Final Independent External Peer Review Report
Upper Ohio Navigation Study
Draft Feasibility Report, Pennsylvania

Prepared by
Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
Inland Navigation Planning Center of Expertise
Huntington District

Contract No. W912HQ-10-D-0002
Task Order: 0050

May 27, 2014

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Executive Summary

PROJECT BACKGROUND AND PURPOSE

The Upper Ohio Navigation Study, Pennsylvania, focuses on Emsworth, Dashields, and Montgomery (EDM) locks and dams. These three navigation projects (also referred to as the Upper Ohio projects) are located on the upper Ohio River near Pittsburgh, Pennsylvania. The Upper Ohio projects allow producers and consumers of bulk commodities to move large quantities of cargo into and through the Pittsburgh area at relatively low cost and with minimal effects on land-based passenger and freight transportation. Coal and aggregate (stone, sand, and gravel) firms are the primary producers, while electric utilities and steel mills are the primary consumers of the commodities that move through the Upper Ohio projects.

The Upper Ohio projects were built in the 1920s and 1930s at a time when waterway carriers had yet to transition from steam-powered pusher boats (called towboats) and wooden barges to the modern diesel-powered towboats and large-dimension steel barges. Consequently, the dimensions of the locks at these projects are the smallest on the Ohio River. Mainstem Ohio River projects are double-lock configurations, with the main chamber typically measuring 110 feet by 1,200 feet (accommodating 15 barge tows in one 60-minute operation) and the auxiliary chamber 110 feet by 600 feet (accommodating 15 barge tows in two operations lasting 160 minutes). While the Upper Ohio projects have two lock chambers, the main chamber is only the size of a typical Ohio River auxiliary lock chamber, and EDM's auxiliary chambers are very small at 56 feet by 360 feet. Emsworth and Dashield's dams provide very short navigation pools of 7 and 13 miles in length, respectively, while Montgomery's dam provides a navigation pool of 23 miles. Navigation pools formed by modern lock and dam projects on the Ohio River average 57 miles and range from 30 to 114 miles in length.

Independent External Peer Review Process

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. The U.S. Army Corps of Engineers (USACE) is conducting an Independent External Peer Review (IEPR) of the Upper Ohio Navigation Study Draft Feasibility Report, Pennsylvania (hereinafter: Upper Ohio IEPR). As a 501(c)(3) non-profit science and technology organization, Battelle is independent, is free from conflicts of interest (COIs), and meets the requirements for an Outside Eligible Organization (OEO) per guidance described in USACE (2012). Battelle has experience in establishing and administering peer review panels for USACE and was engaged to coordinate the IEPR of the Upper Ohio study. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2012) and OMB (2004). This final report presents the Final Panel Comments of the IEPR Panel (the Panel). Details regarding the IEPR (including the process for selecting panel members, the panel members' biographical information and expertise, and the charge submitted to the Panel to guide its review) are presented in appendices.

Based on the technical content of the Upper Ohio review documents and the overall scope of the project, Battelle identified candidates for the Panel in the following key technical areas: economics, environmental, engineering, and planning. Four panel members were selected for the IEPR. USACE was given the list of candidate panel members, but Battelle made the final selection of the Panel.

The Panel received electronic versions of the 6,650 pages of Upper Ohio review documents, along with a charge that solicited comments on specific sections of the documents to be reviewed. USACE prepared the charge questions following guidance provided in USACE (2012) and OMB (2004), which were included in the draft and final Work Plans.

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

IEPR panel members reviewed the Upper Ohio documents individually. The Panel produced individual comments in response to the charge questions. The panel members then met via teleconference with Battelle to review key technical comments and reach agreement on the Final Panel Comments to be provided to USACE. Each Final Panel Comment was documented using a four-part format consisting of: (1) a comment statement; (2) the basis for the comment; (3) the significance of the comment (high, medium/high, medium, medium/low, or low); and (4) recommendations on how to resolve the comment. Overall, 17 Final Panel Comments were identified and documented. Of these, four were identified as having high significance, five were identified as having medium/high significance, six were identified as having medium significance, and two were identified as having medium/low significance.

Results of the Independent External Peer Review

The panel members agreed on their “assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used” (USACE, 2012; p. D-4) in the Upper Ohio Draft Feasibility Report/Integrated Environmental Impact Statement (DFR/EIS) review documents. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel’s findings.

Economics – USACE has assembled a series of supporting studies and models into a robust analytic structure. Although the documents provide a textbook discussion of benefits and their estimation, the Panel’s most significant findings focus on the use of outdated data for estimating benefits and for calculating the benefit-to-cost ratio (BCR). The economics analysis was based on 2006-2007 data. However, the intervening recession, shale gas production expansion, and closures of coal-fired power plants have markedly changed the traffic outlook, particularly for coal shipments on which much of the estimated benefits depend. The Panel recommends that USACE conduct a rigorous sensitivity analysis to determine which portions of the traffic forecast to update, and then update those portions.

The Panel identified additional key economic issues which focus on the age, sources, and validity of the truck and rail rates used in the Ohio River Navigation Investment Model (ORNIM) analysis, and on the predicted shift to Powder River Basin (PRB) coal by utility power plants. These factors have the potential to impact the transportation cost savings estimate, traffic projections, rate analyses, and social cost

estimates. It is recommended that the truck and rail rates be reviewed and that an analysis of the predicted influx of PRB coal on project benefits be completed.

Engineering – The risk analysis associated with the base cost estimate is detailed. However, the Total Project Cost (TPC) estimate may be significantly understated because it does not consider risks associated with funding and schedule uncertainties as well as risks involved in implementing the recommended plan. This issue can be addressed by determining contingencies for the TPC estimate commensurate with the revised schedule and associated risks which are more consistent with the timing for receipt of funding. In addition, risks should be assigned in association with the possibility of having lock or dam failure occur before construction starts.

The Value Engineering (VE) study highlighted several proposals and comments that, in the Panel's opinion, need to be addressed during the feasibility phase of the study because they could impact the selection of the recommended plan. Specifically, the VE study's revised design techniques, the appropriate length for the upstream guardwalls for each EDM site, and testing of the river sediments likely to be disturbed during construction for accumulation of hazardous, toxic, and radioactive waste (HTRW) should be evaluated. The feasibility study's recommended plan design details and associated estimate of cost should subsequently be updated, as appropriate.

Planning – The National Environmental Policy Act (NEPA) requirements have been addressed. However, the Panel is uncertain why the Reactive Maintenance Alternative (RMA) was selected for the future without-project condition (WOPC) when the costs are incomplete and the RMA is projected to be more costly than the Advanced Maintenance Alternative (AMA). In the interest of completeness, the Panel recommends that (1) a comprehensive assessment of the RMA costs be completed, and (2) the other two Major Rehabilitation options (Scheduled Maintenance and Scheduled Rehabilitation) be compared with the AMA.

The discussion of the formulation and screening of ecosystem restoration alternative plans (and how they relate to the planning objectives) in the DFR/EIS lacks sufficient detail. A clear description of the screening process related to the ecosystem restoration planning objectives is needed to ensure that the final set of alternatives represents the most effective means of addressing the ecosystem restoration planning objectives.

Environmental – The description of the processes and outcomes is comprehensive, and the overall interdisciplinary approach utilized by USACE to address complex environmental issues is commendable. The deferral of finalizing mitigation commitments, however, leads to uncertainties regarding compensation for unavoidable impacts. The DFR/EIS should be updated to clearly state the timeframe in which environmental commitments, including mitigation, will be addressed.

Table ES-1. Overview of 17 Final Panel Comments Identified by the Upper Ohio IEPR Panel

No.	Final Panel Comment
High – Significance	
1	The estimated project benefits and the BCR are based on outdated traffic forecasts that are no longer reliable.
2	The transportation rate analysis supporting the estimated project benefits and the BCR is
3	The sources and validity of the truck and rail rates used in the ORNIM analysis and other parts of the analysis are unclear; therefore, the accuracy of the estimated transportation cost savings and
4	The traffic forecast, rate analysis, and social cost analysis do not appear to account for the
Medium/High – Significance	
5	The sensitivity analysis does not address the vulnerability of the benefits estimate and the BCR to recent traffic volume declines, estimated truck and rail rates, potential changes in coal sourcing,
6	The computed contingencies used for the TPC estimate does not consider (1) risks due to funding and schedule uncertainties and (2) some risks involved in implementing the recommended plan.
7	The RMA costs are incomplete and could impact the selection of the future WOPC.
8	It is unclear why the RMA was selected as the future WOPC, even though it was more costly than
9	The VE study for this project developed several revised design technique proposals and comments that are not considered and could potentially have significant impacts on project cost and selection of the recommended plan.
Medium – Significance	
10	The Planning, Engineering, and Design (PE&D) estimated cost of 15 percent of construction costs may be overstated since much of the plans, specifications, and modeling can be used at multiple
11	The assumption that all authorized projects will be implemented in the future may not be realistic, which could affect the impacts of the WOPC and with-project condition (WPC) alternatives.
12	The Economic Appendix of the DFR/EIS does not explain the derivation of the “Equilibrium System Traffic” and “Equilibrium System Savings” shown for the National Economic Development (NED) plan.
13	The DFR/EIS does not contain sufficiently detailed project benefits tables to allow for assessment of the relative importance of commodity flows and benefit sources.

Table ES-1. Overview of 17 Final Panel Comments Identified by the Upper Ohio IEPR Panel (continued)

No.	Final Panel Comment
14	The metrics used to formulate and screen ecosystem restoration alternatives are not described, and it is unclear how these alternatives relate to the project's planning objectives for ecosystem
15	Appropriate mitigation measures to reduce the potential impacts on environmental resources are identified, but the commitment to their implementation and over what timeframe has not been
Medium/Low – Significance	
16	The potential impacts of climate change on the recommended plan are not described.
17	The hydraulic analyses performed to support decision making are not described in sufficient detail to determine the reasonableness of the findings.

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Table of Contents

List of Tables

LIST OF ACRONYMS

AMA	Advanced Maintenance Alternative
ATR	Agency Technical Review
BCR	Benefit-to-Cost Ratio
CCAPS	Climate Change Adaptation Policy Statement
CEQ	Council on Environmental Quality
COI	Conflict of Interest
CWRB	Civil Works Review Board
DFR	Draft Feasibility Report
DrChecks	Design Review and Checking System
EC	Engineer Circular
EDM	Emsworth, Dashields, and Montgomery (Locks and Dams)
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
ER	Engineer Regulation
ERDC	Engineer Research and Development Center
ETL	Engineer Technical Letter
HTRW	Hazardous, Toxic, and Radioactive Waste
IEPR	Independent External Peer Review
LMA	Lock Modernization Alternative
LTI	Leonardo Technologies, Incorporated
MCACES	Micro-Computer Aided Cost Estimating System
NED	National Economic Development
NEPA	National Environmental Policy Act
O&M	Operations and Maintenance
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
ORB	Ohio River Basin
ORMSS	Ohio River Mainstem System Study
ORNIM	Ohio River Navigation Investment Model
ORS	Ohio River Navigation System

PDT	Project Delivery Team
PE&D	Planning, Engineering, and Design
PED	Preconstruction Engineering and Design
PRB	Powder River Basin
RMA	Reactive Maintenance Alternative
STB	Surface Transportation Board
TPC	Total Project Cost
TVA	Tennessee Valley Authority
USACE	United States Army Corps of Engineers
VE	Value Engineering
WOPC	Without-Project Condition
WPC	With-Project Condition

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1. INTRODUCTION

The Upper Ohio is part of the larger Ohio River System, which includes the main navigable tributaries of the Allegheny, Monongahela, Kanawha, Green, Tennessee, and Cumberland rivers, along with smaller navigable tributaries like the Little Kanawha, Big Sandy, and Kentucky rivers. This system is made possible by 56 lock and dam projects in eight states. The Ohio River System is a major component of the Mississippi River System, which is linked to both ocean-going trade at New Orleans, Louisiana, and Great Lakes trade by way of the Illinois River and its connectors to Lake Michigan in and near Chicago, Illinois.

The Upper Ohio Navigation Study, Pennsylvania, focuses on Emsworth, Dashields, and Montgomery (EDM) locks and dams. These three navigation projects (also referred to as the Upper Ohio projects) are located on the upper Ohio River in the vicinity of Pittsburgh, Pennsylvania. The Upper Ohio projects allow producers and consumers of bulk commodities to move large quantities of cargo into and through the Pittsburgh area at relatively low cost and with minimal effects on land-based passenger and freight transportation. Coal and aggregate (stone, sand, and gravel) firms are the primary producers, while electric utilities and steel mills are the primary consumers of the commodities that move through the Upper Ohio projects.

The Upper Ohio projects were built in the 1920s and 1930s at a time when waterway carriers had yet to transition from steam-powered pusher boats (called towboats) and wooden barges to the modern diesel-powered towboats and large-dimension steel barges. Consequently, the dimensions of the locks at these projects are the smallest on the Ohio River. Mainstem Ohio River projects are double-lock configurations, with the main chamber typically measuring 110 feet by 1,200 feet (accommodating 15 barge tows in one 60-minute operation) and the auxiliary chamber 110 feet by 600 feet (accommodating 15 barge tows in two operations lasting 160 minutes). While the Upper Ohio projects have two lock chambers, the main chamber is only the size of a typical Ohio River auxiliary lock chamber, and EDM's auxiliary chambers are very small at 56 feet by 360 feet. Emsworth and Dashield's dams provide very short navigation pools of 7 and 13 miles in length, respectively, while Montgomery's dam provides a navigation pool of 23 miles. Navigation pools formed by modern lock and dam projects on the Ohio River average 57 miles and range from 30 to 114 miles in length.

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Upper Ohio Navigation Study Draft Feasibility Report, Pennsylvania (hereinafter Upper Ohio IEPR) in accordance with procedures described in the Department of the Army, U.S. Army Corps of Engineers (USACE), Engineer Circular (EC) *Civil Works Review* (EC 1165-2-214) (USACE, 2012) and the Office of Management and Budget (OMB) bulletin *Final Information Quality Bulletin for Peer Review* (OMB, 2004). Supplemental guidance on evaluation for conflicts of interest (COIs) was obtained from the *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports* (The National Academies, 2003).

