

# REVIEW PLAN

**Mohawk Dam, Coshocton County, Ohio**  
**Dam Safety Modification Study**

**Huntington District**

MSC Approval Date: pending  
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US Army Corps  
of Engineers ®

REVIEW PLAN

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## 1. PURPOSE AND REQUIREMENTS

**a. Purpose.** This Review Plan defines the scope and level of peer review for the Dam Safety Modification Study (DSMS) for Mohawk Dam (P2 #399447), located in Coshocton County, Ohio. This Review Plan is a standalone component of the Mohawk Dam DSMS Project Management Plan.

### **b. References.**

- (1) Engineering Circular (EC) 1165-2-214, Civil Works Review, 15 Dec 12
- (2) EC 1105-2-412, Assuring Quality of Planning Models, 31 Mar 11
- (3) Engineering Regulation (ER) 1110-1-12, Quality Management, 30 Sep 06
- (4) ER 1105-2-100, Planning Guidance Notebook, Appendix H, Policy Compliance Review and Approval of Decision Documents, Amendment #1, 20 Nov 07
- (5) Mohawk Dam DSMS Project Management Plan (PMP)
- (6) Mohawk Dam Issue Evaluation Study (IES), October 2014

**c. Requirements.** This review plan 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 process for review of all Civil Works projects from initial planning through design, construction, and 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).

## 2. REVIEW MANAGEMENT ORGANIZATION (RMO) COORDINATION

a. The RMO is responsible for managing the overall peer review effort described in this Review Plan. The RMO for decision documents is typically either a Planning Center of Expertise (PCX) or the Risk Management Center (RMC), depending on the primary purpose of the decision document. The RMO for the peer review effort described in this Review Plan is the RMC.

b. The RMO will coordinate 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.

## 3. STUDY INFORMATION

**a. Decision Document.** A Dam Safety Modification Report (DSMR) will document the DSMS for Mohawk Dam, located in Coshocton County, Ohio. The DSMS will address the risks associated with the probability of failure of the Mohawk Dam. These concerns contributed to the dam's original classification by the U.S. Army Corps of Engineers (USACE) Screening Portfolio Risk Assessment (SPRA) as

a Dam Safety Action Class (DSAC) 2 – Urgent (unsafe or potentially unsafe) project. The Issue Evaluations Study (IES) conducted for the dam in 2014 confirmed this rating.

The decision document will present planning, engineering and implementation details of the recommended plan to allow final design and construction (if necessary) to proceed subsequent to the approval of the plan by the USACE Dam Safety Officer (DSO). An Environmental Assessment (EA) is being prepared along with the study, and a Finding of No Significant Impact (FONSI) is anticipated. This project will not require Congressional authorization. A Cost and Schedule Risk Analysis (CSRA) will be scheduled prior to the Agency Technical Review (FY16). This analysis will be performed by Walla Walla District, which is the Cost Engineering Center of Expertise.

**b. Study/Project Description.** Mohawk Dam is a single-purpose Flood Risk Management (FRM) dam located in Coshocton County, Ohio on the Walhonding River (see Figure 1 below), a tributary of the Muskingum River. The dam is located 17.4 miles above the mouth of the Walhonding River and approximately 129.8 miles above the mouth of the Muskingum River. The town located nearest to Mohawk Dam is Nellie, with a population of 134. More sizable population centers downstream of the dam include Coshocton (located 15 miles to the southeast) and Zanesville (located 36 miles to the southwest) with populations of approximately 11,500 and 25,500 respectively. The floodplain between Mohawk Dam and these larger, downstream population centers can be described as consisting of broad, gently sloping valleys. Development is sparse downstream of the dam and is comprised primarily of small towns, some light industrial development and farmland.



Figure 1 – Location of Mohawk Dam in the State of Ohio

Mohawk Dam was completed in September 1937. It is a dry dam and does not retain a permanent pool during any season of the year. The Official Plan<sup>1</sup> for Mohawk did not provide for a permanent lake to be maintained behind the dam and this policy has remained in effect for the 75+ year life of the project. However, since the sluice intake elevation at the dam is approximately 5 feet higher than the original stream bed, a small backwater pool extends upstream about 1.5 miles, but is contained within the stream banks. At the maximum flood control pool level (elevation 890.0), the reservoir has a surface area of 7,950 acres and a flood control capacity of 285,000 acre-feet.

Mohawk Dam also controls the outflow from four other USACE flood control dams located in the Mohawk drainage basin including Mohicanville, Charles Mill, Pleasant Hill, and the North Branch of Kokosing River Dams. Mohawk has an upstream drainage area of approximately 1,504 square miles (821 square miles net area excluding Charles Mill, Pleasant Hill and Mohicanville lake drainage areas).

The embankment is a rolled earthfill structure with a central core flanked by pervious zones and outer rockfill shells. The embankment has a maximum structural height of 115.5 feet, a crest length of 2,300 feet, and a crest width of 35 feet. At the dam site the Walhonding River flood plain, at approximate elevation 810, is over 1,700 feet wide. Presently the Walhonding is degrading the glacial outwash which filled the deeply entrenched preglacial valley after the last Wisconsin glaciation. These alluvial deposits consist primarily of silts, sands, and gravels. The dam is founded on these highly pervious deposits 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.

