Final Independent External Peer Review Report Phase II Post-Authorization Decision Documents (PADD) for the Sacramento River Bank Protection Project (SRBPP), California

Prepared by
Battelle Memorial Institute

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

Contract No. W912HQ-10-D-0002
Task Order: 0025

March 27, 2015

Battelle
The Business of Innovation

This page is intentionally left blank.

CONTRACT NO. W912HQ-10-D-0002
Task Order: 0025

Final Independent External Peer Review Report Phase II Post-Authorization Decision Documents (PADD) for the Sacramento River Bank Protection Project (SRBPP), California

Prepared by

Battelle
505 King Avenue
Columbus, Ohio 43201

for

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

March 27, 2015

This page is intentionally left blank.

Final Independent External Peer Review Report Phase II Post-Authorization Decision Documents (PADD) for the Sacramento River Bank Protection Project (SRBPP), California

Executive Summary

PROJECT BACKGROUND AND PURPOSE

The Sacramento River begins near Mount Shasta in Northern California, flows through the northern Central Valley, and finally joins the San Joaquin River and Sacramento River Delta to discharge to the Suisan Bay.

The Sacramento River Bank Protection Project (SRBPP) is a part of the Sacramento River Flood Control Project (SRFCP). The SRFCP includes approximately 1,300 miles of levees along the Sacramento River, tributaries (American, Feather, Yuba, and Bear Rivers along with additional minor tributaries), and distributary sloughs. The SRFCP also includes the Moulton, Colusa, Tisdale, Fremont, and the Sacramento Flood Overflow Weirs and the Butte Basin and Sutter and Yolo Bypasses and Sloughs. Phase I is 435,000 linear feet of bank protection. Construction of Phase I was completed in 1975.

The purpose of Phase II of the SRBPP is to identify and repair sites along the Sacramento River and Tributaries that may have been weakened due to erosion, while concurrently providing mitigation for any environmental impact as detailed in the supporting Environmental Impact Statement/Environmental Impact Report (EIS/EIR). This portion of Phase II consists of 80,000 linear feet of bank protection along the Sacramento River and tributaries. Authority has been given to Phase II (405,000 linear feet) of this project by Section 202 of the River Basin Monetary Authorization Act of 1974 (Public Law 93-252) and through a joint resolution of Congress (PL 97-377). The additional 80,000 linear feet was authorized by the Water Resources Development Act (WRDA) of 2007. The overall cost of the study is to be cost shared 75 percent Federal, 25 percent non-Federal with the project sponsor, the State of California Central Valley Flood Protection Board (CVFPB).

The appropriate decision document for Phase II (SRBPP) is a Post-Authorization Change Report (PACR). This project is authorized for construction; no further plan formulation or determination of Federal interest is needed. A PACR and supporting documents will in turn support the Project Partnership Agreement (PPA) between the non-Federal sponsor CVFPB and the U.S. Army Corps of Engineers (USACE). There are a number of technical and policy issues that are required to be resolved. Issues will typically involve the USACE vertical team (Division and Headquarters). The PACR will document issue resolution.

Phase III is programmatic future work that will become more defined as Phase II is completed. Prior to any Phase III construction, a General Reevaluation Report (GRR) will be done to resolve planning and policy issues and reformulate remedial action for the SRFCP in light of current conditions and new and upcoming Federal, state, and local activities in the basin. The Phase III reevaluation may be

accomplished under the current SRBPP authority; however, it is anticipated that the reevaluation would result in a recommended plan that would require new or amended authorization.

The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Phase II Post-Authorization Decision Documents (PADD)[1] for the Sacramento River Bank Protection Project (SRBPP), California (hereinafter: SRBPP IEPR) in accordance with procedures described in the Department of the Army, USACE Engineer Circular (EC) *Civil Works Review* (EC 1165-2-214) (USACE, 2012) and the Office of Management and Budget (OMB) *Final Information Quality Bulletin for Peer Review* (OMB, 2004). 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).

This final report presents the Final Panel Comments of the IEPR Panel (the Panel) on the existing engineering, economic, environmental, and plan formulation analyses contained in the SRBPP PADD IEPR documents (Section 4). Appendix A describes in detail how the IEPR was planned and conducted. Appendix B provides biographical information on the IEPR panel members and describes the method Battelle followed to select them. Appendix C presents the final charge to the IEPR panel members for their use during the review; the final charge was submitted to USACE on March 20, 2015.

Independent External Peer Review Process

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. USACE is conducting an Independent External Peer Review (IEPR) of the SRBPP 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 SRBPP PADD. The IEPR was external to the agency and conducted following USACE and OMB guidance described in USACE (2012) and OMB (2004). This final report presents the Final Panel Comments of the IEPR Panel (the Panel). Details regarding the IEPR (including the process for selecting panel members, the panel members' biographical information and expertise, and the charge submitted to the Panel to guide its review) are presented in appendices.

Based on the technical content of the SRBPP IEPR review documents and the overall scope of the project, Battelle identified potential candidates for the Panel in the following key technical areas: hydraulic engineering, Civil Works planning/economics, biology/ecology, civil/construction engineering, and geotechnical engineering. Battelle screened the candidates to identify those most closely meeting the selection criteria and evaluated them for COIs and availability. USACE was given the list of final candidates to confirm that they had no COIs, but Battelle made the final selection of the five-person Panel.

The Panel received electronic versions of the SRBPP IEPR review documents (2,596 pages in total), along with a charge that solicited comments on specific sections of the documents to be reviewed.

[1] The Post-Authorization Decision Documents (PADD) refer to the Post-Authorization Change Report (PACR), its appendices, and the SRBPP Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

USACE prepared the charge questions following guidance provided in USACE (2012) and OMB (2004), which were included in the draft and final Work Plans.

The USACE Project Delivery Team 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 charge questions.

IEPR panel members reviewed the SRBPP documents individually. The panel members then met via teleconference with Battelle to review key technical comments 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/high, medium, medium/low, or low); and (4) recommendations on how to resolve the comment. Overall, 16 Final Panel Comments were identified and documented. Of these, one was identified as having medium/high significance, three were identified as having medium significance, nine had medium/low significance, and three had low significance.

Results of the Independent External Peer Review

The panel members agreed 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 SRBPP review documents. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel's findings.

Based on the Panel's review, the SRBPP PADD is a good evaluation of an extremely complicated flood risk reduction project using the best available information and it is clear to the Panel that considerable effort has been put into the development of this information. The 16 Step implementation procedure outlined in Appendix B, Site Selection Process, used to prioritize site repairs is a logical approach to select the sites for design and construction under the current authorizations. Overall, the Panel felt that the PADD could have been better organized and it was difficult to find information in the documents. The Panel felt that the length of time that the project has been under way might have led to some inconsistencies, details that were difficult to understand, and some challenges in following the steps in project progression. The Panel identified several elements of the project that should be clarified or revised.

Hydraulic Engineering: The Panel was concerned that the PACR does not clearly describe how the original design criteria and current standards will be applied in the models and the design of measures for each action. Standard evaluation criteria and design parameters are needed to ensure that the project repairs will be consistent with the purpose of the project throughout its life. This problem could be resolved by specifying in the document which criteria and standards will be applied for the maintenance actions and how the original design criteria apply or why they do not apply. In addition, the Panel noted that some of the hydrologic and hydraulic methods and analyses are not clearly described in the PACR, in particular the fact that hydrologic changes since project construction have been determined to be insignificant because the bulk of runoff comes from the undeveloped mountainous regions of the basin. To resolve this, the PACR could use a description of the analysis of hydrologic and geomorphic changes

since project construction and how stream geomorphologic and hydrologic changes will be analyzed during the life of the project.

Geotechnical Engineering: The Panel noticed that the Annual Reconnaissance/Erosion Inventory does not appear to have a uniform set of criteria, qualitative or quantitative guidelines, or metrics to assess new erosion sites, evaluate their changes from year to year, or monitor performance of previously repaired sites. Without standardized quantitative and qualitative guidelines, differences in survey team member experience, expertise, and personal bias to influence surveys, repair site prioritization, and project implementation can be introduced to the project. This issue could be resolved by developing formal criteria, qualitative and quantitative guidelines, and performance metrics for use during the Inventory. Relatedly, the Panel sees a high potential for the levee waterside and bank slope angles to vary over the several years that pass between the Annual Reconnaissance/Erosion Inventories, site selection and implementation, preliminary and final design, and construction processes. These variations can lead to high uncertainty and significant cost adjustments associated with alternative designs, material quantities, and real estate acquisition. In addition, the Panel thought that the SRBPP appears to be one-dimensional in the evaluation and mitigation of bank erosion independently, and does not address it as part of a comprehensive integrated risk management or risk-informed design. The inclusion and description of a more comprehensive risk and uncertainty analysis will demonstrate that project benefits are being maximized and that the cost and schedule estimates are reliable. This issue can be resolved by conducting a more comprehensive and integrated risk and uncertainty analysis, in concert with other on-going improvement projects, incorporating PFMA for all potential failure modes.

Civil Works Planning/Economics: The hydraulic and hydrologic engineering models and analyses are not clearly described or referenced in the PACR, in particular the models that were used to assess the life safety hazards and to identify the extent of the inundation areas. The report would be improved by including a more detailed description of the models, assumptions, and criteria used to assess life safety hazards. In addition, the Panel noted that the PACR does not describe the residual risk to the non-Federal sponsor and the floodplain occupants that will exist following project implementation. USACE should provide a detailed description of the residual risk to ensure that the risks are apparent for all readers.

Civil/Construction Engineering: The Panel's primary concern was that the project cost estimate may be low because setback and adjacent levees are underrepresented in the 15 sites chosen for the detailed cost estimate. The Panel noticed that the subset of 15 sites used for the cost estimate is not necessarily an accurate representation of the 106 sites included in this part of the SRBPP. This could result in the project being underfunded and necessary repairs not being made, but could be resolved by developing a cost per linear foot for each of the repair measures and evaluating the total project cost using these costs per linear foot based on the number of linear feet of each repair measure. In addition, the PACR indicates that the without-project and with-project Annual Exceedance Probability (AEP) values were computed by different groups using different data. The Panel understands that USACE claimed no benefits in those sub-basins where the with-project AEP was calculated as higher than the without-project AEP. However, since the AEP values for seven of the 24 basins are shown as (on average) 8 times higher for the with-project than without-project, the Panel questions relying on the AEP values to calculate benefits for the remaining sub-basins. This could be resolved by performing a without-project and with-project AEP analysis for each sub-basin using a consistent data set and consistent methods and then revising the PACR text to incorporate the revised analysis.

Biology/Ecology: The Panel had several issues with different aspects of the Standard Assessment Methodology (SAM) analysis. First, the Panel thought there is inadequate documentation of the SAM analysis in the EIS, including a lack of information on assumptions about how the bank protection measures affected habitat variables. This prevents sufficient transparency and therefore limits effective communication and evaluation of the results. The Panel suggests that Appendix F could be revised to clarify how bank protection measures were assumed to affect the habitat variables, and present additional information on the data and regression and other estimation methods used to derive the values of the habitat variables. In addition, the programmatic evaluation presented in the EIS does not include a detailed plan on how the site-specific analyses will be done in the future as implementation proceeds, particularly because the SAM analyses during implementation will likely be quite different from those presented for the programmatic level in the EIS. An implementation strategy for how SAM will be applied to specific sites will address this issue. Also concerning SAM, the interpretation of the SAM results is inconsistent and varies across the documents that form the EIS and the PACR. Proper interpretation of SAM results is important for the determination of effective restoration to offset the effects of bank stabilization. The Panel also noted that the version of SAM used is a pre-certified version, which may have implications for accuracy. The Panel advises USACE to confirm the results from SAM in programmatic-level analysis in the EIS by repeating analyses that cover a range of conditions (i.e., several fish species, multiple alternatives) using the certified version of SAM.

Table ES-1. Overview of 16 Final Panel Comments Identified by the SRBPP IEPR Panel

No.	Final Panel Comment
Significance – Medium/High	
1	The project costs may be underestimated because setback and adjacent levees are underrepresented in the 15 sites chosen for the detailed cost estimate.
Significance – Medium	
2	The Annual Reconnaissance/Erosion Inventory described in Appendix B is visual and somewhat subjective, without surveys (aside from GPS points for length), qualitative or quantitative guidelines, or engineering analyses, which may increase project cost and schedule risk.
3	Risk and uncertainty do not appear to have been fully addressed throughout the site selection and implementation processes, which may increase project cost and schedule risk and not allow for maximum project benefits.
4	The PACR does not clearly describe which design criteria and standards will be applied to the maintenance actions and how the original design criteria apply or not.
Significance – Medium/Low	
5	The PACR does not include information on which hydraulic and hydrologic models, assumptions, and criteria were used to assess life safety hazards, particularly those used to identify the extent of the inundation areas.
6	Some parts of the Standard Assessment Methodology (SAM) analysis have not been clearly or adequately documented, including assumptions about how the bank protection measures affected the habitat variables.
7	The version of SAM used in the analysis is a pre-certified version, which may have implications for accuracy.
8	A description has not been provided on how SAM will be applied to specific sites, which would ensure sufficient certainty in actual mitigation decisions.
9	Interpretation of the SAM results is inconsistent with descriptions of the results and varies across the documents that form the EIS and the PACR.
10	Little information is provided on what monitoring is planned in order to implement adaptive management.
11	The use of the Annual Reconnaissance/Erosion Inventory results along with the application of the minimum levee geometry and the vegetation free zone (VFZ) template in the programmatic/feasibility phase and initial implementation leads to an increase in risk and a need for higher contingencies in cost and schedule estimates.