This final report presents the Final Panel Comments of the IEPR Panel (the Panel) on the existing economic, environmental, engineering, and plan formulation analyses contained in the Upper Ohio IEPR documents (Section 4). Appendix A describes in detail how the IEPR was planned and conducted. Appendix B provides biographical information on the IEPR panel members and describes the method Battelle followed to select them. Appendix C presents the final charge to the IEPR panel members for their use during the review; the final charge was submitted to USACE on April 10, 2014.

2. PURPOSE OF THE IEPR

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

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

In this case, the IEPR of the Upper Ohio study was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC 1165-2-214). Battelle, a 501(c)(3) organization under the U.S. Internal Revenue Code, has experience conducting IEPRs for USACE.

3. METHODS FOR CONDUCTING THE IEPR

The methods used to conduct the IEPR are briefly described in this section; a detailed description can be found in Appendix A. Table 1 presents the major milestones and deliverables of the Upper Ohio IEPR. Due dates for milestones and deliverables are based on the award/effective date of September 25, 2013. Note that the work items listed under Task 6 occur after the submission of this report. Battelle anticipates submitting the pdf printout of the USACE's Design Review and Checking System (DrChecks) project file (the final deliverable) on June 20, 2014. The actual date for contract end will depend on the date that all activities for this IEPR, including Civil Works Review Board (CWRB) preparation and participation, are conducted.

Table 1. Major Milestones and Deliverables of the Upper Ohio IEPR

Task	Action	Due Date
1	Award/Effective Date	9/25/2013
	Review documents available	4/7/2014[a]
2	Battelle submits list of selected panel members	10/4/2013
	USACE confirms the panel members have no COI	10/9/2013
3	Battelle convenes kick-off meeting with USACE	10/3/2013
	Battelle convenes kick-off meeting with USACE and panel members	4/10/2014
4	Panel members complete their individual reviews	4/30/2014
	Panel members provide draft Final Panel Comments to Battelle	5/13/2014
5	Battelle submits Final IEPR Report to USACE	5/27/2014

Table 1. Major Milestones and Deliverables of the Upper Ohio IEPR (continued)

Task	Action	Due Date
6[b]	Battelle convenes Comment-Response Teleconference with panel members and USACE	6/5/2014
	Battelle submits pdf printout of DrChecks project file to USACE	6/20/2014
	CWRB Meeting (Estimated Date)[c]	9/18/2014
	Contract End/Delivery Date[d]	9/30/2014

[a] *The Real Estate Plan and Hazardous, Toxic, and Radioactive Waste (HTRW) review documents were received on April 28, 2014. This did not affect the project schedule.*

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

[c] *The CWRB meeting was listed in the Performance Work Statement under Task 3 but was relocated in this schedule to reflect the chronological order of activities.*

[d] *It is anticipated that a contract extension will be authorized to extend the period of performance 45 working days after the estimated CWRB date of September 18, 2014, which would be November 20, 2014.*

Battelle identified, screened, and selected four panel members to participate in the IEPR based on their expertise in the following disciplines: economics, environmental, engineering, and planning. The Panel reviewed the Upper Ohio documents and produced 17 Final Panel Comments in response to 52 charge questions provided by USACE for the review. This charge included two questions added by Battelle that sought summary information from the IEPR Panel. Battelle instructed the Panel to develop the Final Panel Comments using a standardized four-part structure:

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

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

4. RESULTS OF THE IEPR

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

4.1 Summary of Final Panel Comments

The panel members agreed among one another on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the Upper Ohio Draft Feasibility Report/Integrated Environmental Impact Statement (DFR/EIS)

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

Economics – USACE has assembled a series of supporting studies and models into a robust analytic structure. Although the documents provide a textbook discussion of benefits and their estimation, the Panel's most significant findings focus on the use of outdated data for estimating benefits and for calculating the benefit-to-cost ratio (BCR). The economics analysis was based on 2006-2007 data. However, the intervening recession, shale gas production expansion, and closures of coal-fired power plants have markedly changed the traffic outlook, particularly for coal shipments on which much of the estimated benefits depend. The Panel recommends that USACE conduct a rigorous sensitivity analysis to determine which portions of the traffic forecast to update, and then update those portions.

The Panel identified additional key economic issues which focus on the age, sources, and validity of the truck and rail rates used in the Ohio River Navigation Investment Model (ORNIM) analysis, and on the predicted shift to Powder River Basin (PRB) coal by utility power plants. These factors have the potential to impact the transportation cost savings estimate, traffic projections, rate analyses, and social cost estimates. It is recommended that the truck and rail rates be reviewed and that an analysis of the predicted influx of PRB coal on project benefits be completed.

Engineering – The risk analysis associated with the base cost estimate is detailed. However, the Total Project Cost (TPC) estimate may be significantly understated because it does not consider risks associated with funding and schedule uncertainties as well as risks involved in implementing the recommended plan. This issue can be addressed by determining contingencies for the TPC estimate commensurate with the revised schedule and associated risks which are more consistent with the timing for receipt of funding. In addition, risks should be assigned in association with the possibility of having lock or dam failure occur before construction starts.

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Planning – The National Environmental Policy Act (NEPA) requirements have been addressed. However, the Panel is uncertain why the Reactive Maintenance Alternative (RMA) was selected for the future without-project condition (WOPC) when the costs are incomplete and the RMA is projected to be more costly than the Advanced Maintenance Alternative (AMA). In the interest of completeness, the Panel recommends that (1) a comprehensive assessment of the RMA costs be completed, and (2) the other two Major Rehabilitation options (Scheduled Maintenance and Scheduled Rehabilitation) be compared with the AMA.

The discussion of the formulation and screening of ecosystem restoration alternative plans (and how they relate to the planning objectives) in the DFR/EIS lacks sufficient detail. A clear description of the screening process related to the ecosystem restoration planning objectives is needed to ensure that the

final set of alternatives represents the most effective means of addressing the ecosystem restoration planning objectives.

Environmental – The description of the processes and outcomes is comprehensive, and the overall interdisciplinary approach utilized by USACE to address complex environmental issues is commendable. The deferral of finalizing mitigation commitments, however, leads to uncertainties regarding compensation for unavoidable impacts. The DFR/EIS should be updated to clearly state the timeframe in which environmental commitments, including mitigation, will be addressed.

4.2 Final Panel Comments

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

Final Panel Comment 1

The estimated project benefits and the BCR are based on outdated traffic forecasts that are no longer reliable.

Basis for Comment

The Panel identified forecast and rate estimation issues related to outdated data. These issues are presented in separate comments to facilitate discussion and response.

Estimated Benefits: The benefits of this project depend on transportation savings for the commodities expected to move through the EDM Reach. As shown in the Sensitivity Analysis (Appendix B, Table 10-2), the BCR is sensitive to the level of traffic expected.

The original traffic forecasts date from 2008-2009 and rely on data from 2006-2007. These forecasts may have been reasonable when completed, as the methodology appears sound. However, the intervening recession, shale gas production expansion, and closures of coal-fired power plants have markedly changed the traffic outlook, particularly for the coal shipments on which much of the estimated benefits depend.

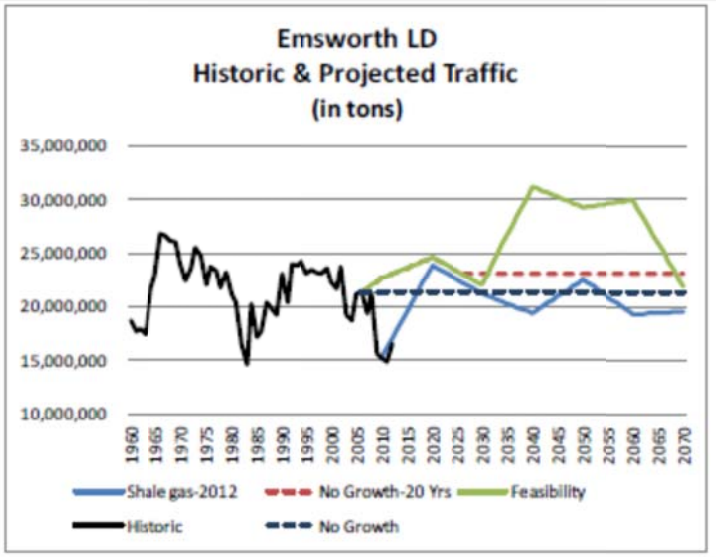
The changed outlook is evident in the 2012 Leonardo Technologies, Inc. (LTI) report prepared for USACE (LTI, 2012). Figure 32 of that report (p. 76) displays the forecast coal consumption for the Ohio River Navigation System (ORS) “Plants of Interest.” The two forecasts incorporating shale gas production (Updated Base+Shale and Shale+CSAPR) indicate coal consumption 25 to 30 percent[1] lower than the Original ORS Base forecast for 2018-2034, critical years for project benefits. The original and updated forecasts do not coincide until approximately 2067.

The February 2014 update prepared by USACE (Appendix B, Attachment 7: Economic Update and Analysis) does not provide sufficient support for reliance on the original 2008-2009 forecasts. Table 12 in Attachment 7 shows a sharp decline in Emsworth tonnage in 2008-2009, which is not reflected in the 2006-2007 data used in the original forecasts. The unfortunate timing of the recession and utility plant closures has apparently led to a wide divergence between forecasted and actual tonnages. The original Emsworth forecast for 2012 was 23,080,000 tons versus the actual 16,536,494 tons, which is 28 percent lower. The other locks likely had similar tonnage drops. Table 12 also shows a “LTI2012” forecast, but it is not clear how that forecast was derived from the information in the LTI report (2012). For example, in 2020, Table 12 shows an LTI2012 Emsworth forecast just 3 percent below the original forecast, while Figure 32 of the LTI report shows forecasts for Updated Base+Shale and Shale+CSAPR coal roughly

[1] The LTI report displays the forecasts only in graph form, so the differences are approximate.

20 percent below the original forecast (coal is about two-thirds of the tonnage) (LTI, 2012). Material received from USACE in response to a Panel clarifying question indicates a high level of confidence in the LTI analysis.

The chart below (following Table 12, Attachment 7) illustrates the need to update the forecast. For the "Shale gas-2012" forecast to approach the Feasibility (green line below) forecast by 2020, a 4.7 percent average annual growth would be required. The "No Growth" scenario actually requires about 4.3 percent average annual growth between 2012 and 2018. Sustained growth at these rates may not be attainable.



The discussion in Attachment 7 notes a positive outlook for Northern Appalachian coal production (Table 11). This positive outlook is interpreted as support for the original forecast. However, outbound/downbound coal accounts for only 35 percent of the coal tonnage, and the predicted growth rate is just 1.1 percent. Moreover, Figure 24 of the LTI report shows a negative outlook for Northern Appalachian coal (LTI, 2012).

A series of coal-fired utility plant closures occurred after the traffic forecasts were completed, and additional closures are expected. A survey taken for the social cost study (Economics Appendix, Attachment 5, Addendum 2, p. 7) found that 20 of the 205 former shippers (10 percent) contacted had stopped shipping by barge by 2008. Information provided by USACE indicates that 7 of the 28 plants receiving coal via EDM in 2009 have either closed or plan to close. The plants in question account for roughly 29 percent of the utility coal shipped via EDM in 2009, and 17 percent of all coal on the EDM Reach. Even if no more closures are announced, there is a significantly smaller base for future growth.

On the positive side, both the CDM Smith and Tioga Group report (cited in Appendix B of the DFR/EIS) and the LTI report cited in this Final Panel Comment note the potential for increased movements of aggregates and other commodities. These items should be included in a forecast update.

Benefit-to-Cost Ratio: The current traffic levels are well below even the "No Growth" scenario, which has a 1.5 BCR. If future tonnage levels remained 25 percent lower than the No Growth scenario (as in 2012) and the relationship were linear, the BCR would fall from 1.5 to 1.1.

Significance – High

The estimated benefits and the BCR depend directly on the traffic forecasts; however, the estimated benefits could change materially with an updated traffic forecast.

Recommendations for Resolution

1. Conduct a rigorous sensitivity analysis to determine how tonnage forecasts affect the benefits estimates and the BCR.
2. Use the results of the sensitivity analysis to identify which portions of the traffic forecast to update.
3. Develop and implement a plan to update those portions of the forecast and benefit estimates, and document the process and results in the relevant portions of Appendix B and the DFR/EIS.

Final Panel Comment 2

The trans
outdated

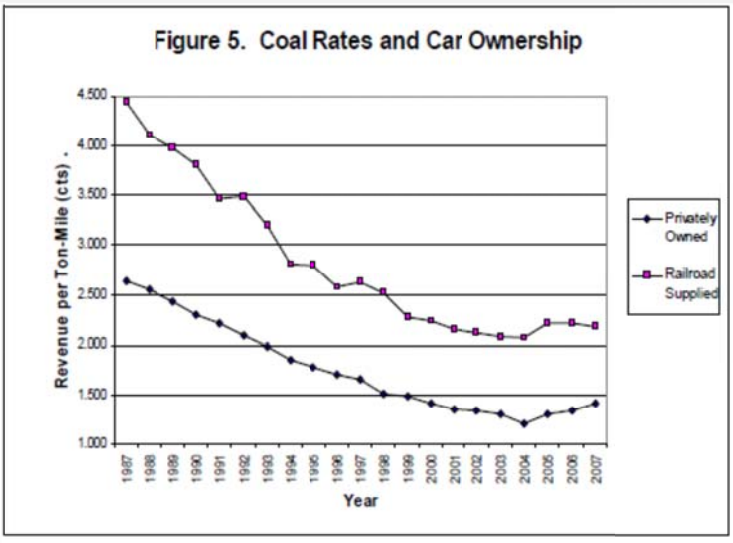
Basis for Comment

Estimated Benefits: The estimated benefits of this project consist almost entirely of transportation cost savings, either from avoiding rerouting during closures or from using barge rather than rail (Appendix B, Table 9-4). Those cost savings are determined by applying estimated truck and rail transportation rates to future traffic flows, making the BCR directly dependent on the accuracy of the rate estimates.