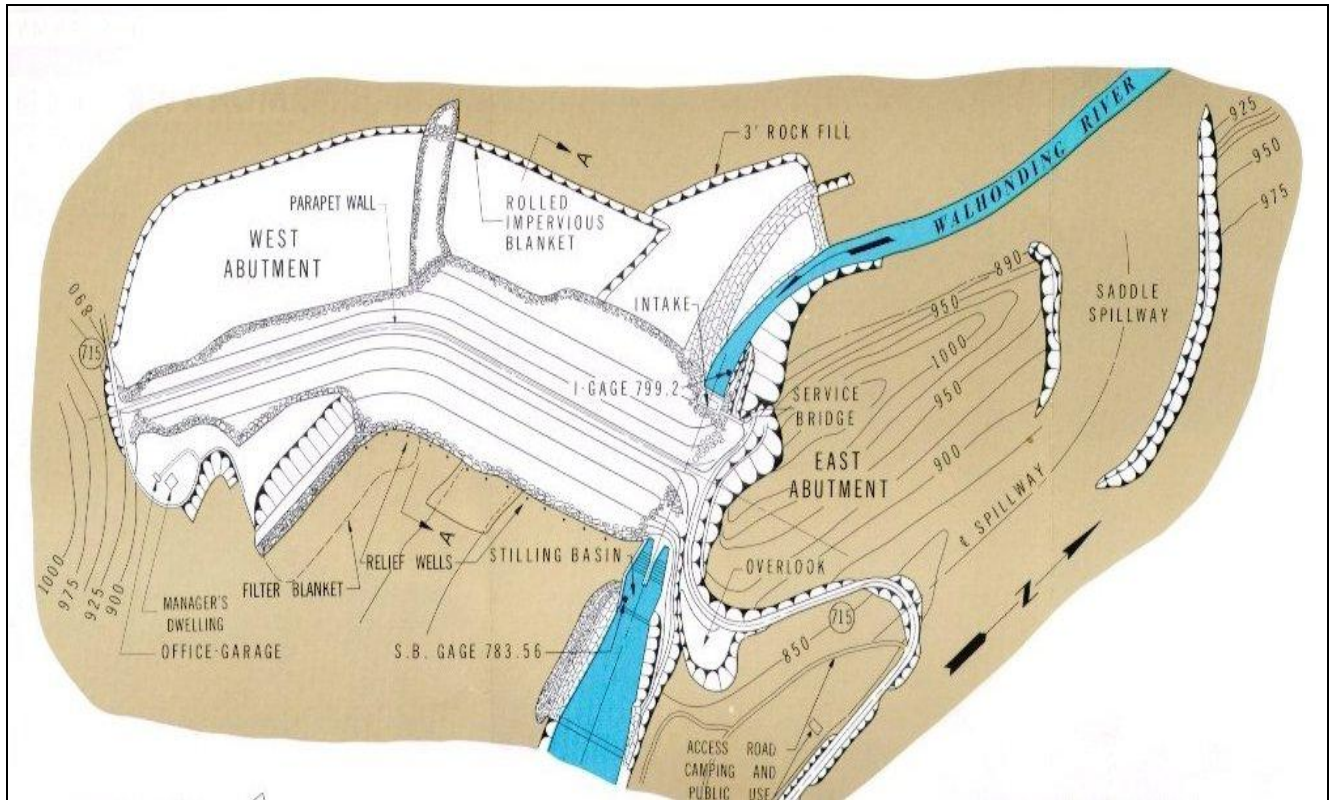
Between 1975 and 1988 a number of seepage control features were installed along the downstream toe of the dam. Present seepage control features include relief wells, a terrace toe drain pipe, valley rock fill toe drain, and a downstream seepage blanket. In January 2005, a small portion of the downstream filter blanket was extended to slow down excessive under-seepage that occurred during a new pool of record. Observations throughout the history of the project indicated that deficiencies existed in the relief wells, terrace toe drain pipe and downstream blanket during a spillway flood pool. Consequently, the District has supplemented these features in an attempt to control excessive underseepage historically observed since construction. Additionally, in 1988, a Dam Safety Assurance Project raised the top of the embankment by 4.5 feet to elevation 914.5 and a parapet wall added another 3.0 feet (elevation 917.5) for freeboard.

The outlet works consist of an approach channel, intake tower, horseshoe shaped tunnel and conduit, stilling basin and outlet channel. The intake structure consists of a reinforced concrete substructure and a brick and stone superstructure to house the gate operating machinery for six 8' x 17' sluice gates and the auxiliary power unit. Access to the structure is by a service bridge extending from the left abutment. The outflow is directed through two 20-foot diameter, concrete-lined horseshoe shaped tunnel and conduit, which extend through the left abutment from a transition section near the gates to the stilling basin.

