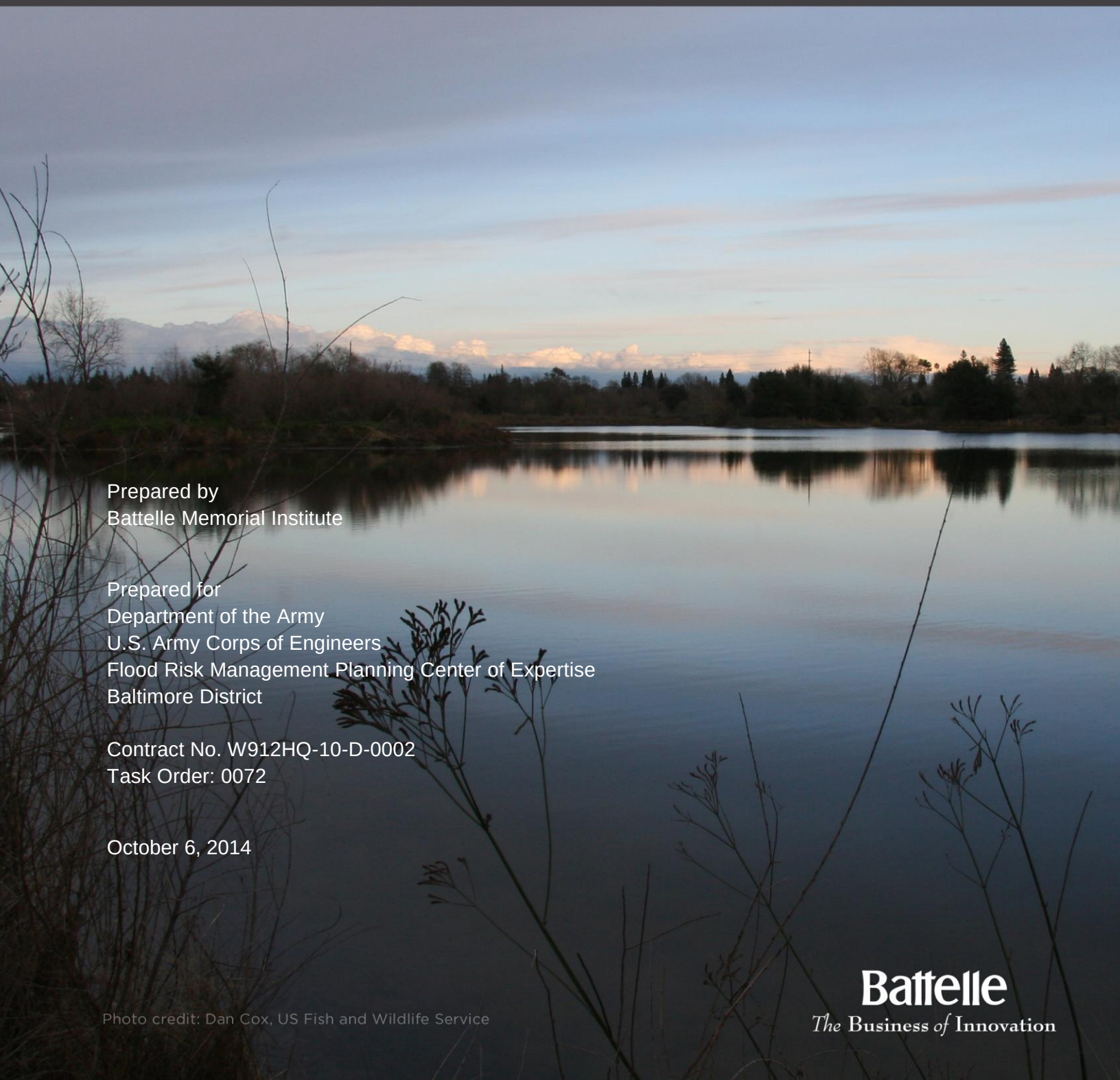
Final Independent External Peer Review Report
West Sacramento Project, California, General Reevaluation Report (GRR) Flood Risk Management (FRM) Project



Prepared by
Battelle Memorial Institute

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

Contract No. W912HQ-10-D-0002
Task Order: 0072

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Flood Risk Management (FRM) Project

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Executive Summary

PROJECT BACKGROUND AND PURPOSE

The purpose of the project is to identify flood-related issues in the West Sacramento, California, study area. The decision document will present planning, engineering, and implementation details of the recommended plan to allow final design and construction to proceed after approval of the recommended plan. The project is a General Reevaluation Report (GRR) undertaken to evaluate structural and non-structural flood risk management (FRM) measures, including in-basin storage, re-operation of existing reservoirs, improvements to existing levees, construction of new levees, and other storage, conveyance, and non-structural options. Because of the scope of the project, an Environmental Impact Study/Environmental Impact Report (EIS/EIR) will be prepared. At direction from Headquarters, U.S. Army Corps of Engineers (USACE), the GRR is being cost shared 50 percent Federal and 50 percent non-Federal with the project sponsors, the State of California Central Valley Flood Protection Board (CVFPB) and the City of West Sacramento.

The Water Resources Development Act (WRDA) of 1992 and the Energy and Water Development and Appropriations Act (EWDAA) of 1999 authorized the West Sacramento Project. Unfortunately, the authorized levee improvements did not consider the underseepage deficiencies facing many of the levees that protect the City. Although the levee improvements authorized for construction were redesigned to address underseepage, the remaining levees that protect the City were not re-evaluated to determine whether they were adequate to withstand the design flood event. The project partners have requested additional investigation into the remaining flood-related issues in the study area.

The study area is in eastern Yolo County in the north-central region of the Central Valley of California. The City of West Sacramento is just west of the City of Sacramento, across the Sacramento River. The Sacramento River flows north to south, from its headwaters near the California-Oregon state line, to the Sacramento-San Joaquin Delta northeast of San Francisco Bay. The study area fundamentally consists of the City of West Sacramento city limit. The city is almost completely bound by floodways and levees: the Yolo Bypass to the west, the Sacramento Bypass to the north, and the Sacramento River to the east. The city is bifurcated by the Port of Sacramento Deep Water Ship Channel and Barge Canal. The non-Federal sponsor is primarily interested in reducing flood risk to the City of West Sacramento and surrounding area. The West Sacramento Project, California GRR, FRM project has been conducted to meet the USACE modernized planning initiative (i.e., SMART [Specific, Measurable, Attainable, Risk Informed, Timely] planning), which is to complete investigations leading to a decision in less time by using a risk-informed evaluation with less detailed information.

This new process has not been business as usual and has required heavy involvement as well as input and decisions from the Vertical Team at multiple points throughout the study. Instead of following the traditional USACE planning milestones, the study has been divided into phases, each with key milestones and associated In-Progress Reviews (IPR). A risk register and other risk management documentation will accompany the decision document. Although one of the objectives of IEPR is to evaluate whether sufficient information was available or technical analyses were completed, the IEPR must be completed within the context of the risk-informed decision-making process.

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 West Sacramento Project, California, General Reevaluation Report (GRR) Flood Risk Management (FRM) Project (hereinafter: West Sacramento GRR 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 West Sacramento GRR. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2012) and OMB (2004). This final report 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 West Sacramento GRR review documents and the overall scope of the project, Battelle identified potential candidates for the Panel in the following key technical areas: geotechnical engineering, hydrologic and hydraulic (H&H) engineering, economics/Civil Works planning, and biology/ecology. 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 four-person Panel.

The Panel received an electronic version of the 1,948-page West Sacramento GRR review documents, along with a charge that solicited comments on specific sections of the documents to be reviewed. USACE prepared the charge questions following guidance provided in USACE (2012) and OMB (2004), which were included in the draft and final Work Plans.

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 West Sacramento GRR 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, 18 Final Panel Comments were identified and documented. Of these, one was identified as having high significance, two were identified as having medium/high significance, eight had a medium significance, four had medium/low significance, and three had low significance.

Battelle received public comments from USACE on the West Sacramento GRR (approximately 11 letters and individual comments, equating to 48 total pages of comments) and provided them to the IEPR panel members. The panel members were charged with determining if any information or concerns presented in the public comments raised any additional discipline-specific technical concerns with regard to the West Sacramento GRR review documents, and if adequate stakeholder involvement had occurred to identify issues of interest and to solicit feedback from interested parties. After completing its review, the Panel confirmed that no new issues or concerns were identified other than those already covered in their Final Panel Comments. The Panel also determined that adequate stakeholder involvement had occurred.

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 West Sacramento GRR 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 review documents are clearly written and well-organized. The West Sacramento Project, California GRR, FRM project addresses a substantial risk presented to life safety and property and offers a solid overall concept. The Panel did, however, identify elements of the project that require further analysis and evaluation and sections of the GRR and Draft EIS/EIR that should be clarified or revised.

Geotechnical Engineering: Of primary concern to the Panel was that the failure probabilities described in the GRR are unreasonably high. These probabilities are then incorporated into the HEC-FDA (Hydrologic Engineering Center Flood Damage Reduction Analysis) analyses, resulting in an overestimate of project benefits. USACE can address this matter by estimating geotechnical failure probabilities using a semi-quantitative risk analysis. Revised failure probabilities should include an assessment of the uncertainty in those probabilities. The Panel was also concerned that economic residual risks associated with seismic damage are not assessed. Without an estimate of the cost of repairing cutoff wall damage in a seismic event and the cost for improving seismic resistance of the levees, the net benefit of the project may be overstated because the cost associated with the residual risk of seismic damage to cutoff walls has not been included in evaluating residual risk. USACE can address this concern by, estimating the cost of levee repairs (including damaged cutoff walls) following an earthquake, and consider developing a conceptual design and cost estimates for improvements to resist seismic damage. The Panel also noted that potential damage due to seismic events as described in the Draft EIS/EIR is sometimes contradicted by the results of analyses presented in the Geotechnical Appendix to the GRR. Clarifying the discussion of seismic hazards presented in the Draft EIS/EIR would eliminate this issue.

Economics/Civil Works Planning: The West Sacramento Project adheres to sound planning principles and USACE regulations and policies. The quality and quantity of the technical analyses and data that support the economics evaluation are sufficient for the feasibility study phase; however, an important

issue the Panel identified was that the GRR does not address potential FRM benefits the project could reasonably be expected to provide. Including the additional sources of project benefits (reductions in emergency costs and agricultural flood damages and greater reductions in flood damages resulting from future development) would provide a more accurate representation of the benefits of the project. To address this issue, USACE can (1) calculate FRM benefits that would be expected in West Sacramento due to reduced emergency costs and include them in the benefit-to-cost ratio, (2) calculate FRM benefits that would result from reduced agricultural flood damages and include them in the benefit-to-cost ratio, and (3) assess future development that is likely to occur in West Sacramento and recalculate FRM benefits based on equivalent annual damages.

The Panel was also concerned that the adequacy of the internal water management system and the incremental costs and benefits of improving the system have not been evaluated. Even if the Federal levee system withstands high river and bypass flows, there could be flooding in West Sacramento if the internal water management system does not function properly during a large storm event. USACE can address this concern by evaluating the design, existing condition, and operations and maintenance practices of the West Sacramento internal water management system to verify that the system is designed appropriately and will continue to function properly in the future. USACE could also evaluate the incremental costs and benefits of improvements to the internal water management system to determine whether such improvements are justified and could increase the total net FRM benefits of the recommended plan.

Hydrologic and Hydraulic (H&H) Engineering: Based on the review of the GRR and the H&H Appendices, the Panel noted the HEC-RAS (Hydrologic Engineering Center River Analysis System) and hydrologic models were applied using the best available current data. One issue the Panel noted concerned levee stability and performance, including poor soil settlement and erosion over time, presence of trees larger than 2 inches in diameter at or near the levee, and the continuous, natural activity of animal burrowing within the levee that have not been fully addressed in the GRR. USACE can address this issue by implementing an active abatement or control program to remove any animals or large trees that are located on or near the levees.

