

IMPLEMENTATION PHASE REVIEW PLAN

**Bolivar Dam, Bolivar Ohio
Major Rehabilitation Project**

Huntington District

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**US Army Corps
of Engineers®**

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1. PURPOSE AND REQUIREMENTS

a. **Purpose.** This Implementation Phase Review Plan (IPRP) defines the scope and level of peer review for the design and construction activities of the Bolivar Dam Major Rehabilitation Project. It will also document review efforts undertaken to date.

b. References

- (1) Engineering Circular (EC) 1165-2-214, Civil Works Review 15 Dec 2012
- (2) EC 1105-2-412, Assuring Quality of Planning Models, 31 Mar 2011
- (3) Engineering Regulation (ER) 1110-1-12, Quality Management, 30 Sep 2006
- (4) ER 1105-2-100, Planning Guidance Notebook, Appendix H, Policy Compliance Review and Approval of Decision Documents, Amendment #1, 20 Nov 2007
- (5) Bolivar Dam, Major Rehabilitation Project, Project Management Plan
- (6) Draft ER 1110-2-1156 Chapter 9, Dam Safety Modification Studies, 9 Nov 2012

c. **Requirements.** This IPRP was developed in accordance with EC 1165-2-214, which establishes an accountable, comprehensive, life-cycle review strategy for Civil Works products by providing a seamless review process for all Civil Works projects from initial planning through design, construction, operation, maintenance, repair, replacement, and rehabilitation (OMRR&R). The EC outlines four general levels of review: District Quality Control/Quality Assurance (DQC), Agency Technical Review (ATR), Independent External Peer Review (IEPR), and Policy and Legal Compliance Review. In addition to these levels of review, decision documents are subject to cost engineering review and certification (per EC 1165-2-214) and planning model certification/approval (per EC 1105-2-412). The Great Lakes and Ohio River Division (CELRD) is the Major Subordinate Command approval authority for this Review Plan.

2. REVIEW MANAGEMENT ORGANIZATION (RMO) COORDINATION AND VERTICAL TEAM

a. **RMO Coordination.** The RMO is responsible for managing the overall peer review effort described in this IPRP. The RMO for the peer review effort described in this RP is the Risk Management Center (RMC).

Traditionally, the RMO has coordinated with the Civil Works Cost Engineering and Agency Technical Review Mandatory Center of Expertise (MCX) to ensure the appropriate expertise is included on review teams to assess the adequacy of cost estimates, construction schedules and contingencies. Some reviews predate the establishment of the RMC. For those reviews, the Huntington District was responsible for the appropriate review coordination with the Cost Engineering MCX.

b. **Vertical Team.** The Vertical Team consists of the District Dam Safety Officer, RMC, Dam Safety Modification Mandatory Center of Expertise (DSMMCX), Great Lakes and Ohio River Division (CELRD), and Headquarters (HQUSACE) team members. The roles and level of involvement for Vertical Team members can vary depending on the current project phase and requirements. The District Dam Safety Officer, representatives from the DSMMCX, Dam Safety Program Managers at CELRD and HQUSACE, and the CELRD District Liaison/Flood Risk Management Business Line Manager are permanent members of the Vertical Team.

While the day-to-day execution of a project remains the responsibility of the Home District, the RMC and DSMMCX are a vital part of the overall Quality Assurance (QA) function for dam safety modification projects. Early and continual involvement as part of the PDT from both is essential. Involving all elements from the inception of a project will ensure the failure modes are identified, the correct alternatives are evaluated, and the best project solution is chosen.

3. STUDY INFORMATION

- a. **Decision Document.** The decision document for the Bolivar Dam Major Rehabilitation Project (located in Bolivar, Ohio) was approved by CELRD on 12 June 2009. An Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) were prepared and the FONSI was signed for the project. The project does not require additional Congressional Authorization.

A Cost and Schedule Risk Analysis was conducted in June 2008 by the Walla Walla District. A Value Engineering (VE) Study was conducted in October 2009 by Strategic Value Solutions, Inc. A separate in-house VE study was performed on the sluice gates contract in February 2012.

The results of the Major Rehabilitation Study are described below in Section 3.b.

- b. **Study/Project Description.** The project is a Major Rehabilitation Project to address reliability problems related to Bolivar Dam. Action is warranted due to excessive, uncontrolled seepage that is negatively affecting the integrity of the dam, increasing risks to the downstream public. These concerns and conditions contributed to its classification by the USACE Screening for Portfolio Risk Assessment (SPRA) as a Dam Safety Action Class 2 – Urgent (unsafe or potentially unsafe) project. Rehabilitation is needed to correct these instability issues and to minimize the potential for catastrophic failure of the dam.

Bolivar Dam is located in northern Tuscarawas County, Ohio, on Sandy Creek of the Tuscarawas River (Figure 1), a tributary of the Muskingum River. The dam was constructed with the singular purpose of Flood Risk Management. The dam is located 183.4 miles above the mouth of the Muskingum River. Bolivar, Ohio is the nearest town in proximity to the dam. The population of Bolivar is 888. More sizable population centers in the inundation area of the dam include Dover and New Philadelphia (located 15 miles to the southeast) with a population of approximately 30,000. The floodplain between Bolivar Dam and the larger downstream population centers generally consists of broad, gently sloping valleys.