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<sup>1</sup> The "Official Plan" is the original agreement between the Muskingum Watershed Conservancy District and the USACE. This document specified the number of dams to be build, their location, authorized project purposes and understanding of how the projects would be operated.

The stilling basin is a shallow pool confined between concrete sidewalls. Below the tunnel and conduit, the channels are flared to reduce the depth of flow at the entrance of the stilling basin. The embankment side is protected by a gravity section retaining wall and the abutment side by a slab placed against and anchored to the rock face. The bottom is paved with a concrete slab anchored into the rock. Two rows of baffle piers and an end sill were constructed into the bottom slab to aid in energy dissipation. The outlet channel extends from the stilling basin approximately 2,400 feet downstream to the Walhonding River.



**Figure 2 – Plan View of Mohawk Dam**

An IES for the dam was completed in October 2014. The IES identified four significant Potential Failure Modes (PFMs) for the dam, including:

- Backward erosion piping of valley outwash into the 1937 rock toe drain.
- Backward erosion piping of valley outwash daylighting at a flaw in the alluvial blanket.
- Backward erosion piping of valley outwash daylighting at the seepage collection system outfall channel.
- Spillway erosion.

The following safety recommendations were approved by the DSOG:

Dam Safety Action Items:

- 2014-OH00016-DS-01: Develop a field exploration program to evaluate the erodibility of materials in the spillway.

- 2014-OH00016-DS-02: Develop a field exploration program, subject to senior advisory panel approval, to collect additional information in the downstream alluvium/outwash area and rock toe to reduce uncertainty.
- 2014-OH00016-DS-03: Evaluate alternatives to reduce risks at Mohawk Dam and complete a Dam Safety Modification Study.

O&M Action Items:

- 2014-OH00016-OM-01: Place impervious fill in gap in upstream impervious blanket on upstream terrace slope.
- 2014-OH00016-OM-02: Repair the joint separations between the 1975 and 1981 toe drains.
- 2014-OH00016-OM-03: Install tailwater gage closer to downstream toe of dam.
- 2014-OH00016-OM-04: Install left abutment leakage collection and monitoring system.

The following alternatives will be considered during project formulations:

- No Action alternative ;
- Meeting full tolerable risk guidelines using ALARP considerations to include applicable essential USACE guidelines;
- Achieving only tolerable risk limit for life safety
- Remove structure;
- Replace structure; and
- Reallocation of flood storage to upstream dams.

Additional alternatives may be added to this list as formulation progresses. Measures utilized as part of these alternatives may include, but are not limited to:

- Relief wells;
- Filter birms;
- Seepage blankets;
- Grout curtains;
- Cut off walls; and
- Nonstructural measures such as flood proofing, pool restrictions, expanded seepage monitoring early warning systems and buyouts.

A potential non-Federal sponsor has been identified as the Muskingum Watershed Conservancy District.

**c. Factors Affecting the Scope and Level of Review.** The project is likely to be justified by life safety issues, given the significant downstream population centers in the inundation area. Additionally, the project will also likely be cost justified as well, given the economic consequences associated with the downstream inundation areas. Given the life loss consequences associated with the dam, project design will require redundancy, resiliency and robustness. These factors will be criteria for selecting the Risk Management Plan.

Recent and ongoing changes in the planning framework, such as the transition to SMART Planning may present challenges as the Project Delivery Team (PDT) works through the formulation process in terms of new milestones and requirements. This coupled with the requirements of the relatively new Dam Safety Guidance outlined in ER 1110-2-1156 could present a learning curve as the study progresses.

Technically however, the DSMS for Mohawk Dam is not anticipated to be particularly challenging. The dam and issues associated with it are not dissimilar from other dams in the Muskingum River Basin. The Major Rehabilitation Project currently under construction at Bolivar Dam, and the recently completely DSMS for Zoar Levee in particular have given the District significant experience dealing with earthen embankment dams experiencing seepage and stability issues.

To date there has not been a request by the Governor of the State of Ohio for a peer review by independent experts. Neither is the project likely to involve significant public dispute. The dam itself is located in a rural area with no residential or commercial areas located directly adjacent. Any work done on the dam is likely to be viewed as favorable by residents and stakeholders.

The information in the decision document and any follow on anticipated project design is not likely to be based on novel methods, involve the use of innovative materials or techniques, present complex challenges for interpretation, contain precedent-setting methods or models, or present conclusions which are likely to change prevailing practices. As previously stated, the Huntington District is well versed in dealing with earthen embankments with seepage and stability issues, and the recommended risk management plan will likely be similar to ones already implemented either in the District or Division.

**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 products and analyses anticipated as part of this study.

#### **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). 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 the home MSC.

A DSMS is listed as a planning document and is therefore subject to ISO Document 3500 LRH – Planning Document Quality Control to District Quality Control (DQC) requirements for EC 1105-2-410.

