



DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DIVISION, GREAT LAKES AND OHIO RIVER
CORPS OF ENGINEERS
550 MAIN STREET
CINCINNATI, OH 45202-3222

CELRD-PD-S

14 November 2018

MEMORANDUM FOR Commander, U.S. Army Corps of Engineers, Louisville District,
ATTN: Barry Schueler, 600 Martin Luther King Jr. Place, Rm 751/PO Box 59, Louisville, KY
40201-0059

SUBJECT: Mississinewa Dam Phase 2 Issue Evaluation Study/SQRA Review Plan

1. References:

- a. Engineering Circular (EC) 1164-2-217 "Civil Works Review", dated 20 FEB 2018.
- b. Memorandum, CECW-P, Subject: Revised Delegation of Authority in Section 2014(a)(5)(A) of the Water Resources Development Act of 2007 (WRDA 2007), as amended (33 U.S.C. 2343), dated 07 JUN 2018.
- c. Memorandum, CELRL-PM-C, Subject: Mississinewa Dam Phase 2 Issue Evaluation Study/SQRA (P2# 453489); Request for Review Plan Approval; Request for Approval, dated 28 AUG 2018.
- d. Memorandum, CEIWR-RMC, Subject: Risk Management Center Endorsement – Mississinewa Dam, Phase II Issue Evaluation Study/SQRA, Review Plan, dated 16 AUG 2018.
- e. Review Plan, Mississinewa Dam, Phase 2 Issue Evaluation Study/SQRA Review Plan (REVISED), original date: OCT 2018.

2. The subject Review Plan (RP) was submitted to the Great Lakes and Ohio River Division on 27 August, 2018. The report will gather information to explain the recent crest settlement observed after the completion of the cutoff wall and explore the potential untreated defects that may still exist in the foundation beneath the cutoff wall and the minimally treated left abutment. In addition, the investigation will include the installation of 19 instruments to be used for analyzing the condition and behavior of the embankment, soil foundation, and bedrock. The district provided a revised RP incorporating all recommended changes and edits generated by the MSC (Risk Management Center) review.

3. Independent External Peer Reviews and MCX Cost Reviews are not required for Issue Evaluation Studies, as is noted in the Review Plan and supported in the Risk Management Center endorsement memo.

CELRD-PD-S

SUBJECT: Review Plan and Integrated Environmental Assessment for Mississinewa Dam,
Phase 2 Issue Evaluation Study/SQRA Review Plan (P2# 453489) – LRD Approval

4. The LRD review team has reviewed the attached RP and concurs that it describes an appropriate scope and level of review. The RP satisfies peer review policy requirements described in EC 1165-2-217, and adequately defines the scope and level of peer review for the activities to be performed for the subject project phase.

5. I concur with the recommendation of the RMO and approve the enclosed RP. The District is requested to post the RP to its website. Prior to posting, the names of all individuals identified in the RP and the dollar values of all project costs should be removed.

6. Point of contact for this action within LRD is Mr. Philip Tilly, at 513-684-3025, philip.r.tilly@usace.army.mil.

BUILDING STRONG and Taking Care of People!

Encl

STEPHEN G. DURRETT, P.E., SES
Regional Program Director

Mississinewa Dam

Phase 2 Issue Evaluation Study / SQRA

Review Plan

ENDORSED

BY:

(signature)

USACE, Risk Management Center

APPROVED

BY:

(signature)

Great Lakes and Ohio River Division

MSC Approval Date: Pending

Last Revision Date: None

Section 1

Purpose and Requirements

1.1 Purpose

This Review Plan for Mississinewa Dam Phase 2 Issue Evaluation Study (IES) (P2# 453489), (Dam NID # IN03004) will ensure a quality-engineering product is developed by the Corps of Engineers in accordance with EC 1165-2-217, "Review Policy for Civil Works". The Review Plan shall layout a value added process and describe the scope of review for the IES.