The transportation rate analysis was conducted by the Tennessee Valley Authority (TVA) using 2004 commodity movement data and 2007 transportation rates and mode choices (see, for example, Attachment 5, Addendum 2, p. 19). The Train/Wilson demand analysis (Attachment 1, Addendum C) is based on a 2007 survey. While this approach may have been defensible given modest changes between 2004 and 2007, the data are now too old for the results to be trustworthy. The 2004 commodity movement data are very outdated, so the rates estimated for those movements may no longer apply to the current and expected traffic pattern.

The rates and mode choice decisions analyzed in 2007 are also now outdated. The 2004 commodity flows existed in an era of $1.70-per-gallon diesel fuel. By mid-2007, diesel was at $2.80 per gallon, and it is has been hovering at about $4.00 per gallon since 2011. Rail, truck, and barge modes respond very differently to fuel price changes. The unit cost savings of barge transport may have increased since the original analysis was completed.

The chart below, from a Surface Transportation Board (STB) study of railroad rates from 1985-2007 (STB, 2009) shows that rail rates for coal had been on an upward trend between 2004 (the date of the commodity movement data) and 2007 (the date of the rate information), another reason why the analysis appears to be outdated.



Benefit-to-Cost Ratio: Although the Sensitivity Analysis (Appendix B, Section 10) establishes the dependence of the BCR on the traffic forecasts, it does not do the same for the rate estimates. Given that the benefits depend on the rate differential between rail, truck, and barge, it is evident that any change in that differential – positive or negative – would yield a corresponding change in the BCR.

Significance – High
Transportation losses from unscheduled closures account for almost all of the project benefits. Differences in estimated truck and rail rates between the completion date of the studies and the present could significantly alter the BCR.
Recommendations for Resolution
1. Update the transportation rate analysis using the most recent available data. 2. Verify rate estimates for the truck and rail with actual rate quotes and/or shipper records. 3. Update the benefits estimates and relevant report sections as needed.

Final Panel Comment 3

The sources and validity of the truck and rail rates used in the ORNIM analysis and other parts of the analysis are unclear; therefore, the accuracy of the estimated transportation cost savings and the BCR cannot be determined.

Basis for Comment

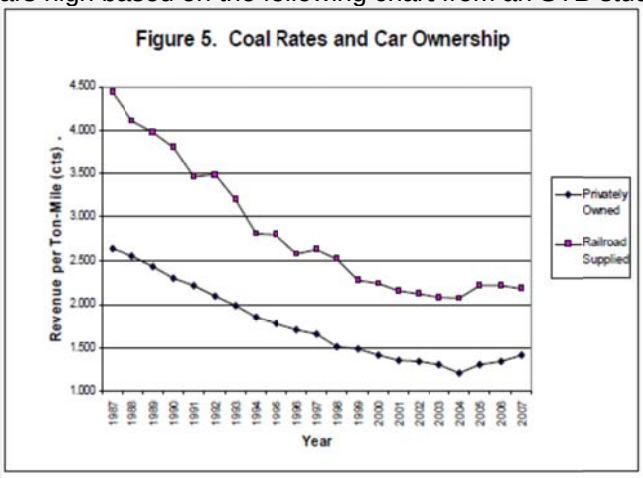
Transportation costs savings (i.e., Waterway Transportation Surplus and Transportation Losses from Unscheduled Closures) account for almost all of the estimated project benefits. Transportation rates, costs, and modal alternatives are discussed in several attachments and addenda to Appendix B. It is not clear what rates were actually used in ORNIM, or in other parts of the analysis leads to the benefits estimate or whether those rates are realistic. All of the truck and rail rates are apparently estimates rather than actual quoted or observed rates, making the estimation approach critical.

Different trucking rates and costs are used in different parts of the benefits analysis:

- The social cost estimate cites a survey figure of $65 per hour, including fuel, for a semi-tractor trailer (Attachment 5, Addendum 1, p. 18).
- The truck rate for "Charge to transfer point" in the TVA National Economic Development (NED) analysis is typically $75 per hour plus an unspecified fuel surcharge (for example, Attachment 4, p. 51, footnote *a*), yielding rates of $0.11 to $0.12 per ton-mile, depending on distance. Other truck trip legs in the TVA analysis use rates of $65 per hour, $85 per hour, or $2.80-$4.40 per loaded mile.
- The Train/Wilson demand analysis (Attachment 1, Addendum C, p. 17, Table 1.9) appears to include a truck rate of $0.395 per ton-mile, equivalent to $9.28 per mile for a truck carrying 23.5 tons of coal (Attachment 5, Addendum 1, p. 9). This rate appears implausibly high and is more than double the TVA rates.

Given that trucking cost as an alternative to barge is a major input to the estimated benefits, the choice and documentation of trucking rates are critical. While it is common to find different assumptions in different analyses, updating and reconciliation appear necessary.

There are also questions regarding the rail rates used in different parts of the analysis. The Train/Wilson demand analysis (Attachment 1, Addendum C, p. 17, Table 1.9) appears to include a rail rate of $0.042 per ton-mile, which appears high based on the following chart from an STB study (2009).



The TVA rate analysis (Appendix B, Attachment 4) does not indicate what rail rates were used. The

TVA NED benefits analysis does, however, note that allowances for the use of private rail equipment were ignored, as were rebates (p. 38). This convention would tend to overestimate rail rates, perhaps significantly. The STB chart above suggests that coal rates for privately owned cars were roughly 36 percent lower in 2007. Rebates (which are not reflected in STB Carload Waybill Statistics data) would lower effective rail rates still further.

Significance – High

Transportation costs savings account for almost all of the estimated project benefits. These estimates and savings depend on estimates of truck and rail rates as alternatives to barge transportation.

Recommendations for Resolution

1. Review, reconcile, and document the trucking and rail rate estimates used in different parts of the analysis.
2. Verify truck and rail rate estimates with actual rate quotes and/or shipper records.
3. Update the benefits estimates and relevant report sections as needed.

Final Panel Comment 4

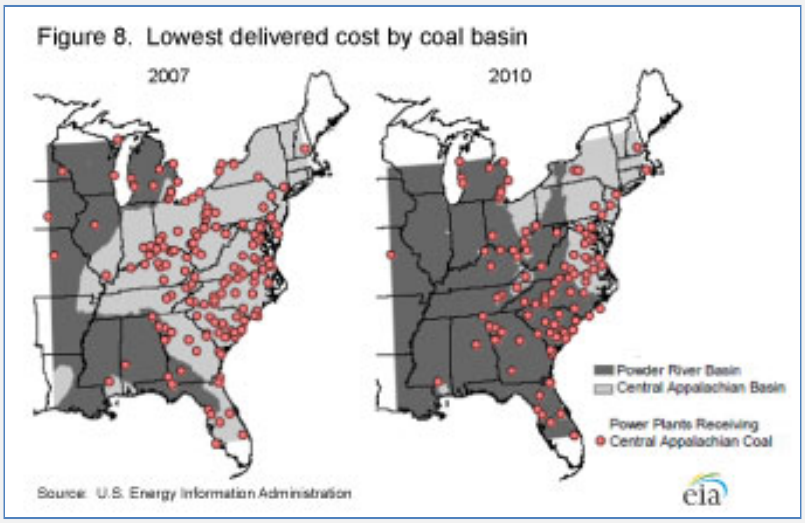
The traffic forecast, rate analysis, and social cost analysis do not appear to account for the predicted utility power plant shift to PRB coal.

Basis for Comment

The LTI 2012 report shows that for all forecast scenarios (including the original forecast), coal originating in the PRB accounts for the growth in ORS steam coal consumption after about 2030 (Figures 33 through 36). PRB coal typically originates at the minehead in unit coal trains (UPRR, 2006) and may be less likely to travel by barge on the EDM Reach. Moreover, unit train transport of coal to rail-served utility power plants normally entails no trucking.

The likelihood of a long-term influx of PRB coal is supported by U.S. Energy Information Administration (EIA) analysis (EIA, 2012). The figure below shows PRB coal becoming the lowest delivered cost option for much of the EDM market area by as early as 2010. The EIA analysis attributes the shift to mine prices for Central Appalachian coal rather than to transportation costs:

> "The decline in competitive market area for [Central Appalachian] can be attributed entirely to mine price." (EIA, 2012)



A brief review of the power plants receiving coal via EDM in 2012[2] suggests that plants without rail connections accounted for about 46 percent of the utility coal.[3] The rest of the plants appear to have rail connections either for receiving coal or for other purposes; these plants could potentially receive PRB coal by rail in the future instead of increasing their inbound coal shipments via barge.

The traffic forecasts used in Appendix B and the DFR/EIS do not appear to account for the predicted sourcing shift. By applying growth rates to existing routings, the traffic forecast may have significantly overestimated the traffic that will ultimately move on the EDM Reach.
The TVA rate analysis (Appendix B, Attachment 4) appears to assume existing sources and routings, and does not appear to consider PRB coal sourcing (Table 3). The cost savings estimates (e.g., the lower cost

[2] Per USACE table provided in response to Panel clarifying questions discussed at the April 24, 2014 mid-review teleconference with the Panel and USACE (facilitated by Battelle).

[3] Derived using Google Earth Pro, May 7, 2014.

of barge over rail) are not reliable if the coal originates on rail at the source, or if rail becomes the dominant delivery mode at some utility plants. The TVA analysis also estimates land line-haul miles as a function of water line-haul miles (p. 13), based on existing sources. This relationship may change dramatically with a shift to PRB coal.

The social (external) cost analysis (Appendix B, Attachment 5, Addendum 1, p. 13) apparently assumed that if coal is diverted to rail during short lock closures (<60 days), it would be trucked to rail and later transferred back to barges. This appears unlikely for PRB coal.

Significance – High

A shift to PRB coal could affect the future coal traffic flows on the EDM Reach and could change the project benefits.

Recommendations for Resolution

1. Analyze the potential impact of the predicted influx of PRB coal on traffic projections, rate analyses, and social cost estimates.
2. Make appropriate adjustments to estimated project benefits and document the process used in support of these changes.
3. Update the relevant report sections as needed.

Final Panel Comment 5

The sensitivity analysis does not address the vulnerability of the benefits estimate and the BCR to recent traffic volume declines, estimated truck and rail rates, potential changes in coal sourcing, or combinations of these factors.

Basis for Comment

Projects benefits are determined by the volume of traffic carried and the rates/costs for alternate routing during closures. Both the traffic volume and the routing during closures are affected by commodity sourcing. As presented, the sensitivity analysis does not address all of these factors, nor does it address them in combination and as such it does not completely document the vulnerability of the BCR to inaccuracies in the estimates or changes in the situation.

Although Appendix B addresses the sensitivity of project benefits to traffic forecasts, recent volumes have been appreciably lower than any of the scenarios considered. In 2012, total Emsworth tonnage was approximately 25 percent below the "No Growth" scenario (Appendix B, Attachment 7, Table 12).

As shown below, the project benefits depend overwhelmingly on estimates of transportation losses from unscheduled closures. These estimates depend in turn on the truck and rail rates and costs that shippers would incur, primarily derived from the TVA Transportation Rate Analysis (Appendix B, Attachment 4).

Average Annual Costs and Benefits - Million $

Benefits	WOPC	600' NED (LMA 7)	Incremental Benefit	Share
Waterway Transportation Surplus	451.4	474.3	22.9	12%
Transportation Losses from Unscheduled Closures	-199.7	-40.0	159.7	87%
Externatility Costs Incurred	-2.1	-0.9	1.2	1%
Benefit Total	249.6	433.4	183.8	100%

Sources: Appendix B Tables 7-4 and 9-4

Those rates were largely estimated rather than derived from surveys or actual rate quotes. The estimated benefits and the BCR would therefore appear to be highly sensitive to the accuracy of the rate estimates. An analysis of this sensitivity would increase confidence in the findings and highlight any issues that require further analysis.

The LTI (2012) report shows that for all forecast scenarios (including the original forecast), coal originating in the PRB accounts for the growth in ORS steam coal consumption after about 2030 (Figures 33 through 36). This shift in sourcing could markedly alter the outlook for steam coal movement on the EDM Reach and the effects of unscheduled closures.

The three factors – traffic outlook, rates, and PRB coal sourcing – could have much greater impacts combined than separately, and some impact could be off-setting. For example, lower traffic levels would lower the BCR, but a growing difference between barge and rail rates would increase it. It would therefore be useful to determine the sensitivity of the BCR to combined impacts as well as separate impacts.

Significance – Medium/High

Appropriate sensitivity analysis would improve the understanding of the potential project and the sensitivity of the BCR to combined and separate impacts of the variables discussed above.

Recommendations for Resolution

1. Analyze and document the sensitivity of the estimated project benefits and the BCR to recent

traffic levels.
2. Analyze and document the sensitivity of the estimated project benefits and the BCR to truck and rail rate estimates.
3. Analyze and document the sensitivity of the estimated project benefits and the BCR to PRB sourcing of steam coal.
4. Analyze and document the sensitivity of the estimated project benefits and the BCR in combination (e.g., more recent truck and rail estimates applied to more recent traffic levels).

Final Panel Comment 6

The computed contingencies used for the TPC estimate do not consider (1) risks due to funding and schedule uncertainties and (2) some risks involved in implementing the recommended plan.

Basis for Comment

The base level estimate for this project, $1,729,973,000, appears to be well documented in the second-generation Micro-Computer Aided Cost Estimating System (MCACES MII). However, several risks were not included when contingencies were computed to develop the TPC estimate, which could result in a TPC that is significantly understated. According to the General Engineering Appendix, it was decided not to assign risk associated with:

- delayed receipt of funding for design and construction,
- failure of the dam or lock prior to initiation of construction, and
- the impact of splitting each project into multiple contracts.

Engineer Technical Letter (ETL) 1110-2-573 (USACE, 2008) requires the TPC estimate to reflect the risks involved with implementing the recommended plan when calculating contingencies for the TPC. The estimate must consider the risk from external influences, including, among several others, the assurance of external funding (Section 6.2.4.1).

The risk analysis starting in January 2010 concluded that the baseline MCACES estimate and schedule, which are based on a 'capability' assumption of having concurrent preconstruction engineering and design (PED) and construction for all three projects, is "unrealistic based on funding constraints, and the projects would likely have to be staggered and will not receive funding for many years."

