  | QV       |          |          |          |
4+35      43.0163    134.91  | QV       |          |          |          |
4+40      43.9490    135.43  | QV       |          |          |          |
4+45      44.8853    135.95  | QV       |          |          |          |
4+50      45.8252    136.48  | QV       |          |          |          |
4+55      46.7689    137.02  | QV       |          |          |          |
5+ 0      47.7163    137.56  | QV       |          |          |          |
5+ 5      48.6674    138.11  | QV       |          |          |          |
5+10      49.6224    138.67  | QV       |          |          |          |
5+15      50.5813    139.22  | QV       |          |          |          |
5+20      51.5440    139.79  | Q V      |          |          |          |
5+25      52.5108    140.37  | Q V      |          |          |          |
5+30      53.4815    140.95  | Q V      |          |          |          |
```

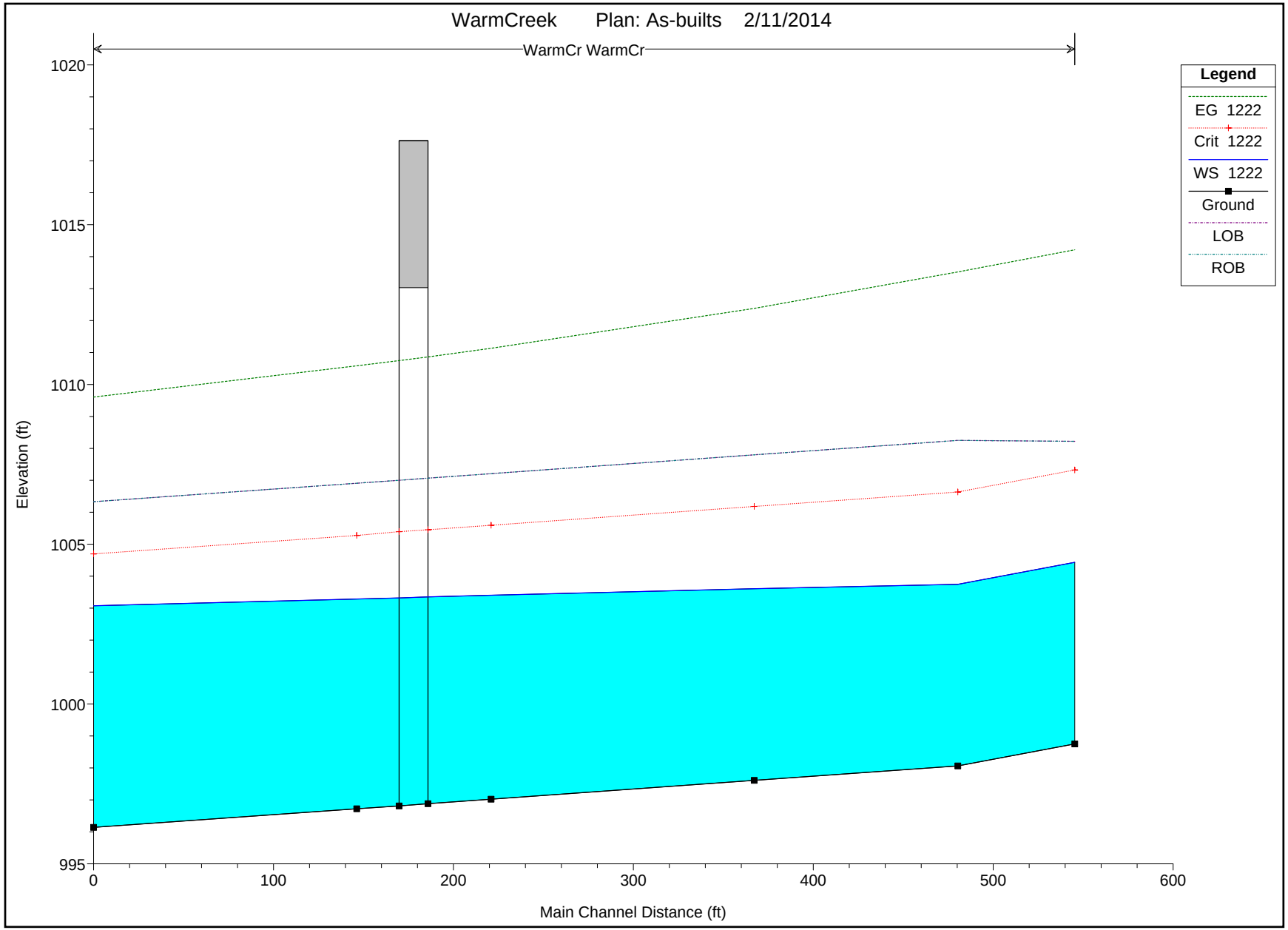
```
 5+35      54.4562    141.54  | Q V     |         |         |         |
 5+40      55.4351    142.13  | Q V     |         |         |         |
 5+45      56.4181    142.73  | Q V     |         |         |         |
 5+50      57.4054    143.35  | Q V     |         |         |         |
 5+55      58.3968    143.96  | Q V     |         |         |         |
 6+ 0      59.3926    144.59  | Q V     |         |         |         |
 6+ 5      60.3927    145.22  | Q V     |         |         |         |
 6+10      61.3972    145.86  | Q V     |         |         |         |
 6+15      62.4062    146.50  | Q V     |         |         |         |
 6+20      63.4197    147.16  | Q V     |         |         |         |
 6+25      64.4378    147.82  | Q  V    |         |         |         |
 6+30      65.4606    148.50  | Q  V    |         |         |         |
 6+35      66.4880    149.18  | Q  V    |         |         |         |
 6+40      67.5202    149.88  | Q  V    |         |         |         |
 6+45      68.5572    150.57  | Q  V    |         |         |         |
 6+50      69.5991    151.29  | Q  V    |         |         |         |
 6+55      70.6459    152.00  | Q  V    |         |         |         |
 7+ 0      71.6978    152.73  | Q  V    |         |         |         |
 7+ 5      72.7547    153.47  | Q  V    |         |         |         |
 7+10      73.8169    154.22  | Q  V    |         |         |         |
 7+15      74.8842    154.98  | Q  V    |         |         |         |
 7+20      75.9569    155.75  | Q  V    |         |         |         |
 7+25      77.0349    156.53  | Q   V   |         |         |         |
 7+30      78.1184    157.33  | Q   V   |         |         |         |
 7+35      79.2075    158.13  | Q   V   |         |         |         |
 7+40      80.3021    158.95  | Q   V   |         |         |         |
 7+45      81.4025    159.77  | Q   V   |         |         |         |
 7+50      82.5086    160.61  | Q   V   |         |         |         |