**a. Documentation of DQC.** Individuals not on the PDT shall be assigned DQC responsibilities for certifying quality of products developed by the following disciplines:

- Planning (including formulation, economics, NEPA, cultural resources, other social effects, environmental)
- Civil Design
- Engineering Geology
- Geotechnical Engineering
- H&H
- Electrical/Mechanical Engineering
- Cost Engineering
- Structural Engineering
- Real Estate
- HTRW



- Office of Counsel
- Operations

It should be noted DQC will be done periodically at critical milestones through the study process. To facilitate this effort the DQC team lead will be identified early in the study process and will be invited to all PDT meetings, vertical team calls, and IPRs. DrChecks review software will be used to document all DQC comments, responses and associated resolutions accomplished throughout the DQC review process. Documentation of significant DQC comments will be provided to the ATR team.

**b. Products to Undergo DQC.** Specific products to undergo DQC include:

- All supporting data, including but not limited to technical analyses, engineering conclusions and environmental documentation
- The draft EA and draft FONSI, technical appendices and supporting documentation and analysis.

**c. Required DQC Expertise.**

- Plan Formulation
- Cultural Resources
- Economics
- NEPA Compliance
- Civil Design
- Engineering Geologist
- Geotechnical Engineering
- H&H Engineering
- Electrical/Mechanical Engineering
- Cost Engineering
- Structural Engineering
- Engineering Construction
- Real Estate

## **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 will assess whether the analyses presented are technically correct and comply with published USACE guidance, and 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 will be 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.

**a. Products to Undergo ATR.** The ATR process will be ongoing throughout the study process. The ATR team lead will be invited to all PDT meetings and vertical team meetings/calls. At each monthly PDT meeting potential ATR issues will be identified, so that the ATR team lead may begin working towards resolutions with the appropriate ATR team member. Identification and resolution of potential ATR issues will be documented using DRCheck software, which will be organized by project phase. Four formal in-progress reviews will be completed during the preparation of the DSMR:

1. A site visit to become familiar with the project;
2. Review of the updated existing baseline condition and Future Without Condition (FWAC);
3. Review of the final array of alternatives prior to the Tentatively Selected Plan (TSP) Meeting; and
4. Review of the draft DSMR and EA, technical appendices and supporting documentation and analysis, prior to the Quality Control and Consistency (QCC) Review.

**b. Required ATR Team Expertise.** The following table summarizes the number of review panel members and expertise required for the required ATR. Additional ATR needs may be identified as the study progresses. All ATR team members should be professionally registered, as required by their respective disciplines, in the area of expertise they are reviewing. Additionally, all Engineering and Construction reviewers must be CERCAP certified. The complete ATR roster is included in Attachment 1.

ATR Team Members/Disciplines	Expertise Required
ATR Lead	The ATR lead should be a senior professional with extensive experience in preparing Civil Works decision documents and conducting ATR. The lead should also have the necessary skills and experience to lead a virtual team through the ATR process. The ATR lead may also serve as a reviewer for a specific discipline (such as planning, economics, environmental resources, etc).
Plan Formulation	The Planning reviewer should be a senior water resources planner with experience in dam safety modification and flood risk management projects. This person should also be familiar with current Administration Policy, Executive Orders and guidance related to planning studies, and alternative optimization.
Cultural Resources	The Cultural Resources reviewer should meet Professional Qualification Standards set forth in the Secretary of the Interior’s Standards and Guidelines for Archeology and Historical Preservation (48 FR 44716) in history, architectural history, archeology and/or in historic architectural.
Economics	The Economics reviewer should be a senior water resources planner with experience in dam safety modification and flood risk management projects. The reviewer should have a strong understanding of economic models or studies relative to flood risk management, including simulation of engineering reliability data.
NEPA Compliance	The Environmental Resources reviewer should have a strong background in inland riverine ecosystems (e.g. riparian, aquatic, wetland), NEPA and other State and Federal environmental laws and regulations.
Civil Design	Reviewer should be a senior level, professionally registered civil engineer with extensive experience with civil site layout and dam safety projects.
Engineering Geologist	The reviewer should be a senior-level engineering geologist with extensive experience in the dam safety analysis and karstic