Biology/Ecology: From a biological resources perspective, an appropriate range of measures are considered within the constraints of meeting the project need and objectives; however, some biological resources in the study area potentially affected by project implementation have not been presented in sufficient detail to describe the existing conditions and support the EIS/EIR analysis. The lack of clear quantitative comparisons of impacts among the alternatives limits the completeness and quality of the report, but can be addressed by adding a table that quantifies (in acres) and compares the amount of each land cover type, including waters of the U.S., assumed to be affected under each alternative. The Panel also noted that baseline conditions for invasive plants in the project area, and an effects analysis for invasive plant spread as a result of project construction, have not been presented. USACE can address this by discussing existing conditions for invasive plants/noxious weeds in the project area and considering whether mitigation to prevent invasive plant spread during construction is needed.

Table ES-1. Overview of 18 Final Panel Comments Identified by the West Sacramento GRR IEPR Panel

No.	Final Panel Comment
High – Significance	
1	The project benefits are overestimated because the probability of geotechnical failure used in the HEC-FDA analyses is unreasonably high.
Medium/High – Significance	
2	Potential FRM benefits have not been evaluated and project benefits are likely to be significantly greater than presented in the GRR.
3	Economic residual risks associated with seismic damage are not assessed.
Medium – Significance	
4	The conclusions regarding seismic hazards in relation to the California Seismic Hazards Mapping Act in the Draft EIS/EIR are contradicted by the results of analyses presented in the Geotechnical Appendix to the GRR.
5	Decisions to upgrade the levee are sometimes based on qualitative criteria that are not clearly defined, potentially resulting in non-essential levee upgrades.
6	The adequacy of the internal water management system and the incremental costs and benefits of improving the system have not been evaluated.
7	The basis for the assumption that the project will receive funding for construction at a rate of $100 million per year has not been provided, and the construction period may be too short, which would result in an underestimate of the cost of interest during construction.
8	The mitigation requirements for the alternatives and the recommended plan are not described in the GRR and it is not clear whether the cost estimates include the cost of implementing and monitoring mitigation measures.
9	Baseline conditions for invasive plants in the project area, and an effects analysis for invasive plant spread as a result of project construction, have not been presented.
10	Some biological resources in the study area potentially affected by project implementation have not been presented in sufficient detail to describe the existing conditions and support the EIS/EIR analysis.
11	Issues that are important to the integrity of the levee that may affect its future performance (such as poor soil composition, presence of any large trees at or near the levee, and the likelihood of animals burrowing the soil) have not been fully addressed.

Table ES-1. Overview of 18 Final Panel Comments Identified by the West Sacramento GRR IEPR Panel (continued)

No.	Final Panel Comment
Medium/Low – Significance	
12	A strategy has not been presented for allocating costs and benefits for West Sacramento alternatives that might be integrated with the Locally Preferred Option being considered in the American River Common Features Project.
13	It is not clear how evaluation metrics were used in screening preliminary alternatives or evaluating the final alternatives.
14	It is not clear how the magnitude of impacts and level of significance were determined for effects of sedimentation and turbidity on fisheries resources.
15	Details about dates, locations, and objectives of reconnaissance-level surveys for some biological resources are not presented.
Low – Significance	
16	No analyses have been reported that confirm that the seepage model extent is sufficient so that boundary effects do not result in inaccurate results.
17	The use of effective peak shear strength parameters may not be appropriate for all materials.
18	The level of significance of impacts on biological resources after mitigation is not clearly presented.

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LIST OF ACRONYMS

ACE	annual chance exceedance
ADM	Agency Decision Milestone
ATR	Agency Technical Review
BMP	best management practices
COI	Conflict of Interest
CVFPB	Central Valley Flood Protection Board
CWRB	Civil Works Review Board
DrChecks	Design Review and Checking System
EC	Engineer Circular
EIS	Environmental Impact Study
EIR	Environmental Impact Report
ER	Engineer Regulation
ERDC	Engineer Research and Development Center
EWDAA	Energy and Water Development and Appropriations Act
FRM	Flood Risk Management
GRR	General Reevaluation Report
H&H	hydrologic and hydraulic
HEC-FDA	Hydrologic Engineering Center Flood Damage Reduction Analysis
HEC-RAS	Hydrologic Engineering Center River Analysis System
HEP	Habitat Evaluation Procedure
IEPR	Independent External Peer Review
IPR	In-Progress Reviews
NEPA	National Environmental Policy Act
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PDT	Project Delivery Team
SAR	Safety Assurance Review
SMART	Specific, Measurable, Attainable, Risk Informed, Timely
USACE	United States Army Corps of Engineers
WRDA	Water Resources Development Act

1. INTRODUCTION

The purpose of the project is to identify flood-related issues in the West Sacramento, California, study area. The decision document will present planning, engineering, and implementation details of the recommended plan to allow final design and construction to proceed after approval of the recommended plan. The project is a General Reevaluation Report (GRR) undertaken to evaluate structural and non-structural flood risk management (FRM) measures, including in-basin storage, re-operation of existing reservoirs, improvements to existing levees, construction of new levees, and other storage, conveyance, and non-structural options. Because of the scope of the project, an Environmental Impact Study/Environmental Impact Report (EIS/EIR) will be prepared. At direction from Headquarters, U.S. Army Corps of Engineers (USACE), the GRR is being cost shared 50 percent Federal and 50 percent non-Federal with the project sponsors, the State of California Central Valley Flood Protection Board (CVFPB) and the City of West Sacramento.

The Water Resources Development Act (WRDA) of 1992 and the Energy and Water Development and Appropriations Act (EWDAA) of 1999 authorized the West Sacramento Project. Unfortunately, the authorized levee improvements did not consider the underseepage deficiencies facing many of the levees that protect the City. Although the levee improvements authorized for construction were redesigned to address underseepage, the remaining levees that protect the City were not re-evaluated to determine whether they were adequate to withstand the design flood event. The project partners have requested additional investigation into the remaining flood-related issues in the study area.

The study area is in eastern Yolo County in the north-central region of the Central Valley of California. The City of West Sacramento is just west of the City of Sacramento, across the Sacramento River. The Sacramento River flows north to south, from its headwaters near the California-Oregon state line, to the Sacramento-San Joaquin Delta northeast of San Francisco Bay. The study area fundamentally consists of the City of West Sacramento city limit. The city is almost completely bound by floodways and levees: the Yolo Bypass to the west, the Sacramento Bypass to the north, and the Sacramento River to the east. The city is bifurcated by the Port of Sacramento Deep Water Ship Channel and Barge Canal. The non-Federal sponsor is primarily interested in reducing flood risk to the City of West Sacramento and surrounding area. The West Sacramento Project, California GRR, FRM project has been conducted to meet the USACE modernized planning initiative (i.e., SMART [Specific, Measurable, Attainable, Risk Informed, Timely] planning), which is to complete investigations leading to a decision in less time by using a risk-informed evaluation with less detailed information.

This new process has not been business as usual and has required heavy involvement as well as input and decisions from the Vertical Team at multiple points throughout the study. Instead of following the traditional USACE planning milestones, the study has been divided into phases, each with key milestones and associated In-Progress Reviews (IPR). A risk register and other risk management documentation will accompany the decision document. Although one of the objectives of IEPR is to evaluate whether sufficient information was available or technical analyses were completed, the IEPR must be completed within the context of the risk-informed decision-making process.

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 West Sacramento Project, California, General Reevaluation Report (GRR), Flood Risk

Management (FRM) Project (hereinafter: West Sacramento GRR 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, and environmental and plan formulation analyses contained in the West Sacramento GRR 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 July 31, 2014.

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, and 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 West Sacramento GRR 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 West Sacramento GRR IEPR. Due dates for milestones and deliverables are based on the award/effective date of July 15, 2014. 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 November 19, 2014. The actual date for contract end will depend on the date that all activities for this IEPR, including Civil Works Review Board (CWRB) preparation and participation, are conducted.

Table 1. Major Milestones and Deliverables of the West Sacramento GRR IEPR

Task	Action	Due Date
1	Award/Effective Date	7/15/2014
	Review documents available	7/22/2014
2	Battelle submits list of selected panel members	7/28/2014
	USACE confirms the panel members have no COI	7/30/2014
3	Battelle convenes kick-off meeting with USACE	7/22/2014
	Battelle convenes kick-off meeting with USACE and panel members	8/12/2014
4	Panel members complete their individual reviews	9/2/2014
	USACE submits public comments to Battelle	9/9/2014
	Battelle submits public comments to Panel	9/9/2014
	Panel members provide draft Final Panel Comments to Battelle	9/16/2014
	Panel members provide response to public comments	9/29/2014
5	Battelle submits Final IEPR Report to USACE	10/6/2014
6[a]	Battelle convenes Comment-Response Teleconference with panel members and USACE	10/30/2014
	Battelle submits pdf printout of DrChecks project file to USACE	11/19/2014
	Agency Decision Milestone (ADM) Meeting[b]	2/2/2015
	Civil Works Review Board (CWRB) Meeting[b c]	6/4/2015
	Contract End/Delivery Date	5/31/2015

[a] *Task 6 occurs after the submission of this report.*
[b] *The ADM and CWRB meetings were listed in the Performance Work Statement under Task 3, but were relocated in this schedule to reflect the chronological order of activities.*
[c] *Because the CWRB has been revised to a date that is beyond the period of performance, a time extension will be needed to accommodate CWRB preparation, participation, and project closeout activities, which includes time to close out subcontracts with panel members.*

Battelle identified, screened, and selected four panel members to participate in the IEPR based on their expertise in the following disciplines: geotechnical engineering, hydrologic and hydraulic engineering (H&H), economics/Civil Works planning, and biology/ecology. The Panel reviewed the West Sacramento GRR document and produced 18 Final Panel Comments in response to 27 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

This section presents the results of the IEPR. A summary of the Panel's findings and the full text of the Final Panel Comments are provided.

4.1 Summary of Final Panel Comments

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 West Sacramento GRR review documents. The following summarizes the Panel's findings.

Based on the Panel's review, the review documents are clearly written and well-organized. The West Sacramento Project, California GRR, FRM project addresses a substantial risk presented to life safety and property and offers a solid overall concept. The Panel did, however, identify elements of the project that require further analysis and evaluation and sections of the GRR and Draft EIS/EIR that should be clarified or revised.

Geotechnical Engineering: Of primary concern to the Panel was that the failure probabilities described in the GRR are unreasonably high. These probabilities are then incorporated into the HEC-FDA (Hydrologic Engineering Center Flood Damage Reduction Analysis) analyses, resulting in an overestimate of project benefits. USACE can address this matter by estimating geotechnical failure probabilities using a semi-quantitative risk analysis. Revised failure probabilities should include an assessment of the uncertainty in those probabilities. The Panel was also concerned that economic residual risks associated with seismic damage are not assessed. Without an estimate of the cost of repairing cutoff wall damage in a seismic event and the cost for improving seismic resistance of the levees, the net benefit of the project may be overstated because the cost associated with the residual risk of seismic damage to cutoff walls has not been included in evaluating residual risk. USACE can address this concern by, estimating the cost of levee repairs (including damaged cutoff walls) following an earthquake, and consider developing a conceptual design and cost estimates for improvements to resist seismic damage. The Panel also noted that potential damage due to seismic events as described in the Draft EIS/EIR is sometimes contradicted by the results of analyses presented in the Geotechnical Appendix to the GRR. Clarifying the discussion of seismic hazards presented in the Draft EIS/EIR would eliminate this issue.

Economics/Civil Works Planning: The West Sacramento Project adheres to sound planning principles and USACE regulations and policies. The quality and quantity of the technical analyses and data that support the economics evaluation are sufficient for the feasibility study phase; however, an important

issue the Panel identified was that the GRR does not address potential FRM benefits the project could reasonably be expected to provide. Including the additional sources of project benefits (reductions in emergency costs and agricultural flood damages and greater reductions in flood damages resulting from future development) would provide a more accurate representation of the benefits of the project. To address this issue, USACE can (1) calculate FRM benefits that would be expected in West Sacramento due to reduced emergency costs and include them in the benefit-to-cost ratio, (2) calculate FRM benefits that would result from reduced agricultural flood damages and include them in the benefit-to-cost ratio, and (3) assess future development that is likely to occur in West Sacramento and recalculate FRM benefits based on equivalent annual damages.