 7+55      83.6206    161.46  | Q   V   |         |         |         |
 8+ 0      84.7386    162.33  | Q   V   |         |         |         |
 8+ 5      85.8627    163.21  | Q   V   |         |         |         |
 8+10      86.9929    164.11  | Q   V   |         |         |         |
 8+15      88.1293    165.01  | Q   V   |         |         |         |
 8+20      89.2721    165.93  | Q    V  |         |         |         |
 8+25      90.4213    166.87  | Q    V  |         |         |         |
 8+30      91.5771    167.82  | Q    V  |         |         |         |
 8+35      92.7395    168.78  | Q    V  |         |         |         |
 8+40      93.9087    169.77  | Q    V  |         |         |         |
 8+45      95.0848    170.76  | Q    V  |         |         |         |
 8+50      96.2679    171.79  | Q    V  |         |         |         |
 8+55      97.4580    172.81  | Q    V  |         |         |         |
 9+ 0      98.6555    173.87  | Q    V  |         |         |         |
 9+ 5      99.8603    174.93  | Q    V  |         |         |         |
 9+10     101.0726    176.03  | Q    V  |         |         |         |
 9+15     102.2925    177.13  | Q     V |         |         |         |
 9+20     103.5202    178.26  | Q     V |         |         |         |
 9+25     104.7557    179.40  | Q     V |         |         |         |
 9+30     105.9994    180.58  | Q     V |         |         |         |
 9+35     107.2512    181.77  | Q     V |         |         |         |
 9+40     108.5115    182.99  | Q     V |         |         |         |
 9+45     109.7802    184.22  | Q     V |         |         |         |
 9+50     111.0576    185.48  | Q     V |         |         |         |
 9+55     112.3439    186.76  | Q     V |         |         |         |
10+ 0     113.6392    188.08  | Q     V |         |         |         |
10+ 5     114.9437    189.41  | Q      V|         |         |         |
10+10     116.2577    190.79  | Q      V|         |         |         |
10+15     117.5812    192.17  | Q      V|         |         |         |
10+20     118.9145    193.60  | Q      V|         |         |         |
10+25     120.2578    195.05  |  Q     V|         |         |         |
10+30     121.6114    196.54  |  Q     V|         |         |         |
10+35     122.9754    198.05  |  Q     V|         |         |         |
10+40     124.3501    199.61  |  Q     V|         |         |         |
10+45     125.7357    201.19  |  Q     V|         |         |         |
10+50     127.1325    202.82  |  Q     V|         |         |         |
10+55     128.5407    204.47  |  Q      V         |         |         |
11+ 0     129.9607    206.18  |  Q      V         |         |         |
```

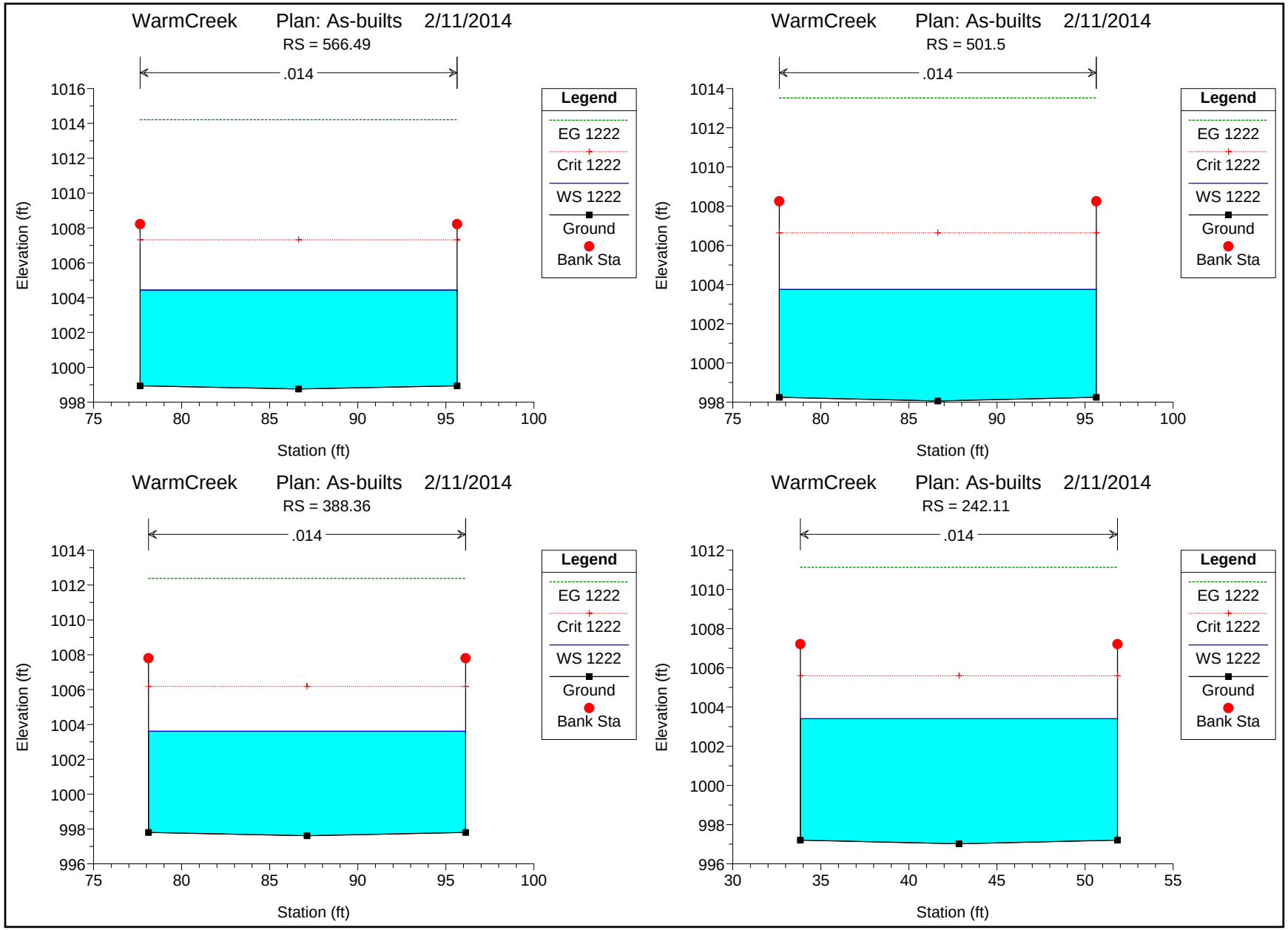
```
11+ 5     131.3926    207.91  |  Q      V          |          |          |
11+10     132.8368    209.70  |  Q      V          |          |          |
11+15     134.2935    211.52  |  Q      V          |          |          |