	geology and be proficient in assessing seepage through sedimentary rock. The reviewer should be experienced in the design of seepage barriers or cutoff walls, and should have knowledge of spillway erodibility in sedimentary rock. The reviewer should have seepage, piping and seismic experience and a working knowledge of all applicable Corps of Engineers design criteria.
Geotechnical Engineering	The reviewer should be a professionally registered engineer with experience in embankment dam design and evaluation, as well as experience in seepage and piping and seepage failure mode analysis, and risk analysis of embankment dams, and familiarity with USACE dam safety guidance. Specific experience with seepage barriers or cutoff walls, relief wells, seepage filters & drainage elements is required.
H&H Engineering	The H&H reviewer should be a professionally registered engineer with experience with engineering analysis related to flood risk management and dam safety projects. He or she should be familiar with standard Corps hydrologic and hydraulic computer models (HEC-RAS, HEC-HMS, & HEC-ResSim), and have experience with unsteady flow dam failure analysis modeling.
Electrical/Mechanical Engineering	The reviewer should either be a professionally registered engineer with extensive knowledge of electrical works, gates and operating equipment on flood risk management dams.
Cost Engineering	The reviewer for cost estimating shall be a registered or certified cost engineer with a BS degree or higher in engineering or construction management, and should have 5-10 years experience estimating complex, phased multi-year civil works construction projects and hydraulic retention structures. The reviewer shall have extensive knowledge of MII software and the Total Project Cost Summary (TPCS) as required during ATR. A certification from the Cost Directorate of Expertise (DX) in Walla Walla District will be required.
Structural Engineering	Reviewer should be a senior level, professionally registered engineer with extensive experience with pump stations and dam safety projects.
Engineering Construction	Reviewer should be a senior level, professionally registered engineer with extensive experience in the engineering construction field with particular emphasis on dam safety projects.
Real Estate	The reviewer should have experience in real estate issues related to flowage easements associated with existing Corps projects, as well as a working knowledge of USACE real estate policy and regulation.
TBD	
TBD	
TBD	

**c. Documentation of ATR.** DrChecks review software will be used to document all ATR comments, responses and associated resolutions accomplished throughout the review process. Comments should be limited to those that are required to ensure adequacy of the product. The four key parts of a quality review comment will 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 been 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.

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

e. 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.

f. 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:

(1) Identify the document(s) reviewed and the purpose of the review;

(2) Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;

(3) Include the charge to the reviewers;

(4) Describe the nature of their review and their findings and conclusions;

(5) Identify and summarize each unresolved issue (if any); and

(6) 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.

g. 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 AFB, draft report, and final report. A sample Statement of Technical Review is included in Attachment 2.

## **6. INDEPENDENT EXTERNAL PEER REVIEW (IEPR)**

a. 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 areas of expertise suitable for the review being conducted. There are two types of IEPR:

(1) 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.

(2) 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.

**b. Decision on IEPR.** Given the life loss consequences associated with the project, as well as the need for redundancy, robustness and resiliency in design, the project meets mandatory triggers for Type I and II IEPR, as described in Paragraph 11.d.(1) and Appendix D of EC 1165-2-214. As Type II IEPR is anticipated, a SAR will be addressed during the Type I IEPR, as stated in Paragraph 2.c.(3) of Appendix D of EC 1165-2-214.

**c. Products to Undergo Type I IEPR (and SAR).** The DSMS, environmental assessment and supporting documentation will undergo a Type I IEPR with an incorporated SAR.

**d. Required Type I IEPR Panel Expertise.** The following table provides an estimate of the number of Type I IEPR panel members and the types of expertise which should be represented on the review panel. Only those disciplines which have the potential to have significant and/or controversial impacts associated with the project have been selected for the Type I IEPR Panel. All IEPR panel members shall be Level 3 reviewers with a minimum of 20 years of specialized experience and are considered to be a recognized expert in their field.

<b>IEPR Panel Members/Disciplines</b>	<b>Expertise Required</b>
Plan Formulator / Economist	The Panel Member should have a degree in planning or a related field and should have extensive experience in the plan formulation process, particularly with the Corps 6 step planning process. Panelist should be familiar with evaluation of alternative plans for flood risk management. The Panel Member should have a degree in economics or a related field and should be able to evaluate the appropriateness cost/benefit analysis used. Experience dealing directly with HEC-FIA is encouraged. The Panel Member should also be familiar with risk and uncertainty analysis (i.e. Monte Carlo type simulation). Panel Member should also have experience with National Economic Development analysis procedures, particularly as they relate to flood risk management projects. At least 5 years experience directly working for or with USACE is highly recommended.
Engineering Geologist	The Engineering Geologist panel member should be a senior-level geologist familiar with identification of geological hazards, exploration techniques, field and laboratory testing, and instrumentation. The Panel Member should be proficient in assessing seepage and piping through and beneath dams constructed on fractured and faulted rock, karstic rock, or within various geologic environments, including but not limited to alluvial (including open-work gravels) and colluvial (including boulders and cobbles) materials. The Panel Member should be experienced in the design and construction of seepage barriers or cutoff walls. The Panel Member should have a working knowledge of all applicable USACE design criteria and shall be a licensed Professional.
Geotechnical Engineer	The Geotechnical Engineering panel member should be a senior-level geotechnical engineer with experience in the field of geotechnical engineering, analysis, design, and construction of embankment dams and levees. The Panel

IEPR Panel Members/Disciplines	Expertise Required
	Member should have knowledge and experience in the forensic investigation and evaluation of seepage and piping, settlement, slope stability, and deformations problems associated with embankments constructed on weathered and jointed rock and alluvial soils. The Panel Member should have experience in the design and construction of seepage barriers or cutoff walls. The Panel Member should have experience in failure mode analysis, risk assessment of embankment dams, evaluating risk reduction measures for dam safety assurance projects, and familiarity with the USACE dam safety guidance. The Panel Member should have a working knowledge of all applicable USACE design criteria, and shall be a licensed Professional Engineer.