The Panel was also concerned that the adequacy of the internal water management system and the incremental costs and benefits of improving the system have not been evaluated. Even if the Federal levee system withstands high river and bypass flows, there could be flooding in West Sacramento if the internal water management system does not function properly during a large storm event. USACE can address this concern by evaluating the design, existing condition, and operations and maintenance practices of the West Sacramento internal water management system to verify that the system is designed appropriately and will continue to function properly in the future. USACE could also evaluate the incremental costs and benefits of improvements to the internal water management system to determine whether such improvements are justified and could increase the total net FRM benefits of the recommended plan.

Hydrologic and Hydraulic (H&H) Engineering: Based on the review of the GRR and the H&H Appendices, the Panel noted the HEC-RAS (Hydrologic Engineering Center River Analysis System) and hydrologic models were applied using the best available current data. One issue the Panel noted concerned levee stability and performance, including poor soil settlement and erosion over time, presence of trees larger than 2 inches in diameter at or near the levee, and the continuous, natural activity of animal burrowing within the levee that have not been fully addressed in the GRR. USACE can address this issue by implementing an active abatement or control program to remove any animals or large trees that are located on or near the levees.

Biology/Ecology: From a biological resources perspective, an appropriate range of measures are considered within the constraints of meeting the project need and objectives; however, some biological resources in the study area potentially affected by project implementation have not been presented in sufficient detail to describe the existing conditions and support the EIS/EIR analysis. The lack of clear quantitative comparisons of impacts among the alternatives limits the completeness and quality of the report, but can be addressed by adding a table that quantifies (in acres) and compares the amount of each land cover type, including waters of the U.S., assumed to be affected under each alternative. The Panel also noted that baseline conditions for invasive plants in the project area, and an effects analysis for invasive plant spread as a result of project construction, have not been presented. USACE can address this by discussing existing conditions for invasive plants/noxious weeds in the project area and considering whether mitigation to prevent invasive plant spread during construction is needed.

4.2 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 benefits are overestimated because the probability of geotechnical failure used in the HEC-FDA analyses is unreasonably high.

Basis for Comment

The computed probabilities reported in Section 14.2 of Appendix C (Geotechnical Appendix) to the GRR, which often exceed 90%, are for "poor performance" of levee reaches. While the Panel agrees that the probability of poor performance in a design flood is indeed very high, this value is not the probability of failure. The GRR describes the probabilities incorrectly (p. 2-12), representing them as the probability of failure. As a result, the failure probabilities described in the GRR are unreasonably high. These probabilities are then incorporated into the HEC-FDA analyses, resulting in an overestimate of project benefits.

One reason that the probability of poor performance significantly exceeds the probability of failure is that the risks associated with seepage constitute a large portion of the total risk of poor performance. As stated in Section 26 (p.26-1) of the recent joint work on Best Practices by USACE and the U.S. Bureau of Reclamation (USBR, 2012), internal erosion is "a potential failure mode that cannot be completely analyzed using numerical formulae or models." Thus, although seepage gradients that exceed standard criteria are a reasonable indication of potential poor performance, they are not an accurate or reasonable measure of the probability of failure.

The probability of a levee breach due to slope instability is also not the same as the probability of poor performance. Not every slope failure inevitably leads to a levee breach. Some failures are only maintenance issues; in other cases active intervention can prevent a downstream failure from developing into a levee breach.

In addition to the analytical challenges of estimating failure probability, the computed probabilities reported in Appendix C (Section 14.2) do not appear to consider the potential risk reduction through intervention by active flood fighting measures. While significant risks of failure remain even with intervention, completely ignoring the benefit overstates risk. The Best Practices work (USBR, 2012) states (pp. 35-37) that "the USACE approach is to evaluate and communicate the potential risk reduction that can be achieved with intervention while at the same time to not mask the seriousness of a potential dam safety issue by relying on intervention to reduce the risk." The analysis conducted for the GRR is inconsistent with this approach because it ignores intervention.

The GRR also does not address the degree of uncertainty associated with estimated probabilities. Best Practices (USBR, 2012) states (p.26-1) that "…risk estimating procedures, although quantitative, do not provide precise or accurate numerical results. The nature of the risk evaluation should be advisory and not prescriptive." In assessing the uncertainty associated with probability estimates, consideration should be given to a general calibration provided by Christian and Baecher (2011) when they indicate that one of the 10 major questions regarding geotechnical risk and reliability is "why failures are less frequent than reliability studies predict." They state that predicted failure frequencies are an order of magnitude larger than observed, and two orders of magnitude larger than the frequency of modes of failure for earth dams. An understanding of the relatively imprecise nature of probabilities estimated for geotechnical events is required so that decisions to fund projects can be made with an appropriate "knowledge of the degree of reliability of the estimated benefits and costs and of the effectiveness of alternative plans," specifically

required by ER 1105-2-100 (USACE, 2000).

Significance – High

Inaccurate geotechnical probabilities in the HEC-FDA analyses result in an overstatement of without-project costs that could be significant and affect the benefit-cost-ratio. Providing calculations of failure probabilities without a description of the degree of reliability of those calculations is inconsistent with policy described by ER-1105-2-100 (USACE, 2000).

Recommendation for Resolution

1. Estimate geotechnical failure probabilities using a semi-quantitative risk analysis conducted in accordance with USBR (2012). It may be necessary to use expert elicitation to establish a conditional probability relationship between poor performance and levee breach. Case history data may also be informative.
2. Revised failure probabilities should include an assessment of the uncertainty in those probabilities to comply with USACE (2000), Section 10. For example, perform sensitivity studies (such as the example provided in USBR [2012], Section 12) to assist in estimating the uncertainty in calculated failure probability that results from uncertainty in input distributions.

Literature Cited:

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. Available online at http://planning.usace.army.mil/toolbox/library/ERs/entire.pdf

USBR (2012). Best Practices in Dam and Levee Safety Risk Analysis. A Joint Publication by U.S Department of Interior, Bureau of Reclamation and U.S. Army Corps of Engineers; 3 December. Available online at:
http://www.usbr.gov/ssle/damsafety/Risk/methodology.html

Christian, J.T. and Baecher, G.B. (2011). Unresolved problems in geotechnical risk and reliability. Geo-Risk 2011:50-63.

Final Panel Comment 2

Potential FRM benefits have not been evaluated and project benefits are likely to be significantly greater than presented in the GRR.

Basis for Comment

The GRR does not address potential FRM benefits the project could reasonably be expected to provide. Reductions in the following costs/damages are likely to result from the project, but are not accounted for in the economic analysis.

- Emergency costs
- Agricultural flood damages associated with crops
- Damages associated with future intensification of land uses in West Sacramento.

Emergency costs would include Federal, state, and local government emergency measures, evacuation and subsistence costs, reoccupation costs, and commercial cleanup and restoration costs. Such costs can represent a significant portion of total damages. For example, reductions in emergency costs accounted for 10 to 15% of the total FRM benefits estimated for the Louisiana Comprehensive Master Plan for a Sustainable Coast (USACE, 2007). It is reasonable to believe that reductions in emergency costs in West Sacramento would be on a similar scale. Although less significant, another benefit category that was not addressed is agricultural crop damage. The land use map (Economics Appendix, Figure 6, p. 2-8) indicates that there is significant agriculture in West Sacramento, particularly in the South Basin.

A third benefit category that is not addressed focuses on land use. The Economics Appendix states (Section 3.3.2, p. 4-3) that the study area is considered to be fully built out and, therefore, expected annual damages are equal to equivalent annual damages. However, the following factors indicate that future growth is probable:

- The land use map (Economics Appendix, Figure 6, p. 2-8) shows large areas of agriculture and open space that could be converted to higher intensity land uses.
- The GRR states that there are plans for infill development in the North Basin.
- The City of West Sacramento plans additional development in the South Basin.
- The GRR states that a 64% increase in population is projected to occur between 2007 and 2030.
- The EIS/EIR describes new development projects that are under way now and into the next 20 years.

Based on the growth that has occurred in the last 10 years in West Sacramento, it is reasonable to believe that growth will continue into the foreseeable future. This would increase future benefits of alternative plans.

Currently, the USACE budgetary guidance (USACE, 2013a) requires that a flood damage reduction project have at least a 2.5 benefit-to-cost ratio at a 7% discount rate to be included in the Administration's budget (which includes Construction General Appropriations). The benefit-to-cost ratio presented in the GRR is calculated with only a 3.5% discount rate. Therefore, based on the existing economic analysis, it is possible that even if the West Sacramento Project gets authorized, the benefit-to-cost ratio may not be adequate to qualify for Construction General Appropriations.

Significance – Medium/High

Including the additional sources of project benefits (reductions in emergency costs and agricultural flood damages and greater reductions in flood damages resulting from future development) would provide a more accurate representation of the benefits of the project.

Recommendations for Resolution

1. Calculate FRM benefits that would be expected in West Sacramento due to reduced emergency costs and include them in the benefit-to-cost ratio.
2. Calculate FRM benefits that would result from reduced agricultural flood damages and include them in the benefit-to-cost ratio.
3. Assess future development that is likely to occur in West Sacramento and recalculate FRM benefits based on equivalent annual damages.

Literature Cited:

USACE (2013a). Army Programs: Corps of Engineers Civil Works Direct Program, Budget Development Guidance, Fiscal Year 2015. Engineer Circular (EC) 11-2-204. Department of the Army, U.S. Corps of Engineers, Washington, D.C. March 31.

USACE (2007). Economic Analysis and Consequences, Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast. New Orleans District, U.S. Army Corps of Engineers. April.

Final Panel Comment 3

Economic residual risks associated with seismic damage are not assessed.

Basis for Comment

The seismic vulnerability of levees has been assessed based on their ability to provide post-seismic flood protection, in accordance with the USACE Draft ETL 1110-2-580, Guidelines for Seismic Evaluation of Levees (not yet published). The analyses and classification in accordance with this ETL (as summarized in the Geotechnical Appendix, p. 12-3), indicates that seismic damage to cutoff walls is possible for the Bypass Levee and very likely for the West South Levee. The Panel understands that these levees do not retain water in the non-flood season, and thus the threat of loss of life only exists when a flood occurs either simultaneously or soon after a major earthquake, a relatively improbable occurrence. However, it appears that neither potential economic benefits nor residual economic risks associated with seismic damage have been fully assessed for the project.

The Geotechnical Appendix does not indicate whether the proposed project will improve seismic resistance of the levees. This would be a potential benefit to the project.

It appears that costs associated with repairing seismic damage to cutoff walls have not been estimated. Thus, the residual economic risks associated with repairing seismic damage to cutoff walls have not been assessed. In addition, no consideration appears to have been given to evaluating whether it would be cost-effective to improve the seismic resistance for the Bypass Levee and the West South Levee to reduce the risk of cutoff wall damage in a seismic event.

Significance – Medium/High

Without an estimate of the cost of repairing cutoff wall damage in a seismic event, the net benefit of the project may be overstated because the cost associated with the residual risk of seismic damage to cutoff walls has not been included in evaluating residual risk.

Recommendations for Resolution

1. Estimate the probability of levee damage due to seismic shaking, and estimate the cost of subsequent repair.
2. Based on the results of the above recommendation, consider whether it would be warranted to develop a conceptual design and cost estimates for improvements to resist seismic damage.

Literature Cited:

USACE Draft ETL 1110-2-580, Guidelines for Seismic Evaluation of Levees (not yet published).

Final Panel Comment 4

The conclusions regarding seismic hazards in relation to the California Seismic Hazards Mapping Act in the Draft EIS/EIR are contradicted by the results of analyses presented in the Geotechnical Appendix to the GRR.

