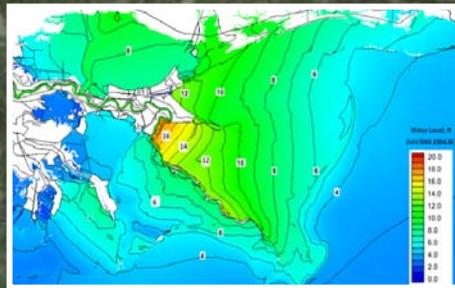


November 25, 2013

Final Independent External Peer Review Report Kansas City, Missouri and Kansas, Section 216 Flood Risk Management Project Phase 2 Feasibility Report



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: 0027



**Final Independent External Peer Review Report
Kansas Citys, Missouri and Kansas, Section 216 Flood Risk Management Project
Phase 2 Feasibility Report**

by

Battelle
505 King Avenue
Columbus, OH 43201

for

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Final Independent External Peer Review Report for the

Kansas Citys, Missouri and Kansas, Section 216 Flood Risk Management Project Phase 2 Feasibility Report

EXECUTIVE SUMMARY

Project Background and Purpose

The U.S. Army Corps of Engineers (USACE), Kansas City District, along with local non-Federal sponsors, are conducting a feasibility study of the existing flood risk management project for the Kansas City metropolitan area. The entire metropolitan system of seven flood risk management (levee) units withstood the Missouri River Flood of 1993, but some elements of the system were seriously challenged as the flood crested. This event raised a concern that the levees may provide less than the authorized benefits for which they were originally designed.

The protective works under study are within the immediate metropolitan area and vicinity of Kansas City, Missouri, and Kansas City, Kansas, along the Missouri and Kansas Rivers. The flood risk management units consist principally of levees, floodwalls, bridge and approach alterations, and channel improvement and alteration. The project extends over the lower 9.5 miles of the Kansas River and, on the Missouri River, from 6.5 miles upstream to 9.5 miles downstream of the mouth of the Kansas River. The 32-square-mile study area covers the heavily industrialized floodplains of the two rivers. Each of the seven flood risk management units was designed and constructed in coordination with the other, but each is operationally independent. Complete effectiveness of the overall project is contingent on adequate reservoir control in the upper Missouri and Kansas River basins.

The study area includes protected areas within Jackson and Clay Counties, Missouri, and Wyandotte County, Kansas. Communities (or portion thereof) within the study area include Kansas City, North Kansas City, Randolph, and Birmingham in Missouri, and Kansas City, Kansas.

The Project Management Plan for this study is based on a two-phase approach to performing the feasibility study. Phase 1 (completed December 2006) developed an Interim Feasibility Report which recommended improvements to increase the performance and reduce the flood risk of four of the seven levee units within the Kansas Citys system: the Argentine Unit, the North Kansas City Unit, the East Bottoms Unit, and the Fairfax-Jersey Creek Unit. A fifth levee unit, the Birmingham Unit, was determined to meet the authorized level of performance assuming continued adequate operations and maintenance (O&M) efforts.

Phase 2 of the Section 216 feasibility study will develop the Final Feasibility Report (FFR), which will address the two remaining levee units—the Armourdale and the Central Industrial District (CID) Units—and other minor isolated locations in the system. Phase 2 will update and verify data on the level of flood risk management provided by the Kansas Citys, Missouri and

Kansas, Local Flood Protection Project, and will develop technically viable, economically feasible, and environmentally acceptable alternative plans for increasing the reliability of the existing system.

Independent External Peer Review Process

USACE is conducting an Independent External Peer Review (IEPR) of the Kansas Citys, Missouri and Kansas, Section 216 Flood Risk Management Project - Phase 2 Feasibility Report (hereinafter Kansas Citys Feasibility Report 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 (2012a, 2012b).¹ Battelle has experience in establishing and administering peer review panels for USACE and was engaged to coordinate the IEPR of the Kansas Citys Feasibility Report. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2012a, 2012b) and OMB (2004). This final report describes the IEPR process, describes the panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel (the Panel).

This IEPR was conducted in two phases. Phase 1 of the IEPR began in September 2012 and officially ended in August 2013. This phase involved the review of the Alternative Formulation Briefing (AFB) Read-Ahead Material (RAM) document, as well as several technical appendices (Section 3.3). Phase 2 of the IEPR began in September 2013 and will be completed in January 2014. This second phase involves the review of the Draft FFR as well as several technical appendices.

Based on the technical content of the Kansas Citys Feasibility Report review documents and the overall scope of the project, Battelle identified candidates for the Panel in the following key technical areas: Civil Works planning, biology/ecology, hydrologic and hydraulic engineering, geotechnical/structural engineering, and civil engineering/construction engineering. Five panel members were selected to perform both phases of the IEPR. However, during the IEPR hiatus between Phase 1 and Phase 2, the Civil Works planning expert who conducted Phase 1 of the IEPR passed away. Battelle selected a replacement Civil Works planning expert to conduct Phase 2 of the IEPR. USACE was given the list of candidate panel members (and, during Phase 2 of the IEPR, the replacement Civil Works panel member), but Battelle made the final selection of the Panel.

During both Phase 1 and Phase 2, the Panel received electronic versions of the Kansas Citys Feasibility Report IEPR review documents, along with charges that solicited comments on specific sections of the documents to be reviewed. USACE prepared the charge questions for both Phase 1 and Phase 2 following guidance provided in USACE (2012a, 2012b) and OMB

¹ On December 15, 2012, USACE issued *Civil Works Review Policy* (EC 1165-2-214), which supersedes EC 1165-2-209. However, the contract for Phase 1 of this IEPR was awarded in September 2012, before EC 1165-2-214 took effect. Accordingly, all tasks under Phase 1 of this contract were performed under EC 1165-2-209, and all tasks under Phase 2 were performed under EC 1165-2-214.

(2004), which were included in the draft and final (Phase 1) and revised final (Phase 2) Work Plans.

The USACE Project Delivery Team (PDT) briefed the Panel and Battelle during kick-off meetings held via teleconference prior to the start of both phases of the IEPR to provide the Panel an opportunity to ask questions of USACE and clarify uncertainties. An in-person site visit and meeting to discuss the Kansas Citys Feasibility Report IEPR was held in Kansas Citys, Missouri, on November 2, 2012. All five Phase 1 panel members and the Battelle Project Manager attended this meeting. As part of this meeting, USACE led Battelle and the Panel on a tour of the Kansas Citys project area. Other than Battelle-facilitated teleconferences and the in-person site visit during Phase 1, there was no direct communication between the Panel and USACE during the peer review process. For both Phase 1 and Phase 2, the Panel produced individual comments in response to the charge questions.

IEPR panel members reviewed the Kansas Citys Feasibility Report IEPR Phase 1 and Phase 2 documents individually. During both phases, the panel members then met via teleconference with Battelle to review key technical comments, discuss charge questions for which there were conflicting responses, and reach agreement on the Final Panel Comments to be provided to USACE. Each Final Panel Comment was documented using a four-part format consisting of: (1) a comment statement; (2) the basis for the comment; (3) the significance of the comment (high, medium, or low); and (4) recommendations on how to resolve the comment. During Phase 1, 14 Final Panel Comments were identified and documented. During Phase 2, seven Final Panel Comments were identified and documented. Of the Phase 2 Final Panel Comments, one was identified as having high significance, two had medium significance, and four had low significance.

Results of the Independent External Peer Review

The panel members agreed between each other on their “assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used” (USACE, 2012a, 2012b; p. D-4) in the Kansas Citys Feasibility Report IEPR review documents. Table ES-1 lists the Phase 2 Final Panel Comments statements by level of significance. The full text of both Phase 1 and Phase 2 Final Panel Comments is presented in Appendix A of this report. The following summarizes the Panel’s findings during Phase 2 of the IEPR.

Civil Works Planning – Planning studies determined that the project area is highly developed with a mix of businesses, industry, and residential development. The consequences of a major flood event could be catastrophic. Lessening flooding impacts, where feasible, is an appropriate water resources planning goal and is consistent with the current use of the floodplain. The recommended project will make a significant contribution toward reducing damages. Extensive analyses are detailed in the review documents in support of the project improvements and Recommended Plan. The project has a healthy benefit/cost ratio and significant net benefits.

The Panel was initially concerned that the consideration of alternatives for the seven levee units was limited by USACE Headquarters guidance to achieve a uniform level of protection for the

entire system. Specifically, the Armourdale and CID units, which are located between the Argentine and the Missouri River units, were constrained to the same level of protection (500 years plus 3 feet) as the other five units, which have already been authorized. This approach is contrary to the traditional incremental analysis of alternatives by unit to identify the National Economic Development (NED) plan for each unit, followed by system adjustments where warranted. However, the Panel's review revealed the need for a holistic system approach given the complex interaction between individual levee units and the area's intense development. Because the Argentine unit was previously authorized to the 500-year plus 3-foot level, and because the downstream units of Armourdale and CID would be more vulnerable if they provided a lesser level of protection than the surrounding Argentine and the Missouri River units, the results of the alternatives analysis indicated that the Armourdale and CID units must provide the same level of protection. Finally, the report included an evaluation of the Argentine, Armourdale, and CID units incrementally to levels of protection of 500 years plus 1 foot, 500 years plus 2 feet, and 500 years plus 3 feet, respectively. The results indicated that the NED plan for all three units is 500 years plus 3 feet. Based on the above discussion, the Panel agrees that the Recommended Plan for the Armourdale and CID units is the NED plan.

Biology/Ecology – The Executive Summary and Recommendations sections are clear and concise, demonstrate the project's Purpose and Need, and do a good job of condensing information from what has been a lengthy project planning and design process. In addition they point out that the potential environmental impacts of this project are minimal. The map figures are well done and add useful detail to explain project need and conceptual design and show the human and natural environments in the project area. The Panel appreciates that this project is sited in an urban area with relatively few biological resources and that the overall footprint of the project will be similar to existing conditions. The Panel believes that USACE efforts to address public and agency concerns could have been better documented. The Panel believes that USACE needs to improve the documentation of project compliance with major environmental laws.

Hydrologic and Hydraulic Engineering – While natural disasters such as earthquakes, hurricanes, and floods are difficult to predict and model accurately, the methods and the assumptions that were utilized by USACE in this study are reasonably accurate and acceptable. Based on the review of the Interim Feasibility Report, the Draft FFR, the models used (Hydrologic Engineering Center-River Analysis System [HEC-RAS] and others), and the Hydrologic and Hydraulic Appendix, the Panel thinks that the best available current data were used and the models were well-calibrated. In addition, the assumptions and boundary conditions for the models are well-documented. As for uncertainty in flood stage is concerned, the “river stage uncertainty values were increased from 1.5 ft to 1.8 ft in the future year 2049” (AFB, p. 7; also Draft FFR, p. 26). Therefore, this increase shows that uncertainty values in stage were sufficiently considered.

While managing a flood event, flood engineers constantly monitor several inputs (including recorded rainfall, upstream reservoirs' levels, and rainfall forecasts) from the Bureau of Meteorology, and also run models to inform their decision-making. It is suggested that USACE add language to the Draft FFR describing in detail how upstream reservoirs will be operated before or during a flood event to minimize flows to the project area.

Geotechnical/Structural Engineering – The Panel concludes that (1) the geotechnical and structural studies supporting the Draft FFR were based on adequate site data, (2) the data were reasonably interpreted, and (3) the levees, floodwalls, and other appurtenant structures were analyzed using state-of-practice methods. The risk-based analyses used to evaluate the reliability of the levee systems’ individual components, presented in the appendices to the Draft FFR, were reasonable, and assumptions and methodology were clearly explained. A major conclusion drawn from the engineering studies was that the return intervals for levee failure were 29 years for the Armourdale levee and 250 years for the CID levee. These return intervals fall far short of the target 500-year plus 3-foot level of protection, a major factor supporting the Recommended Plan. The Engineering Appendix to the Draft FFR provided a thorough presentation of the reliability of individual components of the levee system—e.g., floodwall stability and levee breach potential at specific locations within the levee system. However, the connection between the reliability assessments for these individual components and the overall assessment of system reliability (the above-mentioned 29-year and 250-year return intervals) is not strongly documented. While the weaknesses in the levee system identified in the Engineering Appendix are qualitatively consistent with relatively low failure recurrence intervals, stronger documentation of the process for calculating the reported return intervals would strengthen the case for selection of the Recommended Plan.

Civil Engineering/Construction Engineering – The Kansas Citys Draft FFR is comprehensive and sufficiently detailed to demonstrate that the project will significantly improve overall system performance while reducing disparity between the levee units’ levels of protection. The project will improve system reliability by improving safety factors and reducing vulnerabilities. However, the apparent reliability of proposed structural measures is not echoed in the operational aspect of the closure systems, which is dependent on separate, non-Federal sponsors whose staff will turn-over and whose practices may change over time in ways that may not be consistent with current assumptions and intentions of USACE. Although changes and disparities in O&M practices between units could, in time, prove dangerous, such changes and disparities would not immediately result in catastrophe during the next flood event. The same is not true of the closure systems, which are a vital link in the whole levee protection system and where a momentary lapse in procedure could be the cause of system failure during a flood event. The closure systems and their operation should be viewed in the same light as structural portions of the system since they bear equal weight in the performance of the system as a whole. An O&M manual would, of course provide transfer of key information for the successful operation of the closure systems but will not achieve reliability or ensure consistency on a par with the with-project structural measures. The operation procedures should include periodic reporting of system condition and local sponsor staff readiness as well as after-action reports and utilize a checklist during operation to ensure that good practice is followed and that numerous responsible parties are procedurally informed.

Table ES-1. Overview of 7 Final Panel Comments Identified During Phase 2 by the Kansas Citys IEPR Panel

No.	Final Panel Comment
Significance – High	
1	It is not clear how the condition assessments of two levee units were reduced to lower return intervals, which has implications for project benefits.
Significance – Medium	
2	The Kansas Citys project’s administrative record to document compliance with several federal environmental laws is incomplete.
3	Coordination with non-Federal sponsors to ensure continuity and redundancy relative to the operation of the closure systems and other flood-fighting efforts has not been described, but is needed in order to confirm that the Federal project will function as designed.
Significance – Low	
4	The engineering analysis does not describe whether cost contingencies have been included for existing timber piles that are determined to be in an unacceptable condition for resisting design loads.
5	A detailed description on how upstream reservoirs will be operated before or during a flood event to minimize the water flowing into the Kansas Citys area has not been provided.
6	Information is not provided on how an ongoing scour protection study would be considered in the final design of the Kansas Citys levees.
7	Public concerns regarding Phase 2 of the Kansas Citys Levees project are not adequately described in the project documentation.

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LIST OF ACRONYMS

AFB	Alternative Formulation Briefing
ASCE	American Society of Civil Engineers
ASDSO	Association of State Dam Safety Officials
ATR	Agency Technical Review
CAR	Coordination Act Report (Fish and Wildlife)
CEQ	Council on Environmental Quality
cfs	Cubic Feet per Second
CID	Central Industrial District
COI	Conflict of Interest
CWA	Clean Water Act
DrChecks	Design Review and Checking System
EA	Environmental Assessment
EAP	Emergency Action Plan
EC	Engineer Circular
EIS	Environmental Impact Statement
ER	Engineer Regulation
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FFR	Final Feasibility Report
FIRM	Flood Insurance Rate Map
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
GPR	Ground Penetrating Radar
HEC-FDA	Hydrologic Engineering Center-Flood Damage Reduction Analysis
HEC-HMS	Hydrologic Engineering Center-Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Center-River Analysis System
HTRW	Hazardous, Toxic, and Radioactive Waste
IEPR	Independent External Peer Review

KDWPT	Kansas Department of Wildlife, Parks and Tourism
LPP	Locally Preferred Plan
NED	National Economic Development
NEPA	National Environmental Policy Act
O&M	Operations and Maintenance
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PCX	Planning Center of Expertise
POP	Period of Performance
PDT	Project Delivery Team
RAM	Read-Ahead Material
SAR	Safety Assurance Review
SHPO	State Historic Preservation Office
USACE	United States Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service

1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Kansas City District, along with local non-Federal sponsors, are conducting a feasibility study of the existing flood risk management project for the Kansas City metropolitan area. The entire metropolitan system of seven flood risk management (levee) units withstood the Missouri River Flood of 1993, but some elements of the system were seriously challenged as the flood crested. This event raised a concern that the levees may provide less than the authorized benefits for which they were originally designed.

The protective works under study are within the immediate metropolitan area and vicinity of Kansas City, Missouri, and Kansas City, Kansas, along the Missouri and Kansas Rivers. The flood risk management units consist principally of levees, floodwalls, bridge and approach alterations, and channel improvement and alteration. The project extends over the lower 9.5 miles of the Kansas River and, on the Missouri River, from 6.5 miles upstream to 9.5 miles downstream of the mouth of the Kansas River. The 32-square-mile study area covers the heavily industrialized floodplains of the two rivers. Each of the seven flood risk management units was designed and constructed in coordination with the other, but each is operationally independent. Complete effectiveness of the overall project is contingent on adequate reservoir control in the upper Missouri and Kansas River basins.