According to the Emsworth site appendix, p. 17-18, several key factors drive the funding stream, all of which were fairly uncertain. These factors include:

- the current and future status of the Inland Waterways Trust Fund,
- the availability of Congressional funding,
- the current status of other projects ahead of this project, and
- the possibility of other projects currently in the study phase moving ahead of this project in the funding list.

Cost and schedule models were run under several different scenarios. While these scenarios were being analyzed and run through the model, the risk analysis team found that these risks critical impacts on the contingency and have significant effects on the other risk events, making the project appear either uneconomical or beneficial. USACE concluded that it was "outside of their authority to make assumptions on the availability of funding, and should no longer include or consider funding constraints associated with availability in the risk model" (Emsworth site appendix, p. 17-19). Appendix D-2 of the cost risk analysis for the Emsworth site appendix states that USACE "plans on having this issue resolved during the feasibility study reviews." It appears to the Panel that the issue of how to assign appropriate risk to the uncertain funding for this project is still unresolved.

It appears that a significant amount of risk involved with lock failure was removed before beginning construction of the new lock under the assumption that "it falls outside of the scope of works." The risks of lock failure which would occur during the construction of the new lock, and not the risk of navigation dam or lock failure occurring prior to initiation of construction were the only risks evaluated. Those risks include failure of either the river or lock chamber prior to planned construction leading to expedited construction

which would have significant impact on construction costs.

Additionally, risk was not assigned to reflect the impact of splitting each project into multiple contracts due to funding constraints, inability to use the continuing contract clause, or inability to find sufficient contractor capability to perform in the restricted time frame. All of these factors have significantly impacted the cost of construction on other projects.

The TPC estimate for the recommended plan is $2,143,687,000 (October 2013 dollars) based on an overall contingency of 22 percent, reflecting only those risks that occur once construction is initiated. Not included in the contingencies are the risks associated with delayed funding, lock or dam failure prior to initiation of construction of the new lock, or a need to split the project into multiple contracts. If these risks are not included in determining the contingencies for the TPC, the project is not in compliance with the requirements of ETL 1110-2-573. When computing the TPC, use of a contingency percentage that reflects all the risks will impact the final BCR for the project..

The DFR/EIS indicates that cost-time adjustments due to inflation will be mitigated through the Water Resources Development Act, Section 902, in that the start date of each project will define the appropriation amount (Emsworth site appendix, p. 17-19). However, this inflation adjustment does not replace the significant risks involved with delayed receipt of design and construction funding.

Significance –Medium/High

Economic justification for the recommended plan could be impacted once all the risks are included in computing contingencies for the TPC estimate.

Recommendations for Resolution

1. Develop funding schedules and associated risks considering more realistic assumption of when funds might be made available for this project.
2. Assign risk associated with the possibility of having lock or dam failure occur before construction starts.
3. Assign risk associated with the possibility of having to split each project into multiple contracts due to funding constraints.
4. Determine contingencies for the TPC estimate commensurate with the revised schedule and associated risks.

Final Panel Comment 7

The RMA costs are incomplete and could impact the selection of the future WOPC.

Basis for Comment

The process and findings for selection of the future WOPC are incomplete and are not consistent with USACE guidelines. Engineer Regulation (ER) 1105-2-100 states: "Proper definition and forecast of the future without-project condition are critical to the success of the planning process. The future without-project condition constitutes the benchmark against which plans are evaluated." (USACE, 2000)

The RMA was selected as the future WOPC, but the costs associated with RMA appear incomplete for the following reasons:

- The cost estimates are based on the assumption that funding will be available for repairs when failure occurs. However, in the event of a major failure, USACE will likely have to rely on reprogramming its operations and maintenance (O&M) funds from other projects, probably outside the Pittsburgh District. This possibility is likely to substantially increase the duration of lock closure and the costs associated with disrupted navigation.
- The consequences resulting from a major failure on one of the navigation locks is too large to rely upon a 'Fix as Fails' approach. Procuring sufficient Federal funds during an emergency is difficult but would probably be insignificant when compared to the several months or years that the entire navigation system would be shut down. Attachment 1 to the General Engineering Reference Data Appendix provides estimates of action cost and duration for the chamber to be out of service under emergency conditions. Costs/durations for Emsworth are shown below as an example; values for Dashields and Montgomery would be comparable:

Failure Mode	Cost ($)	Duration for chamber out of service
Replace the wall stem	$19.4M	12 months
Replace the miter gate anchorages	$13.3M	7 months
Replace the land wall monoliths	$291.4M	42 months
Replace the miter gate anchorages	$12.9M	8 months
Replace the middle wall monoliths	$144.1M	36 months
Replace the US and DS guide wall monoliths	$193.8M	32 months

- Page 4-65 of the DFR/EIS states: "Major Rehabilitation of any auxiliary (land) chamber components after construction of a new river chamber is not deemed worthy of economic analysis due to the assumed reliability of the new river chamber components."

  This statement implies that a second lock is not needed; it could fail and not be repaired. This is not consistent with the assumption in the study that the existing 110-foot by 600-foot lock chamber will become the auxiliary chamber.

- The Executive Summary (p. ES-13) states: "Allowing for scheduled replacement of components resulted in numerous economically justified component replacements in the main (land) chambers with optimal timings before 2020, including the land and middle walls. The total cost of these replacements alone would be over $1 billion, mostly for the walls that would each require two years or more to replace. This cost does not account for the added delay cost to industry (lost navigation benefits). As a consequence, scheduled replacement of components was deemed too costly to include in the WOPC, but it was considered in the formulation of With-Project Condition plans. Therefore, the WOPC for EDM was deemed to consist of Reactive

Maintenance only."

The Executive Summary (p. ES-13) further states: "The navigation WOPC carries with the increasing likelihood of extended lock closures with reactive maintenance, and even the possibility of loss of pool from lock wall failure."

- Since the scheduled replacement of components is economically justified, has a cost of over $1 billion, and could take more than 2 years, it appears they should be included in the future WOPC.
- The potential for loss of pool is not adequately addressed. While the probability of loss of pool may be low, potential damages could be substantial. Potential damages associated with loss of pool involve loss of water supply, environmental damages, extended navigation disruptions (which would likely exceed disruptions caused by wall failure without loss of pool), the loss of the ability of municipalities and industries to dispose of treated wastewater, and potential safety hazards to life and property if the loss of pool is sudden.
- The DFR/EIS notes that O&M budgets are not growing significantly. Unanticipated demand for limited O&M funding that would occur with RMA will compete with other important O&M needs. If the funding is made available, it is probable that another USACE district or division O&M project will be delayed. These impacts are not addressed in the report.

Significance –Medium/High

An incomplete accounting of the costs of the RMA may have led to identification of a future WOPC that does not provide the most efficient and cost-effective strategy. Identification of an inappropriate future WOPC may impact the evaluation of alternative plans and the selection of the recommended plan.

Recommendations for Resolution

1. Re-evaluate the cost assessment of the RMA that considers the reasons cited in the bullets in the Basis.
2. Re-evaluate possible alternative strategies for the future WOPC, based on the re-evaluation of RMA costs.
3. Document the approach taken and the results of the evaluation of major rehabilitation for the future WOPC consistent with Appendix E of ER 1105-2-100 in the DFR/EIS.

Final Panel Comment 8

It is unclear why the RMA was selected as the future WOPC, even though it was more costly than the AMA.

Basis for Comment

The DFR/EIS concludes that Major Rehabilitation was not considered as a future WOPC because it was too costly (Section 4.5.1). However, there is no known law, regulation, or policy that places a cap on the total cost of a major rehabilitation report. Furthermore, the RMA is selected as the future WOPC, even though it was found to be more costly than the AMA in terms of capital costs and costs due to navigation delays. This could impact the evaluation of alternative plans and selection of the recommended plan.

A major rehabilitation project will have to successfully compete as a new start based on a Rehabilitation Evaluation Report that provides a level of detail and evidence of criticality commensurate with other Civil Works new starts. Appendix E of ER 1105-2-100 provides guidance on the process for developing a Rehabilitation Report (USACE, 2000). The DFR/EIS should include a similar analysis to define major rehabilitation. The process starts with identification of a "base condition" that represents the most efficient measures possible without rehabilitation. For the EDM locks and dams, the base condition would be the RMA.

USACE guidance for Rehabilitation Evaluation Reports calls for the following step-wise analyses, all of which were performed for the Upper Ohio Navigation Study:

- evaluate the probability of unsatisfactory performance,
- estimate the frequency of service disruption and physical consequences,
- develop an event tree,
- estimate all costs of correction,
- estimate the economic cost of each service disruption, and
- perform a Monte Carlo simulation to combine risks and determine expected values.

According to the guidance, the "With Rehabilitation" alternatives should include Advanced Maintenance, Scheduled Maintenance, Scheduled Rehabilitation, and Immediate Rehabilitation.

The DFR/EIS assesses most of these alternatives, but assigns the name "Major Rehabilitation" to the "Immediate Rehabilitation" option. The "Advanced Maintenance" option was treated separately. The other options (Scheduled Maintenance and Scheduled Rehabilitation) are not addressed, although it is likely that either would be superior to the RMA due to their lower costs in terms of capital costs and disruptions to navigation. The DFR/EIS provides a reasonable level of detail and evidence that the AMA would likely satisfy the current budget criteria. The report states (Section 4.5.2.3): "The optimal replacement dates for the land, middle, and guide walls at each facility dramatically demonstrate that the most economically efficient strategy involves systematic replacement of almost every wall forming the main chambers at each site and Emsworth's guide walls."

Adopting the AMA, or potentially the Scheduled Maintenance or Scheduled Rehabilitation options, as the future WOPC would provide a budgeting and implementation strategy that would minimize required capital costs, minimize disruptions of navigation, and provide a budgetary planning tool to support district and division decisionmaking. The socioeconomic and environmental impacts of the alternative plans would then be compared with the revised future WOPC to determine whether the recommended plan is appropriate.

Significance – Medium/High

Because USACE did not follow the ER 1105-2-100 guidance for consideration of major rehabilitation when establishing the future WOPC, it is likely that selection of the RMA is not appropriate. This could impact the evaluation of alternative plans and selection of the recommended plan.

Recommendations for Resolution

1. Evaluate the other two Major Rehabilitation options (Scheduled Maintenance and Scheduled Rehabilitation), compare them with the AMA and RMA consistent with Appendix E of ER 1105-2-100, and evaluate whether a new future WOPC is warranted.
2. Reassess project socioeconomic and environmental impacts of the alternative plans relative to the new future WOPC.

Final Panel Comment 9

The VE study for this project developed several revised design technique proposals and comments that are not considered but could potentially have significant impacts on project cost and selection of the recommended plan.

Basis for Comment

A VE study on this project was performed in May 2013 in accordance with ER 11-1-321 (USACE, 2011a). Several proposals and comments were considered, three of which merit further consideration for implementation as a part of the DFR/EIS due to the significant costs involved:

- Four revised design techniques with a cost avoidance of $350 million
- Optimal length of upstream guardwalls
- Sampling of river sediments for HTRW

Revised Design Techniques: The VE team considered the following design techniques that have been used at other navigation locks on the Ohio River and the Upper Mississippi:

- Filled coffer cells rather than permanent lock walls for the new 600-foot riverward lock. Savings could be used to rehabilitate or reconstruct the existing landward lock.
- Float-in lock wall modules similar to Braddock, facilitating more efficient construction and improved quality control of the new lock walls.
- Cofferdam approach similar to Chickamagua, where the new middle wall would be constructed using a combination of in-the-wet and in-the-dry methods and the riverside wall totally in the dry.
- Design of the chamber lock walls so that only the miter gate bays would be dewatered.

According to the VE team, these design techniques could result in a cost avoidance of $350 million (17 percent of the Total Project Cost) (p. 9 of the Value Engineering Study Report dated June 10, 2013.) Because these proposals could result in sizable cost savings to the project, the applicability of these techniques at EDM should be considered in the feasibility phase and not postponed to the PED phase.

Guardwalls: The VE team recommended that the length of the proposed upstream guardwalls be re-examined. Section 2.1.1 of the Engineering Appendix indicates that the proposed length of the upstream guardwall was determined to be 600 feet, matching the length of the lock chamber.

The Panel has several concerns based on previous research regarding the safety and efficiency of using an upstream 600-foot wall length with 1,200-foot tows:

- Downbound tows must reduce speed as they approach the end of the wall, thus losing steerageway and the ability to overcome the effects of currents (CHL, 2004)
- Strong cross currents at the end of the guardwall will tend to result in higher approach velocities, which can result in greater wall impact loads and increased danger of hitting the lock gates and landwall bullnose (CHL, 2004).
- Tows, which are anchored against guard walls that are shorter than the tow, expose portions of the tow to cross currents and tend to rotate the tow around the upper end of the guard wall (Wooley, 1989).

The Panel also notes additional lockage times when second downbound tows have to wait further upstream while the first tow completes its double lockage. The VE team noted that physical modeling of approach conditions at Locks and Dams 22 and 25 on the Upper Mississippi River (where the new proposed lock is also located riverward) considered multiple wall lengths prior to finalizing the length at 1,200 feet. Conditions at EDM may also warrant 1,200-foot upstream guardwalls.

Since determination of the guardwall length has such a major impact on construction cost and will likely require time-consuming model studies before plans and specifications are prepared, the recommended length should be determined during the feasibility phase.

Hazardous, Toxic, and Radioactive Waste: The VE team recommended verification on whether any HTRW has accumulated in the river sediments. If so, the sediments will require special handling and disposal during channel excavation. Information provided to Battelle by USACE at the request of the Panel confirmed that sediment being excavated for the new lock chambers and guardwalls has not undergone Phase I testing for the presence of HTRW. Considering the characteristics of the sediments and potential volume of material that may need special handling and disposal, river sediments should be tested for HTRW during the feasibility phase of the study.

Significance –Medium/High

The potential $350-million cost avoidance, modeling time requirements for re-evaluating the proposed guardwall lengths and potential increase in project cost, and the potential cost to remove and dispose of HTRW sediments could have significant impacts on the selection of the recommended plan.