11+20     135.7632    213.40  |  Q      V          |          |          |
11+25     137.2461    215.31  |  Q      V          |          |          |
11+30     138.7426    217.29  |  Q      V          |          |          |
11+35     140.2529    219.30  |  Q      |V         |          |          |
11+40     141.7776    221.39  |  Q      |V         |          |          |
11+45     143.3169    223.51  |  Q      |V         |          |          |
11+50     144.8714    225.71  |  Q      |V         |          |          |
11+55     146.4414    227.96  |  Q      |V         |          |          |
12+ 0     148.0274    230.29  |  Q      |V         |          |          |
12+ 5     149.6279    232.40  |  Q      |V         |          |          |
12+10     151.2390    233.93  |  Q      |V         |          |          |
12+15     152.8526    234.30  |  Q      |V         |          |          |
12+20     154.4643    234.01  |  Q      | V        |          |          |
12+25     156.0690    233.00  |  Q      | V        |          |          |
12+30     157.6675    232.11  |  Q      | V        |          |          |
12+35     159.2709    232.80  |  Q      | V        |          |          |
12+40     160.8839    234.21  |  Q      | V        |          |          |
12+45     162.5120    236.40  |  Q      | V        |          |          |
12+50     164.1581    239.01  |  Q      | V        |          |          |
12+55     165.8245    241.97  |  Q      |  V       |          |          |
13+ 0     167.5136    245.26  |  Q      |  V       |          |          |
13+ 5     169.2263    248.68  |  Q      |  V       |          |          |
13+10     170.9637    252.27  |  Q      |  V       |          |          |
13+15     172.7267    255.99  |  Q      |  V       |          |          |
13+20     174.5168    259.92  |  Q      |  V       |          |          |
13+25     176.3352    264.04  |   Q     |  V       |          |          |
13+30     178.1836    268.39  |   Q     |  V       |          |          |
13+35     180.0631    272.90  |   Q     |   V      |          |          |
13+40     181.9753    277.66  |   Q     |   V      |          |          |
13+45     183.9217    282.61  |   Q     |   V      |          |          |
13+50     185.9042    287.86  |   Q     |   V      |          |          |
13+55     187.9243    293.33  |   Q     |   V      |          |          |
14+ 0     189.9846    299.15  |   Q     |   V      |          |          |
14+ 5     192.0900    305.71  |   Q     |    V     |          |          |
14+10     194.2516    313.86  |   Q     |    V     |          |          |
14+15     196.4862    324.46  |   Q     |    V     |          |          |
14+20     198.8063    336.88  |    Q    |    V     |          |          |
14+25     201.2244    351.11  |    Q    |    V     |          |          |
14+30     203.7445    365.92  |    Q    |    V     |          |          |
14+35     206.3521    378.63  |    Q    |     V    |          |          |
14+40     209.0453    391.04  |     Q   |     V    |          |          |