The study area includes protected areas within Jackson and Clay Counties, Missouri, and Wyandotte County, Kansas. Communities (or portion thereof) within the study area include Kansas City, North Kansas City, Randolph, and Birmingham in Missouri, and Kansas City, Kansas.

The Project Management Plan for this study is based on a two-phase approach to performing the feasibility study. Phase 1 (completed December 2006) developed an Interim Feasibility Report which recommended improvements to increase the performance and reduce the flood risk of four of the seven levee units within the Kansas Citys system: the Argentine Unit, the North Kansas City Unit, the East Bottoms Unit, and the Fairfax-Jersey Creek Unit. A fifth levee unit, the Birmingham Unit, was determined to meet the authorized level of performance assuming continued adequate operations and maintenance (O&M) efforts.

Phase 2 of the Section 216 feasibility study will develop the Final Feasibility Report (FFR), which will address the two remaining levee units—the Armourdale and the Central Industrial District (CID) Units—and other minor isolated locations in the system. Phase 2 will update and verify data on the level of flood risk management provided by the Kansas Citys, Missouri and Kansas, Local Flood Protection Project, and will develop technically viable, economically feasible, and environmentally acceptable alternative plans for increasing the reliability of the existing system.

The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Kansas Citys, Missouri and Kansas, Section 216 Flood Risk Management Project - Phase 2 Feasibility Report (hereinafter Kansas Citys Feasibility Report) in accordance with procedures described in the Department of the Army, USACE Engineer Circular (EC) *Civil*

Works Review Policy (EC 1165-2-214) (USACE, 2012b)¹ and Office of Management and Budget (OMB) bulletin *Final Information Quality Bulletin for Peer Review* (OMB, 2004). Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses.

This IEPR was conducted in two phases. Phase 1 of the IEPR began in September 2012 and officially ended in August 2013. This phase involved the review of the Alternative Formulation Briefing (AFB) Read-Ahead Material (RAM) document, as well as several technical appendices (Section 3.3). Phase 2 of the IEPR began in September 2013 and will be completed in January 2014. This second phase involves the review of the Draft FFR as well as several technical appendices.

This final report details the IEPR process, describes the IEPR panel members and their selection, and summarizes the Panel's Phase 2 Final Panel Comments on the existing environmental, economic, and engineering analyses contained in the Kansas Citys Draft FFR. The full text of the Final Panel Comments from both Phase 1 and Phase 2 is presented in Appendix A.

2. PURPOSE OF THE IEPR

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

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

In this case, the IEPR of the Kansas Citys Draft FFR was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC No. 1165-2-214). Battelle, a 501(c)(3) organization under the U.S. Internal Revenue Code, has experience conducting IEPRs for USACE.

3. METHODS

This section describes the method followed in selecting the members for the IEPR Panel (the Panel) and in planning and conducting the IEPR. The IEPR was conducted following procedures described by USACE (2012a, 2012b) and in accordance with OMB (2004) guidance. Supplemental guidance on evaluation for conflicts of interest (COIs) was obtained from the

¹ On December 15, 2012, USACE issued *Civil Works Review Policy* (EC 1165-2-214), which supersedes EC 1165-2-209. However, the contract for Phase 1 of this IEPR was awarded in September 2012, before EC 1165-2-214 took effect. Accordingly, all tasks under Phase 1 of this contract, including development of this IEPR report, were performed under EC 1165-2-209, and all tasks under Phase 2 were performed under EC 1165-2-214.

Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports (The National Academies, 2003).

3.1 Planning and Schedule for Phase 1 of the IEPR

At the beginning of the Period of Performance (POP) for Phase 1 of the 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 Phase 1 schedule were submitted as part of the final Work Plan. In addition, 71 charge questions were provided by USACE and included in the draft and final Work Plans. The final charge also included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Table 1 presents the schedule followed in executing Phase 1 of the IEPR (distinguished from Phase 2 by the ‘A’ preceding the task numbers). Due dates for milestones and deliverables are based on the award/effective date of September 5, 2012. The review documents were provided by USACE on October 22, 2012. The final deliverable for Phase 1 of the IEPR was the collection of Final Panel Comments, which were uploaded into USACE’s Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents; no final IEPR Report was required for Phase 1. In addition, during an August 1, 2013, teleconference with the Kansas Citys Project Delivery Team (PDT), the Planning Center of Expertise (PCX) representative, and Battelle, it was determined that the comment-response process for Phase 1 of the IEPR would not be completed. At that time, it was decided that the PDT would upload their Evaluator Responses to the Final Panel Comments into DrChecks, but that the Panel would not respond to the Evaluator Responses with BackCheck Responses. Instead, it was agreed that Battelle would upload the following statement into the BackCheck Response field in DrChecks:

“In the interest of documenting that Phase 1 of this IEPR occurred and proceeding with Phase 2, the PCX, PDT, and Battelle agreed to not provide a BackCheck Response to this Evaluator Response.”

Therefore, while the PDT provided draft Evaluator Responses to the Final Panel Comments, the Panel did not respond to them. The Phase 1 Final Panel Comments are provided in Appendix A.

Table 1. Kansas Citys Feasibility Report Phase 1 IEPR Schedule

Task	Action	Due Date
A1	Award/Effective Date	9/5/2012
	Phase 1 review documents available	10/22/2012
	Battelle submits Phase 1 draft Work Plan ^a	10/9/2012
	USACE provides comments on Phase 1 draft Work Plan	10/11/2012
	Battelle submits Phase 1 final Work Plan ^a	10/19/2012
A2	Battelle requests input from USACE on the COI questionnaire	9/26/2012
	USACE provides comments on COI questionnaire	10/5/2012
	Battelle submits list of selected panel members ^a	10/9/2012
	USACE confirms the Panel has no COIs	10/11/2012
	Battelle completes subcontracts for panel members	10/22/2012
A3	Battelle convenes Phase 1 kick-off meeting with USACE	10/2/2012
	Battelle sends Phase 1 review documents to Panel	10/24/2012
	Battelle convenes Phase 1 kick-off meeting with Panel	10/22/2012
	USACE convenes Phase 1 kick-off meeting with Battelle and Panel	10/30/2012
	USACE convenes site visit with Battelle and Panel	11/2/2012
	Battelle convenes Phase 1 mid-review teleconference for Panel to ask clarifying questions of USACE	11/19/2012
A4	Panel members complete their Phase 1 individual reviews	11/21/2012
	Battelle provides Panel merged individual comments and talking points for the Phase 1 Panel Review Teleconference	11/29/2012
	Battelle convenes the Phase 1 Panel Review Teleconference	12/3/2012
	Panel members provide draft Phase 1 Final Panel Comments to Battelle	12/11/2012
	Battelle finalizes Phase 1 Final Panel Comments	12/20/2012
	Battelle delivers Phase 1 Final Panel Comments to USACE ^a	12/21/2012
	Battelle uploads Phase 1 Final Panel Comments into DrChecks	1/10/13
N/A	Battelle convenes teleconference with USACE (PDT and PCX) to determine next steps; it is determined that the comment-response process will not be completed for Phase 1 of the IEPR	8/1/2013
	USACE provides draft PDT Evaluator Responses to Battelle and uploads them into DrChecks	8/13/2013
	Battelle uploads agreed-upon response into DrChecks and closes out DrChecks	9/24/2013

^a Deliverable.

3.2 Identification and Selection of Phases 1 and 2 IEPR Panel Members

The candidates for the Panel were evaluated based on their technical expertise in the following key areas: Civil Works planning, biology/ecology, hydrologic and hydraulic engineering, geotechnical/structural engineering, and civil engineering/construction engineering. These areas correspond to the technical content of the Kansas Citys Feasibility Report IEPR and overall scope of the Kansas Citys Draft FFR.

To identify candidate panel members during Phase 1, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle evaluated these candidate panel members in terms of their technical expertise and potential COIs. Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and ultimately selected five experts for the final Panel. However, during the IEPR hiatus between Phase 1 and Phase 2, the Civil Works planning expert who conducted Phase 1 of the IEPR passed away. Battelle selected a replacement Civil Works planning expert to conduct Phase 2 of the IEPR.

The five selected reviewers constituted the final Panel, with different Civil Works planning experts conducting each phase of the IEPR. 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.

Each of the six candidates was screened for the following potential exclusion criteria or COIs.² These COI questions were intended to serve as a means of disclosure and to better characterize a candidate's employment history and background. Providing a positive response to a COI screening question did not automatically preclude a candidate from serving on the Panel. For example, participation in previous USACE technical peer review committees and other technical review panel experience was included as a COI screening question. A positive response to this question could be considered a benefit.

- Previous and/or current involvement by you or your firm³ in the Kansas Citys, Missouri and Kansas, Section 216 Flood Risk Management Project - Phase 2 Feasibility Report and/or technical appendices.
- Previous and/or current involvement by you or your firm³ in flood risk management projects in the greater Kansas City, Missouri, and/or Kansas City, Kansas, regions.

² 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."

³ Included any joint ventures in which the panel member's firm was involved and if the panel member's firm served as a prime or as a subcontractor to a prime.

- Previous and/or current involvement (conceptual or actual design, construction, or O&M) by you or your firm³ in projects related to the Kansas Citys Flood Risk Management Project.
- Current employment by USACE.
- Previous and/or current involvement with paid or unpaid expert testimony related to the Kansas Citys Flood Risk Management Project.
- Previous and/or current employment or affiliation with members of the cooperating agencies or local sponsors: the City of Kansas City, Missouri; the Kaw Valley Drainage District; the North Kansas City Levee District; and/or the Fairfax Drainage District (for pay or pro bono).
- Past, current or future interests or involvements (financial or otherwise) by you, your spouse or children related to the greater Kansas City, Missouri, and/or Kansas City, Kansas, areas.
- Current personal involvement with other USACE projects, including authorship of any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, Engineer Research and Development Center [ERDC], etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the Kansas City District.
- Previous or current involvement with the development or testing of models that will be used for or in support of the Kansas Citys Flood Risk Management Phase 2 Draft FFR, including, but not limited to, Hydrologic Engineering Center-1 (HEC-1), HEC-Hydrologic Modeling System (HEC-HMS), HEC-2, HEC-River Analysis System (HEC-RAS), and HEC-Flood Damage Reduction Analysis (HEC-FDA).
- Current firm³ involvement with other USACE projects, specifically those projects/contracts that are with the Kansas City 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 Kansas City District. Please explain.
- Any previous employment by the USACE as a direct employee or contractor (either as an individual or through your firm³) within the last 10 years, notably if those projects/contracts are with the Kansas City 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 the Kansas Citys Flood Risk Management project-related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm³ revenues within the last 3 years from USACE contracts.
- A significant portion (i.e., greater than 50%) of personal or firm³ revenues within the last 3 years from contracts with the non-federal sponsors (Kansas City, Missouri; the North Kansas City Levee District; the Fairfax Drainage District; and the Kaw Valley Drainage District).

- Any publicly documented statement (including, for example, advocating for or discouraging against) related to the Kansas Citys Flood Risk Management project.
- Participation in prior Federal studies relevant to the Kansas Citys Flood Risk Management project and/or the Kansas Citys Flood Risk Management Phase 2 Draft FFR.
- Previous and/or current participation in prior non-Federal studies relevant to the Kansas Citys Flood Risk Management project and/or the Kansas Citys Flood Risk Management Phase 2 Draft FFR.
 - The Great Flood of 1993 Post-Flood Report, Lower Missouri River Basin, Kansas City District, U.S. Army Corps of Engineers, September 1994
 - Annual Report of Reservoir Regulation Activities, Summary for 1997-1998, Kansas City District, U.S. Army Corps of Engineers, Water Control Section.
- Is there any past, present or future activity, relationship or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project?

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. During Phase 1 of the IEPR, four of the panel members were affiliated with consulting companies and one of the panel members was affiliated with an academic institution. During Phase 2 of the IEPR, two of the panel members were affiliated with consulting companies, two were independent consultants, and one was affiliated with an academic institution⁴. 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 (and, during Phase 2 of the IEPR, the replacement Civil Works panel member), but Battelle made the final selection of the Panel. Section 4 of this report provides names and biographical information on the panel members.

3.3 Conduct of Phase 1 of the IEPR

Prior to beginning Phase 1 of the IEPR and within one day of their subcontracts being finalized, the Phase 1 panel members 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 Phase 1 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 for Phase 1 of the IEPR as well as the Kansas Citys Feasibility Report IEPR 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.

⁴ The Civil Works panel member for Phase 2 of the IEPR was an independent consultant, while the Phase 1 Civil Works panel member was associated with a consulting company. In addition, the biology/ecology panel member changed her affiliation during the IEPR hiatus from a consulting company to an independent consultant.

- **Alternative Formulation Briefing, Pre Conference Submittal** (35 pages)
- **Appendix A, Engineering, Chapter A-3: Surveying, Mapping, and Other Geospatial Data Requirements [Armourdale Levee Unit]** (15 pages)
- **Appendix A, Engineering, Chapter A-4: Geotechnical Analysis [Armourdale Levee Unit]** (124 pages)
- **Appendix A, Engineering, Chapter A-5: Civil Design [Armourdale Levee Unit]** (99 pages)
- **Appendix A, Engineering, Chapter A-6: Structural Analysis [Armourdale Levee Unit]** (205 pages)
- **Appendix A, Engineering, Chapter A-7: Armourdale Unit Pump Station Analysis [Armourdale Levee Unit]** (659 pages)
- **Appendix A, Engineering, Chapter A-10: Access Roads [Armourdale Levee Unit]** (5 pages)
- **Appendix D: Hazardous and Toxic Waste [Armourdale Levee Unit]** (26 pages)
- **Armourdale Levee Unit Mapbook** (44 pages)
- **Kansas River Bridges Summary [CID Levee Unit]** (87 pages)
- **Appendix A, Engineering, Chapter A-3: Surveying, Mapping, and Other Geospatial Data Requirements [CID Levee Unit]** (12 pages)
- **Appendix A, Engineering, Chapter A-4a: Geotechnical Analysis, CID-Kansas [CID Levee Unit]** (295 pages)
- **Appendix A, Engineering, Chapter A-4b: Geotechnical Analysis, CID-Missouri [CID Levee Unit]** (123 pages)
- **Appendix A, Engineering, Chapter A-5: Civil Design [CID Levee Unit]** (131 pages)
- **Appendix A, Engineering, Chapter A-7: CID Unit Pump Station Analysis [CID Levee Unit]** (289 pages)
- **Appendix A, Engineering, Chapter A-10: Access Roads [CID Levee Unit]** (5 pages)
- **Appendix A, Engineering, Chapter A-12: General Structures Chapter [CID Levee Unit]** (435 pages)
- **Appendix A, Engineering, Chapter A-14: CID Levee Unit-Kansas Structural Features** (33 pages)
- **Appendix A, Engineering, Chapter A-15: CID Levee Unit-Missouri Structural Features** (25 pages)
- **CID Levee Unit (Missouri) Closures, Structural Feasibility Analysis** (15 pages)
- **CID Levee Unit, General Structural Exhibits** (424 pages)
- **CID Levee Unit (Kansas) Exhibits** (11 pages)
- **CID Levee Unit (Kansas) Mapbook** (29 pages)
- **CID Levee Unit (Missouri) Mapbook** (7 pages)

- Interim Feasibility Report, Kansas Citys Levees, Kansas and Missouri (August 2006) (101 pages)
- Appendix A, Engineering, Chapter A-2: Hydrology and Hydraulics (283 pages)
- Appendix A, Engineering, Chapter A-3: Surveying, Mapping, and Other Geospatial Data Requirements (7 pages)
- Appendix A, Engineering, Chapter A-4: Geotechnical Analysis Existing Conditions (50 pages)
- Appendix A, Engineering, Chapter A-16: Cost Engineering (144 pages)
- Appendix A, Engineering, Chapter A-17: Construction Procedures and Water Control Plan (10 pages)
- Appendix A, Engineering, Chapter A-18: Access Roads (14 pages)
- Appendix A, Engineering, Chapter A-19: Schedule for Design and Construction (3 pages)
- Appendix B, Real Estate (28 pages)
- Appendix C, Economics (87 pages)
- Appendix D, Hazardous and Toxic Waste (59 pages)
- Interim Feasibility Report, Kansas Citys Levees, Kansas and Missouri, Exhibits (61 pages)
- Interim Feasibility Report, Kansas Citys Levees, Kansas and Missouri, Plates (21 pages)
- Final Environmental Impact Statement, Kansas Citys, Missouri and Kansas Flood Damage Reduction Study, Missouri and Kansas Rivers (August 2006) (374 pages)
- USACE guidance Civil Works Review, (EC 1165-2-209) dated 31 January 2012
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

About half-way through the review of the Kansas Citys Feasibility Report 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 16 panel member questions to USACE. USACE was able to provide responses to all of the questions during the teleconference.