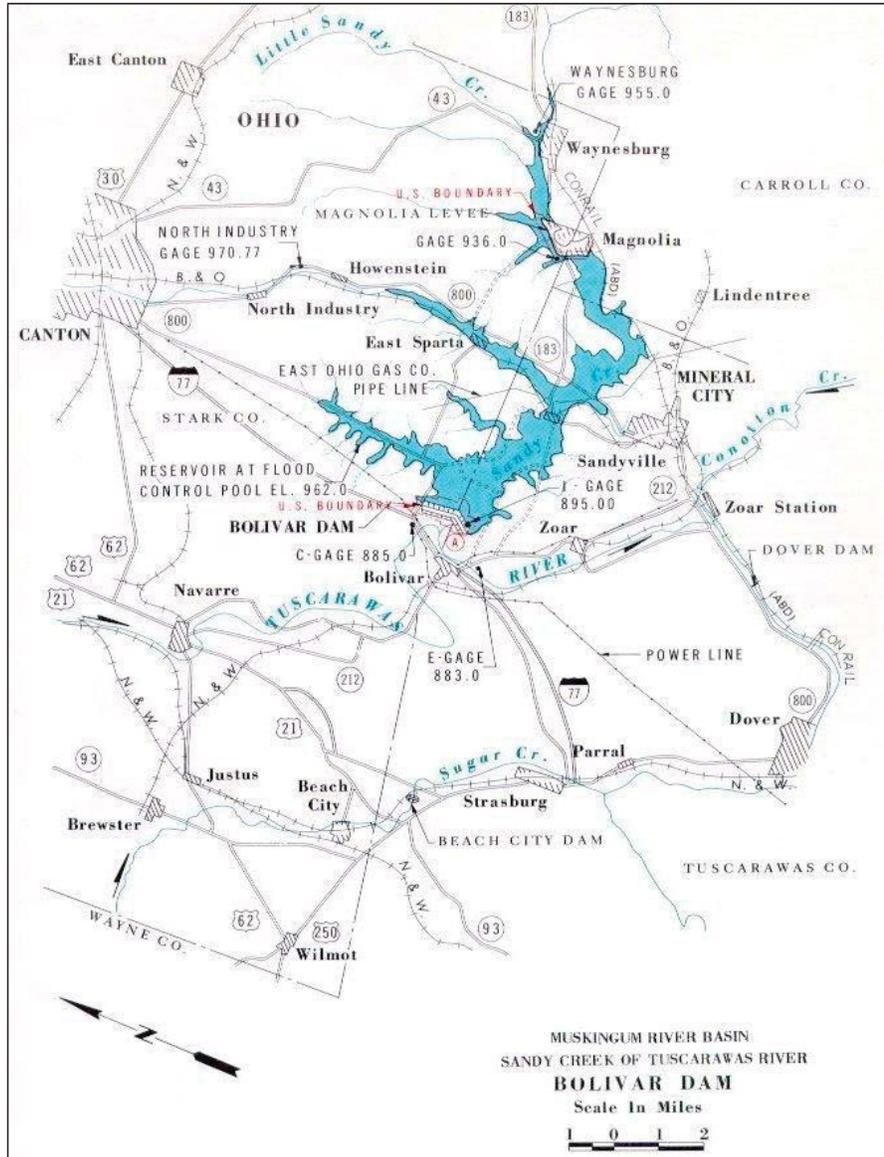


Figure 1 – Location of Bolivar Dam and Upstream Inundation

Bolivar Dam, a “dry dam”, was constructed in December 1938. Being a “dry dam” it does not retain a permanent pool during any season of the year; however, forms a retention pool for control of flood waters below the dam. The crest length is 6,300 feet at an elevation of 982 msl., with a 3.5-foot high concrete parapet wall on the upstream side of the crest.

The outlet works are located in the left (south) abutment and are composed of an approach channel, an intake structure housing six 7-foot x 15-foot gated sluices, two horseshoe shaped tunnels, a stilling basin, and outlet channel. Access to the intake structure is provided by a 12-foot wide single span service bridge. The outlet works normally pass the entire flow of Sandy Creek, except during periods of flood retention. The amount of time required for flood retention varies

from year to year. However, based on historical records, water is usually impounded for about 10% of a typical year.

The spillway is located just beyond the left abutment. It is an uncontrolled, saddle type spillway, having a crest length of 540-feet and a crest elevation of 962.0 msl.

The 6,300 foot long embankment is rolled earth with an impervious core, having a maximum height of 87 feet and is founded on overburden.

The dam was built on pervious glacial outwash deposits (sands and gravels) up to 200 feet deep. The design of the dam predated many current methods for evaluating seepage and slope stability. Although scale models of the dam were built to predict seepage quantities, no evaluations of exit gradients or uplift pressures, or slope stability analyses are contained in the original design documents.

Bolivar Dam has a history of excessive downstream seepage and the potential of under seepage instability at design pools. The Sandy Creek Valley is a broad, deeply filled pre-glacial valley consisting of sorted glacial outwash materials with possible lenses of open work gravels. The glacial deposit, upon which the dam is founded, is composed of pervious, fine to coarse gravelly sand, generally about 150-feet thick. Based on a review of the subsurface and instrumentation data, unsatisfactory performance at similar projects across the U.S. Army Corps of Engineers (USACE) inventory, and observed performance in 2005, it is believed that several areas of the embankment and/or foundation would become unstable at a pool less than the spillway crest level, due to piping. This instability would threaten the integrity of the dam and could lead to complete dam failure.

Major construction features of the approved plan include a partial-depth and partial-length concrete seepage barrier on the upstream toe of the dam, a seepage barrier cutoff wall in the left abutment of the dam, augmentation of the existing downstream seepage blanket, rehabilitation of the operating machinery and gates, the maintenance and/or rehabilitation of the existing relief well system as necessary to maintain adequate efficiency, instrumentation-related improvements (for existing piezometers and relief wells), and the installation of additional instrumentation (piezometers, surface displacement monuments, and inclinometers) to provide adequate post-remediation monitoring capability.

On 19 July 2012 the Dam Senior Oversight Group (DSOG) verified that the DSAC remains appropriate, and recommended corrective actions be taken as soon as possible. The DSOG directed that Huntington District go forward with the current plan as a staged fix, and work with the Risk Management Center on re-evaluation of the abutment treatment. In a re-evaluation of the abutment treatment with the Risk Management Center held on 22 Aug 2012, the decision was made to extend the embankment seepage barrier approximately 100 ft. into the dam abutment and drill and grout the remainder of the abutment cutoff.

c. Factors Affecting the Scope and Level of Review.