14+45     211.8201    402.91  |     Q   |     V    |          |          |
14+50     214.6795    415.19  |     Q   |     V    |          |          |
14+55     217.6267    427.93  |     Q   |      V   |          |          |
15+ 0     220.6675    441.53  |     Q   |      V   |          |          |
15+ 5     223.8100    456.29  |      Q  |      V   |          |          |
15+10     227.0651    472.65  |      Q  |      V   |          |          |
15+15     230.4447    490.71  |      Q  |       V  |          |          |
15+20     233.9638    510.98  |      Q  |       V  |          |          |
15+25     237.6310    532.48  |       Q |       V  |          |          |
15+30     241.4479    554.20  |       Q |       V  |          |          |
15+35     245.4042    574.46  |       Q |        V|          |          |
15+40     249.5131    596.61  |        Q|        V|          |          |
15+45     253.8028    622.87  |        Q|        V|          |          |
15+50     258.3533    660.73  |         Q        V          |          |
15+55     263.3594    726.89  |         |Q       V          |          |
16+ 0     269.1084    834.75  |         | Q      |V         |          |
16+ 5     276.5085   1074.48  |         |     Q  |V         |          |
16+10     286.6211   1468.35  |         |        | Q        |          |
16+15     300.3294   1990.45  |         |        |  V     Q |          |
16+20     316.3040   2319.51  |         |        |   V      |    Q     |
16+25     333.6929   2524.87  |         |        |     V    |       Q  |
16+30     350.0409   2373.74  |         |        |      V   |     Q    |
```

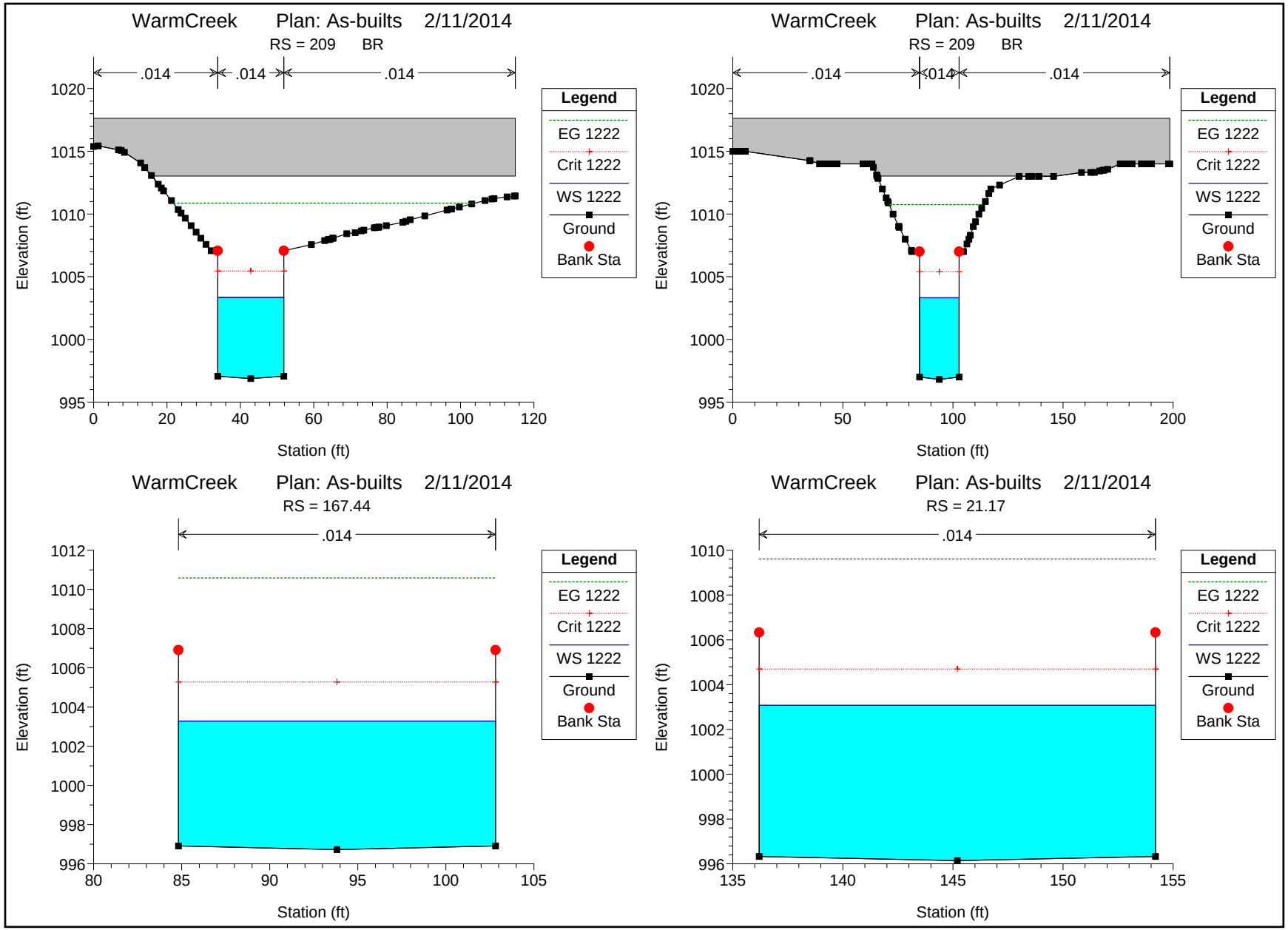
```
16+35     362.0535   1744.23 |          |          |     Q V |          |
16+40     371.6501   1393.42 |          |          |Q       V|          |
16+45     378.8849   1050.49 |          |     Q    |         V|          |
16+50     384.7998    858.84 |          |  Q       |          V          |
16+55     389.6346    702.02 |          Q          |          V          |
17+ 0     393.6743    586.56 |         Q|          |          V          |
17+ 5     397.3427    532.65 |        Q |          |          |V         |
17+10     400.7551    495.48 |       Q  |          |          |V         |
17+15     403.9218    459.81 |       Q  |          |          |V         |
17+20     406.8012    418.08 |      Q   |          |          |V         |
17+25     409.3627    371.93 |     Q    |          |          | V        |
17+30     411.7459    346.04 |     Q    |          |          | V        |
17+35     413.9934    326.34 |     Q    |          |          | V        |
17+40     416.1270    309.80 |    Q     |          |          | V        |
17+45     418.1651    295.94 |    Q     |          |          | V        |
17+50     420.1207    283.94 |    Q     |          |          | V        |
17+55     422.0043    273.50 |    Q     |          |          |  V       |
18+ 0     423.8246    264.31 |    Q     |          |          |  V       |
