APPENDIX H

Hydrology Report for Bridge Crossing

Hydrologic and Hydraulic Analysis for Two Bridge Locations for

Hidden Falls Regional Park

- Phase 1A

Auburn

Placer County

California

Prepared for:

Placer County Department of Facilities Services Parks and Grounds Division
Tim Arndt, Senior Project Manager
11476 "C" Avenue
Auburn, CA 95603

February 2012
Project No.6339-01-08

Prepared by:

Carlton Engineering, Inc
3883 Ponderosa Road
Shingle Springs, Ca
530-677-5515

CARLTON
Engineering Inc.

Table of Contents

Index of Tables and Figures

I. EXECUTIVE SUMMARY:

This hydrologic and hydraulic report has been prepared at the request of the Placer County Department of Facilities Services Parks and Grounds Division to review and address the impacts of two proposed bridge crossings on Coon Creek east of the Hidden Falls Regional Park (HFRP). This report provides a descriptive and analytic observation of the 100-year floodplains as they relate to the proposed bridge locations, and has been written with the intent of presenting the clearest picture possible of the impacts the two bridges will have on the floodplain of Coon Creek. This report will not be used to establish flood mapping for the Federal Emergency Management Agency (i.e. Letter of Map Revision).

The purpose of the bridge crossings is to provide trail network support, pedestrian, equestrian, and connection with existing facilities and access areas east of HFRP.

Coon Creek is a typical Sierra Nevada waterway, draining from east to west, and is shown on the USGS quad map (Gold Hill, CA) as a solid blue line for most of its length throughout the watershed basin. There were many near vertical waterfall sections and alternating bank geometry and cover.

The hydrologic analysis for Coon Creek was based on an existing model provided to Carlton Engineering (Carlton) by the Placer County Flood Control District (District). The existing model was prepared and analyzed with the use of United States Army Corps of Engineers (USACE) Hydrologic Engineering Center HEC-1 modeling program (HEC-1), and analyzed the 100-year peak storm event. The HEC-1 data file provided by the District was updated by Carlton to include the 10-, 25-, and 50-year storm events. The peak flow rates at the two bridge locations are identified in Section IV.B, Table 4.

Bridge 4
Bridge 4 has a drainage area of approximately 26.5 square miles, and is a 10 ft wide (outside to outside, 8 ft deck width), 85 ft long center pre-manufactured steel truss bridge, with two approximately 22 ft long pre-manufactured steel truss bridges on either side supported by two center columns. Bridge 4 is located in a narrow canyon and will be only accessible by pedestrian/equestrian or quads used by Park officials. Bridge 4 will have concrete abutments on either side of Coon Creek and two supporting columns constructed outside of the ordinary high water mark and 100-year floodplain. Bridge 4 will be located above the minimum 3 ft freeboard of the 100-year floodplain.

Bridge 5
Bridge 5 has a drainage area of approximately 26.1 square miles, and is a 12 ft wide (deck width), 100 ft long pre-manufactured steel truss bridge. It may provide access for vehicles, pedestrians, and equestrians. Bridge 5 will have concrete abutments on either side of Coon Creek and will be constructed outside the ordinary high water mark. The south abutment will be located within the 100-year floodplain. Bridge 5 will be located above the minimum 3 ft freeboard of the 100-year floodplain. The southern abutment will be designed to withstand the water velocity and scour during 100-yr storm events.

II. PROJECT INTRODUCTION:

The site is located east of the 1,200 acre Hidden Falls Regional Park northwest of Auburn in Placer County; situated between Garden Bar Road, Mt. Vernon Road, and Bell Road, in Township 13 North, Range 7 East, Sections 13, and 14. Site improvements specific to this report include two (2) proposed bridge locations with accompanying abutments, and approach roads.

The construction access for Bridge 4 is from Hubbard Road through the Campbell property (APN 026-080-059). The HFRP construction access for Bridge 5 is from Orr Creek Lane through the Placer Land Trust property (formerly the Taylor Ranch, APN 026-120-028). The proposed bridge crossings are located along Coon Creek, which runs east to west through the park. The elevation for the sites vary from approximately 830 feet at Bridge 4 in the west to 1015 feet at Bridge 5 in the east.

The purpose of the bridge crossings is to provide trail network support, and connection with existing facilities and access to areas east of HFRP.

The purpose of this hydrologic and hydraulic analysis is to make a determination of significant impacts on Coon Creek as a result of construction of the two bridges.

This report has been prepared in part based on the following available information:

- USGS Topographic Survey
- TopoDepot, 2012
- Carlton Engineering Topographic Survey, 2009, 2012 (Note: All elevations shown in this analysis are based on NAVD 88. To convert elevations from NAVD 88 to NGVD 29 subtract 2.40 feet)
- Google Earth, 2010

- CH2M Hill 1991 Cross Canal Watershed Model (Existing USACE HEC-1)
- Placer County Flood Control and Water Conservation District Stormwater Management Manual, September 1, 1990
- Carlton Engineering Geotechnical Report (2010, 2012)
- Carlton Engineering Bridge Schematic Design Plans (February 2012)

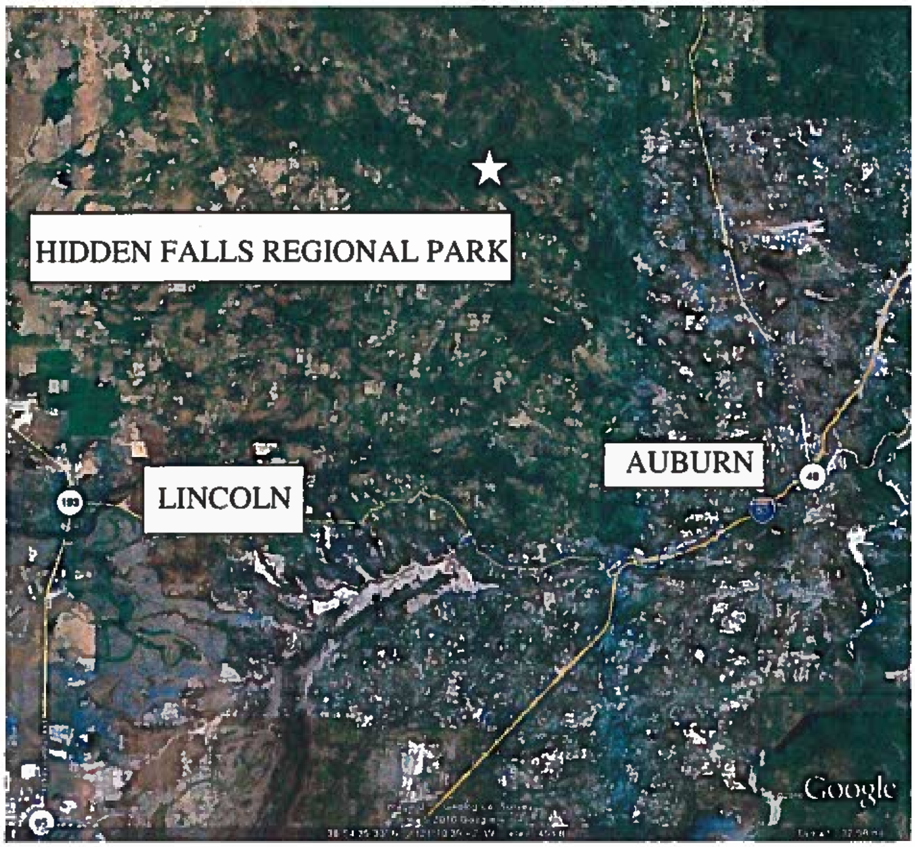


Figure 1: HFRP Location Map

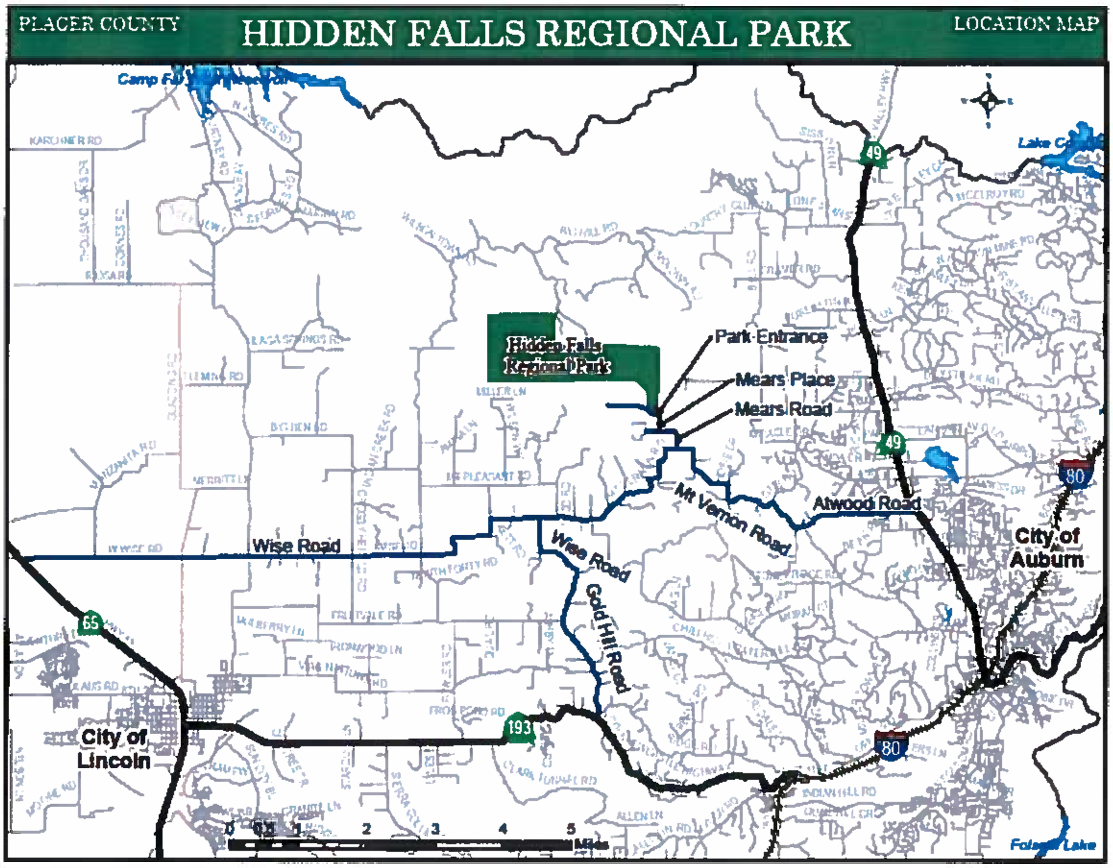


Figure 2: HFRP Vicinity Map

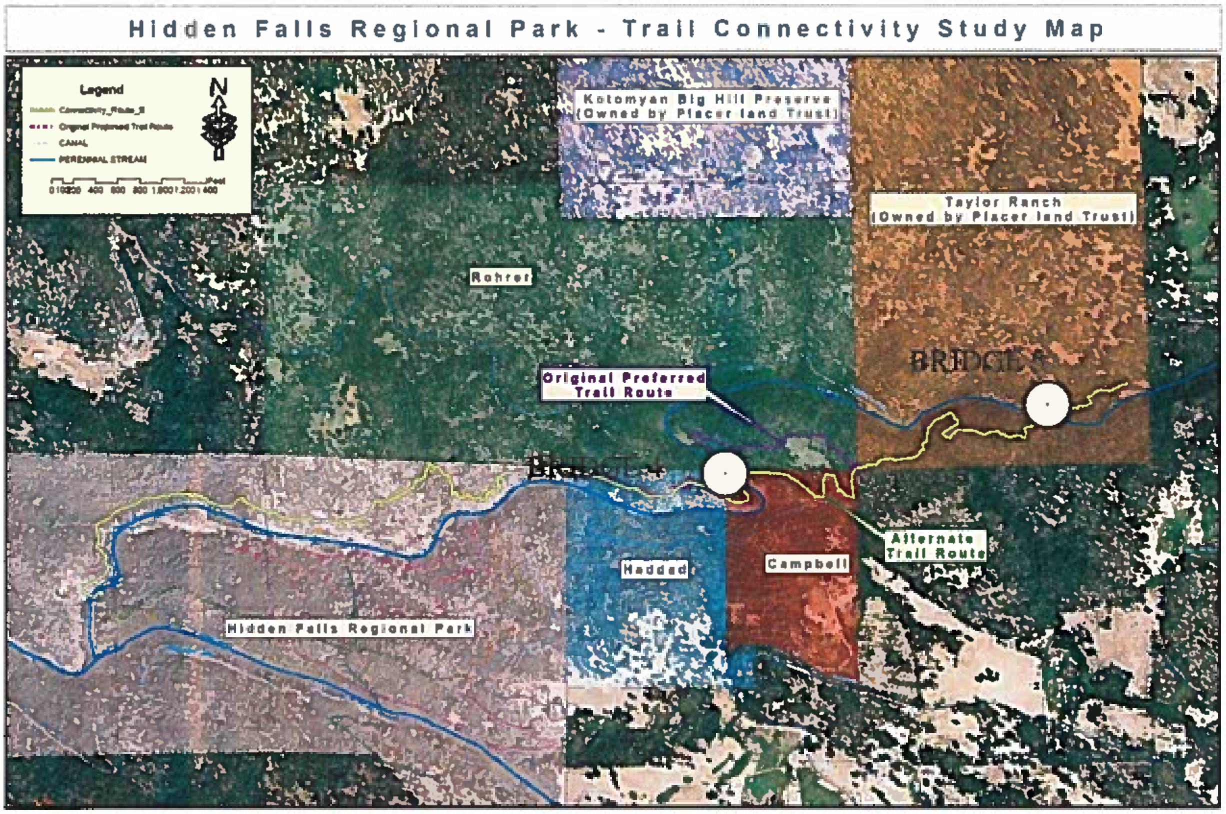


Figure 3: HRFP Project Map

III. OBJECTIVES:

This report outlines the hydrologic and hydraulic conditions associated with the development of two proposed bridge located east of the HFRP. The main objectives of this report are:

- Review an existing hydrology model prepared by others, which determined the 100-yr peak flow rates.
- Prepare a hydraulic model to determine existing and proposed conditions water depth and velocities at the two bridge locations. The data will be used to design erosion and scour protection for the two bridge locations.