Basis for Comment

The Draft EIS/EIR (p. 408) indicates that "the California Seismic Hazards Mapping Act of 1990 (California Public Resources Code [PRC] Sections 2690–2699.6) addresses seismic hazards other than surface rupture, such as liquefaction and induced landslides. The Seismic Hazards Mapping Act specifies that the lead agency for a project may withhold development permits until geologic or soils investigations are conducted for specific sites and mitigation measures are incorporated into plans to reduce hazards associated with seismicity and unstable soils." The Draft EIS/EIR then concludes that because the closest active fault is 35 miles to the northwest, there are no significant issues due to seismicity. However, the seismic assessment presented in Geotechnical Appendix (p. 12-3) indicates that some sections of the levee have medium to high vulnerability, placing the Sacramento River West South Levee in a classification associated with seismically induced flow slides. This is consistent with the Panel's belief that a distance of 35 miles from an active fault is insufficient to conclude that no significant issues exist due to seismicity. Thus, the project as currently proposed appears out of compliance with the Seismic Hazards Act because seismic hazards exist, and no mitigation measures are incorporated to reduce them. If the lead agency withholds development permits until mitigation measures are incorporated, these additional measures could incur significant additional costs, possibly reducing the net project benefit.

The seismic risk is also described inconsistently elsewhere in project documents. The Draft EIS/EIR states (p. 67, second paragraph) that a 200-year seismic event could very likely compromise the levee at several locations due to lateral spreading. However, in the next paragraph, the report states that "because the expected magnitude of ground shaking from large regional earthquakes is relatively low in the project area, the potential for failure or significant damage of project structures is low." The analyses in the Geotechnical Appendix indicate that the expected magnitude of ground shaking is likely to result in significant damage to some levee reaches. The statements are contradictory and the analyses described do not support the latter statement.

Significance – Medium

The conclusions regarding seismic hazards in relation to the California Seismic Hazards Mapping Act are inaccurate. If mitigation measures were deemed necessary to obtain a development permit in accordance with the Act, the costs incurred would reduce net project benefit. Furthermore, inconsistent descriptions of the potential for cutoff wall damage due to seismic events could affect the understanding and accuracy of the project.

Recommendations for Resolution

1. Clarify the discussion of seismic hazards presented in the Draft EIS/EIR (p. 67).
2. Review the conclusions related to the California Seismic Hazards Mapping Act in light of other descriptions of seismic risks (i.e., p. 67 of the EIS/EIR and the GRR, Appendix C, Section 12) and resolve any inconsistency. (The Panel does not have expertise to recommend action required for compliance with the Act.)

Final Panel Comment 5

Decisions to upgrade the levee are sometimes based on qualitative criteria that are not clearly defined, potentially resulting in non-essential levee upgrades.

Basis for Comment

Recommendations regarding whether to upgrade a levee do not consistently rely on analyses and stated design criteria (e.g., exit gradient). Sometimes they are based either on qualitative criteria such as reported seepage and stability problems in a reach or engineering judgment. Because the criteria are unclear, it is not possible to evaluate whether resulting recommendations for levee improvement are essential.

Specific examples from the Geotechnical Appendix where design criteria do not support recommended actions are:

- A shallow cutoff wall is recommended for the North Basin -- Sacramento South Bypass Levee on p. 11-8, apparently to address low calculated stability. However, no analyses were performed for the with-project results.
- Although analyses indicate seepage gradients meet design criteria, a cutoff wall is recommended for the North Basin – Sacramento West Levee on p. 11-10 to "provide continuity to adjoining project reaches as well as mitigate against potential defects in the blanket layer."
- A cutoff wall is recommended for the South Basin – Port South Levee on p. 11-14, even though without-project conditions meet design criteria. The justification is related to soil conditions and historic seepage concerns.
- No analyses are reported to support the recommendation on p. 11-13 that no mitigation measures should be constructed for the southern 75% of the South Basin – Deep Water Ship Channel West Levee.
- A cutoff wall is recommended for the South Basin – Yolo Bypass East Levee on p.11-19, even though seepage criteria are met for without-project conditions.

While the Panel values engineering judgment, it is unclear whether the qualitative criteria used to justify the recommendations are appropriate, cost effective, and consistently applied. Recommended repairs using this justification may not be necessary or cost effective. Including them in the project may add cost without adding corresponding benefits, thus reducing the net benefits from the project.

Significance – Medium

Upgrades that have been recommended based on unclear criteria may be non-essential to the levee, and thus would decrease the net project benefit.

Recommendation for Resolution

1. Evaluate whether qualitative design criteria could be established and described to supplement the quantitative criteria.
2. Perform additional investigations and analyses in future design stages to resolve inconsistencies between observed performance and results of analyses.

Final Panel Comment 6

The adequacy of the internal water management system and the incremental costs and benefits of improving the system have not been evaluated.

Basis for Comment

In order to provide flood protection to West Sacramento, it is necessary to operate and maintain a system of canals, control structures, and pump stations. Even if the Federal levee system withstands high river and bypass flows, there could be flooding in West Sacramento if the internal water management system does not function properly during a large storm event. If the internal water management system fails under such conditions, the benefits of the recommended plan would be reduced. In other words, the Federal expenditures on making improvements to the levee system will not produce the desired benefits without proper functioning of the local system. No analyses of the adequacy of the internal water management system or its operation and maintenance were performed.

The internal water management system is designed for the 1% ACE (annual chance exceedance) event. No analysis was performed to evaluate the incremental costs and benefits of improving the system to provide a greater level of protection, similar to the Federal project (i.e., maximize the net benefits). Therefore, it is possible the full extent of potential net benefits will not be realized without evaluating the incremental costs and benefits of improvements to the internal system.

Significance – Medium

Without an analysis of the design and operation and maintenance practices of the West Sacramento internal water management system, it is not possible to assess whether the system could fail during a major flood event on the Sacramento River.

Recommendations for Resolution

1. Evaluate the design, existing condition, and operations and maintenance practices of the West Sacramento internal water management system to verify that the system is designed appropriately and will continue to function properly in the future.
2. Evaluate the incremental costs and benefits of improvements to the internal water management system to determine whether such improvements are justified and could increase the total net FRM benefits of the recommended plan.

Final Panel Comment 7

The basis for the assumption that the project will receive funding for construction at a rate of $100 million per year has not been provided, and the construction period may be too short, which would result in an underestimate of the cost of interest during construction.

Basis for Comment

The cost of interest during construction is based on the estimated construction period and has a significant impact on the Total Project Cost. Table 38 (Economics Appendix, p. 4-14) shows the Project Costs of the recommended plan at $1,613,768,000. The interest during construction is $646,916,000 for a Total Project Cost of $2,259,684. The interest during construction is about 28% of the Total Project Cost.

The Economics Appendix (Section 4.7, p. 4-13) states that the construction period used to calculate interest during construction was based on an assumption that funding would be provided at a rate of $100 million per year. From the HQ-USACE web site, an examination of the FY 2014 budget justification sheets (USACE, 2013b) shows that a total of just under $120 million was included in the Construction General budget for the Sacramento District. The Economics Appendix (Section 4.7, p. 4-14) states that the construction period for the recommended plan is 17 years. Hence, the assumption that funding for the West Sacramento Project would be provided at an average rate of $100 million per year for 17 consecutive years for a single project appears to be unlikely. Assuming that the FY 2014 appropriations are typical for the Sacramento District, this would require that over 80% of the District's total Construction General budget would be devoted to a single project for 17 years.

Significance – Medium

If the assumption that an average of $100 million will be available annually for 17 consecutive years is overly optimistic, the construction period could be significantly lengthened and the cost of interest during construction would be increased.

Recommendations for Resolution

1. Add a description of the basis for the assumption that the project will receive $100 million per year during the construction period.

Literature Cited:

USACE (2013b). Fiscal Year 2014 -- Civil Works Budget Details for the U.S. Army Corps of Engineers, Volume II. Department of the Army, Office of the Assistant Secretary of the Army (Civil Works). 1 May. Available online at: http://www.usace.army.mil/Portals/2/docs/civilworks/budget_just/just_2014_vol2.pdf

Final Panel Comment 8

The mitigation requirements for the alternatives and the recommended plan are not described in the GRR and it is not clear whether the cost estimates include the cost of implementing and monitoring mitigation measures.

Basis for Comment

Table PAC-7 (p. 11) in the GRR identifies a significant number of mitigation measures that would be required for the recommended plan, but does not describe them. The Draft EIS/EIR gives general descriptions of the mitigation measures, but the level of detail on mitigation requirements is limited. Providing a more detailed description of the proposed mitigation measures for the recommended plan would allow an assessment of their reasonableness and potential obstacles that might be encountered during implementation. More details on the mitigation measures would give confidence that the costs are reasonable, but there is no indication in the GRR whether the cost of the mitigation measures and monitoring are included in the total project cost estimate.

Significance – Medium

Providing descriptions of the mitigation measures and describing the basis for the cost estimates would strengthen the understanding of the project costs and any uncertainty that might exist in the cost estimate.

Recommendation for Resolution

1. Provide more detailed descriptions of the mitigation measures, how they will be implemented, and uncertainties related to implementation.
2. Add a discussion of how the cost estimates for mitigation measures and monitoring were developed, include a line item for mitigation measures and monitoring in the total project cost estimate, and discuss uncertainty.

Final Panel Comment 9

Baseline conditions for invasive plants in the project area, and an effects analysis for invasive plant spread as a result of project construction, have not been presented.

Basis for Comment

The Draft EIS/EIR does not discuss the baseline conditions for invasive plants in the project area (e.g., their presence or potential to occur) and how project implementation could result in their introduction or spread. For example, invasive plants could be inadvertently introduced or spread in the project area during construction activities if nearby source populations passively colonize disturbed ground, or if construction and personnel equipment is transported to the site from an infested area. In addition, soil, vegetation, and other materials transported to the project area from off-site sources for best management practices (BMPs), revegetation, or fill for project construction could contain invasive plant seeds or plant material that could become established in the project area.

Executive Order No. 13112 (1999), which established a National Invasive Species Council, directs all Federal agencies to prevent the introduction and control the spread of invasive species in a cost-effective and environmentally sound manner to minimize their economic, ecological, and human health impacts. If significant impacts could occur, standard invasive plant management practices are available and should be considered as part of the project design or mitigation. However, the Draft EIS/EIR does not present an effects analysis of invasive plant spread as a result of project construction.

Significance – Medium

The Draft EIS/EIR is not clear whether the effects related to invasive plants have been adequately evaluated and, if needed, mitigated.

Recommendation for Resolution

1. Discuss existing conditions for invasive plants/noxious weeds in the project area. If recent field or other site-specific data to characterize invasive plant conditions in the project area are not available, then a summary of the expected or likely conditions there based on land cover types, levels of disturbance, and known invasive plant occurrences in nearby areas would be adequate.
2. Discuss construction-related impacts in the effects analysis and consider whether mitigation to prevent invasive plant spread during construction is needed.

Literature Cited:

Executive Order No. 13112 (1999). Invasive Species, 64 Federal Register 6183 (February 8, 1999). Available online at http://www.gpo.gov/fdsys/pkg/FR-1999-02-08/pdf/99-3184.pdf

Final Panel Comment 10

Some biological resources in the study area potentially affected by project implementation have not been presented in sufficient detail to describe the existing conditions and support the EIS/EIR analysis.

Basis for Comment

Detailed representations of the distribution and types of land cover and other potentially affected biological resources, using graphics and/or tables, are important for describing the existing conditions and evaluating potential impacts. Section 3.6 of the Draft EIS/EIR (pp. 106-107, 120-121) references Figures 3.6-1 through 3.6-5, but they are not in the document. These figures reportedly show the distribution and types of land cover and other biological resources in the study area potentially affected by project implementation. USACE confirmed during the August 21, 2014 mid-review teleconference with the Panel (facilitated by Battelle) that these figures did not exist yet. Additionally, a table that quantifies (in acres) and compares the amount of each land cover type, including waters of the U.S., assumed to be affected under each alternative is not included in the biological resources analysis but would improve the clarity of the analysis and conclusions.