- The cost of the project exceeds \$45 million dollars;
- The project was justified economically in the decision document stage but is also supported by significant life loss numbers associated with the without project condition.
- There has been no request by the Governor for a peer review by independent experts;

- There has been no public dispute associated with the project;
- The information contained in the decision document was not based on novel methods, did not involve the use of innovative materials or techniques, present complex challenges for interpretation, contain precedent-setting methods or models, nor did it present conclusions that changed prevailing practices; and

d. In-Kind Contributions. Products and analyses provided by non-Federal sponsors as in-kind services are subject to DQC, ATR, and IEPR. There are no in kind services anticipated as part of the cost share.

4. DISTRICT QUALITY CONTROL (DQC).

All decision documents (including supporting data, analyses, environmental compliance documents, etc.) shall undergo DQC. DQC is an internal review process of basic science and engineering work products focused on fulfilling the project quality requirements defined in the Project Management Plan (PMP).

Basic quality control tools include:

- a Quality Management Plan providing for seamless review
- quality production
- internal quality checks and reviews
- supervisory reviews; and
- Project Delivery Team (PDT) reviews (including Bidability, Constructability, Operability, Environmental and Sustainability [BCOES]) throughout the life of the project.

DQC efforts include the necessary expertise to address compliance with published Corps policy. The Home District shall manage DQC. Documentation of DQC activities is required and should be in accordance with the Quality Manual of the District and home Major Subordinate Command (MSC).

a. Documentation of DQC.

Decision Document

DQC of the Decision Document predates EC 1165-2-214. It was accomplished using in-district expertise in the relevant subject matters. Documentation of this DQC is available in the Major Rehabilitation Report.

Design Documentation Report (DDR)

DQC of the DDR occurred in May 2010. All comments received as part of the DQC are on file with Huntington District.

Plans and Specifications

DQC documentation of the below plans and specifications are on file with the Huntington District.

- Construction Office – completed May 2011
- Seepage Blanket Extension – completed March 2011

- Service Gates Replacement – completed April 2012
- Seepage Barrier – completed May 2012
- Quality Assurance Plan (QAP)/Engineering Considerations and Instruction for Field Personnel (ECIFP)-completed May 2014
- Phase III Instrumentation-completed August 2016
- Relief Wells- completed February 2017
- Abutment Restoration-completed February 2017

b. Remaining Products to Undergo DQC.

- Post Implementation Evaluation (PIE) (April 2017)
- Project Geotechnical and Concrete Materials Completion Report (March 2018)
- Revision of O&M Manual (March 2018)

c. Required DQC Expertise on Remaining DQC. Civil, Environmental/Cultural, Landscape Architect, Electrical, Engineering Geologist, Construction, Structural, Operations, and Geotechnical Engineer.

5. AGENCY TECHNICAL REVIEW (ATR)

ATR is mandatory for all decision documents (including supporting data, analyses, environmental compliance documents, etc.). The objective of ATR is to ensure consistency with established criteria, guidance, procedures, and policy. The ATR assesses whether the analyses presented are technically correct and comply with published USACE guidance, and if that the document explains the analyses and results in a reasonably clear manner for the public and decision makers. ATR is managed within USACE by the designated RMO and is conducted by a qualified team from outside the home district that is not involved in the day-to-day production of the project/product. ATR teams are comprised of senior USACE personnel and may be supplemented by outside experts as appropriate. The ATR team lead will be from outside the home MSC.

Additionally, to ensure dam safety risks are adequately addressed by the designs and that all construction related risks are fully identified and mitigated to an acceptable level, the ATR team will evaluate the constructability, the schedule, and the cost estimate at the alternative development phase and at the 65% Plans and Specifications (P&S) during Pre-Construction Engineering and Design (PED) via Constructability Evaluations (CE)¹.

These CEs, as part of the ATR process differ from the requirements of the Bidability, Constructability, Operability, Environmental and Sustainability review (BCOES) required by ER 415-1-11.

¹ It should be noted the Bolivar Major Rehabilitation Project has been underway since 2004. All products are in accordance and compliance with applicable guidance in effect at that time.

- a. ATR's Conducted.** The following Bolivar Dam Major Rehabilitation products have underwent ATR:
- Major Rehabilitation Report – the Main Report, Environmental Assessment and all technical appendices
 - Design Documentation Report
 - Plans and Specifications for the following project components:
 - Construction Office
 - Seepage Blanket Extension
 - Service Gates Replacement
 - Seepage Barrier
 - Hydrologic Hazard Team (HHT) Review for PIE
- b. Remaining Products to Undergo ATR.** The following products will undergo ATR during development:
- Project Geotechnical and Concrete Materials Completion Report (March 2018)
 - Revision of O&M Manual (March 2018)
 - Post Implementation Evaluation (April 2017)
- c. Required ATR Team Expertise on Remaining ATR.** ATR has been completed for all products listed in Section 5.a above. The expertise required for remaining products to undergo ATR include Civil, Environmental/Cultural, Landscape Architect, Electrical, Engineering Geologist, Construction, Structural, Operations, and Geotechnical Engineer.
- d. Documentation of ATR.** DrChecks review software was used to document all ATR comments, responses and associated resolutions accomplished throughout the review process. Typically, comments should be limited to those that are required to ensure adequacy of the product. The four key parts of a quality review comment normally include:
- (1) The review concern – identify the product's information deficiency or incorrect application of policy, guidance, or procedures;
 - (2) The basis for the concern – cite the appropriate law, policy, guidance, or procedure that has not be properly followed;
 - (3) The significance of the concern – indicate the importance of the concern with regard to its potential impact on the plan selection, recommended plan components, efficiency (cost), effectiveness (function/outputs), implementation responsibilities, safety, Federal interest, or public acceptability; and
 - (4) The probable specific action needed to resolve the concern – identify the action(s) that the reporting officers must take to resolve the concern.