**e. Documentation of Type I IEPR.** The IEPR panel will be selected and managed by an Outside Eligible Organization (OEO) per EC 1165-2-214, Appendix D. Panel comments will be compiled by the OEO and should address the adequacy and acceptability of the economic, engineering and environmental methods, models, and analyses used. IEPR comments should generally include the same four key parts as described for ATR comments in Section 4.d above. The OEO will prepare a final Review Report that will accompany the publication of the final decision document and shall:

- (1) Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
- (2) Include the charge to the reviewers;
- (3) Describe the nature of their review and their findings and conclusions; and
- (4) 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.

**f. Type I IEPR Final Report.** The final Review Report will be submitted by the OEO no later than 60 days following the close of the public comment period for the draft decision document. USACE shall consider all recommendations contained in the Review Report and prepare a written response for all recommendations adopted or not adopted. The final decision document will summarize the Review Report and USACE response. The Review Report and USACE response will be made available to the public, including through electronic means on the internet.

**g. Type II IEPR.** Type II IEPR takes place during the Implementation phase, it will be fully documented in the Review Plan prepared for PED and construction following the approval of the Decision Document.

**h. Products to Undergo Type II IEPR SAR.** The Type II IEPR SAR team shall perform reviews (and a site visit, as necessary) at the completion of the plans and specifications, at the midpoint of construction, and other important milestones as determined by the RMO and LRD. Representatives from the RMC will be invited to these site visits, as well as all other panel meetings.

**i. Required Type II IEPR SAR Panel Expertise.** The following table provides an estimate of the number of Type II IEPR SAR panel members and the types of expertise that should be represented on the review panel.

IEPR Panel Members/Disciplines	Expertise Required
Geotechnical Engineer	The Geotechnical Engineering panel member should be a senior-level geotechnical engineer with experience in the field of geotechnical engineering, analysis, design, and construction of embankment dams and levees. The Panel Member should have knowledge and experience in the forensic investigation and evaluation of seepage and piping, settlement, slope stability, and deformations problems associated with embankments constructed on weathered and jointed rock and alluvial soils. The Panel Member should have experience in the design and construction of seepage barriers or cutoff walls. The Panel Member should have experience in failure mode analysis, risk assessment of embankment dams, evaluating risk reduction measures for dam safety assurance projects, and familiarity with the USACE dam safety guidance. The Panel Member should have a working knowledge of all applicable USACE design criteria, and shall be a licensed Professional Engineer.
Engineering Geologist	The Engineering Geologist panel member should be a senior-level geologist familiar with identification of geological hazards, exploration techniques, field and laboratory testing, and instrumentation. The Panel Member should be proficient in assessing seepage and piping through and beneath dams constructed on fractured and faulted rock, karstic rock, or within various geologic environments, including but not limited to alluvial (including open-work gravels) and colluvial (including boulders and cobbles) materials. The Panel Member should be experienced in the design and construction of seepage barriers or cutoff walls. The Panel Member should have a working knowledge of all applicable USACE design criteria and shall be a licensed Professional Geologist.
H&H Engineer	The Panel Member should be a Professional Engineer and have experience with engineering analysis related to flood risk management and dam safety projects. The Panel member will hold at minimum, a B.S. degree in Civil Engineering, or Hydrology and Hydraulics Engineering. The Panel Member should be familiar with standard Corps hydrologic and hydraulic computer models (HEC-RAS, HEC-HMS, & HEC-ResSim). The Panel Member should have experience with unsteady flow dam failure analysis modeling. The Panel Member must demonstrate knowledge and



	experience with the routing of inflow hydrographs through multipurpose flood control reservoirs. (The emphasis is focused on flood control reservoirs only, not on navigation structures, open river conditions, highway drainage, culverts, storm/sanitary sewers, open/closed conduits, or water distribution systems. Experience should emphasize modeling spillways and outlet works related to flood control reservoirs, particularly for large dams. Demonstrate experience in dealing with discharge being utilized at the individual flood control reservoir during a large flood event such as the Probable Maximum Flood (PMF).)
Environmental	The Environmental team member should have 10+ years experience in NEPA compliance, demonstrate experience with the USACE planning process and typical environmental concerns associated with dam safety projects.

**j. Documentation of Type II IEPR SAR.** The IEPR will be managed by AE firm which meets the criteria set forth in EC 1165-2-214. The review team will prepare a review report that shall:

- 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.
- 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.

This review report, including reviewer comments and a recommendation letter will be provided to the RMC as soon as they become available.

Written responses to the IEPR Review Report will be prepared to explain the agreement or disagreement with the views expressed in the report, the actions undertaken or to be undertaken in response to the report, and the reasons those actions are believed to satisfy the key concerns stated in the report (if applicable). These comment responses will be provided to the RMC for concurrence. The revised submittal will be provided to the RMO with the USACE response and all other materials related to the review.

