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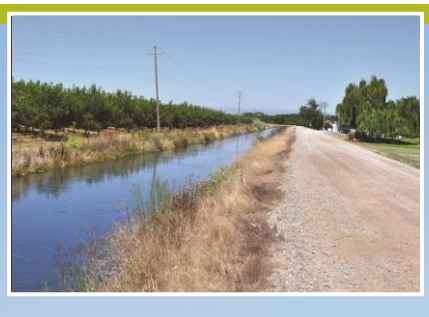
August 19, 2013

Final Independent External Peer Review Report Sutter Basin Pilot Feasibility Draft Report - Draft Environmental Impact Report/Supplemental Environmental Impact Statement



Prepared by
Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
Flood Risk Management Planning Center of Expertise
Baltimore District

Contract No. W912HQ-10-D-0002
Task Order: 0041

Final Independent External Peer Review Report
Sutter Basin Pilot Feasibility Draft Report - Draft Environmental Impact Report/Supplemental Environmental Impact Statement

by

Battelle
505 King Avenue
Columbus, OH 43201

for

Department of the Army
U.S. Army Corps of Engineers
Flood Risk Management Planning Center of Expertise
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Final Independent External Peer Review Report for the

Sutter Basin Pilot Feasibility Draft Report - Draft Environmental Impact Report/Supplemental Environmental Impact Statement

EXECUTIVE SUMMARY

Project Background and Purpose

The purpose of the Sutter Basin Feasibility Study, Sutter Basin, California, is to identify flood risk management (FRM) issues. The decision document, a General Investigation Feasibility Report/Environmental Impact Report (EIR)/Supplemental Environmental Impact Statement (SEIS), will be reviewed by U.S. Army Corps of Engineers (USACE) Headquarters for approval and is expected to be the basis for a recommendation to Congress for authorization of a new project. The report presents planning, engineering, and implementation details of the recommended plan to allow final design and construction to proceed subsequent to approval of the recommended plan. The project study was undertaken to evaluate structural and non-structural FRM measures, including improvements to existing levees, construction of new levees, and other storage, conveyance, and non-structural options. The feasibility phase of this project is cost-shared 50 percent federal, 50 percent non-federal with the project sponsors, the State of California Central Valley Flood Protection Board (CVFPB) and the Sutter Butte Flood Control Agency (SBFCA).

The Sutter Basin study focuses on FRM alternatives within the study area. The CVFPB and SBFCA are primarily interested in reducing flood risk to Yuba City and other communities in the study area, as well as protecting public infrastructure in terms of life safety. The study area is essentially encircled by project levees of the Sacramento River Flood Control Project and the high ground of the Sutter Buttes. Geotechnical analysis and historical performance during past floods indicate that the project levees are at high risk of failure due to underseepage.

The study area, located in California's Sacramento Valley, is roughly bounded by the Feather River, Sutter Bypass, Wadsworth Canal, Sutter Buttes, and Cherokee Canal. The area covers approximately 285 square miles and is 43 miles long and 9 miles wide. It includes the communities of Yuba City, Live Oak, Gridley, and Biggs, with a total population of approximately 80,000. Flood waters potentially threatening the study area originate from the Feather River watershed or the upper Sacramento River watershed, above Colusa Weir.

A historic levee failure in 1955 caused damage and loss of life. There have been three breaches in levees adjacent to the study area since 1986, and more are expected. High water in 1997 required extensive flood fighting and forced a mass evacuation, including the entire city of Yuba City. The risk of unexpected levee failure coupled with the consequence of flooding presents a threat to public safety, property, and critical infrastructure.

On February 18, 2011, the Sutter Basin Feasibility Study was designated as one of the first pilot studies for the USACE National Pilot Program. The pilot initiative for the Sutter Basin Feasibility Study provides an opportunity to test principles that have been outlined in the *USACE Recommendations for Transforming the Current Pre-Authorization Study Process* (USACE, 2011) and associated presentation materials. Instead of following the traditional USACE planning milestones, the pilot study has been divided into four phases, each with a key decision point and associated in-progress reviews;

- Decision Point 1 – Determination of continued federal interest and vertical team concurrence on risk and study methodology.
- Decision Point 2 – Tentatively Selected Plan (TSP) agreement and vertical team approval to release draft report for policy, IEPR, and public review.
- Decision Point 3 – Civil Works Review Board (CWRB) approval to release the final report for state and agency review.
- Decision Point 4 – Signed Chief's Report.

Independent External Peer Review Process

USACE is conducting an Independent External Peer Review (IEPR) of the Sutter Basin Pilot Feasibility Draft Report - Draft Environmental Impact Report/Supplemental Environmental Impact Statement (hereinafter Sutter Basin IEPR). As a 501(c)(3) non-profit science and technology organization, Battelle is independent, is free from conflicts of interest (COIs), and meets the requirements for an Outside Eligible Organization (OEO) per guidance described in USACE (2012). Battelle has experience in establishing and administering peer review panels for USACE and was engaged to coordinate the IEPR of the Sutter Basin review documents. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2012) and OMB (2004). This final report describes the IEPR process, describes the panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel (the Panel).

Based on the technical content of the Sutter Basin review documents and the overall scope of the project, Battelle identified candidates for the Panel in the following key technical areas: Civil Works Economics, biology/ecology, geotechnical engineering, hydrology and hydraulic engineering, and civil engineering. Due to the expedited schedule required to complete the Sutter Basin IEPR and delay in award, the resulting unavailability of one of the original panel members required that the civil engineering and geotechnical engineering disciplines be merged into a dual role. USACE was given the list of candidate panel members, but Battelle made the final selection of the Panel.[1]

The Panel received an electronic version of the 2,433-page Sutter Basin IEPR document, along with a charge that solicited comments on specific sections of the documents to be reviewed. USACE prepared the charge questions following guidance provided in USACE (2012) and OMB (2004), which were included in the draft and final Work Plans.

[1] Battelle identified a candidate who served in a combined role in the disciplines of civil engineering and geotechnical engineering for this IEPR.

The USACE Project Delivery Team (PDT) briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the review to provide the Panel an opportunity to ask questions of USACE and clarify uncertainties. Other than Battelle-facilitated teleconferences, there was no direct communication between the Panel and USACE during the peer review process. The Panel produced individual comments in response to the 75 charge questions.

IEPR panel members reviewed the Sutter Basin documents individually. The panel members then met via teleconference with Battelle to review key technical comments, discuss charge questions for which there were conflicting responses, and reach agreement on the Final Panel Comments to be provided to USACE. Each Final Panel Comment was documented using a four-part format consisting of: (1) a comment statement; (2) the basis for the comment; (3) the significance of the comment (high, medium, or low); and (4) recommendations on how to resolve the comment. Overall, 19 Final Panel Comments were identified and documented. Of these, 1 was identified as having high significance, 15 had medium significance, and 3 had low significance.

Results of the Independent External Peer Review

The panel members agreed between each other on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012, p. D-4) in the Sutter Basin review documents. Table ES-1 lists the Final Panel Comments statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A of this report. The following summarizes the Panel's findings.

Hydrology and Hydraulic Engineering

The Panel acknowledges the unique setting of this project, with the associated significant existing flood risk, and recognizes the tremendous effort USACE has made to quantify the hydrologic and hydraulic (H&H) aspects of this study contributing to the identification of the TSP. The H&H analyses have been conducted following USACE standards and using reasonable methods and appropriate numerical models; however, several assumptions and methods require clarification, and the particular data used in the analyses need further explanation.

Of most concern is the apparent reliance of the study on a federal 1% (100-year) annual chance exceedance (ACE) event standard to achieve feasibility study planning objectives to reduce flood risk. This standard appears to conflict with a 2007 California law that requires flood protection to the 0.5% (200-year) ACE event in urban areas. Since the existing levees will be fixed-in-place and they begin to overtop during the 0.5% ACE event, project objectives would not be met with this higher standard because the project would not have the same flood protection currently stated for the 1% ACE event.

In addition, yet to a lesser extent, several technical assumptions are unclear or are not provided, and methods have not been fully articulated (for example, those related to climate change). As a result, the Panel was not able to confirm the validity of some aspects of the H&H analyses.

These analyses used data of varying ages and/or periods of record, and doing so may have mischaracterized the 1% ACE flood event and resulting floodplains because "best available" data were not used. In light of changes that have occurred in the river systems over the intervening years and the existence of more recent data, the use of these older data could be better explained.

Geotechnical and Civil Engineering

The project clearly addresses a need to improve a levee system that has proven unreliable due to underseepage. However, the accuracy of calculated net benefit for the project concerns the Panel for two reasons. First, residual risks of levee failure in events up to and including the 1% ACE floodplain subsequent to repair have not been evaluated. Second, the Panel believes that calculations of geotechnical risk associated with the levees potentially overestimate actual probability of failure.

Residual risks subsequent to implementing either the National Economic Development (NED) project or the Locally Preferred Plan (LPP) do not appear to have been evaluated. In particular, the Panel is concerned about the potential for failure at the Union Pacific Railroad crossing and the long-term potential for rodent activity and other judgment-based geotechnical failure modes. This issue can be resolved by evaluating residual risks further, and incorporating costs into the calculation of net benefit as appropriate.

Geotechnical risk was calculated using methods described in Engineer Technical Letter (ETL) No. 1110-2-556. When written, the ETL reflected the developing nature of geotechnical reliability analysis by indicating the need for "inevitable adjustments and refinements in the procedure." The Panel strongly believes that any new geotechnical method must be calibrated using field observations. The Panel is not aware that this method has been calibrated or that it has been adjusted and refined. A general calibration for geotechnical reliability methods in their present state of development was recently provided by two pioneers in the field, J.T. Christian and G.B. Baecher, when they indicate that a major question is "why failures are less frequent than reliability studies predict." Recent published literature indicates that predicted failure frequencies are an order of magnitude larger than observed; therefore, the Panel believes that calculations of geotechnical risk likely overestimate failure probability and result in an overestimate of the project benefits. This issue can be resolved by considering alternate techniques that may reduce the calculated uncertainty (and thus the overestimate of failure probability) and then recommends an assessment and discussion of evaluating remaining uncertainty in calculated failure probability and resulting project benefits.

Civil Works Economics

The multi-objective formulation approach to analyze the draft array of alternatives, select the final array of alternatives, and select the TSP recommendation was well-founded and complied with USACE guidance. Placing equal emphasis on the other three accounts in the System of Accounts (Environmental Quality, Regional Economic Development, and Other Social Effects) rather than concentrating on the NED account was also appropriate. Including emphasis on the study objective of public and life safety in the evaluation metrics provided a more effective evaluation of the project than just focusing on the NED account. The evaluation and comparison

of the alternatives based on multiple criteria, including monetary and nonmonetary effects; qualitative and quantitative data; and economic, public safety, environmental, and regional criteria improved the report's findings. However, the Panel was not able to evaluate the processes used to quantify the evaluation criteria because they were not provided. In addition, economic risk and uncertainty associated with future without-project conditions did not take into account expected population growth. Future without-project conditions were assumed to be the same as existing conditions, even though study area population is expected to more than double over the next 40 years. This issue can be resolved by explaining why the analysis of economic risk and uncertainty did not consider population growth.

Environmental

The Sutter Basin EIR/SEIS is thorough and well-written. Inclusion of the Fish and Wildlife Coordination Report and Draft Mitigation and Monitoring Plan as appendices provides additional detail about the biological issues and adds to the thoroughness of the environmental analysis. However, although woodland vegetation removal is identified as a significant and unavoidable impact in the short term (until the mitigation plantings grow to maturity), the spatial impact is not evaluated in terms of potential long-term fragmentation of wildlife habitat. The ability of the proposed habitat mitigation to compensate for potential habitat fragmentation or interference with wildlife movement is not described. This can be addressed by discussing the potential spatial effect of vegetation removal, as well as the spatial relationship of the mitigation planting to where the impact would occur, would provide a more complete analysis.

Table ES-1. Overview of 19 Final Panel Comments Identified by the Sutter Basin IEPR Panel

No.	Final Panel Comment
	Significance – High
1	The feasibility study planning objectives to reduce flood risk utilizing a federal 1% (100-year) annual chance exceedance (ACE) event appears to conflict with a 2007 California law that requires flood protection to the 0.5% (200-year) ACE event in urban areas.
	Significance – Medium
2	Residual risks associated with the 1% annual chance exceedance (ACE) event are not fully evaluated and may not be accounted for in the project costs.
3	The consequences of residual risk from events larger than the 1% annual chance exceedance (ACE) event are not adequately presented, and associated mitigation measures are not fully described.
4	The hydrologic and hydraulic analyses may have mischaracterized the 1% annual chance exceedance (ACE) event and resulting floodplains because "best available" data were not used.
5	The validity of some aspects of the hydraulic and hydrologic analyses cannot be confirmed because several assumptions are unclear or are not provided.
6	The 1957 design water profiles appear to be a key hydraulic design assumption, even though more recent data are available.
7	Methods used to develop geotechnical fragility curves have not been sufficiently calibrated by using observed frequency of actual failures.
8	The statistical parameters and methods used for seepage analyses result in excessive uncertainty in calculations of geotechnical reliability that may overestimate the project's net benefits.
9	Methods used to divide the levees into reaches may result in inaccurate calculations of geotechnical reliability that may impact the estimated net benefit of the project.
10	The rationale for eliminating the setback levee alternative is not provided in sufficient detail, indicating that it may have been prematurely eliminated from the plan formulation objectives.
11	The sensitivity of the alternative selection process to the issue of climate change is unclear because the methodology has not been fully articulated.
12	The process for prioritizing project goals is not supported because the evaluation criteria used in the screening process were not quantified.
13	Economic risk and uncertainty associated with future without-project conditions were not considered when identifying the Tentatively Selected Plan.

Table ES-1. Overview of 19 Final Panel Comments Identified by the Sutter Basin IEPR Panel (continued)

No.	Final Panel Comment
14	The spatial effect of removing vegetation from the levees, which could result in long-term habitat fragmentation, is not discussed, although the total acreage loss is mitigated.
15	The impacts to environmental resources from operation and maintenance activities are not analyzed in accordance with relevant federal and state legislation.
16	The project's impact on the temporal loss of nesting habitat for Swainson's hawk is not evaluated.
	Significance – Low
17	The assumption that through-seepage does not contribute to geotechnical fragility is inconsistent with the description of the risk of through-seepage elsewhere in the report.
18	Evidence is not provided to support using slurry cutoff walls for levee underseepage instead of other repair options such as seepage berms and relief wells; therefore, it cannot be determined whether the optimum solution to seepage management was selected.
19	With regard to the future with-project conditions, the 50-year period of analysis extends over different years for different analyses, and some conditions are not evaluated.

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LIST OF ACRONYMS

ACE	Annual Chance Exceedance
ASCE	American Society of Civil Engineers
ATR	Agency Technical Review
CEQA	California Environmental Quality Act
CNRM	Centre National de Recherches Meteorologiques
COI	Conflict of Interest
CVFED	Central Valley Floodplain Evaluation and Delineation
CVFPB	Central Valley Flood Protection Board
CWRB	Civil Works Review Board
DrChecks	Design Review and Checking System
DWR	Department of Water Resources (California)
EC	Engineer Circular
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ER	Engineer Regulation
ESA	Endangered Species Act
ETL	Engineer Technical Letter
FEMA	Federal Emergency Management Agency
FRM	Flood Risk Management
GIS	Geographic Information System
H&H	Hydrologic and Hydraulic
HEC-FDA	Hydrologic Engineering Center-Flood Damage Reduction Analysis
HEC-HMS	Hydrologic Engineering Center-Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Center-River Analysis System
HEC-ResSim	Hydrologic Engineering Center-Reservoir Simulation
IEPR	Independent External Peer Review
LPP	Locally Preferred Plan
NED	National Economic Development
NEPA	National Environmental Policy Act
NSF	National Science Foundation

NRC	National Research Council
O&M	Operations and Maintenance
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PDT	Project Delivery Team
SAR	Safety Assurance Review
SBFCA	Sutter Butte Flood Control Agency
SEIS	Supplemental Environmental Impact Statement
TSP	Tentatively Selected Plan
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
VE	Value Engineering

1. INTRODUCTION

The purpose of the Sutter Basin Feasibility Study, Sutter Basin, California, is to identify flood risk management (FRM) issues. The decision document, a General Investigation Feasibility Report/Environmental Impact Report (EIR)/Supplemental Environmental Impact Statement (SEIS), will be reviewed by U.S. Army Corps of Engineers (USACE) Headquarters for approval and is expected to be the basis for a recommendation to Congress for authorization of a new project. The report presents planning, engineering, and implementation details of the recommended plan to allow final design and construction to proceed subsequent to approval of the recommended plan. The project study was undertaken to evaluate structural and non-structural FRM measures, including improvements to existing levees, construction of new levees, and other storage, conveyance, and non-structural options. The feasibility phase of this project is cost-shared 50 percent federal, 50 percent non-federal with the project sponsors, the State of California Central Valley Flood Protection Board (CVFPB) and the Sutter Butte Flood Control Agency (SBFCA).