Table ES-1, continued. Overview of 16 Final Panel Comments Identified by the SRBPP IEPR Panel

No.	Final Panel Comment
12	Some hydrologic and hydraulic methods and analyses are not clearly described in the PACR, including the analysis of hydrologic changes since project construction and how stream geomorphologic changes will be analyzed.
13	The method used to determine which basins are economically justified is not based on the AEP analysis.
Significance – Low	
14	The life history summaries and factors affecting abundances of special-status species do not necessarily reflect the current knowledge.
15	Residual risk is not addressed in the PACR, which may lead the non-Federal sponsor and the floodplain occupants to conclude that the degree of flood risk protection provided by the project is higher than it actually is.
16	Some terms (e.g., significant, design discharge, summer/fall waterline, revetment database, and ecological terms) appear to have become standardized over the decades of design, studies, and analyses, yet their definitions have not been provided.

Table of Contents

List of Tables

LIST OF ACRONYMS

AEP	Annual Exceedance Probability
ATR	Agency Technical Review
CDFW	California Department of Fish and Wildlife
CDWR	California Department of Water Resources
CEQA	California Environmental Quality Act
COI	Conflict of Interest
CVFPB	Central Valley Flood Protection Board
DDR	Design Documentation Report
DrChecks	Design Review and Checking System
EC	Engineer Circular
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ER	Engineer Regulation
ERDC	Engineer Research and Development Center
GRR	General Reevaluation Report
HEC	Hydrologic Engineering Center
HEP	Habitat Evaluation Procedure
IEPR	Independent External Peer Review
IWG	Interagency Working Group
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PACR	Post-Authorization Change Report
PADD	Post-Authorization Decision Document
PDT	Project Delivery Team
PFMA	Potential Failure Mode Analysis
PPA	Project Partnership Agreement
SAM	Standard Assessment Methodology

SAR	Safety Assurance Review
SRBPP	Sacramento River Bank Protection Project
SRFCP	Sacramento River Flood Control Project
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Services
VFZ	vegetation free zone
WRDA	Water Resources Development Act

1. INTRODUCTION

The Sacramento River begins near Mount Shasta in Northern California, flows through the northern Central Valley, and finally joins the San Joaquin River and Sacramento River Delta to discharge to the Suisan Bay.

The Sacramento River Basin Protection Project (SRBPP) is a part of the Sacramento River Flood Control Project (SRFCP). The SRFCP includes approximately 1,300 miles of levees along the Sacramento River, tributaries (American, Feather, Yuba, and Bear Rivers along with additional minor tributaries), and distributary sloughs. The SRFCP also includes the Moulton, Colusa, Tisdale, Fremont, and the Sacramento Flood Overflow Weirs and the Butte Basin and Sutter and Yolo Bypasses and Sloughs. Phase I is 435,000 linear feet of bank protection. Construction of Phase I was completed in 1975.

The purpose of Phase II of the SRBPP is to identify and repair sites along the Sacramento River and Tributaries that may have been weakened due to erosion, while concurrently providing mitigation for any environmental impact as detailed in the supporting Environmental Impact Statement/Environmental Impact Report (EIS/EIR). This portion of Phase II consists of 80,000 linear feet of bank protection along the Sacramento River and tributaries. Authority has been given to Phase II (405,000 linear feet) of this project by Section 202 of the River Basin Monetary Authorization Act of 1974 (Public Law 93-252) and through a joint resolution of Congress (PL 97-377). The additional 80,000 linear feet was authorized by the Water Resources Development Act (WRDA) of 2007. The overall cost of the study is to be cost shared 75 percent Federal, 25 percent non-Federal with the project sponsor, the State of California Central Valley Flood Protection Board (CVFPB).

The appropriate decision document for Phase II (SRBPP) is a Post-Authorization Change Report (PACR). This project is authorized for construction; no further plan formulation or determination of Federal interest is needed. A PACR and supporting documents will in turn support the Project Partnership Agreement (PPA) between the non-Federal sponsor CVFPB and the U.S. Army Corps of Engineers (USACE). There are a number of technical and policy issues that are required to be resolved. Issues will typically involve the USACE vertical team (Division and Headquarters). The PACR will document issue resolution.

Phase III is programmatic future work that will become more defined as Phase II is completed. Prior to any Phase III construction, a General Reevaluation Report (GRR) will be done to resolve planning and policy issues and reformulate remedial action for the SRFCP in light of current conditions and new and upcoming Federal, state, and local activities in the basin. The Phase III reevaluation may be accomplished under the current SRBPP authority; however, it is anticipated that the reevaluation would result in a recommended plan that would require new or amended authorization. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis.

The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Phase II Post-Authorization Decision Documents (PADD)[2] for the Sacramento River Bank Protection Project (SRBPP), California (hereinafter: SRBPP IEPR) in accordance with procedures described in the Department of the Army, USACE Engineer Circular (EC) *Civil Works Review* (EC 1165-2-214) (USACE,

[2] The Post-Authorization Decision Documents (PADD) refer to the Post-Authorization Change Report (PACR), its appendices, and the SRBPP Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

2012) and the Office of Management and Budget (OMB) *Final Information Quality Bulletin for Peer Review* (OMB, 2004). 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).

This final report presents the Final Panel Comments of the IEPR Panel (the Panel) on the existing engineering, economic, environmental, and plan formulation analyses contained in the SRBPP PADD IEPR documents (Section 4). Appendix A describes in detail how the IEPR was planned and conducted. Appendix B provides biographical information on the IEPR panel members and describes the method Battelle followed to select them. Appendix C presents the final charge to the IEPR panel members for their use during the review; the final charge was submitted to USACE on March 20, 2015.

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 engineering, economic, environmental, and plan formulation analyses 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 SRBPP PADD was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC 1165-2-214). Battelle, a 501(c)(3) organization under the U.S. Internal Revenue Code, has experience conducting IEPRs for USACE.

3. METHODS FOR CONDUCTING THE IEPR

The methods used to conduct the IEPR are briefly described in this section; a detailed description can be found in Appendix A. Table 1 presents the major milestones and deliverables of the SRBPP IEPR. Due dates for milestones and deliverables are based on the award/effective date of August 14, 2012.[3] Note that the work items listed under Task 6 occur after the submission of this report. Battelle anticipates submitting the pdf printout of the USACE's Design Review and Checking System (DrChecks) project file (the final deliverable) on May 11, 2015.

[3] Battelle was awarded this contract on August 14, 2012. Battelle was notified that the review documents were not available and that the project would be "on hold" until April 2013. Battelle was notified on July 23, 2013 that the IEPR project would be restarted, although no firm date was given. A period of performance modification was received on August 13, 2013, which extended the end date until March 31, 2014; a second modification was received on April 30, 2014, extending the period of performance through March 31, 2015. On December 9, 2014, Battelle was notified that the review documents would be available on or about December 29, 2014; the review documents were transmitted to Battelle via file transfer on December 23, 2014. A final time extension was authorized, extending the period of performance to August 31, 2015.

Table 1. Major Milestones and Deliverables of the SRBPP IEPR

Task	Action	Due Date
1	Award/Effective Date	8/12/2012
	Review documents available	12/23/2014
2	Battelle submits list of selected panel members	1/29/2015
	USACE confirms the panel members have no COI	2/3/2015
3	Battelle convenes kick-off meeting with USACE	2/2/2015
	Battelle convenes kick-off meeting with USACE and panel members	2/6/2015
4	Panel members complete their individual reviews	2/25/2015
	Panel members provide draft Final Panel Comments to Battelle	3/13/2015
5	Battelle submits Final IEPR Report to USACE	3/27/2015
6[a]	Battelle convenes Comment-Response Teleconference with panel members and USACE	4/28/2015
	Battelle submits pdf printout of DrChecks project file to USACE	5/11/2015
	Contract End/Delivery Date	8/31/2015

[a] *Task 6 occurs after the submission of this report.*

Battelle identified, screened, and selected five panel members to participate in the IEPR based on their expertise in the following disciplines: hydraulic engineering, Civil Works planning/economics, biology/ecology, civil/construction engineering, and geotechnical engineering. The Panel reviewed the SRBPP PADD and produced 16 Final Panel Comments in response to 24 charge questions provided by USACE for the review. This charge included two questions added by Battelle that sought summary information from the IEPR Panel. Battelle instructed the Panel to develop the Final Panel Comments using a standardized four-part structure:

1. Comment Statement (succinct summary statement of concern)
2. Basis for Comment (details regarding the concern)
3. Significance (high, medium/high, medium, medium/low, or low; in accordance with specific criteria for determining level of significance)
4. Recommendation(s) for Resolution (at least one implementable action that could be taken to address the Final Panel Comment).

Battelle reviewed all Final Panel Comments for accuracy, adherence to USACE guidance (EC 1165-2-214, Appendix D), and completeness prior to determining that they were final and suitable for inclusion in the Final IEPR Report. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Panel's findings are summarized in Section 4.1; the Final Panel Comments are presented in full in Section 4.2.

4. RESULTS OF THE IEPR

The panel members agreed 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 SRBPP review documents. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel's findings.

The panel members agreed 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 SRBPP review documents. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel's findings.

Based on the Panel's review, the SRBPP PADD is a good evaluation of an extremely complicated flood risk reduction project using the best available information and it is clear to the Panel that considerable effort has been put into the development of this information. The 16 Step implementation procedure outlined in Appendix B, Site Selection Process, used to prioritize site repairs is a logical approach to select the sites for design and construction under the current authorizations. Overall, the Panel felt that the PADD could have been better organized and it was difficult to find information in the documents. The Panel felt that the length of time that the project has been under way might have led to some inconsistencies, details that were difficult to understand, and some challenges in following the steps in project progression. The Panel identified several elements of the project that should be clarified or revised.

Hydraulic Engineering: The Panel was concerned that the PACR does not clearly describe how the original design criteria and current standards will be applied in the models and the design of measures for each action. Standard evaluation criteria and design parameters are needed to ensure that the project repairs will be consistent with the purpose of the project throughout its life. This problem could be resolved by specifying in the document which criteria and standards will be applied for the maintenance actions and how the original design criteria apply or why they do not apply. In addition, the Panel noted that some of the hydrologic and hydraulic methods and analyses are not clearly described in the PACR, in particular the fact that hydrologic changes since project construction have been determined to be insignificant because the bulk of runoff comes from the undeveloped mountainous regions of the basin. To resolve this, the PACR could use a description of the analysis of hydrologic and geomorphic changes since project construction and how stream geomorphologic and hydrologic changes will be analyzed during the life of the project.

Geotechnical Engineering: The Panel noticed that the Annual Reconnaissance/Erosion Inventory does not appear to have a uniform set of criteria, qualitative or quantitative guidelines, or metrics to assess new erosion sites, evaluate their changes from year to year, or monitor performance of previously repaired sites. Without standardized quantitative and qualitative guidelines, differences in survey team member experience, expertise, and personal bias to influence surveys, repair site prioritization, and project implementation can be introduced to the project. This issue could be resolved by developing formal criteria, qualitative and quantitative guidelines, and performance metrics for use during the Inventory. Relatedly, the Panel sees a high potential for the levee waterside and bank slope angles to vary over the several years that pass between the Annual Reconnaissance/Erosion Inventories, site selection and implementation, preliminary and final design, and construction processes. These variations can lead to

high uncertainty and significant cost adjustments associated with alternative designs, material quantities, and real estate acquisition. In addition, the Panel thought that the SRBPP appears to be one-dimensional in the evaluation and mitigation of bank erosion independently, and does not address it as part of a comprehensive integrated risk management or risk-informed design. The inclusion and description of a more comprehensive risk and uncertainty analysis will demonstrate that project benefits are being maximized and that the cost and schedule estimates are reliable. This issue can be resolved by conducting a more comprehensive and integrated risk and uncertainty analysis, in concert with other on-going improvement projects, incorporating PFMA for all potential failure modes.

Civil Works Planning/Economics: The hydraulic and hydrologic engineering models and analyses are not clearly described or referenced in the PACR, in particular the models that were used to assess the life safety hazards and to identify the extent of the inundation areas. The report would be improved by including a more detailed description of the models, assumptions, and criteria used to assess life safety hazards. In addition, the Panel noted that the PACR does not describe the residual risk to the non-Federal sponsor and the floodplain occupants that will exist following project implementation. USACE should provide a detailed description of the residual risk to ensure that the risks are apparent for all readers.

Civil/Construction Engineering: The Panel's primary concerns was that the project cost estimate may be low because setback and adjacent levees are underrepresented in the 15 sites chosen for the detailed cost estimate. The Panel noticed that the subset of 15 sites used for the cost estimate is not necessarily an accurate representation of the 106 sites included in this part of the SRBPP. This could result in the project being underfunded and necessary repairs not being made, but could be resolved by developing a cost per linear foot for each of the repair measures and evaluating the total project cost using these costs per linear foot based on the number of linear feet of each repair measure. In addition, the PACR indicates that the without-project and with-project Annual Exceedance Probability (AEP) values were computed by different groups using different data. The Panel understands that USACE claimed no benefits in those sub-basins where the with-project AEP was calculated as higher than the without-project AEP. However, since the AEP values for seven of the 24 basins are shown as (on average) 8 times higher for the with-project than without-project, the Panel questions relying on the AEP values to calculate benefits for the remaining sub-basins. This could be resolved by performing a without-project and with-project AEP analysis for each sub-basin using a consistent data set and consistent methods and then revising the PACR text to incorporate the revised analysis.