IV. HYDROLOGY

A. PREVIOUS STUDIES

A drainage study was prepared by CH2M Hill in 1991 entitled *Cross Canal Watershed Model.* The drainage model was prepared using the USACE Hydrologic Engineering Center Flood Hydrograph Package (HEC-1) to determine the peak flows associated with the 100-yr design storm. The HEC-1 model assumed full buildout of the watershed. The model was modified by the Placer County Flood Control District (District) in 1992 (see Figure 4 and CCFU.H10 in Appendix B for the original HEC-1 run).

```
1*****************************************                         
*****************************************                          
*                                       *                          *
*                                                                  *   U.S. ARMY CORPS OF ENGINEERS
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                          *   HYDROLOGIC ENGINEERING CENTER
*                                                                  *        609 SECOND STREET
*        SEPTEMBER 1990                 *                          *     DAVIS, CALIFORNIA 95616
*                                                                  *        (916) 756-1104
*         VERSION 4.0                   *                          *
*                                                                    
*                                       *
*                                                                    
*  RUN DATE  10/13/1995  TIME  13:00:30 *
*
*                                       *
*
 *****************************************
*****************************************

                    X     X  XXXXXXX   XXXXX        X
                    X     X  X        X     X      XX
                    X     X  X        X             X
                    XXXXXXX  XXXX     X     XXXXX   X
                    X     X  X        X             X
                    X     X  X        X     X       X
                    X     X  XXXXXXX   XXXXX       XXX

      THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

      THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
      THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
      NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
      DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
      KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                  HEC-1 INPUT                                        PAGE  1

      LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

                  * FDF Vers 1.6 8/22/94
                  * I=[illegible].INP D=[illegible] C=[illegible] R=100
                  * Input File Name = [illegible].INP
         1        ID   CROSS CANAL WATERSHED MODEL
         2        ID   Future (1989) Conditions
         3        ID   Original by CH2M Hill 1991
         4        ID   Modified by Placer County Flood Control District 1992
```

Figure 4: Cross Canal Watershed Model, Original by CH2M Hill (1991), Modified by Placer County Flood Control District (1992), CCFU.H10 HEC-1 Data File

B. CALCULATION RESULTS AND COMPARISON WITH PREVIOUS STUDY

In 2008 Carlton was contracted with Placer County to evaluate and design two bridges across Coon Creek east of the HFRP. The flow rates were derived from the *Cross Canal Watershed Model* HEC-1 program which modeled the final buildout conditions of the upstream watershed to the two bridge sites. Bridge 4 and Bridge 5 are located between HEC 1 Station CO4@D+ and CO4@D+ C05. The 100-year peak flows at the HEC 1 Stations are outlined below in Table 1.

Table 1: 100-yr Peak Flow Rates Per the Cross Canal Watershed Model

HEC 1 Station	100-yr Peak Flow (cfs)	Drainage Area (Square Miles)
C04@D+	5,027	24.9
C04@D+ C05	6,587	29.7

Based on the flows provided by the District, Carlton determined the preliminary 100-yr peak flood elevations at the two bridge sites.

The District provided Carlton with the original HEC-1 file used to create the 100-yr peak flows shown above in Table 1. Per the Placer County Stormwater Management Manual, Page V-B-2, a program entitled "PDP" is used to determine the precipitation data for a storm event based on frequency and average watershed elevation. The District also provided Carlton a copy of the "PDP" program.

Carlton reviewed the original HEC-1 file and noticed that all the subshed elevations were set to a zero foot elevation. It should be noted that for the western Sierra Nevada foothills the intensity and depth of precipitation increases with elevation. It would be expected that the precipitation depths at zero foot elevation are less than precipitation depths at higher elevations. The issue that Carlton discovered is that the 100-yr peak flow rates shown in Table 1 above are based on zero foot elevations for all subsheds within the model. These flow rates should be significantly less when compared to a model where a higher elevation for the subsheds was selected.

Carlton discussed this issue with the District staff. The District staff was not sure why the zero foot elevation was used in the original model. They recommended either continuing to use zero elevation, in order to be consistent with the original model, or adjust the elevation to match the average elevation in the watershed, in which case District staff recommended using 1500 feet, because the Coon Creek watershed extends up to near Applegate.

Using the PDP program at an elevation of zero feet Carlton re-ran the HEC-1 program. Carlton's HEC-1 output varied slightly when compared to the County's original HEC-1 output, see Table 2 below for the results (see attached ccfuel0.dat for Carlton's HEC-1 output file with an elevation of zero feet selected).

Table 2: Difference in 100-yr Peak Flow Rates at 0' Elevation between District and Carlton HEC-1 Runs

HEC 1 Station	District Provided 100-yr Peak Flow (cfs)	Carlton Determined 100-yr Peak Flow (cfs)	Difference in %
C04@D+	5,027	5,132	2.1
C04@D+ C05	6,587	6,692	1.6

These differences were reviewed and discussed with District staff. They did not have a problem with the minor (less than 2%) differences between the output files, and approved the use of the Carlton HEC-1 program file.

Since Carlton demonstrated that the "PDP" program was utilized successfully, Table 3 shows the differences between the original (zero foot) HEC-1 100-yr peak flow rates and the Carlton derived (1500 feet) peak flow rates.

Table 3: Difference in 100-yr Peak Flow Rates at 0' and 1500' Elevation between District and Carlton

HEC 1 Station	District Provided 100-yr Peak Flow at 0 ft Elevation (cfs)	Carlton 100-yr Peak Flow at 1500 ft Elevation (cfs)	Difference in %
C04@D+	5,027	7,801	155
C04@D+ C05	6,587	9,933	151

Shed CO5 in the HEC 1 study is 4.82 square miles and contributes 2,132 cfs during the 100-yr Peak Flow using 1500 ft elevation as discussed above. Bridges 4 and 5 are located within Shed CO5. Bridge 4's drainage shed is approximately 33% of Shed CO5's total, and Bridge 5's drainage shed is approximately 24% of Shed CO5's total. Table 4 below shows the approximate flow at each bridge location that will be used in the 100-yr floodplain elevation study.

Table 4: 100-yr Flow at Bridges 4 and 5

Site Location	Carlton 100-yr Peak Flow at 1500 ft Elevation (cfs)
Bridge #4	8,500
Bridge #5	8,300

C. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The original *Cross Canal Watershed Model* prepared by CH2MH and later updated by Placer County Flood Control District assigned a zero foot elevation to the watersheds in the HEC-1 model. The reason for this oversight was not readily apparent to the District or Carlton. Assuming a 1500 ft watershed elevation, the peak flow rates at the two bridge locations increase between 151% at Bridge 5 to 155% at Bridge 4.

The drainage project improvements meet the minimum design standards of the Placer County Stormwater Management Manual.

Recommendations

In light of these findings and in coordination with District staff, Carlton recommends using the 1500 ft precipitation results to determine peak flood water design surface elevations. It is our recommendation that the flow rates shown in Table 4 along with the USACE Hydrologic Engineering Center River Analysis System (HEC-RAS) program be used to determine the water surface elevations and velocity of the stream profiles at the two bridges.

In order to accommodate future condition peak flows and existing topographic conditions it is recommended that the proposed improvements be graded per the attached improvement plans.

V. HYDRAULICS

A. PREVIOUS STUDIES

It is our understanding that a hydraulic study along this section of Coon Creek at the location of the two bridges has not been performed.

B. HYDRAULIC ANALYSIS

Coon Creek is a typical Sierra Nevada waterway, draining from east to west, and is shown on the USGS quad map (Gold Hill, Ca) as a solid blue line for most of its length throughout the watershed basin. There were many near vertical waterfall sections and alternating bank geometry and cover.

The intent of this report is to delineate the existing and proposed floodplains along Coon Creek at each of the two bridge crossings. The result of the detailed analysis will be an accurate delineation of the existing and proposed floodplain boundaries due to the construction of the bridges.

C. SIMULATION PROGRAM

A detailed analysis utilizing the USACE HEC-RAS program (version 4.0) with variable input derived from field surveys, aerial mapping, USGS Topography of the channel, and USACE guidance materials would be employed.

D. INPUT VARIABLES

Steady State Flows and Boundary Conditions:
Coon Creek was analyzed based on the results found in the *Cross Canal Watershed Model* updated by Carlton Engineering as discussed in Section IV and identified in Table 4. The steady state flows derived from HEC-1 for the 100-year peak storm events served as input flows into the model.

Table 5 shows the upstream and downstream boundary condition assumed for each bridge location.

Table 5: HEC-RAS Boundary Conditions

Bridge Location	Boundary Condition Location	
	Upstream	Downstream
Bridge 4	Critical Depth	Normal Depth S = 0.0300
Bridge 5	Critical Depth	Normal Depth S = 0.0500

Channel Geometry:

Bridges 4 and 5

The channel cross-sections were input from data gathered during a field survey of the channel and data obtained from TopoDepot. TopoDepot provides a 7.5 minute quad map of area which utilizes USGS digital elevation models that are used to generate 3D contour lines. The Carlton survey and TopoDepot data was joined together to obtain a surface model. A digital terrain model (DTM) was created from the topographic sources utilizing CADD based software. The cross-section data was extracted from the DTM at stations that would best represent the channel conditions to be studied.

The following photos (Photos 1 thru 4) show the existing conditions at Bridges 4 and 5 on Coon Creek east of HFRP.

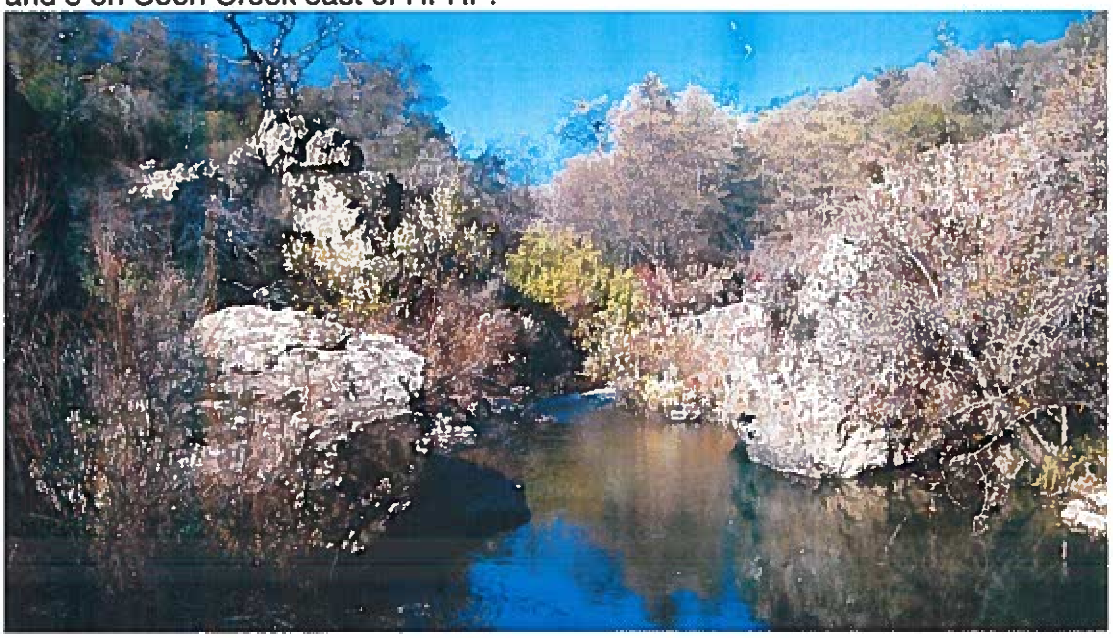


Photo 1: Bridge 4 – Looking Upstream – 12/22/11 Site Visit

Photo 2: Bridge 4 – Looking Downstream – 12/22/11 Site Visit

Photo 3: Bridge 5 – Looking Downstream – 12/22/11 Site Visit

Photo 4: Bridge 5 – Looking Upstream – 12/22/11 Site Visit

Channel Roughness:

Bridges 4 and 5
The Coon Creek channel at Bridges 4 and 5 are very irregular and contains many boulders, overgrown bank areas, and vertical drops, with an estimated water surface top width at flood stage approximately 100 feet. The Manning's 'n' roughness for open channel flow and overbank areas is estimated to be **0.050** and was taken from Table 11.2 (D-3)(b) from *Computer-Assisted Floodplain Hydrology & Hydraulics* (Hoggan, 1997). See Appendix D.

A. RESULTANT CHANGES TO WATER DEPTH AND VELOCITIES DUE TO BRIDGE CONSTRUCTION

A comprehensive 100-year flood event water surface profile was not calculated for the entire reach of Coon Creek through HFRP. The water surface profile was analyzed at each bridge crossing.

Bridge 4
Bridge 4 is located at an elevation above the minimum 3 ft freeboard as measured from the 100-year peak water surface. The resultant 100-year peak water surface profile is shown graphically in Figure 5. Bridge 4 is located at channel Station 1043.

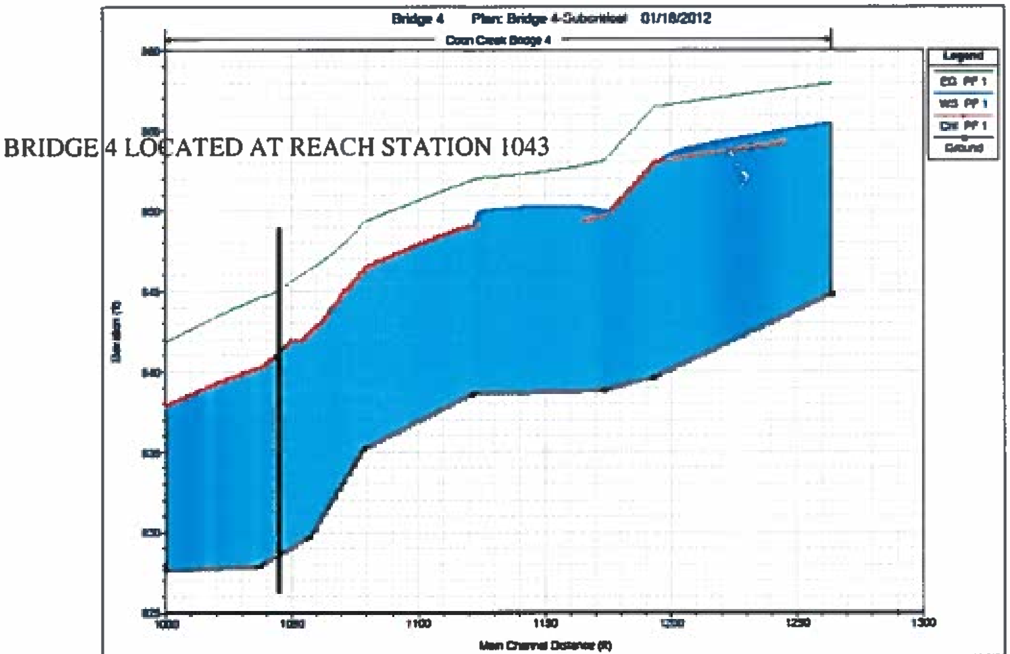


Figure 5: Bridge 4 HEC-RAS 100-Yr Water Surface Profile View

Upstream of Bridge 4 the creek channel has spread out into a wider floodplain. During flood events it is anticipated that the flow in this section is in a subcritical flow regime. At Bridge 4 the creek narrows, where the water has eroded the channel down to bedrock. Below Bridge 4 the creek widens out again. The flows at Bridge 4 are anticipated to be flowing in a supercritical flow regime. In order to calculate the maximum possible water surface elevations the HEC-RAS model was run in subcritical regime mode. In order to calculate the maximum possible velocities the HEC-RAS model was run in mixed regime mode. Table 6 shows a tabulated summary for the 100-year water surface elevations through the channel reach.

Table 6: Bridge 4 HEC-RAS 100-Yr Water Surface and Velocity –Mixed Flow Regime Tabulated Summary

River Sections	River Sta	Min Ch El	W.S. Elev*	Crit W.S.**	E.G. Elev**	E.G. Slope**	Vel Chnl**	Flow Area**	Top Width**	Froude # Chl**
		(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
A	1263	844.8	855.5	854.7	857.9	0.0151	12.5	679.2	97.8	0.84
B	1193	839.6	853.1	853.1	856.5	0.0220	14.8	574.8	85.1	1
C	1173	838.8	850.0	849.7	855.0	0.0685	22.4	380.2	74.0	1.74
D	1121	838.6	849.1	849.1	851.9	0.0253	13.5	631.7	113.0	1
E	1079	835.2	846.5	846.5	849.8	0.0500	17.1	497.8	108.1	1.4
F	1057	829.7	842.5	842.5	848.1	0.0665	23.1	368.8	54.2	1.56
G	1037	827.9	840.3	840.3	846.6	0.0708	24.2	351.3	53.8	1.67
H	1000	827.7	837.9	837.9	843.6	0.0726	23.0	369.1	60.6	1.64

* Subcritical Flow Regime
** Mixed Flow Regime

Figure 6 shows the plan view of the Bridge 4 improvements with respect to the limits of the proposed 100-year peak flood plain, and the HEC-RAS river cross section locations. The support columns are located just outside of the 100-year peak flood plain. For purposes of design, the columns will be designed as if they are located within the floodplain.