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On February 18, 2011, the Sutter Basin Feasibility Study was designated as one of the first pilot studies for the USACE National Pilot Program. The pilot initiative for the Sutter Basin Feasibility Study provides an opportunity to test principles that have been outlined in the *USACE Recommendations for Transforming the Current Pre-Authorization Study Process* (USACE, 2011) and associated presentation materials. Instead of following the traditional USACE planning milestones, the pilot study has been divided into four phases, each with a key decision point and associated in-progress reviews;

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- Decision Point 4 – Signed Chief's Report.

The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Sutter Basin Pilot Feasibility Draft Report - Draft Environmental Impact Report/Supplemental Environmental Impact Statement (hereinafter Sutter Basin IEPR) in accordance with procedures described in USACE Engineer Circular (EC) *Civil Works Review* (EC 1165-2-214) (USACE, 2012) and Office of Management and Budget (OMB) bulletin *Final Information Quality Bulletin for Peer Review* (OMB, 2004). Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. This final report details the IEPR process, describes the IEPR panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel on the existing environmental, economic, and engineering analyses contained in the Sutter Basin IEPR. The full text of the Final Panel Comments is presented in Appendix A.

2. PURPOSE OF THE IEPR

To ensure that USACE documents are supported by the best scientific and technical information, USACE has implemented a peer review process that uses IEPR to complement the Agency Technical Review (ATR), as described in USACE (2012).

In general, the purpose of peer review is to strengthen the quality and credibility of the USACE decision documents in support of its Civil Works program. IEPR provides an independent assessment of the economic, engineering, and environmental analysis of the project study. In particular, the IEPR addresses the technical soundness of the project study's assumptions, methods, analyses, and calculations and identifies the need for additional data or analyses to make a good decision regarding implementation of alternatives and recommendations.

In this case, the IEPR of the Sutter Basin review documents was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC No. 1165-2-214) under Section 501(c)(3) of the U.S. Internal Revenue Code with experience conducting IEPRs for USACE.

3. METHODS

This section describes the method followed in selecting the members for the IEPR Panel (the Panel) and in planning and conducting the IEPR. The IEPR was conducted following procedures described by USACE (2012) and in accordance with OMB (2004) guidance. Supplemental guidance on evaluation for conflicts of interest (COIs) was obtained from the *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports* (The National Academies, 2003).

3.1 Planning and Schedule

At the beginning of the Period of Performance, Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan. In addition, 75 charge questions were provided by USACE and included in the draft and final Work Plans.[2] The final charge also included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Table 1 presents the schedule followed in executing the IEPR. Due dates for milestones and deliverables are based on the award/effective date of July 1, 2013. Review documents were provided by USACE on July 9, 2013; however, a revised set of documents was submitted on July 15, 2013. In addition, due to the accelerated review schedule, USACE requested that Battelle submit interim (working draft) panel comments. Although interim comments are not part of the normal IEPR process (i.e., they are not included in the original scope and are not a deliverable), Battelle provided these to the USACE to allow the Project Delivery Team (PDT) to begin developing the draft Evaluator Responses in order to meet the accelerated schedule. Battelle informed USACE that the interim panel comments could be revised or deleted, or that new comments could be added as the Final Panel Comments were finalized. In addition, the PDT was informed that they should not provide comments or revisions on these interim comments to ensure that no bias or influence enters the process before the Final IEPR Report is submitted. Note that the work items listed under Task 6 in Table 1 occur after the submission of this report. Battelle will enter the 19 Final Panel Comments developed by the Panel into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that USACE can review and respond to them. USACE will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. All USACE and Panel responses will be documented by Battelle. Battelle will provide USACE and the Panel a pdf printout of all DrChecks entries, through comment closeout, as a final deliverable and record of the IEPR results.

[2] Of these 75 charge questions, two were added by Battelle that sought summary information. USACE approved these additional charge questions in the draft and final Work Plans.

Table 1. Sutter Basin IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	7/1/2013
	Review documents available	7/9/2013
	Battelle submits draft Work Plan[a]	7/9/2013
	USACE provides comments on draft Work Plan	7/15/2013
	Battelle submits final Work Plan; revised Work Plan	7/17/2013 & 7/19/2013
2	Battelle requests input from USACE on the COI questionnaire	7/2/2013
	USACE provides comments on COI questionnaire	7/3/2013
	Battelle submits list of selected panel members[a]	7/8/2013
	USACE confirms the Panel has no conflicts of interest	7/9/2013
	Battelle completes subcontracts for panel members	7/15/2013
3	Battelle convenes kick-off meeting with USACE	7/8/2013
	Battelle sends review documents to Panel	7/15/2013
	Battelle convenes Panel kick-off meeting	7/16/2013
	Battelle convenes USACE/Panel kick-off meeting	7/16/2013
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	7/24/2013
4	Panel members complete their individual reviews	7/26/2013
	Battelle provides panel members with talking points for Panel Review Teleconference	7/30/2013
	Battelle convenes Panel Review Teleconference	7/30/2013
	Battelle provides Final Panel Comment templates and instructions to panel members	7/31/2013
	Panel members provide draft Final Panel Comments to Battelle	8/6/2013
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	8/7-8/12/2013
	Battelle finalizes Final Panel Comments	8/13/2013
	Battelle provides interim panel comments per USACE request	8/14/2013
5	Battelle provides Final IEPR Report to panel members for review	8/15/2013
	Panel members provide comments on Final IEPR Report	8/15/2013
	Battelle submits Final IEPR Report to USACE[a]	8/19/2013

Table 1. Sutter Basin IEPR Schedule (continued)

Task	Action	Due Date
6[b]	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	8/20/2013
	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	8/20/2013
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process (if necessary)	8/20/2013
	USACE provides draft PDT Evaluator Responses to Battelle	8/26/2013
	Battelle provides the panel members the draft PDT Evaluator Responses	8/27/2013
	Panel members provide Battelle with draft BackCheck Responses	8/29/2013
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	8/30/2013
	Battelle convenes Comment-Response Teleconference with panel members and USACE	8/30/2013
	USACE inputs final PDT Evaluator Responses to DrChecks	9/4/2013
	Battelle provides PDT Evaluator Responses to panel members	9/5/2013
	Panel members provide Battelle with final BackCheck Responses	9/6/2013
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	9/9/2013
	Battelle submits pdf printout of DrChecks project file[a]	9/10/2013
	Civil Works Review Board	9/18/2013
	Project Closeout	6/20/2014

a Deliverable.

b Task 6 occurs after the submission of this report.

3.2 Identification and Selection of IEPR Panel Members

The candidates for the Panel were evaluated based on their technical expertise in the following key areas: Civil Works Economics, biology/ecology, geotechnical engineering, hydrology and hydraulic (H&H) engineering, and civil engineering. These areas correspond to the technical content of the Sutter Basin IEPR and overall scope of the Sutter Basin.

To identify candidate panel members, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle evaluated these candidate panel members in terms of their technical expertise and potential COIs. Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and initially selected five experts for the final Panel. Due to the expedited schedule required to complete the Sutter Basin IEPR and delay in award, the resulting unavailability of one of the original panel members required that the civil engineering and geotechnical engineering disciplines be merged into a dual role, resulting in four panel members for the five disciplines.

The four selected reviewers constituted the final Panel. The remaining candidates were not proposed for a variety of reasons, including lack of availability, disclosed COIs, or lack of the precise technical expertise required.

The candidates were screened for the following potential exclusion criteria or COIs.[3] These COI questions were intended to serve as a means of disclosure and to better characterize a candidate's employment history and background. Providing a positive response to a COI screening question did not automatically preclude a candidate from serving on the Panel. For example, participation in previous USACE technical peer review committees and other technical review panel experience was included as a COI screening question. A positive response to this question could be considered a benefit.

- Previous and/or current involvement by you or your firm[4] in the Sutter Basin Pilot Feasibility Draft Report - Draft Environmental Impact Report (EIR)/Supplemental Environmental Impact Statement (SEIS) and technical appendices.
- Previous and/or current involvement by you or your firm[4] in FRM or ecosystem restoration in Sutter Basin, California.
- Previous and/or current involvement by you or your firm[4] in the Sutter Basin EIR/SEIS related projects.
- Previous and/or current involvement by you or your firm[4] in the conceptual or actual design, construction, or operations and maintenance (O&M) of any projects in the Sutter Basin EIR/SEIS related projects.
- Current employment by USACE.
- Previous and/or current involvement with paid or unpaid expert testimony related to the Sutter Basin EIR/SEIS.
- Previous and/or current employment or affiliation with the non-federal sponsors or any of the following cooperating federal, state, county, local, and regional agencies, environmental organizations, and interested groups: State of California Central Valley Flood Protection Board (CVFPB) and the Sutter Butte Flood Control Agency (SBFCA). (for pay or pro bono). Associated or affiliated with SBFCA project – Feather River West Levee Project (Section 408).
- Past, current or future interests or involvements (financial or otherwise) by you, your spouse or children related to Sutter Basin or Sutter and Butte Counties, California.
- Current personal involvement with other USACE projects, including whether involvement was to author any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district,

[3] Battelle evaluated whether scientists in universities and consulting firms that are receiving USACE-funding have sufficient independence from USACE to be appropriate peer reviewers. See OMB (2004, p. 18), "….when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review. Likewise, when the agency and a researcher work together (e.g., through a cooperative agreement) to design or implement a study, there is less independence from the agency. Furthermore, if a scientist has repeatedly served as a reviewer for the same agency, some may question whether that scientist is sufficiently independent from the agency to be employed as a peer reviewer on agency-sponsored projects."

[4] Includes any joint ventures in which the panel member's firm is involved.

division, Headquarters, Engineering Research and Development Center [ERDC], etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the Sacramento District.

- Previous or current involvement with the development or testing of models that will be used for or in support of the Sutter Basin EIR/SEIS project.
- Current firm[4] involvement with other USACE projects, specifically those projects/contracts that are with the Sacramento District. If yes, provide title/description, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please also clearly delineate the percentage of work you personally are currently conducting for the Sacramento District. Please explain.
- Any previous employment by the USACE as a direct employee, notably if employment was with the Sacramento District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Any previous employment by the USACE as a contractor (either as an individual or through your firm[4]) within the last 10 years, notably if those projects/contracts are with the Sacramento District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning ecosystem review or flood management, and include the client/agency and duration of review (approximate dates).
- Pending, current or future financial interests in Sutter Basin EIR/SEIS related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[4] revenues within the last 3 years came from USACE contracts.
- A significant portion (i.e., greater than 50%) of personal or firm[4] revenues within the last 3 years from contracts with the non-federal sponsor (State of California CVFPB and the SBFCA).
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to in the Sutter Basin EIR/SEIS.
- Participation in relevant prior federal studies relevant to this project and/or in the Sutter Basin EIR/SEIS.
- Previous and/or current participation in prior non-federal studies relevant to this project and/or in the Sutter Basin EIR/SEIS.
- Is there any past, present or future activity, relationship or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project?

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. The four final reviewers were either affiliated with consulting companies or were independent consultants. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of COIs through a signed COI form. USACE was given the list of candidate panel members, but Battelle made the

final selection of the Panel. Section 4 of this report provides names and biographical information on the panel members.

3.3 Conduct of the IEPR

Prior to beginning their review and within one day of their subcontracts being finalized, all members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel. Battelle planned and facilitated a second kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meetings, the IEPR Panel received an electronic version of the final charge as well as the Sutter Basin review documents and reference materials listed below. The documents and files in bold font were provided for review; the other documents were provided for reference or supplemental information only.

- **Sutter Basin – Draft Pilot Feasibility Study Report EIS/EIR** (400 pages)
- **Risk Register** (5 pages)
- **Engineering Appendix:**
  - **Engineering Appendix Overview** (185 pages)
  - **Hydrology office summary report** (98 pages)
  - **Hydraulic Design and Analysis** (221 pages)
  - **Geotechnical Design** (591 pages)
  - **Civil Design** (81 pages)
  - **Cost Engineering** (348 pages)
  - **Cost Estimates** (5 pages)
- **Economics Appendix** (45 pages)
- **Real Estate Appendix** (90 pages)
- **Plan Formulation Appendix** (55 pages)
- **Environmental Appendix** (300 pages)
- Technical Memorandums
- SBFCA Geotechnical Reports
- H&H References Directory
- Sutter Basin Final Value Engineering (VE) Charette Report
- Feather River West Levee Project Final 408 Permission EIS
- USACE guidance Civil Works Review, (EC 1165-2-214) dated 15 December 2012
- Office of Management and Budget's Final Information Quality Bulletin for Peer Review released December 16, 2004.

In addition, throughout the review period, USACE provided documents at the request of panel members. These documents were provided to Battelle and then disseminated to the Panel as additional information only and were not part of the official review. A list of these additional documents requested by the Panel is provided below.

- 2013_04-22 MFF_Climate Change_Sensitivity_Final
- 2013_08-05 MFF_Climate Change_Sensitivity_Final
- Document 2013_07-24-162901_National Marines Fisheries Service Confirmation
- Sutter_Agricultural Damages_7-15-13
- 2013_07_15_MMF_AG_EAD_REV_PJB

About half-way through the review of the Sutter Basin review documents, a teleconference was held with USACE, the Panel, and Battelle so that USACE could answer any questions the Panel had concerning either the review documents or the project. Prior to this teleconference, Battelle submitted 27 panel member questions to USACE. USACE was able to provide responses to the majority of the questions during the teleconference; the remaining panel member questions that required additional coordination within USACE were addressed by USACE by August 6, 2013.

3.4 Review of Individual Comments

The Panel was instructed to address the charge questions/discussion points within a charge question response table provided by Battelle. At the end of the review period, the Panel produced individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. As a result of the review, Battelle summarized the comments into a preliminary list of 21 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

3.5 IEPR Panel Teleconference

Battelle facilitated a 4-hour teleconference with the Panel so that the panel members could exchange technical information. The main goal of the teleconference was to identify which issues should be carried forward as Final Panel Comments in the Final IEPR Report and decide which panel member would serve as the lead author for the development of each Final Panel Comment. This information exchange ensured that the Final IEPR Report would accurately represent the Panel's assessment of the project, including any conflicting opinions. The Panel engaged in a thorough discussion of the overall positive and negative comments, added any missing issues of high-level importance to the findings, and merged any related individual comments. In addition, Battelle confirmed each Final Panel Comment's level of significance to the Panel.

The Panel also discussed responses to one specific charge questions where there appeared to be disagreement among panel members. The conflicting comments were resolved based on the professional judgment of the Panel, and the Panel agreed to develop a Final Panel Comment based on their responses.

At the end of these discussions, the Panel identified 17 comments and discussion points that should be brought forward as Final Panel Comments.