3.4 Phase 1 Site Visit

An in-person meeting and site visit to discuss the Kansas Citys Feasibility Report IEPR was held in Kansas Citys, Missouri, on November 2, 2012. All five Phase 1 panel members and the Battelle Project Manager attended this meeting. As part of this meeting, USACE led Battelle and the Panel on a tour of the Kansas Citys project area. This tour provided an opportunity for the IEPR panel members to see the project area and proposed project features, and to ask clarifying questions of the PDT. During the tour of the project site, USACE pointed out specific project features to help the panel members better comprehend the design and construction intent of the project and answered questions posed by the panel members.

3.5 Review of Phase 1 Individual Comments

The Panel was instructed to address the charge questions/discussion points within a charge question response table provided by Battelle. At the end of the review period, the Panel produced individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. As a result of the review, Battelle summarized the individual comments into a preliminary list of 22 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

3.6 Phase 1 IEPR Panel Teleconference

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

The Panel also discussed responses to seven specific charge questions where there appeared to be disagreement among panel members. The conflicting comments were resolved based on the professional judgment of the Panel, and all sets of comments were determined not to be conflicting. Each comment was either incorporated into a Final Panel Comment, determined to be consistent with other Final Panel Comments already developed, or determined to be a non-significant issue.

At the end of these discussions, the Panel identified 14 comments and discussion points that should be brought forward as Final Panel Comments for Phase 1 of the IEPR.

3.7 Preparation of Phase 1 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 Kansas Citys Feasibility Report IEPR:

- **Lead Responsibility:** For each Final Panel Comment, one Panel member was identified as the lead author responsible for coordinating the development of the Final Panel Comment and submitting it to Battelle. Battelle modified lead assignments at the direction of the Panel. To assist each lead in the development of the Final Panel Comments, Battelle distributed the merged individual comments table, a summary detailing each draft final comment statement, an example Final Panel Comment following the four-part structure described below, and templates for the preparation of each Final Panel Comment.
- **Directive to the Lead:** Each lead was encouraged to communicate directly with the other panel members as needed and to contribute to a particular Final Panel Comment. If a

significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.

- Format for Final Panel Comments: Each Final Panel Comment was presented as part of a four-part structure:
 1. Comment Statement (succinct summary statement of concern)
 2. Basis for Comment (details regarding the concern)
 3. Significance (high, medium, low; see description below)
 4. Recommendation(s) for Resolution (see description below).
- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:
 1. High: Describes a fundamental problem with the project that could affect the recommendation, success, or justification of the project. Comments rated as high indicate that the Panel analyzed or assessed the methods, models, and/or analyses and determined that there is a “showstopper” issue.
 2. Medium: Affects the completeness of the report in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium indicate that the Panel does not have sufficient information to analyze or assess the methods, models, or analyses.
 3. Low: Affects the understanding or accuracy of the project as described in the report, but will not affect the recommendation or justification of the project. Comments rated as low indicate that the Panel identified information (tables, figures, equations, discussions) that was mislabeled or incorrect or data or report sections that were not clearly described or presented.
- Guidance for Developing Recommendations: The recommendation section was to include specific actions that USACE should consider to resolve the Final Panel Comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

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, 14 Final Panel Comments were prepared and assembled for Phase 1 of the IEPR. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Phase 1 Final Panel Comments are presented in Appendix A of this report.

3.8 Planning and Schedule for Phase 2 of the IEPR

At the beginning of the POP for Phase 2 of the IEPR, Battelle held a kick-off meeting with USACE to review the revised schedule and address any questions about Phase 2. The Phase 2 schedule was submitted as part of the revised final Work Plan. In addition, 59 charge questions were provided by USACE and included in the revised final Work Plan. The final charge also included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Table 2 presents the schedule followed in executing Phase 2 of the IEPR (distinguished from Phase 1 by the 'B' preceding the task numbers). Due dates for milestones and deliverables are based on the contract modification receipt date of September 13, 2013. The review documents for Phase 2 of the IEPR were provided by USACE on September 20, 2013. Note that the work items listed in Task B6 occur after the submission of this report. Battelle will enter the seven Final Panel Comments developed by the Panel during Phase 2 into DrChecks 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 2. Kansas Citys Phase 2 IEPR Schedule

Task	Action	Due Date
B1	Contract Modification Award Date	9/13/2013
	Phase 2 review documents available	9/20/2013
	Battelle submits revised final Phase 2 Work Plan ^a	9/25/2013
	USACE provides comments on revised final Phase 2 Work Plan	9/27/2013
	Battelle submits Phase 2 final Work Plan ^a	10/1/2013
B2	Battelle submits replacement Civil Works planning panel member ^a	9/24/2013
	USACE confirms the replacement panel member has no COI	9/25/2013
	Battelle modifies/completes subcontracts for panel members	10/7/2013
B3	Battelle convenes Phase 2 kick-off meeting with USACE	9/20/2013
	Battelle sends Phase 2 review documents to Panel	10/9/2013
	Battelle convenes Phase 2 kick-off meeting with Panel	10/8/2013
	USACE convenes Phase 2 kick-off meeting with Battelle and Panel	10/8/2013
	Battelle convenes Phase 2 mid-review teleconference for Panel to ask clarifying questions of USACE	10/24/2013
B4	Panel members complete their Phase 2 individual reviews	10/29/2013
	Battelle provides Panel merged individual comments and talking points for the Phase 2 Panel Review Teleconference	11/4/2013
	Battelle convenes the Phase 2 Panel Review Teleconference	11/5/2013
	Panel members provide draft Phase 2 Final Panel Comments to Battelle	11/13/2013
	Battelle finalizes Phase 2 Final Panel Comments	11/19/2013
B5	Battelle submits Final IEPR Report to USACE ^a	11/25/2013
B6	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	11/22/2013
	USACE provides draft PDT Evaluator Responses to Battelle	12/4/2013
	Battelle convenes teleconference with Panel and USACE to discuss Final Panel Comments and draft responses	12/12/2013
	USACE inputs final PDT Evaluator Responses in DrChecks	12/20/2013
	Battelle inputs the Panel's BackCheck Responses in DrChecks	12/31/2013
	Battelle submits pdf printout of DrChecks project file ^a	1/2/2014
	Project Closeout	4/30/2014

^a Deliverable.

3.9 Conduct of Phase 2 of the IEPR

Prior to beginning Phase 2 of the IEPR, the panel members attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to provide a refresher course on the IEPR process and communication procedures, and to review the schedule and other pertinent information. Battelle planned and facilitated a Phase 2 kick-off meeting via teleconference, during which USACE described to the Panel the changes that had been made to the review documents since Phase 1. Before the meetings, the IEPR Panel received an electronic version of the final charge for Phase 2 of the IEPR as well as the Phase 2 Kansas Citys Feasibility Report IEPR 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. Some of the bolded review documents listed below were also bolded in the list of Phase 1 review documents because they had been updated in some way since Phase 1. Battelle provided a guidance document to the panel members that detailed which Phase 2 review documents they had seen during the previous phase and what (if anything) had changed since Phase 1. The unbolded supplemental documents listed below were not specifically provided to Battelle and the Panel during Phase 2; rather, the PDT confirmed that those documents had not changed and that the Panel should be directed to refer to them if necessary during their Phase 2 review.

- **Draft Final Feasibility Report, Kansas Citys , Missouri and Kansas Flood Risk Management Project** (87 pages)
- **Appendix A, Engineering, Chapter A-1: General Engineering Information** (5 pages)
- **Appendix A, Engineering, Chapter A-3: Surveying, Mapping, and Other Geospatial Data Requirements** (17 pages)
- **Appendix A, Engineering, Chapter A-4: Geotechnical Analysis [Armourdale Levee Unit]** (126 pages)
- **Appendix A, Engineering, Chapter A-4a: Geotechnical Analysis, CID-Kansas [CID Levee Unit]** (297 pages)
- **Appendix A, Engineering, Chapter A-4b: Geotechnical Analysis, CID-Missouri [CID Levee Unit]** (125 pages)
- **Appendix A, Engineering, Chapter A-5: Civil Design [Armourdale Levee Unit]** (100 pages)
- **Appendix A, Engineering, Chapter A-5: Civil Design [CID Levee Unit]** (133 pages)
- **Appendix A, Engineering, Chapter A-6: Armourdale Unit Pump Station Analysis [Armourdale Levee Unit]** (665 pages)
- **Appendix A, Engineering, Chapter A-7: CID Unit Pump Station Analysis [CID Levee Unit]** (291 pages)
- **Appendix A, Engineering, Chapter A-8: Access Roads [Armourdale Levee Unit]** (6 pages)
- **Appendix A, Engineering, Chapter A-8: Access Roads [CID Levee Unit]** (7 pages)
- **Appendix A, Engineering, Chapter A-9: Kansas River Bridges** (96 pages)

- **Appendix A, Engineering, Chapter A-12: General Structural Analysis** (438 pages)
- **Appendix A, Engineering, Chapter A-13: Armourdale Structural Analysis** (31 pages)
- **Appendix A, Engineering, Chapter A-14: CID-Kansas Structural Analysis** (35 pages)
- **Appendix A, Engineering, Chapter A-14: CID-Missouri Structural Analysis** (28 pages)
- **Appendix B, Socioeconomic Analysis** (64 pages)
- **Appendix C, Real Estate Plan** (53 pages)
- **Appendix D: Hazardous, Toxic, and Radiological Waste** (29 pages)
- **Appendix E: Cost Estimating** (46 pages)
- **Draft Final Feasibility Report, Kansas Citys Levees, Kansas and Missouri, Exhibits** (7 pages)
- **Draft Final Feasibility Report, Kansas Citys Levees, Kansas and Missouri, Maps** (14 pages)
- Appendix A, Engineering, Chapter A-2: Hydrology and Hydraulics (283 pages)
- Appendix A, Engineering, Chapter A-17: Construction Procedures and Water Control Plan (10 pages)
- Appendix A, Engineering, Chapter A-19: Schedule for Design and Construction (3 pages)
- Final Environmental Impact Statement, Kansas Citys, Missouri and Kansas Flood Damage Reduction Study, Missouri and Kansas Rivers (August 2006) (374 pages)
- USACE guidance Civil Works Review, (EC 1165-2-209) dated 31 January 2012
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

About half-way through the review of the Kansas Citys Feasibility Report 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 12 panel member questions to USACE. USACE was able to provide responses to some of the questions during the teleconference; the remaining panel member questions that required additional coordination within USACE were addressed by USACE by October 25, 2013.

3.10 Review of Phase 2 Individual Comments

The Panel was instructed to address the charge questions/discussion points within a charge question response table provided by Battelle. At the end of the review period, the Panel produced individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. As a result of the review, Battelle summarized the individual comments

into a preliminary list of 19 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

3.11 Phase 2 IEPR Panel Teleconference

Battelle facilitated a 3-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 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 Panel Comments would accurately represent the Panel's assessment of the project. The Panel engaged in a thorough discussion of the overall positive and negative comments, added any missing issues of high-level importance to the findings, and merged any related individual comments. In addition, Battelle confirmed each Final Panel Comment's level of significance to the Panel.

At the end of these discussions, the Panel identified 11 comments and discussion points that should be brought forward as Final Panel Comments for Phase 2 of the IEPR.

3.12 Preparation of Phase 2 Final Panel Comments

The preparation of the Phase 2 Final Panel Comments followed the same procedure described in Section 3.7 of this Final IEPR Report.

Once the Phase 2 panel members had developed their Final Panel Comments, Battelle reviewed and edited the Final Panel Comments for clarity, consistency with the comment statement, and adherence to guidance on the Panel's overall charge, which included ensuring that there were no comments regarding either the appropriateness of the selected alternative or USACE policy. During the development of the Final Panel Comments, the panel members agreed that three of the comments no longer needed to be brought to USACE's attention. The panel members also thought that a fourth Final Panel Comment would best be communicated to USACE via email. At the end of this process, seven Final Panel Comments were prepared and assembled for Phase 2 of the IEPR. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Phase 2 Final Panel Comments are presented in Appendix A of this report.

4. PANEL DESCRIPTION

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

An overview of the credentials of the final six members of the Panel and their qualifications in relation to the technical evaluation criteria is presented in Table 3. More detailed biographical information regarding each panel member and his or her area of technical expertise is presented in the text that follows the table.

Table 3. Kansas Citys Feasibility Report IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Saunders	Shoudy	Dudley	Wardak	Aubeny	O'Brien
Civil Works Planner (Phase 1)						
Minimum 10 years of demonstrated experience in public works planning	X					
Direct experience working for or with USACE	X					
Familiar with USACE plan formulation process, procedures, and standards	X					
Familiar with USACE structural flood risk management projects	X					
Minimum 5 years of experience dealing directly with the USACE six-step planning process governed by Engineer Regulation (ER) 1105-2-100, Planning Guidance Notebook (USACE, 2000)	X					
Familiar with USACE flood risk management analysis and benefit calculations	X					
Familiar with the USACE HEC-FDA computer program	X					
Experience with the National Economic Development (NED) analysis procedures as they relate to flood risk management.	X					
Minimum M.S. degree in appropriate field of study	X					
Civil Works Planner (Phase 2)						
Minimum 10 years of demonstrated experience in public works planning		X				
Direct experience working for or with USACE		X				
Familiar with USACE plan formulation process, procedures, and standards		X				
Familiar with USACE structural flood risk management projects		X				
Minimum 5 years of experience dealing directly with the USACE six-step planning process governed by ER 1105-2-100, Planning Guidance Notebook (USACE, 2000)		X				
Familiar with USACE flood risk management analysis and benefit calculations		X				
Familiar with the USACE HEC-FDA computer program		X				
Experience with the NED analysis procedures as they relate to flood risk management.		X				
Minimum M.S. degree in appropriate field of study		X				

Technical Criterion	Saunders	Shoudy	Dudley	Wardak	Aubeny	O'Brien
Biology/Ecology						
Minimum 10 years of demonstrated experience in the evaluation and conduct of National Environmental Policy Act (NEPA) impact assessments, including cumulative effects analysis, for complex multi-objective public works projects with competing trade-offs			X			
Extensive background experience with and working knowledge of the implementation of the NEPA compliance process			X			
Minimum M.S. degree in appropriate field of study			X			
Hydrologic and Hydraulic Engineering						
Registered professional engineer with a minimum 15 years of experience in hydrologic and hydraulic engineering with an emphasis on large public works				X		
Experience with flood risk management projects with an emphasis on large river control structures				X		
Experience modeling large river systems with an understanding of:						
dynamics of open channel flow systems				X		
flood plain hydraulics				X		
interior flood control systems				X		
Familiar with USACE application of risk and uncertainty analyses in flood risk management studies				X		
Familiar with standard USACE hydrologic and hydraulic computer models including:						
HEC-1				X		
HEC-HMS				X		
HEC-2				X		
Active participation in related professional societies				X		
Minimum M.S. degree in engineering				X		
Geotechnical/Structural Engineering						
Registered professional engineer with a minimum 10 years of experience in civil or construction engineering					X	
Experienced in performing cost engineering/construction management for all phases of flood risk management-related projects					X	
Experience in the design and construction of bridges and large control					X	

Technical Criterion	Saunders	Shoudy	Dudley	Wardak	Aubeny	O'Brien
structures in cold climates						
Experience and familiarity with geotechnical practices associated with concrete floodwalls					X	
earthen levee foundations and dams					X	
line of protection underseepage concerns					X	
Capable of addressing the USACE Safety Assurance Review (SAR) aspects of projects					X	
Active participation in related professional engineering and scientific societies					X	
Minimum M.S. degree in engineering					X	
Civil Engineering/Construction Engineering						
Registered professional engineer with a minimum 10 years of experience in civil or construction engineering and familiarity with the construction industry						X
Experienced in performing cost engineering/construction management for all phases of flood risk management-related projects						X
Experience and familiarity with concrete floodwalls						X
earthen levee foundations						X
pumping station design and construction						X
Experience in associated contracting procedures, total cost growth analysis, and related cost risk analysis						X
Capable of addressing the USACE SAR aspects of projects						X
Active participation in related professional engineering and scientific societies						X
Minimum M.S. degree in engineering						W ^a

^a Waiver statement presented as part of Task 2 deliverable and approved by USACE

Larry Saunders

Role: Civil Works planning expertise (Phase 1)

Affiliation: Horizon Planning Group

Mr. Saunders was a water resource planner for Horizon Planning Group, a consulting firm specializing in water resource planning and economics. He earned his M.S. in water resource economics and planning from Cornell University in 1972 and had more than 45 years of experience supervising and performing benefit-cost analyses on a variety of large, multi-objective water resource projects. He was a USACE economist/plan formulator for 28 years (1966-1994), where he served as Chief of the Economic and Social Analysis Branch (1972-1980) and Chief of the Plan Formulation Branch (1980-1994).

Mr. Saunders was experienced in all phases of USACE economic standards and plan formulation (USACE, 2000) and had conducted numerous plan formulation studies according to USACE Office of Management and Budget and IWR planning guidance and regulations. His experience with National Economic Development (NED) analysis was reflected in his 45-year body of work as both a member of USACE and as a private consultant, including work with the Northeastern North Carolina Economic Development Commission. His experience in the identification and evaluation of non-structural flood risk management alternatives included channelization, levees and floodwalls, dams and reservoirs, and non-structural measures to control floods and reduce damages, including work on USACE's B. Everett Jordan Dam and Lake Project (North Carolina), USACE's Ararat River Flood Control Project (North Carolina), USACE's Flint River Flood Control Project (Michigan), and Roanoke River Flood Control Project (Virginia). In addition, Mr. Saunders was familiar with the USACE HEC-FDA and IMPLAN (plan formulation) models, having recently used them to participate as a panel member for the Chacon Creek Study, Texas, and the Truckee Meadows Project, Nevada, IEPRs and to screen numerous alternatives for projects considered in the Comprehensive Everglades Restoration Plan in Florida.