In some situations, especially addressing incomplete or unclear information, comments may seek clarification in order to then assess whether further specific concerns may exist.

The ATR documentation in DrChecks will include the text of each ATR concern, the PDT response, a brief summary of the pertinent points in any discussion, including any vertical team coordination (the vertical team includes the district, RMO, MSC, and HQUSACE), and the agreed upon resolution. If an ATR concern cannot be satisfactorily resolved between the ATR team and the PDT, it will be elevated to the vertical team for further resolution in accordance with the policy issue resolution

process described in either ER 1110-1-12 or ER 1105-2-100, Appendix H, as appropriate. Unresolved concerns can be closed in DrChecks with a notation that the concern has been elevated to the vertical team for resolution.

At the conclusion of each ATR effort, the ATR team will prepare a Review Report summarizing the review. Review Reports will be considered an integral part of the ATR documentation and shall:

- Identify the document(s) reviewed and the purpose of the review;
- Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
- Include the charge to the reviewers;
- Describe the nature of their review and their findings and conclusions;
- Identify and summarize each unresolved issue (if any); and
- Include a verbatim copy of each reviewer's comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and dissenting views.

ATR may be certified when all ATR concerns are either resolved or referred to the vertical team for resolution and the ATR documentation is complete. The ATR Lead will prepare a Statement of Technical Review certifying that the issues raised by the ATR team have been resolved (or elevated to the vertical team). A Statement of Technical Review should be completed, based on work reviewed to date, for the Alternatives Formulation Briefing (AFB), draft report, and final report. A sample Statement of Technical Review is included in Attachment 2.

6. INDEPENDENT EXTERNAL PEER REVIEW (IEPR)

IEPR may be required for decision documents under certain circumstances. IEPR is the most independent level of review, and is applied in cases that meet certain criteria where the risk and magnitude of the proposed project are such that a critical examination by a qualified team outside of USACE is warranted. A risk-informed decision, as described in EC 1165-2-214, is made as to whether IEPR is appropriate. IEPR panels will consist of independent, recognized experts from outside of the USACE in the appropriate disciplines, representing a balance of expertise suitable for the review being conducted. There are two types of IEPR:

- **Type I IEPR.** Type I IEPR reviews are managed outside the USACE and are conducted on project studies. Type I IEPR panels assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, economic analysis, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, models used in the evaluation of environmental impacts of proposed projects, and biological opinions of the project study. Type I IEPR will cover the entire decision document or action and will address all underlying engineering, economics, and environmental work, not just one aspect of the study. For decision documents where a Type II IEPR (Safety Assurance Review) is anticipated during project implementation, safety assurance shall also be addressed during the Type I IEPR per EC 1165-2-214.
- **Type II IEPR.** Type II IEPR, or Safety Assurance Review (SAR), are managed outside the USACE and are conducted on design and construction activities for hurricane, storm, and flood risk management projects or other projects where existing and potential hazards pose a significant

threat to human life. Type II IEPR panels will conduct reviews of the design and construction activities prior to initiation of physical construction and, until construction activities are completed, periodically thereafter on a regular schedule. The reviews shall consider the adequacy, appropriateness, and acceptability of the design and construction activities in assuring public health safety and welfare.

a. Decision on IEPR.

Limited Type I IEPR

The Major Rehabilitation Report was granted a waiver from a full Type I IEPR. However, a limited Type I IEPR was performed on the economics appendix to the Major Rehabilitation Report during the first Type II IEPR review. The Type I IEPR Waiver is located in Attachment 5.

Type II IEPR

The Bolivar Major Rehabilitation Project meets the mandatory trigger for a Type II IEPR (SAR).

- b. Type II IEPR's Completed.** A Type II IEPR was completed for the DDR in July 2010. Additionally, a Type II IEPR was completed on the 100% Seepage Barrier and Service Gates Replacement P&S in December 2012. The final review report of these IEPRs were approved by LRD on 29 October 2013. The District completed Type II SAR IEPRs during construction of the Service Gates Replacement and Seepage Barrier contracts. These reviews were conducted in compliance with EC 1165-2-214, "Civil Works Review." The IEPR panel was established using LRL's existing contract for IEPR's. The Type II IEPR Team composition was vetted by the PDT through the vertical team and RMC to ensure expertise of the specific individuals was commensurate with the scope and complexity of the project.
- c. Remaining Type II IEPR's to be Completed.** The District plans to complete a Type II SAR IEPR of the Post Implementation Evaluation Report in lieu of a Quality Control and Consistency Review (QCC). The Type II IEPR Team composition will be vetted by the PDT through the vertical team and RMC to ensure expertise of the specific individuals is commensurate with the scope and complexity of the project. The IEPR panel members will be the same panel members that have conducted IEPR reviews of previous products for the ongoing Major Rehabilitation Project. A schedule has been established for the review (May 2017). The IEPR panel will be established using LRL's existing contract for IEPR's.
- d. Required Type II IEPR SAR Panel Experience.** The SAR team shall be composed of licensed engineers with experience in dam design and large construction projects. The members will represent the following disciplines (at a minimum). The final make-up, in size and composition, will be vetted through the PDT, vertical team and RMC to ensure expertise is commensurate with the scope and complexity required for the specific technical details of the accepted construction proposal prior to being finalized by the contractor.

IEPR Panel Members/Disciplines	Expertise Required
Geotechnical Engineer	Will possess a minimum 25 years of experience in design, inspection and construction of levee or dam projects and at least one seepage barrier project. The member(s) shall be a registered Professional Engineers (PE), preferably a registered Geotechnical Engineer (GE), or have equivalent qualifying experience, with a minimum of three completed dam and one seepage barrier projects.
Civil/Construction Engineer	Will possess significant experience with civil works construction quality assurance and control with a minimum 20 years of experience in flood control projects, including dams or levees. The member(s) shall have experience in the construction and/or remediation of dams, with emphasis on seepage barrier construction. The member shall be a registered Professional Engineer (PE) or have equivalent qualifying experience.
Engineering Geologist	Will possess a minimum 20 years of experience in the type of work being performed. The Engineering Geologist shall be proficient in assessing seepage through sedimentary rock, exploration and testing, grouting, and instrumentation. The Engineering Geologist shall be experienced in the design of cutoff walls and must be knowledgeable in mix designs and materials for concrete cutoffs. The Engineering Geologist shall have a working knowledge of all applicable USACE design criteria and shall be a licensed Professional Geologist.