18+ 5     425.5892    256.23 |   Q      |          |          |  V       |
18+10     427.3075    249.49 |   Q      |          |          |  V       |
18+15     428.9917    244.54 |   Q      |          |          |  V       |
18+20     430.6508    240.90 |   Q      |          |          |  V       |
18+25     432.2938    238.56 |   Q      |          |          |  V       |
18+30     433.9233    236.60 |   Q      |          |          |   V      |
18+35     435.5310    233.45 |   Q      |          |          |   V      |
18+40     437.1151    230.01 |   Q      |          |          |   V      |
18+45     438.6727    226.15 |   Q      |          |          |   V      |
18+50     440.2034    222.26 |   Q      |          |          |   V      |
18+55     441.7072    218.36 |   Q      |          |          |   V      |
19+ 0     443.1844    214.48 |   Q      |          |          |   V      |
19+ 5     444.6360    210.78 |   Q      |          |          |   V      |
19+10     446.0634    207.26 |   Q      |          |          |   V      |
19+15     447.4678    203.91 |   Q      |          |          |    V     |
19+20     448.8500    200.70 |   Q      |          |          |    V     |
19+25     450.2107    197.57 |   Q      |          |          |    V     |
19+30     451.5508    194.58 | Q        |          |          |    V     |
19+35     452.8712    191.72 | Q        |          |          |    V     |
19+40     454.1726    188.97 | Q        |          |          |    V     |
19+45     455.4559    186.33 | Q        |          |          |    V     |
19+50     456.7216    183.79 | Q        |          |          |    V     |
19+55     457.9706    181.35 | Q        |          |          |    V     |
20+ 0     459.2034    179.00 | Q        |          |          |     V    |
20+ 5     460.4206    176.73 | Q        |          |          |     V    |
20+10     461.6227    174.55 | Q        |          |          |     V    |
20+15     462.8103    172.44 | Q        |          |          |     V    |
20+20     463.9838    170.40 | Q        |          |          |     V    |
20+25     465.1438    168.42 | Q        |          |          |     V    |
20+30     466.2906    166.51 | Q        |          |          |     V    |
20+35     467.4246    164.67 | Q        |          |          |     V    |
20+40     468.5463    162.87 | Q        |          |          |     V    |
20+45     469.6561    161.14 | Q        |          |          |     V    |
20+50     470.7542    159.45 | Q        |          |          |     V    |
20+55     471.8411    157.81 | Q        |          |          |      V   |
21+ 0     472.9170    156.22 | Q        |          |          |      V   |
21+ 5     473.9823    154.68 | Q        |          |          |      V   |
21+10     475.0372    153.18 | Q        |          |          |      V   |
21+15     476.0821    151.71 | Q        |          |          |      V   |
21+20     477.1172    150.29 | Q        |          |          |      V   |