Biology/Ecology: The Panel had several issues with different aspects of the Standard Assessment Methodology (SAM) analysis. First, the Panel thought there is inadequate documentation of the SAM analysis in the EIS, including a lack of information on assumptions about how the bank protection measures affected habitat variables. This prevents sufficient transparency and therefore limits effective communication and evaluation of the results. The Panel suggests that Appendix F could be revised to clarify how bank protection measures were assumed to affect the habitat variables, and present additional information on the data and regression and other estimation methods used to derive the values of the habitat variables. In addition, the programmatic evaluation presented in the EIS does not include a detailed plan on how the site-specific analyses will be done in the future as implementation proceeds, particularly because the SAM analyses during implementation will likely be quite different from those presented for the programmatic level in the EIS. An implementation strategy for how SAM will be applied to specific sites will address this issue. Also concerning SAM, the interpretation of the SAM results is inconsistent and varies across the documents that form the EIS and the PACR. Proper interpretation of

SAM results is important for the determination of effective restoration to offset the effects of bank stabilization. The Panel also noted that the version of SAM used is a pre-certified version, which may have implications for accuracy. The Panel advises USACE to confirm the results from SAM in programmatic-level analysis in the EIS by repeating analyses that cover a range of conditions (i.e., several fish species, multiple alternatives) using the certified version of SAM.

4.1 Final Panel Comments

This section presents the full text of the Final Panel Comments prepared by the IEPR panel members.

Final Panel Comment 1

The project costs may be underestimated because setback and adjacent levees are underrepresented in the 15 sites chosen for the detailed cost estimate.

Basis for Comment

The Panel believes that the project costs are underestimated since the cost per linear foot (LF) for setback and adjacent levees is expected to be higher than the cost per LF for other repair methods and because the current project costs are based on an average cost per LF that includes an underrepresentation of setback and adjacent levees. As the Panel understands it, primarily from the Project Cost and Schedule Risk Analysis Report (Subappendix 2F to Appendix A, Engineering):

- A detailed cost estimate was prepared for a subset of 15 sites (out of the total 106 sites), with a combined length of 7,157 LF.
- The 15 sites were grouped into four construction contracts in the cost estimate.
- The fully funded cost for these 15 sites is $42,955,000 or $6,002/LF
- If $6,002/LF is extrapolated to the full 80,000 LF, the total project cost is $480.1M, which is greater than the $420.5M reported in the main PACR text.

The reasons behind the $60M difference between these numbers are not apparent to the Panel.

The Panel also noticed that the subset of 15 sites used for the cost estimate is not necessarily an accurate representation of the 106 sites included in this part of the SRBPP. For these 15 sites, 7% (1 site) are Measure 1 (Setback Levee), 27% (4 sites) are Measure 2 (Bank Fill Stone Protection with No On-Site Vegetation), 53% (8 sites) are Measure 5 (Bank Fill Stone Protection with On-Site Vegetation) and 13% (2 sites) are No Action (however, costs are included in the estimate for a repair). The measure numbers were obtained using the descriptions contained in Subappendix 2F and Table 5 of Appendix A.

However, according to Table 5 of Appendix A, the distribution of selected repairs for the 106 sites selected for the 80,000 LF is quite different: 23% (24 sites) are Measure 1, 28% (30 sites) are Measure 2, 25% (27 sites) are Measure 3 (Adjacent Levee), 14% (15 sites) are Measure 4 (Riparian and Wetland Banks with Re-vegetation), 0% (0 sites) are Measure 5, and 9% (10 sites) are No Action.

Based on the experience of the Panel and supported by the higher cost per LF ($10,760) for the one contract in Subappendix 2F that contains a setback levee, the cost per LF for setback and adjacent levees (Measures 1 and 3) is expected to be significantly greater than the cost per LF for other repairs. Since setback and adjacent levees are underrepresented in the subset of 15 sites compared to their actual representation in the full 106 sites, the cost per LF projected from that subset is likely underestimated.

In addition, setback and adjacent levees may require features to meet design criteria, such as cutoff walls, not currently present in the existing levee. It is not clear to the Panel if such features are needed and, if so, if they are included in the estimate for the one setback levee, which could further increase the cost estimate.

Significance – Medium/High

Total project cost as presented in the PACR could be significantly less than the actual total project cost, potentially resulting in the project being underfunded and necessary repairs not being made.

Recommendation for Resolution

1. Develop a cost per LF for each of the repair measures, i.e., Setback Levee, Bank Fill Stone Protection with No On-Site Vegetation, etc.
2. Evaluate the total project cost using these costs per LF based on the number of LF of each repair measure.

Final Panel Comment 2

The Annual Reconnaissance/Erosion Inventory described in Appendix B is visual and somewhat subjective, without surveys (aside from GPS points for length), qualitative or quantitative guidelines, or engineering analyses, which may increase project cost and schedule risk.

Basis for Comment

Since 1997, USACE has been conducting an Annual Reconnaissance/Erosion Inventory to record new erosion sites and update existing erosion sites (Appendix B, p. 2). In 2004, a set of four ranking methodologies were developed as part of the inventories to assist with prioritizing and selecting bank repair sites. It appears that these inventories are subjective and highly dependent upon the survey team members and their experience and expertise. The Panel could not find evidence that these inventories have a uniform set of criteria, qualitative or quantitative guidelines, or metrics to assess new erosion sites, evaluate their changes from year to year, or monitor performance of previously repaired sites.

The lack of quantitative and qualitative guidelines introduces the potential for differences in survey team member experience, expertise, and personal bias to influence surveys, repair site prioritization, and project implementation. In addition, the subjective nature of the inventories increases project cost and schedule risk for which USACE does not appear to have accounted.

The USACE survey team members need a common basis and guidelines so there is consistency across project sites and from year to year. For example, the USACE Levee Safety Program has instituted just such a formal process within the last several years to provide a common basis for performing levee inspections and evaluations across the U.S. The Panel believes that the Annual Reconnaissance/ Erosion Inventory may be appropriate for the programmatic/feasibility stage, provided the cost and schedule risk are accounted for. This is also with the proviso that the project evaluation data, including costs, will be supplemented continuously during implementation, including confirmation and updating from year to year, along with implementation plan adaptation as necessary.

Significance – Medium

Consistency in conducting the Annual Reconnaissance/Erosion Inventories is important to minimize project cost and schedule risk.

Recommendation for Resolution

1. Develop formal criteria, qualitative and quantitative guidelines, and performance metrics for use during the Annual Reconnaissance/Erosion Inventory that are consistent with the USACE Levee Safety Program, including levee inspection.

Final Panel Comment 3

Risk and uncertainty do not appear to have been fully addressed throughout the site selection and implementation processes, which may increase project cost and schedule risk and not allow for maximum project benefits.

Basis for Comment

The site selection and implementation procedure described in Appendix B provides for consideration of risk and uncertainty in key steps in the process. While the procedure provides limited details, the SRBPP review documents appear to focus on bank erosion as the sole factor leading to levee breach and failure. However, bank erosion is one of several (initiator, trigger, or response) factors in a chain of events that could lead to a breach and/or failure. Other factors could be directly or indirectly related, such as seepage and piping, slope instability, settlement and overtopping.

The SRBPP appears to be one-dimensional in the evaluation and mitigation of bank erosion independently, and does not address it as part of a comprehensive integrated risk management or risk-informed design. Risk-informed design may include a Potential Failure Mode Analysis (PFMA) that looks at all potential failure modes, contributing dependent and independent factors and variables, cause and effect, and their sequence and interrelationships.

While the project goal, intent, and focus is bank protection, secondary benefits through improvements in levee stability and seepage control are possible and may provide significant reductions in risk. Secondary benefits may have a place in site selection, alternative development, and project implementation, but do not appear to have been accounted for.

Bank protection appears to have been undertaken as an Operations & Maintenance approach without the benefit of a risk assessment, somewhat independent of other improvement projects that normally involve risk-informed design.

The Panel acknowledges other improvement projects (as referenced in the PACR) are being implemented to mitigate and improve levee stability and seepage control, which also reduce risk and uncertainty. The Panel also acknowledges Step 5 – Identify Opportunities and Constraints (Appendix B) indicates other issues and opportunities that could affect or enhance the project will be addressed. The Panel could not find evidence of the degree to which project coordination and risk-informed decisions, including PFMA, are being made to maximize project benefits and reduce risk and uncertainty.

Significance – Medium

The inclusion and description of a more comprehensive risk and uncertainty analysis will demonstrate that project benefits are being maximized and that the cost and schedule estimates are reliable.

Recommendation for Resolution

1. Eliminate the apparent one-dimensional nature of the bank protection project (focused on bank erosion as the sole factor leading to levee breach and failure) through the use of a more comprehensive and integrated risk and uncertainty analysis, incorporating PFMA for all potential failure modes.
2. Coordinate and integrate bank protection with other improvement projects to reduce risk and uncertainty and maximize benefits.

Final Panel Comment 4

The PACR does not clearly describe which design criteria and standards will be applied to the maintenance actions and how the original design criteria apply or not.

Basis for Comment

The PACR does not clearly explain how the original design criteria and current standards will be applied in the models and the design of measures for each action. Three basic areas need to be addressed: (1) the ability of the project to continue the level of protection it was designed to provide, (2) the economic justification of the action proposed, and (3) the ability of the action to meet current environmental standards.

The PACR does not specify the hydraulic and hydrologic criteria that will be used in the models to set the parameters of the levee dimensions and proposed modifications. In some cases, text refers to the "design discharge" that was used in 1957 to design the levee systems, but USACE's response during the mid-review teleconference implied that current hydrologic frequency flows will be used to determine the economic justification of an action and derive the parameters for a design of a measure. The Panel does not have clarity on which criteria will actually be used.

Significance – Medium

Standard evaluation criteria and design parameters are needed to ensure that the project repairs will be consistent with the purpose of the project throughout its life.

Recommendation for Resolution

1. Specify in the decision document which criteria and standards will be applied for the maintenance actions and how the original design criteria apply or why they do not apply.

Final Panel Comment 5

The PACR does not include information on which hydraulic and hydrologic models, assumptions, and criteria were used to assess life safety hazards, particularly those used to identify the extent of the inundation areas.

Basis for Comment

The hydraulic and hydrologic engineering methods and analysis are not clearly described or referenced in the PACR. Hydraulic and hydrologic models have advanced significantly since the original design and construction of the project. USACE has indicated that it will employ the most current models to evaluate maintenance and repair actions. However, the PACR does not provide a description of the models that were and will be used to assess the life safety hazards, particularly those used to identify the extent of the inundation areas. Appendix B2 (American Rivers Hydrology and Folsom Dam Operations) to Appendix A, Engineering (p. B2-13) explains that the Hydrologic Engineering Center (HEC) model HEC-FDA was used to assess the net economic and life safety benefits of the Common Features project in the Natomas Basin. The Panel assumes that the HEC-FDA model was also used in the PACR, but that is not indicated in the report.

The PACR is also vague and, at times, contradictory with respect to the hydraulic and hydrologic criteria that were and will be used to assess life safety hazards. Portions of Appendix A, Engineering, Final Hydraulic Appendix (pp. 4-6, 13-14) refer to the original "design discharge" that was used in 1957 to design the levee systems. However, information provided elsewhere in Appendix A, Engineering, the Yuba River Basin Project General Reevaluation Report (Chapter 1, p. 1; Chapter 2, pp. 3–11) and throughout Appendix B-2 of the American River Watershed Common Features Project Natomas PACR suggests that current hydrologic frequency flows (200-, 100-, 50-year, etc.) will be used to assess the risk of the reaches that experience erosion and to assess the system after repairs are implemented.

Significance – Medium/Low

An analysis or assessment of the hydraulic and hydrologic models cannot be conducted because details on the model assumptions and criteria are not provided in the PACR.

Recommendation for Resolution

1. Describe the models, assumptions, and criteria used to assess the life safety hazards, particularly those used to identify the extent of the inundation areas in the PACR.

Final Panel Comment 6

Some parts of the Standard Assessment Methodology (SAM) analysis have not been clearly or adequately documented, including assumptions about how the bank protection measures affected the habitat variables.

Basis for Comment

The long-term effects of the SRBPP project on fish habitat of the special-status fish species was assessed quantitatively using the SAM model. The magnitude of these estimated effects was then used to determine that on-site and off-site mitigation is feasible. However, inadequate documentation of the SAM analysis in the EIS prevents sufficient transparency, and therefore limits effective communication and evaluation of the results.

The certified SAM model was developed in consultation with the governmental agencies involved with the conservation of the special-status fish species (California Department of Fish and Wildlife [CDFW], California Department of Water Resources [CDWR], National Marine Fisheries Service [NMFS], and U.S. Fish and Wildlife Service [USFWS]). While the model structure is fixed, the estimation of model inputs to SAM varies across applications because the estimation depends on the form, quality, and accuracy of the available data for the specific locations.