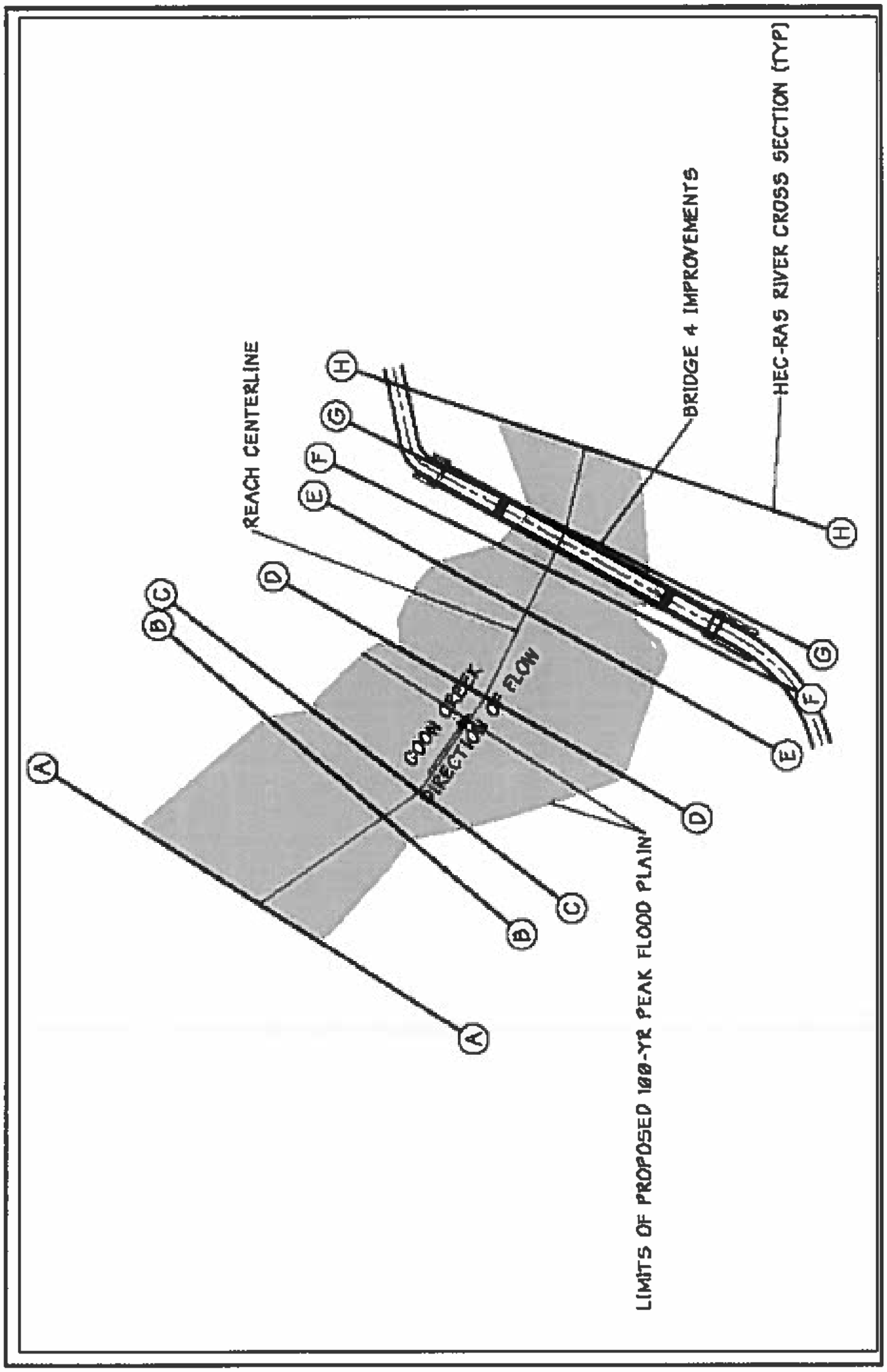


Figure 6: Bridge 4 HEC-RAS Plan View

Bridge 5

The resultant 100-Yr water surface profile is shown graphically in Figure 7. Bridge 5 is located at Station 2209.

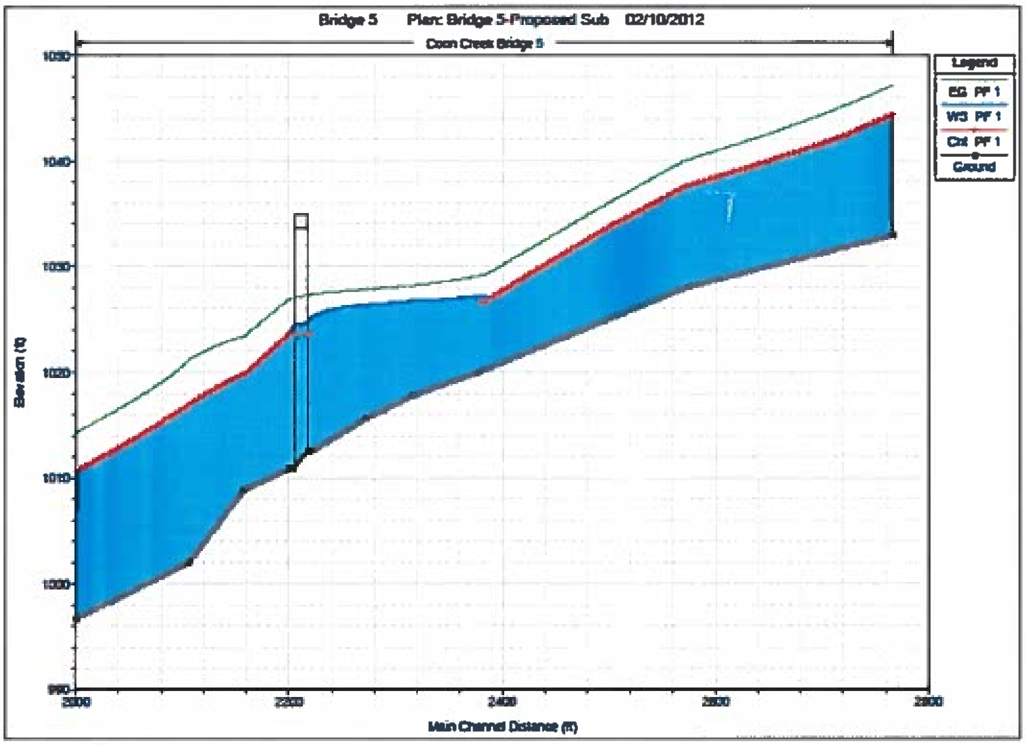


Figure 7: Bridge 5 HEC-RAS 100-Yr Water Surface Profile View

The flows at the Bridge 5 HEC-RAS model are anticipated to be flowing in a mixture of supercritical and subcritical flows. In order to calculate the maximum possible water surface elevations the HEC-RAS model was run in subcritical regime mode. In order to calculate the maximum possible velocities the HEC-RAS model was run in mixed regime mode.

A tabulated summary of existing and proposed water surface elevations and velocities are presented in Table 7. There is a negligible increase to the water surface elevation and velocity from the bridge abutment.

Table 7: Bridge 5 HEC-RAS 100-Yr Water Surface and Velocity –Mixed Flow Regime Tabulated Summary

River Sections	River Sta	Existing WS Elev* (ft)	Proposed Bridge WS Elev* (ft)	Diff Between Ex. And Prop. WS Elev (ft)	Existing Velocity** (ft/s)	Proposed Bridge Velocity** (ft/s)	Diff Between Ex. And Prop Velocity (ft/s)
A	2767	1044.5	1044.5	0	13.5	13.5	0
B	2570	1037.6	1037.6	0	12.9	12.9	0
C	2382	1027.3	1027.3	0	16.9	16.9	0
D	2317	1026.8	1026.8	0	9.6	9.6	0
E	2272	1026.4	1026.4	0	9.5	9.5	0
F	2220	1025.2	1025.2	0	11.8	11.7	0.1
	2209 BRIDGE	1025.3			11.0		
G	2200	1023.7	1023.7	0	14.4	14.4	0
H	2158	1020.0	1020.0	0	21.3	21.3	0
I	2106	1017.0	1017.0	0	21.3	21.3	0
J	2000	1010.7	1010.7	0	21.7	21.7	0

* Subcritical Flow Regime
** Mixed Flow Regime

Figure 8 shows the plan view of the Bridge 2 improvements with respect to the limits of the proposed 100-year peak flood plain, and the HEC-RAS river cross section locations.

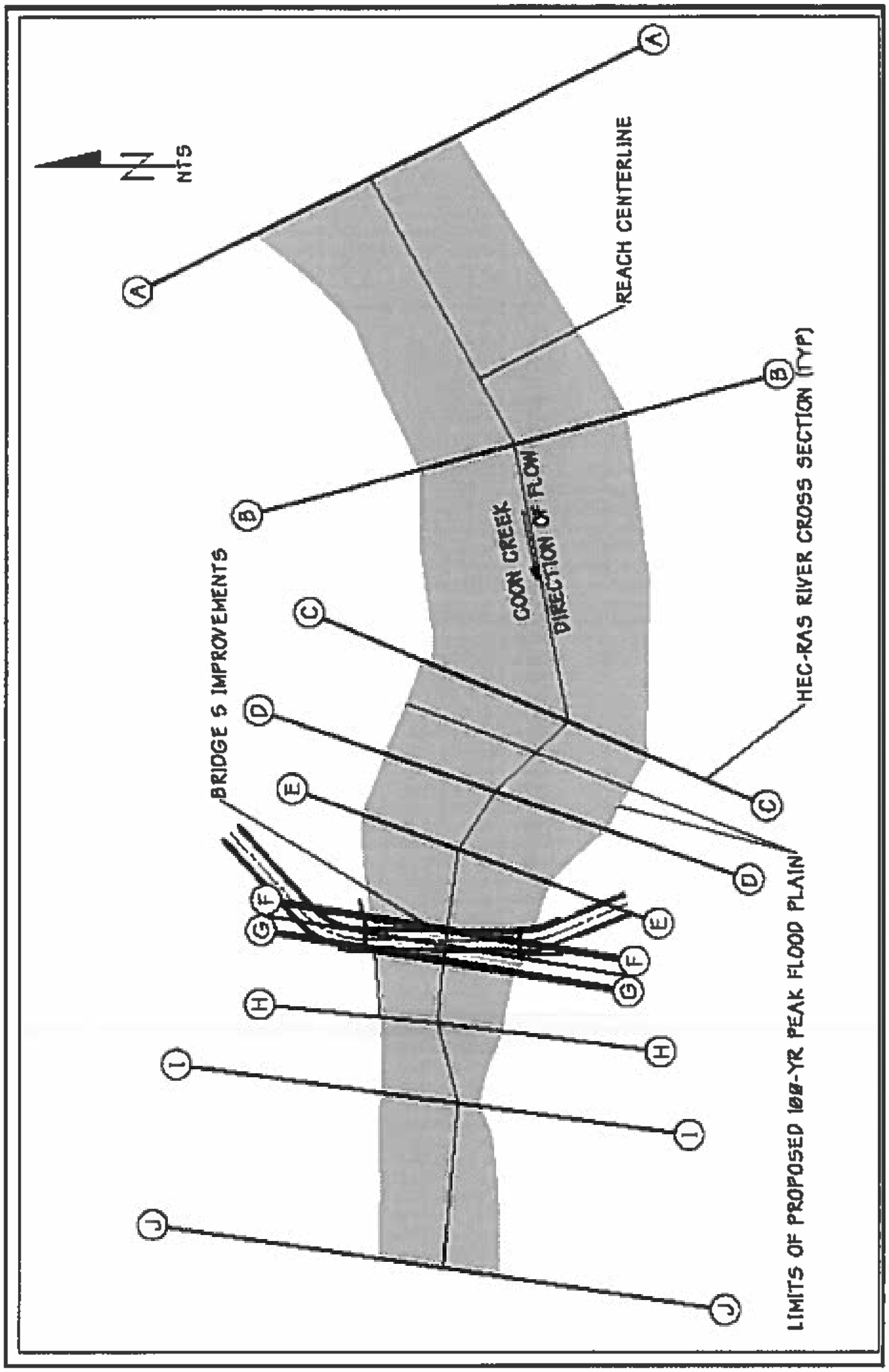


Figure 8: Bridge 5 HEC-RAS Plan View

B. SCOUR ANALYSIS

Scour analysis was not analyzed at Bridge 4 because the support columns are located outside of the 100-year peak flood plain. However, due to the relative location to the 100-year peak flood plain elevation, the design of the support columns will assume that they are submerged. The Bridge 4 support columns will be founded directly on exposed bed rock and will not experience scour from erodible material.

Scour has been analyzed at Bridge 5.

The total depth of scour includes three additive components; long term aggradation or degradation, contraction scour, and local scour. The values for the long term aggradation or degradation can only be qualified by evaluating historic records of the reach for changes in channel geometry. At the location of the bridges Coon Creek has eroded down to bedrock. Long term aggradation or degradation is not anticipated.

The other two components were estimated using HEC-RAS and are only reported for information purposes since the concrete abutments will be founded directly on bedrock, therefore scour will not reach the calculated depths.

Scour occurs at abutments when the abutment and embankment obstruct the flow. The flow obstructed by the abutment forms a horizontal vortex starting at the upstream end of the abutment and running along the toe of the abutment, resulting in a vertical wake vortex at the downstream end of the abutment.

Total scour is the sum of calculated local scour (abutment scour), contraction scour, and long-term bed degradation. The total calculated scour depth for the bridges is shown in Appendix E. These estimated values assume that the scoured material is made up of erodible sediment. The value for D_{50} (0.4 mm) is based on the Geotechnical Engineering Study prepared by Carlton Engineering, Inc. (2010) sieve analysis test report for a bulk sample taken near Coon Creek.

The calculated scour depths exceed the expected depth of erodible overburden. This indicates that during the design event, the design flow will scour the soil to the elevation of bedrock.

C. CONCLUSIONS AND RECOMMENDATIONS

Bridge 4 is located outside and above the limits of the 100-yr peak flood plain and will not affect the limits of the floodplain.

Bridge 5's southern abutment is located within the 100-year peak flood plain and will have a negligible effect on the limits of the flood plain.

The limits of the impact of the bridge construction are as follows:

Bridge 4
Bridge 4 improvements will be constructed outside of the floodplain of the 100-yr peak storm event. Therefore changes to the water surface profile are nonexistent between the pre- and post-construction conditions. Additional design constraints due to scour are not anticipated at Bridge 4.

Bridge 5
The calculated scour depths exceed the expected depth of erodible overburden. This indicates that during the design event, the design flow will scour the soil to the elevation of bedrock. It is recommended that the foundation of the bridges be embedded into bedrock to a sufficient depth in order to ensure structural stability.

