Meeting of the Central Valley Flood Protection Board
May 29, 2015

Staff Report

California Department of Transportation
State Highway 180 Cameron Slough Bridges Construction, Fresno County

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1.0 – REQUESTED ITEM

Consider Central Valley Flood Protection Board (Board) approval to construct two bridges over Cameron Slough as part of a route re-alignment of a section of State Route (SR) 180 (Attachment A) by Draft Permit No. 18982 (Attachment B).

2.0 – APPLICANT

California Department of Transportation (Caltrans)

3.0 – PROJECT LOCATION

The proposed bridge crosses Cameron Slough northeast of the existing SR 180 bridge in a rural agricultural area. Cameron Slough is a Board regulated stream located outside of the federal project west of Minkler in Fresno County (Attachment A).

4.0 – PROJECT DESCRIPTION

Caltrans proposes a route re-alignment for a section of SR 180 (also known as East Kings Canyon Road). The new route is proposed along a new northern alignment approximately 350 feet upstream of the existing highway. The project includes construction of two bridges (Br. No. 42-0436 Left & Right) over Cameron Slough, and placement of rock slope protection (RSP) at the bridge abutments.

5.0 – AUTHORITY OF THE BOARD

California Water Code § 8534, 8590 – 8610.5, and 8700 – 8710

California Code of Regulations Title 23 (Title 23)

- § 6, Need for a Permit

- § 108, Existing Encroachments
- § 112, Streams Regulated and Nonpermissible Work Periods
- § 116, Borrow and Excavation Activities – Land and Channel
- § 121, Erosion Control
- § 123, Pipelines and Conduits
- § 128, Bridges

6.0 – AGENCY COMMENTS AND ENDORSEMENTS

The comments and endorsements associated with the project are as follows:

- The U.S. Army Corps of Engineers (USACE) Sacramento District non-fed letter was received on January 9, 2015 for this application. The letter indicates that the USACE District Engineer has no comments or recommendations regarding flood control because the proposed work does not affect a federally constructed project. The letter has been incorporated into the permit as Exhibit A.
- Kings River Conservation District (KRCD) endorsed the project with conditions on March 27, 2014 (Attachment C). No additional special conditions were needed to incorporate the intent and scope of the KRCD conditions into Draft Permit No. 18982.

7.0 – PROJECT ANALYSIS

7.1 – Project Summary

The proposed Cameron Slough bridges are two (2)-span, reinforced concrete box girder structures, approximately 179 feet long with widths of approximately 42 and 44 feet for the Left (upstream) and Right (downstream) bridges, respectively. The proposed bridge depth is 3.5 feet and the pier configurations will consist of three (3) columns per pier bent. Abutments will be supported on spread-footing foundations with RSP place at the bridge abutments (Attachment D).

7.2 – Hydraulic Summary

The estimated 100-year design discharge is 1,800 cubic feet per second (cfs). Culverts have been included in the design to facilitate floodplain flow conveyance beneath the proposed SR 180 roadway embankment. The result of the multiple opening analyses provided estimated 100-year discharges for the bridge waterway

opening of 1,416 cfs and culvert group of 384 cfs, for a total discharge of 1,800 cfs.

Based on HEC-RAS hydraulic modeling, the proposed bridge has 3 feet of freeboard at the 100-year discharge and is compliant with Title 23 standards. The project increases the water surface elevation (WSE) by 0.12 feet (from 394.63 to 394.75 feet) with the culvert group mitigation in-place (Attachment E).

The proposed culvert group consists of 20 – three (3) -foot diameter concrete pipes. The culverts will reduce the overall discharge conveyed through the proposed bridge waterway opening and reduce impacts to the WSE. The increase of 0.12 feet with the culvert group in-place indicates potential localized impacts to the surrounding area. However, because the proposed bridge is located in a rural area where the floodway is wide and design flows are not contained within the channel banks, adverse hydraulic impacts have been determined by staff to be negligible and cause no significant impacts to the floodway and area adjacent to the project (Attachment E).

Computed channel velocities immediately upstream of the bridge are modeled to decrease from 2.4 feet per second (fps) to 1.95 fps, and a minimum thickness of 2.5 feet of RSP has been proposed to provide erosion protection.

Based on the hydraulic analysis provided, staff has determined that the proposed project is expected to result in no significant adverse hydraulic impacts to the Cameron Slough channel or floodway.

7.3 – Geotechnical Summary

Board staff has reviewed geotechnical information provided by Caltrans and has determined that the proposed project is expected to result in no adverse geotechnical impacts to the Cameron Slough channel or floodway.

All fill, excavation, RSP, and temporary structures will be completed in compliance with Draft Permit No. 18982 and all Title 23 technical standards.

8.0 – CEQA ANALYSIS

Board staff has prepared the following California Environmental Quality Act (CEQA) determination:

The Board, acting as a Responsible Agency under CEQA, has reviewed the Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) (SCH No. 91022072, September 1995), Supplemental EIR (SCH No. 91022072, June 2014)

and Mitigation Monitoring and Reporting Program for the Kings Canyon Expressway, Segment 3 Project submitted by Caltrans. These documents, including the project design, may be viewed or downloaded from the Board's website at http://www.cvfpb.ca.gov/meetings/2015/05-29-2015.cfm under a link for this agenda item. These documents are also available for review in hard copy at the Board and Caltrans offices.

Caltrans determined that the project would not have a significant effect on the environment and subsequently filed a Notice of Determination on September 15, 2014 with the State Clearinghouse. Board staff finds that although the proposed project could have a potentially significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. The project proponent has incorporated mandatory mitigation measures into the project plans to avoid identified impacts or to mitigate such impacts to a point where no significant impacts will occur. These mitigation measures are included in the project proponent's mitigation and monitoring plan and address impacts biological resources and cultural resources. The description of the mitigation measures are further described in the adopted Mitigation Monitoring and Reporting Program.

The documents and other materials which constitute the record of the Board's proceedings in this matter are in the custody of Leslie Gallagher, Acting Executive Officer, Central Valley Flood Protection Board, 3310 El Camino Ave., Rm. 151, Sacramento, California 95821.

9.0 – CALIFORNIA WATER CODE § 8610.5 CONSIDERATIONS

- Evidence that the Board admits into its record from any party, federal, State or local public agency, or nongovernmental organization with expertise in flood or flood plain management:

  The Board has considered all the evidence presented in this matter, including the applications for Permit No. 18982, all supporting hydraulic, geotechnical, and other technical documentation provided by Caltrans.

- The best available science that related to the scientific issues presented by the Executive Officer, legal counsel, the Department of Water Resources or other parties that raise credible scientific issues.

  In making its findings, the Board has used the best available science relating to the issues presented by all parties. On the important issue of hydraulic impacts Caltrans used the HEC-RAS one-dimensional flow model. This

model is considered by many experts as one of the best available and applicable scientific tools for the purpose of modeling rainfall-runoff and river hydraulics for this region.

- Effects of the decision on the facilities of the State Plan of Flood Control, and consistency of the proposed project with the Central Valley Flood Protection Plan as adopted by Board Resolution 2012-25 on June 29, 2012:

  This project is expected to result in no adverse impacts on facilities of the State Plan of Flood Control, and is consistent with the adopted 2012 Central Valley Flood Protection Plan and current Title 23 standards because the proposed project is predicted to result in no increase in water surface elevation or substantial increase in channel velocities, and it replaces a hydraulically deficient bridge with a modern Title 23-compliant structure.

- Effects of reasonable projected future events, including, but not limited to, changes in hydrology, climate, and development within the applicable watershed:

  Caltrans has determined that they do not anticipate any future projects that would impact the bridge replacement based on research of plans and other projects in the area.

10.0 – STAFF RECOMMENDATION

Board staff recommends that the Board:

- adopt the CEQA findings;
- approve Encroachment Permit No. 18982 (in substantially the form provided); and,
- direct the Executive Officer to take the necessary actions to execute the permit and file a Notice of Determination pursuant to CEQA with the State Clearinghouse.

11.0 – LIST OF ATTACHMENTS

A – Project Vicinity and Location Maps

B – Draft Permit No. 18982

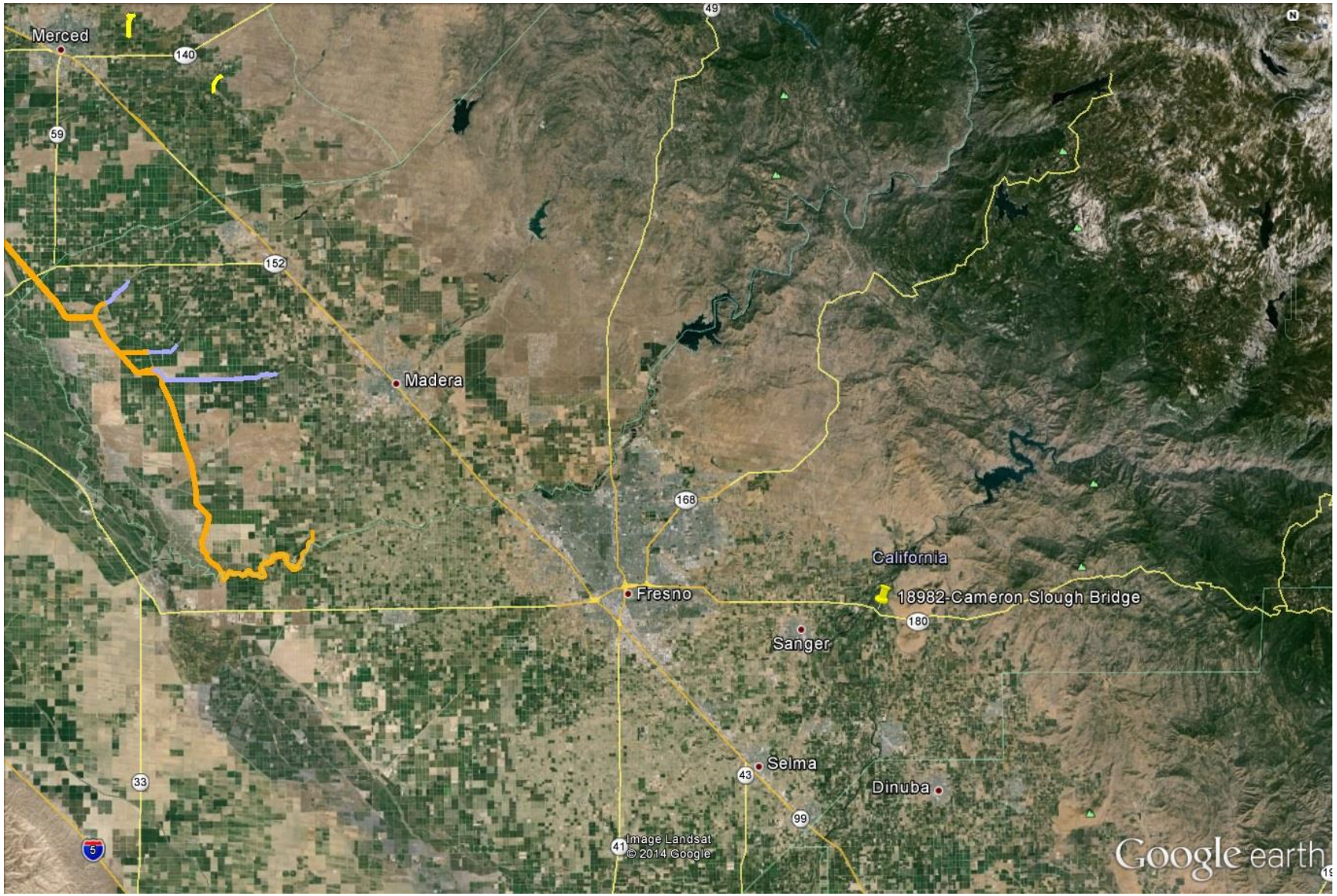
Exhibit A – USACE Non-fed Letter

C – Kings River Conservation District Endorsement

D – Project Drawings

E – Hydraulic Technical Memo

Prepared by:	Sungho Lee, Engineer, Water Resources, Projects Section
Document Review:	Nancy C. Moricz, Senior Engineer, Projects and Environmental Branch
	Andrea Buckley, Senior Environmental Scientist (Specialist)
	Eric Butler, PE, Projects and Environmental Branch Chief
	Len Marino, PE, Chief Engineer
Legal Review	Nicole Rinke, Deputy Attorney General


Merced
140
59
152
Madera
168
California
Fresno
18982-Cameron Slough Bridge
180
Sanger
Selma
43
Dinuba
99
33
5
41
Image Landsat
© 2014 Google
Google earth


18982-Cameron Slough Bridge
180
E Kings Canyon Rd
© 2014 Google
Google earth

DRAFT

STATE OF CALIFORNIA
THE RESOURCES AGENCY

THE CENTRAL VALLEY FLOOD PROTECTION BOARD

PERMIT NO. 18982 BD

This Permit is issued to:

California Department of Transportation (Caltrans)
Attn: Tom Fisher
2015 East Shields Avenue, Suite 100
Fresno, California 93726

Caltrans proposes a route re-alignment for a section of State Highway/Route 180 (also known as East Kings Canyon Road). The new route would be located along a new northern alignment located upstream of the existing highway. The project would include the construction of two approximately 179 foot, two (2)-span bridges (Br. No. 42-0436 Left & Right) over Cameron Slough.

The project is located approximately 350 feet east of the existing Route 180 bridge over Cameron Slough near Minkler in Fresno County. (Section 10, T14S, R23E, MDB&M, Kings River Conservation District, Cameron Slough, Fresno County).