For each of the bank protection measures, there should be an easy-to-follow set of tables that show the assumed percent changes in each of the six habitat variables from baseline for years 1, 2, 4, 5, 15, 25, 50, and 58. Table F-11 is a good template for vegetation changes. Table F-10 seems to provide some of the information for the habitat variables other than vegetation, but the variables listed are not obviously cross-referenced to the six habitat variables used in SAM. The rationale and empirical evidence for the assumed changes in the six habitat variables should also be provided; some changes simply result from the assumed dimensions of the bank protection measure (e.g., slope), while other bank protection measures affect habitat variables in more complicated ways (e.g., inundation).

The Panel could not find evidence to back up the statement (EIS, p. 11-33) that the environmental conditions of the analyses of this suite of special-status fish species adequately cover the full range of conditions and fish species potentially affected by the program. For example, drought conditions are not covered in the environmental conditions, and there are ecologically important species (e.g., largemouth bass) without clear species analogues in the special-status species that were analyzed.

The assumption that summer and fall information for habitat variables can be used to infer their values in other seasons should be better justified. Most of the information about the six habitat variables used in the programmatic analysis is limited to summer and fall conditions (available data from the revetment database, EIS, pp. 11-33), but SAM requires values on all four seasons because the presence information on life stages is season-specific. For some of the physically based habitat variables, it is reasonable to assume the values for the unmeasured seasons equal the values estimated for the measured seasons. However, it is inappropriate to assume this for some of the habitat variables, such as floodplain inundation, and so regression equations have been used to relate summer to winter and summer to spring. While very high R^2 values are reported for these regressions (data referred to coming from previous SAM analyses), at minimum, the scatter plots of the data used to estimate the regressions should be presented.

The EIS initially says (p. 11-34) individual sites were used in the SAM analysis, but then follows with a vague description of the analysis that could be misinterpreted to mean that the habitat variables for the

individual sites were first averaged by region and then input into SAM. This is not how the analysis was performed, rather, each site was input into SAM as a single habitat unit and the resulting habitat predictions generated from SAM were then summed for each region.

Significance – Medium/Low

The SAM analyses are not explained clearly enough to determine whether the conclusions that the significant effects will be offset by the on-site and off-site mitigation are reasonable and justified for the special-status fish species.

Recommendation for Resolution

1. Revise Appendix F by adding text to clarify how bank protection measures were assumed to affect the habitat variables, and present additional information on the data and regression and other estimation methods used to derive the values of the habitat variables.

Final Panel Comment 7

The version of SAM used in the analysis is a pre-certified version, which may have implications for accuracy.

Basis for Comment

The use of the SAM model is efficient because the SAM model went through a rigorous certification process and is specifically designed for evaluating bank stabilization measures on special-status fish habitat. It was developed in consultation with the Interagency Working Group (IWG) and the governmental agencies (CDWR, USFWS, NMFS, CDFW) involved with the special-status fish species. However, due to the timing of the analyses and the certification process, the EIS used a pre-certified version of SAM. A certified version of SAM is now available, so the data used in the SAM analyses for this project can be confirmed by repeating some or all of the analyses with the new certified version of the SAM model. Future analyses will use the certified version, and using the certified version to confirm that the results presented in the EIS are correct will add to the credibility of the programmatic analyses.

Significance – Medium/Low

Use of a pre-certified version of SAM unnecessarily adds uncertainty to the analysis and the results used in the programmatic evaluation.

Recommendation for Resolution

1. Confirm the results from SAM in programmatic-level analysis in the EIS by repeating analyses that cover a range of conditions (i.e., several fish species, multiple alternatives) using the certified version of SAM.

Final Panel Comment 8

A description has not been provided on how SAM will be applied to specific sites, which would ensure sufficient certainty in the estimation of effects and the identification of actual mitigation decisions to offset the effects.

Basis for Comment

The programmatic evaluation using SAM presented in the EIS does not serve as a good illustration of how future SAM analyses will be performed at specific sites during implementation.

For example, whereas single habitat units were used in SAM for each site in the EIS, multiple habitat units will likely be used for each site for implementation. In addition, the estimation of the habitat variables will be different because more detailed data with lower uncertainty will be used for specific sites, rather than the coarse estimation approach used for the programmatic analysis. The estimation of the habitat variables for the analysis of the 88 sites at the programmatic level is not sufficiently precise and accurate for site-specific analyses. Use of different estimation methods for habitat variables in the programmatic analysis is understandable because sacrifices had to be made in data quality and precision in order to have sufficient data to estimate values for habitat variables for all 88 sites. As an example, the estimation of floodplain inundation is based on a method not directly described in the updated SAM 2012 documentation, and it also relies on a set of regression relationships (between seasons, using river mile as explanatory variable, one regression only had two data points [EIS, p.
F-14]). When specific sites are evaluated, such imprecise estimation methods must be replaced by more accurate and precise methods.

Other habitat variables used in the programmatic evaluation are, in effect, categorical. For example, slope and instream structure are assigned one of four values because of the reporting in the revetment database. This adds much uncertainty because all habitat variables are treated as continuous in SAM, and thus only having a reduced number of possible values of a habitat variable (e.g., three values corresponding to three categories) reduces the resolution of the analyses. There are also issues about seasonality, whereby information on two seasons is either simply converted to the other seasons or used for the other seasons in the programmatic analysis (p. F-17). Better seasonal values will be needed for the site-specific analyses.

Significance – Medium/Low

Without a description of how the habitat variables and effects of bank protection measures will be quantified with SAM when specific sites are assessed, there is less certainty of the modeled effects of bank protection measures and that the identified mitigation effectively offsets the negative effects.

Recommendation for Resolution

1. Prepare an implementation strategy document for how SAM will be applied to specific sites. The Programmatic Mitigation Strategy (EIS, Appendix J) is an example of such a document for how, in that case, mitigation will be implemented. Issues to be addressed in a strategy document for SAM in order to provide sufficient information on how site-specific analyses will be performed include:
   (a) How will habitat variables, and the effects of bank stabilization measures on the habitat variables, be estimated for specific sites

(b) How will uncertainty be addressed, such as by using mean or typical values of habitat variables and also using possible low habitat or values measured or expected for if measures underperform
(c) How will mitigation deal with the multiple special-status fish, wildlife, and vegetation species involved, which can, at times, have contradictory responses to measures or mitigation
(d) Will mitigation be based on the most affected of the fish species or as the sum of the effects over the species
(e) How will extreme events like droughts, and climate change that can affect hydrology, be factored into the analyses
(f) What will be the mode of interaction with the IWG and the agencies charged with protecting the special-status species.

Final Panel Comment 9

Interpretation of the SAM results is inconsistent with descriptions of the results and varies across the documents that form the EIS and the PACR.

Basis for Comment

Proper interpretation of SAM results is important for the determination of effective restoration to offset the effects of bank stabilization. The interpretation of SAM results relies on clear definition of baseline conditions upon which bank stabilization measures and restoration are compared, clarity about the rationale for expressing results as percent changes, information about the level of uncertainty with results, clear and appropriate use of the term “significance”, and sufficient presentation of supporting information to enable interpretation of results.

Baseline. The SAM analysis appears to use current conditions (without any future changes) as a baseline upon which to compare the alternatives that involve bank protection measures (p. F-21). Current conditions are not the same as a “no-action” alternative, which is labelled as Alternative 1. In addition, the changes that are assumed to occur from the current conditions to the no-action alternative are not described. Furthermore, in Appendix F, the percent changes are based on Alternative 6 as baseline, and then stated elsewhere that either all analyses or the analyses for percent changes are based on a new baseline that has all habitat variables at their optimal values (p. F-23). Clarity and the rationale for what was used as baseline are important for proper interpretation of the results.

Percent changes. The rationale provided for expressing linear feet of habitat changes as percent changes (p. F-23) is confusing. The text states:

> “Although SAM results are presented in linear feet differences between baseline and project for each life stage of each species, these results are not comparable across species because habitat suitability (i.e., SAM species response indices) differs by species and life stage. In many cases the largest absolute differences (in terms of linear feet) are found for the least sensitive life stages because habitat suitability is high across a range of conditions. Therefore, the standard SAM results were categorized to indicate relative percentage change under the SRBPP from baseline.”

It is not clear how percent changes within the 88 sites accounts for different sensitivities across life stages and species. If the habitat suitability for a habitat variable is flat (insensitive), then there will be small differences in linear feet between baseline and a scenario. Similarly, if the suitability curve is steep, then the changes in linear feet will be larger. Expressing these changes in linear feet results as percent changes is helpful for comparing across life stages because there are different amounts of habitat for each stage under baseline. However, it is not clear how expressing results as percent changes addresses interpretation issues related to the different sensitivities of the life stages.

Uncertainty. The estimation of the SAM habitat variables for the 88 sites at the programmatic level is challenging and it is possible (and perhaps likely) that the uncertainties in their estimation in the analysis of the 88 sites overrides the differences in predicted habitat changes among related alternatives. Some comparison of estimated habitat variables to values determined using site-specific data at some of the more intensely studied sites would strengthen the programmatic analyses by demonstrating that the uncertainties allow for meaningful comparisons across alternatives. At a minimum, the possibility of high uncertainty due to the simple way some habitat variables had to be estimated in order to cover 88 sites should be discussed, and that different estimation methods will be used at implementation.

Significance. A definition of "significance" is attempted (p. 11-34), and the term is widely used to describe the results (p. ES-22; Tables ES-2, ES-3). The document says "effects on fish populations are significant when the project causes or contributes to substantial short- or long-term reductions in abundance and distribution." Habitat, which is the only factor addressed by SAM, is then listed as a possible measure. Then the text states (p. 11-35): "In this effect assessment, effects were considered significant if it was determined that existing conditions would be worsened by program construction, resulting in a substantial reduction in population abundance, movement, and distribution." "Substantial" is not defined, but because of the special status of the species, a low value is selected. It is not clear what this value is and whether this value is species-specific, as stated.

A more important issue than defining "substantial" is that SAM does not provide the information needed to fulfill the stated definition of "significant." SAM only assesses habitat capacity, and does not generate information on population abundance, movement, or distribution (i.e., the components of the definition of "significant" stated above). In addition, the way the analyses were performed does not put the changes in habitat capacity at the population level. All analyses are relative to the 88 sites and do not relate changes from the 88 sites to how much habitat is available to the population or which habitat type is limiting which life stage. Furthermore, all analyses are about habitat quantity and quality, and the aggregation of the SAM output prevents examination of any spatial changes in how the habitat is distributed within each region. This lack of spatially specific results is suitable for a programmatic-level analysis, but then should not be used as a definition of "significant."

The definition of "significant" must match the capabilities of the analyses performed. Changes in habitat suitability cannot be interpreted as changes in the population abundance, either for the 88 sites or for the region or for the project area. Some expression of the changes in habitat from the project relative to the availability of habitat types in the entire system would enable results to be viewed closer to the population level by at least determining habitat losses relative to the habitat of the total population.

Understanding predictions. The presentation of habitat changes (linear feet) separately for each key life stage and process (e.g., adult migration) is useful (e.g., Figures F-1 to F-24). It would also be helpful to report how much each of the habitat variables themselves (before going into the suitability curves) changed in the 88 sites over time in each region under each of the alternatives. Changes in habitat using suitability curves that combine information from six variables into a single value are not simply or intuitively related to changes in each of the habitat variables. Changes in the habitat variables and total habitat can then be compared to total amounts in each region to more closely approach assessing habitat changes due to the project at the population level (at least the habitat changes are population level).

Significance – Medium/Low

Proper and consistent interpretation of the SAM results is necessary for clear communication and determination of appropriate and effective mitigation actions.

Recommendation for Resolution

1. Present additional documentation that explains the baseline used in SAM analyses and that presents the rationale and proper interpretation of results when expressed as percent changes.
2. Redefine "significance" to match the capabilities of the analysis method.
3. Demonstrate, using a few case study well-measured sites, that the estimation methods for the habitat variables for the 88 sites have small enough uncertainty that they are sufficient to allow

for meaningful comparisons across alternatives.

4. Provide frequency histogram or CDFs of the six habitat variables for the alternatives for several of the 58 years in the projections to aid in understanding how the bank protection measures are assumed to change with alternatives.
5. Compare the amount of the habitat variables (input to SAM) and total habitat (output from SAM) in the 88 sites to total amounts in each of the regions to more closely approach the idea of expressing model results at the population-level.

Final Panel Comment 10

Little information is provided on what monitoring is planned in order to implement adaptive management.

Basis for Comment

Adaptive management is discussed in the Mitigation Strategy document (EIS, Appendix J, p. 30), and is described as “an integral component of the Program.” The document states, “Fish population and environmental data collected under the SRBPP will be used, as appropriate, by the IWG in the adaptive management…” However, the monitoring required for adaptive management is not documented in any detail and there is no mention of any performance monitoring of the habitat variables used by SAM or monitoring of fish densities to confirm habitat use. Step 15 of the Site Selection and Implementation Procedure (p. 10) mentions vegetation monitoring on a yearly basis (not less than 5 years) to determine if the compensatory mitigation has met performance standards. There may be monitoring done by the IWG, but if adaptive management is an integral component of the program, then the implementation aspects, especially the monitoring, required for adaptive management need to be described.