VI. APPENDIX A: BRIDGE SCHEMATIC DESIGN DRAWINGS

SEE CD IN APPENDIX D FOR PDF FILES

BRIDGE SCHEMATIC DESIGN PLANS

Hidden Falls Regional Park
Placer County, California

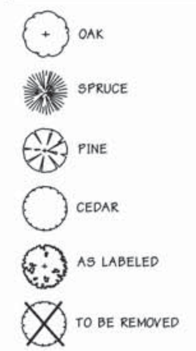
CARLTON Engineering Inc.

PRELIMINARY NOT FOR CONSTRUCTION

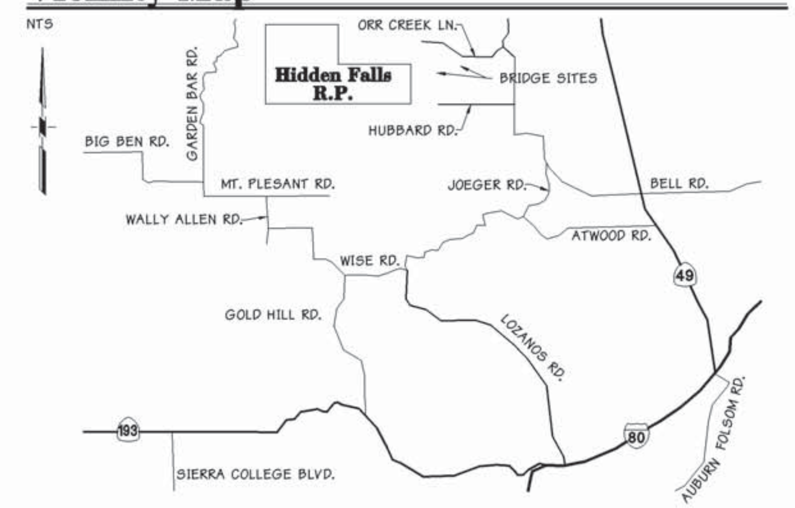
Abbreviations

#	NUMBER
AB	AGGREGATE BASE
AC	ASPHALTIC CONCRETE
APN	ASSESSORS PARCEL NUMBER
ARV	AIR RELEASE VALVE
BC	BEGIN CURVE
BFP	BACKFLOW PREVENTER
BO	BLOW OFF
BOW	BOTTOM OF WALL
BVC	BEGIN VERTICAL CURVE
BW	BACK OF WALK
C/G	CURB AND GUTTER
CH	CHORD
CHL	CHORD LENGTH
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEAN OUT
CONC	CONCRETE
CR	CURB RETURN
DCV	DETECTOR CHECK VALVE
DI	DRAIN INLET
DWY	DRIVEWAY
E	ELECTRICAL
EC	END CURVE
ELV	ELEVATION
EP	EDGE OF PAVEMENT
EVC	END VERTICAL CURVE
(E)	EXISTING
FD	FIRE DEPARTMENT
FDC	FIRE DEPARTMENT CONNECTION
FF	FINISHED FLOOR
FG	FINISHED GRADE
FH	FIRE HYDRANT
FL	FLOWLINE
FP	FINISHED PAVEMENT
FS	FINISHED SURFACE
G	GAS
GB	GRADE BREAK
GT	GRATE
GV	GATE VALVE
INTX	INTERSECTION
INV	INVERT
JP	JOINT POLE
JT	JOIN TRENCH
LF	LINEAR FEET
LT	LEFT
MAX	MAXIMUM
MH	MANHOLE
MIN	MINIMUM
NTS	NOT TO SCALE
OC	ON CENTER
OH	OVERHEAD
OMP	OPEN METAL PIPE
PCC	PORTLAND CEMENT CONCRETE
PIV	POST INDICATOR VALVE
PL	PROPERTY LINE
POC	POINT OF CONNECTION
PP	POWER POLE
PRC	POINT OF REVERSE CURVE
PRVC	POINT OF REVERSE VERTICAL CURVE
PUE	PUBLIC UTILITIES EASEMENT
PVC	POLYVINYL CHLORIDE
PVI	POINT VERTICAL INTERSECTION
R	RADIUS
ROW	RIGHT OF WAY
RC	REVERSE CURVE
RT	RIGHT
RWS	RECYCLED WATER SERVICE
S=#	SLOPE PERCENTAGE
SCH	SCHEDULE
SD	STORM DRAIN
SD#	STANDARD DRAWING NUMBER
SDMH	STORM DRAIN MANHOLE
SP#	STANDARD PLAN NUMBER
SS	SANITARY SEWER
SSCO	SANITARY SEWER CLEAN OUT
SSMH	SANITARY SEWER MANHOLE
STA	STATION
SUBD.	SUBDIVISION
T	TELEPHONE
TBW	TOP BACK OF WALK
TC	TOP OF CURB
TOW	TOP OF WALL
TW	TOP OF WALK
(TYP)	TYPICAL
V	VAULT
VAR	VARIES
VC	VERTICAL CURVE
W	WATER
WM	WATER METER
WS	WATER SERVICE
WV	WATER VALVE

Trees



Vicinity Map

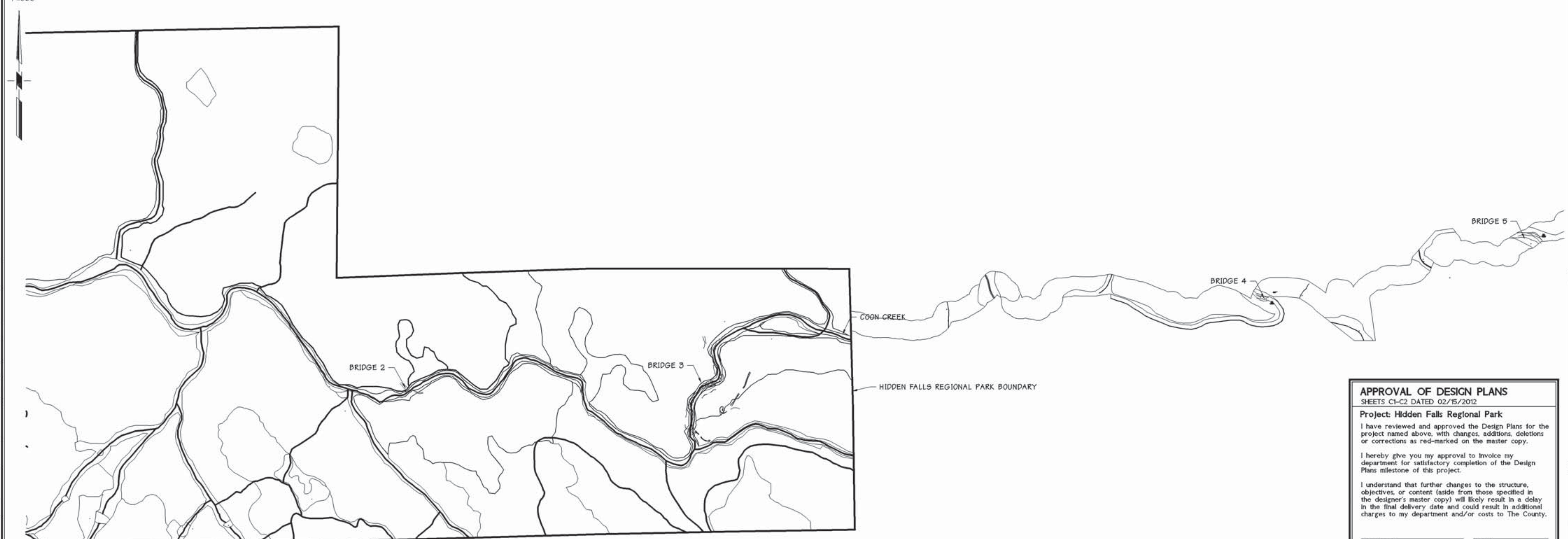


Sheet Index

CS	COVER SHEET
C1	BRIDGE 4 PLAN AND PROFILE
C2	BRIDGE 5 PLAN AND PROFILE

Project Layout

1"=500'



APPROVAL OF DESIGN PLANS
SHEETS C1-C2 DATED 02/15/2012

Project: Hidden Falls Regional Park

I have reviewed and approved the Design Plans for the project named above, with changes, additions, deletions or corrections as red-marked on the master copy.

I hereby give you my approval to invoice my department for satisfactory completion of the Design Plans milestone of this project.

I understand that further changes to the structure, objectives, or content (aside from those specified in the designer's master copy) will likely result in a delay in the final delivery date and could result in additional charges to my department and/or costs to The County.

[signature] [date]

Andy Fisher, Parks Planner
Placer County Parks Division

Revisions

SYM	DESCRIPTION	DATE	BY

HIDDEN FALLS REGIONAL PARK

COVER SHEET

Project Location:
Placer County
Auburn, California 95603

Ownership Information:
Placer County Procurement
11476 "C" Avenue
Auburn, California 95603

DESIGN	DRAWN	RELEASE DATE
MDH	MDH	02/15/2012
Hz SCALE / Vt SCALE		PROJECT NUMBER
AS NOTED		6339-01-08

CHECKED BY & DATE

SHEET

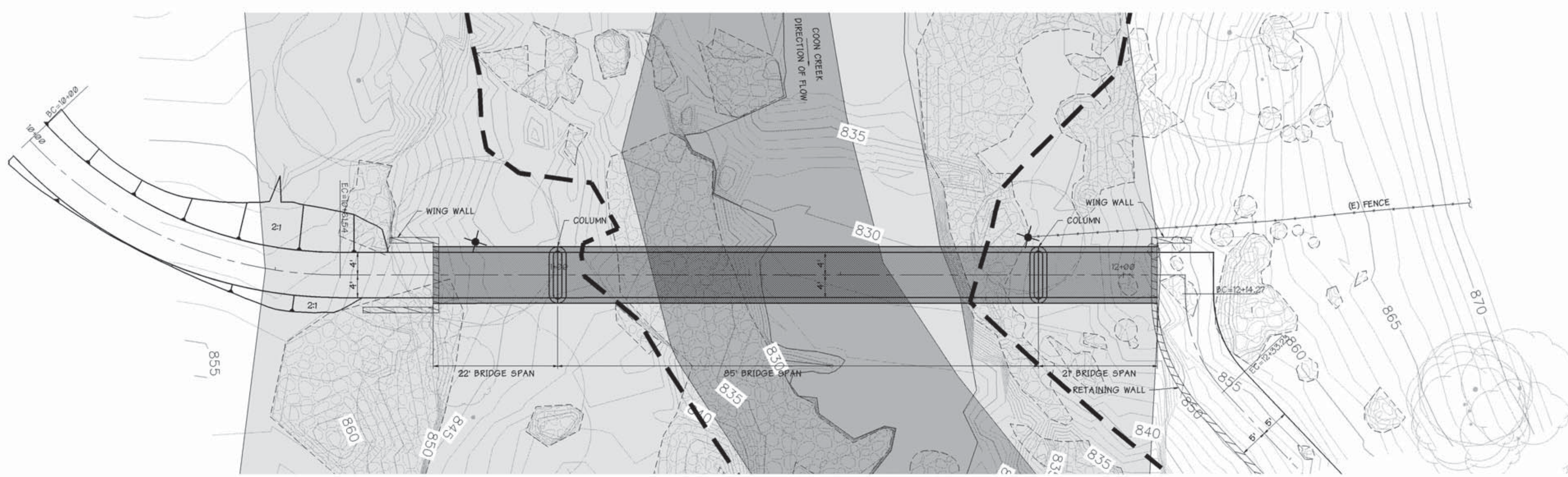
CS

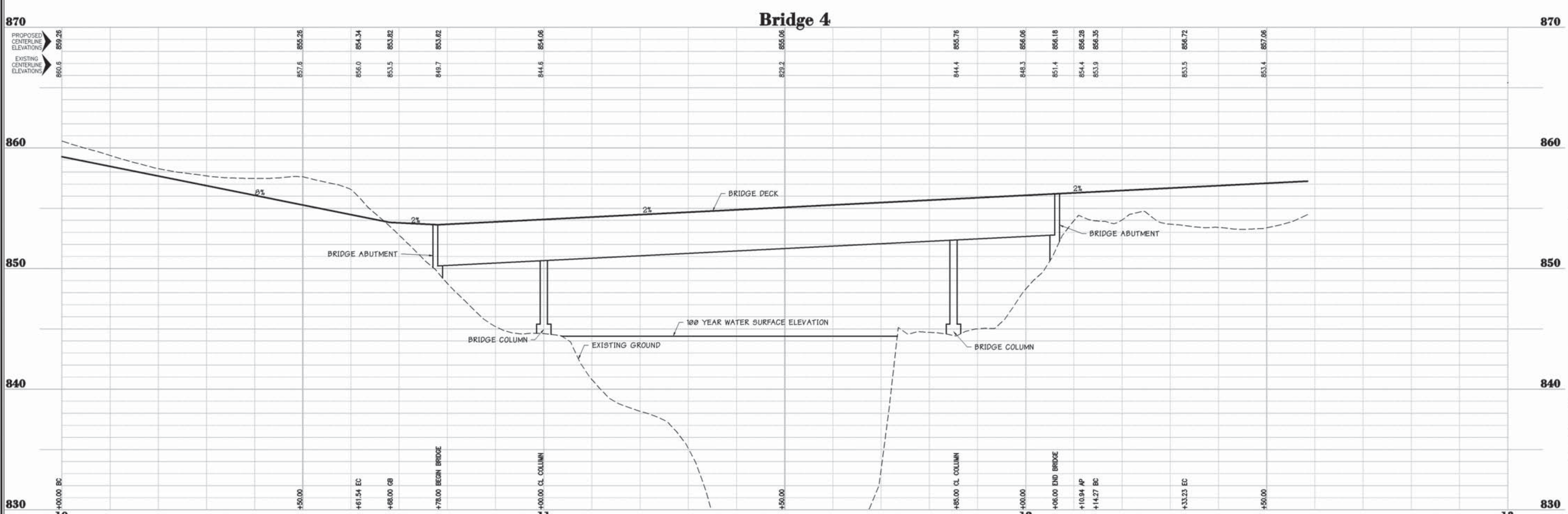
Legend

- 100 YEAR PEAK STORM
- VALLEY FOOTHILL RIPARIAN ZONE*
- PERENNIAL STREAM CHANNEL - OHWM*
- PROPOSED BRIDGE

* LIMITS PROVIDED BY AECOM, JANUARY 2012

1 inch = 10 ft.





CARLTON Engineering Inc.