NOTE: Special Conditions have been incorporated herein which may place limitations on and/or require modification of your proposed project as described above.

(SEAL)

Dated: _____

_____
Executive Officer

GENERAL CONDITIONS:

ONE: This permit is issued under the provisions of Sections 8700 – 8723 of the Water Code.

TWO: Only work described in the subject application is authorized hereby.

THREE: This permit does not grant a right to use or construct works on land owned by the Sacramento and San Joaquin Drainage District or on any other land.

FOUR: The approved work shall be accomplished under the direction and supervision of the State Department of Water Resources, and the permittee shall conform to all requirements of the Department and The Central Valley Flood Protection Board.

FIVE: Unless the work herein contemplated shall have been commenced within one year after issuance of this permit, the Board reserves the right to change any conditions in this permit as may be consistent with current flood control standards and policies of The Central Valley Flood Protection Board.

SIX: This permit shall remain in effect until revoked. In the event any conditions in this permit are not complied with, it may be revoked on 15 days' notice.

SEVEN: It is understood and agreed to by the permittee that the start of any work under this permit shall constitute an acceptance of the conditions in this permit and an agreement to perform work in accordance therewith.

EIGHT: This permit does not establish any precedent with respect to any other application received by The Central Valley Flood Protection Board.

NINE: The permittee shall, when required by law, secure the written order or consent from all other public agencies having jurisdiction.

TEN: The permittee is responsible for all personal liability and property damage which may arise out of failure on the permittee's part to perform the obligations under this permit. If any claim of liability is made against the State of California, or any departments thereof, the United States of America, a local district or other maintaining agencies and the officers, agents or employees thereof, the permittee shall defend and shall hold each of them harmless from each claim.

ELEVEN: The permittee shall exercise reasonable care to operate and maintain any work authorized herein to preclude injury to or damage to any works necessary to any plan of flood control adopted by the Board or the Legislature, or interfere with the successful execution, functioning or operation of any plan of flood control adopted by the Board or the Legislature.

TWELVE: Should any of the work not conform to the conditions of this permit, the permittee, upon order of The Central Valley Flood Protection Board, shall in the manner prescribed by the Board be responsible for the cost and expense to remove, alter, relocate, or reconstruct all or any part of the work herein approved.

SPECIAL CONDITIONS FOR PERMIT NO. 18982 BD

THIRTEEN: All work completed under this permit, as directed by the general and special conditions herein, shall be accomplished to ensure that the work is not injurious to adopted plans of flood control, regulated streams, and designated floodways under the Central Valley Flood Protection Board (Board) jurisdiction, as defined in California Code of Regulations, Title 23. This permit only applies to the completion of work in the project description located within, or adjacent to and having bearing on the Board jurisdiction, and which directly or indirectly affects the Board's jurisdiction. This special condition shall apply to all subsequent conditions herein.

LIABILITY AND INDEMNIFICATION

FOURTEEN: The permittee is responsible for all personal liability and property damage which may arise out of failure on the permittee's part to perform the obligations under this permit. If any claim of liability is made against the Board, the Department of Water Resources (DWR), the United States of America, a local district or other maintaining agencies and the officers, agents or employees thereof, arising out of failure on the permittee's part to perform the obligations under this permit, the permittee shall defend and shall hold each of them harmless from each claim. This condition shall supersede condition TEN.

FIFTEEN: The permittee shall defend, indemnify, and hold the Board, DWR, and their respective officers, agents, employees, successors and assigns, safe and harmless, of and from all claims and damages related to the Board's approval of this permit, including but not limited to claims filed

pursuant to the California Environmental Quality Act. The Board and DWR expressly reserve the right to supplement or take over their defense, in their sole discretion.

SIXTEEN: The permittee is responsible for all liability associated with construction, operation, and maintenance of the permitted facilities and shall defend, indemnify, and hold the Board, DWR, and their respective officers, agents, employees, successors and assigns, safe and harmless, of and from all claims and damages arising from the project undertaken pursuant to this permit, all to the extent allowed by law. The Board and DWR expressly reserve the right to supplement or take over their defense, in their sole discretion.

SEVENTEEN: The Board, DWR, and the Kings River Conservation District shall not be held liable for damages to the permitted encroachment(s) resulting from releases of water from reservoirs, flood fight, operation, maintenance, inspection, or emergency repair.

EIGHTEEN: If the permittee does not comply with the conditions of the permit and enforcement by the Board is required, the permittee shall be responsible for bearing all costs associated with the enforcement action, including reasonable attorney's fees. Permittee acknowledges that State law allows the imposition of fines in enforcement matters.

PERMITTING AND AGENCY CONDITIONS

NINETEEN: Board staff received a letter, dated January 9, 2015, from the U.S. Army Corps of Engineers (USACE) District Engineer stating that the District Engineer has no comments or recommendations regarding flood control because the proposed work does not affect a federally constructed project. This letter is attached to this permit as Exhibit A and is incorporated by reference.

TWENTY: The permittee agrees to incur all costs for compliance with local, State, and Federal permitting. If any conditions issued by other agencies conflict with any of the conditions of this permit, then the permittee shall resolve conflicts between any of the terms and conditions that agencies might impose under the laws and regulations it administers and enforces.

PRE-CONSTRUCTION

TWENTY-ONE: The permittee shall contact the Kings River Conservation District by phone, (559) 237-5567, at least thirty (30) days prior to the commencement of work.

TWENTY-TWO: The permittee shall contact the Board by telephone at (916) 574-0609, and submit the enclosed postcard to schedule a preconstruction conference. Failure to do so at least 20 working days prior to start of work may result in delay of the project.

TWENTY-THREE: Prior to commencement of work, the permittee shall create a photo record, including associated descriptions of project conditions. The photo record shall be submitted to the Board within thirty (30) calendar days of beginning the project.

TWENTY-FOUR: The permittee shall provide construction supervision and inspection services

acceptable to the Board.

TWENTY-FIVE: Thirty (30) calendar days prior to the start of any demolition and / or construction activities within the floodway or within the existing levee prism, the permittee shall submit two sets of detailed plans and specifications and supporting geotechnical and / or hydraulic impact analyses to the Board's Chief Engineer, for any and all temporary, in channel, or levee prism work that may have an impact during the flood season from November 1 through July 15. The Board may request additional information as needed and will seek comment from the USACE and / or the local maintaining agency when necessary. The Board will provide written notification to the permittee if the review period is likely to exceed thirty (30) working days.

CONSTRUCTION

TWENTY-SIX: All work approved by this permit shall be in accordance with the submitted drawings and specifications except as modified by special permit conditions herein. No work, other than that approved by this permit, shall be done in the project area without prior approval of the Board.

TWENTY-SEVEN: All addenda and contract change orders made to the approved plans and / or specifications by the permittee after the Board approval of this permit shall be submitted to the Board's Chief Engineer for review and approval prior to incorporation into the permitted project. The submittal shall include all supplemental plans, specifications, and necessary supporting geotechnical, hydrology and hydraulics, or other technical analyses. The Board shall acknowledge receipt of the addendum or change submittal in writing within ten (10) working days of receipt, and shall work with the permittee to review and respond to the request as quickly as possible. Time is of the essence. The Board may request additional information as needed and will seek comment from the USACE and / or local maintaining agencies when necessary. The Board will provide written notification to the permittee if the review period is likely to exceed forty five (45) calendar days. Upon approval of submitted documents the permit shall be revised, if needed, prior to construction related to the proposed changes.

TWENTY-EIGHT: No construction work of any kind shall be done during the flood season from November 1st to July 15th without prior approval of the Board.

TWENTY-NINE: All debris generated by this project shall be disposed outside of the Cameron Slough floodway.

THIRTY: No material stockpiles, temporary buildings, or equipment shall remain in the floodway during the flood season from November 1 to July 15.

THIRTY-ONE: Rock slope revetment shall be uniformly placed and properly transitioned into the bank, levee slope, or adjacent original ground and in a manner which avoids segregation.

THIRTY-TWO: The recommended minimum thickness of revetment, measured perpendicular to the bank or levee slope is 18 inches below the usual water surface and 12 inches above the usual water surface.

THIRTY-THREE: The revetment shall not contain any reinforcing steel, floatable, or objectionable

material. Asphalt or other petroleum-based products may not be used as fill or erosion protection on the levee section or within the floodway.

THIRTY-FOUR: Density tests by a certified materials laboratory will be required to verify compaction of backfill within the Cameron Slough floodway.

THIRTY-FIVE: Backfill material for excavations within the bank section and within 10 feet of bridge supports within the floodway shall be placed in 4- to 6-inch layers and compacted to a minimum of 90 percent relative compaction per ASTM Method D1557-91, or 97 percent per ASTM D 698-91, and above optimum moisture content.

THIRTY-SIX: Precast reinforced-concrete pipe, box culvert, or concrete cylinder pipe below the design flood elevation shall meet or exceed ASTM Specification C76-90 or equivalent.

THIRTY-SEVEN: Precast reinforced-concrete pipe or concrete cylinder pipe installed below the design flood elevation shall be encased below the springline in concrete cast against firm undisturbed earth.

THIRTY-EIGHT: Pipes shall be inspected prior to installation to ensure no cracked, broken, or defective materials are used.

THIRTY-NINE: The permittee shall be responsible for all damages due to settlement, consolidation, or heave from any construction-induced activities.

FORTY: Except with respect to the activities expressly allowed under this permit, the work area shall be restored to the condition that existed prior to start of work.

VEGETATION / ENVIRONMENTAL MITIGATION

FORTY-ONE: Cleared trees and brush shall be completely burned or removed from the floodway, and downed trees or brush shall not remain in the floodway during the flood season from November 1 to July 15.

FORTY-TWO: In the event that scour of channel bed injurious to the Cameron Slough floodway occurs as a result of the project, the permittee shall repair the eroded area and propose measures, to be approved by the Board, to prevent further erosion.

POST-CONSTRUCTION

FORTY-THREE: The permittee shall be responsible for repair of any damages to the Cameron Slough floodway due to construction, operation, or maintenance of the proposed project.

FORTY-FOUR: Within 120 days of completion of the project, the permittee shall submit to the Board as-built drawings and a certification report, stamped and signed by a professional engineer registered in the State of California, certifying the work was performed and inspected in accordance with Board permit conditions and submitted drawings and specifications.

OPERATIONS AND MAINTENANCE

FORTY-FIVE: The permittee shall be responsible for repair of any damages to the levee, channel, banks, floodway, or any other flood control facilities due to construction, operation, or maintenance of the proposed project.

FORTY-SIX: The permittee shall maintain the permitted encroachment(s) within the utilized area in the manner required and as requested by the authorized representative of the Board, DWR, or any other agency responsible for maintenance.

FORTY-SEVEN: If the bridge is damaged to the extent that it may impair the channel or floodway capacity, it shall be repaired or removed prior to the next flood season.

FORTY-EIGHT: Drainage from the bridge or highway shall not be discharged directly into Cameron Slough without proper erosion control measures in-place.

FORTY-NINE: If the permitted structure results in any adverse hydraulic impact or scouring the permittee shall provide appropriate mitigation measures subject to review and approval of the Board.

FIFTY: All debris that may accumulate around the bridge piers and abutments within Cameron Slough shall be completely removed from the floodway following each flood season.

FIFTY-ONE: The permitted encroachment(s) shall not interfere with the flood conveyance capability of the Cameron Slough floodway. If the permitted encroachment(s) are determined by any agency responsible for operation or maintenance of the Cameron Slough floodway to interfere, the permittee shall be required, at the permittee's cost and expense, to modify or remove the permitted encroachment(s) under direction of the Board. If the permittee does not comply, the Board may modify or remove the encroachment(s) at the permittee's expense.

FIFTY-TWO: At the request of either the permittee or the Board the permittee and the Board shall conduct joint inspections of the project and the Cameron Slough floodway after significant flood events or flood seasons to assess the integrity and operation of the project, and to assess and respond to any adverse impacts on the floodway or adjacent properties.

PROJECT ABANDONMENT, CHANGE IN PLAN OF FLOOD CONTROL

FIFTY-THREE: If the project works, or any portion thereof, is to be abandoned in the future, the permittee shall abandon the project under direction of the Board at the permittee's cost and expense.

FIFTY-FOUR: The permittee may be required, at the permittee's cost and expense, to remove, alter, relocate, or reconstruct all or any part of the permitted project works if removal, alteration, relocation, or reconstruction is necessary as part of or in conjunction with implementation of the Central Valley Flood Protection Plan or other future flood control plan or project, or if damaged by any cause. If the permittee does not comply, the Board may perform this work at the permittee's expense.

END OF CONDITIONS

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Flood Protection and Navigation Section (18982)

JAN 09 2015

Ms. Leslie M. Gallagher, Acting Executive Officer
Central Valley Flood Protection Board
3310 El Camino Avenue, Room 151
Sacramento, California 95821

Dear Ms. Gallagher:

We have reviewed a permit application by California Department of Transportation (application number 18982). This project includes constructing two bridges (Bridge No. 42-0436 Left and Right) over Cameron Slough. The project is located approximately 440 feet east of the existing State Highway/Route 180 bridge over Cameron Slough near Minkler, at 36.726250°N 119.459167°W NAD83, Fresno County, California.

The District Engineer has no comments or recommendations regarding flood control because the proposed work does not affect a federally constructed project.

A Section 10 and/or Section 404 permit application (2011-01010) is in process for this work.

A copy of this letter is being furnished to Mr. Don Rasmussen, Chief, Flood Project Integrity and Inspection Branch, 3310 El Camino Avenue, Suite 200, Sacramento, CA 95821.