Harry Shoudy

Role: Civil Works planning expertise (Phase 2)

Affiliation: Independent consultant

Mr. Shoudy is an independent contractor located in Henrico, North Carolina. He earned a B.S. in economics from Central University of Iowa in 1968 and a M.S. in water resources planning from Colorado State University in 1980. He has over 40 years of economic, water resources planning, and policy experience. Mr. Shoudy worked for USACE for 32 years and served in a dual assignment as a chief economist and senior policy advisor before becoming an independent consultant in 2003. During his tenure at USACE, he performed and directed economic evaluations for the Buffalo District as the chief of economics and served as chief economist for the South Atlantic Division reviewing economic evaluations. From 1990 to 1992, he was the senior policy advisor to the Board of Engineers for Rivers and Harbors, performing economic and plan formulation reviews for the Board. He then worked for USACE Headquarters from 1992 to 2003 providing project reviews, developing policy, issuing implementation guidance, and providing guidance and training, eventually retiring as senior policy advisor and chief economist.

Mr. Shoudy has over 40 years of experience applying USACE principles and standards, principles and guidelines, and Engineer Regulation (ER) 1105-2-100 from its inception. He is familiar with all USACE flood risk management analysis and benefit calculations and was responsible for the review of flood damage reduction planning studies at the division and Headquarters level, including projects involving channel improvements, flood walls, levees, dams, diversion channels, and bridge replacements/modifications as well as non-structural flood risk management projects. His extensive flood damage reduction expertise led to him being selected to represent USACE on the interagency White House task force formed after the 1993 Mississippi River floods. Mr. Shoudy is familiar with the USACE HEC-FDA program and has reviewed numerous flood control reports that have applied HEC-FDA. He also participated in the development and application of a national evaluation model for shore protection projects applying HEC-FDA as a starting point. He is an expert in the understanding, development, and review of NED benefits and analysis procedures as they relate to flood risk analysis; the majority of his 32 years of review experience has focused on traditional economic development benefits. In addition, he participated in the development of a national USACE policy related to flood damage reduction national economic benefits.

Judy Dudley, Ph.D.

Role: Biology/ecology expertise.

Affiliations: AMEC Environment & Infrastructure, Inc. (Phase 1); independent consultant (Phase 2)

Dr. Dudley is an ecologist providing independent consulting services in ecological research, environmental impact analysis, ecological risk assessment and toxicology, aquatic ecology, and environmental policy making. She earned her Ph.D. in ecosystem ecology from Boston University in 1991. A Certified Lake Manager, she has more than 28 years of experience in field surveys, soil/sediment/water analyses, bioassays, biological community surveys, bioaccumulation modeling, nutrient modeling and best management practice evaluation, artificial stream studies, data analysis, and coordinating data collection by volunteers. Dr. Dudley has contributed to permitting efforts with various state and Federal agencies on issues ranging from National Environmental Policy Act (NEPA) compliance, to Clean Water Act (CWA) permits and compliance studies, to Endangered Species Act (ESA) consultations. She is experienced in conducting NEPA impact assessments, including cumulative effects analysis, and she has provided senior technical support and management on numerous NEPA projects for many Federal agencies, including USACE. Notable studies include an environmental assessment (EA) for a City of Temple Terrace, Florida, redevelopment site; multiple EAs and categorical exclusions for the Federal Aviation Administration in Virginia; and EAs at various USACE sites in Washington state. Dr. Dudley has coauthored several publications and given numerous presentations at conferences and international meetings.

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

Role: Hydrologic and hydraulic engineering 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. His primary expertise is in hydraulic/hydrologic modeling and water resources engineering. In addition, as an associate professor at Kabul University, he taught classes in fluid mechanics, hydraulics, engineering mechanics, water resources engineering, groundwater hydrology, and open channel design. 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.

Dr. Wardak has experience with flood risk management projects with emphasis on large river control structures and, with his experience modeling large river systems, has an understanding of the dynamics of open channel flow systems, floodplains, hydraulics, and interior flood control systems. Projects he has worked on include the Sacramento River Bypass System for the National Weather Service; the United Nations Hydro-Electric Potential Study, Mekong River, Thailand; and a Federal Emergency Management Agency (FEMA) Flood Insurance Study, San Diego County, California. 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 has excellent working knowledge 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 used his modeling experience on project work, including 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. Furthermore, he has done extensive research in the area of two-dimensional unsteady flow (Non Linear Partial Differential Equations) modeling using Alternating Direction Implicit Method. He is a member of the American Society of Civil Engineers (ASCE) and is a peer reviewer for the Journal of Hydrologic Engineering.

Charles Aubeny, Ph.D., P.E.

Role: Geotechnical/structural engineering expertise.

Affiliation: Independent consultant

Dr. Aubeny is a professor at Texas A&M University teaching soil mechanics, geotechnical design, geotechnical testing, and numerical methods. He earned his Ph.D. in civil engineering from Massachusetts Institute of Technology in 1992 and is a registered P.E. in Colorado, Texas, and California. His experience includes more than 10 years of academic research involving slope stability, in situ testing, numerical analysis, offshore foundations and pipelines, and unsaturated soils; 8 years with the Embankment Dams Branch of U.S. Bureau of Reclamation (USBR); and 7 years in private consulting.

Dr. Aubeny's relevant geotechnical engineering experience in levee and earth dam design and construction includes supervising geotechnical field investigations and laboratory testing

programs; supervising and/or performing analyses for seepage, slope stability, settlement, liquefaction, and wave run-up; developing and evaluating various foundation design alternatives; designing earthen embankments, including internal filter and drainage systems; designing slope protection measures; designing instrumentation systems for monitoring; supervising cost comparisons for various design alternatives; preparing specifications; preparing construction considerations and monitoring construction; and evaluating the safety of existing dams and levees and preparing upgrade alternatives to address deficiencies. He is knowledgeable in performing cost engineering and construction management for all phases of flood risk management, including levee engineering experience (1992-1999) that included comparative cost evaluations and quantity/cost estimates on dam design and remediation alternatives in embankment dam design at USBR (1978-1986).

Dr. Aubeny is skilled in the design and construction of bridges and large control structures in cold climates. His relevant experience includes his work for McGee Creek Dam, Oklahoma, which involved integrating the river outlet works, municipal/industrial outlet works, control structures, and specifying measures to mitigate degradation of earthfill and exposed shale foundations during winter shutdown. His experience and familiarity with geotechnical practices associated with concrete floodwalls, earthen levee foundations and dams, and line of protection underseepage concerns is reflected in relevant studies such as the Butt Valley Dam upgrade, Twitchell Island Levee stabilization, and Mokelumne Aqueduct upgrade, all in California. He is capable of addressing the USACE Safety Assurance Review (SAR) aspect of projects and has served on the USACE SAR panel for the Santa Maria Levee slope protection upgrade.

Dr. Aubeny actively participates in related professional engineering publications and scientific societies, including the ASCE Embankments, Dams and Slopes Committee; Associate Editor for the ASCE Journal of Geotechnical and Geoenvironmental Engineering; and Associate Editor for the American Society for Testing and Materials Journal of Geotechnical Testing.

James O'Brien, P.E., CFM

Role: Civil engineering/construction engineering expertise.

Affiliation: O'Brien Engineering, Inc.

Mr. O'Brien, president and founder of O'Brien Engineering, Inc., has 33 years of experience in the civil engineering and construction engineering industry, including involvement in water resources projects such as dams, bank stabilizations, channelizations, and pumping stations. A Certified Floodplain Manager, he earned his B.S. in civil engineering from Texas Tech University in 1978 and is a registered Professional Engineer in Texas, Oklahoma, and Utah.

Mr. O'Brien's experience with concrete floodwalls includes his work as the senior engineer and project director on a project in Highland Park, Texas. For that project, he worked on the design approach, materials selection, construction methods, and cost estimates for a floodwall designed to protect against structural and equipment flood damage. The project also involved the reinforcement and floodproofing of several other walls. Mr. O'Brien was involved in designing the 15,000-foot extension of the Irving Flood Control District Section III earthen levee and accompanying sump in Texas. He also designed a 2,000-gallon-per-minute multi-pump fire

booster pump station for a commercial development in addition to numerous low-flow storm water pumping stations.

Mr. O'Brien's experience in contracting procedures includes the preparation of construction drawings, specifications, contract documents, and cost estimates for a Delaware Creek channelization project in Irving, Texas. He also served as the principal engineer for the Grand Prairie Master Flood Study and FEMA Mapping project in Grand Prairie, Texas. For that project, he developed the hydraulic and hydrologic modeling, prepared the new FEMA Digital Flood Insurance Rate Maps, and was responsible for cost estimates and cost/benefit analysis.

Mr. O'Brien is capable of addressing the USACE SAR aspect of projects: he is familiar with evaluating a project's adequacy, appropriateness, and acceptability with regard to assuring public health, safety, and welfare. He routinely performs internal and external reviews of modeling, designs, and reports for completeness, accuracy, liability, and probability of regulatory approval. He has also had numerous flood control-related projects reviewed by local municipalities, state environmental and dam safety agencies, and Federal agencies, including USACE, FEMA, and the U.S. Fish and Wildlife Service (USFWS).

Mr. O'Brien is the current president of the Society of American Military Engineers (Dallas Post), is a member of the Association of State Dam Safety Officials (ASDSO), and is an ASDSO Texas Speaker Bureau participant and volunteer.

5. SUMMARY OF FINAL PANEL COMMENTS

The panel members agreed between each other on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012a, 2012b; p. D-4) in the Kansas Citys Feasibility Report review documents. Table 4 lists the Phase 2 Final Panel Comments statements by level of significance. The full text of both Phase 1 and Phase 2 Final Panel Comments is presented in Appendix A of this report. The following summarizes the Panel's findings during Phase 2 of the IEPR.

Civil Works Planning – Planning studies determined that the project area is highly developed with a mix of businesses, industry, and residential development. The consequences of a major flood event could be catastrophic. Lessening flooding impacts, where feasible, is an appropriate water resources planning goal and is consistent with the current use of the floodplain. The recommended project will make a significant contribution toward reducing damages. Extensive analyses are detailed in the review documents in support of the project improvements and Recommended Plan. The project has a healthy benefit/cost ratio and significant net benefits.

The Panel was initially concerned that the consideration of alternatives for the seven levee units was limited by USACE Headquarters guidance to achieve a uniform level of protection for the entire system. Specifically, the Armourdale and CID units, which are located between the Argentine and the Missouri River units, were constrained to the same level of protection (500 years plus 3 feet) as the other five units, which have already been authorized. This approach is contrary to the traditional incremental analysis of alternatives by unit to identify the National Economic Development (NED) plan for each unit, followed by system adjustments where warranted. However, the Panel's review revealed the need for a holistic system approach given

the complex interaction between individual levee units and the area's intense development. Because the Argentine unit was previously authorized to the 500-year plus 3-foot level, and because the downstream units of Armourdale and CID would be more vulnerable if they provided a lesser level of protection than the surrounding Argentine and the Missouri River units, the results of the alternatives analysis indicated that the Armourdale and CID units must provide the same level of protection. Finally, the report included an evaluation of the Argentine, Armourdale, and CID units incrementally to levels of protection of 500 years plus 1 foot, 500 years plus 2 feet, and 500 years plus 3 feet, respectively. The results indicated that the NED plan for all three units is 500 years plus 3 feet. Based on the above discussion, the Panel agrees that the Recommended Plan for the Armourdale and CID units is the NED plan.

Biology/Ecology – The Executive Summary and Recommendations sections are clear and concise, demonstrate the project's Purpose and Need, and do a good job of condensing information from what has been a lengthy project planning and design process. In addition they point out that the potential environmental impacts of this project are minimal. The map figures are well done and add useful detail to explain project need and conceptual design and show the human and natural environments in the project area. The Panel appreciates that this project is sited in an urban area with relatively few biological resources and that the overall footprint of the project will be similar to existing conditions. The Panel believes that USACE efforts to address public and agency concerns could have been better documented. The Panel believes that USACE needs to improve the documentation of project compliance with major environmental laws.

Hydrologic and Hydraulic Engineering – While natural disasters such as earthquakes, hurricanes, and floods are difficult to predict and model accurately, the methods and the assumptions that were utilized by USACE in this study are reasonably accurate and acceptable. Based on the review of the Interim Feasibility Report, the Draft FFR, the models used (Hydrologic Engineering Center-River Analysis System [HEC-RAS] and others), and the Hydrologic and Hydraulic Appendix, the Panel thinks that the best available current data were used and the models were well-calibrated. In addition, the assumptions and boundary conditions for the models are well-documented. As for uncertainty in flood stage is concerned, the "river stage uncertainty values were increased from 1.5 ft to 1.8 ft in the future year 2049" (AFB, p. 7; also Draft FFR, p. 26). Therefore, this increase shows that uncertainty values in stage were sufficiently considered.

While managing a flood event, flood engineers constantly monitor several inputs (including recorded rainfall, upstream reservoirs' levels, and rainfall forecasts) from the Bureau of Meteorology, and also run models to inform their decision-making. It is suggested that USACE add language to the Draft FFR describing in detail how upstream reservoirs will be operated before or during a flood event to minimize flows to the project area.

Geotechnical/Structural Engineering – The Panel concludes that (1) the geotechnical and structural studies supporting the Draft FFR were based on adequate site data, (2) the data were reasonably interpreted, and (3) the levees, floodwalls, and other appurtenant structures were analyzed using state-of-practice methods. The risk-based analyses used to evaluate the reliability of the levee systems' individual components, presented in the appendices to the Draft FFR, were reasonable, and assumptions and methodology were clearly explained. A major conclusion

drawn from the engineering studies was that the return intervals for levee failure were 29 years for the Armourdale levee and 250 years for the CID levee. These return intervals fall far short of the target 500-year plus 3-foot level of protection, a major factor supporting the Recommended Plan. The Engineering Appendix to the Draft FFR provided a thorough presentation of the reliability of individual components of the levee system—e.g., floodwall stability and levee breach potential at specific locations within the levee system. However, the connection between the reliability assessments for these individual components and the overall assessment of system reliability (the above-mentioned 29-year and 250-year return intervals) is not strongly documented. While the weaknesses in the levee system identified in the Engineering Appendix are qualitatively consistent with relatively low failure recurrence intervals, stronger documentation of the process for calculating the reported return intervals would strengthen the case for selection of the Recommended Plan.

Civil Engineering/Construction Engineering – The Kansas Citys Draft FFR is comprehensive and sufficiently detailed to demonstrate that the project will significantly improve overall system performance while reducing disparity between the levee units’ levels of protection. The project will improve system reliability by improving safety factors and reducing vulnerabilities. However, the apparent reliability of proposed structural measures is not echoed in the operational aspect of the closure systems, which is dependent on separate, non-Federal sponsors whose staff will turn-over and whose practices may change over time in ways that may not be consistent with current assumptions and intentions of USACE. Although changes and disparities in O&M practices between units could, in time, prove dangerous, such changes and disparities would not immediately result in catastrophe during the next flood event. The same is not true of the closure systems, which are a vital link in the whole levee protection system and where a momentary lapse in procedure could be the cause of system failure during a flood event. The closure systems and their operation should be viewed in the same light as structural portions of the system since they bear equal weight in the performance of the system as a whole. An O&M manual would, of course provide transfer of key information for the successful operation of the closure systems but will not achieve reliability or ensure consistency on a par with the with-project structural measures. The operation procedures should include periodic reporting of system condition and local sponsor staff readiness as well as after-action reports and utilize a checklist during operation to ensure that good practice is followed and that numerous responsible parties are procedurally informed.

Table 4. Overview of 7 Final Panel Comments Identified During Phase 2 by the Kansas Citys Feasibility Report IEPR Panel

No.	Final Panel Comment
Significance – High	
1	It is not clear how the condition assessments of two levee units were reduced to lower return intervals, which has implications for project benefits.
Significance – Medium	
2	The Kansas Citys project’s administrative record to document compliance with several federal environmental laws is incomplete.
3	Coordination with non-Federal sponsors to ensure continuity and redundancy relative to the operation of the closure systems and other flood-fighting efforts has not been described, but is needed in order to confirm that the Federal project will function as designed.
Significance – Low	
4	The engineering analysis does not describe whether cost contingencies have been included for existing timber piles that are determined to be in an unacceptable condition for resisting design loads.
5	A detailed description on how upstream reservoirs will be operated before or during a flood event to minimize the water flowing into the Kansas Citys area has not been provided.
6	Information is not provided on how an ongoing scour protection study would be considered in the final design of the Kansas Citys levees.
7	Public concerns regarding Phase 2 of the Kansas Citys Levees project are not adequately described in the project documentation.