Recommendations for Resolution

1. Evaluate the applicability of the VE team's revised design techniques as a part of the feasibility phase of the study.
2. Re-evaluate the appropriate length of upstream guardwalls for each of the EDM sites during the feasibility phase.
3. Conduct Phase I HTRW testing of the river sediments likely to be disturbed during the construction of the new locks and guardwalls.
4. If warranted, revise the recommended plan design details and associated estimate of cost.

Final Panel Comment 10

The Planning, Engineering, and Design (PE&D) estimated cost of 15 percent of construction costs may be overstated since much of the plans, specifications, and modeling can be used at multiple sites.

Basis for Comment

Section 17.1.2.8 of the Emsworth site appendix indicates that the percentage of PE&D was "determined by the Project Design Team and district resource providers based on the results of similar projects in the region." This 15 percent assumption results in a PE&D estimate of $268,845,000 for the three projects.

The VE Study (p. 119) for this project states that the actual PE&D costs for other multi-million dollar Ohio River navigation projects (e.g., Olmsted, Marmet, and Monongahela) were significantly less than15 percent of the construction costs based on 2008 data.

Since the EDM projects are to be designed concurrently and will result in repetitive design efforts for the structural, mechanical, and electrical features at the three EDM lock sites, the overall PE&D costs should also be significantly reduced.

Significance – Medium

The percentage of PE&D for other similar projects indicates that significant savings could be realized in the estimated PE&D costs for this project, especially given the repetitive designs for the structural, mechanical, and electrical features at the three EDM sites.

Recommendations for Resolution

1. Review other navigation projects for actual PE&D costs to determine PE&D costs for the first EDM lock.
2. Estimate the PE&D cost for the second and third EDM locks considering the repetition in design with the first lock site.

Final Panel Comment 11

The assumption that all authorized projects will be implemented in the future may not be realistic, which could affect the impacts of the WOPC and with project condition (WPC) alternatives.

Basis for Comment

Nationwide, many authorized USACE projects have not been implemented. It is likely that many of these will never be implemented; others will require re-evaluations that could substantially alter the recommended plan. Implementation of authorized projects in the future could alter the impacts under both the WOPC and WPC alternatives. The DFR/EIS states: "The WOPC also includes all authorized improvements in the Ohio River Basin that are either under construction or are pending appropriations." (DFR/EIS, Section 4.5.1, p. 4-32)

The report does not discuss the specific projects that are assumed to be in place and does not provide a rationale for USACE's assumption that the projects will be implemented.

Significance – Medium

The existence of other projects could affect the performance and the impacts of the EDM recommended plan.

Recommendations for Resolution

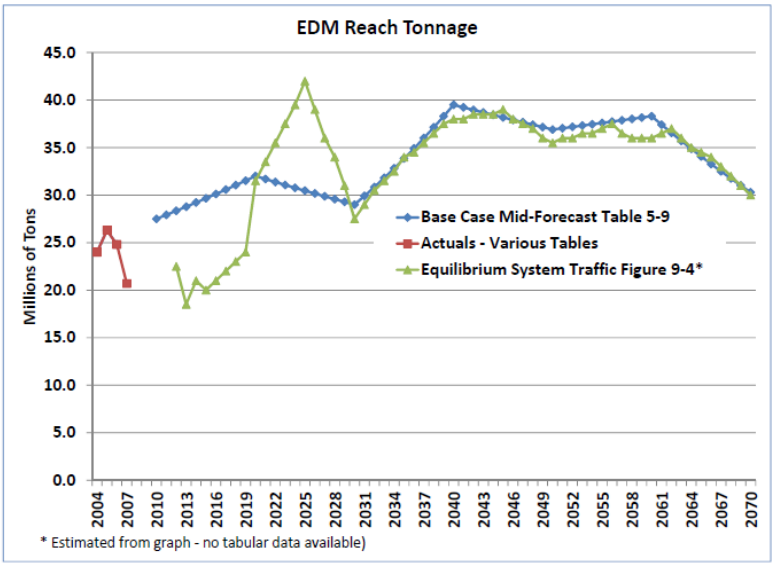
1. Expand the discussion of the future WOPC and WPC to include a description for each project in the Ohio River Basin that is currently authorized but not constructed.
2. Assess the probability that the project will be constructed, and analyze potential impacts under the WOPC and WPC alternatives.

Final Panel Comment 12

The Economic Appendix of the DFR/EIS does not explain the derivation of the "Equilibrium System Traffic" and "Equilibrium System Savings" shown for the National Economic Development (NED) plan.

Basis for Comment

Appendix B of the DFR/EIS presents graphs of "Equilibrium System Traffic" (Figure 9-4), and "Equilibrium System Savings" (Figure 9-6). As shown below, however, the Equilibrium System Traffic estimate appears significantly different from the Base Case forecast presented in Table 5-9 (which was derived from the Projected Traffic Demands in Attachment 3, Table 3-7).



The Equilibrium System Traffic greatly exceeds the Traffic Demand Forecast in 2020-2030. In particular, the Equilibrium System Traffic estimate shows a 31 percent increase in 2019-2020, and rapid growth in 2020-2025, that are not explained in the text.

Significance – Medium

Project benefits, as displayed in "Equilibrium System Savings" (Figure 9-6), appear to depend on the "Equilibrium System Traffic" (Figure 9-4), making the linkage between these concepts and the Traffic Demand Analysis critical to project understanding.

Recommendations for Resolution

1. Revise Appendix B to explain the relationship between the Equilibrium System Traffic and the Projected Traffic Demands.

Final Panel Comment 13

The DFR/EIS does not contain sufficiently detailed project benefits tables to allow for assessment of the relative importance of commodity flows and benefit sources.

Basis for Comment

Project benefits are summarized in Appendix B, Table 9-4, in three categories: Waterway Transportation Surplus, Transportation Losses from Unscheduled Closures, and Externality Costs Incurred. About 87 percent of the NED plan's benefits are in the Transportation Losses from Unscheduled Closures category, but no further breakdown of this category is provided. The Panel cannot determine from the tables and figures in the DFR/EIS how much of the benefits are attributable to coal movements versus other commodities, to upbound/inbound flows versus downbound/outbound flows, or to substituted trucking costs versus substituted rail costs. Without this level of detailed information, the reasonableness of the findings cannot be assessed.

Significance – Medium

Assuming that the detailed breakdown would reflect reasonable benefits estimates and sources, providing more detail would increase confidence in the conclusions.

Recommendations for Resolution

1. Augment the Appendix B benefits tables and charts with more detailed breakdowns by commodity, direction, and type (i.e. transportation costs avoided from closures, water transportation surplus, and social costs),.

Final Panel Comment 14

The metrics used to formulate and screen ecosystem restoration alternatives are not described, and it is unclear how these alternatives relate to the project's planning objectives for ecosystem restoration.

Basis for Comment

The Upper Ohio Navigation Study ecosystem restoration objective is clearly stated. The DFR/EIS references the Programmatic EIS prepared for the Ohio River Mainstem System Study (ORMSS) and describes the 26 high-priority ecosystem restoration opportunities. It then identifies a subset of five ecosystem restoration opportunities applicable to the Upper Ohio Navigation Study. These opportunities could be used to establish evaluation metrics that relate to the ecosystem restoration objectives.

A feasibility report is intended to describe a planning process that formulates, screens, and evaluates alternatives based on a clearly defined set of planning objectives. The DFR/EIS does not describe how the formulation and screening of ecosystem restoration alternative plans relate to the planning objectives even though applicable ecosystem restoration opportunities are made known. As a result, it is not possible to verify that the initial set of alternatives represent a comprehensive range of possibilities or that they are meeting the planning objectives to the maximum extent possible.

Plan formulation typically begins by identifying a set of management measures, each of which will fully or partially meet one or more planning objectives. The DFR/EIS does not describe how management measures were formulated and combined into alternatives. But more importantly, it does not describe how the initial set of 17 alternatives (Section 4.7.3) was formulated based on the planning objectives. Additionally, there is no description of a common set of metrics that were applied uniformly to the initial 17 alternatives to screen them down to a final set of 9 alternatives based on how well they achieved the planning objectives. There is a discussion of why each screened-out alternative was dropped, but it is not obvious that the same criteria were applied in the same manner to all alternatives. As a result, it is not clear that alternatives were screened based on how well they met the study planning objectives.

Significance – Medium

Because the description of the formulation and screening of alternative ecosystem restoration plans is limited, the final set of alternatives may not represent plans that will most effectively address the ecosystem restoration planning objectives.

Recommendations for Resolution

1. Revise Section 4.7.3 to describe how the initial set of 17 alternatives was formulated based on the planning objectives.
2. Clarify the set of metrics applied to the alternatives and how they were uniformly applied to all alternatives.
3. Revise Section 4.7.3 to clarify how the screening process was based on the ecosystem restoration planning objectives.

Final Panel Comment 15

Appropriate mitigation measures to reduce the potential impacts on environmental resources are identified, but the commitment to their implementation and over what timeframe has not been discussed.

Basis for Comment

On January 14, 2011, the White House Council on Environmental Quality (CEQ) issued mitigation and monitoring guidance under NEPA (CEQ, 2011). The guidance addresses mitigation that an agency has committed to implement as part of a project design and mitigation commitments informed by the NEPA review process. The guidance also states that: "When agencies do not document and, in important cases, monitor mitigation commitments to determine if the mitigation was implemented or effective, the use of mitigation may fail to advance NEPA's purpose of ensuring informed and transparent environmental decisionmaking." (CEQ, 2011)

Mitigation measures are used to reduce impacts to acceptable levels or to promote sustainability for Valued Environmental Components. Section 4.6.10.4, Conclusion, of the DFR/EIS states: "Environmental impacts of Plan LMA [Lock Modernization Alternatives] 7 have been identified and appropriate mitigation included in the plan. In view of the above assessment, Plan LMA 7 is also the Preferred Navigation Plan" (DFR/EIS, p. 4-163).

Therefore, determining specific "appropriate mitigation" measures and committing to their implementation are important to the completeness and acceptability of the WPC. The specifics of these mitigation measures may be deferred until more detailed information is available in a later phase. These deferred mitigation measures include measures related to fish passage; cultural resources; protected species; fish; mussels; aquatic habitat; terrestrial habitat; riparian resources; floodplains; HTRW; and invasive species.

In the Panel's experience, it is common practice to defer finalizing mitigation measures until more detailed information is available and additional agency coordination is conducted. The Panel has also experienced projects in which early commitments to mitigate were later overlooked when staff changed or when a project progressed to a new phase such as PED, final design, construction, or O&M. These phases can take place over an extended timeframe. Other agencies such as the Federal Highway Administration and state transportation departments incorporate an environmental commitments/requirements checklist to address this issue and ensure that appropriate mitigation is provided (see attachment to this comment).

Section 5.1.4, Environmental Features and Commitments, presents one specific mitigation measure for aquatic habitat impacted by lock construction. This measure commits to placing large woody debris in Montgomery Slough. It also commits to further agency and stakeholder coordination, monitoring, and adaptive management related to debris placement. The remainder of Section 5.1.4 discusses future opportunities to consider additional measures related to mitigation, ecosystem restoration, environmental sustainability, beneficial use of dredge material, and other measures to improve the environment.

The deferral of finalizing mitigation commitments leaves a degree of uncertainty regarding compensation for unavoidable impacts. The DFR/EIS should clarify that studies will continue and that future decisions on environmental issues such as appropriate mitigation are pending.

Significance – Medium

The DFR/EIS's findings on level of significance of potential impacts could be affected if the project does not follow through on unspecified mitigation and/or environmental improvement measures.

Recommendations for Resolution

1. Add a section at the end of Section 5 of the DFR/EIS that tabulates:
    a) environmental commitments and deferred actions (including determining appropriate mitigation),
    b) a timeframe for when they will be addressed, and
    c) conditions or limitations such as USACE policies, costs, authorities, or other constraints that could affect implementation.

    An example checklist is below (Attachment 1 of this Final Panel Comment).
2. Section 5 of the DFR/EIS should clearly state that studies will continue and that future decisions on environmental issues such as appropriate mitigation are pending.

Attachment 1

ENVIRONMENTAL COMMITMENTS/REQUIREMENTS

Project No.:

Parish:

Status:

Date Updated:

COMMITMENT/REQUIREMENT	DOCUMENT STIPULATED IN	RESPONSIBLE OFFICE	PLACE ON PLANS (Yes or No)	REQUIRES A SPECIAL PROVISION (Yes or No)	STATUS
Pre-Construction Commitments					
During Construction Commitments					
Post Construction Commitments					

Final Panel Comment 16

The potential impacts of climate change on the recommended plan are not described.

Basis for Comment

Climate change is a relatively new issue with considerable uncertainty. Based upon the Panel's experience with similar navigation projects, the potential environmental impacts and operational effects associated with climate change are not expected to be major. However, failure to document the USACE consideration of the potential effects of climate change (including excessive high temperatures, more frequent heavy downpours, more severe droughts, and long-term demands for electric power and steam coal) could represent an oversight.

USACE's Climate Change Adaptation Plan and Report 2011 set forth guidelines for all USACE missions, operations, programs, and projects to address the issue of climate change. The report includes a Climate Change Adaptation Policy Statement (CCAPS) expressing the following principles that are relevant to the DFR/EIS:

> "It is the policy of the USACE to integrate climate change adaptation planning and actions into our Agency's missions, operations, programs, and projects. USACE shall continue undertaking its climate change adaptation planning, in consultation with internal and external experts and with our Districts, Divisions, and Centers, and shall implement the results of that planning using the best available – and actionable – climate science and climate change information." (USACE, 2011b)

The Climate Change Adaptation Plan and Report was reissued in 2013. That more recent report emphasizes the importance of the CCAPS, stating that the policy "remains in force in 2013 and provides the USACE policy framework for climate change adaptation" (USACE, 2013).

Furthermore, on November 6, 2013, Executive Order 13653—Preparing the United States for the Impacts of Climate Change was issued. This Executive Order augments the CCAPS, establishes a national policy to prepare the nation for the impacts of climate change, and directs Federal agencies to integrate consideration of climate change into agency operations and overall mission objectives. USACE's framework for considering and addressing climate change also includes a 2010 presentation titled "Adaptation to Climate Change" (USACE, 2010).