Sincerely,

Ryan Larson, P.E.
Chief, Flood Protection and Navigation Section

KRCD
Kings River Conservation District

4886 East Jensen Avenue
Fresno, California 93725

Tel: 559-237-5567
Fax: 559-237-5560

www.krcd.org

March 27, 2014

Mr. Brian Cullum
Central Valley Flood Protection Board (CVFPB)
P.O. Box 942836
Sacramento, CA 94236

Re: Kings River Designated Floodway - Encroachment Permit Application
KRCD No. 800.05.273 – California Department of Transportation
Highway 180 Cameron Slough Tributary Bridges

Dear Mr. Cullum:

The District is in receipt of application and accompanying drawings and other materials submitted by the California Department of Transportation, hereinafter "Permittee", to construct two bridges crossing the Cameron Slough Tributary as a part of their Highway 180 (Segment 3) construction effort. The bridges are located on the Kings River Designated Floodway (adopted June 25, 1971), C.M. 2.0 (Cameron Slough) in Section 10, T.14S., R.23E., M.D.B. & M. of Fresno County.

The Kings River Conservation District (District) has no objection to the approval of this application subject to the following conditions:

1. The Kings River Conservation District and the Kings River Water Association shall not be held liable for damages to the permitted encroachment resulting from releases of water, flood fight activities, operation, maintenance, inspection, or emergency repair.
2. The Permittee is responsible for all liability associated with construction, operation, and maintenance of the permitted facilities and shall defend and hold harmless the Kings River Conservation District and the Kings River Water Association from any liability or claims of liability associated therewith.
3. The Permittee shall be responsible for the repair of any damages to the Kings River Designated Floodway due to construction, operation, and/or maintenance of the herein permitted project.
4. The Permittee shall be responsible for the removal and clearance of all debris which lodges or collects against any portion of the bridge structure during periods of high water. Cleared trees and brush shall be properly disposed outside the limits of the designated floodway.
5. In the event erosion of the banks occurs at the project site, the Permittee shall repair the eroded areas with adequate protection to prevent future erosion.
6. The Permittee shall submit a water diversion plan to the Central Valley Flood Protection Board for any temporary staging and form work allowed to remain

in the floodway during the flood season (November 15th through July 20th). The plan shall contain all elements required by the Board including: (a) proposed methods to monitor current and predicted flood flow conditions; (b) proposed actions for all flow conditions up to 100-year conditions; and (c) analysis of impacts for failure to take planned action of for the occurrence of unanticipated conditions. The plan shall be stamped and signed by a Registered Civil Engineer. A copy of the plan shall be provided to the Kings River Conservation District at least sixty (60) days prior to the commencement of work.

7. The Permittee is solely responsible for monitoring existing and predicted flow conditions and taking appropriate actions throughout the construction period.
8. The Permittee shall contact the Kings River Conservation District by telephone, (559) 237-5567, at least thirty (30) days prior to the commencement of work.

By copy of this letter, the application has been directed to submit four (4) copies of the application with District endorsement and accompanying data to the Central Valley Flood Protection Board. During the processing of this application, the District requests that the Central Valley Flood Protection Board copy the District on all correspondence and Board action concerning this application.

If you have any questions, please contact me at (559) 237-5567 extension 115.

Sincerely,

Steven P. Stadler, P.E.
Deputy General Manager of Water Resources

SPS/sjs

Cc: Tom Fisher, Caltrans – via email

L14-0043
File: 800.05.273

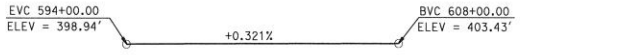
DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
06	Fre	180			

REGISTERED CIVIL ENGINEER — X — DATE

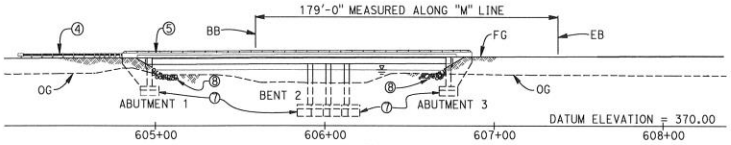
RODNEY SIMMONS No. 51174 Exp. 09-30-15 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

PLANS APPROVAL DATE

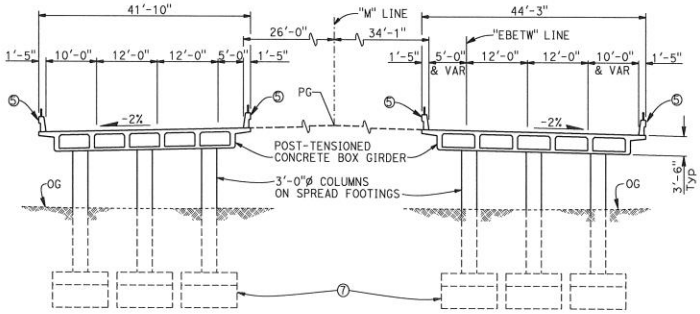
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.



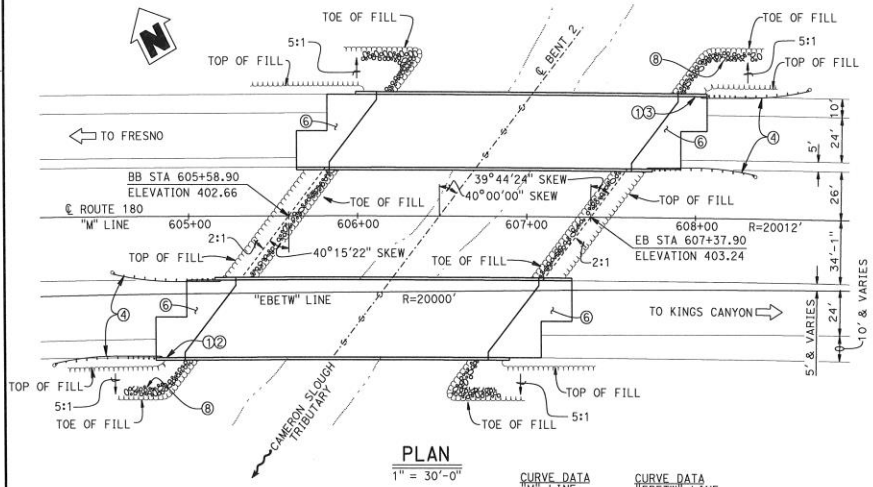
PROFILE GRADE "M" LINE
NO SCALE



ELEVATION
1" = 30'-0"



TYPICAL SECTION
1" = 10'-0"



PLAN
1" = 30'-0"

CURVE DATA "M" LINE
R=20012'
Δ=4°34'48.57"
T=800.28'
L=1599.71'

CURVE DATA "EBETW" LINE
R=20000'
Δ=3°28'56"
T=607.94'
L=1215.50'

NOTES:

① PAINT "CAMERON SLOUGH TRIBUTARY BRIDGE (LEFT)
② PAINT "CAMERON SLOUGH TRIBUTARY BRIDGE (RIGHT)
③ PAINT "BRIDGE NO. 42-0436 L/R"
④ MBGR, SEE "ROAD PLANS"
⑤ CONCRETE BARRIER TYPE 732 Mod WITH TUBULAR HAND RAILING
⑥ STRUCTURE APPROACH TYPE N(30S) Mod
⑦ SEAL COURSE
⑧ ROCK SLOPE PROTECTION

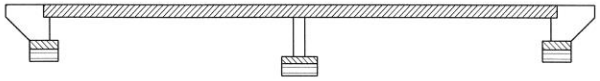
LEGEND:

℄ DESIGN FLOOD ELEV = 394.10' (LEFT BRIDGE), 393.90' (RIGHT BRIDGE) FOR HYDROLOGIC SUMMARY, SEE "FOUNDATION PLAN" SHEET

X DESIGN ENGINEER	DESIGN: BY R. Simmons; CHECKED I. Cherniaglo	LOAD & RESISTANCE FACTOR DESIGN — LIVE LOADING: HL93 W/"LOW-BOY" PERMIT DESIGN VEHICLE	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 17	BRIDGE NO. 42-0436L/R; POST MILE 76.99
	DETAILS: BY A. Onodera\G. Zweier; CHECKED R. Simmons	LAYOUT: BY E. Montevirgen; CHECKED R. Simmons			CAMERON SLOUGH TRIBUTARY BRIDGE
	QUANTITIES: BY D. Murray; CHECKED M. Pope	SPECIFICATIONS: BY X; PLANS AND SPECS COMPARED			GENERAL PLAN
		ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3	UNIT: 3586 PROJECT NUMBER & PHASE: 06000003821	CONTRACT NO.: 06-342531	DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES 8-6-14 12-31-13 12-30-14 2-26-14 — SHEET 1 OF 17

STRUCTURES DESIGN GENERAL PLAN SHEET (ENG 1501 (REV.09-01-10))

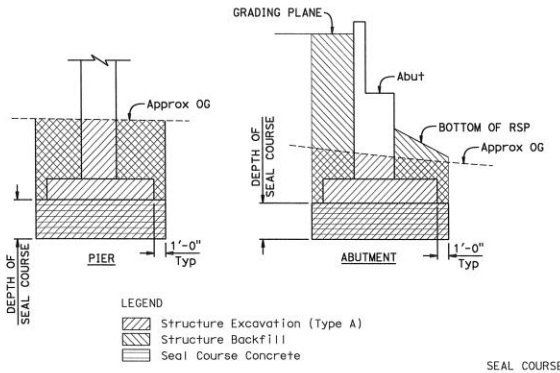
TFILE => 42-0436lr-a-gp.dgn



Structural Concrete, Bridge
Structural Concrete, Bridge Footing
Structural Concrete, Bridge (4,000 psi at 28 days)
Seal Course

LEFT AND RIGHT BRIDGES
CONCRETE STRENGTH AND TYPE LIMITS
NO SCALE

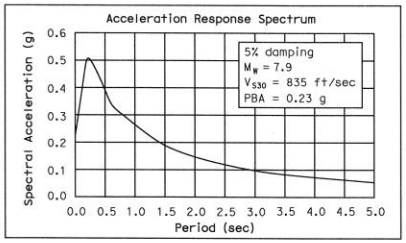
SPREAD FOOTING DATA					
SUPPORT LOCATION	(WORKING STRESS DESIGN)		LOAD AND RESISTANCE FACTOR DESIGN (LRFD)		
	PERMISSIBLE GROSS BEARING STRESS (SETTLEMENT) (ksf)	ALLOWABLE GROSS BEARING CAPACITY (ksf)	SERVICE PERMISSIBLE NET CONTACT STRESS (SETTLEMENT) (ksf)	STRENGTH FACTORED GROSS NOMINAL BEARING RESISTANCE Φ_b= X (ksf)	EXTREME EVENT FACTORED GROSS NOMINAL BEARING RESISTANCE Φ_b= 1.00 (ksf)
Abut 1	20	22	N/A	N/A	N/A
Bent 2	N/A	N/A	26	51	114
Abut 3	20	22	N/A	N/A	N/A



PAY LIMITS OF EXCAVATION AND BACKFILL
NO SCALE

SEAL COURSE NOTE:

SEAL COURSE TO BE PLACED ONLY WHEN ORDERED BY THE ENGINEER. ESTIMATED QUANTITIES INVOLVED ARE BASED ON THE SEAL THICKNESS SHOWN. THE THICKNESS TO BE USED WILL BE DETERMINED IN THE FIELD BY THE ENGINEER . WHEN SEAL IS NOT USED, THE BOTTOM OF THE REINFORCED FOOTING SHALL REMAIN AT THE ELEVATION SHOWN.



SITE SPECIFIC ARS

GENERAL NOTES
LOAD AND RESISTANCE FACTOR DESIGN

DESIGN:
AASHTO LRFD Bridge Design Specifications, 4th edition and the California Amendments, preface dated November 2011.

SEISMIC DESIGN:
Caltrans Seismic Design Criteria (SDC), Version 1.7 dated April 2013.

DEAD LOAD:
Includes 35 psf for future wearing surface.

LIVE LOADING:
HL93 and permit design load.

SEISMIC LOADING:
Site Specific ARS Curve.