The Huntington District's responses shall be submitted to the LRD MSC for final MSC Commander Approval. After the MSC Commander's approval, the District will make the report and responses 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 presentation of findings in decision documents.

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

All decision documents shall be coordinated with the Cost Engineering and ATR MCX, located in the Walla Walla District. The MCX will assist in determining the expertise needed on the ATR team and Type I IEPR team (if required) and in the development of the review charge(s). The MCX will also provide the Cost Engineering certification. The RMO is responsible for coordination with the Cost Engineering MCX.

**9. MODEL CERTIFICATION AND APPROVAL**

a. 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. 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).

b. 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).

**(1) Planning Models.** The following planning models are anticipated to be 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
HEC-FIA Version 2.2	The HEC-FIA (Flood Impact Analysis) software package analyzes the consequences from a flood event. It calculates damages to structures and contents, losses to agriculture, and estimates the potential for life loss. HEC-FIA can also assist Corps Planning studies by looking at single events deterministically to support the OSE account with Life Loss and population at risk, or through helping to determine the impacts to agriculture for typical events for the study region.	Approved

**(2) Engineering Models.** The following engineering models are anticipated to be used in the development of the decision document:

<b>Model Name and Version</b>	<b>Brief Description of the Model and How It Will Be Applied in the Study</b>	<b>Approval Status</b>
MCACES 2 <sup>nd</sup> 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.	Approved
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.	Approved
Primavera Project Management (P5) Release 5.0 SP1 (Build #: 10000002)	Developed by Primavera Systems, Inc., P5 is a comprehensive planning application built on Oracle and Microsoft SQL Server relational databases. P5 was used to develop a detailed, resource-loaded construction schedule from the MII estimate as a basis construction duration and fully-funding.	Approved
HEC-RAS BETA VERSION 5.0	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 the user interface, hydraulic analysis, data storage and management, and graphics and reporting. Standard MMC protocol is to use either Version 4.2 BETA or 5.0 BETA. The District is working closely with HEC as these models are utilized.	Certification Pending
HEC-HMS, Version 3.2	By applying this model the PDT is able to define the watersheds' physical features, describe the metrological conditions, estimate parameters, analyze simulations and obtain GIS connectivity.	Approved
SEEP/W and SLOPE/W – GeoStudio 2007 (Version 7.13, Build	Seepage analysis – Finite Element Software Slope stability analysis – capable of probabilistic analyses	Approved

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## 10. REVIEW SCHEDULES AND COSTS

### a. ATR Schedule and Cost.

Task	Proposed Dates
On-site Kick-off Meeting	March 2015
Review of Updated Existing Baseline Condition and FWAC	April 2015
Review of Final Array of Alternatives	December 2015
Draft Report Complete	August 2016
DQC/ATR of Draft Report	September 2016
ATR Certification of Final Report	October 2016

The cost for ATR is anticipated to be approximately \$90,000.

### b. Type I IEPR Schedule and Cost.

Task	Proposed Dates
Award of IEPR Contract	TBD
IEPR Review of Draft DSMS and EA	TBD
Resolve IEPR Comments	TBD

The cost for Type I IEPR is anticipated to be approximately \$175,000.

### c. Model Certification/Approval Schedule and Cost. N/A

## 11. PUBLIC PARTICIPATION

**a. Review Plan.** Huntington District will provide an opportunity for public comment by posting the approved RP on the public website, located at: <http://www.lrh.usace.army.mil/Missions/PublicReview.aspx>. This is not a formal comment period and there is no set timeframe for the opportunity for public comment. If and when comments are received, the PDT will consider them and decide if revisions to the review plan are necessary. This engagement will ensure that the peer review approach is responsive to the wide array of stakeholders and customers, both within and outside the federal government.

**b. DSMR.** Opportunities for public participation will be given throughout the study process, culminating in the public review of the EA prior to the finalization of the DSMR and EA. All relevant public comments will be provided to the DQC, ATR and IEPR panels. It is not anticipated that the public will be asked to nominate potential peer reviewers. The final EA and FONSI, and all relevant supporting information will be made available to the public via the Huntington District's website: <http://www.lrh.usace.army.mil/Missions/PublicReview.aspx>

## 12. REVIEW PLAN APPROVAL AND UPDATES

The Great Lakes and Ohio River Division Commander is responsible for approving this Review Plan. The Commander's approval reflects vertical team input (involving district, MSC, RMO, and HQUSACE members) as to the appropriate scope and level of review for the decision document. Like the PMP, the Review Plan is a living document and may change as the study progresses. The home district is responsible for keeping the Review Plan up to date. Minor changes to the review plan since the last MSC Commander approval is documented in Attachment 3. Significant changes to the Review Plan (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 Review Plan, along with the Commanders' approval memorandum, should be posted on the Home District's webpage (<http://www.lrh.usace.army.mil/Missions/PublicReview.aspx>). The latest Review Plan should also be provided to the RMO and home MSC.