A USACE pilot study is currently under way to formulate mitigation and adaptation strategies through regional collaboration with the Ohio River Basin (ORB) Alliance. The aim of the pilot study is to collaboratively develop mitigation and adaptation strategies with the ORB Alliance to counteract the anticipated water resource, ecological, and infrastructure impacts of climate change. One intended product is the formation of a permanent climate change working group within the ORB Alliance.

Finally, an important "checklist" item for the DFR/EIS is to document potential risk and vulnerabilities of the operation of the proposed navigation improvements to determine how the CCAPS applies.

Significance – Medium/Low

The USACE CCAPS requires that the potential impacts related to climate change be addressed.

Recommendations for Resolution

1. Discuss the potential effects of climate change, either in the final EIS or in a brief attachment to the DFR/EIS. Include the implications climate change could have on power demands, system operations, engineering, economic analyses, and ecosystems.
2. Document potential risk and vulnerabilities of the operation of the proposed navigation improvements to determine how the CCAPS applies.
3. Include a discussion of the USACE pilot study with the ORB Alliance to demonstrate consideration of climate change in the Ohio River Basin.

Final Panel Comment 17

The hydraulic analyses performed to support decision-making are not described in sufficient detail to determine the reasonableness of the findings.

Basis for Comment

Several important findings presented in the DFR/EIS were based on hydraulic analyses, but there are no descriptions of the data or of the methodologies/models used, nor is there an explanation of the findings. Some examples of important findings that were based on hydraulic analyses are:

- evaluation of the Lock Modernization Alternatives (LMAs) to assess impacts on dam discharge capacity;
- development of hydraulic designs for modification of the dams required for the LMAs;
- evaluation of impacts of the 3-Lock Modernization Plans on dam discharge capacity;
- determination of changes in flood stages for the 2-Lock Modernization Plans; and
- assessment of difficult approach conditions at EDM and difficult navigation conditions due to the design of the Emsworth filling and emptying system.

Because the supporting hydraulic analyses for these issues are not described in sufficient detail, the validity of the findings cannot be confirmed.

Significance – Medium/Low

The DFR/EIS does not provide adequate information on the supporting hydraulic analyses and hydraulic designs to allow the results to be assessed.

Recommendations for Resolution

1. Describe in detail all aspects of the hydraulic analyses, including data sources and characteristics, assumptions, and methodologies/models used.
2. Explain how these aspects of the analyses were applied, provide the results, and discuss the findings and conclusions in the relevant report sections.

5. REFERENCES

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APPENDIX A

IEPR Process for the Upper Ohio Project

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

Table A-1 presents the schedule followed in executing the Independent External Peer Review (IEPR) for the Upper Ohio Navigation Study Draft Feasibility Report (hereinafter: Upper Ohio IEPR). Due dates for milestones and deliverables are based on the award/effective date of September 25, 2013. The U.S. Army Corps of Engineers (USACE) provided most of the review documents on April 7, 2014, which allowed Battelle to initiate the panel review process. The Real Estate Plan and the Hazardous, Toxic, and Radioactive Waste (HTRW) review and supplemental documents were provided on April 28, 2014, after the review had begun. This did not impact the schedule because it was still within the Panel's review period. Note that the work items listed under Task 6 occur after the submission of this report. Battelle will enter the 17 Final Panel Comments developed by the Panel into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that USACE can review and respond to them. USACE will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. All USACE and Panel responses will be documented by Battelle. Battelle will provide USACE and the Panel a pdf printout of all DrChecks entries, through comment closeout, as a final deliverable and record of the IEPR results.

Table A-1. Upper Ohio Complete IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	9/25/2013
	Review documents available[a]	4/7/2014
	Battelle submits draft Work Plan[b]	10/2/2014
	USACE provides comments on draft Work Plan	10/8/2014
	Battelle submits final Work Plan[b]	4/10/2014
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	9/27/2013
	USACE provides comments on COI questionnaire	10/1/2013
	Battelle submits list of selected panel members[b]	10/4/2013
	USACE confirms the panel members have no COI	10/9/2013
	Battelle completes subcontracts for panel members	10/24/2013
3	Battelle convenes kick-off meeting with USACE	10/3/2013
	Battelle sends review documents to panel members	4/10/2014
	Battelle convenes kick-off meeting with panel members	4/10/2014
	Battelle convenes kick-off meeting with USACE and panel members	4/15/2014
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	4/24/2014
4	Panel members complete their individual reviews	4/30/2014
	Battelle provides panel members with talking points for Panel Review Teleconference	5/5/2014

Table A-1. Upper Ohio Complete IEPR Schedule (continued)

Task	Action	Due Date
4	Battelle convenes Panel Review Teleconference	5/5/2014
	Battelle provides Final Panel Comment templates and instructions to panel members	5/6/2014
	Panel members provide draft Final Panel Comments to Battelle	5/13/2014
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	5/14/2014-5/20/2014
	Panel finalizes Final Panel Comments	5/21/2014
5	Battelle provides Final IEPR Report to panel members for review	5/22/2014
	Panel members provide comments on Final IEPR Report	5/23/2014
	Battelle submits Final IEPR Report to USACE[b]	5/27/2014
6[c]	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	5/27/2014
	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	5/28/2014
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	5/28/2014
	USACE provides draft Project Delivery Team (PDT) Evaluator Responses to Battelle	5/30/2014
	Battelle provides the panel members the draft PDT Evaluator Responses	6/2/2014
	Panel members provide Battelle with draft BackCheck Responses	6/4/2014
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	6/5/2014
	Battelle convenes Comment-Response Teleconference with panel members and USACE	6/6/2014
	USACE inputs final PDT Evaluator Responses to DrChecks	6/13/2014
	Battelle provides final PDT Evaluator Responses to panel members	6/16/2014
	Panel members provide Battelle with final BackCheck Responses	6/18/2014
	Battelle inputs the Panel's final BackCheck Responses in DrChecks	6/19/2014
	Battelle submits pdf printout of DrChecks project file[b]	6/20/2014
	Civil Works Review Board (CWRB) Meeting (Estimated Date)[d]	9/18/2014
	Contract End/Delivery Date	9/30/2014

a The Real Estate Plan and HTRW review documents were received on April 28, 2014. This did not affect the project schedule.

b Deliverable.

c Task 6 occurs after the submission of this report.

d The CWRB meeting was listed in the Performance Work Statement under Task 3 but was relocated in this schedule to reflect the chronological order of activities.

At the beginning of the Period of Performance for the Upper Ohio IEPR, Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan. In addition, 52 charge questions were provided by USACE and included in the draft and final Work Plans. Battelle added two questions that sought summary information from the IEPR Panel. The final charge also included general guidance for the Panel on the conduct of the peer review (provided in Appendix C of this final report).

Prior to beginning their review and within 3 days of the final review documents being available, all members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel. Battelle planned and facilitated a second kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meetings, the IEPR Panel received an electronic version of the final charge as well as the Upper Ohio 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.

- **Upper Ohio Navigation Study Draft Feasibility Report Executive Summary and Main Report (378 pages)**
- **Engineering Appendix**
    - **General Engineering Reference Data Appendix (GE) (928 pages)**
    - **Emsworth Engineering Site Appendix (ED-1) (418 pages)**
    - **Dashields Engineering Site Appendix (ED-2) (367 pages)**
    - **Montgomery Engineering Site Appendix (ED-3) (368 pages)**
- **Economics Appendix B (1,130 pages)**
- **Real Estate Plan (56 pages)**
- **Two Lock Modernized Plan (39 pages)**
- **Environmental Appendix**
    - **Benthic Substrate Characterization (80 pages)**
    - **Cumulative Effects Assessment (534 pages)**
    - **Clean Water Act, Section 404(b)(1) Evaluation (20 pages)**
    - **Ecosystem Restoration Study (327 pages)**
    - **Endangered Species Correspondence (11 pages)**
    - **Environmental Justice (10 pages)**
    - **Fish Passage Study (120 pages)**
    - **Hydroacoustic Survey (55 pages)**
    - **Construction Impact & Mitigation Analysis (81 pages)**
    - **Invasive Species Issues (11 pages)**
    - **Larval Fish Survey (397 pages)**
    - **Mussel Survey (104 pages)**

  - **Fish & Wildlife Coordination Act 2(b) Report ORMSS (72 pages)**
  - **Prior Environmental Reports (3 pages)**
  - **Upland Work Area Surveys (225 pages)**
  - **USFWS Planning Aid Report Update (297 pages)**
- **Cultural Resources (465 pages)**
- **HTRW Phase II Environmental Assessments Report (154 pages)**
- Ohio River Mainstem Study (ORMSS) (2,794 pages)
- HTRW Supplemental Information (Phase I report & Phase II appendices) (3,995 pages)
- USACE guidance Civil Works Review, (EC 1165-2-214) dated 15 December 2012
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

About halfway through the review of the Upper Ohio IEPR documents, a teleconference was held with USACE, the Panel, and Battelle so that USACE could answer any clarifying questions the Panel had concerning either the review documents or the project. Prior to this teleconference, Battelle submitted 26 panel member questions to USACE. USACE was able to provide responses to all of the questions during the teleconference or via email within 3 days of the call. The Panel developed 15 additional questions after the teleconference, which were provided to USACE via email. USACE responded to all of these questions through email correspondence.

In addition, throughout the review period, USACE provided documents at the request of panel members and in response to the clarifying questions. These documents were provided to Battelle and then sent to the Panel as additional information only; they were not part of the official review. These additional documents requested by the Panel are listed below.

- Upper Ohio River Navigation Study - Value Engineering Report, 10 June 2013
- Transportation Rate Analysis: Ohio River STSTEM - National Economic Development (report, Transportation Rate Analysis, Report Data Check(W L).xls and 11 surveys)
- Transportation Rate Analysis: Ohio River STSTEM - EDM Regional Economic Development (report and OHR2006 Data Check (WL12).xls)
- Transportation Rate Analysis: Ohio River EDM – Social Costs (report and Table 1 EDM Social Costs.xls)
- Social Costs of Barge Cargo Modal Diversions Due to Unscheduled Closures at Emsworth, Dashields, and Montgomery Locks (report and UT TRC Truck Externality.xls)
- Forecast of Utility Steam Coal Consumption, Sourcing and Transportation for the Great Lakes and Ohio River Basin Regions Shale Gas Scenario, Final Report, Leonardo Technologies, Inc, July 30, 2012.
- Memorandum For: Commander, Lakes and Rivers Division (CECW-LRD, 1110-2-1150a), 28 September 2007
- CELRP-BR-EMFR, September 17, 2007

A.2 Review of Individual Comments

The Panel was instructed to address the charge questions/discussion points within a charge question response table provided by Battelle. At the end of the review period, the Panel produced individual

comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. At the end of the review, Battelle summarized the individual comments in a preliminary list of 13 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

A.3 IEPR Panel Teleconference

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

The Panel also discussed responses to one specific charge question where there appeared to be disagreement among panel members. The conflicting comment was resolved based on the professional judgment of the Panel. This comment was determined to be a non-significant issue.

At the end of these discussions, the Panel identified 20 comments and discussion points that should be brought forward as Final Panel Comments.

A.4 Preparation of Final Panel Comments

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

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

- Directive to the Lead: Each lead was encouraged to communicate directly with the other panel member as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.

- Format for Final Panel Comments: Each Final Panel Comment was presented as part of a four-part structure:

1. Comment Statement (succinct summary statement of concern)
2. Basis for Comment (details regarding the concern)
3. Significance (high, medium/high, medium, medium/low, and low; see descriptions below)
4. Recommendation(s) for Resolution (see description below).

- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:
  1. **High:** Describes a fundamental issue with the project that affects the current recommendation or justification of the project, and which will affect its future success, if the project moves forward without the issue being addressed. Comments rated as high indicate that the Panel determined that the current methods, models, and/or analyses contain a "showstopper" issue.
  2. **Medium/High:** Describes a potential fundamental issue with the project, which has not been evaluated at a level appropriate to this stage in the Planning process. Comments rated as medium/high indicate that the Panel analyzed or assessed the methods, models, and/or analyses available at this stage in the Planning process and has determined that if the issue is not addressed, it could lead to a "showstopper" issue.
  3. **Medium:** Describes an issue with the project, which does not align with the currently assessed level of risk assigned at this stage in the Planning process. Comments rated as medium indicate that, based on the information provided, the Panel identified an issue that would raise the risk level if the issue is not appropriately addressed.
  4. **Medium/Low:** Affects the completeness of the report at this time in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium/low indicate that the Panel does not currently have sufficient information to analyze or assess the methods, models, or analyses.
  5. **Low:** Affects the understanding or accuracy of the project as described in the report, but will not affect the recommendation or justification of the project. Comments rated as low indicate that the Panel identified information that was mislabeled or incorrect or that certain data or report section(s) were not clearly described or presented.
- Guidelines for Developing Recommendations: The recommendation section was to include specific actions that USACE should consider to resolve the Final Panel Comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

Battelle reviewed and edited the Final Panel Comments for clarity, consistency with the comment statement, and adherence to guidance on the Panel's overall charge, which included ensuring that there were no comments regarding either the appropriateness of the selected alternative or USACE policy. During the Final Panel Comment development process, the Panel determined that four of the Final Panel Comments could be either dropped or merged into other Final Panel Comments; however, one Final Panel Comment was divided into two separate Final Panel Comments after the panel review teleconference, bringing the total from 20 to 17 Final Panel Comments. At the end of this process,

17 Final Panel Comments were prepared and assembled. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Final Panel Comments are presented in Section 4.2 of the main report.

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APPENDIX B

Identification and Selection of IEPR Panel Members for the Upper Ohio Project.

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B.1 Panel Identification

The candidates for the Independent External Peer Review (IEPR) of the Upper Ohio Navigation Study Draft Feasibility Report (hereinafter: Upper Ohio IEPR) Panel were evaluated based on their technical expertise in the following key areas: economics, environmental, engineering, and planning. These areas correspond to the technical content of the Upper Ohio IEPR review documents and the overall scope of the Upper Ohio project.