CONCRETE:
fy = 60 ksi
f'c = 3.6 ksi
n = 8
See prestressing notes.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
06	Fre	180			

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — RODNEY SIMMONS — No. 51174 — Exp. 09-30-15 — CIVIL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

INDEX TO PLANS

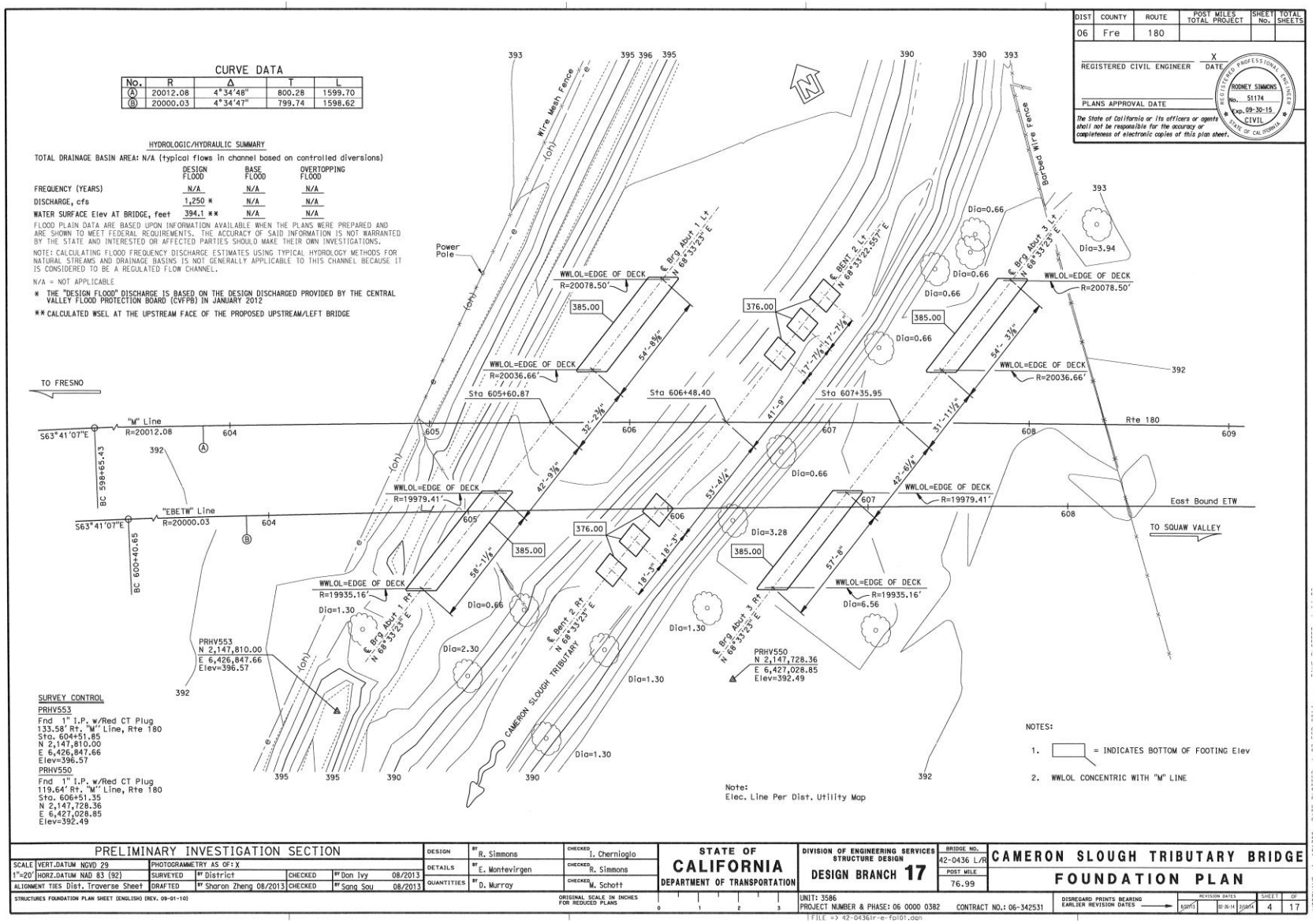
STANDARD PLANS DATED MAY 2010

A10A	ABBREBIEVIATIONS (SHEET 1 OF 2)
A10B	ABBREBIEVIATIONS (SHEET 2 OF 2)
A10C	LINES AND SYMBOLS (SHEET 1 OF 3)
A10D	LINES AND SYMBOLS (SHEET 2 OF 3)
A10E	LINES AND SYMBOLS (SHEET 3 OF 3)
A10F	LEGEND-SOIL (SHEET 1 OF 2)
A10G	LEGEND-SOIL (SHEET 2 OF 2)
A62C	LIMITS OF PAYMENT FOR EXCAVATION AND BACKFILL BRIDGE
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-5	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B6-21	JOINT SEALS (MAXIMUM MOVEMENT RATING=2")
B7-1	BOX GIRDER DETAILS
RSP B8-5	CAST-IN-PLACE PRESTRESSED GIRDER DETAILS
B11-51	TUBULAR HAND RAILING
RSP B11-55	CONCRETE BARRIER TYPE 732

STANDARD PLAN SHEET No.
DETAIL No.

DESIGN	BY R. Simmons	CHECKED I. Cherniglo	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 17	BRIDGE NO. 42-0436L/R; POST MILE 76.99
DETAILS	BY E. Montevirgen	CHECKED R. Simmons			CAMERON SLOUGH TRIBUTARY BRIDGE
QUANTITIES	BY D. Murray	CHECKED M. Pope			INDEX TO PLANS

STRUCTURES DESIGN DETAIL SHEET (ENGLISH) (REV. 09-01-10)
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3
UNIT: 3586
PROJECT NUMBER & PHASE: 06000003821
CONTRACT NO.: 06-342531
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES
SHEET 2 OF 17
FILE => 42-0436lr-o-itp.dgn


CURVE DATA
No. R Δ T L
Ⓐ 20012.08 4°34'48" 800.28 1599.70
Ⓑ 20000.03 4°34'47" 799.74 1598.62
HYDROLOGIC/HYDRAULIC SUMMARY
TOTAL DRAINAGE BASIN AREA: N/A (typical flows in channel based on controlled diversions)
DESIGN FLOOD BASE FLOOD OVERTOPPING FLOOD
FREQUENCY (YEARS) N/A N/A N/A
DISCHARGE, cfs 1,250 * N/A N/A
WATER SURFACE Elev AT BRIDGE, feet 394.1 ** N/A N/A
FLOOD PLAIN DATA ARE BASED UPON INFORMATION AVAILABLE WHEN THE PLANS WERE PREPARED AND ARE SHOWN TO MEET FEDERAL REQUIREMENTS. THE ACCURACY OF SAID INFORMATION IS NOT WARRANTED BY THE STATE AND INTERESTED OR AFFECTED PARTIES SHOULD MAKE THEIR OWN INVESTIGATIONS.
NOTE: CALCULATING FLOOD FREQUENCY DISCHARGE ESTIMATES USING TYPICAL HYDROLOGY METHODS FOR NATURAL STREAMS AND DRAINAGE BASINS IS NOT GENERALLY APPLICABLE TO THIS CHANNEL BECAUSE IT IS CONSIDERED TO BE A REGULATED FLOW CHANNEL.
N/A = NOT APPLICABLE
* THE "DESIGN FLOOD" DISCHARGE IS BASED ON THE DESIGN DISCHARGED PROVIDED BY THE CENTRAL VALLEY FLOOD PROTECTION BOARD (CVFPB) IN JANUARY 2012
** CALCULATED WSEL AT THE UPSTREAM FACE OF THE PROPOSED UPSTREAM/LEFT BRIDGE
DIST COUNTY ROUTE POST MILES TOTAL PROJECT SHEET No. TOTAL SHEETS
06 Fre 180
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.
RODNEY SIMMONS No. 51174 Exp. 09-30-15 CIVIL STATE OF CALIFORNIA
TO FRESNO
"M" Line R=20012.08
S63°41'07"E
BC 598+65.43
"EBETW" Line R=20000.03
S63°41'07"E
BC 600+40.65
Sta 605+60.87
Sta 606+48.40
Sta 607+35.95
Rte 180
East Bound ETW
TO SQUAW VALLEY
WWLOL=EDGE OF DECK R=20078.50'
WWLOL=EDGE OF DECK R=20036.66'
WWLOL=EDGE OF DECK R=19979.41'
WWLOL=EDGE OF DECK R=19935.16'
℄ Brg Abut 1 Lt N 68°33'23" E
℄ Bent 2 Lt N 68°33'23" E
℄ Brg Abut 3 Lt N 68°33'23" E
℄ Brg Abut 1 Rt N 68°33'23" E
℄ Bent 2 Rt N 68°33'23" E
℄ Brg Abut 3 Rt N 68°33'23" E
385.00
376.00
54'-8⅝"
32'-2⅜"
41'-3"
54'- 3⅞"
31'-11½"
42'-9¾"
53'-4¼"
42'-6⅛"
58'-1⅛"
18'-3"
57'-8"
Dia=0.66
Dia=1.30
Dia=2.30
Dia=3.28
Dia=3.94
Dia=6.56
Barbed wire fence
Wire Mesh Fence
Power Pole
(OH)
CAMERON SLOUGH TRIBUTARY
PRHV553
N 2,147,810.00
E 6,426,847.66
Elev=396.57
PRHV550
N 2,147,728.36
E 6,427,028.85
Elev=392.49
SURVEY CONTROL
PRHV553
Fnd 1" I.P. w/Red CT Plug
133.58' Rt. "M" Line, Rte 180
Sta. 604+51.85
N 2,147,810.00
E 6,426,847.66
Elev=396.57
PRHV550
Fnd 1" I.P. w/Red CT Plug
119.64' Rt. "M" Line, Rte 180
Sta. 606+51.35
N 2,147,728.36
E 6,427,028.85
Elev=392.49
Note:
Elec. Line Per Dist. Utility Map
NOTES:
1. = INDICATES BOTTOM OF FOOTING Elev
2. WWLOL CONCENTRIC WITH "M" LINE
PRELIMINARY INVESTIGATION SECTION
SCALE VERT.DATUM NGVD 29
1"=20' HORZ.DATUM NAD 83 (92)
ALIGNMENT TIES Dist. Traverse Sheet
PHOTOGRAMMETRY AS OF: X
SURVEYED BY District CHECKED BY Don Ivy 08/2013
DRAFTED BY Sharon Zheng 08/2013 CHECKED BY Sang Sou 08/2013
DESIGN BY R. Simmons CHECKED I. Cherniaglo
DETAILS BY E. Montevirgen CHECKED R. Simmons
QUANTITIES BY D. Murray CHECKED M. Schott
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN
DESIGN BRANCH 17
BRIDGE NO. 42-0436 L/R
POST MILE 76.99
CAMERON SLOUGH TRIBUTARY BRIDGE
FOUNDATION PLAN
STRUCTURES FOUNDATION PLAN SHEET (ENGLISH) (REV. 09-01-10)
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3
UNIT: 3586
PROJECT NUMBER & PHASE: 06 0000 0382
CONTRACT NO.: 06-342531
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES
SHEET 4 OF 17
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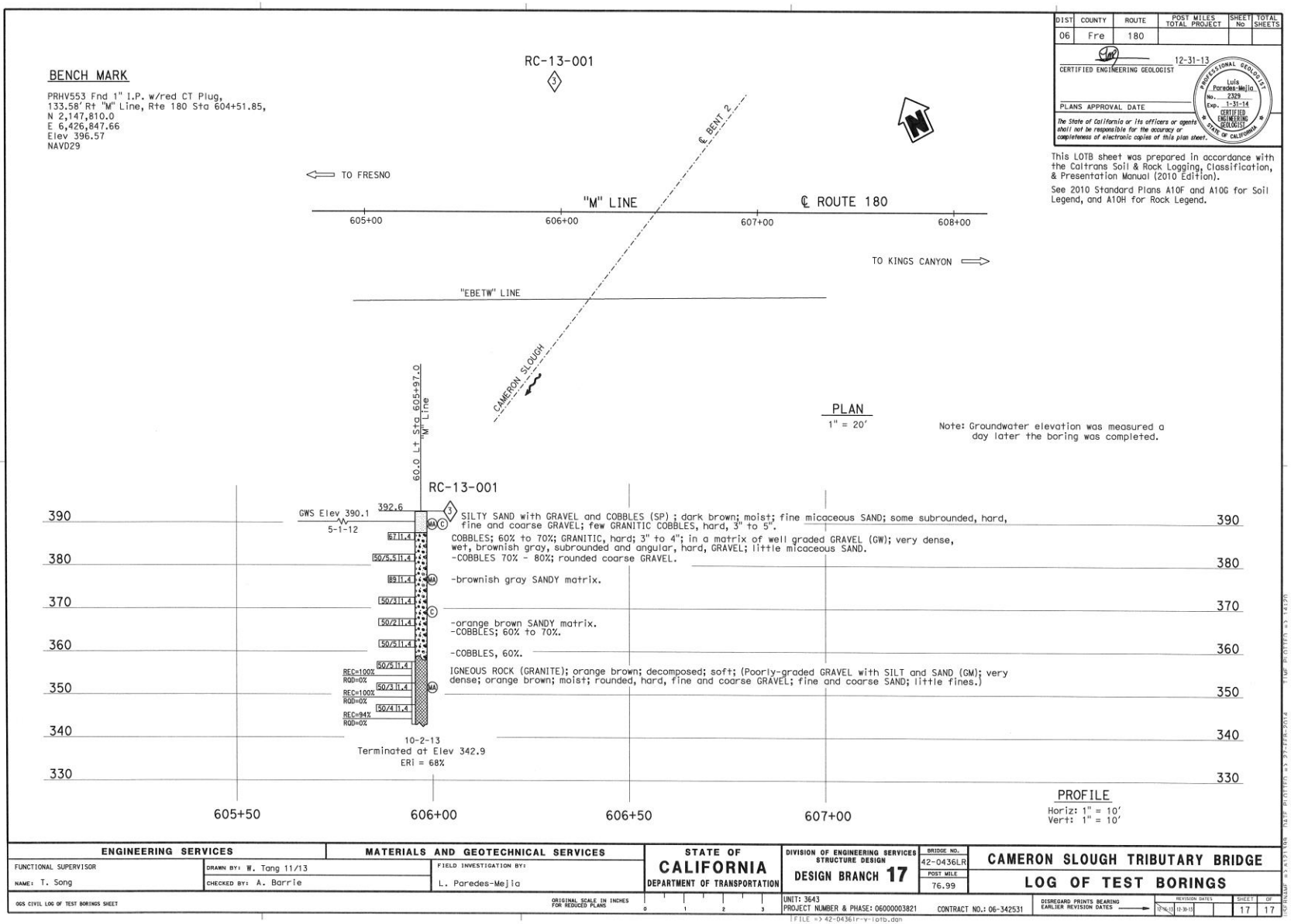
BENCH MARK
PRHV553 Fnd 1" I.P. w/red CT Plug,
133.58' Rt "M" Line, Rte 180 Sta 604+51.85,
N 2,147,810.0
E 6,426,847.66
Elev 396.57
NAVD29
RC-13-001
℄ BENT 2
TO FRESNO
"M" LINE
℄ ROUTE 180
605+00
606+00
607+00
608+00
TO KINGS CANYON
"EBETW" LINE
CAMERON SLOUGH
60.0 Lt Sta 605+97.0 "M" Line
PLAN
1" = 20'
Note: Groundwater elevation was measured a day later the boring was completed.
RC-13-001
GWS Elev 390.1
5-1-12
392.6
SILTY SAND with GRAVEL and COBBLES (SP) ; dark brown; moist; fine micaceous SAND; some subrounded, hard, fine and coarse GRAVEL; few GRANITIC COBBLES, hard, 3" to 5".
COBBLES; 60% to 70%; GRANITIC, hard; 3" to 4"; in a matrix of well graded GRAVEL (GW); very dense, wet, brownish gray, subrounded and angular, hard, GRAVEL; little micaceous SAND.
-COBBLES 70% - 80%; rounded coarse GRAVEL.
-brownish gray SANDY matrix.
-orange brown SANDY matrix.
-COBBLES; 60% to 70%.
-COBBLES, 60%.
IGNEOUS ROCK (GRANITE); orange brown; decomposed; soft; (Poorly-graded GRAVEL with SILT and SAND (GM); very dense; orange brown; moist; rounded, hard, fine and coarse GRAVEL; fine and coarse SAND; little fines.)
67 11.4
50/5.5 11.4
89 11.4
50/3 11.4
50/2 11.4
50/5 11.4
50/5 11.4
REC=100% RQD=0%
50/3 11.4
REC=100% RQD=0%
50/4 11.4
REC=94% RQD=0%
10-2-13
Terminated at Elev 342.9
ERi = 68%
390
380
370
360
350
340
330
605+50
606+00
606+50
607+00
PROFILE
Horiz: 1" = 10'
Vert: 1" = 10'
DIST 06
COUNTY Fre
ROUTE 180
POST MILES TOTAL PROJECT
SHEET No
TOTAL SHEETS
12-31-13
CERTIFIED ENGINEERING GEOLOGIST
Luis Paredes-Mejia No. 2329 Exp. 1-31-14 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA
PLANS APPROVAL DATE
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.
This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, & Presentation Manual (2010 Edition).
See 2010 Standard Plans A10F and A10G for Soil Legend, and A10H for Rock Legend.
ENGINEERING SERVICES
MATERIALS AND GEOTECHNICAL SERVICES
FUNCTIONAL SUPERVISOR
NAME: T. Song
DRAWN BY: W. Tang 11/13
CHECKED BY: A. Barrie
FIELD INVESTIGATION BY:
L. Paredes-Mejia
OGS CIVIL LOG OF TEST BORINGS SHEET
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS
0 1 2 3
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN
DESIGN BRANCH 17
BRIDGE NO. 42-0436LR
POST MILE 76.99
CAMERON SLOUGH TRIBUTARY BRIDGE
LOG OF TEST BORINGS
UNIT: 3643
PROJECT NUMBER & PHASE: 06000003821
CONTRACT NO.: 06-342531
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES
SHEET 17 OF 17
IFILE => 42-0436lr-v-lotb.dgn