21+25     478.1427    148.91 | Q        |          |          |      V   |
21+30     479.1589    147.56 | Q        |          |          |      V   |
21+35     480.1661    146.24 | Q        |          |          |      V   |
21+40     481.1644    144.96 | Q        |          |          |      V   |
21+45     482.1541    143.71 | Q        |          |          |      V   |
21+50     483.1354    142.48 | Q        |          |          |      V   |
21+55     484.1085    141.29 | Q        |          |          |      V   |
22+ 0     485.0736    140.13 | Q        |          |          |       V  |
```

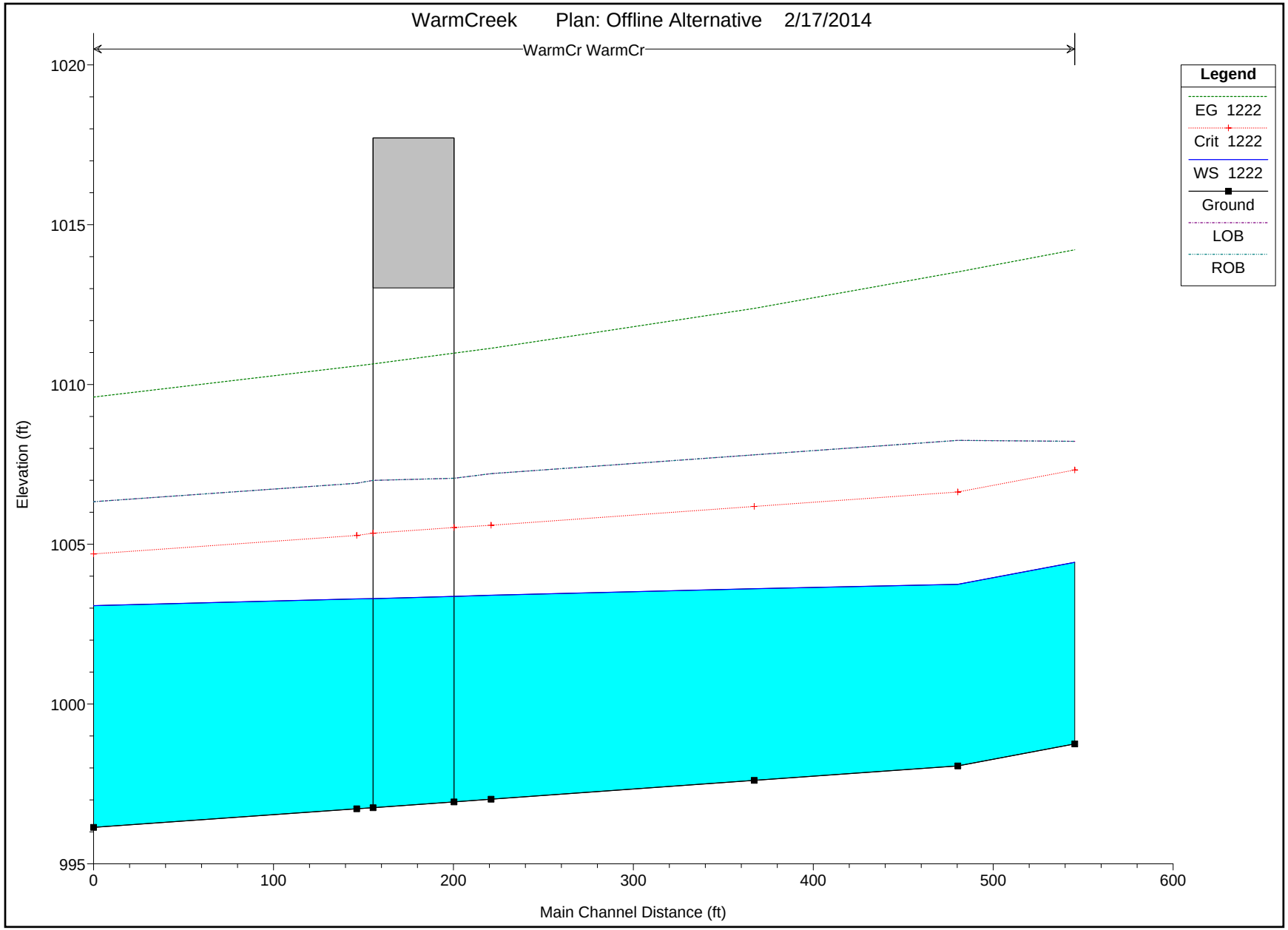
```
   22+ 5     486.0308    138.99  | Q       |         |         |       V |
   22+10     486.9804    137.88  | Q       |         |         |       V |
   22+15     487.9225    136.79  | Q       |         |         |       V |
   22+20     488.8572    135.73  | Q       |         |         |       V |
   22+25     489.7848    134.69  | Q       |         |         |       V |
   22+30     490.7054    133.67  | Q       |         |         |       V |
   22+35     491.6192    132.68  | Q       |         |         |       V |
   22+40     492.5262    131.70  | Q       |         |         |       V |
   22+45     493.4267    130.75  | Q       |         |         |       V |
   22+50     494.3207    129.81  |Q        |         |         |       V |
   22+55     495.2084    128.89  |Q        |         |         |       V |
   23+ 0     496.0898    127.99  |Q        |         |         |       V |
   23+ 5     496.9653    127.11  |Q        |         |         |       V |
   23+10     497.8348    126.25  |Q        |         |         |        V|
   23+15     498.6984    125.40  |Q        |         |         |        V|
   23+20     499.5563    124.57  |Q        |         |         |        V|
   23+25     500.4086    123.75  |Q        |         |         |        V|
   23+30     501.2554    122.95  |Q        |         |         |        V|
   23+35     502.0967    122.16  |Q        |         |         |        V|
   23+40     502.9327    121.39  |Q        |         |         |        V|
   23+45     503.7635    120.63  |Q        |         |         |        V|
   23+50     504.5892    119.89  |Q        |         |         |        V|
   23+55     505.4098    119.15  |Q        |         |         |        V|
   24+ 0     506.2255    118.43  |Q        |         |         |        V|
   24+ 5     507.0254    116.15  |Q        |         |         |        V|
   24+10     507.7822    109.89  |Q        |         |         |        V|
   24+15     508.4470     96.53  |Q        |         |         |        V|
   24+20     508.9896     78.78  |Q        |         |         |        V|
   24+25     509.3791     56.56  Q         |         |         |        V|
   24+30     509.6168     34.52  Q         |         |         |        V|
   24+35     509.7662     21.69  Q         |         |         |        V|
   24+40     509.8518     12.43  Q         |         |         |        V|