Revisions

HIDDEN FALLS REGIONAL PARK

BRIDGE 4 PLAN AND PROFILE

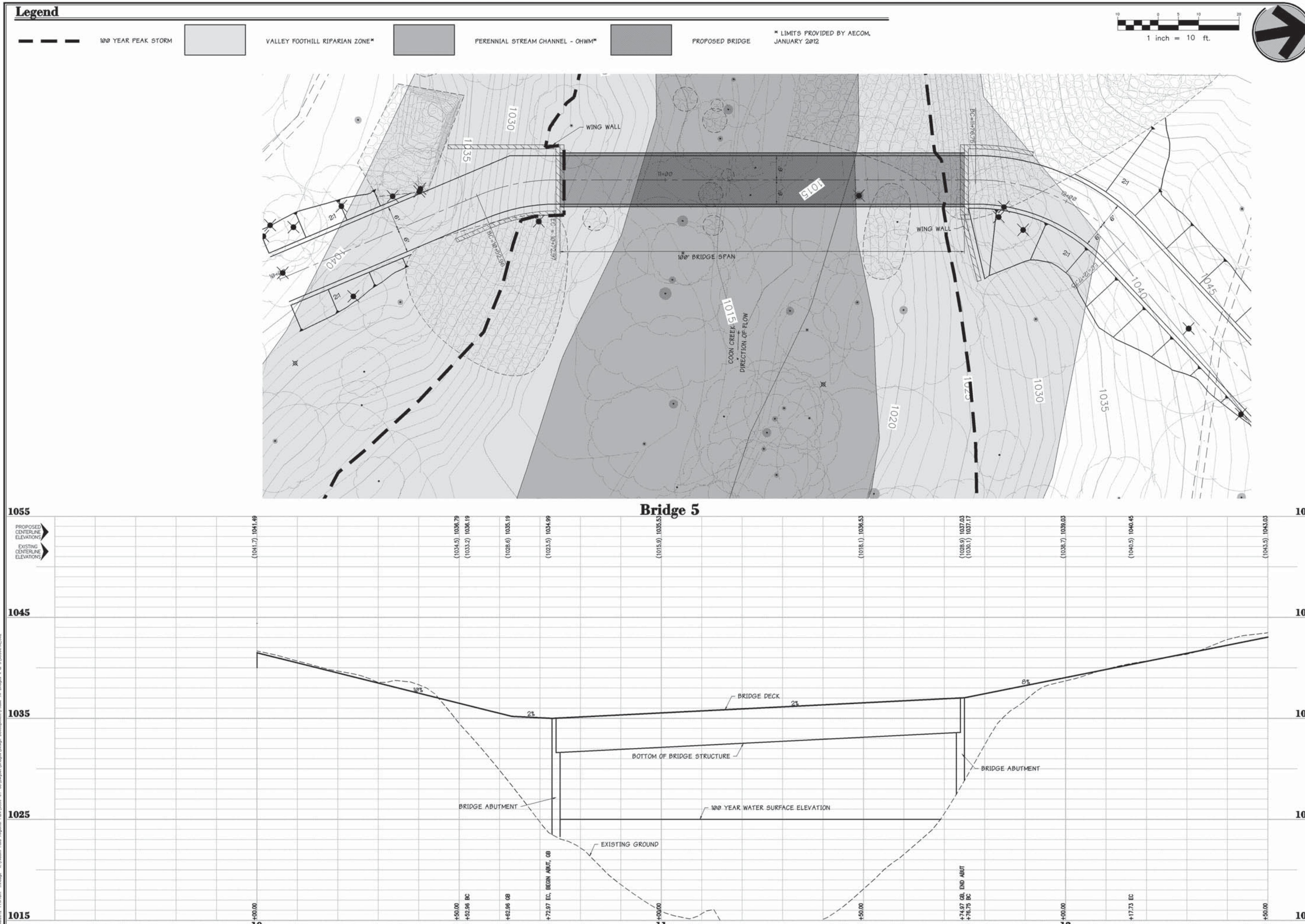
Project Location:
Placer County
Auburn, California 95603

Ownership Information:
Placer County Procurement
11476 "C" Avenue
Auburn, California 95603

DESIGN	DRAWN	RELEASE DATE
MDH	MDH	02/15/2012
HZ SCALE	VT SCALE	PROJECT NUMBER
1"=10'	1"=4'	6339-01-08

SHEET

C1



TEAM DRIVEN SOLUTIONS FOR THE BUILT ENVIRONMENT

CARLTON
Engineering Inc.
3883 Ponderosa Road, Shingle Springs, CA 95682
Voice 530.677.5515 Fax 530.677.6645

REGISTERED PROFESSIONAL ENGINEER
MICHAEL D. HAUGE
No. 61061
CIVIL
STATE OF CALIFORNIA
PRELIMINARY
SIGNING DATE:

Revisions

SYM	DESCRIPTION	DATE	BY

HIDDEN FALLS REGIONAL PARK

BRIDGE 5 PLAN AND PROFILE

Project Location:
Placer County
Auburn, California 95603

Ownership Information:
Placer County Procurement
11476 "C" Avenue
Auburn, California 95603

DESIGN	DRAWN	RELEASE DATE
MDH	MDH	02/15/2012

Hz SCALE	Vt SCALE	PROJECT NUMBER
1"=10'	1"=4'	6339-01-08

CHECKED BY & DATE

SHEET

C2

VII. APPENDIX B: HEC-1 SUPPORTING DOCUMENTS

SEE CD IN APPENDIX D FOR PDF FILES

VIII. APPENDIX C: HEC-RAS SUPPORTING DOCUMENTS

Bridge 4 Water Surface Summary verses Flow Regime

River Sta	Q Total (cfs)	Existing W.S. Elev (ft) Subcritical	Supercritical	Mixed
1263.63	8500	855.5	854.65	855.5
1193.34	8500	853.05	853	853.05
1173.46	8500	849.98	847.25	847.25
1121.61	8500	849.09	848.39	849.09
1079.04	8500	846.46	845.15	845.29
1057.52	8500	842.53	839.8	839.87
1037.52	8500	840.27	837.5	837.54
1000	8500	837.88	835.38	835.39

Bridge 4 Velocity Summary verses Flow Regime

		Existing		
		W.S. Elev		
River Sta	Q Total	(ft)		
	(cfs)	Subcritical	Supercritical	Mixed
1263.63	8500	12.51	14.24	12.51
1193.34	8500	14.79	14.91	14.79
1173.46	8500	14.21	22.35	22.35
1121.61	8500	13.46	15.32	13.46
1079.04	8500	13.53	17.58	17.07
1057.52	8500	15.75	23.27	23.05
1037.52	8500	16.74	24.35	24.2
1000	8500	15.93	23.07	23.03

Bridge 4
Subcritical Existing

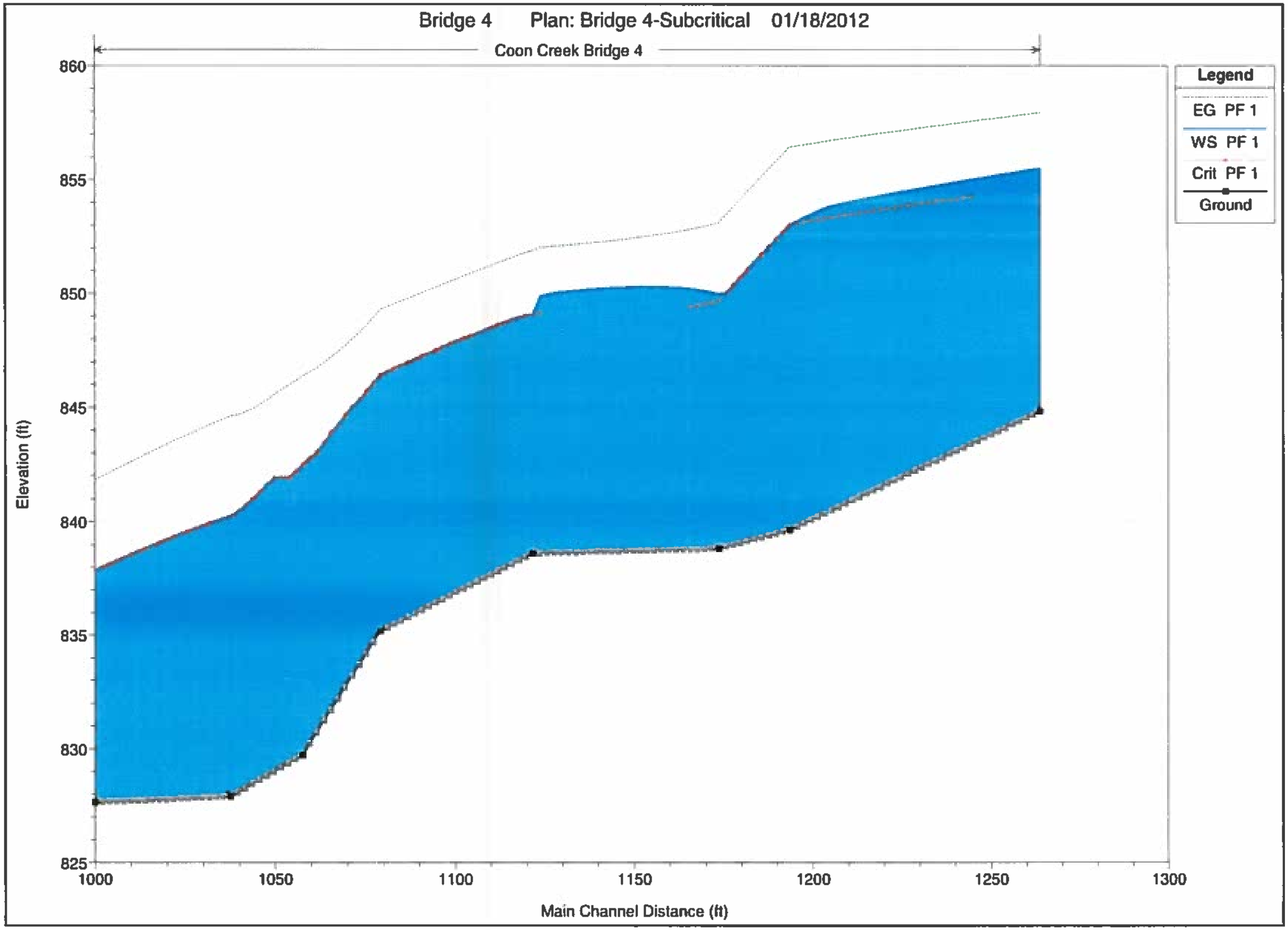
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bridge 4	1263.63	PF 1	8500	844.82	855.5		857.93	0.015107	12.51	679.2	97.77	0.84
Bridge 4	1193.34	PF 1	8500	839.63	853.05	853.05	856.45	0.022011	14.79	574.75	85.08	1
Bridge 4	1173.46	PF 1	8500	838.82	849.98	849.66	853.12	0.018638	14.21	598.07	85.61	0.95
Bridge 4	1121.61	PF 1	8500	838.6	849.09	849.09	851.9	0.025331	13.46	631.68	113.03	1
Bridge 4	1079.04	PF 1	8500	835.17	846.46	846.46	849.3	0.024555	13.53	628.26	112.97	1.01
Bridge 4	1057.52	PF 1	8500	829.72	842.53	842.53	846.38	0.02559	15.75	539.65	70.64	1
Bridge 4	1037.52	PF 1	8500	827.9	840.27	840.27	844.62	0.024508	16.74	507.63	58.99	1.01
Bridge 4	1000	PF 1	8500	827.65	837.88	837.88	841.82	0.025714	15.93	533.73	68.29	1

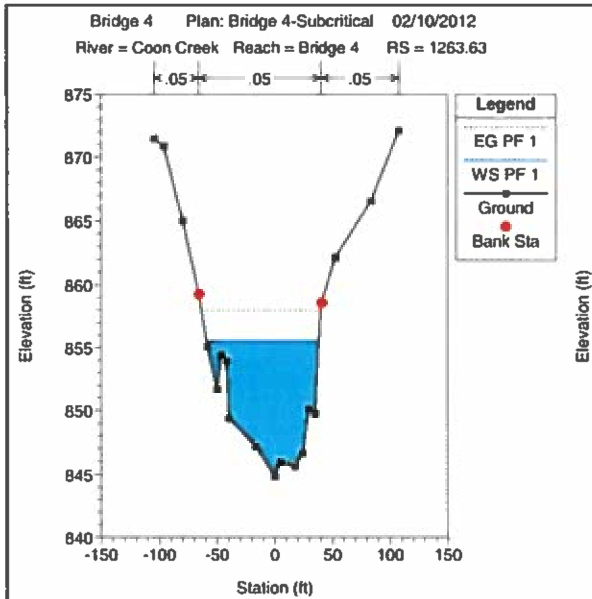
Bridge 4
Supercritical Existing

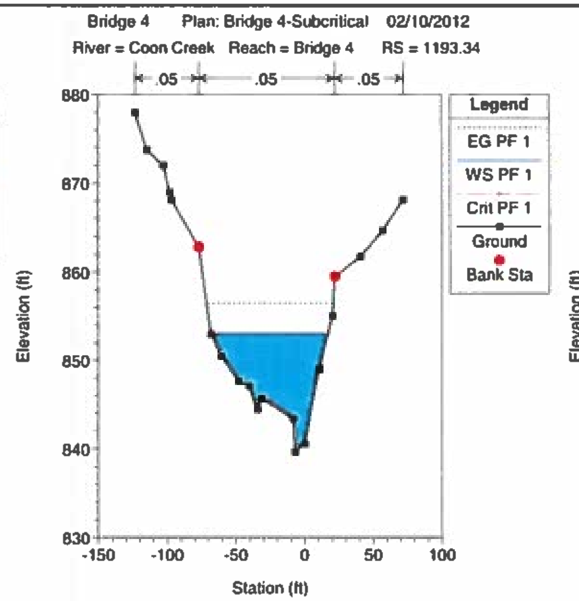
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bridge 4	1263.63	PF 1	8500	844.82	854.65	854.65	857.8	0.022375	14.24	596.73	95.37	1
Bridge 4	1193.34	PF 1	8500	839.63	853	853.02	856.45	0.022548	14.91	570.18	84.95	1.01
Bridge 4	1173.46	PF 1	8500	838.82	847.25	849.68	855.01	0.068479	22.35	380.38	73.98	1.74
Bridge 4	1121.61	PF 1	8500	838.6	848.39	849.09	852.04	0.036464	15.32	554.8	107.19	1.19
Bridge 4	1079.04	PF 1	8500	835.17	845.15	846.45	849.95	0.0543	17.58	483.57	106.85	1.46
Bridge 4	1057.52	PF 1	8500	829.72	839.8	842.53	848.21	0.06795	23.27	365.29	53.72	1.57
Bridge 4	1037.52	PF 1	8500	827.9	837.5	840.29	846.71	0.072068	24.35	349.13	53.64	1.68
Bridge 4	1000	PF 1	8500	827.65	835.38	837.86	843.65	0.073122	23.07	368.38	60.57	1.65