State of California
DEPARTMENT OF TRANSPORTATION

California State Transportation Agency

Memorandum

Serious drought.
Help save water!

To: **SUNGHO LEE**
Department of Water Resources
Central Valley Flood Protection Board
3310 El Camino Avenue, Room 151
Sacramento, CA 95821

Date: May 4, 2015

File: Cameron Slough Trib.
Br. No. 42-0436 L/R
06-Fre-180-PM 76.99
EA: 06-342531
(EFIS: 06 0000 0382)

From: **JOSE VARGAS**
Department of Transportation (Caltrans)
Division of Engineering Services
Structure Hydraulics & Hydrology Branch
1801 30th Street, Sacramento, CA 95816

Subject: **Technical Hydraulic Memorandum for Cameron Slough Tributary (Br. No. 42-0437 L/R), Permit # 18982**

A Final Hydraulic Report (FHR) dated 2/3/14 and HEC-RAS hydraulic model files for the above-mentioned bridge project were electronically submitted to Central Valley Flood Protection Board (CVFPB) and U.S. Army Corps of Engineers (USACE) (via CVFPB) in February 2014 for permit review purposes. The 2014 FHR and hydraulic model provided a hydraulic/scour analysis based on CVFPB's official design flow of 2,500 cfs for Byrd Slough (main channel) and included cases for both existing (pre-project) and proposed (post-project) conditions.

For each individual low-flow channel downstream of the flow split location (which occurs just north of State Route 180 ("*East Kings Canyon Road*"), CVFPB had provided assumed discharges of 1,250 cfs for Byrd Slough and 1,250 cfs for Cameron Slough Tributary based on a document dated 1/27/12. The discharges provided by CVFPB for the low-flow channels were based on an assumed flow distribution of 50/50 (50% in each low-flow channel) of Byrd Slough (main channel).

This Technical Hydraulic Memorandum ("May 2015 Memo") is considered supplementary to the 2014 FHR and is intended to provide additional hydraulic information as requested by CVFPB. This study provides additional hydraulic analysis results for Cameron Slough Tributary based on an updated assumed discharge that was estimated from a revised flow distribution of Byrd Slough (main channel). The updated hydraulic model is a copy of the 2014 FHR hydraulic model that has been modified to include the additional analysis and assumptions.

Although some selected information from the 2014 FHR study have been included below, this study is intended to provide supplementary hydraulic analysis results for permit review purposes. Considering the supplementary nature of this May 2015 Memo, the 2014 FHR study should be reviewed prior to reviewing the following information. In general, please refer to the 2014 FHR for more complete and detailed information (as applicable). As discussed in the Caltrans/CVFPB meeting held on 4/16/15, some additional information is included in this memo to facilitate the permit review.

General Notes:

1) *For general comparison and evaluation purposes only, calculated water surface elevation (WSEL) and velocity values as obtained directly from HEC-RAS output to two decimal places (0.01) may have been included for this study; however, due to many factors affecting calculated values, reported WSEL's and velocities are typically rounded off to 0.1 feet and 0.1 ft/s, respectively.*

2) *Unless otherwise indicated, elevations shown in this report are based on the National Geodetic Vertical Datum of 1929 (NGVD29). Reported elevations are rounded off to 0.1 feet.*

3) *Unless otherwise indicated, the following channel names are used for this study:*
   - ***Byrd Slough (main channel)** - the main channel upstream (U/S) of the flow division location*
   - ***Cameron Slough Tributary** - the western low-flow channel downstream (D/S) of the flow division location*
   - ***Byrd Slough** - the eastern low-flow channel downstream of the flow division location*

SUPPLEMENTARY STUDY

This May 2015 Memo is considered a supplementary study. Please review the 2014 FHR dated 2/3/14 prior to reviewing the following information.

PROJECT DESCRIPTION

The Kings Canyon Expressway (Segment 3) project proposes a route re-alignment for a section of State Highway/Route 180 (also known as the "*East Kings Canyon Road*" - Source: Google Maps) in Fresno County. The new route would be located along a new northern alignment located upstream of the existing highway. The project would include the construction of several bridge structures and culverts along the revised route, including parallel Cameron Slough Tributary Bridges (Br. No. 42-0436 Left & Right).

As discussed in the 2014 FHR, Rock Slope Protection (RSP) is proposed for both new bridge abutment locations as shown on the Bridge Plans. The proposed RSP areas extend from upstream to downstream along each bridge abutment (embankment), providing a continuous RSP coverage area across both parallel bridges. The proposed RSP at both abutments is intended to only provide local "surface armoring" and to help reduce the local water velocities near the abutments (due to a slightly higher roughness coefficient).

DISCHARGE

The 2014 FHR includes a complete hydraulic/scour analysis based on CVFPB's assumed design flow of 1,250 cfs. As mentioned previously, this study provides updated hydraulic results based on a revised flow distribution for Byrd Slough (main channel). Although the updated discharge (1,800 cfs) for Cameron Slough Tributary is significantly higher than the discharge assumed for the 2014 FHR study (1,250 cfs), culverts have been added to the updated hydraulic model (May 2015 Model) in the floodplain area which reduces the overall discharge conveyed through the proposed bridge opening and helps reduce local calculated velocities at the bridge site. Although the calculated WSEL's for this study are slightly more conservative (higher) than WSEL's in the 2014 FHR due to the higher assumed discharge, the 2014 FHR is considered more conservative for bridge design purposes for scour due to slightly higher local water velocities as compared to this study.

The 2014 FHR study considered an assumed discharge of 1,250 cfs for Cameron Slough Tributary which was provided by CVFPB and based on CVFPB's assumed flow distribution of Byrd Slough (main channel) into Byrd Slough and Cameron Slough Tributary. The CVFPB assumption was that half (50%) of the total 2,500 cfs entered each low-flow channel at the flow division location. However, the CVFPB-assumed discharge for Cameron Slough Tributary is significantly low as compared to the local channel conveyance capacity upstream of the proposed bridge site.

Reviewing the WSEL results in the 2014 FHR Model using direct side-by-side comparisons of directly-adjacent channel cross-sections for Byrd Slough and Cameron Slough Tributary indicated local WSEL's significantly lower in Cameron Slough Tributary between the flow division (split) location and the proposed bridge site. The WSEL's and local channel/ground/floodplain elevations suggested a significant imbalance of discharge assumed for each low-flow channel within this section of Cameron Slough Tributary. It may be noted that some distance downstream of the proposed bridge site, the discharges appeared more balanced based on local channel conveyance capacity of each low-flow channel.

In the area between the flow split location and the proposed bridge site, the discharge imbalance caused severe overbanking of the main channel in Byrd Slough due to exceeding the local channel conveyance capacity. To provide a more balanced and reasonable flow distribution for Byrd Slough and Cameron Slough Tributary, an updated flow distribution for Cameron Slough Tributary was estimated based on a simplified "matching WSEL" balance assumption (i.e. local flow conveyance capacity) for the Existing (pre-project) Condition at a reference location just upstream of the proposed bridge. Using trial and error, discharges for Byrd Slough and Cameron Slough Tributary were determined which resulted in a "matching WSEL" between the two adjacent reference cross-section locations just upstream of the proposed bridges. Based on the simplified analysis, the calculated flow distribution for "matching WSEL" at the reference location were roughly 25.2% for Byrd Slough and 74.8% for Cameron Slough Tributary, which result in calculated discharges of 630 cfs and 1,870 cfs, respectively.

The significant reduction of discharge in Byrd Slough based on the revised flow distribution resulted in a higher discharge for Cameron Slough Tributary to compensate for the reduction in Byrd Slough. Considering the already-relatively conservative CVFPB discharge of 2,500 cfs for Byrd Slough (main channel) and then adding the significant increase in discharge to Cameron Slough Tributary from Byrd Slough, the final flow distribution percentages used for the study were slightly adjusted and balanced to mitigate for some of the potential effects of using the much more conservative discharge assumption at Cameron Slough Tributary.

The official CVFPB Design Flow for "Byrd Slough" (main channel) is 2,500 cfs; the flow distribution of the total flow of Byrd Slough (main channel) entering Byrd Slough and Cameron Slough Tributary is assumed. For the purpose of this study only, the updated assumed discharge based on the revised flow distribution for Cameron Slough Tributary is referred to as the "Assumed CVFPB Design Flow (or Discharge)". The assumed flow distribution and discharges considered for this study are shown in **Table 1**.

Table 1 - Updated Discharges Based on Revised Flow Distribution

	2014 FHR Study		May 2015 Memo Study	
Byrd Slough (main channel)	2,500 cfs	*(100%)*	**2,500 cfs**	*(100%)*
Byrd Slough	1,250 cfs	*(50%)*	**700 cfs**	*(28%)*
Cameron Slough Tributary	1,250 cfs	*(50%)*	**1,800 cfs**	*(72%)*

NOTE: The official CVFPB Design Flow for (main) "Byrd Slough" is 2,500 cfs; the flow distribution is assumed

Flow Distribution Along the Study Reach

Overall, the HEC-RAS results and a general comparison of local ground/channel/floodplain elevations suggest that between the flow split location and the proposed bridge site (and some distance downstream), most of the Byrd Slough (main channel) discharge may be conveyed downstream in Cameron Slough Tributary. Just upstream of the existing State Route 180 bridges, it is possible that some flow (assuming lateral conveyance is possible via local low-spots and other connections) may potentially exit Cameron Slough Tributary and re-enter Byrd Slough just before crossing through the existing bridge waterway (Kings River Overflow, Br. No. 42-0074).

Although some potential flow re-distribution may occur just upstream of the existing State Route 180, the updated discharge based on the revised flow distribution considers a more realistic flow distribution upstream of the proposed bridge which is based on local channel conveyance capacity and local ground/channel/floodplain elevations as compared to the CVFPB-assumed flow distribution considered for the 2014 FHR study. In addition, assuming that some flow re-distribution does occur just upstream of the existing State Route 180, the flow re-distribution would be expected to similarly occur under both existing (pre-project) and proposed (post-project) conditions and therefore is assumed to occur independently of the proposed project.