1.2 References

- EC 1165-2-217, Review Policy For Civil Works, 20 February 2018
- ER 1110-1-12, Quality Management, 31 Mar 2011
- ER 1110-2-1156, Safety of Dams – Policy and Procedure, 31 Mar 2014
- ER 5-1-11, USACE Business Process
- LRD Regional Business Processes Manual, Section 08504 LRD – QC / QA Procedures for Civil Works, Engineering and Design Products
- ER 1110-1-8159 DRCHECKS, 1 January 2015
- ECB 2013-28, Use of Certified Engineering and Construction (E&C) Community of Practice (CoP) Members for Agency Technical Reviews (ATRs) on Civil Works Projects, 24 September 2013
- ECB 2015-18, Technical Lead for E&C Deliverables, 19 October 2015
- ECB 2016-9, Civil Works Review, 4 March 2016

1.3 Requirements

This RP was developed in accordance with EC 1165-2-217, which establishes an accountable, comprehensive, life-cycle review strategy for Civil Works products. This RP will be provided to Project Delivery Team (PDT), District Quality Control (DQC), Hydrologic Hazards and Loading Curve Reviewer, Agency Technical Review (ATR), and Quality Control and Consistency Review (QCC) Teams. Any levels of review not performed in accordance with EC 1165-2-217 will require documentation in the Review Plan of the risk-informed decision not to undertake that level of review. Note: For IES's Independent External Peer Reviews and MCX Cost Reviews are not required.

1.4 Review Management Organization

The USACE Risk Management Center (RMC) is the Review Management Organization (RMO) for dam or levee safety studies. Louisville District (LRL) is the home district, and Great Lakes and Ohio River Division (LRD) is the home Major Subordinate Command (MSC). This RP has been coordinated with the RMC and the

MSC. Coordination with the MSC will occur throughout the SQRA, including briefings to the LRD Dam Safety and Program Review Board (PRB) updates. In-Progress Review (IPR) team meetings with the RMC, MSC, and Headquarters USACE (HQUSACE) will be scheduled to discuss programmatic, policy, and technical matters. The LRD Dam Safety Program Manager (DSPM) will be the point-of-contact for MSC vertical team coordination. This Review Plan will be updated for additional project phases.

Section 2

Project Background and Information

2.1 Project Background

Mississinewa Lake Dam was categorized as a DSAC 3 (moderate urgency) based on the results of the 2009 Screening Portfolio Risk Analysis (SPRA). However, based on the July 2014 Periodic Assessment (PA), the dam was reclassified to a DSAC 2. The incremental risks were driven by internal erosion of the embankment material into solution features within the limestone foundation rock, supported by the recent crest settlement observed after the completion of the cutoff wall and the potential untreated defects that may still exist in the foundation beneath the cutoff wall and at the minimally treated left abutment.

The purpose of this issue evaluation study is to perform a quantitative analysis of the risk associated with the project. The results will be used to determine if there are potential failure modes that warrant further action. In order to perform this analysis, a field investigation program is required to gather information to evaluate the condition of the embankment and foundation as they pertain to the dam's risk driving failure modes: PFM #4: Internal erosion through the rock under the cutoff wall in the area of the historic crest settlement (Sta. 40+00 to 42+00); and PFM #1: Internal erosion into/along rock defects in the left abutment.

The main objective of the work is to gather information to explain the recent crest settlement observed after the completion of the cutoff wall, explore the potential untreated defects that may still exist in the foundation beneath the cutoff wall, and explore the minimally treated left abutment. The investigation will also include the installation of 19 instruments that will be used for analyzing the condition and behavior of the embankment, soil foundation, and bedrock.

The Mississinewa Lake Dam is a high hazard dam located in Indiana on the Mississinewa River, 7.1 miles above its confluence with the Wabash River. (As defined by FEMA's Federal Guidelines for Dam Safety, high hazard potential classification are those dams where failure or mis-operation will probably cause loss of human life.) The project consists of an 8,100 foot long earth fill embankment, having a maximum height of 132 feet, a gate controlled outlet works along the base of the left abutment, and a 1550 foot wide uncontrolled, open cut spillway one mile to the east of the right abutment at elevation 779. The incremental risks associated with a breach of Mississinewa Lake Dam are considered to be moderate. The incremental risks are mostly driven by the potential for internal erosion of the embankment material into solution features (e.g., cavities or channels) within the limestone foundation rock.