   24+45     509.9028      7.41  Q         |         |         |        V|
   24+50     509.9314      4.15  Q         |         |         |        V|
   24+55     509.9479      2.39  Q         |         |         |        V|
   25+ 0     509.9599      1.74  Q         |         |         |        V|
   25+ 5     509.9686      1.27  Q         |         |         |        V|
   25+10     509.9741      0.79  Q         |         |         |        V|
   25+15     509.9763      0.32  Q         |         |         |         V
-----------------------------------------------------------------------
```

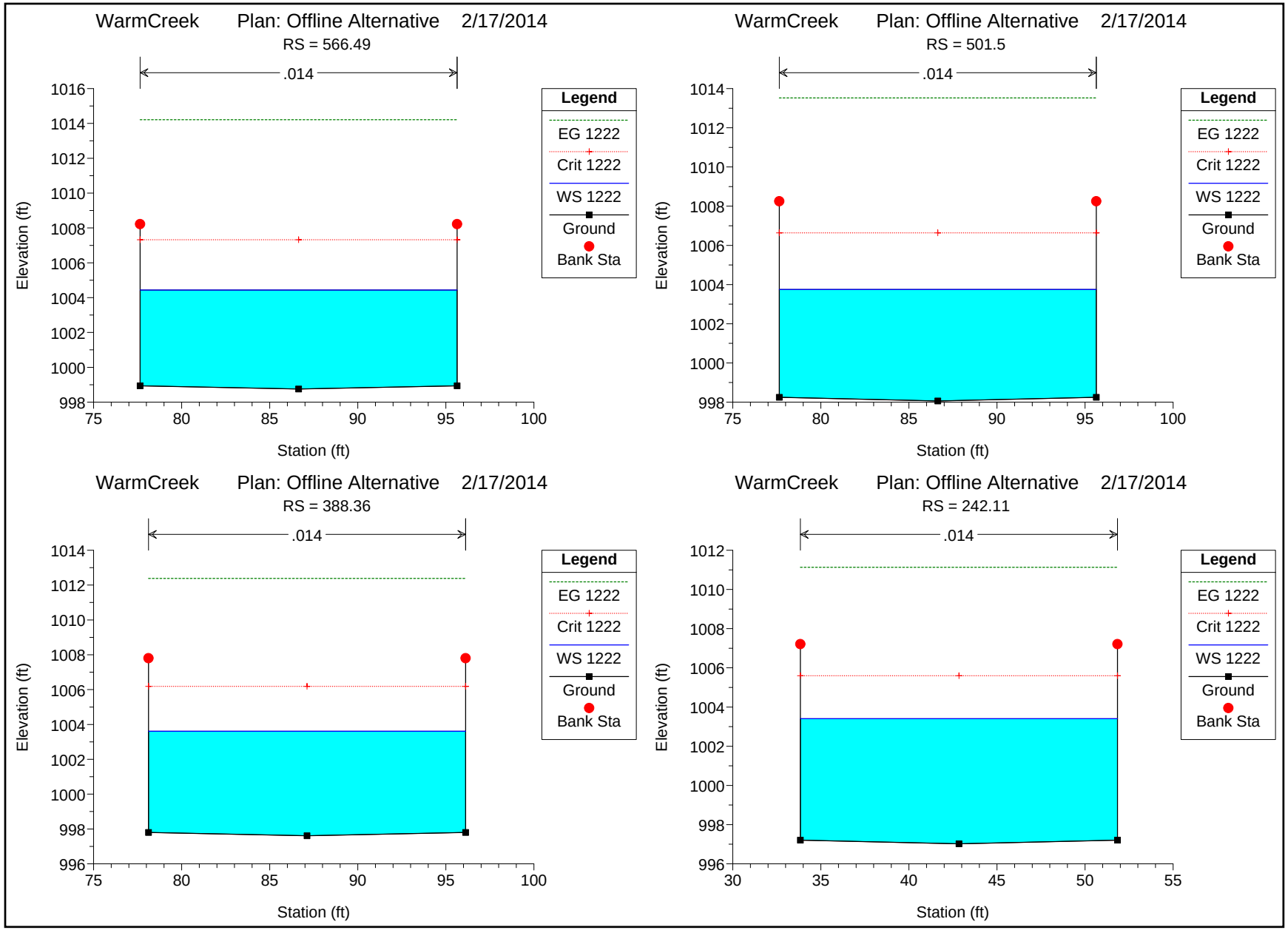
Attachment 2 – HEC-RAS Modeling Exhibits

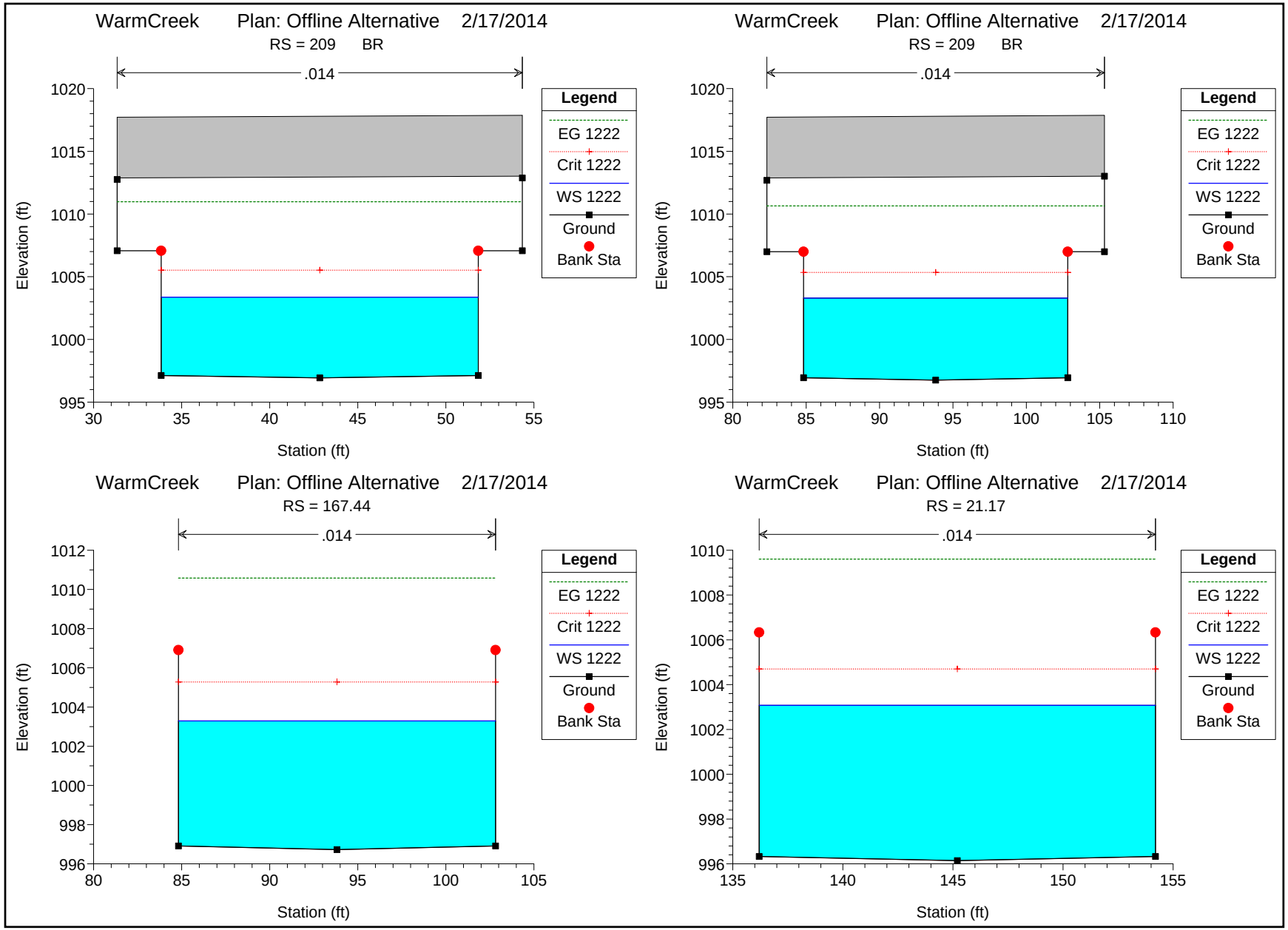

WarmCreek Plan: As-builts 2/11/2014
WarmCr WarmCr
Legend
EG 1222
Crit 1222
WS 1222
Ground
LOB
ROB
Elevation (ft)
1020
1015
1010
1005
1000
995
0
100
200
300
400
500
600
Main Channel Distance (ft)

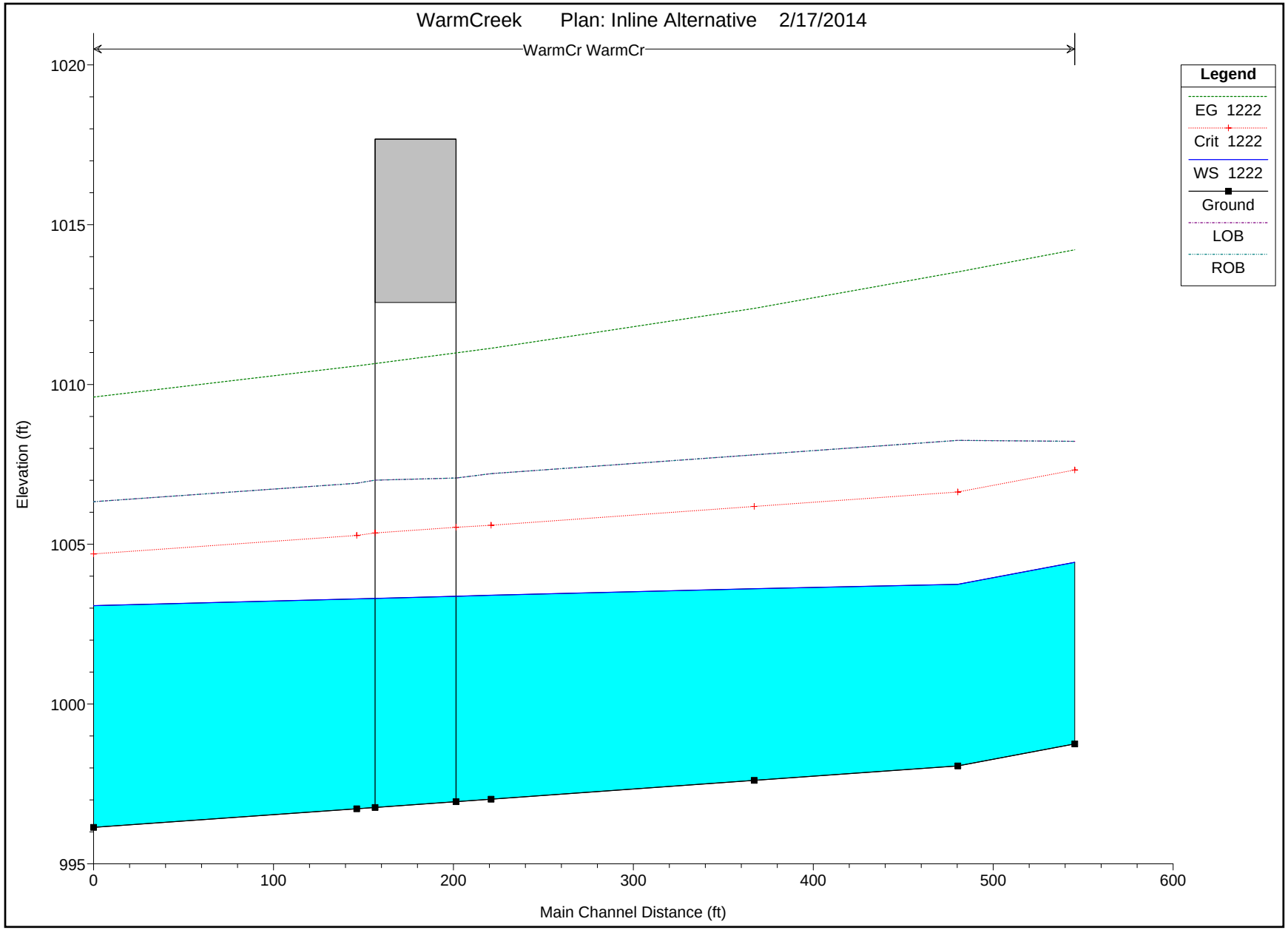

WarmCreek Plan: As-builts 2/11/2014
RS = 566.49
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: As-builts 2/11/2014
RS = 501.5
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: As-builts 2/11/2014
RS = 388.36
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: As-builts 2/11/2014
RS = 242.11
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta

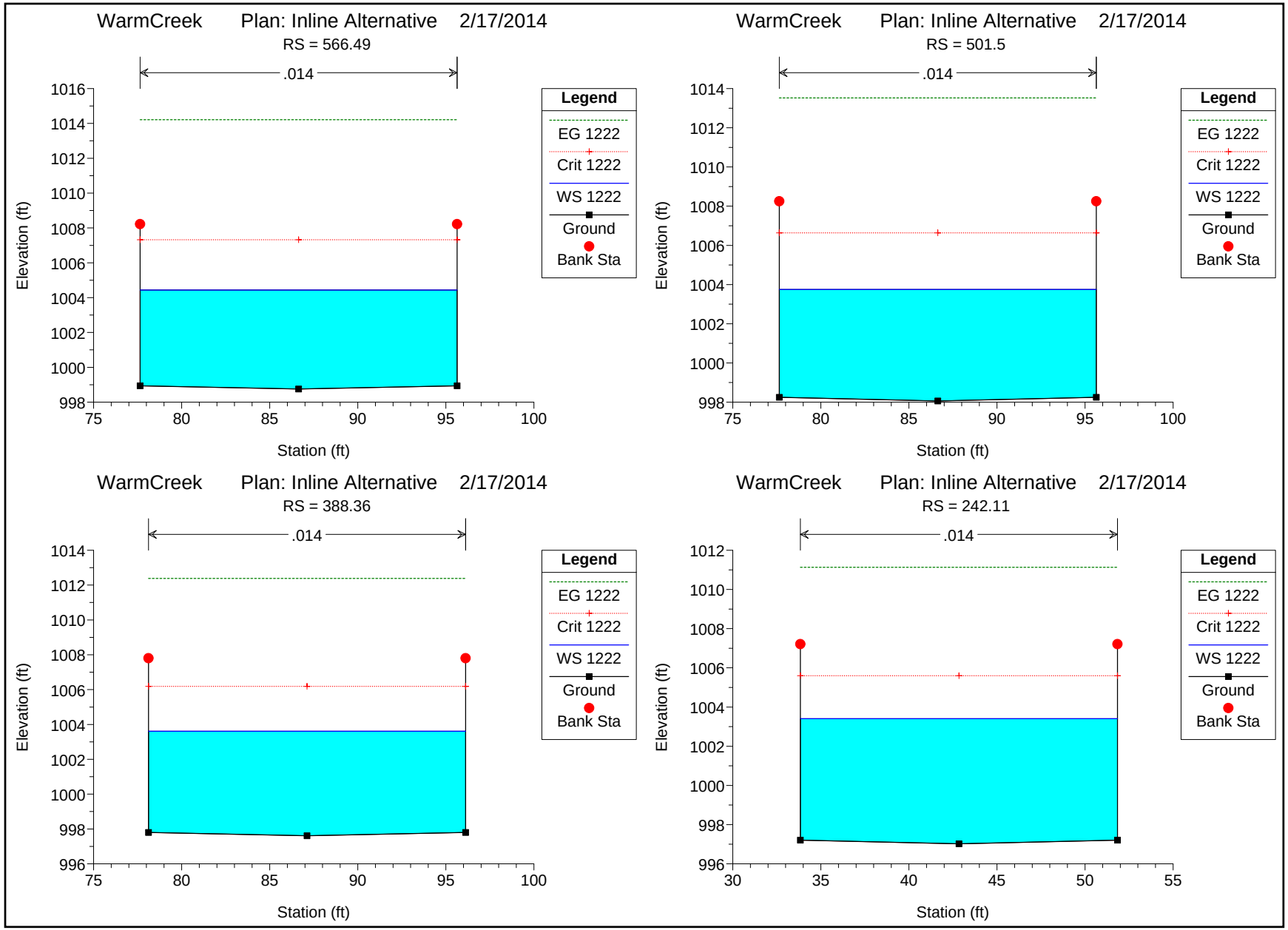

WarmCreek Plan: As-builts 2/11/2014
RS = 209 BR
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: As-builts 2/11/2014
RS = 209 BR
.014
.014
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: As-builts 2/11/2014
RS = 167.44
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: As-builts 2/11/2014
RS = 21.17
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta

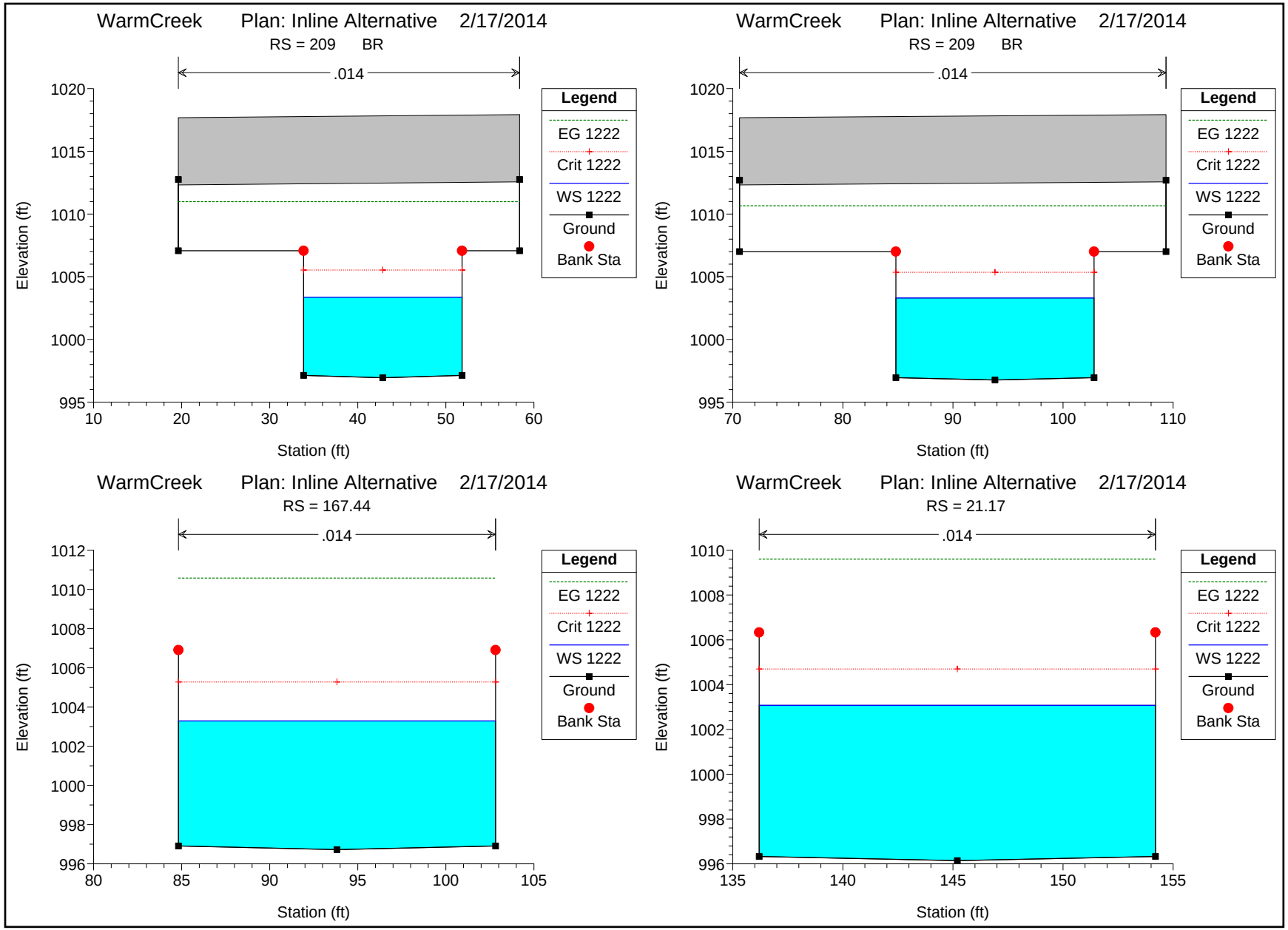

WarmCreek Plan: Offline Alternative 2/17/2014
WarmCr WarmCr
Legend
EG 1222
Crit 1222
WS 1222
Ground
LOB
ROB
Elevation (ft)
1020
1015
1010
1005
1000
995
0
100
200
300
400
500
600
Main Channel Distance (ft)


WarmCreek Plan: Offline Alternative 2/17/2014
RS = 566.49
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Offline Alternative 2/17/2014
RS = 501.5
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Offline Alternative 2/17/2014
RS = 388.36
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Offline Alternative 2/17/2014
RS = 242.11
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta


WarmCreek Plan: Offline Alternative 2/17/2014
RS = 209 BR
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Offline Alternative 2/17/2014
RS = 209 BR
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Offline Alternative 2/17/2014
RS = 167.44
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Offline Alternative 2/17/2014
RS = 21.17
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta


WarmCreek Plan: Inline Alternative 2/17/2014
WarmCr WarmCr
Legend
EG 1222
Crit 1222
WS 1222
Ground
LOB
ROB
Elevation (ft)
1020
1015
1010
1005
1000
995
0
100
200
300
400
500
600