To identify candidate panel members, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle evaluated these candidate panel members in terms of their technical expertise and potential conflicts of interest (COIs). Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and ultimately selected four experts for the final Panel.

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

The candidates were screened for the following potential exclusion criteria or COIs.[4] These COI questions serve as a means of disclosure and to better characterize a candidate's employment history and background. Providing a positive response to a COI screening question did not automatically preclude a candidate from serving on the Panel. For example, participation in previous USACE technical peer review committees and other technical review panel experience was included as a COI screening question. A positive response to this question could be considered a benefit.

- Previous and/or current involvement by you or your firm[5] in the Upper Ohio project, including the project's decision document.
- Previous and/or current involvement by you or your firm[5] in navigation projects on the Ohio River.
- Previous and/or current involvement by you or your firm[5] in the Upper Ohio Navigation Study-related projects.
- Previous and/or current involvement by you or your firm[5] in the conceptual or actual design, construction, or operations and maintenance (O&M) of any projects in the Upper Ohio Navigation Study-related projects.
- Current employment by the U.S. Army Corps of Engineers (USACE).

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[4] 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."

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

- Previous and/or current involvement with paid or unpaid expert testimony related to the Upper Ohio Navigation Study.
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse or children related to the Upper Ohio River or the general Pittsburgh, Pennsylvania, region.
- Current personal involvement with other USACE projects, including whether involvement was to author any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, Engineer Research and Development Center [ERDC], etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the Pittsburgh District.
- Previous or current involvement with the development or testing of models that will be used for or in support of the Upper Ohio Navigation Study, including the Barge Testing Model, the Greenmont Energy Model, the Waterways Analysis Model, the Navigation Investment Model, the Navigation Predictive Analysis Technique, or Fish Passage Connectivity Index model.
- Current firm[5] involvement with other USACE projects, specifically those projects/contracts that are with the Pittsburgh 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 Pittsburgh District. Please explain.
- Any previous employment by the USACE as a direct employee, notably if employment was with the Pittsburgh District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Any previous employment by the USACE as a contractor (either as an individual or through your firm[5]) within the last 10 years, notably if those projects/contracts are with the Pittsburgh 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 navigation or lock and dam projects, and include the client/agency and duration of review (approximate dates).
- Pending, current or future financial interests in Upper Ohio Navigation Study-related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[5] revenues within the last 3 years came from USACE contracts.
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to the Upper Ohio Navigation Study.
- Participation in relevant prior and/or current Federal studies relevant to this project and/or the Upper Ohio Navigation Study, including the Ohio River Mainstem System Study (ORMSS).
- Previous and/or current participation in prior non-Federal studies relevant to this project and/or the Upper Ohio Navigation Study.
- Is there any past, present, or future activity, relationship, or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project? If so, please describe.

Other considerations:

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

B.2 Panel Selection

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. Three of the four final reviewers are affiliated with consulting companies; the other is an independent consultant. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of COIs through a signed COI form. USACE was given the list of candidate panel members, but Battelle selected the final Panel.

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

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

Technical Criterion	Smith	McClure	Loss	Hornung
Economics				
Expertise in transportation economics	X			
Experience with financing transportation infrastructure	X			
Experience with national and international logistics and transportation requirements	X			
Minimum 10 years of experience directly related to water resource economic evaluation or review	X			
Minimum 5 years of experience directly dealing with USACE planning process as outlined in Engineer Regulation (ER) 1105-2-100, Planning Guidance Notebook, especially with regard to inland navigation studies, outlined in Appendix E	X			
Minimum 2 years of experience reviewing Federal water resource economic documents justifying construction efforts	X			
M.S. degree or higher in related field	X			
Environmental				

Technical Criterion	Smith	McClure	Loss	Hornung
Minimum 15 years of experience in evaluating and conducting National Environmental Policy Act (NEPA) analyses for federal projects		X		
Experience with determining the scope and appropriate methodologies for interagency interests and having project impacts to nearby sensitive habitats along the Ohio River or similar riverine system		X		
M.S. degree or higher in appropriate field of study		X		
Engineering				
Primary experience centers around lock and dam design and construction along the inland waterways system			X	
Minimum 10 years of experience in risk and reliability analysis of lock and dam systems			X	
Registered Professional Engineer			X	
Planning				
Minimum 10 years of experience in planning and the plan formulation process				X
Experience with water resource transportation projects				X
Minimum 5 years of experience directly dealing with the USACE planning process as outlined in ER 1105-2-100, Planning Guidance Notebook				X
Minimum B.S. degree				X

B.3 Panel Member Qualifications

Daniel Smith

Role: Economic expertise.
Affiliation: The Tioga Group, Inc.

Mr. Smith is the principal and founder of a firm that has provided freight transportation consulting services since 1997. He earned his Master's degree in Public Policy from the University of California-Berkeley in 1976 and his B.A. in Mathematics from the University of California-Berkeley in 1973, with degree requirements also completed in economics. He has over 34 years of consulting experience in freight transportation strategy, policy, and planning, including maritime freight transportation. Since 2002, Mr. Smith has supported a variety of USACE projects requiring expertise related to water resource economic evaluation or review; the USACE planning process; and economic documentation review for Federal water resources.

Much of Mr. Smith's consulting experience has focused on national and international logistics and transportation requirements. This experience includes conducting marine, inland waterway, rail, trucking, intermodal, and logistics studies for public- and private-sector clients. He has also authored numerous reports and papers, made multiple conference presentations, conducted webinars, and testified before Congress on transportation and logistics issues. Mr. Smith's expertise in transportation economics includes supporting clients for the deep-draft ports of Los Angeles, Long Beach, Oakland, Richmond, Stockton, Redwood City, New York and New Jersey, Seattle, and Vancouver. He has also led analyses of the maritime transportation system outlook, container port capacity, and the U.S. inland waterways system outlook for the USACE Institute for Water Resources. Mr. Smith also has experience with the financing of transportation infrastructure. He was principal investigator and author for the Transportation Research Board's National Cooperative Freight Research Program Report 15, Dedicated Revenue Mechanisms for Freight Transportation Investment, and co-author of a 2012 paper on the subject.

Mr. Smith has direct experience related to water resource economic evaluation and review. Since 2002, he has participated in economic reviews as a peer reviewer of multiple USACE projects, including projects in Port Iberia, Louisiana; Chesapeake Bay, Maryland/Virginia; and the Sabine-Neches Waterway, Texas. Mr. Smith has also reviewed multiple water resource construction project justification documents since 2002, most recently serving on IEPR panels for Lake Worth and Port Everglades, Florida.

In addition, since 2002, Mr. Smith has provided planning expertise in support of multiple inland navigation projects. Specifically, he has worked with the USACE planning process as outlined in Engineer Regulation (ER) 1105-2-100, Planning Guidance Notebook, to support the IEPR of projects for the Port of Sacramento, California; the Pacific Northwest's Columbia River; the Delaware River; and the Port of Freeport, Texas.

Nathaniel (Skeeter) McClure, P.E., D.WRE

Role: Environmental expertise.
Affiliation: Volkert, Inc.

Mr. McClure is an environmental engineer, environmental scientist, and project manager for an environmental consulting firm in Alabama. He earned his M.S. in Engineering from the University of Alabama in 1967 and his B.S. in Civil Engineering from Auburn University in 1961. Mr. McClure has over 51 years of experience in water resources, transportation, and environmental compliance activities,

including 35 years of National Environmental Policy Act (NEPA) experience. From 1970 to 1997, he worked for USACE in the Mobile District. For eight years during his USACE career, he was Chief of the Planning and Environmental Division. In that capacity, he supervised a multi-disciplinary staff responsible for water resources planning, floodplain management, and environmental compliance for the Mobile District. Since 1997, a major focus of his consulting career has been managing the preparation of environmental impact statements (EISs) for major transportation projects. He also has provided project management, environmental consultation, and quality assurance expertise.

Mr. McClure's many years of experience have involved the evaluation and conduct of numerous NEPA analyses for Federal projects. During his time with USACE, he managed the development of a court-ordered supplemental EIS for the Tennessee-Tombigbee Waterway, a controversial, $2 billion inland waterway project with 10 locks and dams that connects the Tennessee River with the Tombigbee River system. More recently, he managed the development of a third-party EIS for the Alabama State Port Authority. That EIS allowed the Mobile District, USACE, to issue permits for construction of a $300 million container terminal in 2005.

Mr. McClure's expertise includes determining the scope and appropriate methodologies for environmental impact analyses. He has participated in the preparation, review, and approval of over 100 NEPA documents, including over 30 EISs. Major projects demonstrating his expertise in this area include the Tennessee-Tombigbee Waterway, the Alabama State Port Authority Container Port, the $1 billion Interstate-85 Extension EIS, and the Interstate-10 Mobile River Bridge and Bayway Widening EIS (under way). He also has extensive experience in leading interdisciplinary teams and in coordinating public involvement for complex environmental projects.

Mr. McClure is a registered Professional Engineer in Alabama and a Diplomate of the American Academy of Water Resources Engineers.

Gary Loss, P.E., D.WRE

Role: Engineering expertise.
Affiliation: Missman, Inc.

Mr. Loss is a civil engineer for an Illinois consulting firm with 42 years of experience managing large Civil Works planning, design, and construction programs on the Upper Mississippi River basin. He earned his M.S. in Water Resources/Civil Engineering from the Michigan Technological University in 1976 and his B.S. in Civil Engineering from the University of Wisconsin-Platteville in 1971. He is a registered Professional Engineer in Wisconsin and a Diplomate, Water Resources Engineer. Mr. Loss has a thorough knowledge of USACE processes and requirements for planning, design, and construction of Civil Works projects. Most recently, Mr. Loss has worked with several directors of public works on the periodic inspection of their flood protection systems and with the City of Rock Island, Illinois, on its Section 408 permit request to USACE. He also provided civil engineering review of engineering reports and construction plans and contributed to the preparation and review of project proposals. Other recent experience includes managing the periodic inspection program for several large USACE levee systems in Illinois. In addition, for the Howard Hanson Dam (USACE Seattle District), he provided civil engineering expertise and team leadership for the IEPR of feasibility studies for a $350 million fish passage facility and led the IEPR of construction plans for a $17 million tunnel modification and $4 million of interim remedial measures.

Mr. Loss's civil engineering experience includes managing the design and construction of navigation and flood control structures along inland waterways and the risk and reliability analysis of navigation systems. He has more than 35 years of experience working for USACE's Rock Island District (1971 to 2008). From 1999 to 2000, he was Project Manager for the Upper Mississippi River Illinois Waterway System Navigation Feasibility Study. For 2 years, he led several multi-discipline teams involving 80 technical staff (engineering, environmental, economics, and public affairs) from four USACE districts to determine the feasibility of expanding navigation capacity on the Upper Mississippi River system. The feasibility study included more than $24 million of innovative engineering techniques, cutting-edge economics, and ecosystem restoration studies. His responsibilities included several detailed design reports (including risk and reliability analyses) for the major rehabilitation of navigation locks and dams on both the Mississippi River and Illinois Waterways. As Project Manager, Mr. Loss also facilitated significant collaboration with state agencies, non-governmental organizations, and the public.

Mr. Loss served for 12 years as Assistant Chief and Acting Chief of the Engineering Division for the Rock Island District (1986-1998). In that capacity, he provided technical leadership for 160 personnel responsible for design, hydrology and hydraulics, geotechnical, cost engineering, and survey work. He also was the district's Dam Safety Officer with responsibility for three large flood control dams and 22 navigation dams. His expertise includes oversight of engineering studies and reports, plans and specifications for major rehabilitation of navigation and flood control structures, construction of ecosystem restoration projects, and O&M of infrastructure projects.

Mr. Loss's earlier USACE experience includes serving 2 years as Chief, Project Engineering Section, Design Branch at the Rock Island District. He supervised project engineers responsible for the preparation of design reports, plans, and specifications for flood protection projects and rehabilitation of locks and dams on the Mississippi River and Illinois Waterway. In addition, as Chief, General Engineering Section, Design Branch from 1979 to 1984, he supervised technical personnel (civil, mechanical, and electrical engineers and technicians) in the design of flood protection and recreation projects, plus rehabilitation of navigation locks and dams.

Mr. Loss also served as Deputy for Programs and Project Management and as Chief, Planning, Programs and Project Management Division, for the Rock Island District. As senior civilian, he was responsible for a $160 million annual program that included 22 locks and dams, three large reservoirs, and $20 million annually in ecosystem restoration. He also provided regional program management for several multi-million-dollar water resource programs, including the Environmental Management Program, Upper Mississippi River System Navigation Study, Illinois River Ecosystem Master Plan, and the Upper Mississippi River Comprehensive Plan.

Lewis Hornung

Role: Planning expertise.
Affiliation: Independent Consultant

Mr. Hornung earned his B.S. in Civil Engineering from the University of Houston in 1977. His 36-year career includes 19 years with USACE, 2 years as Executive Director of the Southern Everglades Restoration Alliance, 6 years with the South Florida Water Management District, and 9 years with an architectural/engineering consulting firm. Mr. Hornung's primary experience has been planning and project management. He has played lead roles in a large number of navigation planning projects, as well as planning studies for environmental restoration, flood damage reduction, and water supply.

Mr. Hornung has direct experience in planning and the plan formulation process. His career at USACE includes more than 12 years in the Planning Division. For 6 years, he worked for a local sponsor for the Jacksonville District's Comprehensive Everglades Restoration Project, leading Project Delivery Teams (PDTs) in the development of supplemental planning documents. For the last 9 years working in the private sector, he has worked on a variety of planning projects for multiple clients. His planning experience has included navigation, flood damage reduction, water quality, and water supply studies.