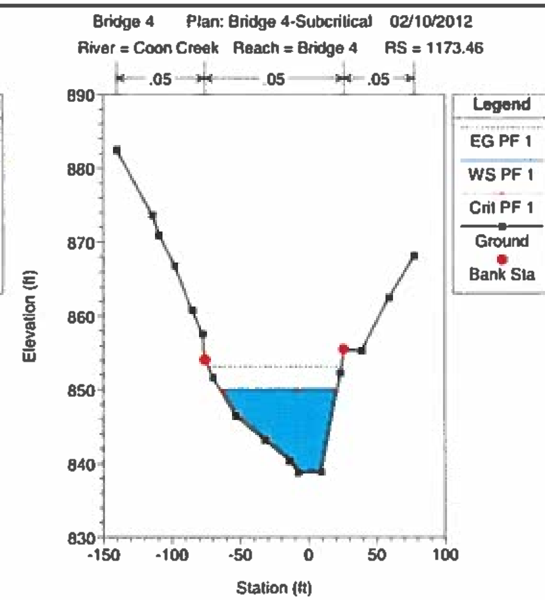
Bridge 4
Mixed Existing

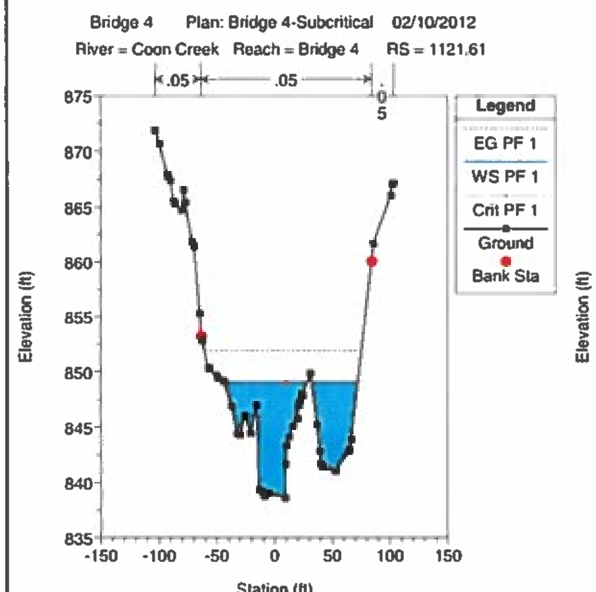
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bridge 4	1263.63	PF 1	8500	844.82	855.5	854.66	857.93	0.015107	12.51	679.2	97.77	0.84
Bridge 4	1193.34	PF 1	8500	839.63	853.05	853.05	856.45	0.022011	14.79	574.75	85.08	1
Bridge 4	1173.46	PF 1	8500	838.82	847.25	849.68	855.01	0.068551	22.35	380.24	73.97	1.74
Bridge 4	1121.61	PF 1	8500	838.6	849.09	849.09	851.9	0.025331	13.46	631.68	113.03	1
Bridge 4	1079.04	PF 1	8500	835.17	845.29	846.45	849.81	0.050074	17.07	497.84	108.13	1.4
Bridge 4	1057.52	PF 1	8500	829.72	839.87	842.53	848.12	0.066568	23.05	368.75	54.17	1.56
Bridge 4	1037.52	PF 1	8500	827.9	837.54	840.29	846.63	0.07082	24.2	351.29	53.76	1.67
Bridge 4	1000	PF 1	8500	827.65	835.39	837.86	843.63	0.072683	23.03	369.1	60.58	1.64

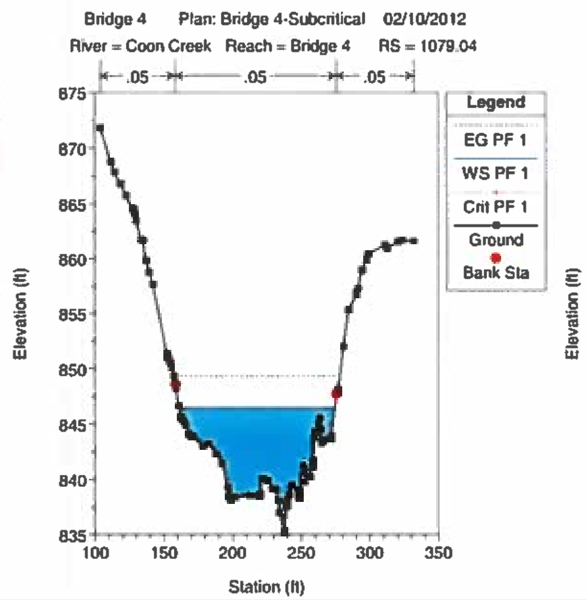

Bridge 4 Plan: Bridge 4-Subcritical 01/18/2012
Coon Creek Bridge 4
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
860
855
850
845
840
835
830
825
1000
1050
1100
1150
1200
1250
1300
Main Channel Distance (ft)

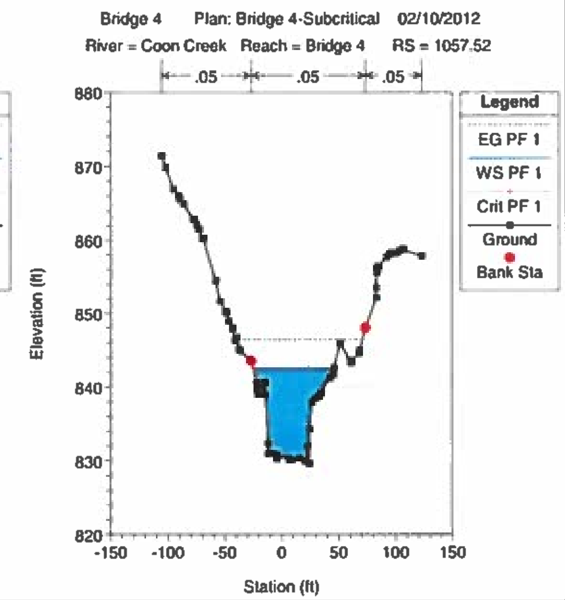

Bridge 4 Plan: Bridge 4-Subcritical 02/10/2012
River = Coon Creek Reach = Bridge 4 RS = 1263.63
.05 .05 .05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
875
870
865
860
855
850
845
840
-150 -100 -50 0 50 100 150

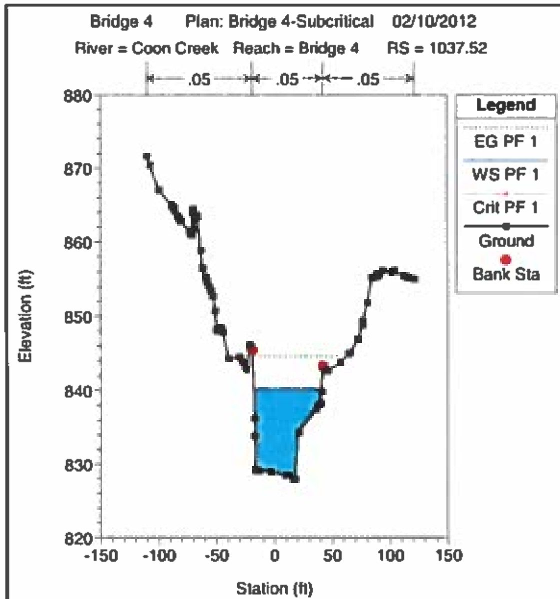

Bridge 4 Plan: Bridge 4-Subcritical 02/10/2012
River = Coon Creek Reach = Bridge 4 RS = 1193.34
.05 .05 .05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
880
870
860
850
840
830
-150 -100 -50 0 50 100


Bridge 4 Plan: Bridge 4-Subcritical 02/10/2012
River = Coon Creek Reach = Bridge 4 RS = 1173.46
.05 .05 .05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
890
880
870
860
850
840
830
-150 -100 -50 0 50 100

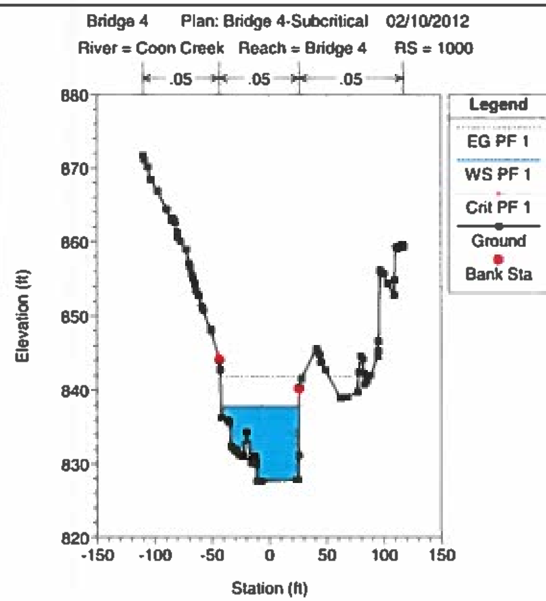

Bridge 4 Plan: Bridge 4-Subcritical 02/10/2012
River = Coon Creek Reach = Bridge 4 RS = 1121.61
.05 .05
0
5
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
875
870
865
860
855
850
845
840
835
-150 -100 -50 0 50 100 150


Bridge 4 Plan: Bridge 4-Subcritical 02/10/2012
River = Coon Creek Reach = Bridge 4 RS = 1079.04
.05 .05 .05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
875
870
865
860
855
850
845
840
835
100 150 200 250 300 350


Bridge 4 Plan: Bridge 4-Subcritical 02/10/2012
River = Coon Creek Reach = Bridge 4 RS = 1057.52
.05 .05 .05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
880
870
860
850
840
830
820
-150 -100 -50 0 50 100 150



Bridge 4 Plan: Bridge 4-Subcritical 02/10/2012
River = Coon Creek Reach = Bridge 4 RS = 1037.52
.05
.05
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)



Bridge 4 Plan: Bridge 4-Subcritical 02/10/2012
River = Coon Creek Reach = Bridge 4 RS = 1000
.05
.05
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

Bridge 5 Water Surface Summary verses Flow Regime

		Existing W.S. Elev (ft)			Proposed Bridge W.S. Elev (ft)			Difference Between Existing and Proposed W.S. Elev (ft)		
River Sta	100 Yr Peak Q Total (cfs)	Subcritical	Supercritical	Mixed	Subcritical	Supercritical	Mixed	Subcritical	Supercritical	Mixed
2767.01	8300	1044.52	1044.56	1044.5	1044.52	1044.56	1044.52	0	0	0
2570.32	8300	1037.6	1037.48	1037.5	1037.6	1037.48	1037.48	0	0	0
2381.91	8300	1027.29	1025.36	1025.4	1027.29	1025.37	1025.37	0	-0.01	-0.01
2316.54	8300	1026.78	1024.88	1026.8	1026.78	1024.9	1026.78	0	-0.02	0
2272.43	8300	1026.43	1023.98	1026.4	1026.43	1023.94	1026.43	0	0.04	0
2219.75	8300	1025.22	1023.7	1025.2	1025.24	1023.7	1025.24	-0.02	0	-0.02
2209.73	Bridge 5	1025.27	1023.18	1025.3						
2199.7	8300	1023.66	1023.66	1023.7	1023.66	1023.66	1023.66	0	0	0
2157.92	8300	1020.03	1017.67	1017.7	1020.03	1017.67	1017.67	0	0	0
2106.18	8300	1017.01	1015.07	1015.1	1017.01	1015.08	1015.08	0	-0.01	-0.01
2000	8300	1010.73	1008.42	1008.4	1010.73	1008.4	1008.4	0	0.02	0.02

Bridge 5 Velocity Summary verses Flow Regime

		Existing			Proposed Bridge			Difference Between Existing and Proposed		
	100 Yr Peak	Velocity			Velocity			Velocity		
River Sta	Q Total	(ft/s)			(ft/s)			(ft/s)		
	(cfs)	Subcritical	Supercritical	Mixed	Subcritical	Supercritical	Mixed	Subcritical	Supercritical	Mixed
2767.01	8300	13.53	13.44	13.53	13.53	13.44	13.53	0	0	0
2570.32	8300	12.55	12.86	12.86	12.55	12.86	12.86	0	0	0
2381.91	8300	11.04	16.95	16.95	11.04	16.93	16.93	0	0.02	0.02
2316.54	8300	9.64	13.7	9.64	9.63	13.65	9.63	0.01	0.05	0.01
2272.43	8300	9.48	14.36	9.48	9.47	14.48	9.47	0.01	-0.12	0.01
2219.75	8300	11.77	14.53	11.77	11.73	14.53	11.73	0.04	0	0.04
2209.73	Bridge 5	11.02	14.72	11.02						
2199.7	8300	14.42	14.42	14.42	14.42	14.42	14.42	0	0	0
2157.92	8300	14.69	21.28	21.28	14.69	21.27	21.27	0	0.01	0.01
2106.18	8300	16.41	21.3	21.3	16.41	21.26	21.26	0	0.04	0.04
2000	8300	15.11	21.65	21.65	15.11	21.71	21.71	0	-0.06	-0.06

Bridge 5											
Subcritical Existing											
Reach	River Sta	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)	
Bridge 5	2767.01	8300	1033	1044.52	1044.52	1047.18	0.01452	13.53	688.13	144.73	0.87
Bridge 5	2570.32	8300	1028	1037.6	1037.6	1040.04	0.022297	12.55	661.56	137.83	1.01
Bridge 5	2381.91	8300	1020.18	1027.29	1026.67	1029.16	0.013922	11.04	769.46	156.66	0.82
Bridge 5	2316.54	8300	1017.84	1026.78		1028.21	0.008844	9.64	876.38	151.19	0.67
Bridge 5	2272.43	8300	1015.67	1026.43		1027.82	0.008236	9.48	875.77	129.33	0.64
Bridge 5	2219.75	8300	1012.48	1025.22		1027.31	0.009859	11.77	735.46	101.32	0.7
Bridge 5	2209.73	8300	1010.78	1025.27		1027.15	0.008961	11.02	763.26	99.92	0.67
Bridge 5	2199.7	8300	1010.85	1023.66	1023.66	1026.89	0.021809	14.42	576.02	90.22	1
Bridge 5	2157.92	8300	1008.86	1020.03	1019.78	1023.38	0.018763	14.69	564.89	77.81	0.96
Bridge 5	2106.18	8300	1002	1017.01	1017.01	1021.19	0.022275	16.41	505.66	61.8	1.01
Bridge 5	2000	8300	996.7	1010.73	1010.73	1014.27	0.020866	15.11	549.42	78.34	1.01