### **13. REVIEW PLAN POINTS OF CONTACT**

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

Huntington District – [REDACTED]  
Great Lakes and Ohio River Division – [REDACTED]  
Risk Management Center – [REDACTED]

**ATTACHMENT 1: TEAM ROSTERS**

<b>LRH/DSPC PDT Roster</b>		
<b>Team Member</b>	<b>Expertise</b>	<b>Email</b>
[REDACTED]	Project Manager	[REDACTED]
[REDACTED]	Lead Planner/Economics	[REDACTED]
[REDACTED]	Plan Formulation/Other Social Effects	[REDACTED]
[REDACTED]	Environmental	[REDACTED]
[REDACTED]	Lead Engineer	[REDACTED]
[REDACTED]	Engineering Manager/Civil Design	[REDACTED]
[REDACTED]	Engineering Geology	[REDACTED]
[REDACTED]	DSPC Lead Geotechnical Engineer	[REDACTED]
[REDACTED]	District Lead Geotechnical Engineer	[REDACTED]
[REDACTED]	Electrical/Mechanical	[REDACTED]
[REDACTED]	Cost Engineering	[REDACTED]
[REDACTED]	Structural Engineer	[REDACTED]
[REDACTED]	Dam Safety	[REDACTED]
[REDACTED]	Operations Manager MUR	[REDACTED]
[REDACTED]	Real Estate	[REDACTED]
[REDACTED]	HTRW	[REDACTED]
[REDACTED]	Office of Counsel	[REDACTED]
[REDACTED]	Public Affairs	[REDACTED]

<b>NAD Cadre Roster</b>		
<b>Team Member</b>	<b>Expertise</b>	<b>Email</b>
[REDACTED]	Cadre Lead/Geotechnical Engineer	[REDACTED]
[REDACTED]	Geotechnical Engineer	[REDACTED]
[REDACTED]	Geologist	[REDACTED]
[REDACTED]	H&H Engineer	[REDACTED]
[REDACTED]	Structural Engineer	[REDACTED]
[REDACTED]	Consequences	[REDACTED]
[REDACTED]	RMC – Technical Advisor	[REDACTED]
[REDACTED]	RMC – Senior Advisor	[REDACTED]

<b>DQC Team Roster</b>		
<b>Team Member</b>	<b>Expertise</b>	<b>Email</b>
TBD	Plan Formulation	
TBD	Cultural Resources	
TBD	Economics	
TBD	NEPA Compliance	
TBD	Civil Design	
TBD	Engineering Geologist	
TBD	Geotechnical Engineering	
TBD	H&H Engineering	
TBD	Electrical/Mechanical Engineering	
TBD	Cost Engineering	
TBD	Structural Engineering	
TBD	Engineering Construction	
TBD	Real Estate	

<b>ATR Team Roster</b>		
<b>Discipline</b>	<b>ATR Member</b>	<b>Contact Information</b>
Lead	[REDACTED]	[REDACTED]
Structural Engineering	[REDACTED]	[REDACTED]
Geotechnical Engineering	[REDACTED]	[REDACTED]
Geology	[REDACTED]	[REDACTED]
H&H	[REDACTED]	[REDACTED]
Economics	[REDACTED]	[REDACTED]
Environmental	TBD	
Planning	[REDACTED]	[REDACTED]
Engineering Construction	[REDACTED]	[REDACTED]
Cost Engineering	TBD	
Real Estate	TBD	
Cultural Resources	TBD	
NEPA Compliance	TBD	
Civil Design	TBD	

**ATTACHMENT 2: SAMPLE STATEMENT OF TECHNICAL REVIEW FOR DECISION DOCUMENTS**

**COMPLETION OF AGENCY TECHNICAL REVIEW**

The Agency Technical Review (ATR) has been completed for the <type of product> for <project name and location>. The ATR was conducted as defined in the project’s Review Plan to comply with the requirements of EC 1165-2-209. 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 DrChecks<sup>sm</sup>.

SIGNATURE  
Name  
ATR Team Leader  
Office Symbol/Company \_\_\_\_\_ Date \_\_\_\_\_

SIGNATURE  
Name  
Project Manager  
Office Symbol \_\_\_\_\_ Date \_\_\_\_\_

SIGNATURE  
Name  
Architect Engineer Project Manager<sup>1</sup>  
Company, location \_\_\_\_\_ Date \_\_\_\_\_

SIGNATURE  
Nate Snorteland  
Review Management Office Representative  
RMC \_\_\_\_\_ Date \_\_\_\_\_

**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  
Chief, Engineering Division  
Office Symbol \_\_\_\_\_ Date \_\_\_\_\_

SIGNATURE  
Name  
Chief, Planning Division  
Office Symbol \_\_\_\_\_ Date \_\_\_\_\_

<sup>1</sup> Only needed if some portion of the ATR was contracted



**ATTACHMENT 3: REVIEW PLAN REVISIONS**

<b>Revision Date</b>	<b>Description of Change</b>	<b>Page / Paragraph Number</b>

**ATTACHMENT 4: ACRONYMS AND ABBREVIATIONS**

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