The conclusions of the biological resources analysis may be accurate; however, some of the biological resources information needed to evaluate the magnitude of effects and support the conclusions are not clearly presented in the Draft EIS/EIR.

Significance – Medium

The lack of figures that are referenced in the Draft EIS/EIR and the lack of clear quantitative comparisons of impacts among the alternatives limit the completeness and quality of the report.

Recommendation for Resolution

1. Prepare and add Figures 3.6-1, 3.6-2, 3.6-3, 3.6-4, and 3.6-5 to the Draft EIS/EIR.
2. Add a table that quantifies (in acres) and compares the amount of each land cover type, including waters of the U.S., assumed to be affected under each alternative.

Final Panel Comment 11

Issues that are important to the integrity of the levee that may affect its future performance (such as poor soil composition, presence of any large trees at or near the levee, and the likelihood of animals burrowing the soil) have not been fully addressed.

Basis for Comment

As the nation's levee system continues to grow older and the risk to public health and safety grows along with it, levee owners and operators can greatly mitigate these risks by implementing a basic protection/maintenance plan of levees. Issues that concern levee stability include poor soil settlement and erosion over time, presence of trees larger than 2 inches in diameter at or near the levee, and the continuous, natural activity of animal burrowing within the levee. Burrows that are created by animals can cause great damage to the integrity of levees and can often lead to rapid levee failures during times of flood. Therefore, some consideration must given to these conditions that occur at or near the levee.

The GRR acknowledges that poor soil composition is an issue (p. 1-19, Section 1.5.1.4) and the soil does not meet today's engineering standards. The GRR (Sections 2-10 to 2-12 and 4-3) does not fully address the size of the trees on or near the levee, riprapped areas, or drainage channels that would pose a problem. In addition, the GRR does not fully address an animal abatement program or control techniques that should be put in place. The presence of burrowing animals may not be readily detected without conducting a thorough inspection or putting in place control techniques such as bait stations, trapping, or removal of animals (in the case of beavers).

Since these issues could be a problem for future levee owners and operators, the diameter of the trees posing a problem should be specified and specific control techniques should be stated to address the issue of burrowing animals. Treatment of the soil (if possible), removal of oversized trees (larger than 2 inches in diameter) that pose a problem to the levee, and detection of the activities of burrowing animals is crucial to the integrity of the levee. If these issues are addressed and actively monitored, the levee is expected to perform well. By understanding that no single plan can guarantee that a levee system will not fail under all circumstances, levee owners and operators are encouraged to work with local public safety officials in assisting them to develop effective protection/maintenance plans. One of the most important links in the "safety chain" of flood risk management is, indeed, the protection of levees.

Significance – Medium

Without addressing issues that play a factor in levee stability (e.g., poor soil composition of the levee, presence of large trees at or near the levees, and the likelihood of animals burrowing the soil), it is not possible to assess the future performance of the levee.

Recommendation for Resolution

1. Implement an active abatement or control program to remove any animals or large trees that are located at or near the levees.

Literature Cited:

USACE (2006). Levee Owner's Manual for Non-Federal Flood Control Works. The Rehabilitation and Inspection Program, Public Law 84-99. U.S. Army Corps of Engineers. March. Available online at: http://media.swf.usace.army.mil/pubdata/ppmd/emermgt/pdf/leveeownersmanual.pdf

Final Panel Comment 12

A strategy has not been presented for allocating costs and benefits for West Sacramento alternatives that might be integrated with the Locally Preferred Option being considered in the American River Common Features Project.

Basis for Comment

The GRR states (Section 3.12.2, p. 3-26) that widening the Sacramento Weir and Bypass is being carried forward as part of the Locally Preferred Option (i.e., the alternative that is preferred by the non-Federal sponsor) in the American River Common Features Project. Implementation of these measures would preclude the need to raise portions of the West Sacramento levees along the Sacramento River. The West Sacramento GRR also indicates (Section 3.12.4, p.3-28) that the costs of widening the Sacramento Weir and Bypass could be "cost shared" between the two projects. However, the West Sacramento GRR does not present a strategy for how to allocate the total costs between the projects. If the costs of widening the Sacramento Weir and Bypass are shared between the two projects, it would be reasonable for the benefits that result from the costs to also be shared. Care must be taken to account for and allocate all benefits and costs, but avoid double-counting costs or benefits. Additionally, with two different non-Federal sponsors, a cost sharing strategy is needed.

Significance – Medium/Low

Without presenting a strategy for allocating the costs and benefits between the American River Common Features and the West Sacramento Projects, it will not be possible to determine the full benefits and costs of alternative plans for both projects, which may impact the benefit-to-cost ratios of alternatives for both projects.

Recommendations for Resolution

1. Develop and apply a strategy for allocating costs and benefits to the American River Common Features Locally Preferred Option and the West Sacramento Project alternatives, assuming both projects are authorized.
2. Assess and document the non-Federal sponsors' willingness to participate in plans that integrate the American River Common Features Locally Preferred Alternative with the West Sacramento recommended plan.
3. Develop strategies for the West Sacramento Project based on future scenarios with and without authorization and construction of the American River Common Features Project.

Final Panel Comment 13

It is not clear how evaluation metrics were used in screening preliminary alternatives or evaluating the final alternatives.

Basis for Comment

Table 3-18 of the GRR (p. 3-35) provides a set of evaluation metrics that could be used to assess how well alternatives meet the planning objectives. However, there is no description in the GRR of how the evaluation metrics were applied and how they were used to screen or compare alternatives. Nor does the GRR describe how the alternatives were uniformly evaluated using a common set of evaluation metrics.

Significance – Medium/Low

A clear description of how the alternatives were evaluated is necessary to determine how well they met the planning objectives.

Recommendations for Resolution

1. Provide a description of how the evaluation metrics in Table 3-18 were applied to the alternatives and how the alternatives compared. A table could be added to compare how well each alternative met the planning objectives based on the evaluation matrix.

Final Panel Comment 14

It is not clear how the magnitude of impacts and level of significance were determined for effects of sedimentation and turbidity on fisheries resources.

Basis for Comment

The Draft EIS/EIR (Section 3.7, pp. 131-135) concludes that an increase in sedimentation and turbidity could be considered significant for fisheries in general; however, the specific types and magnitude of these effects under each alternative are not described.

In terms of the specific significance criteria used for fisheries resources (Draft EIS/EIR, p.129), it is not clear how the level of significance was determined. For example, it is not clear what assumptions were made about the amount of increased sedimentation and turbidity that would be considered substantial and therefore significant.

Significance – Medium/Low

Without a discussion of the magnitude of impacts on fisheries resources relative to baseline conditions, the quality and completeness of the analysis are limited and the biological rationale to support the conclusions is not clear.

Recommendation for Resolution

1. Expand the discussion of anticipated project effects on fisheries resources. The discussion should describe impact mechanisms and the types and magnitude of biological effects.
2. Discuss the assumptions made about the amount of project-related increased sedimentation and turbidity (relative to baseline conditions) that would be considered substantial and therefore significant. If any amount of increase is considered significant, then clarify that point.

Final Panel Comment 15

Details about dates, locations, and objectives of reconnaissance-level surveys for some biological resources are not presented.

Basis for Comment

Sections 3.6 and 3.8 of the Draft EIS/EIR (pp. 107, 137, 150, 151, 167) mention that reconnaissance-level surveys to characterize existing biological resource conditions and analyze project-related impacts were conducted. The Panel believes they are likely appropriate to support the analysis. However, no information is provided about the methodology and timing of the surveys, or the types of information collected (e.g., vegetation mapping, evaluating habitat suitability for special-status species, etc.). Section 3.7 of the Draft EIS/EIR does not mention whether reconnaissance-level or other surveys for fisheries resources were conducted.

Significance – Medium/Low

The overall quality and adequacy of the reconnaissance-level surveys cannot be evaluated without some additional detail about the timing, objectives, and methods of the surveys.

Recommendation for Resolution

1. Provide a discussion of the survey methods, including survey areas, dates, and types of information collected in Sections 3.6, 3.7, and 3.8 of the Draft EIS/EIR.

Final Panel Comment 16

No analyses have been reported that confirm that the seepage model extent is sufficient so that boundary effects do not result in inaccurate results.

Basis for Comment

As described in the Geotechnical Appendix, Section 11.1, no-flow boundary conditions were applied at the downstream extent of the seepage model used to determine exit gradients and evaluate whether seepage control measures are required. The boundary conditions are unlikely to represent actual conditions because some landward flow probably exists. The Panel infers that it was assumed that the numerical seepage model extent of 2000 ft described in Section 11.1 is large enough that boundary conditions will not affect the results near the levee. No information is provided whether any analyses have been conducted to confirm this assumption. Instead of no-flow boundary conditions, an option would be to use a constant head boundary based on assumed groundwater conditions on the landside boundary of the seepage model.

Significance – Low

Confirming that boundary conditions used for seepage analyses do not result in inaccurate results will improve the understanding and accuracy of the project.

Recommendation for Resolution

1. The inferred assumption should be confirmed in future design phases either by analyzing a few cases with larger model extents and comparing results to confirm that exit gradients are the same, or by applying constant head boundary conditions on vertical surfaces with reasonably assumed piezometric levels.

Final Panel Comment 17

The use of effective peak shear strength parameters may not be appropriate for all materials.

Basis for Comment

The strength parameters used for concept level analyses are appropriate for the vast majority of the project; however, it is possible that in a few cases the risk of slope instability is somewhat higher than present calculations indicate. Stability analyses used effective shear strength parameters for all materials and were determined using the 33% percentile value from either in situ tests or triaxial tests. While the method is appropriate for the majority of the soils encountered for the proposed project, special cases exist where performing analyses using undrained or fully softened parameters might reduce calculated stability for both with- and without-project conditions. Using effective stress parameters is not appropriate for soft to medium stiff foundation clays and silty clays that generate positive pore pressure during shear, unless sophisticated and unusual methods are used to determine these pore pressures. Stability analyses of such materials are appropriately performed using undrained strength, as described by Ladd (1986).

Using strength determined from in situ and triaxial tests may be unconservative for fat clays, even using the 33% percentile value. This is especially true when subjecting the materials to alternating cycles of wetting and drying. For these materials, Duncan and Wright (2005) summarize research demonstrating that the fully softened strength is more appropriate for these materials. In situ tests and standard triaxial testing provide peak strength, not fully softened strength. Duncan and Wright discuss appropriate lab testing methods, and provide correlations for estimating appropriate strengths.

The Panel believes that in a few cases the use of undrained or fully softened strength parameters may overestimate both with- and without-project condition level slope stability. Reanalyzing the slopes with more appropriate parameters could increase both the cost of levee repair, but also the likelihood of failure for without-project conditions, thus increasing the benefit of the project. As a result, any changes in the benefit-to-cost ratio are almost certainly within the margin of uncertainty for the project.

Significance – Low

Using undrained or fully softened strength parameters will improve the accuracy and technical quality of the project, notably in the future design phase.

Recommendation for Resolution

1. During future design phases, evaluate whether conditions exist where using undrained or fully softened strength parameters might affect details of recommended repairs. If necessary, perform lab tests or use applicable correlations to determine appropriate strength parameters for use in detailed design.

Literature Cited:

Duncan, J. Michael and Wright, Stephen G. (2005). Soil Strength and Stability. John Wiley and Sons Inc., 312 pp.

Ladd, C.C. (1986). Stability evaluation during staged construction. ASCE Journal of Geotechnical Engineering, 1986:117(4)

Final Panel Comment 18

The level of significance of impacts on biological resources after mitigation is not clearly presented.

Basis for Comment

The Panel believes the overall conclusions of the analysis of the impacts on biological resources may be accurate, and the biological effects of implementing and operating the project with mitigation incorporated could be relatively minor. However, the biological rationale and evidence to support the conclusions are not always consistent or clearly presented. Clear presentation of this information is important for supporting the analysis, conclusions, and whether proposed mitigation is adequate.