Conservative CVFPB Design Flow

Based on available information, the official CVFPB Design Flow of 2,500 cfs for Byrd Slough (main channel) appears to be a significantly conservative design flow. As discussed in the 2014 FHR, the two principal sources of flow entering Byrd Slough (main channel) are the Alta Wastegate Weir (or "Alta Wasteway") and the "old" Byrd Slough channel, both of which divert water from the Alta Canal. The Alta Canal Headgate (located on Alta Canal at North Frankwood Avenue and just south of the Alta Wastegate) controls discharges entering Alta Main Canal to the south.

Considering the two main sources of flow entering Byrd Slough (main channel), the CVFPB design flow appears to be based on the very conservative assumption that the Alta Main Canal Headgate is completely closed off and all upstream flows would enter Byrd Slough (main channel). Considering the significant size of Alta Canal and its potential conveyance capacity, it would not be reasonably-

expected that all the flow (2,500 cfs) would be forced entirely into Byrd Slough (main channel) while having the Alta Canal convey no flow at all. In a rare extreme flood event, it would be expected that a more reasonable flow distribution between Byrd Slough (main channel) and Alta Canal would be implemented, such as based on conveyance capacity, in order to mitigate flows in both channels.

Considering a significantly conservative design flow for hydraulic/scour purposes will accordingly provide conservative results. Considering assumed discharges that are higher than the actual design capacity and flow conveyance capacity of Byrd Slough and Cameron Slough Tributary may potentially result in some unusual or unexpected hydraulic results.

HYDRAULIC MODEL

As mentioned previously, the 2014 FHR hydraulic model was copied and modified based on the revised flow distribution. The updated model for this study is referred to as the "May 2015 Model". As noted in the 2014 FHR, the 2014 FHR Model includes all three study reaches in a single hydraulic model: Byrd Slough (main channel), Cameron Slough Tributary, and Byrd Slough. The modifications to the originally-submitted model includes the following changes:

1) the assumed flow distribution (discharges) for Byrd Slough and Cameron Slough Tributary have been updated to better reflect local channel conveyance capacities
2) ineffective flow areas for existing and proposed conditions have been revised for the updated flow distribution
3) due to the updated flow distribution and reduced discharge for Byrd Slough, assumed floating drift for the Proposed Byrd Slough Bridges was not considered applicable for this study; floating drift at the piers is not included for the Proposed Byrd Slough Bridges
4) for hydraulic evaluation purposes, culverts have been included in the Cameron Slough Tributary study reach for additional flow conveyance purposes in the floodplain area

In addition to the changes to the model itself, some of the names used for the Plans, Flow Data, and other descriptions within the updated HEC-RAS model may have been modified for clarification purposes.

WSEL AND VELOCITY CHANGES

Although the May 2015 Model includes all three study reaches in a single hydraulic model: Byrd Slough (main channel), Cameron Slough Tributary, and Byrd Slough, only the hydraulic results for Cameron Slough Tributary are included in this study. The results for Byrd Slough are available in a separate May 2015 Memo for Byrd Slough. The results for Byrd Slough (main channel) were not included since there were no calculated changes to WSEL or velocity observed from the existing to proposed conditions.

HEC-RAS Output Table Results

Based on calculated WSEL and velocity results from HEC-RAS output tables for the Cameron Slough Tributary study reach, the maximum and minimum calculated increases and decreases between existing and proposed conditions based on the Assumed CVFPB Design Flow of 1,800 cfs for Cameron Slough Tributary are provided in **Table 2**. The WSEL and velocity results from the "*Standard Table 1*" and "*Six XS Bridge*" tables were reviewed and the larger (magnitude) calculated value of both tables is shown in **Table 2**. For reference purposes, calculated hydraulic results (*Standard Table 1* and *Six XS Bridge* tables) for Cameron Slough Tributary and channel cross-sections are included in the Attachments.

Table 2 - HEC-RAS Output Table Results

	Calculated Difference Between Existing Conditions and Proposed Conditions	
	Assumed CVFPB Design Flow (1,800 cfs)	
	Δ WSEL (feet)	**Δ Velocity (ft/s)**
Maximum Decrease	0.02	0.78
Maximum Increase	0.12	0.45

NOTES:
Δ denotes "change in"
WSEL = "W.S. Elev" variable in the HEC-RAS table = calculated water surface from energy equation
Velocity = "Vel Chnl" variable in the HEC-RAS table = average velocity of flow in main channel

Calculated WSEL/velocity values shown to 0.01 are intended for discussion and evaluation purposes only. Reported WSEL/velocity values are typically rounded off to the nearest 0.1.

River Station Locations of Maximum WSEL/Velocity from Table 2

Assumed CVFPB Design Flow (1,800 cfs)

- Maximum increase in WSEL of 0.12 feet occurs at River Stations 1,616.1 and 1,649.7 feet.
- Maximum decrease in WSEL of 0.02 feet occurs at River Station 1,352.7 feet
- Maximum increase in velocity of 0.45 ft/s occurs at River Station 1,316.1 feet.
- Maximum decrease in velocity of 0.78 ft/s occurs at River Station 1,278.1 feet.

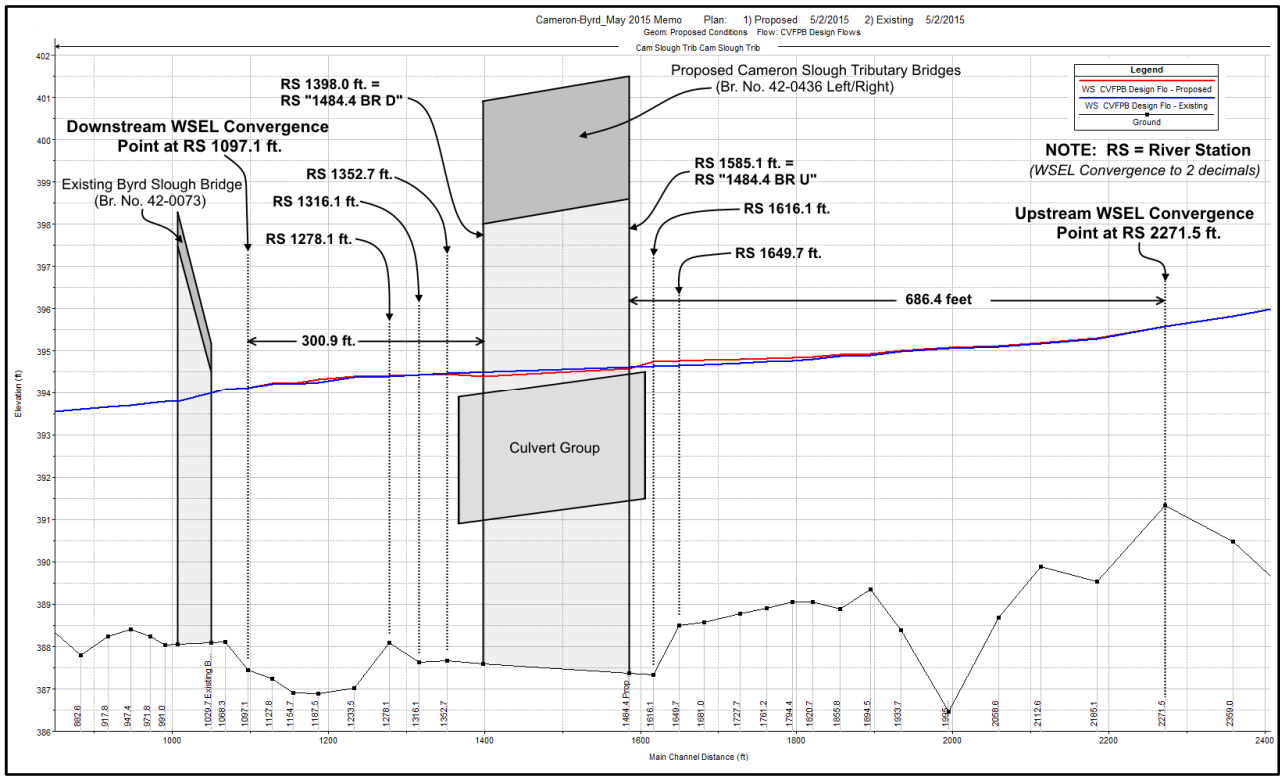

Figure 1 - HEC-RAS Model WSEL Profiles Near the Bridges

HEC-RAS Output Table - Multiple Opening (Analysis)

Due to including culverts for the Cameron Slough Tributary study reach to facilitate floodplain flow across the proposed State Route 180 roadway embankment, the HEC-RAS Multiple Opening analysis method was used to model the culverts in conjunction with the proposed bridge waterway opening. The HEC-RAS output table provides basic results of the combined bridge/culvert analysis in the "Multiple Opening" output table. For reference purposes, the Multiple Opening output table is included as **Attachment 6**. The basic results of the Multiple Opening analysis provided estimated discharges for the bridge waterway opening and culvert group as shown in **Table 3**.

Table 3 - CVFPB Existing and Proposed Hydraulic Results Comparison

	Assumed CVFPB Design Flow = 1,800 cfs	
	Discharge	**Percentage of Total**
Bridge Opening Conveyance	1,416 cfs	78.7 %
Culvert Group (Total) Conveyance	384 cfs	21.3 %

WSEL Comparison at Proposed Bridge Site

As mentioned previously, the results in **Table 2** provide the minimum and maximum (magnitude) changes in WSEL and velocity based on the HEC-RAS output results from the *Standard Table 1* and *Six XS Bridge* tables, which generally provide global model results for the entire study reach. However, as discussed in the 2014 FHR, the WSEL values provided in these two output tables do not directly provide the calculated WSEL difference/change between existing and proposed conditions at the proposed upstream and downstream bridge face locations. The interpolated results of the WSEL profile for existing conditions at the proposed upstream/downstream bridge face locations may be obtained in the WSEL Profile Plot to manually calculate WSEL differences at these two reference locations.

Hydraulic result output tables generated by the HEC-RAS program provide hydraulics results (as applicable) at each channel cross-section location. The proposed condition includes channel cross-sections at the upstream and downstream faces of proposed roadway/bridge. However, the upstream and downstream bridge face cross-sections in the proposed conditions do not exist in the existing ("no bridge") condition model. Therefore, no direct hydraulic results are available at the upstream/downstream bridge face cross-sections at the proposed bridge for the existing condition model. For example, the upstream face of proposed (upstream/Left) bridge is located at River Station 1,585.1 feet (*River Station "1484.4 BR U"*) in the proposed condition model. River Station 1,585.1 feet (channel cross-section) does not exist in the existing condition model in order to have hydraulic results computed at that location.

The calculated differences in WSEL between existing and proposed conditions at the upstream and downstream faces of proposed bridges are shown in **Table 4**.

Table 4 - WSEL Comparison at Proposed Bridge Site
(Assumed CVFPB Design Flow = 1,800 cfs)

HEC-RAS River Station	River Station Reference Location	Condition	WSEL *(feet, NGVD29)*	WSEL Difference *(feet)*
1,585.1 (feet)	Upstream Face of Upstream/Left Bridge	Proposed	394.59	0.02
		Existing	394.61	
1,398.0 (feet)	Downstream Face of Downstream/Right Bridge	Proposed	394.40	0.10
		Existing	394.50	

NOTES:

(1) For general comparison and evaluation purposes only, calculated WSEL values to 0.01 feet from HEC-RAS output are included in the table. Reported WSEL's are typically rounded off to 0.1 feet.

(2) River Station 1,585.1 feet = River Station "1484.4 BR U" (BR U = upstream bridge face)
River Station 1,398.0 feet = River Station "1484.4 BR D" (BR D = downstream bridge face)

Upstream and Downstream WSEL Change Limits

In order to estimate the overall limits of WSEL changes both upstream and downstream of the proposed bridge site, the location of the upstream and downstream WSEL convergence points (i.e. the location of no observed change between existing and proposed WSEL's) was determined. Based on HEC-RAS results to 2 decimals, the upstream and downstream WSEL convergence points occur at River Station 2,271.5 feet and River Station 1,097.1 feet, respectively. Based on the difference in River Station values (representing the distance measured along the main channel centerline), the upstream limit is roughly 686.4 feet upstream of River Station 1,585.1 feet and the downstream limit is roughly 300.9 feet downstream of River Station 1,398.0 feet.

Overall, based on the calculated changes in WSEL's from existing to proposed conditions, the proposed WSEL varied from "- 0.02 feet" (lower than existing) to a maximum of 0.12 feet (higher than existing). For calculated changes to velocity, the proposed velocity varied from " - 0.78 ft/s" (lower than existing) to a maximum of 0.45 ft/s (higher than existing).

It should be noted that the assumed upstream and downstream WSEL convergence points are relative and will vary depending on how many decimal places are required to be considered "no change". Considering too few or too many decimals for convergence purposes may result in either reducing or extending the WSEL convergence limits. Due to considering 2 decimal places for this study, the estimated WSEL convergence limits noted above are considered conservative.

Minimum Bridge Soffit Elevation / Freeboard

Calculated minimum bridge soffit elevations and available freeboard at the Proposed Cameron Slough Tributary Bridges based on the new flow distribution discharge have been updated. As discussed in the 2014 FHR, the controlling location with the least amount of local (available) freeboard for the entire bridge site occurs at the downstream face of the downstream/Right bridge at Abutment 1 (west side). The calculated local minimum bridge soffit elevation at this location is roughly 397.4 feet.

Based on an estimated maximum local WSEL of 394.4 feet at the same reference location, the proposed minimum bridge soffit elevation provides roughly 3.0 feet of available local freeboard (clearance) above the calculated WSEL. For information purposes, the estimated local freeboard available at the other 3 similar reference locations (at the extreme "corners" of the two bridges - i.e. at the upstream/downstream faces at each abutment) are roughly 3.4 feet, 3.6 feet, and 4.0 feet.