3.6 Preparation of Final Panel Comments

Following the teleconference, Battelle prepared a summary memorandum for the Panel documenting each Final Panel Comment (organized by level of significance). The memorandum provided the following detailed guidance on the approach and format to be used to develop the Final Panel Comments for the Sutter Basin IEPR:

- Lead Responsibility: For each Final Panel Comment, one Panel member was identified as the lead author responsible for coordinating the development of the Final Panel Comment and submitting it to Battelle. Battelle modified lead assignments at the direction of the Panel. To assist each lead in the development of the Final Panel Comments, Battelle distributed the merged individual comments table, a summary detailing each draft final comment statement, an example Final Panel Comment following the four-part structure described below, and templates for the preparation of each Final Panel Comment.
- Directive to the Lead: Each lead was encouraged to communicate directly with the other panel members as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.
- Format for Final Panel Comments: Each Final Panel Comment was presented as part of a four-part structure:
    1. Comment Statement (succinct summary statement of concern)
    2. Basis for Comment (details regarding the concern)
    3. Significance (high, medium, low; see description below)
    4. Recommendation(s) for Resolution (see description below).
- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:
    1. High: Describes a fundamental problem with the project that could affect the recommendation, success, or justification of the project. Comments rated as high indicate that the Panel analyzed or assessed the methods, models, and/or analyses and determined that there is a "showstopper" issue.
    2. Medium: Affects the completeness of the report in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium indicate that the Panel does not have sufficient information to analyze or assess the methods, models, or analyses.
    3. Low: Affects the understanding or accuracy of the project as described in the report, but will not affect the recommendation or justification of the project. Comments rated as low indicate that the Panel identified information (tables, figures, equations, discussions) that was mislabeled or incorrect or data or report sections that were not clearly described or presented.

- Guidance for Developing Recommendations: The recommendation section was to include specific actions that USACE should consider to resolve the Final Panel Comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

Two additional Final Panel Comments were prepared by individual panel members and submitted to the entire Panel for consideration after the panel review teleconference, bringing the total from 17 to 19 Final Panel Comments. Battelle reviewed and edited the Final Panel Comments for clarity, consistency with the comment statement, and adherence to guidance on the Panel's overall charge, which included ensuring that there were no comments regarding either the appropriateness of the selected alternative or USACE policy. At the end of this process, 19 Final Panel Comments were prepared and assembled. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Final Panel Comments are presented in Appendix A of this report.

4. PANEL DESCRIPTION

Candidates for the Panel were identified using Battelle's Peer Reviewer Database, targeted Internet searches using key words (e.g., technical area, geographic region), searches of websites of universities or other compiled expert sites, and referrals. Battelle prepared a draft list of primary and backup candidate panel members (who were screened for availability, technical background, and COIs), and provided it to USACE for feedback. Battelle made the final selection of panel members.

An overview of the credentials of the final four members of the Panel and their qualifications in relation to the technical evaluation criteria is presented in Table 2. More detailed biographical information regarding each panel member and his or her area of technical expertise is presented in the text that follows the table.

Table 2. Sutter Basin IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Ator	Leeman	Coulton	Sisson (dual role)
Civil Works Economics				
Minimum 10 years of demonstrated experience in public works planning economics	X			
Direct experience working for or with USACE	X			
Familiar with USACE plan formulation process, procedures, and standards	X			

Technical Criterion	Ator	Leeman	Coulton	Sisson (dual role)
as it relates to FRM				
Minimum 5 years of experience directly dealing with the USACE six-step planning process, governed by Engineer Regulation (ER) 1105-2-100, Planning Guidance Notebook	X			
Familiar with the USACE FRM analysis and economic benefit calculations, including use of standard USACE computer programs such as the Hydrologic Engineering Center – Flood Damage Reduction Analysis (HEC – FDA) program	X			
Experience with the National Economic Development (NED) analysis procedures, particularly as they relate to FRM	X			
Participation in related professional societies	X			
M.S. degree or higher in economics	X			
Biology/Ecology				
Minimum 10 years of demonstrated experience in evaluating and conducting National Environmental Policy Act (NEPA) impact assessments, including cumulative effects analyses, for complex multi-objective public works projects with competing trade-offs		X		
Extensive background experience and working knowledge with the implementations of NEPA compliance process		X		
Extensive background experience and working knowledge with the Endangered Species Act (ESA) requirements		X		
Experienced in NEPA/California Environmental Quality Act (CEQA) process and analysis and have a biological or environmental background that is familiar with the project area		X		
M.S. degree or higher in an appropriate field of study		X		
Geotechnical Engineering *(dual role)*				
Registered professional engineer having a minimum 10 years of experience in geotechnical engineering				X
Demonstrated experience in performing geotechnical evaluation and geo-civil design for FRM projects				X

Technical Criterion	Ator	Leeman	Coulton	Sisson (dual role)
Familiar with, and have demonstrated experience related to, USACE geotechnical practices associated with:				
a. levee and floodwall design and construction				X
b. static and dynamic slope stability				X
c. seepage through earthen embankments				X
d. underseepage through the foundation				X
e. settlement evaluation of the FRM structures (including levee embankments, floodwalls, closure structures, and other pertinent features of the structures)				X
Capable of addressing the USACE Safety Assurance Review (SAR) aspects of all projects				X
Active participation in related professional engineering and scientific societies				X
Hydrology and Hydraulic Engineering				
Licensed professional engineer with a minimum 15 years of experience in hydrologic and hydraulic engineering			X	
Experience in watersheds ranging from 10 square miles (interior drainage) to 12,000 square miles			X	
Experience in reservoir regulation			X	
Understands computer modeling techniques used for this project including:				
a. HEC-FDA			X	
b. HEC-Hydrologic Modeling System (HEC-HMS)			X	
c. HEC-5 (or HEC-Reservoir Simulation [HEC-ResSim])			X	
d. HEC-River Analysis System (HEC-RAS)			X	
e. UNET			X	
f. FLO-2D			X	
Expert in hydraulics with an understanding of the dynamics of the both open channel flow systems and unconfined levee breach type flooding			X	

Technical Criterion	Ator	Leeman	Coulton	Sisson (dual role)
Experience in the evaluation of levees and flood walls, and non-structural measures involving flood warning systems, and flood proofing			X	
Experienced in risk and uncertainty analysis			X	
Active participant in related professional societies			X	
M.S. degree or higher engineering			X	
Civil Engineering *(dual role)*				
Registered professional engineer having a minimum 10 years of experience in civil or construction engineering				X
Demonstrated experience in performing construction management for all phases of FRM projects				X
Experience with:				
a. levee design				X
b. floodwall design				X
c. box culvert design				X
d. drainage structure design				X
e. utility relocation				X
Capable of addressing the USACE SAR aspects of all projects				X
Active participation in related professional engineering and scientific societies				X
M.S. degree or higher in engineering				X

Donald Ator, M.S., MBA

Role: Civil Works Economics
Affiliation: Independent Contractor

Mr. Ator is an independent consultant and economist with 34 years of specialized experience developing and analyzing economic data for Civil Works water resources planning, design, construction, and O&M as related to Civil Works projects. He earned his M.S. in Economics and Agricultural Economics and an MBA in Finance and Accounting from Louisiana State

University.

Mr. Ator's demonstrated experience involves working with 22 USACE districts nationwide, as well as with the Bureau of Land Management, Bureau of Reclamation, and the Department of Commerce. He was the Associate Director and Senior Economist for Gulf South Research Institute and project/program manager and senior economist at three private engineering firms. He has conducted more than 500 Civil Works projects that required the development of relevant and credible socioeconomic information and analysis. He also was responsible for performing the quality assurance review for all economic aspects of these Civil Works projects. His notable USACE experience with large, complex Civil Works projects with high public and interagency interest includes: the Missouri River Authorized Purposes Study Project Management Plan (Omaha and Kansas City Districts); the Plan of Study for the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basins Comprehensive Study (Mobile District); the Grand and White Lakes Water Management Study (New Orleans District); and the Reallocation of Storage from Flood Control to Hydropower, Economic Analysis, Greer's Ferry Lake (Little Rock District).

Mr. Ator's experience has made him intimately familiar with the USACE plan formulation process, procedures, and standards as they relate to FRM. He has demonstrated proficiency in the USACE six-step planning process, governed by Engineer Regulation (ER) 1105-2-100, Planning Guidance Notebook. This proficiency is evidenced by his development of a template for preparing project management plans or feasibility studies for the USACE Mississippi Valley Regional Planning and Environment Division-South in 2011, and field testing the template in 2012. Most recently, he worked with the USACE New Orleans District PDT to develop the project management plan for the West Shore Lake Pontchartrain Flood and Storm Damage Risk Reduction Project using the template he developed.

Mr. Ator is very familiar with the USACE FRM analysis and economic benefit calculations and standard USACE computer programs, including the Hydrologic Engineering Center-Flood Damage Reduction Analysis (HEC-FDA) program. A majority of the projects he has conducted required the use of HEC-FDA. He attended a USACE-sponsored workshop on the model certified version of HEC-FDA in March 2010 hosted by the Mississippi Valley Division. His related USACE experience includes: the Structure and Content Depth Damage Relationship Surveys, Ouachita Parish, Louisiana (Vicksburg District); the Development of Content to Structure Value Relationships for Urban Flood Control Economic Analysis, Cypress Creek, Texas (Galveston District.); and the Orleans Parish, Louisiana, Urban Flood Control Feasibility Study, Structure Inventory (New Orleans District).

Mr. Ator's experience with the National Economic Development (NED) analysis procedures, particularly as they relate to FRM, includes serving as a Team Leader in 2010 while embedded in the Plan Formulation Branch (USACE, New Orleans District). His responsibilities included directing plan formulation activities and providing project oversight and review to ensure compliance with USACE guidelines. In that capacity, he worked closely with PDTs to identify and evaluate measures and alternatives using appropriate planning methodologies on 13 FRM projects.

Mr. Ator is an active member of the Society of American Military Engineers, where he is currently serving on the Board of Directors, and the American Society of Civil Engineers (ASCE), where he served on the Report Card for Louisiana's Infrastructure Committee.

Linda Leeman, M.S.

Role: Biology/ecology
Affiliation: Ascent Environmental Inc.

Ms. Leeman is a senior biologist with Ascent Environmental and has over 18 years of experience in wildlife biology, habitat assessments, restoration and mitigation planning, and endangered species permitting. She earned her M.S. in natural resources from Humboldt State University and is a Certified Wildlife Biologist by the Wildlife Society. Ms. Leeman has extensive experience with the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA), and the federal and California Endangered Species Act (ESA) compliance for projects throughout northern and central California. Since 2000, she has prepared numerous impact analyses for biological resources and prepared documents in accordance with CEQA and NEPA requirements. The environmental review process included cumulative effects analyses, compliance with other environmental regulations, and public outreach and comment periods. She has worked on many complex, multi-objective public works projects with multiple objectives and competing trade-offs, including flood protection, flood flow conveyance, water supply reliability, riparian habitat restoration, and sensitive biological resource protection.

Ms. Leeman has extensive experience in the regulatory compliance process for water projects in California, particularly with the preparation of joint EIS/EIR documents. She prepared the biological analysis for NEPA and CEQA documents for projects such as the San Joaquin River Restoration Program EIS/EIR, Contra Costa Water District Alternative Intake Project EIS/EIR, Shasta Lake Water Investigation EIS/EIR, and Calaveras Dam Replacement Project EIR. Ms. Leeman is an expert in federal and state ESA compliance requirements. She oversaw the ESA compliance and monitoring process for three phases of the Sacramento Flood Control Agency's Natomas Levee Improvement Program. The program involved comprehensive levee improvements to address levee height deficiencies, levee seepage potential, and stream bank erosion conditions along the Natomas Basin perimeter levee system and habitat restoration to mitigate for significant impacts to threatened and endangered species. She is very familiar with the key endangered species in the project area, including Swainson's hawk, giant garter snake, and valley elderberry longhorn beetle.

Kevin Coulton, P.E., CFM

Role: Hydrology and hydraulic engineering
Affiliation: cbec, inc.

Mr. Coulton is a water resources engineer with cbec, inc. He has more than 28 years of experience in hydraulic engineering and hydrology. His experience includes riverine and coastal flood studies in the Pacific Northwest for the Federal Emergency Management Agency (FEMA) and state and local governments in California, Washington, Oregon, Idaho, and Montana. He earned his M.S. in civil/hydraulic engineering from Washington State University. He is a

certified floodplain manager (CFM) and is a registered professional engineer in the states of California, Idaho, Montana, Oregon and Washington.

Mr. Coulton has experience in a variety of watersheds and interior drainage areas, including Reclamation District 799 (RD799) levee breach analysis, California (5 square miles); Rio Santa Catarina watershed, Mexico (512 square miles); Owens Valley, California (3,300 square miles); Central Valley, California (42,000 square miles); and the area of coastal flood hazard zones estimated for the U.S. and U.S. Territories during the FEMA Coastal Demographics Study (3,536,000 square miles). His experience in reservoir regulation includes assessing the regulation of Barney Reservoir for the USACE Portland District as part of an EIS related to the expansion of that reservoir. Other direct reservoir regulatory experience includes evaluating the regulation of Hungry Horse Reservoir, Montana, for the Bonneville Power Administration and Bureau of Reclamation as part of an investigation of reservoir bank storage.

Mr. Coulton has experience with the HEC-1, HEC-Hydrologic Modeling System (HEC-HMS), HEC-2, HEC-River Analysis System (HEC-RAS), Storm Water Management Model (SWMM), Natural Resources Conservation Service (NRCS) Technical Release 55 (TR-55) and (TR-20), U.S. Geological Survey (USGS) Water-Surface PROfile computations (WSPRO), Hydrologic Simulation Program Fortran (HSPF), FLO-2D, MIKE-11, National Weather Service BREACH modeling packages. He also has experience with ESRI's Geographic Information System (GIS) software, which he utilized to analyze the entire United States to assess national flood risk. He understands the modeling techniques for the HEC-FDA program and has performed benefit-cost analyses for FEMA that use similar data and techniques such as stage-discharge functions, stage-damage functions, and damage categories. He managed and reviewed the development of HEC-HMS models to assess flood peak flows to the Rio Santa Catarina, Mexico, and also developed a HEC-HMS model to assess runoff in the 5 Mile Creek watershed near Boise, Idaho. He understands the modeling techniques used in HEC-5 and HEC-Reservoir Simulation (HEC-ResSim), and he has used the HEC-3 model to simulate the operation of reservoir systems. Mr. Coulton also developed a HEC-RAS model to evaluate flooding and sediment transport on Grant Creek in Missoula, Montana, and managed the development of a HEC-RAS model of the Feather River during the California Department of Water Resources (DWR) Central Valley Floodplain Evaluation and Delineation (CVFED) program. He understands the modeling techniques used for employing the UNET model such as unsteady flow, bridge hydraulics, submerged flow, and storage areas. Mr. Coulton was responsible for managing the development of FLO-2D models for the Feather River, Honcut Creek, Yuba River North, Bear River, Yankee Slough, and Coon Creek during the DWR CVFED program. Additionally, as part of an EIS, he managed the development of a FLO-2D model to assess potential flood inundation in downtown Los Angeles, California from the hypothetical failure of a 10-million-gallon cooling tank.

Mr. Coulton has performed numerous projects focused on open channel flow and several projects addressing levee breaching. For example, for the California Central Valley Flood Protection Plan (CVFPP), he managed and led the technical efforts to develop new spatial methods to assess channel floodplain morphology and flood potential, including height above river and flood inundation potential GIS analyses. Additionally, his graduate school work involved physical modeling of open-channel flow, field work related to stream restoration and fish passage, and coursework on fluid dynamics and open-channel hydraulics. He has experience in the evaluation

of levees, floodwalls, and non-structural measures for flood management. He is also experienced in risk analyses associated with flood frequency events and participated in a nationwide study for FEMA to define flood risk throughout the United States, and he is experienced in assessing uncertainty in the results of these analyses.

Mr. Coulton is a member of the Association of State Floodplain Managers, Northwest Regional Floodplain Managers Association, and ASCE.

Richard Sisson P.E., Ph.D. (dual role)

Role: Geotechnical and civil engineering
Affiliation: Barr Engineering Company

Dr. Sisson is a senior geotechnical consultant with the Barr Engineering Company. He has more than 25 years of experience in the field of geotechnical engineering and is a registered professional engineer in California and Alberta, Canada. He earned a Ph.D. in geotechnical engineering from the University of California, Berkeley.