- e. **Documentation of Type II IEPR.** At the conclusion of the Type II IEPR the IEPR panel will prepare a review report. All panel comments shall be entered as team comments that represent the group and be non-attributable to individuals. The team lead is to seek consensus, but where there is a lack of consensus, note the non-concurrence and why. A suggested report outline includes: an introduction, the composition of the review team, a summary of the review during design, a summary of the review during construction, any lessons learned in both the process and/or design and construction, appendices for conflict of disclosure forms, appendices for supporting analyses, and assessments of the adequacy and acceptability of the methods, models, and analyses used. All comments in the report will be finalized by the panel prior to their release to USACE for each review plan milestone.

After receiving a report on a project from the peer review panel, the District Chief of Engineering,

in coordination with the Chiefs of Construction and Operations, shall consider all comments contained in the report and prepare a written response for all comments and note concurrence and subsequent action or non-concurrence with an explanation. The District Chief of Engineering shall submit the Panel's report and the District's responses to the MSC Chief of Business Technical Division for final review and concurrence. The final report is then presented to the MSC Commander for approval. After MSC commander approval, the report and responses shall be made available to the public on the District's website.

7. POLICY AND LEGAL COMPLIANCE REVIEW

All decision documents will be reviewed throughout the study process for their compliance with law and policy. Guidance for policy and legal compliance reviews is addressed in Appendix H, ER 1105-2-100. These reviews culminate in determinations that the recommendations in the reports and the supporting analyses and coordination comply with law and policy, and warrant approval or further recommendation to higher authority by the home MSC Commander. DQC and ATR augment and complement the policy review processes by addressing compliance with pertinent published Army policies, particularly policies on analytical methods and the findings in decision documents.

8. COST ENGINEERING AND ATR MANDATORY CENTER OF EXPERTISE (MCX) REVIEW AND CERTIFICATION

As previously stated in Section 2, the RMO has coordinated with the Civil Works Cost Engineering and Agency Technical Review Mandatory Center of Expertise (MCX) to ensure the appropriate expertise is included on the review teams to assess the adequacy of cost estimates, construction schedules and contingencies. However, this RP describes a project that is nearly in its final stage of construction. Some reviews predate the establishment of the RMC. For those reviews, the Huntington District was responsible for the appropriate review coordination with the Cost Engineering MCX.

9. QUALITY ASSURANCE DURING CONSTRUCTION

Engineering representatives from the RMC, DSMMCX, and MSC office are an integral part of the vertical team. Thus, they should be continually advised of construction progress in order to permit participation by personnel from those offices in field inspections at critical construction stages in accordance with the requirements of ER 1110-2-112 (reference A.48). This involvement, along with Design Construction Evaluation inspections, is a vital part of the QA role for MSC/HQ on dam safety modification projects. This includes their participation in the latter stages of construction (prior to final acceptance).

This shall be accomplished through a regular project update prepared by the Project Manager and distributed to the entire vertical/horizontal team. This project update shall include updates on construction progress to include charts, photographs, graphs that depict current status, progress for the current month, issues (both funding and technical), and a 30 to 90 day look-ahead. Summaries of field tests, trials, and status of Interim Risk Reduction Measures (IRRM) shall be included. The frequency of the project update will be agreed upon prior to the initiation of construction.

10. MODEL CERTIFICATION AND APPROVAL

EC 1105-2-412 mandates the use of certified or approved models for all planning activities to ensure the

models are technically and theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions. Planning models, for the purposes of the EC, are defined as any models and analytical tools that planners use to define water resources management problems and opportunities, to formulate potential alternatives to address the problems and take advantage of the opportunities, to evaluate potential effects of alternatives and to support decision making. The use of a certified/approved planning model does not constitute technical review of the planning product being satisfied. The selection and application of the model and the input and output data is still the responsibility of the users and is subject to DQC, ATR, and IEPR (if required).

EC 1105-2-412 does not cover engineering models used in planning. The responsible use of well-known and proven USACE developed and commercial engineering software will continue and the professional practice of documenting the application of the software and modeling results will be followed. As part of the USACE Scientific and Engineering Technology (SET) Initiative, many engineering models have been identified as preferred or acceptable for use on Corps studies and these models should be used whenever appropriate. The selection and application of the model and the input and output data is still the responsibility of the users and is subject to DQC, ATR, and IEPR (if required).

- a. **Planning Models.** The following planning models were used in the development of the decision document:

Model Name and Version	Brief Description of the Model and How It Will Be Applied in the Study	Certification / Approval Status
HEC-FDA 1.2.5a (Flood Damage Analysis)	The Hydrologic Engineering Center’s Flood Damage Reduction Analysis (HEC-FDA) program provides the capability for integrated hydrologic engineering and economic analysis for formulating and evaluating flood risk management plans using risk-based analysis methods. The program will be used to evaluate and compare the future without- and with-project plans along Sandy Creek and the Tuscarawas River to aid in the selection of a recommended plan to manage flood risk.	Certified
LRP Risk and Uncertainty Model	The Risk and Uncertainty model used in the calculation of project benefits was developed by Pittsburgh District. This model incorporated OMBL information, unit day calculations for recreation, geotechnical analysis, alternative costs, dam break analysis information, and a project structure inventory and utilized Monte Carlo simulation (via the @Risk program) to determine net project benefits and the benefit to cost ratio.	Certified

- b. **Engineering Models.** The following engineering models were used in the development of the decision document.