Peak Velocity at Bridge Site

The 2014 FHR study indicated a local peak (water) velocity in the main channel of 5.4 feet per second (ft/s) at the proposed bridge site. Based on the updated flow distribution discharge of 1,800 cfs, the local peak (water) velocity in the main channel is roughly 3.4 ft/s at the bridge site. Comparing local peak (water) velocity at the first cross-section upstream of the proposed bridge (River Station 1,616.1 feet) was roughly 3.8 ft/s for the 2014 FHR study and 2.9 ft/s for this study.

Culverts Added for Floodplain Flow Conveyance

As mentioned previously, changes made to the 2014 FHR hydraulic model for the updated May 2015 Model included adding culverts in the Cameron Slough Tributary study reach for additional flow conveyance purposes in the floodplain area.

For hydraulic evaluation and analysis purposes, twenty (20) 36-inch diameter concrete pipe culverts were added in the floodplain area to facilitate floodplain flow conveyance across the proposed State Route 180 roadway embankment and reduce the overall discharge conveyed through the Proposed Cameron Slough Tributary Bridge waterway opening. It should be emphasized that the culverts included in the model are only representative and are not intended to provide final culvert configurations and/or design details.

The "representative" culverts assumed for modeling purposes were only used to determine a total discharge when used in conjunction with the Proposed Cameron Slough Tributary Bridge waterway opening. Assuming the final culvert design is able to convey the same (or higher) discharge as determined in this study for the modeled culverts (384 cfs), the final culvert configuration and design details should be determined based on cost, availability, efficiency, and other significant factors. The final culvert configuration and design details will be determined by Caltrans District 6.

CVFPB Summary Table

Below is an updated version of the CVFPB Summary Table included in the 2014 FHR which summarizes expected changes at the proposed bridge site between the existing and proposed conditions with respect to the proposed project. (Refer to 2014 FHR for further discussion)

Table 5 - CVFPB Existing and Proposed Hydraulic Results Comparison

Design Discharge	Existing (Pre-Construction)				Proposed (Post-Construction)				Change, Δ *(Existing to Future)*	
	Soffit Elevation	WSEL	Velocity	Freeboard	Soffit Elevation	WSEL	Velocity	Freeboard	Δ WSEL	Δ Velocity
(cfs)	*(feet)*	*(feet)*	*(ft/s)*	*(feet)*	*(feet)*	*(feet)*	*(ft/s)*	*(feet)*	*(feet)*	*(ft/s)*
1,800	N/A	394.6	2.4	N/A	398.0	394.6	2.0	3.4	0	- 0.4

NOTES:

(1) The WSEL comparison location is the upstream face of the upstream/Left bridge at River Station 1,585.1 feet. The velocity comparison location is the first cross-section upstream from the bridge site at River Station 1,616.1 feet. The "Soffit Elevation" and "Freeboard" values reported in Table 5 are based on the local soffit and local freeboard at the upstream face of the upstream/Left bridge at River Station 1,585.1feet.

(2) The "Velocity" shown in the table represents the "average velocity of flow in main channel".

(3) Elevations are rounded off to 0.1 feet and are referenced to the NGVD29 vertical datum.

OTHER CONSIDERATIONS

Additional information has been included below in this document based on discussions at the Caltrans/CVFPB Meeting held on April 16, 2015. The information below is intended to provide additional details and further clarification. Some of the information presented below is discussed in more detail in the 2014 FHR.

Calculated WSEL & Velocity Increase Factors

Calculated differences in WSEL and velocity values between existing (pre-project) and proposed (post-project) conditions may be affected by many factors. Some factors for Cameron Slough Tributary and in general are briefly discussed below and include: (1) general limitations of one-dimensional hydraulic modeling, (2) flow conveyance differences between the existing and proposed conditions near the proposed roadway/bridge location, (3) differences in ineffective flow areas (ineffective flow area boundaries) between the existing and proposed conditions, and (4) assumed drift conditions in the model.

General Limitations of One-Dimensional Hydraulic Modeling

It is important to note that one-dimensional hydraulic modeling attempts to simulate often-complex, three-dimensional (real-world) hydraulic environments within a simplified one-dimensional hydraulic modeling environment. General limitations of one-dimensional hydraulic modeling and analysis generally require some simplified assumptions and calculation routines by the software to provide hydraulic results. At some bridge structures and floodplain areas where more complex flow conditions may exist, WSEL/velocity (and other hydraulic) results provided by the HEC-RAS program at bridge structures may potentially include some unusual or unexpected results due to limitations of the program.

Differences in Ineffective Flow Areas (Ineffective Flow Area Boundaries)

Ineffective flow areas (ineffective flow area boundaries) in one-dimensional hydraulic modeling are generally used to represent and define areas within channel cross-sections where flow is not being actively conveyed in the downstream direction (i.e. where the water velocity in the downstream direction is zero or effectively zero). Ineffective flow areas are used to represent areas with stagnant or ponded water and storage areas. Water may be present in ineffective flow areas, but is considered to not contribute to active flow conveyance in the downstream direction.

For typical bridge situations, ineffective flow areas are generally used near bridges (or other flow conveyance structures such as culverts) to define areas that are considered "inactive" for flow conveyance purposes in the downstream direction. By defining ineffective flow areas, areas with active downstream (flow) conveyance are also defined in the model.

Ineffective flow areas are also often used in modeling floodplain areas located adjacent to or some distance away from the main channel, such as relatively wide, flat, shallow-depth floodplain areas not actively conveying flow in the downstream direction. Relatively wide and flat floodplains with shallow depths are generally more likely to be considered or include ineffective flow areas due to the increased effect of local roughness coefficient values (roughness coefficient as a function of depth) and relatively flat downstream gradients (longitudinal "channel" slopes).

The use of ineffective flow areas in a model may directly and/or indirectly affect hydraulic calculations and results in the HEC-RAS program due to hydraulic computation routines and changes in hydraulic characteristic/parameters related to ineffective flow areas. Significant differences in ineffective flow areas (boundaries) between existing and proposed conditions may cause some observed differences in calculated WSEL and velocity.

For the updated Cameron Slough Tributary model, revised ineffective flow areas were defined for both existing and proposed conditions based on the updated discharge, revised flow conditions, and revised flow conveyance method across the proposed roadway embankment. The 2014 FHR assumed a slightly lower assumed discharge as considered for this study and also required all the flow in Cameron Slough Tributary (including any local floodplain flow) to only be conveyed across the proposed roadway through the proposed bridge waterway opening. The addition of culverts to convey floodplain flows across the proposed State Route 180 roadway required setting the ineffective flow areas to accommodate the expected downstream conveyance areas through the culverts and the bridge waterway opening. The revised ineffective flow areas for both existing and proposed conditions are shown in **Attachment 2**.

For information purposes, the 2014 FHR Model required significantly different ineffective flow areas (boundaries) for the existing and proposed conditions due mainly to the different design discharge considered for the 2014 study and due to the different flow conveyance methods across the proposed State Route 180 roadway between existing and proposed conditions. The significantly different flow conditions and flow conveyance methods considered for the 2014 FHR required significantly different ineffective flow areas (boundaries) for the existing and proposed conditions.

Drift Conditions

As discussed in detail in the 2014 FHR, assumed floating drift was included in the 2014 FHR Model as a conservative assumption to address Kings River Conservation District (KRCD) concerns regarding potential floating drift conditions at the bridge. No changes to the assumed floating drift conditions or assumptions were made for this study.

Scour Analysis

As discussed in the 2014 FHR, the scour analysis for the proposed bridges was based on the CVFPB Design Flow of 1,250 cfs for Cameron Slough Tributary. Although the calculated WSEL's for this study are slightly more conservative (higher) than WSEL's in the 2014 FHR due to the higher assumed discharge, the 2014 FHR is considered more conservative for bridge design purposes for scour due to slightly higher local water velocities as compared to this study.

As mentioned previously, RSP is proposed at both abutment locations (both bridges) and would extend between the bridge abutments of the parallel bridges to provide continuous RSP protection along the common banks. As noted in the 2014 FHR, the local channelbed material was conservatively assumed to be fully scourable for potential scour evaluation purposes. It was further noted that the estimated scour depths provided in the report and/or thalweg migration assumptions considered in the study may be potentially limited by actual geotechnical site conditions and other site-specific factors.

Channelbed armoring effects due to the sufficient presence of larger-sized (gravel/cobble) material in the top surface layer of the channelbed may generally help reduce local pier scour (depths) as compared to small-sized, non-cohesive sandy soil. Larger-sized (and heavier) channelbed particles tend to better resist local scour forces as compared to smaller-sized material since higher velocities are generally required to initiate movement of larger/heavier soil particles.

When applicable based on local channelbed (soil) material characteristics/properties and certain flow conditions, a "coarse-bed armoring" equation for local pier scour in coarse soils is available which may reduce calculated scour depths. The local pier scour estimates determined in the 2014 FHR study did not consider the coarse-bed armoring equation due to the unavailability of required channelbed (soil) material characteristics/properties (i.e. channelbed material gradation analysis results). Therefore, the scour depths estimated for the piers may be slightly conservative by not considering any potential channelbed armoring effects.

Bridge site photos at the proposed bridge location (**Refer to Attachment 9**) and field observations indicate larger-sized (gravel/ cobble) material located within the main channel area. Although coarse-bed armoring was not considered for the 2014 FHR scour evaluation, it should be noted that bridge site photos and field observations indicate the presence of larger-sized (gravel/cobble) material at the proposed bridge site, which suggests some channelbed armoring effects may occur under typical flow conditions. The final Log-of-Test-Borings (LOTB) plan sheet at the proposed bridge site indicates the presence of larger-sized channelbed material (gravel/cobble) in the main channel area located beneath a layer of silty sand with gravel/cobbles. The available LOTB descriptions for the existing bridge "Byrd Slough, Br. No. 42-0073" located on Cameron Slough Tributary roughly 350 feet downstream of the proposed bridge site also similarly indicates the presence of larger-sized channelbed material (gravel/cobble) in the main channel area.

Rural Location of Proposed Bridge Site

The proposed new State Highway 180 roadway and Proposed Cameron Slough Tributary Bridges (and Proposed Byrd Slough Bridges) are located within a generally rural area with large areas of undeveloped land and relatively few structures. Any impacts and risks due to any potential changes in WSEL or velocities within the study reach are generally considered significantly lower for rural areas than for urban areas.

This May 2015 Memo and all included attachments have been merged into a single PDF format file for convenience and to ensure delivery of all attachments when forwarded electronically. Along with a copy of the originally-submitted 2014 FHR and this Memo, the electronic files for the updated HEC-RAS model for Cameron Slough Tributary are also being submitted for your review. The revised Cameron Slough Tributary hydraulic model includes analysis for the Assumed CVFPB Design Flow of 1,800 cfs (based on a revised flow distribution), as discussed in the Memo.

This memo was printed directly to "PDF format" and submitted electronically (via email) to CVFPB - there is no "original hardcopy" of this memo. Please forward all submitted documents to the U.S. Army Corps of Engineers (USACE) for their permit review. If you have any questions regarding this Memo, please contact Jose Vargas at (916) 227-9856 (email: *Jose_J_Vargas@dot.ca.gov*) or the Structure Hydraulics & Hydrology Branch Chief, Steve Ng, at (916) 227-8018.

Prepared by:

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Registered Civil Engineer
Registration Number C 65612

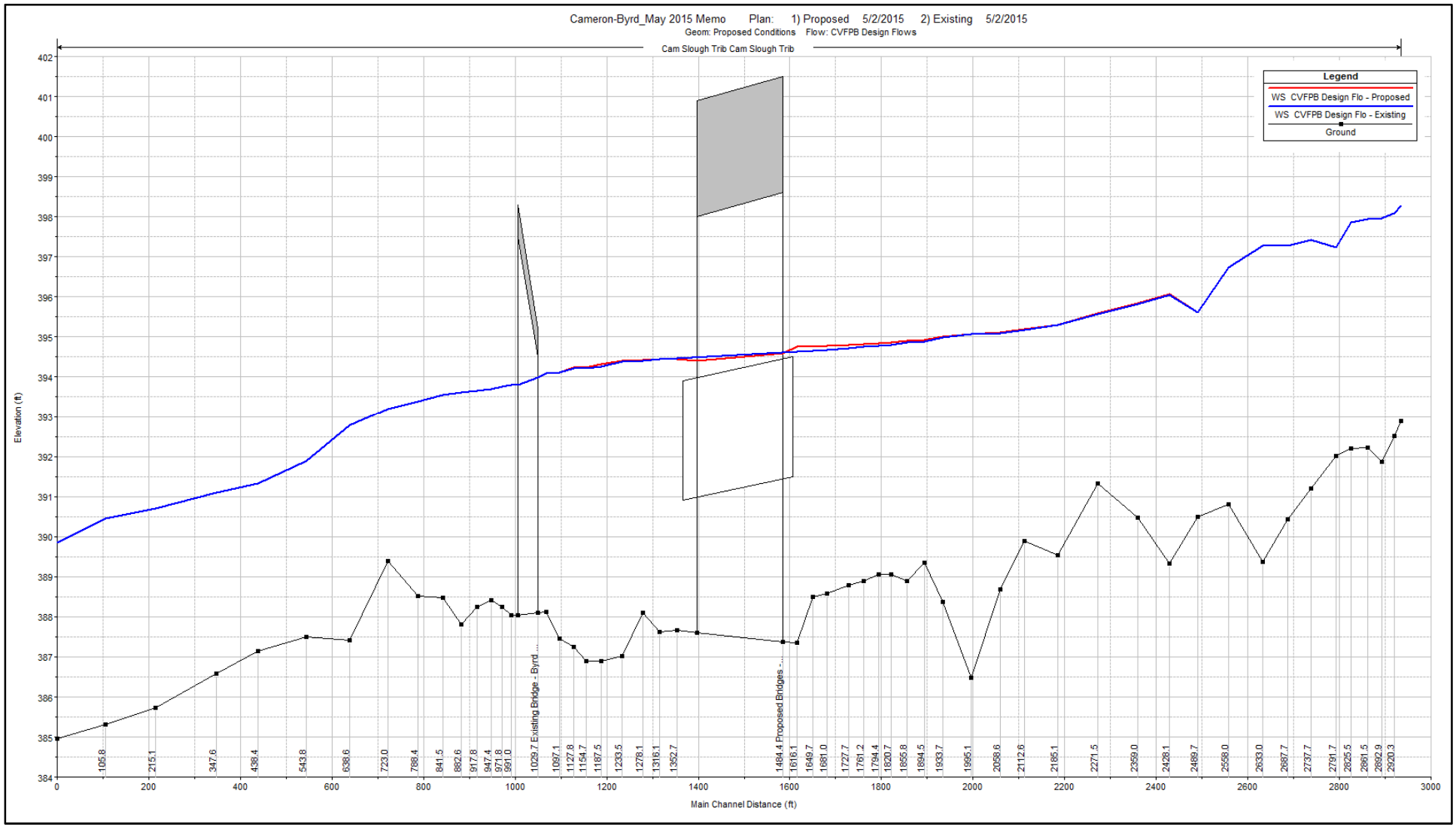
List of Attachments:

Attachment 1 - WSEL Profile Plot of Cameron Slough Tributary
Attachment 2 - Ineffective Flow Areas (Boundaries), Existing and Proposed Conditions
Attachment 3 - HEC-RAS Channel Cross-Sections, Existing and Proposed Conditions
Attachment 4 - HEC-RAS Output Table "*Standard Table 1*"
Attachment 5 - HEC-RAS Output Table "*Six XS Bridge*"
Attachment 6 - HEC-RAS Output Table "*Multiple Opening*"
Attachment 7 - Calculated WSEL/Velocity Changes "*Standard Table 1*"
Attachment 8 - Calculated WSEL/Velocity Changes "*Six XS Bridge*"
Attachment 9 - Bridge Site Photos *(taken 4/22/15)*
Attachment 10 - FEMA FIRM (Flood Insurance Rate Map) *(revised: 2/18/09)*

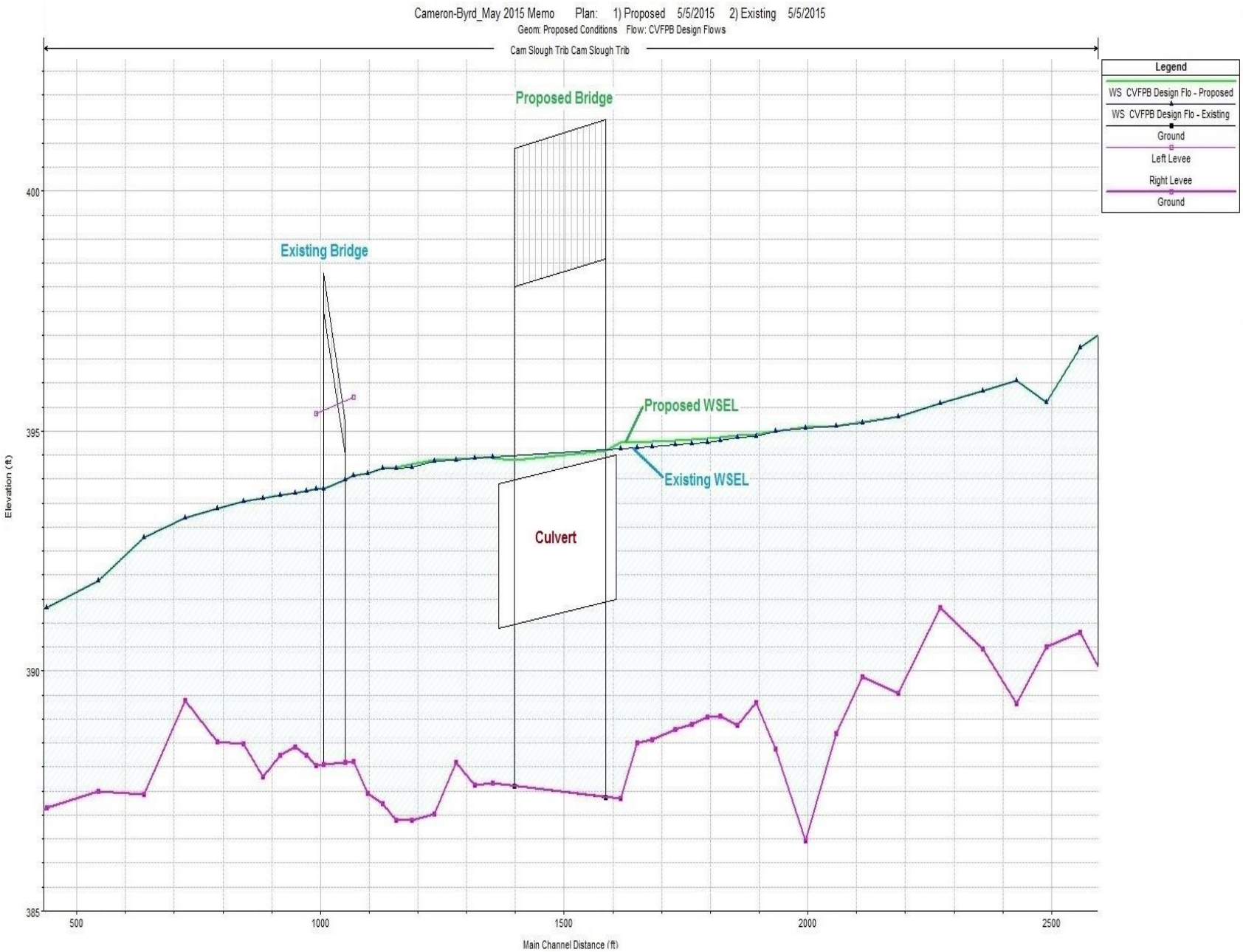
c: Steve Ng, Structure Hydraulics & Hydrology Branch Chief, Caltrans, MS9-1/2I
Tom Fisher, Central Region/District 6 Hydraulics Branch Chief, Caltrans
Neil Bretz, Central Region/District 6 Project Manager, Caltrans
Nancy Moricz, Central Valley Flood Protection Board, Section Chief, CVFPB

Attachment 1

WSEL Profile Plot of Cameron Slough Tributary



Attachment 1 - WSEL Profile Plot of Cameron Slough Tributary


Cameron-Byrd_May 2015 Memo Plan: 1) Proposed 5/5/2015 2) Existing 5/5/2015
Geom: Proposed Conditions Flow: CVFPB Design Flows
Cam Slough Trib Cam Slough Trib
Proposed Bridge
Existing Bridge
Proposed WSEL
Existing WSEL
Culvert
Legend
WS CVFPB Design Flo - Proposed
WS CVFPB Design Flo - Existing
Ground
Left Levee
Right Levee
Ground
Elevation (ft)
400
395
390
385
500
1000
1500
2000
2500
Main Channel Distance (ft)

Profile Output Table - Standard Table 1

File Options Std. Tables User Tables Locations Help

HEC-RAS River: Cam Slough Trib Reach: Cam Slough Trib Profile: CVFPB Design Flo — Reload Data

Reach	River Sta	Profile	Plan	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)	
Cam Slough Trib	1761.2	CVFPB Design Flo	Proposed	1800.00	388.90	394.83	393.71	394.91	0.001065	2.80	851.06	437.45	0.31
Cam Slough Trib	1761.2	CVFPB Design Flo	Existing	1800.00	388.90	394.75	393.72	394.86	0.001392	3.16	742.65	436.58	0.36
Cam Slough Trib	1727.7	CVFPB Design Flo	Proposed	1800.00	388.78	394.81	393.29	394.88	0.000786	2.52	927.50	448.08	0.28
Cam Slough Trib	1727.7	CVFPB Design Flo	Existing	1800.00	388.78	394.72	393.14	394.82	0.001085	2.92	786.06	447.04	0.33
Cam Slough Trib	1681.0	CVFPB Design Flo	Proposed	1800.00	388.57	394.78	393.27	394.84	0.000730	2.29	971.56	461.84	0.26
Cam Slough Trib	1681.0	CVFPB Design Flo	Existing	1800.00	388.57	394.67	393.32	394.76	0.001084	2.74	798.77	460.73	0.32
Cam Slough Trib	1649.7	CVFPB Design Flo	Proposed	1800.00	388.50	394.77	393.05	394.82	0.000524	2.10	1069.80	452.28	0.22
Cam Slough Trib	1649.7	CVFPB Design Flo	Existing	1800.00	388.50	394.65	393.09	394.73	0.000763	2.51	874.07	449.85	0.26
Cam Slough Trib	1616.1	CVFPB Design Flo	Proposed	1800.00	387.34	394.75	392.92	394.80	0.000483	1.95	1120.19	463.74	0.20
Cam Slough Trib	1616.1	CVFPB Design Flo	Existing	1800.00	387.34	394.63	392.99	394.71	0.000760	2.40	892.95	460.99	0.25
Cam Slough Trib	1484.4	Proposed Bridge		Mult Open									
Cam Slough Trib	1352.7	CVFPB Design Flo	Proposed	1800.00	387.66	394.45	392.23	394.48	0.000261	1.77	1434.91	693.68	0.16
Cam Slough Trib	1352.7	CVFPB Design Flo	Existing	1800.00	387.66	394.47	391.78	394.54	0.000504	2.47	968.29	694.14	0.22
Cam Slough Trib	1316.1	CVFPB Design Flo	Proposed	1800.00	387.62	394.44	392.08	394.47	0.000280	1.82	1400.16	699.07	0.16
Cam Slough Trib	1316.1	CVFPB Design Flo	Existing	1800.00	387.62	394.44	391.63	394.52	0.000571	2.60	909.20	699.07	0.22
Cam Slough Trib	1278.1	CVFPB Design Flo	Proposed	1800.00	388.09	394.42	392.03	394.46	0.000319	1.97	1295.93	703.24	0.16
Cam Slough Trib	1278.1	CVFPB Design Flo	Existing	1800.00	388.09	394.41	391.72	394.50	0.000627	2.75	854.07	703.20	0.23
Cam Slough Trib	1233.5	CVFPB Design Flo	Proposed	1800.00	387.02	394.39	390.94	394.44	0.000399	2.12	1146.83	625.17	0.17
Cam Slough Trib	1233.5	CVFPB Design Flo	Existing	1800.00	387.02	394.37	390.94	394.47	0.000665	2.73	823.87	625.08	0.21
Cam Slough Trib	1187.5	CVFPB Design Flo	Proposed	1800.00	386.89	394.32	391.39	394.42	0.000597	2.83	865.79	620.82	0.24
Cam Slough Trib	1187.5	CVFPB Design Flo	Existing	1800.00	386.89	394.25	391.39	394.42	0.000930	3.51	623.34	620.55	0.30
Cam Slough Trib	1154.7	CVFPB Design Flo	Proposed	1800.00	386.90	394.24	391.45	394.39	0.000877	3.23	662.16	620.60	0.28
Cam Slough Trib	1154.7	CVFPB Design Flo	Existing	1800.00	386.90	394.22	391.44	394.39	0.000971	3.39	585.01	620.53	0.30
Cam Slough Trib	1127.8	CVFPB Design Flo	Proposed	1800.00	387.24	394.23	391.42	394.36	0.000788	3.02	684.17	615.23	0.26
Cam Slough Trib	1127.8	CVFPB Design Flo	Existing	1800.00	387.24	394.22	391.45	394.36	0.000844	3.12	623.72	615.19	0.27
Cam Slough Trib	1097.1	CVFPB Design Flo	Proposed	1800.00	387.45	394.11	391.69	394.32	0.001234	3.69	492.08	484.70	0.33
Cam Slough Trib	1097.1	CVFPB Design Flo	Existing	1800.00	387.45	394.11	391.68	394.32	0.001234	3.69	492.08	484.70	0.33
Cam Slough Trib	1068.3	CVFPB Design Flo	Proposed	1800.00	388.11	394.08	391.71	394.28	0.001327	3.57	504.48	140.00	0.33
Cam Slough Trib	1068.3	CVFPB Design Flo	Existing	1800.00	388.11	394.08	391.71	394.28	0.001327	3.57	504.48	140.00	0.33
Cam Slough Trib	1029.7	Existing Bridge		Bridge									
Cam Slough Trib	991.0	CVFPB Design Flo	Proposed	1800.00	388.03	393.79	391.48	394.01	0.001430	3.77	493.94	154.78	0.35
Cam Slough Trib	991.0	CVFPB Design Flo	Existing	1800.00	388.03	393.79	391.48	394.01	0.001430	3.77	493.94	154.78	0.35
Cam Slough Trib	971.8	CVFPB Design Flo	Proposed	1800.00	388.24	393.76	391.72	393.98	0.001652	3.85	500.36	341.35	0.37
Cam Slough Trib	971.8	CVFPB Design Flo	Existing	1800.00	388.24	393.76	391.72	393.98	0.001652	3.85	500.36	341.35	0.37

Total flow in cross section.