Dr. Sisson's experience in the fields of geotechnical and civil engineering includes providing consulting services for levee upgrades; and engineering and project management for heavy civil infrastructure, water resources, transportation; and land development projects. Dr. Sisson has demonstrated experience with construction engineering for FRM projects, including the Twitchell Island Levee upgrade in the Northern California Delta Area, and the Horizon Dam construction and Horizon Dyke 10 projects in Canada. These projects also included static and dynamic slope stability analyses, and the Twitchell Island Levee upgrade included a stability assessment of the berms. Dr. Sisson performed stability analyses for the levee systems described above plus Horizon Dam, Horizon Waste Area 1, Horizon Raw Water Pond, and highway slopes and embankments in California, Idaho, and Colorado. In addition, he determined the static liquefaction potential for Little Bow Dam (Alberta, Canada), and assessed slope failures in Lethbridge Alberta, Canada. Dr. Sisson's experience in assessing seepage through levee systems and/or underseepage through the foundation is demonstrated by the projects described above, as well as water treatment levees in Whitehorse, Yukon Territory. He also managed seepage analyses performed for the 65-meter high Horizon Tailings Dam.

Dr. Sisson provided geotechnical levee design engineering services for the Byron Tract and Thornton levee system in California, and was the engineer of record for the design and construction of the Tar River Diversion system for the Horizon Mine that included a 30-meter high diversion dam. He is familiar with USACE guidance for floodwall design and has provided loading recommendations for numerous highway and land development retaining structures. Dr. Sisson is knowledgeable in assessing geotechnical conditions, analyzing earth stresses on buried structures, and providing backfill recommendations for box culvert designs. He is also experienced in providing geotechnical input to hydraulic and structural engineers responsible for the design of drainage structures. Utility relocation was a component of Dr. Sisson's geotechnical evaluations of the West Midnapore Storm Sewer Trunk and Crowchild Trail Stormwater Diversion Project, both located in Calgary, Alberta, Canada.

Dr. Sisson is capable of addressing all aspects of the USACE Safety Assurance Review (SAR).

For example, he performed risk assessments and developed Construction Quality Management Plans for the Horizon Dam and Horizon Dyke 10 projects. He also managed Suncor and Canadian Natural Resources Limited Horizon Geotechnical Expert Review Board meetings. He is a member of ASCE, the Canadian Geotechnical Society, and the Canadian Institute of Mining.

5. SUMMARY OF FINAL PANEL COMMENTS

The panel members agreed between each other on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012, p. D-4) in the Sutter Basin review documents. Table 3 lists the Final Panel Comments statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A of this report. The following summarizes the Panel's findings.

Hydrology and Hydraulic Engineering

The Panel acknowledges the unique setting of this project, with the associated significant existing flood risk, and recognizes the tremendous effort USACE has made to quantify the hydrologic and hydraulic (H&H) aspects of this study contributing to the identification of the TSP. The H&H analyses have been conducted following USACE standards and using reasonable methods and appropriate numerical models; however, several assumptions and methods require clarification, and the particular data used in the analyses need further explanation.

Of most concern is the apparent reliance of the study on a federal 1% (100-year) annual chance exceedance (ACE) event standard to achieve feasibility study planning objectives to reduce flood risk. This standard appears to conflict with a 2007 California law that requires flood protection to the 0.5% (200-year) ACE event in urban areas. Since the existing levees will be fixed-in-place and they begin to overtop during the 0.5% ACE event, project objectives would not be met with this higher standard because the project would not have the same flood protection currently stated for the 1% ACE event.

In addition, yet to a lesser extent, several technical assumptions are unclear or are not provided, and methods have not been fully articulated (for example, those related to climate change). As a result, the Panel was not able to confirm the validity of some aspects of the H&H analyses. These analyses used data of varying ages and/or periods of record, and doing so may have mischaracterized the 1% ACE flood event and resulting floodplains because "best available" data were not used. In light of changes that have occurred in the river systems over the intervening years and the existence of more recent data, the use of these older data could be better explained.

Geotechnical and Civil Engineering

The project clearly addresses a need to improve a levee system that has proven unreliable due to underseepage. However, the accuracy of calculated net benefit for the project concerns the Panel for two reasons. First, residual risks of levee failure in events up to and including the 1% ACE floodplain subsequent to repair have not been evaluated. Second, the Panel believes that calculations of geotechnical risk associated with the levees potentially overestimate actual probability of failure.

Residual risks subsequent to implementing either the National Economic Development (NED) project or the Locally Preferred Plan (LPP) do not appear to have been evaluated. In particular, the Panel is concerned about the potential for failure at the Union Pacific Railroad crossing and the long-term potential for rodent activity and other judgment-based geotechnical failure modes. This issue can be resolved by evaluating residual risks further, and incorporating costs into the calculation of net benefit as appropriate.

Geotechnical risk was calculated using methods described in Engineer Technical Letter (ETL) No. 1110-2-556. When written, the ETL reflected the developing nature of geotechnical reliability analysis by indicating the need for "inevitable adjustments and refinements in the procedure." The Panel strongly believes that any new geotechnical method must be calibrated using field observations. The Panel is not aware that this method has been calibrated or that it has been adjusted and refined. A general calibration for geotechnical reliability methods in their present state of development was recently provided by two pioneers in the field, J.T. Christian and G.B. Baecher, when they indicate that a major question is "why failures are less frequent than reliability studies predict." Recent published literature indicates that predicted failure frequencies are an order of magnitude larger than observed; therefore, the Panel believes that calculations of geotechnical risk likely overestimate failure probability and result in an overestimate of the project benefits. This issue can be resolved by considering alternate techniques that may reduce the calculated uncertainty (and thus the overestimate of failure probability) and then recommends an assessment and discussion of evaluating remaining uncertainty in calculated failure probability and resulting project benefits.

Civil Works Economics

The multi-objective formulation approach to analyze the draft array of alternatives, select the final array of alternatives, and select the TSP recommendation was well-founded and complied with USACE guidance. Placing equal emphasis on the other three accounts in the System of Accounts (Environmental Quality, Regional Economic Development, and Other Social Effects) rather than concentrating on the NED account was also appropriate. Including emphasis on the study objective of public and life safety in the evaluation metrics provided a more effective evaluation of the project than just focusing on the NED account. The evaluation and comparison of the alternatives based on multiple criteria, including monetary and nonmonetary effects; qualitative and quantitative data; and economic, public safety, environmental, and regional criteria improved the report's findings. However, the Panel was not able to evaluate the processes used to quantify the evaluation criteria because they were not provided. In addition, economic risk and uncertainty associated with future without-project conditions did not take into account expected population growth. Future without-project conditions were assumed to be the same as existing conditions, even though study area population is expected to more than double over the next 40 years. This issue can be resolved by explaining why the analysis of economic risk and uncertainty did not consider population growth.

Environmental

The Sutter Basin EIR/SEIS is thorough and well-written. Inclusion of the Fish and Wildlife

Coordination Report and Draft Mitigation and Monitoring Plan as appendices provides additional detail about the biological issues and adds to the thoroughness of the environmental analysis. However, although woodland vegetation removal is identified as a significant and unavoidable impact in the short term (until the mitigation plantings grow to maturity), the spatial impact is not evaluated in terms of potential long-term fragmentation of wildlife habitat. The ability of the proposed habitat mitigation to compensate for potential habitat fragmentation or interference with wildlife movement is not described. This can be addressed by discussing the potential spatial effect of vegetation removal, as well as the spatial relationship of the mitigation planting to where the impact would occur, would provide a more complete analysis.

Table 3. Overview of 19 Final Panel Comments Identified by the Sutter Basin IEPR Panel

No.	Final Panel Comment
	Significance – High
1	**The feasibility study planning objectives to reduce flood risk utilizing a federal 1% (100-year) annual chance exceedance (ACE) event appears to conflict with a 2007 California law that requires flood protection to the 0.5% (200-year) ACE event in urban areas.**
	Significance – Medium
2	**Residual risks associated with the 1% annual chance exceedance (ACE) event are not fully evaluated and may not be accounted for in the project costs.**
3	**The consequences of residual risk from events larger than the 1% annual chance exceedance (ACE) event are not adequately presented, and associated mitigation measures are not fully described.**
4	**The hydrologic and hydraulic analyses may have mischaracterized the 1% annual chance exceedance (ACE) event and resulting floodplains because "best available" data were not used.**
5	**The validity of some aspects of the hydraulic and hydrologic analyses cannot be confirmed because several assumptions are unclear or are not provided.**
6	**The 1957 design water profiles appear to be a key hydraulic design assumption, even though more recent data are available.**
7	**Methods used to develop geotechnical fragility curves have not been sufficiently calibrated by using observed frequency of actual failures.**
8	**The statistical parameters and methods used for seepage analyses result in excessive uncertainty in calculations of geotechnical reliability that may overestimate the project's net benefits.**
9	**Methods used to divide the levees into reaches may result in inaccurate calculations of geotechnical reliability that may impact the estimated net benefit of the project.**

Table 3. Overview of 19 Final Panel Comments Identified by the Sutter Basin IEPR Panel (continued)

No.	Final Panel Comment
10	The rationale for eliminating the setback levee alternative is not provided in sufficient detail, indicating that it may have been prematurely eliminated from the plan formulation objectives.
11	The sensitivity of the alternative selection process to the issue of climate change is unclear because the methodology has not been fully articulated.
12	The process for prioritizing project goals is not supported because the evaluation criteria used in the screening process were not quantified.
13	Economic risk and uncertainty associated with future without-project conditions were not considered when identifying the Tentatively Selected Plan.
14	The spatial effect of removing vegetation from the levees, which could result in long-term habitat fragmentation, is not discussed, although the total acreage loss is mitigated.
15	The impacts to environmental resources from operation and maintenance activities are not analyzed in accordance with relevant federal and state legislation.
16	The project's impact on the temporal loss of nesting habitat for Swainson's hawk is not evaluated.
	Significance – Low
17	The assumption that through-seepage does not contribute to geotechnical fragility is inconsistent with the description of the risk of through-seepage elsewhere in the report.
18	Evidence is not provided to support using slurry cutoff walls for levee underseepage instead of other repair options such as seepage berms and relief wells; therefore, it cannot be determined whether the optimum solution to seepage management was selected.
19	With regard to the future with-project conditions, the 50-year period of analysis extends over different years for different analyses, and some conditions are not evaluated.

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APPENDIX A

Final Panel Comments

on the

Sutter Basin IEPR

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Final Panel Comment 1

The feasibility study planning objectives to reduce flood risk utilizing a federal 1% (100-year) annual chance exceedance (ACE) event appears to conflict with a 2007 California law that requires flood protection to the 0.5% (200-year) ACE event in urban areas.

Basis for Comment

The first two feasibility planning objectives identified in Section 2.2.3 of the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) refer to reducing risks due to flooding. Subsequent alternatives developed to achieve these objectives are presented in the EIR/SEIS with reference to the 1% (1/100-year) ACE floodplain. However, California Senate Bill (SB) 5, signed into law on October 10, 2007, created a new 1/200-year event (i.e., 200-year level of protection) standard for urban development in the Central Valley; Yuba City and the City of Marysville are considered urban areas.

The design flood event used to evaluate and eventually select an alternative is a fundamental parameter and materially affects the outcome of the project design. For example, the Locally Preferred Plan (LPP) proposes to fix-in-place existing levees that can protect to the 1% ACE floodplain; however, they begin to overtop at the 0.5% ACE floodplain. Therefore, if the larger flood event is required, the project would not achieve the same flood protection currently shown at the 1% ACE floodplain. The apparent conflict has not been raised by the non-federal sponsors (the State of California Central Valley Flood Protection Board [CVFPB] and the Sutter Butte Flood Control Agency [SBFCA]), and a plan to present the benefits of this flood protection project with reference to the state-mandated 200-year level of protection has not been presented in the report.

Furthermore, a May 7, 2013, letter from Ms. Jo-Ellen Darcy (Assistant Secretary of the Army, Civil Works) (Appendix B) says the CVFPB will: "…support the Locally Preferred Plan (LPP) in lieu of the National Economic Development (NED) Plan in order to comply with California Government Code requirements for a 200-year level of protection for urban and urbanizing areas by 2025". This statement is also made in Section 7.1 of the EIR/SEIS.

The Panel acknowledges that the 0.5% (200-year) ACE and the 0.2% (500-year) ACE floodplain have been evaluated and discussed in the hydrology and hydraulics reports in Appendix C. Although Appendix B acknowledges the Assistant Secretary of the Army's approval of the LPP, the flood protection capabilities of the LPP (Alternative SB-8) appear to be presented solely with reference to the 1% ACE floodplain (which is believed to be inconsistent with State of California law).

Significance – High

Because the existing levees begin to overtop at the 0.5% ACE floodplain, the project objectives would not be met because the project would not achieve the same flood protection currently shown at the 1% ACE floodplain.

Recommendations for Resolution

1. Confirm and clarify the applicability of state and federal design flood standards governing U.S. Army Corps of Engineers projects having federal and non-federal sponsors.
2. Clarify the applicability of California SB5 to the Sutter Basin project.
3. Edit the EIR/SEIS and Appendix C accordingly to clarify the issues presented in this Final Panel Comment.
4. Provide results in the main body of the EIR/SEIS, through the use of text and figures, to demonstrate the ability of the LPP (Alternative SB-8) to achieve flood risk planning objectives for the 0.5% (200-year) ACE.

Literature Cited:

California Senate Bill No. 5, 2007. Chapter 364, Flood Management, October 10. http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0001-0050/sb_5_bill_20071010_chaptered.pdf. Accessed August 14, 2013.

Final Panel Comment 2

Residual risks associated with the 1% annual chance exceedance (ACE) event are not fully evaluated and may not be accounted for in the project costs.

Basis for Comment

It appears that residual risk of levee failure in events up to and including the 1% ACE floodplain have not been fully evaluated. Specific residual risks that should be considered are:

- The need for manual intervention at the Union Pacific railroad crossing of the levee. (The description of the intervention is also inconsistent. It is unclear whether stop-logs or sand bags are the planned method to prevent overtopping.)
- Slope instability after levee repair.
- "Judgmental" failure modes such as encroachments that remain after repair, rodent activity subsequent to repair, and defects in slurry walls and other proposed repairs.

Significance – Medium

The overall project costs would be more accurate if the probable annual costs associated with residual risk are included.

Recommendations for Resolution

1. Clarify whether stop-logs or sand bags are planned to address the low levee elevation at the railroad crossing.
2. Describe and, if necessary, assess the contribution of slope instability to geotechnical fragility to post-repair conditions.
3. Assess the effect of "judgment" contribution on post-repair conditions, including the potential for defects in the slurry walls.
4. Evaluate the probability that human error or failure of the stop-log/sand bag structure could lead to overtopping at the train track, and include the probability in the assessment of residual risk.
5. Develop fragility curves for post-repair conditions if the assessed risk due to slope instability or judgment is considered significant.
6. Calculate the equivalent annual cost associated with residual risk of failure after levee repair.

Final Panel Comment 3

The consequences of residual risk from events larger than the 1% annual chance exceedance (ACE) event are not adequately presented, and associated mitigation measures are not fully described.

Basis for Comment

Appendix C provides estimates of the 0.5% (200-year) and 0.2% (500-year) ACE peak flows and flood profiles, and Section 4.1.4 of the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) describes "levee superiority" where controlled failure of the levees from overtopping will occur between the 0.5% and 0.2% ACE events. However, "residual risk" is predominantly addressed in the EIR/SEIS only in association with the 1% ACE flood event. For example, Section 3.4.2.1 of the EIR states that: "Alternatives that removed communities and population from the [1% ACE] residual floodplain were determined generally to have a lower residual risk ranking". However, less frequent (i.e., larger) floods may occur, and a description of this possibility and the consequences should be addressed to fully communicate the risk of flooding.

Furthermore, "residual risk" is not clearly defined in the EIR/SEIS. A 2013 report by the National Research Council (NRC) states: "Residual risk is the risk that remains after considering the mitigating effects of structural, nonstructural, and other risk reduction measures. Residual risk is always present behind a levee, because no levee is failsafe". (NRC, 2013)

This statement means there are residual risks associated with flood events less frequent than the 1% ACE. The NRC report also states: "If development behind a levee substantially increases [over time] the consequences of a levee failure or overtopping will also substantially increase…" (NRC, 2013). In other words, residual risk may increase with increased development.