Significance – Medium/Low

Use of adaptive management to ensure effective restoration and for dealing with uncertainties is a sound approach, but is not feasible without the collection of appropriate data.

Recommendation for Resolution

1. Prepare an implementation plan that describes how adaptive management will be used, including the collection of necessary data and the use of existing or anticipated data collected by others.

Final Panel Comment 11

The use of the Annual Reconnaissance/Erosion Inventory results along with the application of the minimum levee geometry and the vegetation free zone (VFZ) template in the programmatic/feasibility phase and initial implementation leads to an increase in risk and a need for higher contingencies in cost and schedule estimates.

Basis for Comment

In addition to the subjective nature of the Annual Reconnaissance/Erosion Inventory slope observations, there is a high potential for the levee waterside and bank slope angles to vary over the several years that pass between the Annual Reconnaissance/Erosion Inventories, site selection and implementation, preliminary and final design, and construction processes. These variations can lead to increased project cost and schedule risk and significant adjustments associated with alternative designs, material quantities, and real estate acquisition.

The assumptions used in the application of the minimum levee geometry and determination of the landside toe and waterside toe (Appendix A, pp. 103-104) (and, by extension, the overlay of the VFZ template) appear to deviate in some cases from the Geotechnical Levee Practice (2008), yet no engineering bases are provided to justify these deviations. The Geotechnical Levee Practice (2008) references a waterside levee slope of 3H:1V (inferred as no steeper than), whereas Appendix A (p. 114) references both 3H:1V and 2H:1V (minimum - no steeper than). The use of 2H:1V appears to be based on a need to make the repair geometry fit, and a desire to limit channel/river encroachment. Without the benefit of engineering analyses, it is not clear if the 2H:1V minimum will meet all USACE levee requirements including stability.

The assumptions used in the application of the minimum levee geometry, determination of the landside toe and waterside toe, and the interpretation of outcomes of the waterside toe are confusing and may increase project cost and schedule risk. Examples include Appendix A (p. 103):

> "… In the case of the physical levee exceeding the levee minimum geometry, the programmatic plan will use the actual physical slope to establish the waterside toe. …For levee sections that exceed the minimum geometry, the full physical levee will be considered the critical structure. The initial assumption is that the original design as exists on the ground is correct. … the programmatic plan will follow is that the minimum levee geometry or the actual physical levee, whichever is bigger, will determine the size of levee."

The strict application of the minimum levee geometry without the benefit of engineering judgment may result in either a conservative or an un-conservative design, depending upon the cross section and other levee parameters.

A brief review of specific proposed repairs in the Levee Geometry Technical Memorandum, June 2011, (Appendix A, p. 258) calls for repairs when, based on the information presented, there appears to be little risk to the levee from observed erosion, or conversely it is thought sections having higher risk may not call for repairs based on the above geometry interpretation. For example, see Appendix A Sacramento River 63.0R (p.326) and 104.0L (p. 346). The discussion of why repair is being recommended in these areas is not well-presented since there appears to be little risk to the levee proper. Subsurface explorations, data, surveys, and geotechnical engineering are thought to be minimal for feasibility or conceptual design of alternatives. However, the Panel notes that the bank protection project continues on an existing project with a rich and complete history of exploration, analyses, design,

construction, operations and maintenance, inspection, improvements and upgrades, and monitoring and performance under flood loadings over many years dating back to 1917. As such, USACE and non-Federal sponsor project-specific experience, geotechnical engineering and judgment (i.e., as-built drawings, inspection reports, annual reconnaissance surveys, Geotechnical Levee Practice [2008], etc.) provide strong bases on which to proceed with conceptual design.

Significance – Medium/Low

Consistency in the Annual Reconnaissance/Erosion Inventory and application of the minimum levee geometry and the VFZ template reduces risk and minimizes the need for higher contingencies in cost and schedule estimates.

Recommendation for Resolution

1. Add information on sensitivity of programmatic/ feasibility outcomes and cost estimates to the PACR to address: (1) visual observations from reconnaissance/erosion surveys, such as an estimated waterside levee slope of, say, 3H:1V versus an actual slope of 2.5H:1V, or river bank slope of, say, 2H:1V versus an actual 1.5H:1V; and (2) use of a minimum waterside slope of 3H:1V (per Geotechnical Levee Practice, 2008) versus minimum 2H:1V (Appendix A, p. 114).
2. Revisit and revise (if necessary) the interpretation and application of the Geotechnical Levee Practice (2008) and the VFZ template in developing and refining the Levee Geometry Technical Memorandum.

Final Panel Comment 12

Some hydrologic methods and analyses are not clearly described in the PACR, including the analysis of hydrologic changes since project construction and how stream geomorphologic changes will be analyzed.

Basis for Comment

The PACR does not document the hydrologic and geomorphologic changes in the system since the construction of the project. Based on USACE's responses to the Panel's mid-review questions, hydrologic changes since project construction have been determined to be insignificant because the bulk of runoff comes from the undeveloped mountainous regions of the basin. However, the PACR does not describe this situation or provide a referenced study to support the conclusion.

During the mid-review teleconference, USACE also indicated that geomorphic changes to the stream system were to be addressed during the Design Documentation Report (DDR) phase of a specific measure or action. While the stability of the stream channel alignment is critical to the success of the levee system, the PACR does not identify the methodology that will be employed to analyze these geomorphic changes.

Significance – Medium/Low

Hydrologic and geomorphic changes since the construction of the levee system and their impacts on the performance of the system should be documented and parameters should be defined that identify changes that threaten project safety to ensure consistency of the project.

Recommendation for Resolution

1. Describe the analysis of hydrologic and geomorphic changes since project construction and how stream geomorphologic and hydrologic changes will be analyzed during the life of the project.

Final Panel Comment 13

The method used to determine which basins are economically justified is not based on the AEP analysis.

Basis for Comment

The Panel has concerns about the methods used to calculate the without-project and with-project Annual Exceedance Probability (AEP) values presented in Table 4 and discussed in Section 11.0 of the PACR.

Specifically, the PACR indicates (p. 25) that the without-project and with-project AEP values were computed "… using data from different sources (i.e. the URS AEP vs. Comp study/recent District studies)." The PACR indicates in two different statements on that page that at least some of the AEP values are not correct:

> "In some cases, the 'with-project' AEP is greater than the 'without-project' AEP, implying that the levee performance gets worse with improvements to the erosion site. This is not expected to occur, but is mainly an effect of the difficulty of distinguishing levee failure due to erosion from other levee failure modes (such as over topping)."
>
> "It is important to note that for many reaches, the assumption regarding the maximum attainable AEP value as listed in Table 4 is greater (lower performing) than the without-project AEP estimate from a contractor-prepared report, which appears to imply that the levee performance in these areas gets worse with repairs to the erosions site. This would not actually occur, but is mainly an effect of: 1) there are worse performance conditions for other potential failure modes, and that the AEP for the impact area is not governed by the erosion performance and/or 2) using data from different sources (i.e. the URS AEP vs. Comp study/recent District studies."

The PACR (p. 25) includes the statement "… basins being recommended at this time are primarily those within heavily urbanized and populated areas where risk is unarguably high…" The Panel accepts USACE's conclusion that many of the basins are in heavily urbanized and populated areas and concurs that some basins could be justified by experience/observation. In addition, the Panel understands that USACE claims no benefits in those sub-basins where the with-project AEP was calculated as higher than the without-project AEP. However, since the AEP values for seven of the 24 basins are shown as (on average) 8 times higher for the with-project than without-project, the Panel questions relying on the AEP values to calculate benefits for the remaining sub-basins.

Significance – Medium/Low

The Panel believes that the project would be proven as justified, and possibly more basins would be justified, if a complete AEP analysis with compatible methods and data were performed.

Recommendation for Resolution

1. Perform a without-project and with-project AEP analysis for each sub-basin using a consistent data set and consistent methods. If a consistent data set is not available for use at this time, the Panel expects that with the PDT's knowledge of the sub-basins that the PDT could estimate reasonable AEP values for both the without- and the with- project condition.
2. Revise the PACR text to incorporate the revised AEP analysis.

Final Panel Comment 14

The life history summaries and factors affecting abundances of special-status species do not necessarily reflect the current knowledge.

Basis for Comment

The text summarizing the life histories and factors affecting abundance of the special-status fish species (EIS, pp. 11-11 and 11-27) is important for providing context for interpreting the results from SAM results and from other analyses. The literature cited is reasonable but is too limited in scope and does not reflect the most current information. For example, the life history summary of Delta Smelt does not cite papers after 2009, yet there has been much research and analyses done on Delta Smelt since then.

One of the uses of the life history summaries and discussion about the factors affecting abundance is to enable a clear description of how the bank stabilization measures can affect individuals in the populations. Seven possible effects of bank stabilization measures are assessed for vegetation, four possible effects for fish, and four possible effects for wildlife. There is a list of direct and indirect effects (mechanisms) listed for wildlife (p. 12-38) that seems complete, but the relationship of these effects to the four wildlife effects actually assessed is not clear. On the other hand, the relationship between the four wildlife effects and the mitigation measures is clearly described. Similarly, for vegetation, there are effects mechanisms listed that could be better linked to the four effects that are evaluated. For the fish, the mechanisms are listed with the specific effects. Some of the mechanisms described are too limited, but would not affect the analyses at the programmatic level. The conceptual life history models available for each of these species should be used to ensure all relevant mechanisms are covered by the direct effects actually analyzed, and if not, the unaddressed mechanisms and effects should be clearly noted as not being addressed and why. For the special-status fish species, most of the information is nicely presented in the updated documentation for the SAM model.

The life history summaries also enable clear communication of possible indirect effects of bank stabilization measures. The SAM analyses for the special status fish species do not include any indirect effects that occur from project activities affecting other non-special-status species that then go on to affect the special-status species (e.g., more vegetation increasing largemouth bass that eat delta smelt). Such analyses of indirect effects are not feasible, but should be discussed as caveats to the SAM analyses. These unquantified indirect effects contribute to the uncertainty of SAM predictions. Discussion of these possible indirect effects requires a thorough description of the life histories and factors affecting abundance.

Significance – Low

Background material in the report serves as a foundation for the interpretation of the SAM analyses and results, and therefore is most effective when it is up to date and reflects the state of our knowledge.

Recommendation for Resolution

1. Update the descriptions of the life history and factors affecting abundance of the special-status fish species and by updating the literature cited in the qualitative assessment of wildlife and vegetation. For example, there are conceptual models of the life cycles of many special-status fish species (Delta Regional Ecosystem Restoration Implementation Plan, DRERIP [CDFW, online]) and there is a detailed life history and life cycle documentation of delta smelt just published (IEP MAST, 2015).

2. Enhance the existing sections on the mechanisms of effects to be systematic and acknowledging direct effects not addressed and any potentially critical indirect effects (necessarily not addressed).

Literature Cited:

CDFW (online). DRERIP Conceptual Models. California Department of Fish and Wildlife website. Available online at http://www.dfg.ca.gov/erp/conceptual_models.asp

IEP MAST (2015). An updated conceptual model of Delta smelt biology: our evolving understanding of an estuarine fish. Technical Report 90. Interagency Ecological Program for the San Francisco Delta Bay and Estuary. IEP Management, Analysis, and Synthesis Team. January. Available online at: http://www.water.ca.gov/iep/docs/Delta_Smelt_MAST_Synthesis_Report_January%202015.pdf

Final Panel Comment 15

Residual risk is not addressed in the PACR, which may lead the non-Federal sponsor and the floodplain occupants to conclude that the degree of flood risk protection provided by the project is higher than it actually is.

Basis for Comment

There are no changes in the project purpose of flood risk management for the SRBPP, but the PACR does not discuss the residual risk to the non-Federal sponsor and the flood plain occupants that will exist following project implementation. The non-Federal sponsor and the flood plain occupants will not be aware of the flood risk that will remain following project implementation if it is not addressed in the PACR. The PACR (p. 7) states: “For bank protection that is fix-in-place stone placement, the SRBPP does not include other levee corrective measures such as seepage and cutoff walls, raising low spots along the levee crests, improving slope stability, correcting seismic deficiencies or reducing risk of overtopping.” However, the PACR does not provide any qualitative or quantitative indication of what the potential or probabilities are for levee failures from not including these other potential levee corrective measures.

Significance – Low

The project identified in the PACR will provide the non-Federal sponsor and the flood plain occupants with improved flood risk protection compared to what exists under the without-project condition, but the PACR needs to explain that there are still residual risks and clearly describe what they are.

Recommendation for Resolution

1. Provide a qualitative and/or quantitative description of the residual risk that will exist following implementation of the PACR’s recommendation.

Final Panel Comment 146

Some terms (e.g., significant, design discharge, summer/fall waterline, revetment database, and ecological terms) appear to have become standardized over the decades of design, studies, and analyses, yet their definitions have not been provided.

Basis for Comment

The Panel realizes that the SRBPP project is the result of several decades of design, studies, operations, and analyses and, as a result, some terms have become "standardized" and are assumed to be understood by the reader. However, the clarity of the SRBPP documents would improve if these terms were accompanied by a definition upon first use.