Table ES-1 of the Draft EIS/EIR (pp. ES-13 to 20) summarizes the environmental effects, mitigation, and levels of significance for each alternative. In the "Vegetation and Wildlife" category, all the effects are listed as "significant" (with mitigation incorporated); however, the analysis in Section 3.6 (pp. 114-121) describes the effects as being reduced to a less-than-significant level with mitigation incorporated. The same issue applies to Table 4-2 (p. 392).

The cumulative effects analyses for vegetation and wildlife, fisheries resources, and special-status species (Draft EIS/EIR, pp. 384-387) do not describe or provide a rationale for whether the project's contribution to a cumulative effect is considered significant.

The mitigation proposed for impacts on special-status bat species states (Draft EIS/EIR, p. 182): "The same measures described above for migratory bird species would also be used to minimize the effects to bats." However, because survey techniques and timing for detecting migratory birds are different than those for detecting bat species, the measures proposed for migratory birds would not likely be appropriate for detecting and minimizing/avoiding impacts on bats.

Significance – Low

The biological rationale and evidence to support the conclusions of the analysis of impacts on biological resources are not consistent or clearly presented, which limits the completeness and technical quality of the Draft EIS/EIR.

Recommendation for Resolution

1. For the biological resources impact discussions presented in Sections 3.6, 3.7, and 3.8 of the Draft EIS/EIR (pp. 114-124, 131-135, 168-185), include a conclusion about whether all potentially significant effects have been reduced to a less-than-significant level, and which (if any) have not. (For consistency, this revision could be made to all of the resource sections.)
2. Review and, if needed, revise Tables ES-1 and 4-2 to make them consistent with the analysis conclusions for biological resources.
3. Provide details of the proposed mitigation for impacts on special-status bat species (e.g., survey methods, limited operating periods, minimization/avoidance measures, etc.).
4. Expand the cumulative effects discussion (pp. 384-387) to include a discussion of the project's contribution to a cumulative effect and its level of significance. (For consistency, this revision could be made to all of the resource sections.)

5. REFERENCES

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APPENDIX A

IEPR Process for the West Sacramento GRR Project

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

Table A-1 presents the schedule followed in executing the West Sacramento Project, California, General Reevaluation Report (GRR), Flood Risk Management (FRM) Project Independent External Peer Review (hereinafter: West Sacramento GRR IEPR). Due dates for milestones and deliverables are based on the award/effective date of July 15, 2014. The review documents were provided by U.S. Army Corps of Engineers (USACE) on July 22, 2014. Note that the work items listed under Task 6 occur after the submission of this report. Battelle will enter the 18 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. West Sacramento GRR Complete IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	7/15/2014
	Review documents available	7/22/2014
	Battelle submits draft Work Plan[a]	7/23/2014
	USACE provides comments on draft Work Plan	7/30/2014
	Battelle submits final Work Plan[a]	7/31/2014
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	7/17/2014
	USACE provides comments on COI questionnaire	7/21/2014
	Battelle submits list of selected panel members[a]	7/28/2014
	USACE confirms the panel members have no COI	7/30/2014
	Battelle completes subcontracts for panel members	8/8/2014
3	Battelle convenes kick-off meeting with USACE	7/22/2014
	Battelle sends review documents to panel members	8/7/2014
	Battelle convenes kick-off meeting with panel members	8/12/2014
	Battelle convenes kick-off meeting with USACE and panel members	8/12/2014
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	8/21/2014
	Agency Decision Milestone (ADM) Meeting (tentative date)	2/2/2015
	Civil Works Review Board (CWRB) Meeting (tentative date)	6/4/2015
4	Panel members complete their individual reviews	9/2/2014
	Battelle convenes Panel Review Teleconference	9/4/2014

Table A-1. West Sacramento GRR Complete IEPR Schedule (continued)

Task	Action	Due Date
4	USACE provides public comments to Battelle	9/9/2014
	Battelle sends public comments to Panel	9/9/2014
	Panel members provide draft Final Panel Comments to Battelle	9/16/2014
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	9/17/2014 - 9/30/2014
	Panel finalizes Final Panel Comments	10/2/2014
5	Battelle provides Final IEPR Report to panel members for review	10/3/2014
	Panel members provide comments on Final IEPR Report	10/3/2014
	Battelle submits Final IEPR Report to USACE[a]	**10/6/2014**
6[b]	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	10/7/2014
	Battelle inputs Final Panel Comments to the Design Review and Checking System (DrChecks) and provides Final Panel Comment response template to USACE	10/8/2014
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	10/8/2014
	USACE provides draft Project Delivery Team (PDT) Evaluator Responses to Battelle	10/21/2014
	Battelle provides the panel members the draft PDT Evaluator Responses	10/23/2014
	Panel members provide Battelle with draft BackCheck Responses	10/28/2014
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	10/29/2014
	Battelle convenes Comment-Response Teleconference with panel members and USACE	10/30/2014
	USACE inputs final PDT Evaluator Responses to DrChecks	11/3/2014
	Battelle provides final PDT Evaluator Responses to panel members	11/6/2014
	Panel members provide Battelle with final BackCheck Responses	11/12/2014
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	11/18/2014
	Battelle submits pdf printout of DrChecks project file[a]	11/19/2014
	Contract End/Delivery Date	5/31/2015

a Deliverable.

b Task 6 occurs after the submission of this report

At the beginning of the Period of Performance for the West Sacramento GRR 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, 25 charge questions were provided by USACE and included in the draft and final Work Plans. Battelle added two questions that sought 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 two days 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 West Sacramento GRR 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.

- **General Reevaluation Report (194 pages)**
- **Appendix A: Hydrology (189 pages)**
- **Attachment B: Hydraulics Appendix (89 pages)**
- **Attachment C: Geotechnical Report (111 pages)**
- **Appendix G: Economics (96 pages)**
- **Appendix M: Public and Agency Comments (i.e. public review comments) (48 pages)**
- **Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) (1,207 pages)**
- Decision Management Plan (4 pages)
- Decision Log (1 page)
- Risk Register (9 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 West Sacramento GRR 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 24 panel member questions to USACE. USACE was able to provide responses to all of the questions during the teleconference or after the call via email.

In addition, throughout the review period, USACE provided documents at the request of panel members. These documents were provided to Battelle and then sent to the Panel as additional information only and were not part of the official review. The following additional documents were requested by the Panel.

- Plate1 West Sacramento Project Area
- Seismic Vulnerability Designation
- Enclosure 6 - West Sacramento GRR Report Synopsis July 2014
- Enclosure 9 - District Quality Control Certification.

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 20 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.

At the end of these discussions, the Panel identified 18 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 West Sacramento GRR 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 SMART 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 SMART 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 SMART 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. At the end of this process, 18 Final Panel Comments were prepared and assembled. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Final Panel Comments are presented in the main report.

A.5 Conduct of the Public Comment Review

Battelle received public comments from USACE on the West Sacramento GRR (approximately 11 letters and individual comments, totaling 48 pages of comments) and provided them to the IEPR panel members along with two charge questions to guide the public comment review:

1. **Does information or concerns raised in the public comments raise any additional discipline-specific technical concerns with regard to the overall report?**
2. **Has adequate stakeholder involvement occurred to identify issues of interest and to solicit feedback from interested parties?**

The Panel produced individual comments in response to the two charge questions. Battelle reviewed the comments to identify any new technical concerns that had not been previously identified during the initial IEPR. Upon review, Battelle determined and the Panel confirmed that no new issues or concerns were identified other than those already covered in their Final Panel Comments. The Panel also determined that adequate stakeholder involvement had occurred.

APPENDIX B

Identification and Selection of IEPR Panel Members
for the West Sacramento GRR Project

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B.1 Panel Identification

The candidates for the West Sacramento Project, California, General Reevaluation Report (GRR), Flood Risk Management (FRM) Project (hereinafter: West Sacramento GRR IEPR) Panel were evaluated based on their technical expertise in the following key areas: geotechnical engineering, hydrologic and hydraulic (H&H) engineering, economics/Civil Works planning, and biology/ecology. These areas correspond to the technical content of the West Sacramento GRR review documents and overall scope of the West Sacramento GRR 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 four experts for the final Panel.

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

The candidates were screened for the following potential exclusion criteria or COIs.[1] 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[2] in the West Sacramento Project, California GRR, FRM Project.
- Previous and/or current involvement by you or your firm[2] in flood risk management studies/projects in the Sacramento-area.
- Previous and/or current involvement by you or your firm[2] in West Sacramento GRR FRM Project-related projects.

[1] 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."

[2] Includes any joint ventures in which a 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[2] in the conceptual or actual design, construction, or operation and maintenance (O&M) of any projects in any West Sacramento GRR FRM Project-related projects.
- Current employment by USACE.
- Previous and/or current involvement with paid or unpaid expert testimony related to the West Sacramento GRR FRM Project.
- Previous and/or current employment or affiliation with the non-Federal sponsors (West Sacramento Area Flood Control Agency and the State of California Central Valley Flood Protection Board) or any of the following cooperating Federal, State, County, local, and regional agencies, environmental organizations, and interested groups: City of West Sacramento, Reclamation District 900, and/or Reclamation District 537(for pay or pro bono).
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to the Sacramento, California area.
- 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 West Sacramento GRR FRM Project, which include HEC-FDA, Habitat Evaluation Procedures (HEP), HEC-HMS, MCACES MII, HEC-ResSim, HEC-RAS, FLO-2D, Groundwater Modeling System (GMS), and/or Utexas.
- Current firm[2] 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, notably if employment was with the Sacramento District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Any previous employment by USACE as a contractor (either as an individual or through your firm[2]) 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 West Sacramento GRR FRM Project -related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years came from USACE contracts.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years from contracts with the non-Federal sponsors (West Sacramento Area Flood Control Agency and the State of California Central Valley Flood Protection Board).

- Any publicly documented statement (including, for example, advocating for or discouraging against) related to the West Sacramento GRR FRM Project.
- Participation in relevant prior and/or current Federal studies relevant to this project and/or the West Sacramento GRR FRM Project.
- Previous and/or current participation in prior non-Federal studies relevant to this project and/or the West Sacramento GRR FRM Project.
- 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? If so, please describe.

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 four final reviewers are affiliated with a consulting company; the other is an independent consultant. 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 four 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 panel members and their area of technical expertise is presented in Section B.3.

Table B-1. West Sacramento GRR IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Sisson	Wardak	Hornung	Henderson
Geotechnical Engineering				
Minimum 10 years of experience in geotechnical studies	X			
Minimum 10 years of experience in design of flood control works (i.e., dams, levees, floodwalls, and closure structures)	X			
Experience in fluvial processes and geomorphology	X			
Expertise in geotechnical risk analysis, specifically the application of probabilistic methods to geotechnical aspects of levees	X			
Experience in:	X			
site investigation planning	X			
implementation of flood risk management projects	X			
minimization of environmental impacts	X			
static and dynamic slope stability evaluation	X			
evaluation of seepage through earthen embankments	X			
evaluation of underseepage through the foundation of flood control structures (including dam and levee embankments, floodwalls, closure structures)	X			
settlement evaluation of flood control structures	X			
Familiarity with geotechnical practices used in California	X			
Experience in seismic characterization of soil analysis with experience in liquefaction evaluations of sites and earth structures, particularly flood control structures	X			
Ability to address the SAR (i.e., Safety Assurance Review) aspects of all projects	X			
Active participation in related professional societies	X			
M.S. degree or higher in engineering	X			
Hydrologic and Hydraulic Engineering				
Minimum 10 years of experience in hydraulic engineering, with an emphasis on large public work projects		X		
Registered professional engineer		X		
Experience in the application of risk and uncertainty in defining project performance and assurance		X		

Table B-1. West Sacramento GRR IEPR Panel: Technical Criteria and Areas of Expertise (continued)

Technical Criterion	Sisson	Wardak	Hornung	Henderson
Familiar with standard /USACE hydrologic and hydraulic computer models, including:		X		
HEC-HMS		X		
HEC-RAS		X		
FLO-2D		X		
Active participation in related professional societies		X		
M.S. degree or higher in engineering		X		
Economics/Civil Works Planning				
Minimum 10 years of experience in public works planning			X	
Familiarity with USACE plan formulation process, procedures, and standards			X	
Familiarity with USACE structural flood risk management projects			X	
Minimum of five years of experience directly dealing with the USACE six-step planning process, which is governed by ER 1105-2-100, Planning Guidance Notebook.			X	
Familiarity with USACE flood risk management analysis and benefit calculations, including use of USACE's HEC-FDA computer program			X	
Experience with the National Economic Development analysis procedures, particularly as they relate to flood risk management			X	
Biology/Ecology				
Minimum 10 years of experience in evaluating and conducting National Environmental Policy Act (NEPA) impact assessments, including cumulative effects analyses, for multi-objective, large, public works projects				X
Familiarity with USACE calculation of evaluation of environmental benefits via Habitat Evaluation Procedure (HEP) models				X
Extensive background, experience, and working knowledge of the implementation of the NEPA compliance process				X
Familiarity with species from the West Coast and their habitat requirements, particularly salmon				X
M.S. degree or higher in an appropriate field of study				X

B.3 Panel Member Qualifications

Richard Sisson, P.E., Ph.D.