For the Sutter Basin project, the current without-project potential levee failure from underseepage presents one residual risk scenario, while the future with-project condition may still lead to residual risk from a flood greater than the 1% ACE event and associated levee failure from levee crest overtopping. While the EIR/SEIS focuses on improving and constructing levees to reduce risk, it briefly mentions or does not address other measures that federal, state, and local entities can take, including evacuation planning, contingency plans, risk communication, and zoning and building codes changes within the study area. These measures have the potential to significantly reduce residual risk in the future, under any flood scenario (NRC, 2013 [Figure 6-1]; USACE, 2013).

With respect to evacuation planning, Section 3.4.4.1.2 of the EIR/SEIS (p. 3-38) states: "Other internal evacuation routes from populated areas to the higher ground of Sutter Buttes or the town of Sutter were considered not viable due to the number of connector

roads that would need to be raised. Evacuating to essentially an "island" at Sutter Buttes would be high risk and difficult to logistically support in emergencies. Evacuation out of the flooding area is always a best practice where practicable".

Evacuation routes, shown in Figure 3-9, indicate three routes to the east across the Feather River; however, the supporting text in Section 3.4.6.1.2 describes the risk associated with these routes because flooding would occur in essentially all directions. No viable evacuation routes appear to be presented in the study.

The Panel believes evacuation planning is a significant public safety element of the project. For that reason, the assumptions made to select (and reject) specific evacuation routes must be clear. For example, the EIR/SEIS should clarify whether a traffic study was considered in evacuation planning to assess traffic volume and patterns during a flood event. Also, if people remain in the study area and are in imminent threat of loss of life, especially if the design capacity of the project is exceeded (e.g., levee overtopping occurs), evacuation to the high ground of Sutter Buttes may be the only logical alternative.

With respect to zoning, the association of "residual risk" to "potentially developable floodplains" is unclear. For example, the characterization of alternative effects in Appendix A, Table 17, includes the "Wise Use of Floodplains". This metric appears to be solely related to acreage for "future development". Table ES-2 summarizes "life safety metrics for residual risk" and shows a 40 percent increase in potentially developable floodplain acreage between the LPP and no-action alternative. Section ES.8.4 of the EIR/SEIS states: "The wise use of floodplains concept, as described in [Executive Order] EO 11988, was incorporated as a life safety evaluation metric for this study".

The Panel did not find a reference to "wise use" in EO 11988 (1977) and is concerned that development is being implied in areas where residual risk will exist, and potentially increase. The Panel acknowledges that local flood-related issues listed in Section ES.2 of the EIR/SEIS imply "wise" floodplain policies that will sustain agricultural land use in the southern portion of the basin and allow limited growth adjacent to the existing communities. However, the potential for increased development has not been stated.

Significance – Medium

The project is being designed to the federal 1.0% (100-year) ACE floodplain and risk has been addressed to the level of this standard; however, flooding is a highly uncertain phenomenon, and it is not clear how residual risk will be dealt with for events greater than the 1.0% (100-year) ACE floodplain.

Recommendations for Resolution

1. Define "residual risk", "potentially developable floodplains", and other terms used in conjunction with residual risk in the Sutter Basin EIR/SEIS.
2. Revise the discussion on all measures capable of reducing initial risk to a residual

risk level (see Figure 6-1 of NRC, 2013).
3. Revise the discussion on how residual risk will be addressed for events greater than the 1% ACE standard.
4. Consider the use of numerical hydraulic model capabilities to guide evacuation planning, such as the ability of the FLO-2D model to estimate times to reach specified flood depths.
5. Clarify whether the potential for increased development in residual risk locations within the study area has been considered.

Literature Cited:

NRC (2013). Levees and the National Flood Insurance Program: Improving Policies and Practices. National Research Council. The National Academies Press, Washington, DC. 258 pp. Available at http://www.nap.edu/catalog.php?record_id=18309. Accessed August 14, 2103.

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Final Panel Comment 4

The hydrologic and hydraulic analyses may have mischaracterized the 1% annual chance exceedance (ACE) event and resulting floodplains because "best available" data were not used.

Basis for Comment

The data used in the Sutter Basin project have come from various sources and, accordingly, the datasets have various ages and/or periods of record. In its review of the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) and supporting technical materials, the Panel noted several instances where "best available" data were not mentioned as being used in the hydrologic and hydraulic analyses, or an acknowledgment was not made as to why more recent data were available but not used. The use of older data, as opposed to "best available" data, may change technical findings that affect the alternative selection process and/or the assumed ability of the preferred alternative to provide the desired level of flood protection. Some examples are presented below.

- Terrain data for hydraulic modeling were apparently obtained from the 2002 Sacramento and San Joaquin River Basins Comprehensive Study (Comp Study) and from United States Geological Survey (USGS) data, as mentioned in Section 3.3 of the Appendix C hydraulics report. It is not clear why the more recent Department of Water Resources (DWR) Central Valley Floodplain Evaluation and Delineation (CVFED) (DWR, 2012a) terrain data (derived from LIDAR flown in 2008) were stated as being used in the hydrologic and hydraulic analyses – in Appendix C, Engineering Appendix, Section 2.5.2 – but apparently were not used in the hydraulic modeling. As part of the CVFED program, the LIDAR data were augmented by field surveys of channel bathymetry and hydraulic structures, and apparently these CVFED data were used in the construction of the channel and hydraulic structures for the Hydrologic Engineering Center-River Analysis System model of Wadsworth Canal, as described in Section 3.3.b.(1) and (3) of the Appendix C hydraulics report.

- It is not clear why DWR Central Valley Hydrology Study (CVHS) (DWR, 2012b) data were not used in the hydrologic and hydraulic analyses.

- This study adopted rain flood frequency curves prepared during the 2002 Comp Study from stream gage data with a period of record ending in 1997; however, Section 2.5 of the Appendix C hydraulics report, Table 3, shows that most of the stream gages in the Sutter Basin study area have periods of record ending in 2010. Current baseline conditions would ideally be based on all available data.

- The Panel acknowledges that the inclusion of annual peak flow data over the intervening 13-year period may not significantly affect estimates of the lower frequency events if the frequency analyses were to be redone. However, it is noted that the 13th-largest flood on the Feather River at Oroville, as shown in Section 2.5 of the Appendix C hydraulics report, Table 4, appears to have been

omitted from the flood frequency statistics used in this study.

- In some cases, data that were presented for informational purposes (i.e., not used in the study) were not representative of the most current data assumed to be available. For example, precipitation data shown in Tables 3 and 4 of the hydrology report are dated 2004. The Panel assumes that more recent data are available.

Significance – Medium

The use of older data, as opposed to "best available" data, could raise concerns about whether the results of the hydrologic and hydraulic analyses accurately reflect the impact of the predicted 1% ACE event.

Recommendations for Resolution

1. Provide the rationale for using the data presented in the EIR/SEIS and supporting technical documentation, and acknowledge the existence of other data that may be considered "best available" data.
2. Provide examples of sensitivity testing to demonstrate the relative changes anticipated in using different datasets.

Literature Cited:

DWR (2012a). Central Valley Floodplain Evaluation and Delineation (CVFED) Program. California Department of Water Resources. Available at http://www.water.ca.gov/floodsafe/docs/CVFED.pdf. Accessed August 14, 2013.

DWR (2012b). Central Valley Hydrology Study (CVHS), FloodSAFE Focus, October 2012 (Volume 3, Issue 3), October. California Department of Water Resources. Available at http://www.water.ca.gov/floodsafe/newsletters/cv-hydro-study.cfm. Accessed August 14, 2013.

Final Panel Comment 5

The validity of some aspects of the hydraulic and hydrologic analyses cannot be confirmed because several assumptions are unclear or are not provided.

Basis for Comment

Overall, many assumptions in the hydraulic and hydrologic analyses appear to be sound and reflect standards of practice; however, some assumptions require clarification or are not provided. Specific examples of assumptions the Panel found unclear or missing are described below and organized into general categories associated with the analyses.

1. Hydrologic Engineering Center-River Analysis System (HEC-RAS) modeling – Several assumptions related to this modeling were not clear:
    - Appendix C, Section 3.3.a.(9), states that to establish the downstream boundary condition for the modeling, the current rating curve for the United States Geological Survey (USGS) gage on the Sacramento River at Verona was modified to reflect the average conditions expected throughout the life of the project. A review of Plate 7 indicates that the rating curve was raised (median estimate) from the current curve (USGS Rating Table V-2). It is not clear why the current USGS rating curve was not used (perhaps it was raised to reflect long-term channel aggradation expected over the 50-year project life) and what the underlying assumptions were to modify the current curve.
    - Appendix C, Section 3.3.a.(1), states that the HEC-RAS model was built using 1999 cross-section data from the 2002 Sacramento and San Joaquin River Basins Comprehensive Study (Comp Study), as opposed to data from the 2008 Central Valley Floodplain Evaluation and Delineation (CVFED) Program.
    - Appendix C, Section 3.3.a.(5), states that blocked obstructions in the HEC-RAS model extend from the levee centerline to the end of the cross section on the landward side. It is not clear if this is the levee geometry that was assumed in the hydraulic modeling.
2. Levee overtopping and breaching - Several assumptions related to these analyses were not clear:
    - The Panel noted the extensive wind wave runup analysis provided in Appendix C, Section 3.6 (and by reference Sections 4.6 and 5.6), of the hydraulics report and Table 20 estimates that runup heights up to 7 feet may occur. However, Section 3.8a states that wind wave runup and setup were not included in the assurance calculations. It is not clear why wave runup and setup were assumed not to occur and therefore were not included in the assurance calculations. Also, the 2011 report titled “Sutter Basin wave runup analysis” mentioned in Section 3.6 is assumed to have been prepared specifically for this study; however, it is not included as an attachment to the hydraulics report, nor is it available in the supporting materials to the best of the Panel’s knowledge.
    - Section ES.8.1 in the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) indicates that erosion control will

be provided at two locations where levee overtopping is anticipated (when the design capacity is exceeded) to increase the resiliency of the overtopped section and increase flood warning and evacuation time prior to overtopping failure. Section 4.1.4 of the EIR/SEIS and Section 8.5.3 in Appendix C, Geotechnical Report, describes "levee superiority" design and how erosion protection matting will be installed on the landside of the levee in these locations. The Panel could not locate, either in the EIR/SEIS or in the Appendix C engineering reports, the assumptions or design calculations estimating the hydraulic conditions (overtopping discharges, velocities, shear stresses, durations, etc.) used in the design of the erosion protection matting.

- Appendix C, Section 3.8.c, states that a 1,500-foot-wide breach width was used for the simulations based on a sensitivity analysis presented in the F3 Sutter Basin Feasibility Study report. The Panel could not find this report attached to the hydraulics report, or in other materials, to understand why a 1,500-foot breach width was assumed. Similarly, Appendix C, Section 3.8.c, states that a 1-hour breach formation time was assumed, but no basis for this assumption is provided.
- Appendix C, Section 3.8.c, states that all breach scenarios assume levees were overtopped without failure at all locations other than the breach location. However, the Feather River levee breaches were initiated at the beginning of the flood simulation, and breaches on the Cherokee Canal were initiated 1 hour before the peak flood stage. If levee failure is based on physical overtopping of the levees, it is not clear why levee breaching was initiated prior to the peak flood stage.
- Appendix C, Section 3.8.d.(1), states the following: "…velocities from levee breaches within 1000 feet of the breach were assumed to be great enough to destroy buildings…" and "This distance is based on evaluation of the 1955 levee breach which showed structures knocked off their foundations." It is not clear why the FLO-2D model was not used to estimate flood velocities and velocity x depth relationships. Panel member experience includes the application of FLO-2D in Federal Energy Regulatory Commission dam failure inundation mapping projects, where the model was used to estimate time to specific flood depths at locations of downstream campgrounds to guide emergency action planning.

3. Loss of life and building damage – Several assumptions related to the assessment of flood risk to people and property are unclear:
   - Appendix C, Section 3.8.g, states the following: "…to evaluate the potential for loss of life, the population density within the study area was compared to the composite floodplain maps". It is not clear whether the population was assumed to be uniformly distributed throughout a census block or whether the population within a block was assumed to be concentrated in or near habitable structures (where people would likely be during a flood event) prior to the comparison with composite floodplain maps. The latter would provide a more

realistic estimate of loss-of-life potential. Also, it is not clear whether any consideration was given to the portion of the population capable of evacuating, or if it was assumed that no people would have evacuated.

- Potentially developable land is defined in Section ES.8.4 of the EIR/SEIS as land within the 1% ACE floodplain that would flood to a depth of less than 3 feet. Section 3.4.4.1.2.of the EIR/SEIS indicates that flood depths of 1 to 3 feet are "shallow" in the northern portion of the study area; however, Section ES.6.3 of the EIR/SEIS states that flood depths in this same area are "shallow" at depths up to 6 feet.
  - Section ES.8.4 of the EIR/SEIS states the following: "Potentially developable floodplain is developable land within the 1% ACE floodplain that would flood to a depth of less than 3 feet". If "developable" implies constructing buildings, the velocity of floodwaters should be considered together with the depth of flooding. For "shallow" flood depths ranging to 6 feet, the U.S. Army Corps of Engineers (USACE) Business Depth-Damage Analysis Procedures (USACE, 1985) provide building collapse curves as a function of flood water depth and velocity. For example, for Class D wood buildings (Figure C-1), building failure may occur at a 3-foot depth of water if velocities are approximately 8 feet per second or higher, and in 6 feet of water if velocities are 7 feet per second or higher. Also, breaking waves 1.5 feet or higher, potentially from wind wave generation across flooded land or from levee breach hydraulic effects, may cause damage to buildings. The Federal Emergency Management Agency recently established new guidance to define this threshold condition within AE Zones in coastal areas (FEMA, 2008); however, the transient conditions of interior flooding may replicate similar physical forces in this riverine setting.

Significance – Medium

Several assumptions used in the hydrologic and hydraulics analyses are unclear, which could affect the understanding of the associated findings and how they support the Tentatively Selected Plan.

Recommendations for Resolution

1. Clarify why the current USGS rating curve was not used in the HEC-RAS modeling.
2. Explain why the more recent CVFED HEC-RAS cross-section data were not used.
3. Discuss whether ground elevation data in the HEC-RAS model properly represent the sloped river side of the levee up to the elevation of the levee crest, where the blocked obstruction apparently begins (obstructions can only provide a vertical face), and explain why the levee option in HEC-RAS was not used to represent levees.

4. Explain why wave runup and setup estimates were made but not included in the assurance calculations.
5. Provide the assumptions or design calculations estimating the hydraulic conditions (overtopping discharges, velocities, shear stresses, durations, etc.) used in the design of the erosion protection matting.
6. Present the basis for the assumed 1,500-foot-wide breach width and 1-hour breach formation time.
7. Describe the basis for the assumption that initiates levee breaching prior to the peak flood stage.
8. Explain why the FLO-2D model was not used to estimate flood velocities and velocity x depth relationships.
9. Clarify the assumptions made to estimate populations from census block data and explain whether any portion of the population was assumed to be capable of evacuating.
10. Correct the apparent discrepancy in the definition of “shallow” flooding.
11. Explain why the velocity of floodwaters is not considered together with the depth of flooding when assessing “developable” floodplain land areas.
12. Describe the specific activities that would occur in “developable” floodplains, and clarify whether zoning and building code provisions would be changed to accommodate or restrict construction in floodplains.

Literature Cited:

FEMA (2008). Procedure Memorandum No. 50 – Policy and Procedures for Identifying and Mapping Areas Subject to Wave Heights Greater than 1.5 feet as an Informational Layer on Flood Insurance Rate Maps (FIRMs), December 8. Available at http://www.fema.gov/media-library/assets/documents/14801?id=3481. Accessed August 14, 2013.

USACE (1985). Business Depth-Damage Analysis Procedures. U.S. Army Corps of Engineers, Engineer Institute for Water Resources. Research Report 85-R-5. September 1985. Available at http://www.iwr.usace.army.mil/Portals/70/docs/iwrreports/85-R5.pdf. Accessed August 14, 2013.

Final Panel Comment 6

The 1957 design water profiles appear to be a key hydraulic design assumption, even though more recent data are available.