Model Name and Version	Brief Description of the Model and How It Will Be Applied in the Study	Approval Status
MCACES 2 nd Generation (MII) Version 3.01	Developed by Project Time and Cost, Inc. (PT&C), MII is a detailed cost estimating application used by the USACE and its A-E contractors for military, civil works, and hazardous, toxic and radioactive waste (HTRW) projects. MII was first released in June 2003 and replaced the MCACES and MCACES for Windows programs.	Certified
Crystal Ball Fusion Edition, Release 11.1.3.00 (Build 11.1.1077.0 on 7/23/2009)	Developed by Oracle, this Excel add-in is used to perform a risk analysis based on the Monte-Carlo principles. It involves selecting a distribution type for an identified risk, determining the input parameters to fit the selected distribution, completing the correlation matrix, running the simulation, allocating the risk dollars back to the appropriate line items, and running final reports on the analysis. The forecasts that result from these simulations help quantify areas of risk so decision-makers can have as much information as possible to support wise decisions.	Certified
HEC-RAS Version 4.0 and the BETA Version 4.0	The function of this model is to complete one-dimensional hydraulic calculations for a full network of natural and manmade channels. HEC-RAS major capabilities are: <ul style="list-style-type: none"> • User interface • Hydraulic analysis • Data storage and management • Graphics and reporting 	Certified
HEC-HMS, Version 3.2	By applying this model the PDT is able to: <ul style="list-style-type: none"> • Define the watersheds' physical features • Describe the metrological conditions • Estimate parameters • Analyze simulations • Obtain GIS connectivity 	Certified
SEEP/W and SLOPE/W – GeoStudio 2007 (Version 7.13, Build 4419) Copyright 1991-2008 GEO-SLOPE International, Ltd.	<ul style="list-style-type: none"> • Seepage analysis – Finite Element Software • Slope stability analysis – capable of probabilistic analyses 	Certified

11. REVIEW SCHEDULES AND COSTS

a. ATR Schedule and cost.

The following products have undergone ATR:

- Major Rehabilitation Report – ATR completed July 2008
- Design Documentation Report – ATR completed August 2010
- Hydrologic Hazard Team Review of PIE-ATR completed February 2017
- Plans and Specifications for project components
 - Construction Office – ATR completed July 2011
 - Seepage Blanket Extension – ATR completed May 2011
 - Service Gates Replacement – ATR completed September 2011
 - Seepage Barrier – ATR completed January 2013

ATR of the remaining products (Revision of O&M Manual, PIE and Project Completion Report) will follow the completion of the Seepage Barrier contract expected in 2017 and 2018. Based on past experience the remaining ATR's are expect to be approximately \$110,000.

b. Type I IEPR Schedule and Cost. Not Applicable.

c. Type II IEPR Schedule and Cost. A Type II IEPR will be performed on the Post Implementation Evaluation Report. Based on District experience with past Type II IEPR the cost for these reviews is anticipated to be approximately \$150,000.

d. Model Certification/Approval Schedule and Cost. As evidenced in the chart above, all models have been certified.

12. PUBLIC PARTICIPATION

Since initiation of the Bolivar Major Rehabilitation Report in October 2005, numerous public meetings have been conducted. Close coordination with Tuscarawas County officials regarding the current condition of Bolivar Dam, the study efforts and implementation of interim risk reduction measures has occurred and is ongoing. As a result, Tuscarawas County updated their Emergency Evacuation Plan in June 2007. Portions of the plan were utilized in March 2008 as a result of significant precipitation in the region. A scoping meeting for the Bolivar Major Rehabilitation Report was conducted with other agencies, including the U.S. Fish and Wildlife Service, on 19 June 2007. A public meeting was conducted on 28 May 2008 to inform the public of the current condition of Bolivar Dam, the progress of the Major Rehabilitation Report, the entire implementation schedule for the project and to solicit public review and comment on the Draft Environmental Assessment and Major Rehabilitation Report. It was stated in the first iteration of the Review Plan that additional public meetings would be conducted, as necessary, through the DDR, plans and specifications and construction phases. None of these meetings have proved to be necessary. Information will continue to be conveyed to the public through the use of press releases, briefing local civic groups, and media interviews as necessary and through the use of posting information to the Huntington District's web site.

13. IMPLEMENTATION PHASE REVIEW PLAN APPROVAL AND UPDATES

The Great Lakes and Ohio River Division Commander is responsible for approving this IPRP. The

Commander's approval reflects vertical team input (involving the District, MSC, RMO, and HQUSACE members) as to the appropriate scope and level of review for the decision document. Like the PMP, the IPRP is a living document and is likely to change as the study progresses. The home district is responsible for keeping the IPRP up to date. Significant changes such as changes to the scope and/or level of review should be re-approved by the MSC Commander following the process used for initially approving the plan. The latest version of the IPRP, along with the Commanders' approval memorandum, should be posted on the Home District's webpage. The latest IPRP should also be provided to the RMO and home MSC.

Several changes have taken place over the life of this project. This document represents a minor rewrite, to incorporate and document all review efforts completed thus far. The previous review plan is maintained in the Huntington District and is available upon request. Revisions are documented in Attachment 3.