Role: Geotechnical engineering experience and expertise.
Affiliation: Barr Engineering Company

Dr. Sisson is a senior geotechnical consultant with Barr Engineering Company. He earned a Ph.D. in geotechnical engineering from the University of California (UC), Berkeley and has performed, planned, and managed numerous site investigations for over 25 years for diverse projects including levees, tailings and water retention dams, major industrial plants, and transportation infrastructure. He is a registered professional engineer in California and Alberta, Canada, and is familiar with geotechnical practices used in California. He passed the California Geotechnical Engineering Exam and has practiced geotechnical engineering in the state for seven years.

Dr. Sisson's experience in the fields of geotechnical and civil engineering includes providing consulting services for levee upgrades; engineering and project management for flood risk management (FRM); heavy civil infrastructure; water resources; transportation; and land development projects. He is experienced in the design of flood control works, including dams, levees, floodwalls, and closure structures, with relevant studies including levee upgrade designs for Twitchell Island, Byron Tract, and Thornton Levee systems. His educational background includes fundamentals of geology applied to engineering and fluid mechanics; he has applied his knowledge of fluvial processes and geomorphology in numerous levee studies, diversion channel design, and a tailings sedimentation study. He has also authored a paper on the theory of fluvial processes applied to tailings deposition.[3] He is experienced in geotechnical risk analysis, specifically the application of probabilistic methods to geotechnical aspects of levees and has performed risk assessments of several large fluid tailings storage projects, as well as water storage structures using tools including event tree analyses, failure modes and effects analyses, and qualitative risk assessment. He is also familiar with risk quantification methods for levees described by Engineering Technical Letter 1110-2-556.

Dr. Sisson is well-versed in site investigation planning, implementation of FRM projects, and the minimization of environmental impacts. He has been involved in the construction engineering for Twitchell Island Levee Upgrade, the engineering during construction of the Tar River Diversion Project, Alberta, and the construction of numerous large fluid tailings storage facilities. His projects are often conducted and constructed in environmentally sensitive settings such as riparian habitat and wetlands, and routinely includes the evaluation of construction design options for minimization and mitigation of environmental impacts.

Dr. Sisson has worked on seismic characterization of soil analysis and has experience in liquefaction evaluations of sites and earth structures, particularly flood control structures. He was trained at UC Berkeley under Drs. H.B. Seed and John Lysmer and applied the training to the assessment of seismic stability of levees in Sacramento Delta area. Demonstrable project experience includes his earthquake analyses and slope design for the Guadalupe Landfill in Los Gatos, California and the Little Bow Dam Project in Southern Alberta where he assessed the potential for static liquefaction of weak alluvial soils.

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[3] An Analytical Model for Tailings Deposition Developed from Pilot Scale Testing, R. Sisson et al.; 3rd International Oil Sands Tailing Conference, 2012.

Dr. Sisson is capable of addressing all aspects of the USACE Safety Assurance Review (SAR). For example, he performed risk assessments and developed Construction Quality Management Plans for the Horizon Tailings Dam and Horizon Dyke 10 projects.

Over the past 25 years, Dr. Sisson has performed and managed numerous stability analyses, including levee systems, mining facilities in Northern Alberta, and highways in California and Idaho. He has also assessed seepage through earthen embankments and foundations and has evaluated underseepage through the foundation of flood control structures (including dam and levee embankments, floodwalls, closure structures). Relevant experience includes his engineering of the Horizon Dam, Horizon Raw Water Pond, levees in Whitehorse, Yukon Territory, and seepage analyses performed for the 65 meter high Horizon Tailings Dam.

Soorgul Wardak, P.E., Ph.D.

Role: Hydrologic and hydraulic engineering experience and expertise.
Affiliation: GENTERRA Consultants, Inc.

Dr. Wardak is an Associate Civil Engineer with GENTERRA, specializing in projects involving dams, levees, channels, and other water storage and water conveyance facilities. He earned his Ph.D. in civil engineering from North Carolina State University, Raleigh, in 1976, is a registered professional engineer in California, and has more than 30 years of professional teaching and research experience on large public work projects focusing on hydraulics, hydrology, water quality/water resources modeling, and groundwater engineering. His primary expertise is in H&H modeling and water resources engineering. He has taught professional engineer's license courses in California and Senior Design Project and Water Supply at California State University at Pomona, California. He was also a former associate Professor of Civil Engineering at Kabul University where he taught fluid mechanics, hydraulics, engineering mechanics, water resources engineering, groundwater hydrology, and open channel design.

Dr. Wardak has extensive experience in hydraulic engineering based, large public work projects, with an emphasis on flood risk management projects on large river control structures. Relevant projects include the Sacramento River Bypass System for the National Weather Service; the United Nations Hydro-Electric Potential Study, Mekong River, Thailand; and the Federal Emergency Management Agency (FEMA) Flood Insurance Study, San Diego County, California. He is experienced in the application of risk and uncertainty in defining project performance and assurance, with a strong working knowledge of HEC-1 and HEC-HMS and the risk analysis module of HEC-1, which is being used for flood damage and management studies. In the past 30 years, he has completed numerous projects that required hydrologic, hydraulic, channel flood/detention routing, flood proofing and sediment analysis. He has used both HEC-1 and HEC-RAS on the Foothill Transportation Corridor-South, Orange County, California, Phase I study. He was Project Engineer in charge of complete hydrologic analysis for six major watersheds in south Orange County, California, to assess the hydrologic and sedimentation/erosion impacts associated with a variety of alternatives for the Foothill Transportation Corridor-South. The major watershed included San Mateo, San Juan, San Onofre, Trabuco Creek Watershed, Oso Creek Watershed, and Prima Deshecha Watershed. The plans required identification of hydrologic criteria and possible best alternative. In addition, he used both HEC-1 and HEC-HMS for the Paradise Valley project where he modeled about 60 square miles of watershed.

Dr. Wardak is experienced with standard USACE hydrologic and hydraulic computer models and has also developed several computer programs for use in hydrologic, hydraulic, and sedimentation engineering. He is skilled in the use of HEC-1, HEC-2, HEC-RAS, HEC-6, HEC-HMS, Advanced Engineering

Software, HYDRA, WSPG, FESWMS, Flo-2d, H2oNET, MORA, and SEEP2D Modeling. He has applied his modeling experience on projects that include the Hydraulic and Sediment Analysis of Big Tujunga Wash and Haines Canyon Channels in Los Angeles, and the Aliso Creek Water Surface Profile Analysis in Orange County, California. He has also conducted extensive research in the area of two-dimensional unsteady flow (non-linear partial differential equations) modeling using the Alternating Direction Implicit Method.

Dr. Wardak recently served on the Independent External Peer Review panel as the H&H engineering expert for the Kansas Citys, Missouri and Kansas, Section 216 Flood Risk Management Project. He is a member of the American Society of Civil Engineers and a peer reviewer for the Journal of Hydrologic Engineering.

Lewis Hornung

Role: Economics/civil works planning experience and expertise.
Affiliation: Independent Consultant

Mr. Hornung is an independent consultant with L Hornung Consulting, Inc. He earned his B.S. in civil engineering from the University of Houston in 1977. His 37-year career includes 19 years with USACE, six years with the South Florida Water Management District, and 12 years with architectural/engineering consulting firms. His primary experience has been planning and project management. He has played lead roles in a large number of planning projects, including studies for environmental restoration, flood damage reduction, and water supply. He is also familiar with USACE's 2011 Planning Modernization initiative, has served as project manager for the development of a planning modernization implementation plan for USACE Headquarters, and has served on previous IEPR panels for Battelle.

Mr. Hornung has direct experience in USACE plan formulation process, procedures and standards and his career at USACE included more than 12 years in the Planning Division. He has applied the USACE six-step planning process, governed by ER 1105-2-100 Planning Guidance Notebook, for reconnaissance studies, feasibility studies, limited reevaluation reports, general reevaluation reports, major rehabilitation reports, and continuing authority studies. Relevant studies include the C-111 General Reevaluation Report (GRR) (SAJ), the C-51 West GRR (SAJ), the Lake Okeechobee Watershed Feasibility Study (SAJ), and the Alexandria to the Gulf Flood Control Feasibility Study (New Orleans District (MVN).

For the past 12 years working in the private sector, Mr. Hornung has worked on a variety of planning projects for government and private-sector clientele. His planning experience includes structural and non-structural FRM projects, and water quality, and water supply studies. The majority of the USACE studies that he has been involved with have been for multi-purpose projects that addressed flood risk management, water supply, water quality, and/or ecosystem restoration. Demonstrable projects include Modified Water Deliveries to Everglades National Park (SAJ), Calcasieu Lock Navigation Feasibility Study (MVN), and Alexandria to the Gulf of Mexico Flood Control Feasibility Study (MVN).

Mr. Hornung is familiar with USACE flood risk management analysis and benefit calculations, including use of USACE's HEC-FDA computer program and has applied them to many USACE studies. Project experience where HEC-FDA was used include the Alexandria to the Gulf of Mexico Feasibility Study for the New Orleans District, where an automated data entry process was used with HEC-FDA and was later adopted by HEC. He is also experienced with national economic development (NED) analysis procedures, particularly as they relate to flood risk management. NED benefit calculations have been a

part of the vast majority of USACE planning studies he has been involved with, and flood risk management benefits have been the primary source of NED benefits for the projects described above.

Steven Henderson

Role: Biology/ecology experience and expertise.
Affiliation: Ascent Environmental, Inc.

Mr. Henderson is a senior biologist at Ascent Environmental, Inc., specializing in natural resources planning and management, impact assessment and mitigation design, design and conduct of biological inventories and analyses, wildlife surveys and habitat suitability assessments, and biological monitoring and adaptive management. He earned his M.S. in biological sciences (ecology and conservation biology emphasis) from Montana State University and has more than 15 years of professional experience. He works closely, and coordinates frequently, with local, state, and Federal regulatory and resource management agencies and has worked on many complex public work projects with multiple objectives, including transportation planning, flood protection, water supply reliability, river restoration, upland habitat restoration, and sensitive biological resource protection. He is familiar with the biological and environmental resources located in central and northern California, and has extensive project experience in several regions of California and Nevada.

Mr. Henderson has extensive background experience and working knowledge of the implementation of the NEPA compliance process and is experienced in performing analyses of direct, indirect, and cumulative impacts for biological resources and has prepared numerous documents in accordance with the requirements of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). His experience includes such projects as the Biological Studies for the Upper San Joaquin River Basin Storage Investigation Project for the U.S. Bureau of Reclamation; the Upper Truckee River Restoration and Golf Course Relocation Project Environmental Impact Report/Environmental Impact Statement for California State Parks, Sierra District; and Willow Flycatcher Studies in Support of ESA Compliance for Operation of Isabella Dam and Reservoir for USACE. He is familiar with USACE calculation of evaluation of environmental benefits via Habitat Evaluation Procedure (HEP) models and is knowledgeable in the development, application, and interpretation of HEP models. He has also peer-reviewed a Habitat Suitability Index (HSI) model, a component of HEP, for the Federally endangered southwestern willow flycatcher, and developed quantitative habitat association models (to be implemented similar to an HSI model) for that species to evaluate relative habitat suitability of different riparian areas being evaluated for protection and restoration.