Basis for Comment

Section 3.2.1.1.1 of the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) states: “The 1957 design profile and operations and maintenance manuals for the [Sacramento River Flood Control Project] define the currently authorized design flow, design water surface elevation, and minimum design top of levees. In no cases would the reconstructed levee height exceed the existing or 1957 design profiles”. Additionally, hydraulic design assumptions, listed in Section 3.1 of the hydraulics report (see Appendix C), include a key assumption that “all existing federal levees are assumed to be maintained to the 1957 design top of levee” which is “based on the 1957 design water surface profiles”. However, Tables 16 and 17 in the hydraulics report show instances where the 2008 National Levee Data Base Top of Levee elevation is lower than the1957 Design Top of Levee elevation in several locations along the Sutter Bypass and Wadsworth Canal. It is not clear if the older 1957 levee elevations are being relied upon for design when newer 2008 data indicate that the actual levee elevations may be lower than elevations shown in the 1957 data.

In addition, Table 2-1 in Section 2.6.3 of Appendix C shows 1957 Design Flows compared to Regulated Peak Flows. In 8 out of 12 cases, the regulated 1% annual chance exceedance (ACE) peak flow is higher than the 1957 Authorized Design flow. It is not clear why the 1957 water surface profiles are relied on when the flood discharges associated with those profiles are lower in many cases than the 1.0% ACE design flows.

In Section 3.3.a.(10) of the Appendix C hydraulics report, the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center-River Analysis System model was modified from existing conditions by “undoing” the two major levee setback projects on the Feather River so that the model could be calibrated to two historic (1997 and 2006) floods using the channel/floodplain geometry and hydraulic roughness that existed at that time. The Panel acknowledges that the intent of this effort was to re-create the historic conditions to properly associate high water marks to simulated historic flood water surface profiles. Accordingly, it is not clear why the 1957 flood profiles are currently relied upon without accounting for channel/floodplain geometry and hydraulic roughness changes that may have occurred over the intervening years.

Significance – Medium

Assuming that the hydraulic design has been performed to USACE standards, the design implications between the Sacramento District’s standard practice to use the 1957 design profiles versus other hydraulic data are not clear.

Recommendations for Resolution

1. Review all references to the 1957 design criteria and clarify how those criteria are used (or not used) in relationship to the design 1% ACE.
2. Clearly state early in the design documentation the implications of using the 1957 design profiles versus other hydraulic data.

Literature Cited:

USACE (2008). National Levee Database (NLDB). Available at http://www.usace.army.mil/Missions/CivilWorks/LeveeSafetyProgram/NationalLeveeDatabase.aspx. Accessed August 14, 2013.

Final Panel Comment 7

Methods used to develop geotechnical fragility curves have not been sufficiently calibrated by using observed frequency of actual failures.

Basis for Comment

The fragility curves used to calculate the probability of geotechnical failure are based on the U.S. Army Corps of Engineers (USACE) Engineer Technical Letter (ETL) No. ETL-1110-2-556 (USACE, 1999) (hereafter referred to as ETL556). ETL556 was published in 1999 and is now well past its expiration date of June 2004. ETL556 acknowledged the need for calibration with "inevitable adjustments and refinements in the procedure." A subsequent National Science Foundation (NSF) review (2000) of USACE procedures recommended: "…that the Corps undertake statistical ex post studies to compare predictions of geotechnical levee failure probabilities made by the reliability model against frequencies of actual levee failures during floods. In addition, the committee recommends that the Corps conduct statistical ex post[4] studies with respect to the performance of other flood damage reduction structures (e.g., embankments, detention basins, hydraulic facilities). These latter studies should be conducted in order to identify the vulnerabilities (failure modes) of these systems and to verify engineering reliability models."

The Panel is concerned that the predictions using ETL556 may lead to an overestimate of failure probability. The Panel strongly concurs that geotechnical methods must be calibrated using actual frequencies of levee failures during floods. It appears that while USACE has used the expert elicitation process to qualitatively calibrate underseepage specifically for this project as discussed below, no qualitative comparison has been performed by USACE in accordance with NSF recommendations. A general calibration is provided by Christian and Baecher (2011) when they indicate that one of ten major questions regarding geotechnical risk and reliability is "why failures are less frequent than reliability studies predict." They indicate that predicted failure frequencies are an order of magnitude larger than observed, and two orders of magnitude larger than the frequency of all modes failures of earth dams.

One result of the expert elicitation process used by the project was a reduction in failure probability at critical gradient that depended on river stage level, which might be considered calibration. The reduction recommended by the expert panel is significant at reasonably frequent river stages, and relatively small at rare (high) river stages.

Underseepage analysis relates failure to exit gradient, not river stage. The Panel believes that if the calculated failure probability at critical gradient overpredicts failures at frequent river stage levels, it would likely have a similar impact at infrequent river stages. Therefore, it may be more appropriate to adjust the failure probability based on exit gradient instead of river stage. The Panel notes that ETL556 describes limitations of the

[4] After the fact.

expert elicitation process such as overconfidence bias, motivational bias, and problems with cognitive discrimination with extremely low probability values. Furthermore, experts in levee management and maintenance may not have had specific geotechnical expertise in underseepage analyses or experience outside the Feather River Levee System. Considering these factors, one reasonable interpretation of the experts' recommendation is that the experts accurately calibrated performance where considerable experience exists (common flood stages), but overestimated the potential for failure where little experience exists (rare flood stages). Thus, the Panel does not believe that the expert elicitation sufficiently calibrates the methods in ETL556.

Significance – Medium

Overstating the failure probability associated with predicted poor levee performance would result in overstating project benefits.

Recommendations for Resolution

1. Assess whether the fragility curves and failure probabilities are statistically consistent with observed behavior of the Feather River Levees and have been appropriately extrapolated to relatively rare events such as the design flood.
2. Determine and discuss whether more advanced methods have been developed since ETL556 was issued that might improve confidence in the development of fragility curves.
3. Assess whether it is possible to evaluate and report the likely range in the reported failure probability and resulting project benefits in addition to the mean values.
4. Evaluate the probability of failure given that the probability of poor performance has been accurately extrapolated by expert elicitation to relatively rare events such as the design flood so that the probability of failure is consistent with geotechnical theory and observed performance.
5. Conduct sensitivity studies to determine the effect of reducing levee failure probability by one and two orders of magnitude.

Literature Cited:

Christian, J.T., and Baecher, G.B. (2011). Unresolved Problems in Geotechnical Risk and Reliability. Geo-Risk 2011: pp. 50-63. doi: 10.1061/41183(418)3.

NSF (2000). Risk Analysis and Uncertainty in Flood Damage Reduction Studies. National Science Foundation. The National Academies Press, Washington, D.C.

USACE (1999). Risk-Based Analysis in Geotechnical Engineering for Support of Planning Studies. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Technical Letter (ETL) No. 1110-2-556. May 28.

Final Panel Comment 8

The statistical parameters and methods used for seepage analyses result in excessive uncertainty in calculations of geotechnical reliability that may overestimate the project's net benefits.

Basis for Comment

Appendix C of the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) indicates that: "…the mean, standard deviation, and coefficient of variation for the blanket thickness, pervious layer thickness, and the permeability ratio (horizontal permeability of the pervious layer divided by the vertical permeability of the blanket layer) are calculated for each index point using nearby soil borings on the first sheet in the workbook."

The Panel is concerned about the accuracy of this approach and believes that computation of statistical parameters should be limited to common depositional environments. Given that levee reaches extend several miles, it appears likely that parameters are averaged for significantly different depositional environments.

In addition, statistical parameters have been adjusted to prevent negative (physically impossible) values of engineering parameters. The need to adjust parameters could be eliminated by improving the methods used to calculate statistical parameters with a resulting reduction in the calculated uncertainty for levee performance.

It is also not clear whether statistical parameters are calculated using samples sizes that, in at least some instances, are too small, because Appendix C of the EIR/SEIS does not provide sample sizes. Samples sizes that are too small are the rule rather than the exception in geotechnical engineering. Duncan (2000) notes that: "…if the only method of determining values of standard deviation was (computation from data), reliability analyses could not be used much in geotechnical engineering, because in most cases the data is insufficient for use". Duncan presents three other methods to determine standard deviation that may address both small sample size and large variance.

Significance – Medium

Use of methods that inflate statistical parameters describing variability may overemphasize the project's net benefits.

Recommendations for Resolution

1. Assess whether uncertainty could be reduced by calculating statistical moments for engineering parameters using only samples from a similar depositional environment.
2. Assess whether using methods for estimating variance presented by Duncan (2000) would reduce uncertainty.
3. Consider using lognormal random variables where appropriate.

Literature Cited:

Duncan, J.M. (2000). Factors of Safety and Reliability in Geotechnical Engineering. J. Geotech. Geoenviron. Eng., 126(4), 307–316. April.

Final Panel Comment 9

Methods used to divide the levees into reaches may result in inaccurate calculations of geotechnical reliability that may impact the estimated net benefit of the project.

Basis for Comment

The approach used to address spatial variability is to divide the levee into thirteen reaches of varying length using subjective criteria, including foundation conditions and levee geometry. Each reach is treated as a series element in a system. The typical length of these reaches is well beyond the distance where soil properties typically can be correlated, and is an order of magnitude larger than the typical reach of 500 meters used in a Dutch study referenced in the U.S. Army Corps of Engineers (USACE) Engineer Technical Letter (ETL) No. 1110-2-556 (USACE, 1999). Hollenback and Moss (2011) suggest that subjective criteria are not ideal when considering sensitivity of failure probability estimates to the number of reaches. The Panel does not have sufficient information to evaluate the selection of levee reaches and determine what effect the selection might have on the accuracy of the geotechnical fragility curves. The Panel recognizes that a fully defensible and practical method to divide the levee into reaches is currently unavailable to USACE because it appears that the geotechnical community has not reached consensus on an appropriate method for incorporating spatial variance when analyzing long structures. Nevertheless, testing state-of-the-art analysis methods in combination with sensitivity studies could be used to assess the influence of the levee reach selection on the calculated project benefits.

Significance – Medium

Inaccuracies in the methods for estimating geotechnical risk may result in inaccurate estimates of net project benefits.

Recommendations for Resolution

1. Conduct a detailed technical review to estimate whether significant errors may have been introduced by the method used to divide the levee into reaches.

Literature Cited:

USACE (1999). Risk-Based Analysis in Geotechnical Engineering for Support of Planning Studies. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Technical Letter (ETL) No. 1110-2-556. May 28.

Hollenback, J., and Moss, R. (2011). Bounding the Probability of Failure for Levee Systems. Geo-Risk 2011: pp. 468-475. doi: 10.1061/41183(418)44.

Final Panel Comment 10

The rationale for eliminating the setback levee alternative is not provided in sufficient detail, indicating that it may have been prematurely eliminated from the plan formulation objectives.

Basis for Comment

Ecosystem restoration and recreational opportunities make up 40 percent of the project's planning objectives. The Panel expected to see the rationale for eliminating the setback levee alternative because two of the five planning objectives listed in Section 2.2.3 of the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) relate to ecosystem restoration. Section ES 7.1 states that "…setback levees were the only [flood risk management] measure associated with potential measures that would improve ecosystem functions and recreation opportunities." Furthermore, Alternative 4.1, Setbacks with Ecosystem Restoration, was reported as achieving the highest performance score of all of the alternatives considered in the Value Engineering (VE) Study (p. 40). However, in Section 3.3.2 of the EIR/SEIS, Alternative 4.1 was screened out of further consideration because fix-in-place levee measures were found to be more efficient in terms of cost and addressing geotechnical issues. The VE Study indicates that the cost for Alternative 4.1 is $2,273,500,000, 65 percent higher than the $1,376,900,000 cost of the Preferred Alternative (Alternative 3.2). The VE Study (p. 4) states that the additional cost of Alternative 4.1 compared to Alternative 3.2 exceeds the additional restoration benefits.

Significance – Medium

Elimination of Alternative 4.1 from consideration in the final array of alternatives without providing the rationale affects the understanding of the purpose of the planning objectives.

Recommendations for Resolution

1. Provide a detailed rationale for eliminating Alternative 4.1.
2. Calculate the cost differential between fix-in-place and setback levee measures and compare the additional cost to the value of the ecosystem restoration benefits forgone.

Final Panel Comment 11

The sensitivity of the alternative selection process to the issue of climate change is unclear because the methodology has not been fully articulated.

Basis for Comment

Comments received during the scoping and public comment periods revealed climate change to be an area of controversy, as described in Section ES.8.5 of the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS). A June 2011 U.S. Army Corps of Engineers (USACE) policy requires the integration of climate change adaptation into all USACE projects (USACE, 2011). However, the Panel found the subsequent discussion of this topic relatively brief, fragmented, and ambiguous in the EIR/SEIS and in the Appendix C hydrology and hydraulics reports. Because the methodology for evaluating the alternatives in consideration of climate change is not clearly presented, the incorporation of climate change into the screening criteria is unclear.

For example, in the EIR/SEIS, climate change is presented in the context of air quality. However, Effect CC-3 (p. 4-52 of the EIR/SEIS) states the following: “The levee improvements are designed to accommodate changes in flood frequency and floodwater elevations caused by global climate change.”

A methodology and findings related to changes in floodwater elevations could not be found to support this statement.

Furthermore, Section 2.5 of the hydraulics report indicates that sea level rise would have no impact on the project, but the more important process to address is impacts from changing runoff processes. Section 2.5 also indicates that more information on the Hydrologic Engineering Center-Flood Damage Reduction Analysis (HEC-FDA) of climate change is provided in Appendix A, but that information was not found in that appendix.

The Panel requested the January 3, 2013, memorandum on the “Sensitivity of Alternative Selection to Climate Change” referenced in Section 4.8.4 of the Appendix C hydrology report and was subsequently presented with draft (April 22, 2013) and then final (August 5, 2013) versions of the document. Results in the final memorandum state:

“…although the regulated flow frequency curves (which are shifted based upon the unregulated flow frequency curves) show significant change between existing conditions. The resulting economics doesn’t see as significant a change due to the nature of depth damage curves and discounting of future damages to present value”.

The memorandum concludes: “The results indicate that the ranking of the alternatives

on the basis of net annual benefits is not sensitive to the climate change scenarios".

The Panel found this conclusion to be unsubstantiated because the methodology has not been fully articulated. Specific items in the climate change memorandum lacking clarity include the following:

- Section 5.0, Steps 2 and 3, indicate that the unregulated/regulated flow relationship at index points does not change under climate change scenarios based on hydraulic routing and reservoir operation simulation because reservoir rules and storage do not change. However, if more inflow is coming into a reservoir from a "wet" climate change scenario and reservoir rules and storage do not change, the Panel expected regulated outflow to change. In Section 9.0, annual damages are shown to have increased above existing conditions (6 percent to 16 percent), which implies that higher stages and associated higher discharges must have occurred under climate change scenarios, as can be expected.
- Section 5, Step 7, mentions a "period of analysis"; the Panel was not clear if this refers to the 2001-2049 timeframe mentioned in Section 6.0.
- Section 6.0 states that flood magnitudes for less than the 50% annual chance exceedance (ACE) were "extrapolated"; however, it was not clear why this was done.
- In Table 1, it is not clear why the Centre National de Recherches Meteorologiques (CNRM) increase of 35% percent does not change between the 2% and 1% ACE.
- Section 7.0 provides very clear hydrologic assumptions on unregulated flow frequency; however, assumptions on the conversion of these unregulated flows to regulated flows and subsequent damages are not provided.
- For the economic results presented in Section 9.0, the Panel assumed that the FLO-2D model was rerun to obtain revised flood stages from which to assess new damages from the unchanged stage-damage curves; however, this is not mentioned as part of the methodology.
- The Panel is not clear whether consideration was given to increased runoff from *unregulated* portions of the contributing drainage areas.

Significance – Medium

A detailed discussion of the specific methodology used to analyze the alternatives with respect to climate change would increase the understanding how climate change may impact the project objectives.

Recommendations for Resolution

1. Revise, as necessary, the methodology used to assess the sensitivity of alternative selection to climate change.
2. Coordinate discussion and conclusions of climate change between the EIR/SEIS and supporting documentation.

Literature Cited:

Darcy, J-E, 2011. USACE Climate Change Adaptation Policy Statement, June 3. http://corpsclimate.us/adaptationpolicy.cfm. Accessed August 19, 2013.

Final Panel Comment 12

The process for prioritizing project goals is not supported because the evaluation criteria used in the screening process were not quantified.