14. IPRP POINTS OF CONTACT

Public questions and/or comments on this review plan can be directed to the following points of contact:

- Jami Buchanan, Huntington District, Lead Planner 304-399-5347
- Rebecca Bennett, Huntington District, Project Manager 304-399-5711
- Jeffrey Maynard, Dam Safety Production Center, Lead Engineer 304-399-5956
- Amy Jo Riffie, Huntington District Chief, Quality Management 304-399-5544
- Troy O'Neal, Great Lakes and Ohio River Division, Dam Safety Program Manager 513-684-3804

ATTACHMENT 1: TEAM ROSTERS

TABLE 1.1 Product Delivery Team		
Functional Area	Name	Office
Project Manager	Rebecca Bennett	CELRH
Lead Engineer	Jeffrey Maynard	CELRH-DSPC
Civil/Engineering Manager	Stephen Wallington	CELRH
Real Estate	Elizabeth Cooper	CELRH
Contracting	Richard Horton	CELRH
Operations	Jean Siedel	CELRH
Public Affairs	Brian Maka	CELRH
Geology	Mike Nield	CELRH-DSPC
Cost Engineering	Dustin Sawyers	CELRH-DSPC
Hydrology and Hydraulics	Jim Schray	CELRH
Structural	James Waddle	CELRH
Dam Safety	Mike Stickler	CELRH
Geotechnical	Kenneth Darko	CELRH
Mechanical Engineer	Keith Ward	CELRH
Electrical Engineer	Gregory Gilkison	CELRH
Archeology	Rodney Parker	CELRH
Geotechnical	Seth Lyle	CELRH-DSPC
Construction	Matt Folk	CELRH
Environmental	Christy Bollinger	CELRH
HTRW	Dan Stark	CELRH

TABLE 1.2 ATR Team - Major Rehabilitation Report		
Functional Area	Name	Office
ATR Team Leader / Civil Design	Terry Shilley	CELRH
Structural	Doug Kish	CELRH
Mechanical	Brenden McKinley	CELRH
Operations	Dave Carter	CELRH
Hydraulics	Ken Halstead	CELRH
Soils	Mark Vance	CENAE
Environmental	Ray Hedrick	CELRN
HTRW/Construction	Larry Drown	CELRH
Geology	Mike Nield	CELRH
Geology	Mike Navin	CEMVS
Cost	Don Whitmore	CELRH
Real Estate	Gary Walker	CELRH
Dam Safety	Charlie Barry	CELRH
Mapping	Jim Vassar	CELRH

TABLE 1.3 Agency Technical Review Team Roster – Design Documentation Report		
Functional Area	Name	Office
Dam Safety/Geotechnical/Team Leader	Mark Vance	CENAE
Geotechnical	Philip Smith	CESAS
Civil/Site	Jennifer Savitz	CELRP
Hydrology and Hydraulics	Jim Kosky	CELRP
Construction	Denise Polizzano	CELRP
Environmental/Archeological	Ray Hedrick	CELRN
Structural	Stephen Stoltz	CELRP
Mechanical	Chuck Palmer	CENWW
Cost Engineering	Jim Neubauer	CENWW
Cost Engineering	Gareth Clausen	CENWW
Engineering Geology	Kenneth Henn	CELRL

TABLE 1.4: Agency Technical Review Team Roster – Service Gates Replacement		
Functional Area	Name	Office
Team Lead-Mechanical	Chuck Palmer	CENWW
Construction	Denise Polizzano	CELRP
Structural	Paul Surace	CELRP
Electrical	John Nites	CELRP

TABLE 1.5 Agency Technical Review Team Roster – Seepage Barrier P&S		
Functional Area	Name	Office
Team Lead/Geology	Mark Harris	SWL
Civil/Site	Beth Schneller	LRP
Construction	David Howell	SWL
Environmental/Arch	Kimberly Franklin	LRN
Cost Engineering	Paula Boren	LRP
Geotechnical	Mark Vance	NAE
Electrical	John Nites	LRP

TABLE 1.6: Agency Technical Review Team Roster – Seepage Blanket Extension P&S		
Functional Area	Name	Office
Team Lead/Geotechnical	Philip Smith	CESAS
Construction/Civil	Denise Polizzano	CELRP

TABLE 1.7: Agency Technical Review Team Roster – Construction Office P&S		
Name	Discipline	Office
Team Lead/Construction/Civil	Denise Polizzano	CELRP
Mechanical	Long Truong	CELRN
Architectural	Todd Mitchell	CELRH
Electrical	John Nites	CELRP

TABLE 1.8 Agency Technical Review Team Roster – Post Implementation Evaluation Report		
Functional Area	Name	Office
TBD	TBD	TBD

TABLE 1.9 Hydrologic Hazard Team Roster – Post Implementation Evaluation Report		
Functional Area	Name	Office
Hydrology and Hydraulics	Edward Stowasser	CELRH-DSPC

TABLE 1.10 Agency Technical Review Team Roster – Operations and Maintenance Manual		
Functional Area	Name	Office
TBD	TBD	TBD

TABLE 1.11 Agency Technical Review Team Roster – Project Geotechnical and Concrete Materials Completion Report		
Functional Area	Name	Office
TBD	TBD	TBD

ATTACHMENT 2: Sample AGENCY TECHNICAL REVIEW Template

STATEMENT OF TECHNICAL REVIEW

[Project Name and Location]

[Product Type]

[Date]

COMPLETION OF AGENCY TECHNICAL REVIEW

The Agency Technical Review (ATR) has been completed for the *[product type & short description of item]* for *[project name and location]*. The ATR was conducted as defined in the project's Review Plan to comply with the requirements of EC 1165-2-214. During the ATR, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of: assumptions, methods, procedures, and material used in analyses, alternatives evaluated, the appropriateness of data used and level obtained, and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing US Army Corps of Engineers policy. The ATR also assessed the District Quality Control (DQC) documentation and made the determination that the DQC activities employed appear to be appropriate and effective. All comments resulting from the ATR have been resolved and the comments have been closed in DrCheckssm.

Signature

[Name, Office Symbol] [Date]

ATR Team Leader

Signature

[Name, Office Symbol] [Date]

[Home District] Project Manager

Signature

[Name] [Date]

Architect Engineer Project Manager ¹

[Company, Location]

Signature

[Name, Office Symbol] [Date]

Review Management Organization Representative

CERTIFICATION OF AGENCY TECHNICAL REVIEW

Significant concerns and the explanation of the resolution are as follows:

[Describe the major technical concerns and their resolution]

As noted above, all concerns resulting from the ATR of the project have been fully resolved.