Mr. Henderson is familiar with species from the West Coast, including salmon, along with their habitat requirements; he has focused on the wildlife species and habitats throughout California, particularly central and northern California. He attended the University of California Davis for his undergraduate degree, and the majority of his professional career has been focused on the West Coast (central and northern California, including the Sacramento region). He is familiar with salmon habitat and management issues, and has conducted assessments and impact analyses of various aquatic and riparian habitats and species. Relevant studies include the Gray Creek Watershed Assessment and Restoration Plan, Lower Blackwood Creek Restoration Project, Lake Tahoe Passenger Ferry Project EIS/EIR/EIS, CalPeco 625 and 650 Electric Line Upgrade Project EIS/EIS/EIR, Edgewood Hotel and Golf Course Realignment Project EIS, Upper Truckee River and Marsh Restoration Project Planning and EIR/EIS/EIS, Sacramento Regional County Sanitation District “EchoWater” Wastewater Treatment Plant Upgrade EIR, and

Biological Surveys and Habitat Restoration of Sacramento Regional County Sanitation District Bufferlands.

Mr. Henderson recently served on the Independent External Peer Review panel as the biology/ecology expert for the Orestimba Creek Flood Risk Management Project Feasibility Study, West Stanislaus County, California. He is also a member of The Society for Conservation Biology and The Wildlife Society, served as a peer reviewer of manuscripts submitted for publication to the journals Conservation Biology (Society for Conservation Biology) and The Condor (Cooper Ornithological Society), and has presented at the Tahoe Science Conference, Incline Village, Nevada.

APPENDIX C

Final Charge to the IEPR Panel as Submitted to USACE on July 31, 2014 for the West Sacramento GRR Project

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Charge Questions and Guidance to the Panel Members for the IEPR of the West Sacramento Project, California, General Reevaluation Report (GRR) Flood Risk Management (FRM) Project

BACKGROUND

The purpose of the project is to identify flood-related issues in the West Sacramento, California, study area. The decision document will present planning, engineering, and implementation details of the recommended plan to allow final design and construction to proceed after approval of the recommended plan. The project is a General Reevaluation Report (GRR) undertaken to evaluate structural and non-structural flood risk management (FRM) measures, including in-basin storage, re-operation of existing reservoirs, improvements to existing levees, construction of new levees, and other storage, conveyance, and non-structural options. Because of the scope of the project, an Environmental Impact Study/Environmental Impact Report (EIS/EIR) will be prepared. At direction from Headquarters, U.S. Army Corps of Engineers (USACE), the GRR is being cost shared 50 percent Federal and 50 percent non-Federal with the project sponsors, the State of California Central Valley Flood Protection Board (CVFPB) and the City of West Sacramento.

The Water Resources Development Act (WRDA) of 1992 and the Energy and Water Development and Appropriations Act (EWDAA) of 1999 authorized the West Sacramento Project. Unfortunately, the authorized levee improvements did not consider the underseepage deficiencies facing many of the levees that protect the City. Although the levee improvements authorized for construction were redesigned to address underseepage, the remaining levees that protect the City were not re-evaluated to determine whether they were adequate to withstand the design flood event. The project partners have requested additional investigation into the remaining flood-related issues in the study area.

The study area is in eastern Yolo County in the north-central region of the Central Valley of California. The City of West Sacramento is just west of the City of Sacramento, across the Sacramento River. The Sacramento River flows north to south, from its headwaters near the California-Oregon state line, to the Sacramento-San Joaquin Delta northeast of San Francisco Bay. The study area fundamentally consists of the City of West Sacramento city limit. The city is almost completely bound by floodways and levees: the Yolo Bypass to the west, the Sacramento Bypass to the north, and the Sacramento River to the east. The city is bifurcated by the Port of Sacramento Deep Water Ship Channel and Barge Canal. The non-Federal sponsor is primarily interested in reducing flood risk to the City of West Sacramento and surrounding area. The West Sacramento Project, California GRR, FRM project has been conducted to meet the USACE modernized planning initiative (i.e., “SMART” planning), which is to complete investigations leading to a decision in less time by using a risk-informed evaluation with less detailed information.

This new process has not been business as usual and has required heavy involvement as well as input and decisions from the Vertical Team at multiple points throughout the study. Instead of following the traditional USACE planning milestones, the study has been divided into phases, each with key milestones and associated In-Progress Reviews (IPR). A risk register and other risk management documentation will

accompany the decision document. Although one of the objectives of IEPR is to evaluate whether sufficient information was available or technical analyses were completed, the IEPR must be completed within the context of the risk-informed decision-making process.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the West Sacramento Project, California General Reevaluation Report (GRR), Flood Risk Management (FRM) Project (hereinafter: West Sacramento GRR IEPR) in accordance with the Department of the Army, U.S. Army Corps of Engineers (USACE), Water Resources Policies and Authorities' *Civil Works Review* (Engineer Circular [EC] 1165-2-214, dated December 15, 2012), and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

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

The purpose of the IEPR is to assess the "adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (EC 1165-2-214; p. D-4) for the West Sacramento GRR 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 geotechnical engineering, hydrologic and hydraulic (H&H) engineering, economics/Civil Works, and biological/ecological issues relevant to the project. They will also have experience applying their subject matter expertise to FRM.

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. The documents and files in bold font were provided for review; the other documents were provided for reference or supplemental information only.

Document	Geotechnical Engineer	H&H Engineer	Economics/ Civil Works planner	Biologist/ Ecologist
General Reevaluation Report (194 pages)	194	194	194	194
Decision Management Plan (4 pages)	4	4	4	4
Decision Log (1 page)	1	1	1	1
Risk Register (9 pages)	9	9	9	9
Appendix A: Hydrology (189 pages)		189		
Attachment B: Hydraulics Appendix (89 pages)		89		
Attachment C: Geotechnical Report (111 pages)	111			
Appendix G: Economics (96 pages)			96	
Appendix M: Public and Agency Comments (i.e., public review comments) (~48 pages)	48	48	48	48
Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) (1,207 pages)	1,207	1,207	1,207	1,207
Total Review Pages (1,948):	**1,574**	**1,741**	**1,559**	**1,463**

Documents for Reference

- 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).

SCHEDULE

This final schedule is based on the July 22, 2014, receipt of the final review documents.

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	8/11/2014
	Battelle convenes kick-off meeting with panel members	8/12/2014
	Battelle convenes kick-off meeting with USACE and panel members	8/12/2014
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	8/21/2014
	Panel members complete their individual reviews	9/2/2014

Task	Action	Due Date
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members with talking points for Panel Review Teleconference and convenes Panel Review Teleconference	9/4/2014
	Battelle provides Final Panel Comment templates and instructions to panel members	9/5/2014
	Battelle provides public comments to Panel	9/9/2014
	Panel members provide draft Final Panel Comments to Battelle	9/16/2014
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments, including any on public comments	9/17/2014 - 9/30/2014
	Panel finalizes Final Panel Comments	10/2/2014
	Battelle provides Final IEPR Report to panel members for review	10/3/2014
	Panel members provide comments on Final IEPR Report	10/3/2014
	Battelle submits Final IEPR Report to USACE	10/6/2014
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	10/8/2014
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	10/8/2014
	USACE provides draft Project Delivery Team (PDT) Evaluator Responses to Battelle	10/21/2014
	Battelle provides the panel members the draft PDT Evaluator Responses	10/23/2014
	Panel members provide Battelle with draft BackCheck Responses	10/28/2014
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	10/29/2014
	Battelle convenes Comment-Response Teleconference with panel members and USACE	10/30/2014
	USACE inputs final PDT Evaluator Responses to DrChecks	11/3/2014
	Battelle provides final PDT Evaluator Responses to panel members	11/6/2014
	Panel members provide Battelle with final BackCheck Responses	11/12/2014
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	11/18/2014
Agency Decision Milestone (ADM) Meeting	Agency Decision Milestone meeting (tentative date)	2/2/2015

Task	Action	Due Date
Civil Works Review Board (CWRB)	Panel prepares and/or reviews slides for CWRB	TBD
	Civil Works Review Board Meeting (tentative date)	6/4/2015

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the West Sacramento GRR 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 resource, and plan formulation analyses. 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 West Sacramento GRR 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, and 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 (Rachel Sell, sellr@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 Rachel Sell, **sellr@battelle.org**, no later than September 2, 2014, 10 pm ET.

IEPR of the West Sacramento Project, California, General Reevaluation Report (GRR), Flood Risk Management (FRM) Project

CHARGE QUESTIONS AND RELEVANT SECTIONS AS SUPPLIED BY USACE

General

1. Were all models used in the analyses, including the models assessing the hazards, used in an appropriate manner?
2. Are the assumptions that underlie the various analyses sound?
3. Are potential life safety issues accurately and adequately described under existing, future without-project, and future with-project conditions?
4. Are the quality and quantity of the surveys, investigations, and engineering sufficient for a concept design?
5. Does the analysis adequately address the uncertainty and residual risk given the consequences associated with the potential for loss of life for this type of project?

Problem, Opportunities, Objectives, and Constraints

6. Are the problems, opportunities, objectives, and constraints adequately and correctly defined? Are there any gaps or overstatements? Are they developed with a watershed context?
7. In describing the criteria, goals, and objectives of the study, were the resources and issues important to the decision-making process clearly identified? Did the study address those resources and issues?

Existing and Future Without Project Resources

8. Have the character and scope of the study area been adequately described, and is the identified study area appropriate in terms of undertaking a watershed-based investigation?
9. For your particular area of expertise, provide an in-depth review of whether the analyses of the existing social, financial, and natural resources within the project area are sufficient to support the estimated impacts for the array of alternatives.
10. Was the hydrology discussion sufficient to characterize current baseline conditions and to allow for evaluation of how forecasted conditions (with and without proposed actions) are likely to affect hydrologic conditions?
11. Were the assumptions used as the basis for developing the most probable future without-project conditions reasonable? Were adequate scenarios effectively considered (applied during analyses where relevant and/or reasonably investigated)? Were the potential effects of climate change addressed?

Plan Formulation/Alternative Development

12. Was a reasonably complete array of possible measures considered in the development of alternatives?

13. Did the formulation process follow the requirement to avoid, minimize, and then mitigate adverse impacts on resources?
14. Does each alternative meet the formulation criteria of being effective, efficient, complete, and acceptable?
15. Have system perspectives been considered in the formulation of alternatives?
16. Is there sufficient information presented to identify, explain, and comment on the assumptions that underlie the engineering analyses?
17. Are the uncertainties inherent in our evaluation of benefits, costs, and impacts, and any risk associated with those uncertainties, adequately addressed and described for each alternative?
18. Are future Operation, Maintenance, Repair, Replacement, and Rehabilitation efforts adequately described, and are the estimated costs of those efforts reasonable for each alternative?
19. Please comment on the screening of the proposed alternatives. Are the screening criteria appropriate?
20. Were the engineering, economic, and environmental analyses used for this study consistent with generally accepted methodologies?
21. Are cumulative impacts adequately described and discussed? If not, please explain.

Recommended Plan

22. Are there any unmitigated environmental impacts that were not identified? If so, could they impact plan selection?
23. Please comment on the likelihood that the recommended plan will achieve the expected outputs or outcomes.
24. Are residual risks adequately described, and is there a sufficient plan for communicating the residual risk to affected populations?
25. Has the project implementation been adequately described? Has the implementation relationship between the West Sacramento proposed Tentatively Selected Plan considered relevant factors? Are there other implementation issues that have not been addressed?

Overview Questions As Supplied by Battelle

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

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

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