6. REFERENCES

Final IEPR Report and Phase 2 Final Panel Comment References

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USACE (2012b). Water Resources Policies and Authorities: Civil Works Review. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Circular (EC) No. 1165-2-214. December 15.

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

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APPENDIX A

Final Panel Comments

on the

Kansas Citys Feasibility Report IEPR

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**FINAL PANEL COMMENTS MADE
DURING PHASE 1 OF THE IEPR**

Final Panel Comment 1 (Phase 1)

The closure system and its required processes lack detailed documentation and appear to exclude redundancy, which could affect reliability.

Basis for Comment

Based on review of the documentation and the USACE Project Delivery Team's (PDT) comments during the November 2, 2012 site visit and the November 19, 2012 mid-review teleconference, it appears that each sand bag gap or stop log gap element of the closure system is the responsibility of the operator of the corresponding unit. The PDT assured the Panel that the operators are local, known to each other, and in regular communication with each other.

The Panel believes that the closure system may have an inherent lack of redundancy since key functions are being conducted by and known only by single individuals. Because closure relies on elaborate procedures and specialized materials and equipment that may not be formally documented and that may be known only to a small number of people, the risk of failure in some element(s) is increased. Understandably, this type of information probably requires limited dissemination for security purposes; however, detailed documentation would provide a thorough checklist of all aspects of the system, consistent record keeping of incidents and systems needs, and effective transfer of knowledge to key individuals and entities in the event of modifications, new personnel, and contingencies.

Significance – High

Failure to address the redundancy issue would result in a closure system that is significantly less reliable than the upgraded structural components.

Recommendations for Resolution

1. Prepare formal documentation on the closure system, which should include structures, materials, equipment, processes, training, setup and takedown, monitoring, repair, and maintenance.
2. Keep current with contact information of primary and backup individuals and entities and share that information with key authorities and emergency responders.
3. Establish an annual tabletop exercise with primary and backup responders and corresponding managers to assure readiness and to update procedures, contacts, and documentation.

Final Panel Comment 2 (Phase 1)

The Environmental Impact Statement contains information that is considered outdated by NEPA standards and does not fully consider the resources and impacts associated with Phase II of the project.

Basis for Comment

The Council on Environmental Quality's (CEQ) National Environmental Policy Act (NEPA) recommends that Environmental Impact Statements (EISs) over five years old should be reexamined (CEQ 1981, Item #32). This project's 2006 EIS should be formally reexamined for Phase II and that reexamination process should be documented for the Administrative Record. In addition, the Panel believes that this reexamination will conclude that parts of the 2006 EIS are no longer valid and that a Supplemental EIS or Environmental Assessment (EA) is warranted. Specific issues that need to be addressed for Phase II include:

1. Relocating residents out of the floodplain does not appear to have been considered, even though it is a standard alternative to consider on flood control projects and its evaluation is implied under 40 CFR 1502.14 ("Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated."). If this is an alternative that was removed from consideration, it should be discussed in the NEPA and Alternative Formulation Briefing (AFB) Read-Ahead Material (RAM).
2. Not all of the non-structural measures summarized on page 11 of the AFB RAM were evaluated in the 2006 EIS. For example, the tree clearing alternative was removed from the EIS, presumably because of objections documented by the U.S. Fish and Wildlife Service (USFWS) in the Draft Coordination Act Report (2006 EIS, Appendix C).
3. The list of state- and Federally-protected species reported for the counties has changed since the 2006 EIS was published. Federally listed species that were not evaluated in Phase I and that will likely require further evaluation for Phase II include the Indiana bat and shovelnose sturgeon (USFWS 2012a and 2012b). The USFWS specifically stated in their Final Coordination Act Report (2006 EIS, Appendix C) that Phase II of the Kansas Citys Levees project had not been included in their review.
4. Wetland assessment and delineation reports that were prepared over five years ago are generally considered to be obsolete and the wetlands information presented in the 2006 EIS is over five years old.
5. A new census has been completed since the 2006 EIS was published, there has been a significant economic downturn in the country, and local circumstances may have changed related to socioeconomic resources in the Armourdale and Central Industrial District (CID) neighborhoods.
6. The impact of hazardous, toxic, and radioactive waste (HTRW) needs to be evaluated as promised in the 2006 EIS for Phase II of this project (p. 42 and 84).
7. The Cumulative Impacts discussion in the 2006 EIS did not break down the

- discussion by levee unit or project phase so the Panel could not evaluate the cumulative impacts associated with construction and implementation of Phase II.
8. The impact discussion related to recreation in Chapter 4 of the EIS (p. 118) did not break the discussion out by levee unit or project phase, so it is difficult to tell whether or not the discussion is complete and accurate for the Phase II units.
 9. Appendix I of the EIS had concurrence letters from the Kansas State Historic Preservation Office (SHPO) related to levee improvements at the Armourdale and CID units. The SHPO letter for the borrow area stated that their records review was conducted for the “Argentine Levee Improvements,” but there is no indication that such a review was conducted for the borrow area to be used for levee improvements at the Armourdale and CID units.
 10. Volume estimates of fill material and impact analysis of the proposed commercial borrow area were completed for the material needed for Phase I. However, it appears that the volume of fill material for the Armourdale and CID borrow areas was not calculated (2006 EIS, Appendix C, pp. 20-22) and therefore it has not been demonstrated whether or not the commercial borrow pit has an adequate supply of material for Phase II.
 11. The preferred alternative for Phase II includes levee removal, which will generate waste material. The impact of removal and disposal of this waste was not discussed in the 2006 EIS.

Significance – High

The project is not yet in compliance with NEPA, which includes (among other issues) having the USFWS and other partner agencies complete their associated compliance reviews.

Recommendations for Resolution

1. Complete a formal re-evaluation of the 2006 EIS to document those resource topics that require additional evaluation.
 - a. The socioeconomic impact analysis should be formally re-evaluated by USACE to create an administrative record of its continued relevance and adequacy for Phase II.
2. Coordinate with SHPO, USFWS, Kansas Department of Wildlife and Parks, and other relevant agencies to discuss data requirements and mitigation options.
 - a. There should be further coordination/consultation with USFWS to ensure that all listed species evaluated and their habitat requirements are current. The Kansas Department of Wildlife and Parks may require further consultation on potential impacts to the state-endangered sturgeon chub and its critical habitat in the Kansas River (KDWPT 2011).
 - b. Further consultation with Kansas SHPO should be conducted for the borrow materials to be used for the Armourdale and CID units.
3. Prepare a Supplemental NEPA document (EA or EIS)
 - a. Resident relocation should be considered as an alternative. If that alternative was already removed from consideration, such removal should be documented in the AFB RAM.
 - b. The list of alternatives discussed in the AFB RAM should be consistent

- with those evaluated in the EIS. For example, the tree clearing alternative should either be evaluated in a supplemental EA/EIS or removed from the AFB RAM.
- c. An updated assessment of the wetland resources in the Armourdale and CID units as well as the borrow pit area needs to be prepared and the wetland impacts evaluated.
 - d. HTRW impacts need to be evaluated.
 - e. Cumulative impacts by levee unit should be re-evaluated in the supplemental NEPA document for Phase II of the project.
 - f. The discussion of recreation impacts should be broken down by levee unit to increase clarity.
 - g. The Supplemental EA/EIS should (1) quantify volume of borrow material needed for Phase II, (2) identify where the borrow materials will come from for Phase II, (3) discuss aquatic and wetland resources near the borrow area, and (4) evaluate all impacts (including wetland impacts) associated with excavation, transport, and use of borrow materials.
 - h. The Supplemental EA/EIS needs to quantify fill material that will be removed from the project area as part of the levee removal measures and evaluate the environmental impacts associated with excavation, transport and disposal of those materials.
4. Reexamine selection of preferred alternative based upon Supplemental NEPA process.

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<http://www.fws.gov/mountain-prairie/endspp/CountyLists/Kansas.pdf>

Final Panel Comment 3 (Phase 1)

Potential risks to the riverside impermeable blanket and levee embankments from tree roots, animal burrows, and man-made features (including scour associated with bridge piers) were not discussed.

Basis for Comment

Section 4.4.4 of the Armourdale Geotechnical Appendix indicates that an extensive riverside impermeable blanket forms one component of the underseepage control system, the intent of which is to prevent seepage through the stratified natural blanket. The condition of the blanket with regard to possible penetration due to tree roots, animal burrows, and man-made features is not addressed; the discussion assumes the blanket will function. The Panel believes that the confidence level in the effectiveness of the blanket would increase with the inclusion of some evidence (i.e., operation and maintenance reports).

Scour around bridge piers is adequately addressed from the standpoint of the vulnerability of the bridge structures. However, in instances where bridge piers penetrate the levee embankments or the impermeable blankets, scour around the piers could affect the integrity of the levee. This issue did not appear to be addressed.

The Civil Engineering appendices document the presence of utility lines within the levee footprint. The failure assessment focuses almost exclusively on uplift on these lines. If a utility line penetrates from riverside to landside through or beneath the levee, piping erosion is also a risk. This issue deserves attention. For example, documentation is needed on whether any such utility penetrations satisfy EM 1110-2-1913 guidelines.

The Panel believes that the issues described above are of sufficient significance to warrant attention in the feasibility design, even though they may ultimately be addressed in the final design phase of the project.

Significance – High

The issues cited above, if neglected, could affect the integrity and performance of the levee system.

Recommendations for Resolution

1. Include in the report consideration of the risk and uncertainty associated with the issues cited above.
2. Assess the potential cost of mitigating measures, if needed; for example, the cost of thickening and/or repairing the impermeable blanket, providing scour protection around bridge piers, and installing graded filters around the landside portion of penetrating utility lines to prevent piping.

Final Panel Comment 4 (Phase 1)

The risk and uncertainty associated with a number of project structural features are not fully described.

Basis for Comment

The Panel recognizes that some project structural features are of sufficient significance to warrant attention in the feasibility design, even though they may ultimately be addressed in the final design phase of the project:

- Pile Inspection: While the excavation and inspection of two existing piles under the floodwall will reduce uncertainty, it will not eliminate it. The review documents do not include information on why more inspections were not conducted given the potential repercussions of failure of this part of the system.
- Potential Impacts of Bridge Failure: There is insufficient documentation that a bridge failure would not likely damage flood control systems. For instance, such a failure would presumably occur nearer to the peak of flooding than to the ebb, in which case falling debris could cause a large splash wave, or the debris could cause a standing wave or backup, any of which (at least locally) could overtop an otherwise comfortable freeboard.
- Abandoned Conduits: The Panel did not see consideration given to potential piping along abandoned conduits penetrating the levee or otherwise situated such that they could impair the integrity of the levee.
- Uplift of Storm Drains: There is no information about the potential for uplift of a storm drain, flap-gated on the riverside, at a time when there is insufficient interior drainage to fill the pipe. A small misalignment for any reason could negate the flap gate by opening a joint.
- Piping Risk: The risk of piping or deconsolidation within the existing levee due to misalignment, cave-ins, and corrosion in utilities to be left in place has not been thoroughly evaluated.
- Uplift of Utilities and Manholes: The Panel did not see an accounting for increased uplift of utilities and manholes in areas upstation of 138+29 in the event of a flood that overtops the old floodwall but not the proposed tieback.

Significance – High

The issues cited above could affect the integrity and performance of the levee system.

Recommendations for Resolution

1. Consider the risk and uncertainty associated with the issues cited above.
2. Assess the potential cost for mitigating measures, if needed. For example, provide an estimate of cost of replacement of some portion of the existing timber piles.
3. Provide support for the statement that underground electrical lines are assumed to not be affected by uplift.
4. Consider using a secure seal pipe (such as reinforced concrete cylinder pipe) at least from the flap-gate, back through the levee, as opposed to using reinforced

concrete pipe to replace the corrugated metal pipes.

5. Consider measures such as (a) videotaping utilities that are to be left in place prior to grouting, and (b) ground penetrating radar (GPR) to obtain profiles of levees to be left in place to assess the condition of existing wooden piles, assuming GPR would provide a different signature for sound wood as opposed to rotted wood.

Final Panel Comment 5 (Phase 1)

The costs of providing easements and acquiring additional land are not well documented.

Basis for Comment

The review documents provided did not include a Real Estate appendix. The only documents that discussed adjacent properties described how construction contractors would access the Armourdale and CID units during the construction phase of project modification (Chapters A-10 for both the Armourdale and CID units).

The review documents described a basic assumption that most of the new construction would take place within the footprint of the existing project. Little or no documentation was provided for the land acquisition and easements necessary for the construction of the proposed “tie backs,” which cross over a variety of commercial and industrial properties, including active railroad yards.

The Panel’s concern is that the cost of these lands and/or easements was not provided in the cost estimates and that these costs could be significant given the urban/commercial/industrial setting of the proposed modifications.

Significance – High

Real estate costs, if significant, could affect the economic justification of the proposed modifications and/or the selection of the National Economic Development (NED) plan.

Recommendations for Resolution

1. Provide documentation on all costs of lands, easements, and rights-of-way.
2. Provide data on how these non-Federal costs are used in determining the apportionment of total project costs between the Federal and the non-Federal sponsor.

Final Panel Comment 6 (Phase 1)

Documentation on public involvement could not be found in the review documents.

Basis for Comment

Based on the Panel's review, it appears that there has not been any public involvement for Phase II of this project outside of the NEPA process completed in 2006. The public and agency comments summarized in the 2006 EIS were not separated by levee unit or project phase, therefore, comments specifically targeted for Phase II could not be distinguished. The review documents also did not contain a clear description of the Phase II coordination with project sponsors and Federal, state, and local agencies, and no information was provided on the opinions of the general public or residents of the Armourdale and CID levee units. Planning regulation ER 1105-2-100, Appendix B; The Administrative Procedures Act (including Section 3, the Freedom of Information Act); and NEPA (PL 91-190) all require an active public involvement program.

Significance – Medium

Documenting the public involvement program will improve the completeness of the AFB RAM.

Recommendations for Resolution

1. Provide a discussion of Phase II public involvement activities in the AFB RAM.
2. Conduct an active public involvement program as the study proceeds through the Feasibility Stage, including convening public information meetings as well as scoping and comment meetings required for the Supplemental EA/EIS.

Final Panel Comment 7 (Phase 1)

Potential impacts associated with HTRW have not been fully evaluated for the Armourdale and CID units.

Basis for Comment

The 2006 EIS identifies the potential for hazardous waste impacts at the Armourdale and CID units (pp. 42, 84). In addition, the 2006 EIS states, “Additional hazardous waste investigations will be conducted during Phase II of the proposed project” (p. 84). The Panel did not find any indication that these additional studies have been done and the Panel therefore assumes that potential HTRW impacts have not been evaluated.

Specifically, potential direct impacts to water quality (and indirect impacts to aquatic resources) from hazardous chemicals in the rail yard area associated with the tieback alternative in the CID have not been discussed. Although the Kansas River is on the 303(d) list for copper impairment (2006 EIS, p. 34), the Panel could find no evaluation of the potential for copper-containing substrates originating in the rail yard to enter the river under high flow conditions.

Significance – Medium

The results of Phase II HTRW studies may identify issues that could affect project design.

Recommendations for Resolution

1. Complete additional hazardous waste investigations in the Armourdale and CID units.
2. Evaluate risks and potential impacts associated with the results from the HTRW survey.
3. Reconsider selection of the preferred alternative once the HTRW risks and impacts have been fully evaluated.

Final Panel Comment 8 (Phase 1)

With no backup power for the pumping system, the assumed conditions for the outfall of the interior drainage might be different than FEMA's modeling assumptions.

Basis for Comment

The Panel could not find evidence in the review documents that any hydrologic/hydraulic modeling of the interior drainage was done. During the mid-review teleconference, the PDT confirmed that no assessment of interior flood storage had been made and they stated that, due to the flatness of the interior areas, a large local storm that might coincide with the peak of a river flood event would only result in shallow, wide-spread interior flooding if the pumps (or power to them) failed. However, during the site visit and the mid-review teleconference the PDT also indicated that a river flood event can last 30 days or longer, a length of time which could increase the risk that a pump failure would occur during a coincident interior flood. If FEMA's interior floodplain has been calculated under this assumption, higher interior base flood elevations and a consequently larger 1% annual chance flood plain could result.

The effective FEMA Flood Insurance Rate Map (FIRM) shows a zone 'AE' (100-year or 1% annual chance flood) with an elevation of 751.0 in the CID. Typically, a zone 'AE' is determined by FEMA or their contractor through hydrologic, hydraulic, or hydrodynamic modeling using certain assumptions concerning outfall or confluence conditions. If such assumptions are incorrect, the modeling results could be incorrect. Where flood-stage conditions of a receiving river are short in duration (i.e., less than 24 hours), the likelihood of a coincident interior local storm-caused flood is negligible. Where the duration of flood-stage conditions is substantial, it measurably increases the probability that an elevated water surface in the receiving river would exist at the time of a local storm-caused flood in the interior. It is possible that FEMA's interior drainage model is based on a free outfall into a river during non-flood conditions or a similar condition created by pumping. According to discussions with the PDT during the mid-review teleconference, the pumps are not supplied with backup power. Without backup power, the likelihood of system failure during an interior local storm-caused flood is increased. Recalculating the zone 'AE' using the assumed condition of pump failure could result in an interior 1% flood stage greater than 751.