Signature

[Name, Office Symbol] [Date]
Chief, Engineering Division or Equivalent

Signature

[Name, Office Symbol] [Date]
Chief, Operations Division

Signature

[Name, Office Symbol] [Date]
Chief, Planning Division²

ATTACHMENT 3: REVIEW PLAN REVISIONS

Revision Date	Description of Change	Page / Paragraph Number
1 June 2011	Phased implementation of Plans and Specifications for a contract to construct downstream seepage blanket and tree clearing risk reduction measures.	Revisions marked in red
March 2012	Phased implementation of Service Gates Replacement contract P&S, documentation of VE Study completion, review of Risk Assessment, and general schedule and review roster	Revisions marked in blue
December 2013	Major Re-write for Seepage Barrier Implementation Phase.	
March 2017	<p>Added DQC Reviews of:</p> <ul style="list-style-type: none"> • Relief Well Plans and Specification • Abutment Restoration Plans and Specification • Phase III Instrumentation <p>Removed an ATR Review of:</p> <ul style="list-style-type: none"> • Abutment Restoration Plans and Specification <p>Added ATR Reviews of:</p> <ul style="list-style-type: none"> • Post Implementation Evaluation • Hydrologic Hazard Team Review of Post Implementation Evaluation <p>Updated the Completed and To-be Completed IEPR paragraphs</p> <p>Updated the PDT Roster Table to current day PDT members</p> <p>Added Tables 1.8 through 1.11</p> <p>Minor editorial and page layout format corrections</p> <p>Added ATTACHMENT 6: ADDITIONAL INFORMATION ON RISK DRIVERS</p>	<p>Paragraph 4</p> <p>Paragraph 5</p> <p>Paragraph 5</p> <p>Paragraphs 6b and 6c</p> <p>Page 16</p> <p>Page 18</p> <p>Throughout</p> <p>Page 25-27</p>

ATTACHMENT 4: ACRONYMS AND ABBREVIATIONS

Term	Definition	Term	Definition
AFB	Alternative Formulation Briefing	NED	National Economic Development
ASA(CW)	Assistant Secretary of the Army for Civil Works	NER	National Ecosystem Restoration
ATR	Agency Technical Review	NEPA	National Environmental Policy Act
CSDR	Coastal Storm Damage Reduction	O&M	Operation and maintenance
DDR	Design Documentation Report	OMB	Office and Management and Budget
DPR	Detailed Project Report	OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
DQC	District Quality Control/Quality Assurance	OEO	Outside Eligible Organization
EA	Environmental Assessment	OSE	Other Social Effects
EC	Engineer Circular	PCX	Planning Center of Expertise
EIS	Environmental Impact Statement	PDT	Project Delivery Team
EO	Executive Order	PAC	Post Authorization Change
ER	Ecosystem Restoration	PMP	Project Management Plan
FDR	Flood Damage Reduction	PL	Public Law
FEMA	Federal Emergency Management Agency	QMP	Quality Management Plan
FRM	Flood Risk Management	QA	Quality Assurance
FSM	Feasibility Scoping Meeting	QC	Quality Control
GRR	General Reevaluation Report	RED	Regional Economic Development
Home District/MS	The District or MSC responsible for the preparation of the decision document	RMC	Risk Management Center
HQUSACE	Headquarters, U.S. Army Corps of Engineers	RMO	Review Management Organization
IEPR	Independent External Peer Review	RTS	Regional Technical Specialist
ITR	Independent Technical Review	SAR	Safety Assurance Review
LRR	Limited Reevaluation Report	USACE	U.S. Army Corps of Engineers
MCX	Mandatory Center of Expertise	WRDA	Water Resources Development Act
MSC	Major Subordinate Command		

ATTACHMENT 5: Type I IEPR Waiver



DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DIVISION, GREAT LAKES AND OHIO RIVER
CORPS OF ENGINEERS
660 MAIN STREET
CINCINNATI, OH 45202

APR 10 2009

CELRD-DE

MEMORANDUM FOR Commander, Huntington District (CELRH-DE), 502 Eighth Street,
Huntington, WV 25701-2070

SUBJECT: Request for Waiver of Type I Independent External Peer Review (IEPR) of Bolivar
Dam Major Rehabilitation Report

1. Reference:

- a. CELRH-DE memorandum, same subject, dated 26 January 2009
- b. EC 1105-2-410, 22 August 2008, Review of Decision Documents
- c. EC 1165-2-209 Draft, 6 January 2009, Civil Works Review Policy

2. Reference 1.a. provided a summary of Bolivar Dam Major Rehabilitation Report and requested a waiver of a Type I Independent External Peer Review (IEPR) for that report.

3. Paragraph 6.d. of reference 1.b. states that the decision to conduct an IEPR rests with the MSC Commander. Furthermore, paragraph 7.f. of reference 1.c. says, "the vertical team (involving district, MSC, RMO, and HQ members) will advise the MSC Commander as to whether IEPR is appropriate. The decision to conduct IEPR rests with the MSC Commander."

4. Based on advice from the vertical team, I have determined that a Type I IEPR is not required for Bolivar Dam Major Rehabilitation provided that:

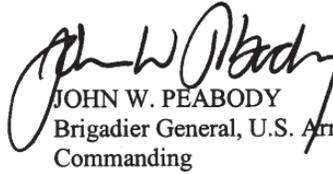
- a. The work does not require an Environmental Impact Statement (EIS);
- b. The work is within the footprint of the existing dam;
- c. The work is for an activity for which there is ample experience within the Corps of Engineers and industry to treat the activity as being routine; and

CELRD-DE

SUBJECT: Request for Waiver of Type I Independent External Peer Review (IEPR) of Bolivar Dam Major Rehabilitation Report

d. A Type II, Independent External Peer Review (Safety Assurance Review), with the addition of a review of economics of the alternatives, is started as one of the first activities in the design phase of the modification.

5. POC for this item is Robert Taylor, CELRD-RBT, 513-684-3804.


JOHN W. PEABODY
Brigadier General, U.S. Army
Commanding