The Panel identified several terms that are not clearly defined in the PACR and the EIS:

- "combined adjacent" and "single adjacent" alternatives
- the 1957 profile (PACR, Appendix A, Subappendix 5, Final Hydraulic Appendix)
- "summer/fall waterline" (PACR, pp. 16-17)
- "design discharge" (PACR, Appendix A, Subappendix 5, Final Hydraulic Appendix)
- "significant," as related to effects on fish populations (EIS, p. 11-34)
- "worst-case," as related to identifying programmatic environmental effects (PACR, p. 18)
- "minimizes," as related to the impacts on riparian vegetation and habitat (PACR, p. 40).

Significance – Low

Providing definitions of these terms will improve the clarity of the PACR and EIS and will ensure that these terms are used consistently in future documentation.

Recommendation for Resolution

1. Define all unique terms upon first use.

5. REFERENCES

CDFW (online). DRERIP Conceptual Models. California Department of Fish and Wildlife website. Available online at http://www.dfg.ca.gov/erp/conceptual_models.asp

IEP MAST (2015). An updated conceptual model of Delta smelt biology: our evolving understanding of an estuarine fish. Technical Report 90. Interagency Ecological Program for the San Francisco Delta Bay and Estuary. IEP Management, Analysis, and Synthesis Team. January. Available online at: http://www.water.ca.gov/iep/docs/Delta_Smelt_MAST_Synthesis_Report_January%202015.pdf

OMB (2004). Final Information Quality Bulletin for Peer Review. Executive Office of the President, Office of Management and Budget, Washington, D.C. Memorandum M-05-03. December 16.

The National Academies (2003). Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports. The National Academies (National Academy of Science, National Academy of Engineering, Institute of Medicine, National Research Council). May 12.

USACE (2012). Water Resources Policies and Authorities: Civil Works Review. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Circular (EC) 1165-2-214. December 15.

USACE (2000). Planning – Planning Guidance Notebook. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Regulation (ER) 1105-2-100. April 22.

APPENDIX A

IEPR Process for the SRBPP PADD

This page is intentionally left blank.

A.1 Planning and Conduct of the Independent External Peer Review (IEPR)

Table A-1 presents the schedule followed in executing the Phase II Post-Authorization Decision Documents (PADD) for the Sacramento River Bank Protection Project (SRBPP), California Independent External Peer Review (hereinafter: SRBPP IEPR). Due dates for milestones and deliverables are based on the award/effective date of August 12, 2012[4]. The review documents were provided by U.S. Army Corps of Engineers (USACE) on December 23, 2014. Note that the work items listed under Task 6 occur after the submission of this report. Battelle will enter the 16 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.

Table A-1. SRBPP Complete IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	8/14/2012
	Review documents available	12/23/2014
	Battelle submits draft Work Plan[a]	1/21/2015
	USACE provides comments on draft Work Plan	2/3/2015
	Battelle submits final Work Plan[a]	2/6/2015
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	9/24/2013
	USACE provides comments on COI questionnaire	9/27/2013
	Battelle submits list of selected panel members[a]	1/29/2015
	USACE confirms the panel members have no COI	2/3/2015
	Battelle completes subcontracts for panel members	2/6/2015
3	Battelle convenes kick-off meeting with USACE	2/2/2015
	Battelle sends review documents to panel members	2/6/2015
	Battelle convenes kick-off meeting with panel members	2/6/2015
	Battelle convenes kick-off meeting with USACE and panel members	2/6/2015
	Battelle convenes Mid-Review Teleconference for panel members to ask clarifying questions of USACE	2/19/2015

[4] See Section 3 of the main Final IEPR Report for more on the timeline after the award/effective date and before the receipt of the review documents.

Table A-1. SRBPP Complete IEPR Schedule (continued)

Task	Action	Due Date
4	Panel members complete their individual reviews	2/25/2015
	Battelle provides panel members with talking points for Panel Review Teleconference	3/3/2015
	Battelle convenes Panel Review Teleconference	3/6/2015
	Battelle provides Final Panel Comment templates and instructions to panel members	3/6/2015
	Panel members provide draft Final Panel Comments to Battelle	3/13/2015
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	3/14/2015 - 3/22/2015
	Panel finalizes Final Panel Comments	3/23/2015
5	Battelle provides Final IEPR Report to panel members for review	3/24/2015
	Panel members provide comments on Final IEPR Report	3/26/2015
	Battelle submits Final IEPR Report to USACE[a]	**3/27/2015**
6[b]	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	3/30/2015
	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	3/30/2015
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	3/30/2015
	USACE provides draft Project Delivery Team (PDT) Evaluator Responses to Battelle	4/20/2015
	Battelle provides the panel members the draft PDT Evaluator Responses	4/21/2015
	Panel members provide Battelle with draft BackCheck Responses	4/24/2015
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	4/27/2015
	Battelle convenes Comment-Response Teleconference with panel members and USACE	4/28/2015
	USACE inputs final PDT Evaluator Responses to DrChecks	5/1/2015
	Battelle provides final PDT Evaluator Responses to panel members	5/5/2015
	Panel members provide Battelle with final BackCheck Responses	5/8/2015
	Battelle inputs the Panel's final BackCheck Responses in DrChecks	5/11/2015
	Battelle submits pdf printout of DrChecks project file[a]	5/11/2015
	Contract End/Delivery Date	8/31/2015

a Deliverable.

b Task 6 occurs after the submission of this report

At the beginning of the Period of Performance for the SRBPP IEPR, 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, 24 charge questions were provided by USACE and included in the draft and final Work Plans. Battelle added two questions that seek summary information from the IEPR Panel. The final charge also included general guidance for the Panel on the conduct of the peer review (provided in Appendix C of this final report).

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 SRBPP 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.

- **Sacramento River Bank Protection Project (SRBPP) Draft Post-Authorization Change Report (PACR) (50 pages)**
    - **Appendix A: Engineering Main Report (805 pages)**
    - **Appendix B: Site Selection Process (14 pages)**
    - Appendix C: Real Estate Plan (39 pages)
    - Appendix D: Economics (143 pages)
- **SRBPP Environmental Impact Statement/ Environmental Impact Report (692 pages)**
    - **Appendix A: Public Notice and Scoping Materials (162 pages)**
    - **Appendix B: Cultural Resources Programmatic Agreement (317 pages)**
    - **Appendix C: Regulatory Background (105 pages)**
    - **Appendix D: Air Quality Mitigation Measures by Air District (21 pages)**
    - **Appendix E: Riparian Vegetation Analysis (19 pages)**
    - **Appendix F: Standard Assessment Methodology (SAM) Analysis (51 pages)**
    - **Appendix G: Cultural Context (39 pages)**
    - **Appendix H: Cultural Resources Section 106 Correspondence (95 pages)**
    - **Appendix I: U.S. Fish and Wildlife Service CAR (85 pages)**
    - **Appendix J: SRBPP Phase II Supplemental Authorization Programmatic Mitigation Strategy (141 pages)**
- USACE guidance *Civil Works Review* (EC 1165-2-214), 15 December 2012
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review,* December 16, 2004.

About halfway through the review of the SRBPP IEPR 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 19 panel member questions to USACE. USACE was able to provide responses to all of the questions during the teleconference or within the following week via email.

A.2 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. At the end of the review, Battelle summarized the individual comments in a preliminary list of 23 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

A.3 IEPR Panel Teleconference

Battelle facilitated a four -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 significant importance to the findings, and merged any related individual comments. At the conclusion of the teleconference, Battelle reviewed each Final Panel Comment with the Panel, including the associated level of significance, and confirmed the lead author for each comment.

The Panel also discussed responses to three 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 all sets of comments were determined not to be conflicting. Each comment was either incorporated into a Final Panel Comment, determined to be consistent with other Final Panel Comments already developed, or determined to be a non-significant issue.

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

A.4 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 SRBPP 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 member 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/high, medium, medium/low, and 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 issue with the project that affects the current recommendation or justification of the project, and which will affect its future success, if the project moves forward without the issue being addressed. Comments rated as high indicate that the Panel determined that the current methods, models, and/or analyses contain a "showstopper" issue.

    2. **Medium/High:** Describes a potential fundamental issue with the project, which has not been evaluated at a level appropriate to this stage in the Planning process. Comments rated as medium/high indicate that the Panel analyzed or assessed the methods, models, and/or analyses available at this stage in the Planning process and has determined that if the issue is not addressed, it could lead to a "showstopper" issue.

    3. **Medium:** Describes an issue with the project, which does not align with the currently assessed level of risk assigned at this stage in the Planning process. Comments rated as medium indicate that, based on the information provided, the Panel identified an issue that would raise the risk level if the issue is not appropriately addressed.

    4. **Medium/Low:** Affects the completeness of the report at this time in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium/low indicate that the Panel does not currently have sufficient information to analyze or assess the methods, models, or analyses.

    5. **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 that was mislabeled or incorrect or that certain data or report section(s) were not clearly described or presented.

- Guidelines 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).

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. During the Final Panel Comment development process, the Panel determined that one of the Final Panel Comments could be dropped; therefore, the total Final Panel Comment count was reduced to 16. 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 the main report.

This page is intentionally left blank.

APPENDIX B

Identification and Selection of IEPR Panel Members for the SRBPP Project

This page is intentionally left blank.

B.1 Panel Identification

The candidates for the Phase II Post-Authorization Decision Documents (PADD) for the Sacramento River Bank Protection Project (SRBPP), California (hereinafter: SRBPP IEPR) Panel were evaluated based on their technical expertise in the following key areas: hydraulic engineering, Civil Works planning/economics, biology/ecology, civil/construction engineering, and geotechnical engineering. These areas correspond to the technical content of the SRBPP IEPR review documents and overall scope of the SRBPP project.

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 conflicts of interest (COIs). Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and ultimately selected five experts for 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.[5] These COI questions 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 in the Phase II Post-Authorization Decision Documents (PADD) for the Sacramento River Bank Protection Project (SRBPP), California.
- Previous and/or current involvement by you or your firm[6] in flood control management in the Sacramento Valley and Sacramento-San Joaquin Delta, including the Sacramento River and its tributaries (American, Feather, Yuba, and Bear Rivers along with additional minor tributaries); the Moulton, Colusa, Tisdale, Fremont, and the Sacramento Flood Overflow Weirs; the Butte Basin; the Sutter and Yolo Bypasses and Sloughs; the northern Central Valley; the San Joaquin River; and Sacramento River Delta and the Suisan Bay.
- Previous and/or current involvement by you or your firm[5] in the Phase II PADD for SRBPP-related projects.

---

[5] 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."

[6] Includes any joint ventures in which the panel member's firm is involved and if the firm serves as a prime or as a subcontractor to a prime.

- Previous and/or current involvement by you or your firm[5] in the conceptual or actual design, construction, or O&M of any projects in the Phase II PADD for SRBPP-related projects.
- Current employment by the U.S. Army Corps of Engineers (USACE).
- Previous and/or current involvement with paid or unpaid expert testimony related to Phase II PADD for the SRBPP.
- 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 (for pay or pro bono): State of California Central Valley Flood Protection Board (CVFPB), California Department of Water Resources (DWR), Sacramento Area Flood Control Agency (SAFCA), West Sacramento Area Flood Control Agency (WSAFCA).
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to the Sacramento Valley and Sacramento-San Joaquin Delta, including the Sacramento River and its tributaries (American, Feather, Yuba, and Bear Rivers along with additional minor tributaries); the Moulton, Colusa, Tisdale, Fremont, and the Sacramento Flood Overflow Weirs; the Butte Basin; the Sutter and Yolo Bypasses and Sloughs; the northern Central Valley; the San Joaquin River; and Sacramento River Delta and the Suisan Bay.
- 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, division, Headquarters, 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 Phase II PADD for the SRBPP.
- Current firm[5] 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 USACE as a direct employee or contractor (either as an individual or through your firm[5]) 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 flood risk management, and include the client/agency and duration of review (approximate dates).
- Pending, current, or future financial interests in Phase II PADD for SRBPP-related contracts/ awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[5] revenues within the last 3 years from USACE contracts.
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to Phase II PADD for the SRBPP.
- Participation in relevant prior Federal studies relevant to this project and/or Phase II PADD for the SRBPP.

- Previous and/or current participation in prior non-Federal studies relevant to this project and/or Phase II PADD for the SRBPP.
- 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?

Other considerations:

- Participation in previous USACE technical review panels
- Other technical review panel experience.

B.2 Panel Selection

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. Three of the five final reviewers are affiliated with consulting companies; the other two are 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 selected the final Panel.

An overview of the credentials of the final five members of the Panel and their qualifications in relation to the technical evaluation criteria is presented in Table B-1. More detailed biographical information regarding each panel member and his area of technical expertise is presented in Section B.3.