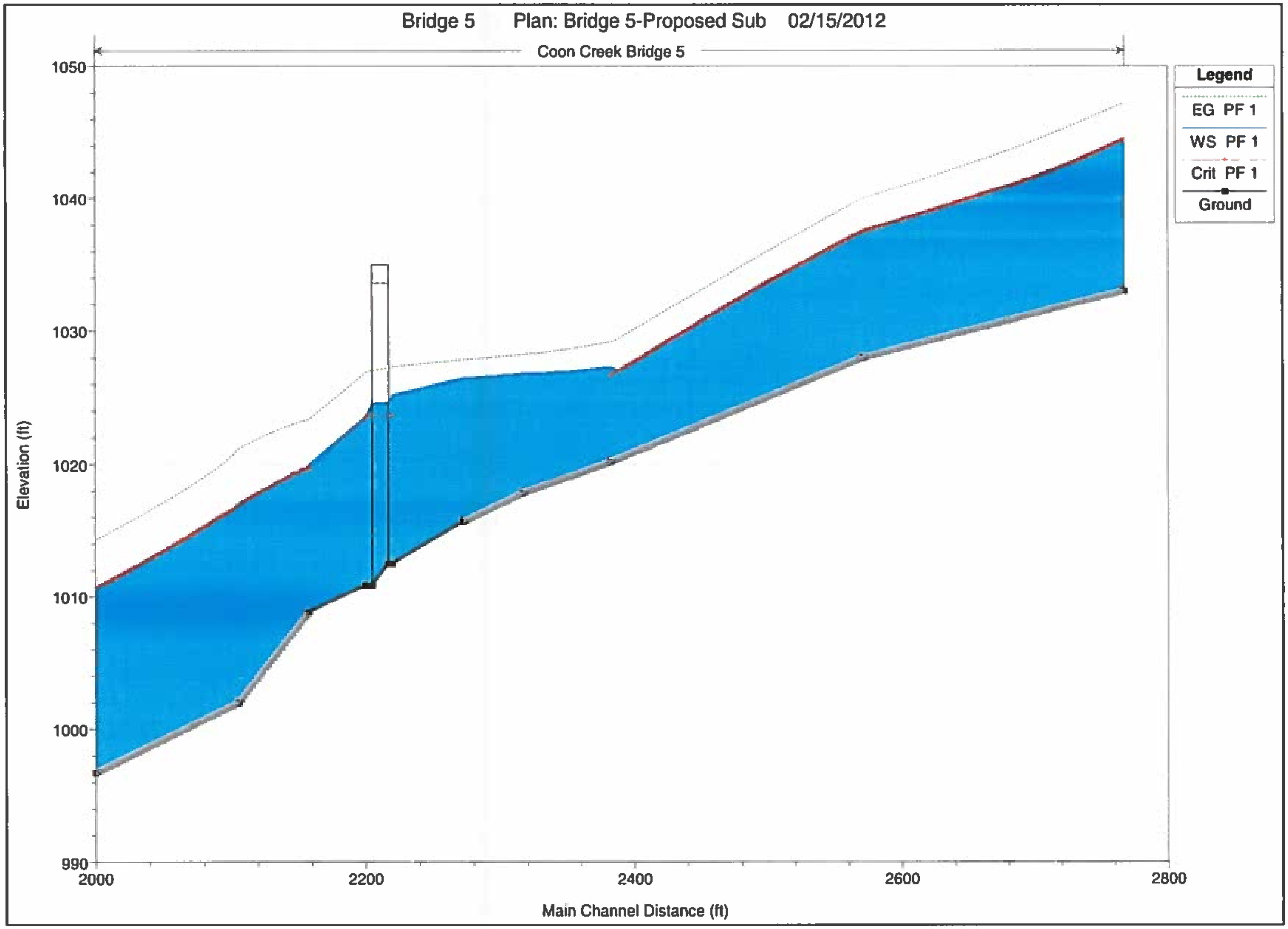
Bridge 5											
Supercritical Existing											
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bridge 5	2767.01	8300	1033	1044.56	1044.56	1047.18	0.014216	13.44	693.99	145.54	0.86
Bridge 5	2570.32	8300	1028	1037.48	1037.63	1040.05	0.023803	12.86	645.54	136.15	1.04
Bridge 5	2381.91	8300	1020.18	1025.36	1026.67	1029.81	0.055606	16.95	492.52	133.75	1.53
Bridge 5	2316.54	8300	1017.84	1024.88	1025.26	1027.79	0.0283	13.7	606.35	133.38	1.12
Bridge 5	2272.43	8300	1015.67	1023.98	1024.4	1027.18	0.027886	14.36	578.19	113.2	1.12
Bridge 5	2219.75	8300	1012.48	1023.7	1023.7	1026.94	0.019406	14.53	586.05	96.14	0.96
Bridge 5	2209.73	8300	1010.78	1023.18	1023.25	1026.55	0.022413	14.72	564.64	88.91	1.01
Bridge 5	2199.7	8300	1010.85	1023.66	1023.66	1026.89	0.021809	14.42	576.02	90.22	1
Bridge 5	2157.92	8300	1008.86	1017.67	1019.78	1024.7	0.055275	21.28	389.98	70.15	1.59
Bridge 5	2106.18	8300	1002	1015.07	1017.03	1022.12	0.04748	21.3	389.66	58.08	1.45
Bridge 5	2000	8300	996.7	1008.42	1010.73	1015.7	0.054478	21.65	383.37	65.44	1.58

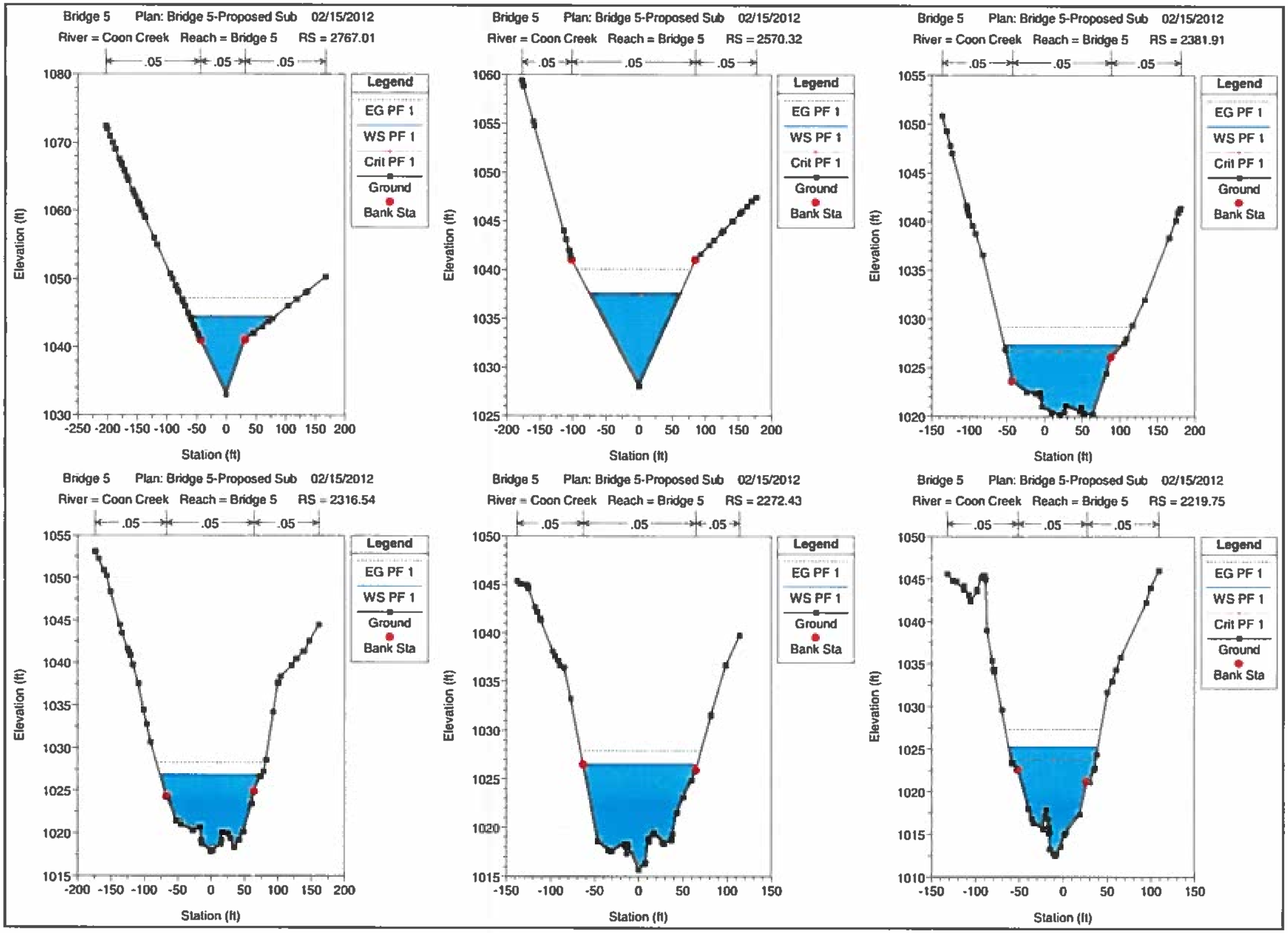
Bridge 5											
Mixed Existing											
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bridge 5	2767.01	8300	1033	1044.52	1044.52	1047.18	0.01452	13.53	688.13	144.73	0.87
Bridge 5	2570.32	8300	1028	1037.48	1037.63	1040.05	0.023803	12.86	645.54	136.15	1.04
Bridge 5	2381.91	8300	1020.18	1025.36	1026.67	1029.81	0.055606	16.95	492.52	133.75	1.53
Bridge 5	2316.54	8300	1017.84	1026.78		1028.21	0.008844	9.64	876.38	151.19	0.67
Bridge 5	2272.43	8300	1015.67	1026.43		1027.82	0.008236	9.48	875.77	129.33	0.64
Bridge 5	2219.75	8300	1012.48	1025.22		1027.31	0.009859	11.77	735.46	101.32	0.7
Bridge 5	2209.73	8300	1010.78	1025.27		1027.15	0.008961	11.02	763.26	99.92	0.67
Bridge 5	2199.7	8300	1010.85	1023.66	1023.66	1026.89	0.021809	14.42	576.02	90.22	1
Bridge 5	2157.92	8300	1008.86	1017.67	1019.78	1024.71	0.055286	21.28	389.96	70.15	1.59
Bridge 5	2106.18	8300	1002	1015.07	1017.03	1022.12	0.047489	21.3	389.64	58.08	1.45
Bridge 5	2000	8300	996.7	1008.42	1010.73	1015.7	0.054478	21.65	383.37	65.44	1.58

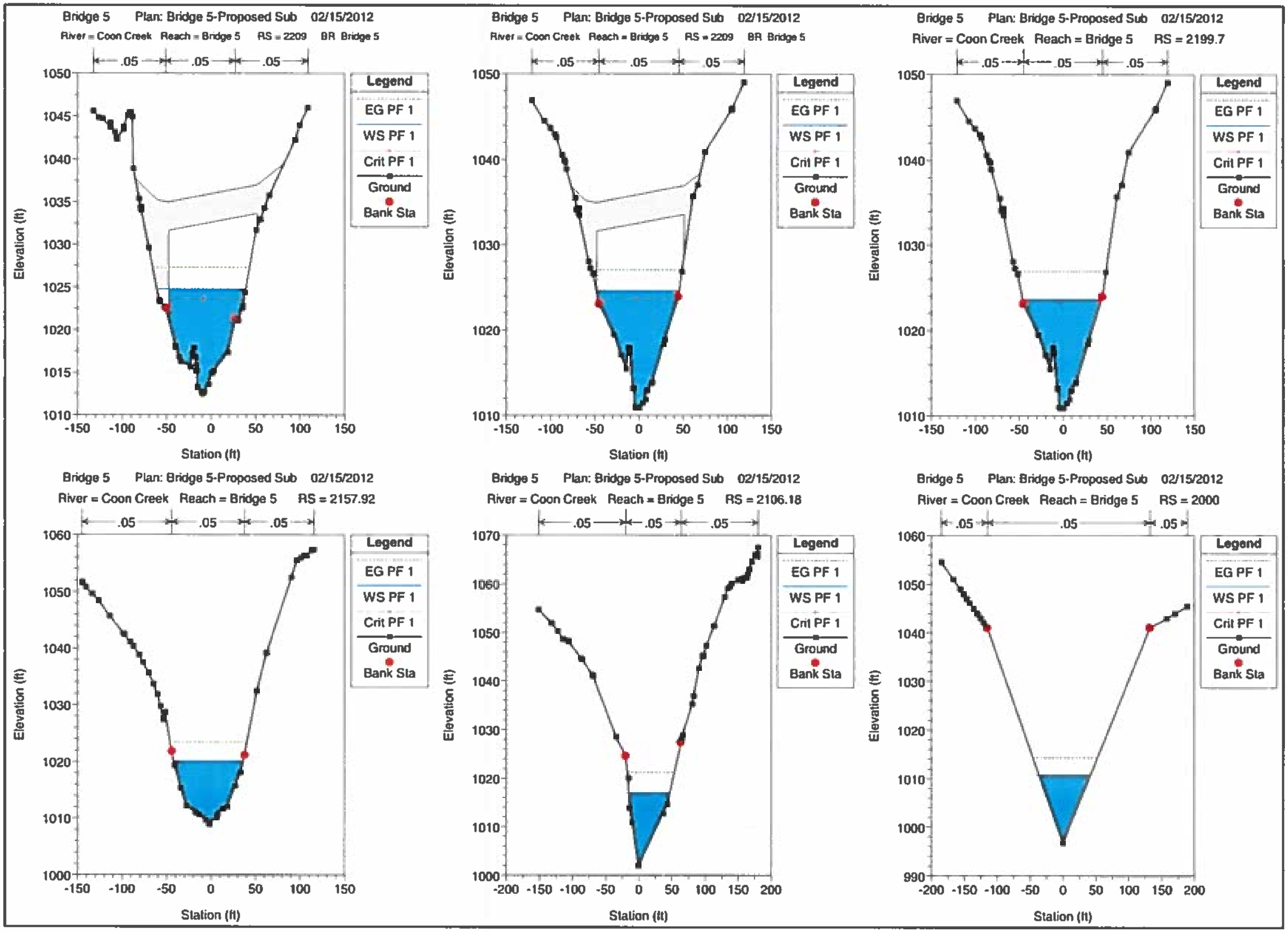
Bridge 5											
Subcritical Proposed											
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bridge 5	2767.01	8300	1033	1044.52	1044.52	1047.18	0.01452	13.53	688.13	144.73	0.87
Bridge 5	2570.32	8300	1028	1037.6	1037.6	1040.04	0.022297	12.55	661.56	137.83	1.01
Bridge 5	2381.91	8300	1020.18	1027.29	1026.67	1029.16	0.013918	11.04	769.53	156.67	0.82
Bridge 5	2316.54	8300	1017.84	1026.78		1028.21	0.008816	9.63	877.3	151.27	0.66
Bridge 5	2272.43	8300	1015.67	1026.43		1027.83	0.008203	9.47	876.91	129.38	0.64
Bridge 5	2219.75	8300	1012.48	1025.24	1023.7	1027.32	0.009755	11.73	738.09	101.41	0.7
Bridge 5	2209	Bridge									
Bridge 5	2199.7	8300	1010.85	1023.66	1023.66	1026.89	0.021809	14.42	576.02	90.22	1
Bridge 5	2157.92	8300	1008.86	1020.03	1019.78	1023.38	0.018757	14.69	564.96	77.81	0.96
Bridge 5	2106.18	8300	1002	1017.01	1017.01	1021.19	0.022274	16.41	505.67	61.8	1.01
Bridge 5	2000	8300	996.7	1010.73	1010.73	1014.27	0.020866	15.11	549.42	78.34	1.01

Bridge 5											
Supercritical Proposed											
Reach	River Sta	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)	
Bridge 5	2767.01	8300	1033	1044.56	1044.56	1047.18	0.014216	13.44	693.99	145.54	0.86
Bridge 5	2570.32	8300	1028	1037.48	1037.63	1040.05	0.023805	12.86	645.53	136.15	1.04
Bridge 5	2381.91	8300	1020.18	1025.37	1026.67	1029.8	0.055338	16.93	493.29	133.79	1.53
Bridge 5	2316.54	8300	1017.84	1024.9	1025.26	1027.79	0.027943	13.65	608.7	133.54	1.12
Bridge 5	2272.43	8300	1015.67	1023.94	1024.4	1027.2	0.028602	14.48	573.12	112.86	1.13
Bridge 5	2219.75	8300	1012.48	1023.7	1023.7	1026.94	0.019406	14.53	586.05	96.14	0.96
Bridge 5	2209	Bridge									
Bridge 5	2199.7	8300	1010.85	1023.66	1023.66	1026.89	0.021809	14.42	576.02	90.22	1
Bridge 5	2157.92	8300	1008.86	1017.67	1019.78	1024.7	0.055175	21.27	390.23	70.17	1.59
Bridge 5	2106.18	8300	1002	1015.08	1017.03	1022.1	0.047221	21.26	390.39	58.1	1.45
Bridge 5	2000	8300	996.7	1008.4	1010.73	1015.72	0.054912	21.71	382.23	65.34	1.58

Bridge 5											
Mixed Proposed											
Reach	River Sta	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)	
Bridge 5	2767.01	8300	1033	1044.52	1044.52	1047.18	0.01452	13.53	688.13	144.73	0.87
Bridge 5	2570.32	8300	1028	1037.48	1037.63	1040.05	0.023805	12.86	645.53	136.15	1.04
Bridge 5	2381.91	8300	1020.18	1025.37	1026.67	1029.8	0.055338	16.93	493.29	133.79	1.53
Bridge 5	2316.54	8300	1017.84	1026.78		1028.21	0.008816	9.63	877.3	151.27	0.66
Bridge 5	2272.43	8300	1015.67	1026.43		1027.83	0.008203	9.47	876.91	129.38	0.64
Bridge 5	2219.75	8300	1012.48	1025.24	1023.7	1027.32	0.009755	11.73	738.09	101.41	0.7
Bridge 5	2209	Bridge									
Bridge 5	2199.7	8300	1010.85	1023.66	1023.66	1026.89	0.021809	14.42	576.02	90.22	1
Bridge 5	2157.92	8300	1008.86	1017.67	1019.78	1024.7	0.05518	21.27	390.22	70.16	1.59
Bridge 5	2106.18	8300	1002	1015.08	1017.03	1022.1	0.047225	21.26	390.38	58.1	1.45
Bridge 5	2000	8300	996.7	1008.4	1010.73	1015.72	0.054912	21.71	382.23	65.34	1.58


Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
Coon Creek Bridge 5
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
1050
1040
1030
1020
1010
1000
990
2000
2200
2400
2600
2800
Main Channel Distance (ft)


Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2767.01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2570.32
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2381.91
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2316.54
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2272.43
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2219.75
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2209 BR Bridge 5
Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2209 BR Bridge 5
Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2199.7
Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2157.92
Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2106.18
Bridge 5 Plan: Bridge 5-Proposed Sub 02/15/2012
River = Coon Creek Reach = Bridge 5 RS = 2000
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
.05

IX. APPENDIX D: REFERENCES

From: Andrew Darrow [mailto:ADarrow@placer.ca.gov]
Sent: Monday, October 06, 2008 3:48 PM
To: Tim Arndt
Cc: Carl Sloan
Subject: RE: two maps for HFRP

Tim,

Here are the recommended 100-year peak flow rates for the three Hidden Falls bridge sites:

Bridge #1: 8,440 cfs (based on 36.43 square mile drainage area)
Bridge #2: 7,454 cfs (32.67 sq. mi.)
Bridge #3: 6,587 cfs (29.70 sq. mi.)