Basis for Comment

The evaluation criteria used to prioritize project goals and the manner in which the goals were quantified must be clearly described in the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) in order to evaluate the results.

In Appendix B, Plan Formulation (B3. Plan Formulation, Multi-Criteria Analysis, Section 5. Evaluation Criteria), the following evaluation criteria/metrics are identified:

a) National Economic Development (NED) Costs
a) NED Benefits
b) Annualized Population at Risk
c) Critical Infrastructure – Life Safety
d) Critical Infrastructure – Regional
e) Wise Use of Floodplain
f) Environmental Effects
g) Ecosystem Restoration

The descriptions of these evaluation criteria and the process by which they were quantified are reported to be detailed in separate memoranda and were not available. The Panel was therefore not able to evaluate the results of the analysis.

Significance – Medium

The evaluation criteria and the processes by which they were quantified affect the Panel's understanding of the EIR/SEIS plan formulation process.

Recommendations for Resolution

1. Incorporate the specific evaluation criteria and the processes by which they were quantified in the Sutter Basin EIR/SEIS.

Final Panel Comment 13

Economic risk and uncertainty associated with future without-project conditions were not considered when identifying the Tentatively Selected Plan.

Basis for Comment

In Appendix H, Economics, of the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) (Decision Point #2), future without-project conditions are assumed to be the same as existing conditions (see Section 6.6, p.19).

The economic risk and uncertainty associated with future without-project conditions should take into account expected population growth discussed in the EIR/SEIS (Section 4.13.1, pp. 4-141 through 4-144). Population in the affected area is forecast to increase from 323,922 in 2010 to 724,490 by 2050, more than double (124 percent) the 2010 population over the 40-year period.

A doubling of the affected area's population over this timeframe would have a significant impact on future without-project flood damages, even if the future without-project development takes place above the mean 1 percent annual chance of exceedance (ACE) floodplain boundary/water surface elevation. This future without-project condition is dramatically different from existing conditions.

Significance – Medium

The economic risk and uncertainty under future without-project conditions could impact the project's expected flood risk reduction benefits.

Recommendations for Resolution

1. Develop a future without-project condition that accurately describes expected future conditions in the study area without the project.

Final Panel Comment 14

The spatial effect of removing vegetation from the levees, which could result in long-term habitat fragmentation, is not discussed, although the total acreage loss is mitigated.

Basis for Comment

The impact of removing riparian and oak woodland in compliance with the U.S. Army Corps of Engineers (USACE) Vegetation Engineer Technical Letter (ETL) (USACE, 2009) encompasses the entire length of the biological study area—41 miles. Effect WILD-11 in the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) (p. 4-111) does not discuss whether sufficient riparian vegetation would remain along the linear corridor to provide cover for wildlife movement. In addition, Mitigation Measure VEG-MM-1 does not discuss whether the proposed replacement planting at the two mitigation sites (Star Bend Conservation Area and Three Rivers Levee Improvement Authority Feather River Floodway Corridor Restoration Project) would provide a connected corridor of woodland vegetation that could be used for wildlife movement in the study area.

The loss of woodland is mitigated sufficiently in terms of total acreage (2:1 replacement-to-impact ratio).The EIR/SEIS includes a discussion of temporal impact and concludes that the loss would be a significant and unavoidable impact on riparian woodland because of the time required for the mitigation vegetation to grow after planting. Effect WILD-11, however, does not discuss the potential spatial impact of vegetation removal on wildlife movement corridors. Loss of connectivity of the woodland vegetation could result in habitat fragmentation and interfere with wildlife movement along the levee system because of a lack of vegetative cover and riparian habitat.

Significance – Medium

An evaluation of the spatial effect of vegetation removal from levees in compliance with the Vegetation ETL would strengthen the impact discussions in Effect WILD-11 (by clearly stating whether the vegetation removal would interfere with wildlife movement along the linear study area) and in Mitigation Measure VEG-MM-1 (by identifying whether the mitigation plantings would compensate for any significant habitat fragmentation).

Recommendations for Resolution

1. Discuss how vegetation removal in compliance with the Vegetation ETL would affect the spatial distribution of woodland habitat within the study area.
2. Include in Effect WILD-11 a conclusion about whether the vegetation removal would result in wildlife habitat fragmentation and whether the potential habitat fragmentation would interfere with wildlife movement in the project area.
3. Discuss how the mitigation plantings provided in Mitigation Measure VEG-MM-1 would compensate for habitat fragmentation if the spatial loss of woodland is determined to result in significant wildlife habitat fragmentation.

Literature Cited:

USACE (2009). Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Technical Letter (ETL) No 1110-2-571. April 10.

Final Panel Comment 15

The impacts to environmental resources from operation and maintenance activities are not analyzed in accordance with relevant federal and state legislation.

Basis for Comment

The Sutter Basin Environmental Impact Report/Environmental Impact Statement (EIR/SEIS) states that the existing project levees are subject to continuing Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) activities, and that the OMRR&R cost is expected to increase under the Tentatively Selected Plan (TSP) by approximately $22,000 (EIR/SEIS, p. 7-3). Section 7.1.2, p. 7-3, describes in general how the primary OMRR&R activities would change over time, but the environmental impacts of this change are not discussed.

Although some OMRR&R activities may be considered part of the existing baseline conditions, Chapter 4, Affected Environment and Environmental Consequences, does not describe how the activities might change under the proposed alternatives and does not analyze whether this change would have an impact on environmental resources. The effect of the OMRR&R activities on biological resources, in particular, is not described in the impact analysis (Sections 4.7 and 4.8 of the EIR/SEIS). Often, ongoing operational activities can have an adverse impact on biological resources through mechanisms such as repeated habitat removal or disturbance or spread of invasive weeds by maintenance activities. The impact analysis is silent on whether the OMRR&R activities would have an environmental effect on the individual environmental resources or a cumulative impact to those resources. This type of analysis is required under the National Environmental Policy Act and the California Environmental Quality Act.

Significance – Medium

Impacts to environmental resources may have been overlooked in the EIR/SEIS because the potential impacts of future changes in OMRR&R activities are not described.

Recommendations for Resolution

1. Provide more detail in the EIR/SEIS about the OMRR&R activities and how they may change under the alternatives. Clearly state what the changed OMRR&R activities would include.
2. Clearly state in the EIR/SEIS whether any of the OMRR&R activities are likely to adversely affect environmental resources.
3. Analyze and describe in Sections 4.7 and 4.8 of the EIR/SEIS whether impacts to the biological resources described in those sections would occur.
4. Determine whether OMRR&R activities should be considered within the cumulative context to evaluate potential cumulative impacts to biological resources (or other environmental resources) as appropriate.

Final Panel Comment 16

The project's impact on the temporal loss of nesting habitat for Swainson's hawk is not evaluated.

Basis for Comment

The Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) identifies the temporal gap between riparian woodland removal and restoration planting as a significant and unavoidable impact in the vegetation section (p. 4-82) and in the cumulative section (p. 4-147).

The impacts to nesting Swainson's hawk are described in Effect WILD-5 (EIR/SEIS, p. 4-106), with mitigation for loss of nesting habitat provided by Mitigation Measure VEG-MM-1. The mitigation plantings will take many years (likely more than 15 years) to grow large enough to provide suitable nesting habitat. Swainson's hawk tend to nest in tall trees in California's Central Valley, with the average height of a nest tree measured at 17.6 meters (Estep, 1989). The gap in time between the tree removal from the levees and the suitability of the replacement habitat could affect the number of nesting Swainson's hawk in the project area. The analysis in WILD-5 does not discuss whether the temporal (likely more than 15 years) loss of riparian woodland would be a significant impact to Swainson's hawk, as it is under Effect VEG-1, and thus could be considered incomplete.

Significance – Medium

A discussion of the project's potential impact on Swainson's hawk nesting habitat due to a temporal loss of suitable nesting trees would make the Section 4.8 analysis regarding this issue complete.

Recommendations for Resolution

1. Include in Effect WILD-5 the number of potential Swainson's hawk nesting pairs that could be affected by the vegetation removal based on available survey data or as reported to the California Natural Diversity Database (CNDDB 2013).
2. Discuss whether alternate nesting habitat is available to support potentially displaced nesting pairs.
3. Analyze whether the loss of riparian woodland would result in a regional loss of productivity for Swainson's hawk.

Literature Cited:

California Natural Diversity Database (CNDDB). 2013. California Department of Fish and Wildlife. Biogeographic Data Branch. Sacramento, California. http://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp. Accessed August 19, 2013.

Estep, J.A. (1989). Biology, movements, and habitat relationships of the Swainson's Hawk in the Central Valley of California, 1986-87. California Department of Fish and Game, Nongame Bird and Mammal Section Report, 52 pp.

Final Panel Comment 17

The assumption that through-seepage does not contribute to geotechnical fragility is inconsistent with the description of the risk of through-seepage elsewhere in the report.

Basis for Comment

Developing the fragility curves assuming that through-seepage does not contribute to geotechnical fragility is inconsistent with the description in the executive summary and is not supported by the Geotechnical Analyses for Pre-Design Formulation.
Through-seepage is described follows:

- The executive summary (p. ES-2) states that "*the Sutter Basin is still at serious risk of flood, not from levee overtopping, but from geotechnical failure as a result of under- and through-seepage*."
- The Geotechnical Analyses for Pre-Design Formulation (Enclosure M to Appendix C) (p. 3-2) states that: "*Some locations along the [Feather River West Levee] have experienced other geotechnical-related problems during high water events that appeared to have been associated with through-seepage, landside instability, waterside instability, or erosion*".
- Appendix C (p. 5-7) states "*The through-levee seepage performance mode was not included in the development of fragility curves"* and "*there is almost no history of this performance mode causing levee distress in the two levee systems covered under the [Sutter Basin Pilot Feasibility Study]"*.

Significance – Low

The quality of the report would be improved by describing and treating the risk of through-seepage consistently.

Recommendations for Resolution

1. Develop a consensus regarding the risk level associated with through-seepage, conduct analyses as appropriate, and revise the text of the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement appropriately.
2. Include risks in the development of geotechnical fragility curves. If the risks are not considered significant, revise the text of the executive summary. Alternatively, if the risks are as described in the Geotechnical Analyses for Pre-Design Formulation, explain why the through-seepage problems are not significant enough to include in the determination of geotechnical fragility curves.

Final Panel Comment 18

Evidence is not provided to support using slurry cutoff walls for levee underseepage instead of other repair options such as seepage berms and relief wells; therefore, it cannot be determined whether the optimum solution to seepage management was selected.

Basis for Comment

Section 8.4.2 indicates that slurry cutoff walls are the primary feature for remediating geotechnical deficiencies. A list of five points is provided to qualitatively support this decision; however, no quantification is provided. The decision criteria appear to be cost (capital and maintenance), effectiveness, and environmental impact. Although the Panel considers these criteria appropriate, it does not find the evidence presented in support of slurry walls to be compelling. As described in Enclosure B of the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) Geotechnical Appendix to the Feasibility Study, several reaches of levee have been repaired in the past using other means such as seepage berms and relief wells, so it does not appear that slurry walls are necessarily a superior solution.

Significance – Low

Although the application of slurry cutoff walls is an acceptable solution, more cost-effective alternatives may exist that will increase the net benefits of the project.

Recommendations for Resolution

1. Conduct a value engineering analysis that examines alternative repair options for levee underseepage.

Final Panel Comment 19

With regard to the future with-project conditions, the 50-year period of analysis extends over different years for different analyses, and some conditions are not evaluated.

Basis for Comment

Section 2.2.3 of the Sutter Basin Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) states: “All of the [planning] objectives focus on activity within the study area and within the 50-year period of analysis”.

The Panel noted several instances where the 50-year planning period was different and future conditions were mentioned, but the implications of these future conditions were not specifically addressed within the context of the future with-project condition.

For example, Section 2.3 of the EIR/SEIS states: “Future without-project conditions for this study are projected assuming a base year of 2020 and a 50-year period of analysis out to 2070.”

However, a climate change sensitivity analysis was conducted for a future 50-year period from 2001-2049. It is not clear why these 50-year periods extend over different years. Also, the years comprising the 50- year (and 10- and 30-year) period are not specifically identified in Appendix A, Economic Analysis.

Regarding population, estimates of the number of people that will be protected by this project into the future are based solely on the 2010 Census. The Panel expected projections of population growth (or decline) over the project’s 50-year time period to better articulate the long-term population at risk and associated public safety issues.

Regarding natural processes, Sections 3.4 and 3.7 in the Appendix C hydraulics report describe annual sedimentation rates and stream stability (note that Section 3.4 references acre-feet/year and Section 3.7 tons/year). The existing conditions are adequately described; however, given the 50-year planning period for the project, the Panel questions whether consideration was given to assessing future channel aggradation/degradation and river meander migration and the ensuing potential geologic or hydraulic impacts to the existing levees that will be fixed-in-place under the Preferred Alternative.

Significance – Low

The long-term viability of design assumptions that may change over time (such as the effects of river sedimentation on channel geometry and flood elevations) or anthropogenic changes (population growth/decline) and their implications on flood risk may affect alternative selection.

Recommendations for Resolution

1. Review and confirm that the specific dates of the 50-year planning period for this project are coordinated between design, economics, climate change, and other pertinent analyses, or at least explain the differences.
2. Review Section 2.3 of the EIR/SEIS (Critical Assumptions Affecting Development of Future Without-Project Conditions) and confirm that all reasonable assumptions are addressed. For example, consider identifying the physical and anthropogenic changes that may occur over this 50-year period, such as sedimentation rates and population growth/decline, and assess the implications of these changes on design assumptions and alternative selection.

APPENDIX B

Final Charge to the Independent External Peer Review Panel as Submitted to USACE on July 19, 2013

on the

Sutter Basin IEPR

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Charge Questions and Guidance to the Peer Reviewers for the Independent External Peer Review of the Sutter Basin Pilot Feasibility Draft Report – Draft Environmental Impact Report (EIR)/Supplemental Environmental Impact Statement (SEIS)

BACKGROUND

The purpose of the study is to identify flood risk management (FRM) issues. The decision document, a General Investigation Feasibility Report/EIS/EIR, will be reviewed by Headquarters, U.S. Army Corps of Engineers (HQUSACE) for approval and is expected to be the basis for a recommendation to Congress for authorization of a new project. The report will present planning, engineering, and implementation details of the recommended plan to allow final design and construction to proceed subsequent to approval of the recommended plan. The project is a General Investigations study undertaken to evaluate structural and non-structural FRM measures including improvements to existing levees, construction of new levees, and other storage, conveyance and non-structural options. The feasibility phase of this project is cost shared 50 percent Federal, 50 percent non-Federal with the project sponsors, the State of California Central Valley Flood Protection Board (CVFPB) and the Sutter Butte Flood Control 6 Agency (SBFCA).

The study will focus on FRM alternatives within the study area. The non-Federal sponsors, the CVFPB and SBFCA, are primarily interested in reducing flood risk to Yuba City and other communities in the study area, as well as protecting public infrastructure in terms of life safety. The study area is essentially encircled by project levees of the Sacramento River Flood Control Project and the high ground of the Sutter Buttes. Geotechnical analysis and historical performance during past floods indicate the project levees are at high risk of failure due to underseepage.

The study area is roughly bounded by the Feather River, Sutter Bypass, Wadsworth Canal, Sutter Buttes, and Cherokee Canal. The study area covers approximately 285 square miles and is 43 miles long and 9 miles wide. The study area includes the communities of Yuba City, Live Oak, Gridley, and Biggs, with a total population of approximately 80,000. Flood waters potentially threatening the study area originate from the Feather River watershed or the upper Sacramento River watershed, above Colusa Weir.

A historic levee failure in 1955 caused damage and loss of life. There have been three breaches in levees adjacent to the study area since 1986 and more are expected. High water in 1997 required extensive flood fighting and forced a mass evacuation, including the entire city of Yuba City, CA. The risk of unexpected levee failure coupled with the consequence of flooding presents a threat to public safety, property, and critical infrastructure.