Significance – Medium

An increase in the number of interior properties falling within the 1% annual chance floodplain would result in a reduction in property values and consequently a change in the benefits/costs of the project.

Recommendations for Resolution

1. Determine the outfall conditions assumed for FEMA's effective model of the interior, specifically, if the model assumes a completely impeded outfall (total pump system failure).

2. Assess the likelihood that such a pump system failure could be resolved within a short period of time (e.g., one day) in order not to measurably affect the calculation of the probability of a 1% flood.
3. Model the interior and request a map revision from FEMA or modify the interior pumping/storage system, if the assumed conditions are found to be substantially inaccurate.

Final Panel Comment 9 (Phase 1)

No emergency action plan is described should a flood ever overtop the levees.

Basis for Comment

The Panel did not find an emergency action plan (EAP) described in the review documents. As the nation's levee system gets older and the risk to public health and safety grows, communities can greatly mitigate risk by implementing a basic EAP. One of the lessons learned from Hurricane Katrina was not to focus solely on flood protection, but on emergency management as well (USACE 2011). The development of an EAP is a vital step in mitigating damages if a failure occurs.

There has been evidence to suggest that the majority of local sponsors do not have an EAP in place and, if they do, the EAP is not specific to a levee breach (Davis 2011). People who have spent their entire lives living next to a levee and who have never seen its strength tested often feel no sense of urgency, falsely believing that the levee will never be breached and cause damages if failure occurs. The flood risk management (FRM) policy includes prevention, protection, preparation, response, and recovery (i.e., the so-called "safety chain"). This implies that objectives, measures, and prioritization in all these fields should occur in any integrated Flood Risk Management Plan (FRMP).

Significance – Medium

Although no loss of life would be expected given the levees' 500-year protection level, the absence of an EAP specific to a levee breach affects the completeness of the project.

Recommendations for Resolution

1. Develop (and allow for regular updating and revisions) an EAP that includes (but is not limited to) guidelines specific to the levee system and community at risk, i.e., that address education, training, emergency management, communication, evacuations, transportation, and casualty care.
 - a. In addition, the EAP should contain definitions of what expected river conditions would prompt flood watches or warnings and what conditions would trigger evacuations; descriptions of how failed levees would be repaired quickly and efficiently; and information on sand bag storage locations and accessibility.

Literature Cited:

Davis, Jason (2011). Emergency Action Plans. *The Military Engineer*. July-August 2011, pp. 63-64.

USACE (2011). Flood Risk Management Approaches as Being Practiced in Japan, Netherlands, United Kingdom, and United States. IWR Report 2011-R-08.

Final Panel Comment 10 (Phase 1)

The AFB documentation describing how the NED Plan was selected and how the benefits were evaluated appears to be incomplete and may contain inaccuracies.

Basis for Comment

The Panel notes that the AFB RAM (p. 29) displays the benefits, costs, and net benefits for three levee units: the Argentine, Armourdale, and CID units. All other documentation within the AFB RAM refers only to the Armourdale and CID units since the Argentine unit was authorized during Phase I. The inclusion of the Argentine unit in the net benefit analysis skews the analysis in favor of a three foot raise for all three levee units, which was determined to be the NED Plan as well as the Recommended Plan.

This might be appropriate if the whole project (seven units) were considered as a system. However, the Panel understands that the benefits and costs of each of the levee units are analyzed independently. The units are being independently authorized for design and construction and have independent non-Federal sponsors and independent management of operation and maintenance activities.

Based on the Panel's interpretation of the table on page 29 of the AFB RAM, the Armourdale unit maximizes net benefits with only a one foot raise and thus is the NED plan for this unit. If the non-Federal project sponsor wishes to add an additional one or two foot raise the plan becomes a Locally Preferred Plan (LPP) and the additional costs are not cost shared.

The Panel is also concerned about the lack of documentation on how the benefits and costs were evaluated. There are no data on the number, type, and value of properties subject to inundation in either the Armourdale or CID units or damages and benefits at various inundation levels. Very little data are presented on how risk and uncertainty were considered in the benefit evaluation and no breakdown on how annual costs were determined.

Significance – Medium

This issue affects how the NED plan was selected and the potential impact on cost-sharing between Federal and non-Federal interests.

Recommendations for Resolution

1. Provide additional documentation on how the benefits for the Armourdale and CID-Kansas units were calculated, similar to that provided for the Argentine unit in the 2006 Economic Appendix
2. Eliminate the Argentine unit from the net benefits analysis table (the data in which led to the selection of the NED plan).
3. Redefine the NED plan for the Armourdale unit.
4. Redesignate the plan for the Armourdale unit as the LPP if the non-Federal

sponsor desires a two or three foot raise rather than a one foot raise.

Final Panel Comment 11 (Phase 1)

Recreational opportunities that provide access to the Kansas River have not been considered in depth.

Basis for Comment

The review documents provided do not address the potential for providing recreational facilities (e.g., jogging paths, rest areas, restrooms, picnic tables, etc.) as part of the Recommended Plan. During the site visit, the Panel noted that portions of some of the levee units were being used for walking and jogging and that large sections of the levees in both the Armourdale and the CID units were gated and fenced off, thus preventing public access.

The majority of the public comments received during the development of the 2006 Environmental Impact Statement (EIS) indicated a strong interest in more public access. There may be an opportunity for both Federal and non-Federal interests to provide cost-shared recreational facilities and access for the general public.

Significance – Medium

The absence of an evaluation of recreational facilities and access affects the completeness of the report and may have an impact on the benefit/cost ratios.

Recommendations for Resolution

1. Determine whether there is sufficient demand for recreational access and facilities along the Kansas River in the Armourdale and CID units to warrant the addition of recreation as a project purpose.
2. Determine the potential to develop recreational access and facilities in both levee units.
3. Provide documentation in the Feasibility Report that consideration was given to adding recreation as a project component.

Final Panel Comment 12 (Phase 1)

It is unclear whether or not rapid drawdown is a condition to which the levees will be subjected, or if further assessment is required.

Basis for Comment

The discussion of the performance of the levees under rapid drawdown in the CID Geotechnical Appendix (e.g., pp. 4-21, 4-23, 4-31) implies that the issue is unresolved; the appendix states that inadequate data are available to evaluate drawdown stability. However, during the mid-review teleconference, a member of the PDT indicated that the river hydrology was such that rapid drawdown during a flood recession state was unlikely. It was unclear to the Panel whether the assessment of the rapid drawdown condition requires further data or if it is not a condition to which the levees will be subjected. As stated in the CID Geotechnical Appendix (p. 4-23), a rapid drawdown slide is unlikely to result in breaching of the levee; while it is not a critical safety issue, it may have economic impacts.

Significance – Medium

The ambiguity presented in the review documents on whether rapid drawdown levee embankment failure is a problem affects the understanding of the report.

Recommendations for Resolution

1. Add a paragraph clarifying whether or not rapid drawdown stability of the embankment slopes is a significant design issue. This paragraph can be included in the Geotechnical Appendix for the CID and Armourdale levees and (if necessary with regard to any changes in costs) the Economics and Costs sections of the document.
2. If it is an issue, provide an assessment as to whether it will have a significant impact on project costs or if it is of secondary significance and can reasonably be addressed in the final design phase of the project.

Final Panel Comment 13 (Phase 1)

The project need has not been clearly stated with respect to the description of the 1993 flood event.

Basis for Comment

The Panel thinks that the project need is vaguely described and has not been clearly demonstrated. The AFB RAM does not clearly state whether or not the 1993 flood was a 500-year flood (or what kind of flood it was), so the need to design for a 500-year flood is not clear. While the maximum flow rates for which the system is designed are reported for both the Armourdale and the CID units in the AFB RAM, the discharge/flow rates in the Kansas and Missouri rivers during the 1993 event are not reported. Therefore it is not clear how close the system came to the design maximum in 1993. The Panel does not think the reasoning that the CID and Armourdale units need to be raised to bring them in line with the height of adjacent units should be the sole justification to demonstrate “need” (AFB RAM, p. 10). That reasoning could lead to unnecessary cost expenditures.

Significance – Low

Without a clear statement of need, the project’s justification has not been communicated.

Recommendations for Resolution

1. Revise the AFB RAM to clearly characterize the 1993 event, whether or not the preferred alternative will handle the maximum flow rates expected in a 500-year flood, and why three feet of additional capacity is needed in a system designed for a 500-year flood.
2. Adopt the same or similar text in the Purpose and Need section of the Supplemental EA/ EIS.

Final Panel Comment 14 (Phase 1)

Information on upstream storage and the re-regulation of dams and reservoirs is not presented.

Basis for Comment

The review documents present an array of measures that were combined in various ways to increase the flood protection provided by the Armourdale and the CID units. These include levee raises of various heights, increasing the heights of floodwalls, replacing portions of levees with floodwall, and constructing new “tie backs.” However, based on the review of the documents, the Panel could not determine if consideration was given to providing upstream storage in existing reservoirs or modifying the operation of these reservoirs to reduce flood flows in the project area.

Significance – Low

Information on upstream storage and reservoir operation should be included to demonstrate that all alternatives have been considered.

Recommendations for Resolution

1. Include documentation of the consideration given to upstream opportunities to provide storage or to modify the operation of existing dams and reservoirs.

**FINAL PANEL COMMENTS MADE
DURING PHASE 2 OF THE IEPR**

Final Panel Comment 1 (Phase 2)

It is not clear how the condition assessments of two levee units were reduced to lower return intervals, which has implications for project benefits.

Basis for Comment

The existing Armourdale and Central Industrial District (CID) levees were authorized in 1962 to pass a discharge of 390,000 cubic feet per second (cfs). Construction of the Armourdale levees was completed in 1976, and construction of the CID levees was completed in 1979. The 0.2-percent probability flood event (500-year flow discharge) for the Kansas River at the mouth is currently 341,000 cfs; therefore, the existing project was designed to safely pass the current 500-year flood event. The engineering performance of the project has deteriorated from the 500-year return interval such that, under existing conditions, the engineering performance is now a 29-year return interval for Armourdale and a 250-year return interval for CID. The economic justification of the Recommended Plan is based on the analyses of flood damages that would be prevented by applying the engineering performance probabilities for various flood frequencies and associated stages. Given the significant degradation in engineering performance and the corresponding increase in estimated flood damages prevented by the Recommended Plan, the Panel believes it is essential to summarize the specific findings of the engineering appendix, relative to the hydrology, geotechnical, and structural failure issues, and provide a discussion of the methodology applied in going from the engineering issues to the combined probabilities of failure to the benefits claimed for implementing the recommended plan. These discussions should be included in the main report of the Draft Final Feasibility Report (FFR).

Table 12 of the Draft FFR summarizes performance probabilities, but little supporting information is provided regarding (1) the engineering deficiencies contributing to the risk of a breach, or (2) the calculation methodologies that were used to develop the reported combined probabilities. For example, the geotechnical appendices indicate significant risk of piping failure, especially for the Armourdale levees (Table A-4.6). While it is plausible that the combined risk of piping failure and overtopping led to the degraded performance of the Armourdale and CID levees (29-year and 250-year return intervals, respectively), the analysis supporting this evaluation was not apparent. The structural appendices also report some probability of failure calculations indicating a high risk of floodwall failure (e.g., the CID Missouri 12-foot floodwall in Exhibit 1 of Chapter A-12 of the Engineering Appendix). A high risk of floodwall failure could have contributed to the reported degradation of performance, but the analysis leading to this conclusion was not reported or discussed.

Significance – High

Understanding how performance probabilities were evaluated is essential to understanding the estimates of flood damages prevented and, therefore, the economic justification of the project.

Recommendations for Resolution

1. Include a summary in the main report documenting the major deficiencies in the levees identified in the engineering studies that contributed to the deterioration in the engineering performance of the levees to the current existing condition.
2. Describe the risk assessment methodology that led to the reported 29-year and 250-year return interval for failure of the Armourdale and CID levees, respectively.

Final Panel Comment 2 (Phase 2)

The Kansas Citys project’s administrative record to document compliance with several federal environmental laws is incomplete.

Basis for Comment

There is not sufficient documentation to demonstrate that the Kansas Citys levees project is in compliance with the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), and Section 404 of the Clean Water Act (CWA). The Draft Final Feasibility Report (FFR) has not provided references to the documents that were used to derive the conclusions in the Executive Summary and in Sections II.F and V.I related to environmental issues and impacts. Further documentation needed to demonstrate project compliance includes the following:

National Environmental Policy Act

The Council on Environmental Quality’s (CEQ) NEPA guidance recommends that environmental impact statements (EISs) over 5 years old be reexamined (CEQ, 1981, item #32). The EIS for this project is over 5 years old. The preferred alternative for the Armourdale and Central Industrial District (CID) Units, as described in this Draft FFR, was not available for detailed evaluation at the time the 2006 Final EIS (FEIS) was published. The Draft FFR does not reference any documents to indicate that a reexamination has occurred or that the 8-year-old FEIS was found to adequately address all impacts associated with Phase 2 of the project.

Endangered Species Act

Per the 2006 FEIS for this project, the U.S. Fish and Wildlife Service’s (USFWS) Fish and Wildlife Coordination Act Report (CAR) did not include an evaluation of potential impacts to federally listed species at the Armourdale and CID Units (see Final CAR and the Supplemental Letter in Appendix C of the FEIS). In its Final CAR (2006 FEIS, Appendix C), the USFWS specifically stated that Phase 2 of the Kansas Citys project had not been included in its review. The list of state- and Federally-protected species reported for the counties in the project area has changed since 2006. It is possible that the USFWS will require that impacts to these newly listed species be considered in addition to the species identified in the Draft FFR (p. 19). The Draft FFR does not reference any documents to indicate that a more recent protected species consultation has been conducted with USFWS.

Clean Water Act Section 404

The wetland study conducted for the Borrow Area, CID Unit, and Armourdale Unit was conducted 10 years ago, making it too old to be useful. The 2006 FEIS confirms that wetlands were present within both the CID and Armourdale units in 2003 and states that “Wetland delineation and impact assessment would be conducted prior to the release of the final feasibility report” (FEIS, p. 90). The Draft FFR does not reference any documents to indicate that these more recent wetland delineations or impact assessments have been conducted. The wetland impacts at the Borrow Area discussed

in the USFWS's Final CAR were for the borrow material required for Phase 1 only. Potential wetland impacts at the Borrow Area associated with Phase 2 do not appear to have been evaluated. Per the 2006 FEIS for this project, the USFWS did not include an evaluation of wetland impacts at the Armourdale and CID Units in its CAR (see both the Draft and Final CARs; see also the Supplemental Letter in Appendix C of the FEIS).

Significance – Medium

The results of the work required to demonstrate that this project is in compliance with NEPA, ESA and the Clean Water Act may identify environmental impacts for the Recommended Plan that could affect project design, thereby resulting in a more significant concern.

Recommendations for Resolution

1. Revise the Draft FFR to cite the sources used to derive the conclusions in Sections II.F and V.I related to environmental impacts. Provide complete references and/or a bibliography for these sources in the Draft FFR.
2. Complete a formal reexamination of this project's 2006 FEIS to determine its relevance to the Recommended Plan for the Phase 2 levee units, and document the reexamination process.
3. Complete the wetland studies in the Armourdale and CID units (as noted on p. 90 of the 2006 FEIS) and at the Borrow Area for the borrow material required for Phase 2 of this project.
4. Complete the required coordination (e.g., more recent protected species consultation, wetland impacts) with USFWS before releasing the Draft FFR.

Literature Cited:

CEQ (1981). Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations. Council on Environmental Quality. 46 Fed. Reg. 18026 (1981). Available at <http://energy.gov/sites/prod/files/G-CEQ-40Questions.pdf>.

Final Panel Comment 3 (Phase 2)

Coordination with non-Federal sponsors to ensure continuity and redundancy relative to the operation of the closure systems and other flood-fighting efforts has not been described, but is needed in order to confirm that the Federal project will function as designed.

Basis for Comment

Once the Federal project is completed, it will be turned over to the non-Federal sponsors for operations and maintenance (O&M). In addition, non-Federal sponsors will be responsible for taking actions during flood events so that the project performs as designed.

The Panel understands that, according to U.S. Army Corps of Engineers (USACE) policy (ER 1110-2-401, *Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors*), operation of the levees will be left to the non-Federal sponsors. However, the Panel believes that this transferring of levee operations may lack the redundancy that is intended for the overall project. ER 1110-2-401 states that the operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) manual should “set forth a surveillance program covering appropriate measurements, observations, and other activities to be performed that will ensure project benefits are being obtained. An outline of surveillance records to be maintained and available for inspection is to be provided” (Section 11, *Surveillance*). EM 1110-2-2705 (*Structural Design of Closure Structures for Local Flood Protection Projects*) states: “Proper maintenance of closure structures is essential to the continuous satisfactory performance of the structures. The required maintenance provisions must be included in the agreement with the local sponsor. Current agreements with local sponsors require annual periodic inspections of the closure structures and the adjoining levee or floodwall. Inspections must be thorough so that any deficiencies that are critical to the function of the project are detected and promptly corrected. Designs should incorporate materials, systems, and features which are economically feasible and require minimal maintenance” (Section 2.3, subparagraph c). The Panel believes that USACE has the responsibility to “ensure project benefits are being obtained”, and that periodic inspection by USACE of records maintained by the local sponsor, is the intended avenue to achieve that goal.