Table B-1. SRBPP IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	James	McCaskie	Ator	Lambert	Rose
Hydraulic Engineering					
Registered professional engineer with a minimum 15 years' experience in hydrologic and hydraulic engineering	X				
Familiar with large, complex Civil Works projects with high public and interagency interests	X				
Experience modeling water surface profiles for flood risk management project	X				
Understanding of dynamics of open channel flow systems	X				
Understanding of flood plain hydraulics	X				
Understanding of interior flood control systems	X				
Understanding of dynamic river meandering	X				
Familiarity with standard USACE application of risk and uncertainty analyses in flood risk management studies	X				
Experience modeling and analyzing sediment transport models	X				
Experience working with both 1D and 2D hydraulic models	X				
Experience designing vegetated riprap	X				
Familiarity with standard USACE hydrologic and hydraulic computer models including HEC-6, HEC-RAS, FLO-2D, RMA2, HEC-FDA, and HEC-DSS	X				
Active participation in related professional societies	X				
Minimum M.S. degree in engineering	X				
Geotechnical Engineering					
Registered professional engineer with a minimum 10 years' experience in civil or construction cost engineering		X			
Experience performing cost/construction engineering management for all phases of flood risk management related projects		X			
Demonstrated experience related to geotechnical practices associated with floodwall design and construction		X			
Ability to address the USACE Safety Assurance Review (SAR) aspect of projects		X			
Active participation in related professional engineering and scientific societies		X			
Civil Works Planning/Economics					

Minimum 10 years' experience directly related to water resource economic evaluation or review			X		
Minimum 5 years' experience working directly for or with USACE			X		
Minimum 5 years' experience dealing directly with the Six-Step Planning Process governed by ER 1105-2-100 Planning Guidance Notebook			X		
Minimum M.S. degree in economics			X		
Civil/ Construction Engineering					
Registered professional engineer with a minimum 10 years' experience in civil or construction cost engineering				X	
Experience performing cost/construction engineering management for all phases of flood risk management related projects				X	
Demonstrated experience related to floodwall design and construction				X	
Ability to address the USACE SAR aspect of projects				X	
Active participation in related professional engineering and scientific societies				X	
Biology/Ecology					
Minimum 10 years' experience in evaluation and conducting National Environmental Policy Act (NEPA) impact assessments					X
Experience performing cumulative effects analyses for complex multi-objective publics works projects with competing trade-offs					X
Extensive experience working with fisheries, in particular Chinook salmon					X
Familiarity with USACE calculation of evaluation of environmental benefits					X
Extensive background in implementation of NEPA compliance process					X
Experience and working knowledge of CA Environmental Quality act (CEQA)					X
Experience and working knowledge of Habitat Evaluation Procedures (HEP)					X
Minimum M.S. degree in appropriate field of study					X

B.3 Panel Member Qualifications

Maurice James, P.E.

Role: Hydraulic engineering expert.
Affiliation: Water Resources Consulting, LLC

Mr. James is a hydraulic engineering consultant with Water Resources Consulting, LLC and is a registered professional engineer in Mississippi and Alabama. He earned his M.S. in engineering mechanics with a major in fluid mechanics and minor in water pollution control from the University of Alabama in 1972. He has 43 years of experience in research and design in the fields of hydrology, hydraulics, and riverine geomorphology with USACE and in the private sector. He served as an engineering specialist in hydrology, sedimentation, riverine geomorphology, and hydraulics for USACE Mobile District from 1972 to 2003. He is familiar with large Civil Works projects with high public and interagency interests that have included flood control, geomorphologic analysis, navigation, locks and dams, and hydropower. He has extensive experience with determination of flood profiles, frequency analysis, risk analysis, and the analysis of reservoir operation for flood control and is familiar with standard USACE application of risk and uncertainty analyses in flood risk management studies.

Mr. James is familiar with the dynamics of open-channel flow systems, floodplain hydraulics (from large rivers to small streams), the design and analysis of interior flood control systems hydraulics, and dynamic river meandering. He has experience in the design of dams, reservoirs, spillways, navigation channels, levees, hydraulic outlet works, navigation locks, dredge material containment facilities, bank protection, stream stabilization, and sediment basins, including the identification of streams' tendencies to migrate, the movement of bendways, impacts of sedimentation loads, and the influence of rock outcrops and varying materials in the alluvial plain. Mr. James managed a $7.5 million program in Honduras associated with U. S. assistance for restoration of infrastructure damages caused by Hurricane Mitch that included the coordination, design, and construction of approximately 11 related projects that included problem identification, evaluation of changes in stream morphology, determination of stream stability, identification of solutions, design of appropriate measures, contracting and monitoring of construction projects. During his last few years at the Mobile District, Mr. James served as the lead hydraulic engineer assigning work and providing technical oversight and review of work performed by 12 hydraulic engineers.

As senior design engineer in the Engineering Division, Hydraulic and Hydrology Branch, USACE Mobile District, he conducted simulations and analyses with various hydraulic and sediment modeling packages. He has significant design experience with the application of one- and two-dimensional hydraulic, hydrologic, and sediment transport computer simulation models for the design of flood control projects, channel stability, water supply, drought management, watershed management, navigation channels, port facilities, navigation structures, dam failure analysis, and dredged materials disposal techniques. He has design experience with vegetated riprap on previous projects, is experienced with standard USACE hydrologic and hydraulic computer models, has conducted numerous modeling studies, has extensive experience with HEC-RAS in both unsteady and steady state modes, has used HEC-6, HEC-FDA, HEC-SSP, and HEC-DSS and is familiar with concepts of both FLO-2D and RMA2. During the last two years, Mr. James has developed models using ArcGIS and GeoRAS to generate HEC-RAS models to determine impacts of dam failures on the Tallulah and Chattahoochee Rivers in GA. Mr. James is active in related professional societies such as the Alabama Chapter of the American Water Resources Association.

Stephen McCaskie, P.E.

Role: Geotechnical engineering expert.
Affiliation: Hanson Professional Services, Inc.

Mr. McCaskie serves as a project manager and senior geotechnical engineer for Hanson Professional Services, Inc. He is a registered professional engineer in California, Colorado, Florida, Iowa, Illinois, Kansas, Louisiana, Missouri, North Dakota, and Texas and a registered geotechnical engineer in California. He earned his M.S. in civil engineering (geotechnical) from Carnegie-Mellon University in 1980 and has more than 37 years of experience in project management; engineering, design, permitting, and quality assurance/quality control (QA/QC) of flood protection, water resource, transportation, inland navigation, underground, port and harbor projects; planning, conducting, and supervising subsurface explorations; condition surveys/evaluations/assessments, safety inspections, analysis and design, construction monitoring and inspection; operations and maintenance; flood monitoring; and specialized foundation analyses, earth dam/levee and embankment design, instrumentation, data collection and analyses, soil-structure interaction, and earthquake engineering. He is experienced with geotechnical engineering for all phases of flood risk management and has demonstrated expertise related to geotechnical practices associated with levee and floodwall design and construction. Relevant studies include the Monarch-Chesterfield Levee, the Centaur Road Railroad and Walnut Grove Railroad Closure Structures, and the Walnut Grove Floodwall.

Mr. McCaskie has conducted risk analyses involving probabilistic methods for assessment of geotechnical and hydrologic/hydraulic parameters in the evaluation of percent chance of overtopping and percent chance of failure for benefit-cost ratio and alternative studies. He has also served as the project manager and lead geotechnical engineer for numerous flood risk management projects involving the analyses, design, and engineering during construction for such studies as the Devils Lake Flood Risk Management, Roads Acting as Dams (RAADS), Phases 1, 2, 2A, and 2B Embankments and Pump Stations, and the Missouri Department of Conservation Busch Wildlife Lake No. 35 Dam and Spillway Improvements. He has expertise conducting SAR reviews for USACE IEPR projects including the Greater New Orleans Hurricane Protection; WBV 14C.2 – New Westwego Pump Station to Orleans Village – 3rd Enlargement – Phase 1; LPV 18.2 – Floodwall and Gate at Williams Blvd. Boat Launch Phase 2; LPV 109.2a – Levee Enlargements South Point to CSX Railroad; LPV 111.01 – Levee Raise CSX Railroad to Michoud Canal; NESP L&D #22 Fish Passage; Trinity River Hard Edge Retaining/Floodwalls, Trinity River Bypass Channel, and South Florida Water Management District L-33, -35, -35A, -36, and -37 Levees (Broward County). His active participation in related professional engineering societies includes his membership in Society of American Military Engineers (St. Louis Post officer/board member since 2004), U.S. Society on Dams (Levee Committee member), American Society of Civil Engineers, Association of State Dam Safety Officials, and the Earthquake Engineering Research Institute.

Donald Ator

Role: Civil Works planning/economics expert.
Affiliation: Independent consultant

Mr. Ator is a Research Associate, Professor, and Undergraduate Advisor in the Department of Agriculture Economics and Agribusiness at Louisiana State University. Mr. Ator's responsibilities include research, grant writing and proposal development, extension and outreach, undergraduate advising and

teaching Agricultural Commodity Marketing and Risk Management. His current research is in financial resiliency planning for local governments in Louisiana, Texas, Alabama, Mississippi, Florida, Georgia, Kentucky, and Nebraska.

He has 35 years of experience working for 22 USACE districts, first as a full-time employee with USACE Vicksburg District for one year, and then in the private sector with a not-for-profit research institute and with architect-engineer firms. He earned his M.S.in economics and agriculture economics from Louisiana State University in 1978 and his M.B.A. in finance and accounting from Louisiana State University in 1984. He has conducted more than 500 water resources studies and technical reviews nationwide of USACE water resources projects for flood and/or storm damage risk reduction, ecosystem restoration, navigation, shoreline protection, and watershed planning. Relevant studies include Analysis of Economics and Flood Damage Reevaluation Report, Dark Hollow, North Little Rock, Arkansas (USACE Little Rock District) and Flood Damage Reduction Benefit Analysis Report, Imperial Valley, California (USACE Los Angeles District). He has worked extensively with USACE conducting Civil Works planning/economics studies in accordance with ER 1105-2-100 and other pertinent guidance, laws, and regulations applicable to the USACE Six-Step Planning Process and EC 1165-2-209 review requirements. Representative studies include Sensitivity Analysis of Benefit and Cost Evaluation Criteria to Risk and Uncertainty Associated with Study Parameters, Passaic River Basin, New Jersey (USACE New York District) and the Licking River Watershed and Dillon Lake Ecosystem Restoration Project Feasibility Study, OH (USACE Huntington District). He has experience participating in the IEPR of Federal water resources planning documents justifying construction of Civil Works projects including Grays Harbor, Washington, Navigation Improvement Project (USACE Seattle District), and Sutter Basin Pilot Feasibility Study (USACE Sacramento District).

Mr. Ator's demonstrable proficiency in USACE study process is evidenced by his development of a template for preparing Project Management Plans for Feasibility Studies for the USACE Regional Planning and Environment Division South, Mississippi Valley Division in 2011, as well as field testing the template in 2012. He also attended a workshop on the latest version of HEC-FDA in March of 2010 hosted by the USACE Mississippi Valley Division. He has economic and Civil Works planning experience in California and the Pacific Northwest, including serving as the project manager and senior economist for the Imperial Valley Inundation Reduction Benefit Report for USACE, Los Angeles District. In this role, he delineated land use categories, evaluated crop and non-crop damages from flooding, determined structure replacement values, and generated expected annual damages. Mr. Astor is actively involved in related professional engineering and scientific societies including Society of American Military Engineers and American Society of Civil Engineers.

Michael Lambert, P.E.

Role: Civil/construction engineering expert.
Affiliation: Shannon & Wilson, Inc

Mr. Lambert is a geotechnical engineer with Shannon & Wilson, Inc. overseeing site investigations, developing geotechnical-related design and construction recommendations, developing and reviewing project plans and specifications, and monitoring compliance with project plans and specifications. He earned his M.E. in civil engineering from the University of Louisville in 1988, has more than 26 years direct engineering experience, and is a registered professional engineer in Missouri, Arkansas, Oregon, Tennessee, and California. He is experienced in performing cost engineering and construction

management for flood risk management-related projects. He has prepared ad reviewed construction cost estimates for the geotechnical portions of construction projects such as the U.S. Bureau of Reclamation Scoggins Dan/Henry Hagg Lake project for which he coordinated the efforts of consulting engineering firms, contractors, and stakeholders to validate project costs and schedules.

Mr. Lambert is experienced with the geotechnical aspects of floodwalls, earthen levees, closure structures, and pumping stations. Relevant projects have included support for the Howard Bend Levee System in Maryland Heights, Missouri, and the Harrah's Casino, Relief Well Rehabilitation and Testing in Maryland Heights, Missouri. He has also performed inspections for more than 408 miles of USACE levees and over 56 miles of U.S. Bureau of Reclamation irrigation canals. His experience with floodwall design and construction is demonstrated by the Howard Bend Levee System in Maryland Heights. As senior geotechnical engineer and project manager, he was responsible for reconstruction and upgrading to provide protection from a 500-year flood event. The flood protection system included earthen levee floodwalls, closure structures, and a pump station.

As design engineer on over a dozen USACE projects, he has a thorough understanding of USACE design methodologies associated with water retaining structures and is capable of addressing USACE SAR aspects of projects. He has published technical papers in his field of expertise and remains involved with professional organizations related to his field of expertise including Society of American Military Engineers, American Society of Civil Engineers, and the Association of State Dam Officials.

Kenneth Rose, Ph.D.