Mr. Hornung's experience includes navigation planning and the design and construction of navigation projects for a variety of water resource transportation projects. With regard to navigation planning, he drafted an addendum to the Port of Iberia Feasibility Report for the New Orleans District. The original report had been reviewed by the Civil Works Review Board (CWRB) and received substantive comments regarding the recommended plan. The addendum provided a description and justification of a modified recommended plan in response to comments. With regard to navigation project design and construction, Mr. Hornung served as project manager for the detailed design of a replacement of the Bayou Sorrel Lock for the New Orleans District. The project team consisted of individuals from all five districts within the Mississippi Valley Division. Three-dimensional computer-aided designs were prepared with input from all five districts. During the process, it was discovered that the estimated project costs exceeded the Section 902 limit, triggering the initiation of a post-authorization change report. Mr. Hornung also served as project manager for the construction of the Miami Harbor and Turning Basin Deepening Project for the Jacksonville District. The local sponsor, the Port of Miami, decided to utilize conventional cutter head dredging technology rather than blasting as recommended in the feasibility report. As a result, unanticipated issues arose during construction that required a prompt, focused effort to address the issues.

Mr. Hornung also has worked on planning studies that have conformed to the requirements of ER 1105-2-100, Planning Guidance Notebook. He is familiar with the six-step planning process and has used the process on many projects. He has worked on reconnaissance studies, feasibility studies, limited re-evaluation studies, general re-evaluation studies, major rehabilitation studies, and operational planning studies. He also is familiar with USACE's 2011 Planning Modernization initiative. As a subconsultant, he currently serves as project manager for development of a planning modernization implementation plan for USACE Headquarters and has served on previous IEPR panels for Battelle.

APPENDIX C

Final Charge to the IEPR Submitted to USACE on April 10, 2014, for the Upper Ohio Project .

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CHARGE QUESTIONS AND GUIDANCE TO THE PANEL MEMBERS FOR THE IEPR OF THE UPPER OHIO NAVIGATION STUDY DRAFT FEASIBILITY REPORT

BACKGROUND

The Upper Ohio is part of the larger Ohio River System, which includes the main navigable tributaries of the Allegheny, Monongahela, Kanawha, Green, Tennessee, and Cumberland rivers, along with smaller navigable tributaries like the Little Kanawha, Big Sandy, and Kentucky rivers. This system is made possible by 56 lock and dam projects in eight states. The Ohio River System is a major component of the Mississippi River System, which is linked to both ocean-going trade at New Orleans, Louisiana, and Great Lakes trade by way of the Illinois River and its connectors to Lake Michigan in and near Chicago, Illinois.

The Upper Ohio Navigation Study, Pennsylvania (the Upper Ohio Study) focuses on Emsworth, Dashields, and Montgomery (EDM) locks and dams. These three navigation projects are located on the upper Ohio River in the vicinity of Pittsburgh, Pennsylvania. The Upper Ohio projects allow producers and consumers of bulk commodities to move large quantities of cargo into and through the Pittsburgh area at relatively low cost and with minimal effects on land-based passenger and freight transportation. Coal and aggregate (stone, sand and gravel) firms are the primary producers, while electric utilities and steel mills are the primary consumers of the commodities that move through the Upper Ohio projects.

EDM locks and dams were built in the 1920s and 1930s at a time when waterway carriers had yet to transition from steam-powered pusher boats (called towboats) and wooden barges to the modern diesel-powered towboats and large-dimension steel barges. Consequently, the dimensions of the locks at these projects are the smallest on the Ohio River. Mainstem Ohio River projects are double-lock configurations, with the main chamber typically measuring 110 feet by 1,200 feet (accommodating 15 barge tows in one 60-minute operation) and the auxiliary chamber 110 feet by 600 feet (accommodating 15 barge tows in two operations lasting 160 minutes). While the Upper Ohio projects have two lock chambers, the main chamber is only the size of a typical Ohio River auxiliary lock chamber, and EDM's auxiliary chambers are very small at 56 feet by 360 feet. Emsworth and Dashield's dams were built in the 1920s and provide very short navigation pools of 7 and 13 miles in length, respectively, while Montgomery's dam provides a navigation pool of 23 miles. Navigation pools formed by modern lock and dam projects on the Ohio River average 57 miles and range from 30 to 114 miles in length.

OBJECTIVES

The objectives of this work are to conduct an Independent External Peer Review (IEPR) of the Upper Ohio Navigation Study Draft Feasibility Report (hereinafter: Upper Ohio IEPR). The IEPR will follow the procedures described in the Department of the Army, U.S. Army Corps of Engineers' (USACE) guidance Peer Review of Decision Documents (Engineer Circular [EC] 1165-2-214), dated December 15, 2012, and the Office of Management and Budget's (OMB) 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, the validity of the research design, the quality of data collection procedures, the robustness of the methods employed, the appropriateness of the methods for the hypotheses being

tested, the extent to which the conclusions follow from the analysis, and the strengths and limitations of the overall product.

The purpose of this IEPR will be to analyze the adequacy and acceptability of economic, environmental and engineering methods, models, data, and analyses employed (EC 1165-2-214; p. D-4). The independent review will be limited to technical review and will not involve policy review. The peer review will be conducted by subject matter experts with extensive experience in economics, environmental, engineering, and planning as they specifically relate to inland navigation. The subject matter experts will be "charged" with responding to specific technical questions as well as providing a technical evaluation of the overall project.

The subject matter experts (i.e., the Panel) will identify, explain, and comment upon assumptions that underlie the analyses and evaluate the soundness of models, methods, and assumptions. The panel members will evaluate whether the interpretations of analyses and conclusions are technically sound and reasonable, provide effective review in terms of both usefulness of results and of credibility, and have the flexibility to bring important issues to the attention of decision-makers. The panel members may offer opinions as to whether there are sufficient technical analyses upon which to base the ability to implement the project. The panel members will address factual inputs, data, and the use of economics and cost engineering models, analyses, assumptions, and other scientific and engineering tools/methodologies to inform decision-making.

DOCUMENTS PROVIDED

The following is a list of documents, supporting information, and reference materials that will be provided for the review. The review documents will be provided to the Panel in two parts due to the delayed availability of the Hazardous, Toxic, and Radioactive Waste (HTRW) Reports and the Real Estate Plan. The Panel will review the documents as they become available. This delay will not impact the schedule because it is anticipated the documents will be received within the Panel's review period.

Documents for Review

The following documents are to be reviewed by designated discipline:

Review Documents	
Title	**Number of Pages**
Upper Ohio Navigation Study Draft Feasibility Report Executive Summary and Main Report	378
Engineering Appendix	
General Engineering Reference Data Appendix (GE)	928
Emsworth Engineering Site Appendix (ED-1)	418
Dashields Engineering Site Appendix (ED-2)	367
Montgomery Engineering Site Appendix (ED-3)	368
Economics Appendix B	1,130

Real Estate Plan	56
Two Lock Modernized Plan	39
Environmental Appendix	
Benthic Substrate Characterization	80
Cumulative Effects Assessment	534
Clean Water Act, Section 404(b)(1) Evaluation	20
Ecosystem Restoration Study	327
Endangered Species Correspondence	11
Environmental Justice	10
Fish Passage Study	120
Hydroacoustic Survey	55
Construction Impact & Mitigation Analysis	81
Invasive Species Issues	11
Larval Fish Survey	397
Mussel Survey	104
Fish & Wildlife Coordination Act 2(b) Report Ohio River Mainstem Study (ORMSS)	72
Prior Environmental Reports	3
Upland Work Area Surveys	225
U.S. Fish and Wildlife Service Planning Aid Report Update	297
HTRW Phase II Environmental Assessments Report	154
Cultural Resources	465
Total Page Count:	**6,650**
Supplemental Documents	
Ohio River Mainstem Study (ORMSS)	2,794
HTRW Supplemental Information (Phase I report and Phase II Appendices)	4,995
Total Page Count:	**7,789**

Documents for Reference

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

SCHEDULE

This final schedule is based on the April 7, 2014, receipt of the final review documents.

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	4/8/2014
	Battelle convenes kick-off meeting with panel members	4/10/2014
	Battelle convenes kick-off meeting with USACE and panel members	4/15/2014
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	4/21/2014
	Panel members complete their individual reviews	4/30/2014
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members with talking points for Panel Review Teleconference	5/2/2014
	Battelle convenes Panel Review Teleconference	5/5/2014
	Battelle provides Final Panel Comment templates and instructions to panel members	5/6/2014
	Panel members provide draft Final Panel Comments to Battelle	5/13/2014
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	5/14/2014-5/20/2014
	Panel finalizes Final Panel Comments	5/20/2014
	Battelle provides Final IEPR Report to panel members for review	5/21/2014
	Panel members provide comments on Final IEPR Report	5/22/2014
	Battelle submits Final IEPR Report to USACE	5/27/2014
Comment/ Response Process		5/27/2014
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	5/28/2014

Task	Action	Due Date
	USACE provides draft Project Delivery Team (PDT) Evaluator Responses to Battelle	5/30/2014
	Battelle provides the panel members the draft PDT Evaluator Responses	6/2/2014
	Panel members provide Battelle with draft BackCheck Responses	6/4/2014
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	6/5/2014
	Battelle convenes Comment-Response Teleconference with panel members and USACE	6/6/2014
	USACE inputs final PDT Evaluator Responses to DrChecks	6/13/2014
	Battelle provides PDT Evaluator Responses to panel members	6/16/2014
	Panel members provide Battelle with final BackCheck Responses	6/18/2014
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	6/19/2014
	Battelle submits pdf printout of DrChecks project file	6/20/2014

CHARGE FOR PEER REVIEW

Members of the Panel are asked to determine whether the technical approach and scientific rationale presented in the Upper Ohio Navigation Study Draft Feasibility Report are credible and whether the conclusions are valid. The Panel is asked to determine whether the technical work is adequate, competently performed, and properly documented; satisfies established quality requirements; and yields scientifically credible conclusions. The Panel is being asked to provide feedback on the economic, environmental, and engineering analyses. The reviewers are not being asked whether they would have conducted the work in a similar manner.

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Upper Ohio Navigation Study Draft Feasibility Report. Please focus on your areas 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 items 2 and 3 below per USACE guidance (EC 1165- 2-214; Appendix D).

1. Your response to the charge questions should not be limited to a “yes” or “no.” Please provide complete answers to fully explain your response.

2. Assess the adequacy and acceptability of the economics, environmental, and engineering methods, models, and analysis used.

3. If appropriate, offer opinions as to whether there are sufficient analyses upon which to base a recommendation for construction, authorization, or funding.

4. Identify, explain, and comment on assumptions that underlie economic, environmental, and engineering analyses.

5. Evaluate whether the interpretations of analysis and conclusions based on analysis are reasonable.

6. Please focus the review on scientific information, including factual inputs, data, the use and soundness of models, analyses, assumptions, and other scientific and engineering matters that inform decision makers.

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 other. 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 (Lynn McLeod, mcleod@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 and in DrChecks. Your comments will be included in the Final IEPR Report but will remain anonymous.

Please submit your comments in electronic form to Lynn McLeod, mcleod@battelle.org and Jessica Tenzar, tenzarj@battelle.org, no later than April 30, 2014, 10 pm ET.

IEPR of the Upper Ohio Navigation Study Draft Feasibility Report

CHARGE QUESTIONS AND RELEVANT SECTIONS AS SUPPLIED BY USACE

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

2. Please comment on the adequacy and acceptability of the economic model and analyses used, as well as any assumptions made.

3. Are the interpretations of analysis and conclusions based on the analysis reasonable?

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

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

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

7. Were risk and uncertainty sufficiently considered?

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

9. Does the environmental documentation satisfy the requirements of the National Environmental Policy Act (NEPA)? Were adequate considerations given to significant resources in the documentation?

10. Assess the recommended alternatives from the perspective of systems. The assessment should consider systemic aspects from a temporal perspective, including the potential effects of climate change.

Objectives

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

12. Has the project need been clearly described?

13. Are the specific objectives adequately described?

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

Alternatives

15. Have the criteria to eliminate plans from further study been clearly described?

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

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

18. Are the changes between the without-project condition (WOPC) and the WPC adequately described for each alternative?

19. Have comparative impacts been clearly and adequately described?

20. Please comment on the likelihood that the recommended alternative will achieve the expected outputs.

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

22. Within the context of risk-informed decision-making, have the impacts to the existing infrastructure (existing and remaining navigation facilities at these locations) been adequately addressed?

Affected Environment

23. Is the description of wetland resources in the project area complete, accurate, and commensurate with the scope of the study?

24. Is the description of aquatic resources in the project area complete, accurate, and commensurate with the scope of the study?

25. Is the description of threatened and endangered species resources in the study area complete, accurate, and commensurate with the scope of the study?

26. Is the description of the historical and existing recreational resources in the study area complete, accurate, and commensurate with the scope of the study?

27. Is the description of the cultural resources in the study area complete, accurate, and commensurate with the scope of the study?

28. Is the description of the historical and existing socioeconomic resources in the study area complete, accurate, and commensurate with the scope of the study? Were specific socioeconomic issues not addressed?

Environmental Consequences

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

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

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

Cumulative Impacts

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

Mitigation

33. Are mitigation measures adequately described, discussed, and justified in accordance with USACE policies? If not, please explain.

Hydraulics

34. Was the hydraulic discussion sufficient to characterize current baseline conditions and to allow for evaluation of how forecasted conditions (with and without proposed actions) are likely to affect hydraulic conditions?

Geotechnical Engineering

35. Is the description of the geomorphic and physiographic setting of the proposed project area accurate, comprehensive, and commensurate with the scope of the study?

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

Design

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

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

Real Estate Plan

39. Comment on the extent to which assumptions and data sources used in the Real Estate Plan are clearly identified and the assumptions are justified and reasonable.

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

Relocations

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

Hazardous, Toxic, and Radioactive Waste (HTRW)

42. Comment on the extent of impacts the alternatives may have on HTRW issues.

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

44. Within the context of risk-informed decision-making, do the HTRW analyses adequately address all issues and provide reasonable support for the alternatives?

Cost Estimates and Economics

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

46. Were risk and uncertainty sufficiently considered in relation to the future development process?

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

48. Are the costs adequately justified?

Public Involvement and Correspondence

49. Based on your experience with similar projects, has adequate public, stakeholder, and agency involvement occurred prior to public release of the draft feasibility report to determine all issues of interest and to ensure that the issues have been adequately addressed to the satisfaction of those interested parties? Is the draft report distribution list comprehensive?

Final Overview Questions

50. 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?

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

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

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