On 18 February 2011, the Sutter Basin Feasibility Study, Sutter Basin, California, was designated as one of the first pilot studies for the USACE National Pilot Program. The pilot initiative for the Sutter Basin Feasibility Study provide an opportunity to test principles that have been outlined in the *USACE Recommendations for Transforming the Current Pre-Authorization*

Study Process (January 2011) and associated presentation materials. This new process has not been business as usual and has required heavy involvement as well as input and decisions from the Vertical Team at multiple points throughout the study. Instead of following the traditional USACE planning milestones, the pilot study has been divided into four phases each with a key decision point and associated in-progress reviews;

- Decision Point 1 – Determination of continued Federal interest and Vertical Team concurrence on risk and study methodology.
- Decision Point 2 – Tentatively Selected Plan agreement and vertical team approval to release Draft Report for Policy, IEPR, and Public Review.
- Decision Point 3 – Civil Works Review Board Approval to release the final report for State and Agency Review.
- Decision Point 4 – Signed Chief's Report.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Sutter Basin Pilot Feasibility Study, Sutter Basin, California: Draft Feasibility Report – Environmental Impact Statement/Environmental Impact Report (EIS/EIR) (hereinafter: Sutter Basin IEPR) in accordance with the Department of the Army, USACE, Water Resources Policies and Authorities' *Civil Works Review* (EC 1165-2-214, dated December 15, 2012), and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

Peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community. Peer review typically evaluates the clarity of hypotheses, validity of the research design, quality of data collection procedures, robustness of the methods employed, appropriateness of the methods for the hypotheses being tested, extent to which the conclusions follow from the analysis, and strengths and limitations of the overall product.

The purpose of the IEPR is to assess the "adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (EC 1165-2-214; p. D-4) for the Sutter Basin documents. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by subject matter experts (i.e., IEPR panel members) with extensive experience in Civil Works Economics, biology/ecology, civil engineering, hydrology and hydraulic engineering, and geotechnical engineering issues relevant to the project. They will also have experience applying their subject matter expertise to flood risk management.

The Panel will be "charged" with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. Per EC 1165-2-214, Appendix D, review panels should identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods. Review panels should be able to evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable. Reviews should focus on assumptions, data, methods, and models. The

panel members may offer their opinions as to whether there are sufficient analyses upon which to base a recommendation.

DOCUMENTS PROVIDED

The following is a list of primary and secondary review documents and reference materials that will be provided for the review.

Documents for Review

The following primary documents are to be reviewed by each designated discipline:

Primary Review Documents[5]		
Title	**Approximate Number of Pages**	**Required Disciplines**
Sutter Basin – Draft Pilot Feasibility Study Report EIS/EIR	400	All Disciplines
Risk Register	5	All Disciplines
Engineering Appendix:		
Engineering Appendix Overview 2-185	185	Hydrology & Hydraulics Engineering/ Civil Engineering/Geotechnical Engineering
Hydrology office summary report 186-283	98	Hydrology & Hydraulics Engineering/ Civil Engineering/Geotechnical Engineering
Hydraulic Design and Analysis 284-504	221	Hydrology & Hydraulics Engineering
Geotechnical Design 505-1095	591	Civil Engineering/Geotechnical Engineering
Civil Design 1096-1176	81	Civil Engineering/Geotechnical Engineering
Cost Engineering 1177-1524	348	Civil Engineering/Geotechnical Engineering
Cost Estimates 1525-1529	5	Civil Engineering/Geotechnical Engineering
Economics Appendix	40	Civil Works Economics
Real Estate Appendix	90	Civil Works Economics
Plan Formulation Appendix	55	Civil Works Economics
Environmental Appendix	300	Biology/Ecology
Total Pages	**2,433**	

[5] Reviewed in total by each panel member listed under required disciplines as it pertains to their technical area.

Primary Review Documents[5]	
Title	**Required Disciplines**
Technical Memorandums	As needed for all Disciplines
Feather River West Levee Project Final 408 Permission EIS	As needed for all Disciplines
SBFCA Geotechnical Reports	As needed for all Disciplines
H&H References Directory	As needed for all Disciplines
Sutter Basin Final (VE) Charette Report	As needed for all Disciplines

Documents for Reference

- USACE guidance *Civil Works Review,* (EC 1165-2-214, December 15, 2012)
- Office of Management and Budget's Final Information Quality Bulletin for Peer Review (December 16, 2004) memorandum M-05-03.

SCHEDULE

This final schedule was based on the July 9, 2013 receipt of the final review documents. The schedule will be revised upon receipt of final review documents.

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	7/15/2013
	Battelle convenes kick-off meeting with panel members	7/16/2013
	Battelle convenes kick-off meeting with USACE and panel members	7/16/2013
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	7/22/2013
	Panel members complete their individual reviews	7/26/2013
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members with talking points for Panel Review Teleconference	7/30/2013
	Battelle convenes Panel Review Teleconference	7/30/2013
	Battelle provides Final Panel Comment templates and instructions to panel members	7/31/2013
	Panel members provide draft Final Panel Comments to Battelle	8/6/2013
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	8/7-8/12/2013
	Battelle finalizes Final Panel Comments	8/13/2013
	Battelle provides Final IEPR Report to panel members for review	8/15/2013
	Panel members provide comments on Final IEPR Report	8/15/2013
	*Battelle submits Final IEPR Report to USACE	8/19/2013
Comment/ Response Process	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	8/20/2013
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process (if necessary)	8/20/2013
	USACE provides draft PDT Evaluator Responses to Battelle	8/26/2013
	Battelle provides the panel members the draft PDT Evaluator Responses	8/27/2013
	Panel members provide Battelle with draft BackCheck Responses	8/29/2013
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	8/30/2013
	Battelle convenes Comment-Response Teleconference with panel members and USACE	8/30/2013
	USACE inputs final PDT Evaluator Responses to DrChecks	9/4/2013
	Battelle provides PDT Evaluator Responses to panel members	9/5/2013
	Panel members provide Battelle with final BackCheck Responses	9/6/2013
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	9/9/2013
	*Battelle submits pdf printout of DrChecks project file	9/10/2013
Civil Works	Panel prepares and/or reviews slides for CWRB	9/15/2013

Task	Action	Due Date
Review Board (CWRB)	Civil Works Review Board	9/18/2013

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the Sutter Basin documents are credible and whether the conclusions are valid. The Panel is asked to determine whether the technical work is adequate, competently performed, properly documented, satisfies established quality requirements, and yields scientifically credible conclusions. The Panel is being asked to provide feedback on the economic, engineering, environmental resources, and plan formulation. The panel members are not being asked whether they would have conducted the work in a similar manner.

Specific questions for the Panel (by report section or Appendix) are included in the general charge guidance, which is provided below.

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Sutter Basin documents. Please focus your review on the review materials assigned to your discipline/area of expertise and technical knowledge. Even though there are some sections with no questions associated with them, that does not mean that you cannot comment on them. Please feel free to make any relevant and appropriate comment on any of the sections and appendices you were asked to review. In addition, please note the following guidance. Note that the Panel will be asked to provide an overall statement related to 2 and 3 below per USACE guidance (EC 1165-2-214; Appendix D).

1. Your response to the charge questions should not be limited to a "yes" or "no." Please provide complete answers to fully explain your response.
2. Assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, and any biological opinions of the project study.
3. Assess the adequacy and acceptability of the economic analyses, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, and models used in evaluating economic or environmental impacts of the proposed project.
4. If appropriate, offer opinions as to whether there are sufficient analyses upon which to base a recommendation.
5. Identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods.
6. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable
7. Please focus the review on assumptions, data, methods, and models.

Please **do not** make recommendations on whether a particular alternative should be implemented, or whether you would have conducted the work in a similar manner. Also please **do not** comment on or make recommendations on policy issues and decision making. Comments should be provided based on your professional judgment, **not** the legality of the document.

1. If desired, panel members can contact one another. However, panel members **should not** contact anyone who is or was involved in the project, prepared the subject documents, or was part of the USACE Agency Technical Review (ATR).
2. Please contact the Battelle Project Manager (Dick Uhler, uhlerr@battelle.org) or Program Manager (Karen Johnson-Young (johnson-youngk@battelle.org) for requests or additional information.
3. In case of media contact, notify the Battelle Program Manager, Karen Johnson-Young (johnson-youngk@battelle.org) immediately.
4. Your name will appear as one of the panel members in the peer review. Your comments will be included in the Final IEPR Report, but will remain anonymous.

Please submit your comments in electronic form to Dick Uhler, uhlerr@battelle.org, no later than July 26, 2013, 10 pm ET.

Independent External Peer Review of the

Sutter Basin Pilot Feasibility Draft Report – Draft Environmental Impact Report (EIR)/Supplemental Environmental Impact Statement (SEIS) Charge Questions and Relevant Sections as Supplied by USACE

General Questions

1. Within the context of risk-informed decision-making, to what extent has it been shown that the project is technically sound?

2. Are the assumptions that underlie the engineering, and environmental analyses sound?

3. Within the context of risk-informed decision-making, are the engineering, and environmental methods, models and analyses used adequate and acceptable?

4. Were all models used in the analyses used in an appropriate manner with assumptions appropriately documented and explained?

5. Were risk and uncertainty sufficiently considered?

6. Was the process used to select the recommended alternative rational and was the process implemented in a reasonable manner given the project constraints?

7. Does the environmental assessment satisfy the requirements of NEPA? Were adequate considerations given to significant resources by the project?

8. Assess the recommended alternatives from the perspective of systems. It should also include systemic aspects being considered from a temporal perspective, including the potential effects of climate change.

Safety Assurance Review Questions

9. Within the context of risk-informed decision-making, were the methods used to evaluate the condition of the structural features adequate and appropriate given the circumstances?

10. Have the appropriate alternatives been considered and adequately described for this project and do they appear reasonable?

11. Within the context of risk-informed decision-making, do the project features adequately address redundancy, resiliency, or robustness with an emphasis on interfaces between structures, materials, members, and project phases?

12. For the current design developed, are the quality and quantity of the surveys, investigations, and engineering sufficient to assess expected risk reduction?

13. Have the hazards that affect the structures been adequately documented and described?

14. Are the models used to assess hazards appropriate?

15. Are the assumptions made for the impacts appropriately documented and explained in the report documentation and/or risk register?

16. Is there sufficient information presented to identify, explain, and comment on the assumptions that underlie the engineering analyses? Has the risk register adequately documented assumptions and corresponding risks associated information associated with the various engineering analyses?

17. Are there any additional analyses or information available or readily obtainable that would affect decisions regarding the structures?

18. Does the physical data and observed data provide adequate information to characterize the structures and their performance? If not, is the risk register documented accordingly?

19. Have all characteristics, conditions, and scenarios leading to potential failure, along with the potential impacts and consequences, been clearly identified and described? Have all pertinent factors, including but not necessarily limited to population-at-risk been considered?

20. Does the analysis adequately address the uncertainty given the consequences associated with the potential loss of life for this type of project?

21. From a public safety perspective, is the proposed alternative reasonably appropriate or are there other alternatives that should be considered?

22. Has anything significant been overlooked in the development of the assessment of the project or the alternatives?

23. Do the alternatives and their associated costs appear reasonable? Do the benefits and consequences appear reasonable?

Specific Charge Questions
for the
Sutter Basin Pilot Feasibility Draft Report –
Draft Environmental Impact Report (EIR)/Supplemental
Environmental Impact Statement (SEIS)
Independent External Peer Review

Study Information

24. Is the purpose of the project adequately defined? If not, why?

25. Has the project need been clearly described?

Problem Description and Objectives

26. Are the specific objectives adequately described?

27. In your opinion, are there any other issues, resources, or concerns that have not been identified and/or addressed?

Alternatives

28. Has the criteria to eliminate plans from further study been clearly described?

29. Is each of the different alternative plans clearly described?

30. Within the context of risk-informed decision-making, were the assumptions made for use in developing the future with-project conditions for each alternative reasonable? Were adequate scenarios considered? Were the assumptions reasonably consistent across the range of alternatives and/or adequately justified where different?

31. Are the changes between the without- and with-project conditions adequately described for each alternative?

32. Have comparative impacts been clearly and adequately described?

33. Comment on the optimization and incremental analysis process for the final array of alternatives.

34. Was the multi objective analysis and its evaluation metrics used to look beyond the NED into the other accounts (Other Social Effects [OSE]) adequate and appropriate?

35. Are future Operation, Maintenance, Repair, Replacement, and Rehabilitation efforts adequately described and are the estimated cost of those efforts reasonable for each alternative?

36. Are there any unmitigated environmental impacts not identified and if so could they impact project designs?

37. Please comment on the likelihood of the recommended alternative will achieve the expected outputs.

38. Are residual risks adequately described and is there a sufficient plan for communicating the residual risk to affected populations?

39. Within the context of risk-informed decision-making, have the impacts to the existing infrastructure, utilities, and transportation infrastructure been adequately addressed?

Affected Environment

40. Is the description of the climate in the study area sufficiently detailed and accurate?

41. Is the description of wetland resources in the project area complete and accurate?

42. Is the description of aquatic resources in the project area complete and accurate?

43. Is the description of threatened and endangered species resources in the study area complete and accurate?

44. Is the description of the historical and existing recreational resources in the study area complete and accurate?

45. Is the description of the cultural resources in the study area complete and accurate?

46. Is the description of the historical and existing socioeconomic resources in the study area complete and accurate? Were specific socioeconomic issues not addressed?

Environmental Consequences

47. Have impacts to significant resources been adequately and clearly described?

48. To what extent have the potential impacts of the alternatives on significant resources been addressed and supported?

49. Are the scope and detail of the potential adverse effects that may arise as a result of project implementation sufficiently described and supported?

50. Have impacts from borrow areas been adequately and clearly described?

Cumulative Impacts

51. Are cumulative impacts adequately described and discussed? If not, please explain.

Mitigation

52. Are mitigation measures adequately described and discussed? If not, please explain.

Traffic

53. Were mitigation measures proposed during construction adequately described and discussed? If not, please explain why.

Hydrology and Hydraulics

54. Was the hydrology discussion sufficient to feasibility scope to characterize current baseline conditions and to allow for evaluation of how forecasted conditions (with- and without-proposed actions) are likely to affect hydrologic conditions?

Geotechnical Engineering

55. Is the description of the geomorphic and physiographic setting of the proposed project area accurate and comprehensive?

56. Were the geotechnical analyses adequate and appropriate for the current level of design as presented in the report documentation?

Design

57. Have the design and engineering considerations presented been clearly outlined and will they achieve the project objectives?

58. Are any additional design assumptions necessary to validate the preliminary design of the primary project components?

59. Are the assumptions used to determine the cost of operations and maintenance for the proposed project adequately documented and explained?

Real Estate Plan

60. Comment on the extent to which assumptions and data sources used in the economics analyses are clearly identified and the assumptions are justified and reasonable.

61. Does the Real Estate Plan adequately address all real estate interests (public and private)?

Relocations

62. Have potential relocations as a result of the project been adequately addressed?

Hazardous, Toxic, and Radioactive Waste

63. Comment on the extent to which impacts of the alternatives may have on hazardous, toxic, and radioactive waste issues?

Cost Estimates and Economics

64. Were the benefit categories used in the economic analysis adequate to calculate a benefit-to-cost ratio for each of the project alternatives?

65. Was the methodology used to determine the characteristics and corresponding value of the structure inventory for the study area adequate?

66. Were the methods used to develop the content-to-structure value rations appropriate and were the generated results applicable to the study area?

67. Were the methods to develop the depth-damage relationships appropriate and were the generated results applicable to the study area?

68. Has the economic analyses addressed the issue of repetitive flood damages and the subsequent extent of rebuild/repair by property owners as it relates to annual damage estimation?

69. Were risk and uncertainty sufficiently considered in relation to future development?

70. To what extent have significant project construction costs been adequately identified and described?

71. Are the costs adequately justified?

Public Involvement and Correspondence

72. Based on your experience with similar projects, has adequate public, stakeholder, and agency involvement occurred to determine all issues of interest and to ensure that the issues have been adequately addressed to the satisfaction of those interested parties? Should additional public outreach and coordination activities be conducted?

FINAL OVERVIEW QUESTION

73. What is the most important concern you have with the document or its appendices that was not covered in your answers to the questions above?

Summary Questions

74. Please identify the most critical concerns (up to 5) you have with the project and/or review documents. These concerns can be (but do not need to be) new ideas or issues that have not been raised previously.

75. Please provide positive feedback on the project and/or review documents.