It appears that the responsibility for performing closures and other flood-fighting efforts is being delegated to the non-Federal sponsors with no indication that a specific operations manual or plan, describing in detail what flood-fighting operations would entail, will be provided. If flood-fighting operations are not performed in accordance with documented procedures and practices, the benefits of the project may not be realized and significant residual damages could occur.

The Draft Final Feasibility Report (FFR) should provide details on the expected coordination by USACE with the non-Federal sponsors both before and during flood

events. In addition, the Panel believes that USACE should provide the non-Federal sponsors with a detailed operations/flood-fighting manual or plan. USACE should also require at least annual reporting that, at a minimum,

- updates contact lists of responsible parties for various critical functions,
- documents the condition of flood-fighting tools and materials,
- notes changes in procedure, and
- documents training activities.

If USACE already intends to provide a plan, the Draft FFR should discuss that intent and include relevant specifics.

Significance – Medium

The overall reliability of the levee system would be improved if the project's intended O&M practices, especially flood-fighting operations, were described before project completion.

Recommendations for Resolution

1. Describe in detail the expected coordination between USACE and local sponsors, including preparation and training in advance, readiness and condition assessments in the run-up to a flood event, and condition assessments and after-action reports after the event. To ensure reliability on a par with structural elements of the project and consistent among the numerous unit operators, a checklist (similar to an aviator's preflight checklist) should be used to ensure comprehensiveness and to document compliance.
2. Prepare an operation manual for reference and use by the non-Federal sponsors in operating and maintaining stoplog and sandbag gaps.
3. Require the non-Federal sponsors to annually demonstrate compliance with training and conduct tabletop exercises.
4. Require the non-Federal sponsors to annually update contact lists and emergency action plans, and provide these to USACE.
5. Require the non-Federal sponsors to provide annual condition assessments of structures, tools, and materials required for closures and overall readiness.

Literature Cited

Department of the Army, U.S. Army Corps of Engineers. (1994a). ER 1110-2-401, Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors. Washington DC. September 30, 1994.

Department of the Army, U.S. Army Corps of Engineers. (1994b). EM 1110-2-2705 Structural Design of Closure Structures for Local Flood Protection Projects. Washington DC. March 31, 1994.

Final Panel Comment 4 (Phase 2)

The engineering analysis does not describe whether cost contingencies have been included for existing timber piles that are determined to be in an unacceptable condition for resisting design loads.

Basis for Comment

The existing Central Industrial District (CID) floodwall foundations are supported on timber piles. The condition of these piles can have a significant effect on the cost of raising the floodwalls. If the timber piles are capable of supporting a raise, wall replacement can be avoided and fewer additional piles will be needed. To support the Draft Final Feasibility Report (FFR), the timber piles were sampled at two locations and judged capable of supporting a floodwall raise. In the assessment of future floodwall conditions (CID Engineering Appendix, Chapter A-14, Section 5.1), it is assumed that the existing timber piles are in good condition; however, it is noted that the limited nature of the pile investigation does not eliminate uncertainty regarding their condition. It is further assumed in Section 5.1 that a more complete assessment of the existing timber piles will be made during the final design and construction stages of the project. The text of the appendix indicates that additional new piles are expected to be needed, but the assumptions made in determining how much load can be resisted by the existing piles and how much must be resisted by additional piles are not clear.

Given that further assessment of the existing piles' integrity will eventually be performed, the Panel assumes that any deficiencies will be addressed during design and construction and has no major concerns regarding the reliability of the floodwall foundations following the upgrades. However, noting that some uncertainty still exists with regard to the condition of the existing piles, it is not clear from the Draft FFR how this uncertainty was accounted for in the cost estimate for raising the floodwalls.

Significance – Low

The reliability of the estimated project costs used in the economic analysis would be strengthened if the project documentation clarifies how uncertainties in the condition of the existing timber piles were considered in the cost analysis for raising the floodwalls.

Recommendations for Resolution

1. Describe the assumptions made in the cost estimate for raising the floodwalls with respect to the capabilities of the existing timber piles for resisting the additional loads imposed by raising the floodwalls.

Final Panel Comment 5 (Phase 2)

A detailed description on how upstream reservoirs will be operated before or during a flood event to minimize the water flowing into the Kansas Citys area has not been provided.

Basis for Comment

As the nation's levee system ages and the risk to public health and safety grows, an integrated flood management mitigation plan developed and implemented by non-Federal sponsors can greatly mitigate the risk of flooding. The Panel acknowledges that no plan can guarantee that a levee system will never fail; there would always be a possibility of residual risk. However, the Panel believes that levee owners and operators would benefit by working with local public safety officials and assisting them develop an effective upstream reservoirs operation plan. Currently, the Draft Final Feasibility Report (FFR) does not state whether an upstream reservoir operation plan already exists for the current project (and if so, whether it will be updated) or whether a new plan will be prepared for the project being implemented.

Significance – Low

Without a detailed description of how upstream reservoirs will be operated before or during flood events, the level of residual risk may not be reduced to optimally achievable levels.

Recommendations for Resolution

1. In the Draft FFR, describe in detail how upstream reservoirs will be operated before or during a flood event to minimize flows to the project area.

Final Panel Comment 6 (Phase 2)

Information is not provided on how an ongoing scour protection study would be considered in the final design of the Kansas Citys levees.

Basis for Comment

Bridge piers penetrate the levee embankments at a number of locations. The acceleration of flow around piers and abutments makes bridge pier locations susceptible to scour. This process will not necessarily compromise the operation of the bridge structures, as long as the foundations extend sufficiently below the scour depth. However, a scour hole in the levee embankment can destabilize the embankment. Additionally, a scour hole could penetrate an impermeable barrier such as a riverside impermeable blanket, which can significantly increase the risk of a piping failure.

The Panel understands that scour protection around bridge piers is being evaluated in a U.S. Army Corps of Engineers (USACE) study independent of the Draft Final Feasibility Report (FFR). However, the Draft FFR does not describe this ongoing study; therefore, the degree to which scour-related risk contributes to overall risk of levee failure is unclear. In addition, in the event that some scour protection measures will be needed, it is not clear how the costs will be factored into the Kansas Citys project's overall cost estimate and economic justification.

Significance – Low

The description of overall level of system reliability and the economic justification of the project would be improved by clarifying how the risks and costs associated with scour-related issues fit within the context of the Draft FFR.

Recommendations for Resolution

1. Describe how scour-related risk and cost issues will be addressed within the context of the Draft FFR.

Final Panel Comment 7 (Phase 2)

Public concerns regarding Phase 2 of the Kansas Citys Levees project are not adequately described in the project documentation.

Basis for Comment

The National Environmental Policy Act (NEPA) process for the 2006 Final Environmental Impact Statement (FEIS) included public involvement to address the public's concerns with regard to the project at that time. Since then, it is not clear whether there has been any public involvement for Phase 2 of the project. The public and agency comments summarized in the 2006 FEIS were not separated by levee unit or project phase; therefore, comments specifically targeted for Phase 2 could not be distinguished. No information is provided in the Draft Final Feasibility Report (FFR) on the opinions of the residents of the Armourdale and Central Industrial District (CID) levee units. In addition, the Draft FFR does not sufficiently document how (or whether) previously raised public concerns have been addressed in developing the Recommended Plan.

Significance – Low

Documenting the outcomes of the public involvement process across all phases of the project will improve the completeness of the FFR.

Recommendations for Resolution

1. Document all Phase 2 public involvement activities completed prior to release of the Draft FFR. Include a summary describing how public comments raised in Phase 1 of this project were addressed.
2. Provide a clear summary of Phase 2 public involvement activities that will be completed moving forward, and explain how public concerns will be addressed.
3. Revise the Draft FFR to cite the sources used to derive the conclusions in Sections VI.I, VI.J, and VI.K of the Draft FFR.

APPENDIX B

Final Charge to the Independent External Peer Review Panel for the Phase 1 IEPR on the Kansas Citys Feasibility Report as Submitted to USACE on October 19, 2012

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**Charge Questions and Guidance to the Peer Reviewers
for the
Independent External Peer Review of the Kansas Citys, Missouri and Kansas, Section 216
Flood Risk Management Project - Phase 2 Feasibility Report**

BACKGROUND

The U.S. Army Corps of Engineers (USACE), Kansas City District (CENWK) along with local non-Federal sponsors, are conducting a feasibility study of the existing flood risk management project for the Kansas City metropolitan area. The entire metropolitan system of seven flood risk management (levee) units withstood the Missouri River Flood of 1993, but some elements of the system were seriously challenged as the flood crested. This event raised a concern that the levees may provide less than the authorized benefits for which they were originally designed.

The protective works under study are within the immediate metropolitan area and vicinity of Kansas City, Missouri and Kansas City, Kansas along the Missouri and Kansas Rivers. The flood risk management units consist principally of levees, floodwalls, bridge and approach alterations, and channel improvement and alteration. The project extends over the lower 9.5 miles of the Kansas River and on the Missouri River from 6.5 miles upstream to 9.5 miles downstream of the mouth of the Kansas River. The 32 square mile study area covers the heavily industrialized floodplains of the two rivers. Each of the seven flood risk management units was designed and constructed in coordination with the other, but each is operationally independent. Complete effectiveness of the overall project is contingent on adequate reservoir control in the upper Missouri and Kansas River basins.

The study area includes protected areas within Jackson and Clay Counties, Missouri and Wyandotte County, Kansas. Communities (or portion thereof) within the study area include Kansas City, North Kansas City, Randolph, and Birmingham in Missouri, and Kansas City, Kansas.

The Project Management Plan for this study is based on a two-phase approach to performing the feasibility study. Phase 1 (completed Dec 2006) developed an Interim Feasibility Report which recommended improvements to increase the performance and reduce the flood risk of four of the seven levee units within the Kansas Citys system. These units included the Argentine Unit, the North Kansas City Unit, the East Bottoms Unit, and the Fairfax-Jersey Creek Unit. A fifth levee unit, the Birmingham Unit, was determined to meet the authorized level of performance assuming continued adequate operations and maintenance efforts.

Phase 2 of the Section 216 feasibility study will develop the Final Feasibility Report which will address the two remaining levee units, the Armourdale and the Central Industrial District Units, and other minor isolated locations in the system. Phase 2 will update and verify data on the level of flood risk management provided by the Kansas Citys, Missouri and Kansas, Local Flood Protection Project, and will develop alternative plans for increasing the reliability of the existing system. Such plans will be technically viable, economically feasible and environmentally acceptable.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Kansas Citys, Missouri and Kansas, Section 216 Flood Risk Management Project - Phase 2 Feasibility Report (hereinafter: Kansas Citys IEPR) in accordance with the Department of the Army, USACE, Water Resources Policies and Authorities' *Civil Works Review Policy*, Change 1 (EC 1165-2-209) dated January 31, 2012, and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released 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 1165-2-209; p. D-4) for the Kansas Citys documents. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by subject matter experts (i.e., IEPR panel members) with extensive experience in Civil Works planning, biology/ecology, hydrologic and hydraulic engineering, geotechnical/structural engineering, and civil engineering/construction engineering issues relevant to the project. They will also have experience applying their subject matter expertise to flood risk management.

The Panel will be “charged” with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. Per EC 1165-2-209, 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 Phase 1 documents and reference materials that will be provided for the review.

Documents for Review

The following documents are to be reviewed for Phase 1:

Title	Approx. No. of Pages
Alternative Formulation Briefing (AFB) Read-Ahead Material	150
Technical Appendices	2,000
Hydrology and Hydraulics	
Economics	
Civil Engineering	
Geotechnical Engineering	
HTRW	
Cost Estimates	
Cultural Resources	
Ecological Resources	
Real Estate	

Documents for Reference

- USACE guidance *Civil Works Review Policy*, Change 1 (EC 1165-2-209) dated January 31, 2012
- CECW-CP Memorandum dated March 31, 2007
- Office of Management and Budget’s Final Information Quality Bulletin for Peer Review released December 16, 2004.

SCHEDULE

This Phase 1 draft schedule is based on the October 22, 2012 receipt of the final review documents. The schedule will be revised upon receipt of final review documents.

TASK	ACTION	DAYS TO COMPLETE ACTION	DUE DATE
Conduct Peer Review	Battelle sends Phase 1 review documents to Panel	Within 1 day of Panel being under subcontract or submission of final Phase 1 Work Plan, whichever is later	10/22/2012
	Battelle convenes Phase 1 kickoff meeting with Panel	Within 2 days of Panel being under subcontract or submission of final Phase 1 Work Plan, whichever is later	10/22/2012
	USACE convenes Phase 1 kickoff meeting with Battelle and Panel	Within 2 days of Panel being under subcontract or submission of final Phase 1 Work Plan, whichever is later	10/30/2012
	USACE convenes site visit with Battelle and Panel	Within 9 days of Panel being under subcontract	11/2/2012
	Battelle convenes Phase 1 mid-review teleconference for Panel to ask clarifying questions of USACE	At the three-quarters point of Panel Phase 1 review	11/7/2012
	Panel members complete their Phase 1 individual reviews	Within 16 days of Battelle/Panel Phase 1 kick-off meeting	11/14/2012
Prepare Final Panel Comments and Final IEPR Report	Battelle provides Panel merged individual comments and talking points for Phase 1 Panel Review Teleconference	Within 4 days of panel members completing their Phase 1 review	11/20/2012
	Battelle convenes Phase 1 Panel Review Teleconference	Within 5 days of panel members completing their Phase 1 review	11/21/2012
	Phase 1 Final Panel Comments finalized	Within 7 days of receipt of draft Phase 1 Final Panel Comments	12/12/2012
	Phase 1 Final Panel Comments delivered to USACE	Within 8 days of receipt of draft Phase 1 Final Panel Comments	12/13/2012

TASK	ACTION	DAYS TO COMPLETE ACTION	DUE DATE
Comment/ Response Process	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	Within 2 days of submittal of Phase 1 Final Panel Comments	12/17/2012
	USACE provides draft PDT Phase 1 Evaluator Responses to Battelle	Within 10 days of receipt of Phase 1 Final Panel Comments	12/19/2012
	Battelle provides the Panel the draft PDT Phase 1 Evaluator Responses	Within 2 days of receipt of draft PDT Phase 1 Evaluator Responses	12/20/2012
	Panel members provide Battelle with draft comments on draft Phase 1 PDT Evaluator Responses (i.e., draft Phase 1 BackCheck Responses)	Within 3 days of receipt of draft PDT Phase 1 Evaluator Responses from Battelle	12/27/2012
	Battelle convenes teleconference with Panel to discuss draft Phase 1 BackCheck Responses	Within 1 day of receipt of draft Phase 1 BackCheck Responses	12/28/2012
	Battelle convenes teleconference with Panel and USACE to discuss Phase 1 Final Panel Comments and draft responses	Within 7 days of USACE providing draft PDT Phase 1 Evaluator Responses	1/2/2013
	USACE inputs final PDT Phase 1 Evaluator Responses in DrChecks	Within 5 days of Phase 1 Final Panel Teleconference	1/7/2013
	Battelle provides PDT Phase 1 Evaluator Responses to Panel	Within 1 day of final PDT Phase 1 Evaluator Responses being available	1/8/2013
	Panel members provide Battelle with final Phase 1 BackCheck Responses	Within 3 days of receipt of final PDT Phase 1 Evaluator Responses	1/11/2013
	Battelle inputs the Panel's Phase 1 BackCheck Responses in DrChecks	Within 5 days of notification that USACE final PDT Phase 1 Evaluator Responses have been posted in DrChecks	1/10/2013
	*Battelle submits pdf printout of Phase 1 DrChecks project file	Within 1 day of Phase 1 DrChecks closeout	1/11/2013
Civil Works Review Board	Civil Works Review Board		Target date: 11/2013

CHARGE FOR PEER REVIEW

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

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

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Kansas Citys IEPR 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 1165-2-209; Appendix D).

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

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

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

Please submit your comments in electronic form to Corey Wisneski, wisneskic@battelle.org, no later than November 14, 2012, 10 pm ET.

**Independent External Peer Review
of the
Kansas Citys, Missouri and Kansas, Section 216 Flood Risk Management Project –
Phase 2 Feasibility Report
Charge Questions and Relevant Sections As Supplied By USACE**

General Questions

1. To what extent has it been shown that the project is technically sound?
2. Are the assumptions that underlie the engineering, and environmental analyses sound?
3. Are the engineering, and environmental methods, models and analyses used adequate and acceptable?
4. Were all models used in the analyses used in an appropriate manner with assumptions appropriately documented and explained?
5. Were risk and uncertainty sufficiently considered?
6. Was the process used to select the recommended alternative rational and was the process implemented in a reasonable manner given the project constraints?
7. Does the supplemental EIS satisfy the requirements of NEPA? Were adequate considerations given to significant resources by the project?
8. Assess the recommended alternatives from the perspective of systems. It should also include systemic aspects being considered from a temporal perspective, including the potential effects of climate change.