Main Channel Distance (ft)


WarmCreek Plan: Inline Alternative 2/17/2014
RS = 566.49
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Inline Alternative 2/17/2014
RS = 501.5
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Inline Alternative 2/17/2014
RS = 388.36
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Inline Alternative 2/17/2014
RS = 242.11
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta


WarmCreek Plan: Inline Alternative 2/17/2014
RS = 209 BR
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Inline Alternative 2/17/2014
RS = 209 BR
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Inline Alternative 2/17/2014
RS = 167.44
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta
WarmCreek Plan: Inline Alternative 2/17/2014
RS = 21.17
.014
Elevation (ft)
Station (ft)
Legend
EG 1222
Crit 1222
WS 1222
Ground
Bank Sta

Attachment 3 – Hydraulic Analysis Results

HEC-RAS Plan: as-built River: WarmCr Reach: WarmCr Profile: 1222

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)	
WarmCr	566.49	1222	2525.00	998.75	1004.44	1007.32	1014.22	0.010642	25.10	100.62	18.00	1.87
WarmCr	501.5	1222	2525.00	998.06	1003.75	1006.63	1013.52	0.010635	25.09	100.64	18.00	1.87
WarmCr	388.36	1222	2525.00	997.61	1003.61	1006.19	1012.38	0.009134	23.77	106.24	18.00	1.72
WarmCr	242.11	1222	2525.00	997.02	1003.41	1005.60	1011.13	0.007651	22.31	113.20	18.00	1.57
WarmCr	209		Bridge									
WarmCr	167.44	1222	2525.00	996.72	1003.29	1005.28	1010.59	0.007068	21.68	116.47	18.00	1.50
WarmCr	21.17	1222	2525.00	996.14	1003.08	1004.70	1009.61	0.006062	20.51	123.13	18.00	1.38

HEC-RAS Plan: Offline Alt River: WarmCr Reach: WarmCr Profile: 1222

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)	
WarmCr	566.49	1222	2525.00	998.75	1004.44	1007.32	1014.22	0.010642	25.10	100.62	18.00	1.87
WarmCr	501.5	1222	2525.00	998.06	1003.75	1006.63	1013.52	0.010635	25.09	100.64	18.00	1.87
WarmCr	388.36	1222	2525.00	997.61	1003.61	1006.19	1012.38	0.009134	23.77	106.24	18.00	1.72
WarmCr	242.11	1222	2525.00	997.02	1003.41	1005.60	1011.13	0.007651	22.31	113.20	18.00	1.57
WarmCr	209		Bridge									
WarmCr	167.44	1222	2525.00	996.72	1003.29	1005.28	1010.58	0.007061	21.67	116.52	18.00	1.50
WarmCr	21.17	1222	2525.00	996.14	1003.08	1004.70	1009.61	0.006056	20.50	123.17	18.00	1.38

HEC-RAS Plan: Inline Alt River: WarmCr Reach: WarmCr Profile: 1222

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)	
WarmCr	566.49	1222	2525.00	998.75	1004.44	1007.32	1014.22	0.010642	25.10	100.62	18.00	1.87
WarmCr	501.5	1222	2525.00	998.06	1003.75	1006.63	1013.52	0.010635	25.09	100.64	18.00	1.87
WarmCr	388.36	1222	2525.00	997.61	1003.61	1006.19	1012.38	0.009134	23.77	106.24	18.00	1.72
WarmCr	242.11	1222	2525.00	997.02	1003.41	1005.60	1011.13	0.007651	22.31	113.20	18.00	1.57
WarmCr	209		Bridge									
WarmCr	167.44	1222	2525.00	996.72	1003.29	1005.28	1010.58	0.007061	21.67	116.52	18.00	1.50
WarmCr	21.17	1222	2525.00	996.14	1003.08	1004.70	1009.61	0.006056	20.50	123.17	18.00	1.38

Attachment 4 – Digital Information (CD)