Role: Biology/ecology expert.
Affiliation: Independent consultant

Dr. Rose is a professor in the Oceanography & Coastal Sciences Department, and Associate Dean of Research in the School of the Coast and Environment at Louisiana State University. He earned his Ph.D. in fisheries from the University of Washington in 1985 and has 27 years of experience in fish biology, ecology, and population dynamics, including extensive experience researching estuarine and coastal fisheries. Dr. Rose is experienced evaluating, conducting, and implementing NEPA impact assessments and was an expert to EPA on revisions to the 316b assessments. He has also reviewed multiple EISs related to small and large projects, including the Mississippi River Gulf Outlet Ecosystem Restoration Study River. He has also participated in multiple review panels for large-scale EISs, biological opinions, and Section 7 consultations. He is experienced in performing cumulative effects analyses for complex public works projects with competing trade-offs and participates in multiple review panels and committees for the San Francisco Delta, including the NRC committee on Sustainable California Bay-Delta, the Independent Science Board of the CALFED Bay Authority (2004-2006), and the Independent Review Panel of the Delta Risk Management Strategy for the San Francisco Bay Ecosystem (2007).

Dr. Rose has extensive experience working with fisheries and Chinook salmon, and has published more than 100 papers on ecological modeling and fish population dynamics. Additional experience includes teaching a graduate course on "Population Dynamics Modeling"; participating in the independent review panel of the Long-Term Central Valley Project (CVP) and State Water Project (SWP) Operations Criteria and Plan (OCAP) Biological Opinion on Salmon, 2009; participating in the Klamath River Expert Panel, Scientific Assessment of Two Dam Removal Alternatives on Chinook Salmon (2011); and serving as

chairperson of the Salmonid Integrated Life Cycle Models Workshop, Delta Science Program (2011). Dr. Rose recently was a member of the Review of the SALSIM Population Model for Fall-Run Chinook in the San Joaquin River (2012).

Dr. Rose is familiar with USACE calculation of the evaluation of environmental benefits. He was a member of the team that applied the Habitat Suitability Index (HSI) to coastal Louisiana planning; was co-author on papers that used HSI for crappie and smallmouth spawning models in U.S. reservoirs and trout population dynamics in streams; and is familiar with the Wetland Value Assessment (WVA) methodology from several earlier reviews.

Dr. Rose is experienced with CEQA and has been a member of several review panels for Biological Opinions, Habitat Conservation Plans, and EISs in California, including the Science Advisory Panel for the Santa Clara Habitat Conservation Plan and Natural Community Conservation Plan (2006) and the Bay Delta Conservation Plan Steering Committee, 2007-2009. Dr. Rose was a participant in a workshop on Developing Conceptual Ecological Models for Coastal Louisiana (Baton Rouge, 2008). He was an external peer reviewer for model certification of USACE's EnviroFish model and the Standard Assessment Methodology (SAM) and SAM Electronic Calculation Template (ECT). Recently, Dr. Rose was a member of the Bay-Delta Independent Science Expert Panel on Fishery Resources to advise the California State Water Resources Control Board (2012).

Dr. Rose is a Fellow at the American Association for the Advancement of Science, received the Award of Excellence from the American Fisheries Society for lifetime achievement in 2014, and has been an editor for the Canadian Journal of Fisheries and Aquatic Sciences, San Francisco Estuary and Watershed Science, Transactions of the American Fisheries Society, and Fisheries Research.

APPENDIX C

Final Charge to the IEPR Submitted to USACE on March 20, 2015 for the SRBPP Project

This page is intentionally left blank.

CHARGE QUESTIONS AND GUIDANCE TO THE PANEL MEMBERS FOR THE IEPR OF THE PHASE II POST-AUTHORIZATION DECISION DOCUMENTS (PADD) FOR THE SACRAMENTO RIVER BANK PROTECTION PROJECT (SRBPP), CALIFORNIA

BACKGROUND

The Sacramento River begins near Mount Shasta in Northern California, flows through the northern Central Valley, and finally joins the San Joaquin River and Sacramento River Delta to discharge to the Suisan Bay. The Sacramento River Bay Protection Project (SRBPP) is a part of the Sacramento River Flood Control Project (SRFCP). The SRFCP includes approximately 1,300 miles of levees along the Sacramento River, tributaries (American, Feather, Yuba, and Bear Rivers along with additional minor tributaries), and distributary sloughs. The SRFCP also includes the Moulton, Colusa, Tisdale, Fremont, and the Sacramento Flood Overflow Weirs and the Butte Basin and Sutter and Yolo Bypasses and Sloughs. Phase I was 435,000 linear feet of bank protection. Construction of Phase I was completed in 1975.

The purpose of Phase II of the SRBPP is to identify and repair sites along the Sacramento River and Tributaries that may have been weakened due to erosion, while concurrently providing mitigation for any environmental impact as detailed in the supporting Environmental Impact Statement/Environmental Impact Report (EIS/EIR). This portion of Phase II consists of 80,000 linear feet of bank protection along the Sacramento River and tributaries. Authority has been given to Phase II (405,000 linear feet) of this project by Section 202 of the River Basin Monetary Authorization Act of 1974 (Public Law 93-252) and through a joint resolution of Congress (PL 97-377). The additional 80,000 linear feet was authorized by the Water Resources Development Act (WRDA) of 2007. The overall cost of the study is to be cost shared 75 percent Federal, 25 percent non-Federal with the project sponsor, the State of California Central Valley Flood Protection Board (CVFPB).

The appropriate decision document for Phase II (SRBPP) is a Post-Authorization Decision Document (PADD). This project is authorized for construction; no further plan formulation or determination of Federal interest is needed. A PADD and supporting documents will in turn support the Project Partnership Agreement (PPA) between the non-Federal sponsor CVFPB and the U.S. Army Corps of Engineers (USACE). There are a number of technical and policy issues that are required to be resolved. Issues will typically involve the USACE vertical team (Division and Headquarters). The PADD will document issue resolution.

Phase III is programmatic future work that will become more defined as Phase II is completed. Prior to any Phase III construction, a General Reevaluation Report (GRR) will be done to resolve planning and policy issues and reformulate remedial action for the SRFCP in light of current conditions and new and upcoming Federal, state, and local activities in the basin. The Phase III reevaluation may be accomplished under the current SRBPP authority; however, it is anticipated that the reevaluation would result in a recommended plan that would require new or amended authorization.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Phase II Post-Authorization Decision Documents (PADD) for the Sacramento River Bank Protection Project (SRBPP), California (hereinafter: SRBPP IEPR) in accordance with the Department of the Army, USACE, Water Resources Policies and Authorities' *Civil Works Review* (Engineer Circular [EC] 1165-2-214, December 15, 2012), and the Office of Management and Budget's (OMB) *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 SRBPP 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 hydraulic engineering, civil works planning/economics, biology/ecology, civil/construction 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 documents, supporting information, and reference materials that will be provided for the review.

Documents for Review

The following documents are to be reviewed by designated discipline:

Title	Approx. No. of Pages	Required Disciplines
Sacramento River Bank Protection Project (SRBPP) Draft Post-Authorization Change Report (PACR)	50	All disciplines
Appendix A: Engineering Main Report	805	Hydraulic engineering; civil/ construction engineering; geotechnical engineering
Appendix B: Site Selection Process	14	All disciplines
SRBPP Environmental Impact Statement/ Environmental Impact Report	692	Biology/ecology
Appendix A: Public Notice and Scoping Materials	162	Biology/ecology
Appendix B: Cultural Resources Programmatic Agreement	317	Biology/ecology
Appendix C: Regulatory Background	105	Biology/ecology
Appendix D: Air Quality Mitigation Measures by Air District	21	Biology/ecology
Appendix E: Riparian Vegetation Analysis	19	Biology/ecology
Appendix F: Standard Assessment Methodology (SAM) Analysis	51	Biology/ecology
Appendix G: Cultural Context	39	Biology/ecology
Appendix H: Cultural Resources Section 106 Correspondence	95	Biology/ecology
Appendix I: U.S. Fish and Wildlife Service CAR	85	Biology/ecology
Appendix J: SRBPP Phase II Supplemental Authorization Programmatic Mitigation Strategy	141	Biology/ecology
Total Page Count	**2,596**	

Documents for Reference

- 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.

SCHEDULE

The following final schedule is based on the December 23, 2015 receipt of the final review documents.

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	2/6/2015
	Battelle convenes kick-off meeting with panel members	2/6/2015
	Battelle convenes kick-off meeting with USACE and panel members	2/6/2015
	Battelle convenes Mid-Review Teleconference for panel members to ask clarifying questions of USACE	2/19/2015
	Panel members complete their individual reviews	2/25/2015
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members with talking points for Panel Review Teleconference	3/3/2015
	Battelle convenes Panel Review Teleconference	3/6/2015
	Battelle provides Final Panel Comment templates and instructions to panel members	3/6/2015
	Panel members provide draft Final Panel Comments to Battelle	3/13/2015
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	3/14/2015 - 3/22/2015
	Panel finalizes Final Panel Comments	3/23/2015
	Battelle provides Final IEPR Report to panel members for review	3/24/2015
	Panel members provide comments on Final IEPR Report	3/26/2015
	Battelle submits Final IEPR Report to USACE*	3/27/2015
Comment/ Response Process	Battelle inputs Final Panel Comments to the Design Review and Checking System (DrChecks) and provides Final Panel Comment response template to USACE	3/30/2015
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	3/30/2015
	USACE Project Delivery Team (PDT) provides draft Evaluator Responses to USACE Planning Center of Expertise (PCX) for review	4/13/2015
	USACE PCX reviews draft Evaluator Responses and works with USACE PDT regarding clarifications to responses, if needed	4/17/2015
	USACE PCX provides draft PDT Evaluator Responses to Battelle	4/20/2015
	Battelle provides the panel members the draft PDT Evaluator Responses	4/21/2015
	Panel members provide Battelle with draft BackCheck Responses	4/24/2015
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	4/27/2015
	Battelle convenes Comment-Response Teleconference with panel members and USACE	4/28/2015
	USACE inputs final PDT Evaluator Responses to DrChecks	5/1/2015

Task	Action	Due Date
	Battelle provides final PDT Evaluator Responses to panel members	5/5/2015
	Panel members provide Battelle with final BackCheck Responses	5/8/2015
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	5/11/2015
	Battelle submits pdf printout of DrChecks project file*	5/11/2015

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the SRBPP documents are credible and whether the conclusions are valid. The Panel is asked to determine whether the technical work is adequate, competently performed, and 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 SRBPP 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 (Corey Wisneski, wisneskic@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 Corey Wisneski, **wisneskic@battelle.org**, no later than February 25, 2015, 10 pm ET.

IEPR of the Phase II Post-Authorization Decision Documents (PADD) for the Sacramento River Bank Protection Project (SRBPP), California

CHARGE QUESTIONS AND RELEVANT SECTIONS AS SUPPLIED BY USACE

1. Is the need for and intent of the decision document clearly described?
2. Does the decision document adequately address the stated need and intent?
3. Given the need for and intent of the decision document, assess the adequacy and acceptability of the project evaluation data used in the study analyses.
4. Given the need for and intent of the decision document, assess the adequacy and acceptability of the economic, environmental, and engineering assumptions that underlie the study analyses.
5. Given the need for and intent of the decision document, assess the adequacy and acceptability of the economic, environmental, and engineering methodologies, analyses, and projections.
6. Given the need for and intent of the decision document, assess the adequacy and acceptability of the models used in the evaluation of existing and future without-project conditions and of economic or environmental impacts of alternatives.
7. Given the need for and intent of the decision document, assess the adequacy and acceptability of the methods for integrating risk and uncertainty.
8. Given the need for and intent of the decision document, assess the adequacy and acceptability of the quality and quantity of the surveys, investigations, and engineering sufficient for conceptual design of alternative plans.
9. Given the need for and intent of the decision document, assess the adequacy and acceptability of the overall assessment of significant environmental impacts and any biological analyses.
10. Are the impacts on significant resources such as sensitive habitat, riparian habitat, fisheries, and threatened and endangered species adequately addressed?
11. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable.
12. Was climate change and sea level rise considered appropriately in accordance with USACE guidance given the programmatic nature of the project?
13. For the suite of measures proposed to implement the program, assess whether the models used to assess life safety hazards are appropriate.
14. For the suite of measures proposed to implement the program, assess whether the assumptions made for the life safety hazards are appropriate.

15. For the suite of measures proposed to implement the program, assess whether the quality and quantity of the surveys, investigations, and engineering are sufficient (1) for a conceptual design considering the life safety hazards, and (2) to support the models and assumptions made for determining the hazards.

16. For the suite of measures proposed to implement the program, assess whether the analysis adequately addresses the uncertainty and residual risk given the consequences associated with the potential for loss of life for this type of project.

17. For the suite of measures proposed to implement the program, assess whether, from a public safety perspective, the proposed approach is reasonably appropriate.

Specific Technical and Scientific Charge Questions

18. Is the Site Selection approach in Appendix B adequate for implementing the Sacramento Bank Protection Project Phase II additional 80,000 linear feet?

19. Does the Site Selection approach reasonably incorporate risk and uncertainty?

20. Are the assumptions and methodology for developing the programmatic cost estimate for the 80,000 linear feet reasonable?

21. Is the use of geotechnical vulnerability combined with potential consequences (that might result from breach) an appropriate basis for site selection approach in Appendix B?

22. Are the H&H data and economic data used to support programmatic conclusions about the economic and technical feasibility of future proposed site repairs adequate?

Overview Questions (as supplied by Battelle)

1. Please identify the most critical concerns (up to five) you have with the project and/or review documents.

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

This page is intentionally left blank.

Battelle
The Business *of* Innovation