Safety Assurance Review Questions

9. Were the methods used to evaluate the condition of the structure adequate and appropriate given the circumstances?
10. Have the appropriate alternatives been considered and adequately described for this project and do they appear reasonable?
11. Do the project features adequately address redundancy, resiliency, or robustness with an emphasis on interfaces between structures, materials, members, and project phases?
12. Are the quality and quantity of the surveys, investigations, and engineering sufficient to assess expected risk reduction?
13. Have the hazards that affect the structures been adequately documented and described?
14. Are the models used to assess hazards appropriate?

15. Are the assumptions made for the impacts appropriately documented and explained?
16. Is there sufficient information presented to identify, explain, and comment on the assumptions that underlie the engineering analyses?
17. Are there any additional analyses or information available or readily obtainable that would affect decisions regarding the structures?
18. Does the physical data and observed data provide adequate information to characterize the structures and their performance?
19. Have all characteristics, conditions, and scenarios leading to potential failure, along with the potential impacts and consequences, been clearly identified and described? Have all pertinent factors, including but not necessarily limited to population-at-risk been considered?
20. Does the analysis adequately address the uncertainty given the consequences associated with the potential loss of life for this type of project?
21. From a public safety perspective, is the proposed alternative reasonably appropriate or are there other alternatives that should be considered?
22. Has anything significant been overlooked in the development of the assessment of the project or the alternatives?
23. Do the alternatives and their associated costs appear reasonable? Do the benefits and consequences appear reasonable?

Specific Charge Questions for the Kansas City, Missouri and Kansas Section 216 Flood Risk Management Project, Phase 2 AFB RAM and Accompanying Appendices

Objectives

24. Is the purpose of the project adequately defined? If not, why?
25. Has the project need been clearly described?
26. Have the public concerns been identified and adequately described?
27. Are the specific objectives adequately described?
28. In your opinion, are there any other issues, resources, or concerns that have not been identified and/or addressed?

Alternatives

29. Has the criteria to eliminate plans from further study been clearly described?
30. Is each of the different alternative plans clearly described?
31. Were the assumptions made for use in developing the future with-project conditions for each alternative reasonable? Were adequate scenarios considered? Were the assumptions reasonably consistent across the range of alternatives and/or adequately justified where different?
32. Are the changes between the without- and with-project conditions adequately described for each alternative?
33. Have comparative impacts been clearly and adequately described?
34. Are future Operation, Maintenance, Repair, Replacement, and Rehabilitation efforts adequately described and are the estimated cost of those efforts reasonable for each alternative?
35. Are there any unmitigated environmental impacts not identified and if so could they impact project designs?
36. Please comment on the likelihood of the recommended alternative will achieve the expected outputs.
37. Are residual risks adequately described and is there a sufficient plan for communicating the residual risk to affected populations?
38. Have the impacts to the existing infrastructure, including the existing flood risk management project, utilities, and transportation infrastructure, been adequately addressed?

Affected Environment

39. Is the description of the climate in the study area sufficiently detailed and accurate?
40. Is the description of wetland resources in the project area complete and accurate?
41. Is the description of aquatic resources in the project area complete and accurate?
42. Is the description of threatened and endangered species resources in the study area complete and accurate?
43. Is the description of the historical and existing recreational resources in the study area complete and accurate?
44. Is the description of the cultural resources in the study area complete and accurate?
45. Is the description of the historical and existing socioeconomic resources in the study area complete and accurate? Were specific socioeconomic issues not addressed?

Environmental Consequences

46. Have impacts to significant resources been adequately and clearly described?
47. To what extent have the potential impacts of the alternatives on significant resources been addressed and supported?
48. Are the scope and detail of the potential adverse effects that may arise as a result of project implementation sufficiently described and supported?
49. Have impacts from borrow areas been adequately and clearly described?

Cumulative Impacts

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

Mitigation

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

Hydrology and Hydraulics

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

Geotechnical Engineering

53. Is the description of the geomorphic and physiographic setting of the proposed project area accurate and comprehensive?
54. Were the geotechnical analyses adequate and appropriate for the current level of design as presented in the report documentation?

Design

55. Have the design and engineering considerations presented been clearly outlined and will they achieve the project objectives?
56. Are any additional design assumptions necessary to validate the preliminary design of the primary project components?
57. Are the assumptions used to determine the cost of operations and maintenance for the proposed project adequately documented and explained?

Real Estate Plan

58. Comment on the extent to which assumptions and data sources used in the economics analyses are clearly identified and the assumptions are justified and reasonable.
59. Does the Real Estate Plan adequately address all real estate interests (public and private)?

Relocations

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

Hazardous, Toxic, and Radioactive Waste

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

Cost Estimates and Economics

62. Were the benefit categories used in the economic analysis adequate to calculate a benefit-to-cost ratio for each of the project alternatives?
63. Was the methodology used to determine the characteristics and corresponding value of the structure inventory for the study area adequate?
64. Were the methods used to develop the content-to-structure value ratios appropriate and were the generated results applicable to the study area?
65. Were the methods to develop the depth-damage relationships appropriate and were the generated results applicable to the study area?
66. Has the economic analyses addressed the issue of repetitive flood damages and the subsequent extent of rebuild/repair by property owners as it relates to annual damage estimation?
67. Were risk and uncertainty sufficiently considered in relation to the future development process?
68. To what extent have significant project construction costs been adequately identified and described?
69. Are the costs adequately justified?

Public Involvement and Correspondence

70. Based on your experience with similar projects, has adequate public, stakeholder, and agency involvement occurred to determine all issues of interest and to ensure that the issues have been

adequately addressed to the satisfaction of those interested parties? Should additional public outreach and coordination activities be conducted?

FINAL OVERVIEW QUESTION

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

APPENDIX C

Final Charge to the Independent External Peer Review Panel for the Phase 2 IEPR on the Kansas Citys Feasibility Report as Submitted to USACE on October 1, 2013

**Phase 2 Charge Questions and Guidance to the Peer Reviewers
for the
Independent External Peer Review of the Kansas Citys, Missouri and Kansas, Section 216
Flood Risk Management Project - Phase 2 Feasibility Report**

BACKGROUND

The U.S. Army Corps of Engineers (USACE), Kansas City District (CENWK) along with local non-Federal sponsors, are conducting a feasibility study of the existing flood risk management project for the Kansas City metropolitan area. The entire metropolitan system of seven flood risk management (levee) units withstood the Missouri River Flood of 1993, but some elements of the system were seriously challenged as the flood crested. This event raised a concern that the levees may provide less than the authorized benefits for which they were originally designed.

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Phase 2 of the Section 216 feasibility study will develop the Final Feasibility Report which will address the two remaining levee units, the Armourdale and the Central Industrial District Units, and other minor isolated locations in the system. Phase 2 will update and verify data on the level of flood risk management provided by the Kansas Citys, Missouri and Kansas, Local Flood Protection Project, and will develop alternative plans for increasing the reliability of the existing system. Such plans will be technically viable, economically feasible and environmentally acceptable.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Kansas Citys, Missouri and Kansas, Section 216 Flood Risk Management Project - Phase 2 Feasibility Report (hereinafter: Kansas Citys IEPR) in accordance with the Department of the Army, USACE, Water Resources Policies and Authorities' *Civil Works Review Policy*, Change 1 (EC 1165-2-209) dated January 31, 2012, and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

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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 1165-2-209, 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 Phase 2 documents and reference materials that will be provided for the review.

Documents for Review

Title	Actual No. of Pages
Kansas Citys, KS and MO, Flood Risk Management Project – Final Feasibility Report (September 2013)	87
Report Exhibits	19
Report Maps	14
Appendix A: Engineering Analysis	2,402
Appendix B: Socioeconomic Analysis	64
Appendix C: Real Estate Plan	53
Appendix D: Hazardous, Toxic, and Radioactive Waste	29
Appendix E: Cost Estimating	46

Documents for Reference

- USACE guidance *Civil Works Review Policy*, Change 1 (EC 1165-2-209) dated January 31, 2012
- Office of Management and Budget's Final Information Quality Bulletin for Peer Review released December 16, 2004.

SCHEDULE

This Phase 2 schedule is based on the September 20, 2013 receipt of the final review documents.

Task	Action	Due Date
Conduct Peer Review	Battelle sends Phase 2 review documents to Panel	10/10/2013
	Battelle convenes Phase 2 kickoff meeting with Panel	10/11/2013
	USACE convenes Phase 2 kickoff meeting with Panel and Battelle	10/11/2013
	Battelle convenes Phase 2 mid-review teleconference for Panel to ask clarifying questions of USACE	10/22/2013
	Panel members complete their Phase 2 individual reviews	10/31/2013
Prepare Final Panel Comments and Final IEPR Report	Battelle provides Panel merged individual comments and talking points for Phase 2 Panel Review Teleconference	11/4/2013
	Battelle convenes Phase 2 Panel Review Teleconference	11/5/2013
	Battelle provides Phase 2 Final Panel Comments directive to Panel	11/6/2013
	Panel members provide draft Phase 2 Final Panel Comments to Battelle	11/13/2013
	Battelle provides feedback to Panel on draft Phase 2 Final Panel Comments; Panel provides revised draft Phase 2 Final Panel Comments per Battelle feedback (iterative process)	11/13 - 11/19/2013
	Phase 2 Final Panel Comments finalized	11/19/2013
	Battelle provides Final Phase 2 IEPR Report to Panel for review	11/20/2013
	Panel provides comments on Final Phase 2 IEPR Report	11/21/2013
	*Battelle submits Final Phase 2 IEPR Report to USACE	11/25/2013
Comment/Response Process	Battelle inputs Phase 2 Final Panel Comments to DrChecks; Battelle provides Phase 2 Final Panel Comment response template to USACE	11/25/2013
	Battelle provides the Panel the draft PDT Phase 2 Evaluator Responses	11/27/2013
	Panel members provide Battelle with draft comments on draft Phase 2 PDT Evaluator Responses (i.e., draft Phase 2 BackCheck Responses)	12/2/2013
	Battelle convenes teleconference with Panel to discuss draft Phase 2 BackCheck Responses	12/3/2013
	Battelle convenes teleconference with Panel and USACE to discuss Phase 2 Final Panel Comments and draft responses	12/5/2013
	USACE inputs final PDT Phase 2 Evaluator Responses in DrChecks	12/10/2013
	Battelle provides PDT Phase 2 Evaluator Responses to Panel	12/11/2013
	Panel members provide Battelle with final Phase 2 BackCheck Responses	12/16/2013
	Battelle inputs the Panel's Phase 2 BackCheck Responses in DrChecks	12/17/2013
	*Battelle submits pdf printout of Phase 2 DrChecks project file	12/18/2013
Civil Works Review Board (CWRB)	Panel prepares and/or reviews slides for CWRB	TBD
	Civil Works Review Board	January 2014

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the Kansas Citys IEPR Phase 2 documents are credible and whether the conclusions are valid. The Panel is asked to determine whether the technical work is adequate, competently performed, properly documented, satisfies established quality requirements, and yields scientifically credible conclusions. The Panel is being asked to provide feedback on the economic, engineering, environmental resources, and plan formulation. The panel members are not being asked whether they would have conducted the work in a similar manner.

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

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Kansas Citys IEPR 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 1165-2-209; Appendix D).

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

Please **do not** make recommendations on whether a particular alternative should be implemented, or whether you would have conducted the work in a similar manner. Also please

do not comment on or make recommendations on policy issues and decision making. Comments should be provided based on your professional judgment, **not** the legality of the document.

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

Please submit your comments in electronic form to Corey Wisneski, wisneskic@battelle.org, no later than October 31, 2013, 10 pm ET.

**Independent External Peer Review
of the
Kansas Citys, Missouri and Kansas, Section 216 Flood Risk Management Project –
Phase 2 Feasibility Report
Charge Questions and Relevant Sections As Supplied By USACE**

General Questions

1. To what extent has it been shown that the project is technically sound?
2. Are the assumptions that underlie the engineering, and environmental analyses sound?
3. Are the engineering, and environmental methods, models and analyses used adequate and acceptable?
4. Were all models used in the analyses used in an appropriate manner with assumptions appropriately documented and explained?
5. Were risk and uncertainty sufficiently considered?
6. Was the process used to select the recommended alternative rational and was the process implemented in a reasonable manner given the project constraints?
7. Assess the recommended alternatives from the perspective of systems. It should also include systemic aspects being considered from a temporal perspective, including the potential effects of climate change.

Safety Assurance Review Questions

8. Were the methods used to evaluate the condition of the structure adequate and appropriate given the circumstances?
9. Have the appropriate alternatives been considered and adequately described for this project and do they appear reasonable?
10. Do the project features adequately address redundancy, resiliency, or robustness with an emphasis on interfaces between structures, materials, members, and project phases?
11. Are the quality and quantity of the surveys, investigations, and engineering sufficient to assess expected risk reduction?
12. Have the hazards that affect the structures been adequately documented and described?
13. Are the models used to assess hazards appropriate?
14. Are the assumptions made for the impacts appropriately documented and explained?

15. Is there sufficient information presented to identify, explain, and comment on the assumptions that underlie the engineering analyses?
16. Are there any additional analyses or information available or readily obtainable that would affect decisions regarding the structures?
17. Does the physical data and observed data provide adequate information to characterize the structures and their performance?
18. Have all characteristics, conditions, and scenarios leading to potential failure, along with the potential impacts and consequences, been clearly identified and described? Have all pertinent factors, including but not necessarily limited to population-at-risk been considered?
19. Does the analysis adequately address the uncertainty given the consequences associated with the potential loss of life for this type of project?
20. From a public safety perspective, is the proposed alternative reasonably appropriate or are there other alternatives that should be considered?
21. Has anything significant been overlooked in the development of the assessment of the project or the alternatives?
22. Do the alternatives and their associated costs appear reasonable? Do the benefits and consequences appear reasonable?

Specific Charge Questions for the Kansas Citys, Missouri and Kansas Section 216 Flood Risk Management Project, Phase 2 DRAFT Final Feasibility Report and Accompanying Appendices

Objectives

23. Is the purpose of the project adequately defined? If not, why?
24. Has the project need been clearly described?
25. Have the public concerns been identified and adequately described?
26. Are the specific objectives adequately described?
27. In your opinion, are there any other issues, resources, or concerns that have not been identified and/or addressed?

Alternatives

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

29. Is each of the different alternative plans clearly described?
30. Were the assumptions made for use in developing the future with-project conditions for each alternative reasonable? Were adequate scenarios considered? Were the assumptions reasonably consistent across the range of alternatives and/or adequately justified where different?
31. Are the changes between the without- and with-project conditions adequately described for each alternative?
32. Have comparative impacts been clearly and adequately described?
33. Are future Operation, Maintenance, Repair, Replacement, and Rehabilitation efforts adequately described and are the estimated cost of those efforts reasonable for each alternative?
34. Are there any unmitigated environmental impacts not identified and if so could they impact project designs?
35. Please comment on the likelihood of the recommended alternative will achieve the expected outputs.
36. Are residual risks adequately described and is there a sufficient plan for communicating the residual risk to affected populations?
37. Have the impacts to the existing infrastructure, including the existing flood risk management project, utilities, and transportation infrastructure, been adequately addressed?

Cumulative Impacts

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

Mitigation

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

Geotechnical Engineering

40. Is the description of the geomorphic and physiographic setting of the proposed project area accurate and comprehensive?
41. Were the geotechnical analyses adequate and appropriate for the current level of design as presented in the report documentation?

Design

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

43. Are any additional design assumptions necessary to validate the preliminary design of the primary project components?
44. Are the assumptions used to determine the cost of operations and maintenance for the proposed project adequately documented and explained?

Real Estate Plan

45. Comment on the extent to which assumptions and data sources used in the economics analyses are clearly identified and the assumptions are justified and reasonable.
46. Does the Real Estate Plan adequately address all real estate interests (public and private)?

Relocations

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

Hazardous, Toxic, and Radioactive Waste

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

Cost Estimates and Economics

49. Were the benefit categories used in the economic analysis adequate to calculate a benefit-to-cost ratio for each of the project alternatives?
50. Was the methodology used to determine the characteristics and corresponding value of the structure inventory for the study area adequate?
51. Were the methods used to develop the content-to-structure value ratios appropriate and were the generated results applicable to the study area?
52. Were the methods to develop the depth-damage relationships appropriate and were the generated results applicable to the study area?
53. Has the economic analyses addressed the issue of repetitive flood damages and the subsequent extent of rebuild/repair by property owners as it relates to annual damage estimation?
54. Were risk and uncertainty sufficiently considered in relation to the future development process?
55. To what extent have significant project construction costs been adequately identified and described?
56. Are the costs adequately justified?

Public Involvement and Correspondence

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

FINAL OVERVIEW QUESTIONS

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

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