These flow rates are based on buildout conditions of the upstream watershed.

Let me know if you need anything else.

Andy

Andrew J. Darrow, P.E.
Development Coordinator
Placer County Flood Control and
Water Conservation District
3091 County Center Drive, Suite 220
Auburn, CA 95603
adarrow@placer.ca.gov
(530) 745-7541
(530) 745-3531 (fax)

Mike Hauge

From: Melissa Larsen
Sent: Wednesday, December 16, 2009 2:26 PM
To: Mike Hauge
Subject: FW: PDP help
Attachments: PDPbatchfile2.old

From: Andrew Darrow [mailto:ADarrow@placer.ca.gov]
Sent: Tuesday, December 01, 2009 2:33 PM
To: Melissa Larsen
Subject: RE: PDP help

Melissa,

Yes, I used the CCFU.GEN file as the PDP input file. I've attached the batch file that I used to run PDP (you'll have to change the extension to ".bat"). It produced the same incremental precip values that are shown in the CCFU.H1I file (for the 100-year event). You can then edit the batch file for each separate storm event (25-year, 50-year, etc.) and create separate HEC-1 input files for each event.

With regards to the zero elevation, I honestly don't know why this was used. I would recommend either continuing to use zero (in order to be consistent with the current model), or adjust the elevation to match the avg. elevation in the subshed(s) you are looking at.

Let me know if you have any questions.

Andy

Andrew J. Darrow, P.E.
Development Coordinator
Placer County Flood Control and
Water Conservation District
3091 County Center Drive, Suite 220
Auburn, CA 95603
adarrow@placer.ca.gov
(530) 745-7541
(530) 745-3531 (fax)

From: Melissa Larsen [mailto:mlarsen@carlton-engineering.com]
Sent: Monday, November 30, 2009 5:49 PM
To: Andrew Darrow
Subject: RE: PDP help

Andy,
I used the file that you sent me (CCFU.GEN) as the input file for PDP in order to generate the 100-yr storm precipitation input cards for HEC1. I took the HEC1 input file that PDP created and ran it through HEC1. I was trying to duplicate the HEC1 output file "CCFU.H1O" so that I know we have the right data files for the Hidden Falls project. I was unable to duplicate it. I think this is because PDP input file called H1100AFU.INP is called up and used to create CCFU.H1O.

If I understand you correctly (in the email below) we should use the CCFU.GEN file as input to PDP rather than the CCFU.H1I file that I have been using. Can you confirm this for me?

Also, I see that an elevation of zero is used in the PDP files that you sent us. Can you explain why the County would use zero?

Thanks,
Melissa

From: Andrew Darrow [mailto:ADarrow@placer.ca.gov]
Sent: Monday, November 23, 2009 3:24 PM
To: Melissa Larsen
Subject: RE: PDP help

Melissa,

Attached is the Cross Canal HEC-1 data file (ccfu.gen) without any inserted PI data. I was able to generate the HEC-1 input file (with the PI data inserted) using this file with the PDP batch file. You only need to edit the first * PI line and it will automatically apply the same parameters to all subsheds in the model. Let me know if this works for you.

Andy

Andrew J. Darrow, P.E.
Development Coordinator
Placer County Flood Control and
Water Conservation District
3091 County Center Drive, Suite 220
Auburn, CA 95603
adarrow@placer.ca.gov
(530) 745-7541
(530) 745-3531 (fax)

From: Melissa Larsen [mailto:mlarsen@carlton-engineering.com]
Sent: Saturday, November 21, 2009 4:59 PM
To: Andrew Darrow
Cc: Mike Hauge
Subject: PDP help

Andrew,
I'm working with Mike Hauge at Carlton Engineering on the Hidden Falls Regional Park project. I'm attempting to get the PDP program to create input files for HEC1 for the 25-, 50-, and 75-year storm frequencies. Mike has forwarded your and the program files that you sent him. It seems like your instructions are simple and straight forward but I feel like I'm creating files that call each other in a circular, never-ending mishap. Do you have some time on Monday or Tuesday of this week to speak with me by telephone? The program seems simple and with some instant feedback, I might be able to get it up and running for us.

Melissa Larsen
Sr. Project Engineer

CARLTON Engineering

Corporate Office
3883 Ponderosa Road
Shingle Springs, CA 95682

Rocklin Office
590 Menlo Drive. Ste. 1
Rocklin, CA 95765

mlarsen@carlton-engineering.com
Phone: (530) 748-8235

Fax: (530) 677-6645
www.carlton-engineering.com
3883 Ponderosa Road
Shingle Springs, CA 95682

Mike Hauge

From: Melissa Larsen
Sent: Wednesday, December 16, 2009 2:26 PM
To: Mike Hauge
Subject: FW: Hidden Falls Regional Park

From: Andrew Darrow [mailto:ADarrow@placer.ca.gov]
Sent: Tuesday, December 08, 2009 10:34 AM
To: Melissa Larsen
Subject: RE: Hidden Falls Regional Park

Melissa,

I do not see any significant differences in the models. Fortunately, the differences in peak flow rates appear to be minor (about 1 to 2 percent?). I don't have a problem with using the HEC-1 file that you attached.

Regarding the elevation for the upstream watershed, I would recommend using an elevation of 1500 feet. The Coon Creek watershed extends up to near Applegate.

Andy

Andrew J. Darrow, P.E.
Development Coordinator
Placer County Flood Control and
Water Conservation District
3091 County Center Drive, Suite 220
Auburn, CA 95603
adarrow@placer.ca.gov
(530) 745-7541
(530) 745-3531 (fax)

From: Melissa Larsen [mailto:mlarsen@carlton-engineering.com]
Sent: Friday, December 04, 2009 4:08 PM
To: Andrew Darrow
Subject: Hidden Falls Regional Park

Andrew,
I have successfully created the HEC1 input files – the PI data looks the same as the CCFU.H1I data file. However, I'm still getting different peak flow values in the HEC1 output files. I've attached the 100-year event (using zero elevation for consistency) output from HEC1. Do you see any obvious red flags in the data (Input or output)?

I used the same PDP input file and the same PDP command line as you. It is different than the CCFU.H1O file that I received from you (via Mike Hauge) a few weeks ago. Any thoughts?

I'd appreciate any suggestions you may have.

Melissa

Mike Hauge

From: Andrew Darrow [ADarrow@placer.ca.gov]
Sent: Friday, January 08, 2010 8:09 AM
To: Mike Hauge
Cc: Carl Sloan
Subject: RE: Coon Creek Hydrology

Carl/Mike,

Thank you for the HEC-1 file. At this point I am recommending that you use the precipitation, and corresponding peak flow rates, based on the 1500 elevation. Let me know if you need the subshed combination points that should be used for each bridge site, I believe I still have those.

As I mentioned before, I have not found any background information on why a "0" elevation was used in the original model. Precipitation amounts based on the 1500 feet elevation more closely match the watershed conditions for the Hidden Falls Park area and the requirements in the Placer County Stormwater Management Manual.

Let me know if you need anything else.

Andy

Andrew J. Darrow, P.E.
Development Coordinator
Placer County Flood Control and
Water Conservation District
3091 County Center Drive, Suite 220
Auburn, CA 95603
adarrow@placer.ca.gov
(530) 745-7541
(530) 745-3531 (fax)

From: Mike Hauge [mailto:mhauge@carlton-engineering.com]
Sent: Monday, January 04, 2010 9:00 AM
To: Andrew Darrow
Cc: Carl Sloan
Subject: RE: Coon Creek Hydrology

Andy,

Good morning. Attached is the HEC-1 output file for the 100 year storm using an elevation of 1500 ft. Please let us know if you need anything else.

Thanks,

Mike Hauge

From: Andrew Darrow [mailto:ADarrow@placer.ca.gov]
Sent: Monday, January 04, 2010 8:09 AM
To: Carl Sloan
Cc: Mike Hauge
Subject: RE: Coon Creek Hydrology

Hi Carl,

Thanks for the clarification. Hope you had a nice holiday break.

Can you send me the HEC-1 models that Melissa revised based on a 1500 feet elevation? I just need the 100-year files at this point.

I'm leaning towards recommending the hydrology that is based on the 1500 feet elevation. I have not found any background information on why a "0" elevation was used in the original model. Precipitation amounts based on the 1500 feet elevation more closely match the watershed conditions for the Hidden Falls Park area and the requirements in the Placer County Stormwater Management Manual.

Andy

Andrew J. Darrow, P.E.
Development Coordinator
Placer County Flood Control and
Water Conservation District
3091 County Center Drive, Suite 220
Auburn, CA 95603
adarrow@placer.ca.gov
(530) 745-7541
(530) 745-3531 (fax)

From: Carl Sloan [mailto:csloan@carlton-engineering.com]
Sent: Wednesday, December 23, 2009 8:16 AM
To: Andrew Darrow
Cc: Mike Hauge
Subject: Coon Creek Hydrology

Hello Andy,

Just a quick follow up on our phone conversation. It is important that we understand which model we should be using for the following reasons:

1. The flows in the creek will have an effect on the amount of money that the County spends on the bridges. For example, if the flow from the 1500' model shows the 100 yr flood has a 100' wide footprint, vs the 0' model showing an 80' wide footprint, than that will affect the clear span of the bridge and therefore the cost.
2. We need to accurately map the flood level in the creek at the 10, 25, 50 and 100 year storms so we can give the County options on where to place their abutments and the associated risk. We need to be able to tell them that if they place their abutment in a certain location, the odds of a storm are X and be confident that we are correct within reason. Because the County is going to invest $250k to $500k in a bridge at each location, we need to be sure we are giving them the best information possible to manage the risk.

I was not sure I communicated this information clearly so I wanted to follow up with this note. Thank you very much for your help and I look forward to getting your thoughts on the model. Have a great holiday!

Regards,

Carl Sloan, PE
Civil Department Manager
Survey Department Manager

Cell: (530) 391-6849
Phone: (530) 677-5515
Direct Phone: (530) 672-4031

Fax: (530) 677-6645
www.carlton-engineering.com

Holiday Schedule: Carlton Engineering will be closed begining December 24, reopening on January 4.

CARLTON Engineering

Corporate Office
3883 Ponderosa Road
Shingle Springs, CA 95682

Rocklin Office
590 Menlo Drive. Ste. 1
Rocklin, CA 95765

Computer-Assisted Floodplain Hydrology and Hydraulics

Second Edition

Daniel H. Hoggan

TABLE 11.2 Values of Roughness Coefficient *n* (*Continued*)

(Underscored Values Are Generally Recommended in Design)

Type of channel and description	Minimum	Normal	Maximum
D. Natural streams (*cont.*)			
6. Same as 4, but more stones	0.045	0.050	[illegible]
7. Sluggish reaches, weedy, deep pools	0.050	0.070	[illegible]
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	[illegible]
b. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles, and few boulders	0.030	0.040	[illegible]
2. Bottom: cobbles with large boulders	0.040	0.050	[illegible]
D-2. Floodplains			
a. Pasture, no brush			
1. Short grass	0.025	0.030	[illegible]
2. High grass	0.030	0.035	[illegible]
b. Cultivated areas			
1. No crop	0.020	0.030	[illegible]
2. Mature row crops	0.025	0.035	[illegible]
3. Mature field crops	0.030	0.040	[illegible]
c. Brush			
1. Scattered brush, heavy weeds	0.035	0.050	[illegible]
2. Light brush and trees, in winter	0.035	0.050	[illegible]
3. Light brush and trees, in summer	0.040	0.060	[illegible]
4. Medium to dense brush, in winter	0.045	0.070	[illegible]
5. Medium to dense brush, in summer	0.070	0.100	[illegible]
d. Trees			
1. Dense willows, summer, straight	0.110	0.150	[illegible]
2. Cleared land with tree stumps, no sprouts	0.030	0.040	[illegible]
3. Same as above, but with heavy growth of sprouts	0.050	0.060	[illegible]
4. Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	[illegible]
5. Same as above, but with flood stage reaching branches	0.100	0.120	[illegible]
D-3. Major streams (top width at flood stage >100 ft). The *n* value is less than that for minor streams of similar description because banks offer less effective resistance.			
a. Regular section with no boulders or brush	0.025		[illegible]
b. Irregular and rough section	0.035		[illegible]

SOURCE: Chow.[2]

X. APPENDIX E: SCOUR ANALYSIS

Hydraulic Design Data
Abutment Scour

	Left	Right

Input Data

	Left	Right
Station at Toe (ft):	-47.60	51.20
Toe Sta at appr (ft):	-59.29	88.82
Abutment Length (ft):	3.96	1.80
Depth at Toe (ft):	4.29	-6.65
K1 Shape Coef:	1.00 - Vertical abutment	
Degree of Skew (degrees):	90.00	90.00
K2 Skew Coef:	1.00	1.00
Projected Length L' (ft):	3.96	1.80
Avg Depth Obstructed Ya (ft):	6.91	0.30
Flow Obstructed Qe (cfs):	256.94	0.62
Area Obstructed Ae (sq ft):	27.36	0.54

Results

Scour Depth Ys (ft):	16.22	
Qe/Ae = Ve:	9.39	
Froude #:	0.63	
Equation:	Froehlich	Default

NOTE: SCOUR DEPTH IS CALCULATED TO BE 16.2' BELOW THE SOUTH ABUTMENT. THE ABUTMENT WILL BE FOUNDED ON COMPETENT BEDROCK WHICH IS LESS THAN THE CALCULATED SCOUR DEPTH. THEREFORE SCOUR WILL NOT REACH THE CALCULATED DEPTHS.