2.2 Project Sponsor

Products and analyses provided by non-Federal sponsors as in-kind services are subject to DQC, ATR, and policy and legal compliance reviews. Sponsor Peer Review of In-Kind Contributions - There will not be in-kind contributions for this effort. There are no non-Federal Sponsors for this project.

Section 3

District Quality Control

3.1 Requirements

All work products (including supporting data, analyses, reports, etc.) shall undergo DQC in accordance with EC 1165-2-217. The District shall perform these minimum required reviews in accordance with the District's Quality Management Plan.

DQC is an internal review process of basic science and engineering work products focused on fulfilling the project quality requirements. All work products undergo DQC. Basic quality control tools include quality checks and reviews, supervisory reviews, and Project Delivery Team (PDT) reviews, etc. The home district will manage and document the DQC.

Quality checks and reviews occur during the development process and are carried out as a routine management practice. Quality checks may be performed by staff responsible for the work, such as supervisors, work leaders, team leaders, designated individuals from the senior staff, or other qualified personnel. However, they will not be performed by the same people who performed the original work, including managing/reviewing the work in the case of contracted efforts.

PDT reviews are performed by members of the PDT, which includes the risk cadre, to ensure consistency and effective coordination across all project disciplines. Additionally, the PDT and RMC-assigned advisors are responsible for a complete reading of any reports and accompanying appendices prepared by or for the PDT to assure the overall coherence and integrity of the report, technical appendices, and the recommendations.

All DQC review comments and responses will be documented in accordance with the District's Quality Management Plan. Microsoft Word (using track changes) or Adobe Acrobat may be used to provide typographical comments and edits. The DQC comments and responses will be part of the DQC review documentation and provided to the ATR team to assess appropriateness and effectiveness of the DQC activities. A certification of DQC review will be completed by the home District.

As a part of DQC, the RMC Senior Advisor and Technical Advisor will review the IES/SQRA report prior to submission for ATR to ensure completeness.

See Attachment 1, Table 10, "DQC Reviewers" for the DQC Lead, reviewers, and reviewer's disciplines.

3.2 Documentation

Documentation of DQC activities is required and will be implemented by the process described in paragraph 3.1.

3.3 DQC Schedule and Estimated Cost

Although DQC is always seamless, the following reviews are scheduled in Table 1. The cost for DQC is approximately \$20,000.

| Project Phase/Submittal | Review Start Date | Review End Date |
|-------------------------|-------------------|-------------------|
| DQC Review | 15 August 2018 | 19 September 2018 |

Table 1 DQC Schedule

Section 4

Agency Technical Review

4.1 Requirements

All civil works products (including supporting data, analyses, environmental compliance documents, water control manuals, etc.) shall undergo ATR in accordance with EC 1165-2-217. ATR reviews will occur seamlessly, including early involvement of the ATR team for key decisions, and at the scheduled milestones as shown in Table 2 ATR Schedule. ATR Reviews will be scaled to the appropriate level of technical effort required to evaluate the project findings and recommendations based on the complexity of the project and the level of risk assessment that was conducted. A site visit will not be scheduled for the ATR Team.

4.1.1 ATR Requirements for Hydrologic Hazards and Loading Curves

The Hydrologic Hazards Assessment and Loading Curve will undergo an Agency Technical Review by an RMC Hydrology and Hydraulic (H&H) Advisor or designated Alternate prior to the Risk Assessment Elicitation, or as directed by the RMC. The reviewer will provide advance review of this work product to avoid unnecessary delays to the completion of the risk analysis and SQRA report. Ideally, this reviewer will serve as the H&H ATR team member for the SQRA Report. The reviewer is shown in Attachment 1. If the assigned Hydrologic Hazards reviewer differs from the H&H ATR reviewer, both names will be provided.

4.1.2 ATR Requirements for IES SQRA Reports

ATR for Issue Evaluation Studies conducted using semi-quantitative risk methodology will consist of a review of the technical products by an independent team of USACE dam safety professionals who have past experience with dam safety projects and work products. The team shall be selected by the RMO, and team members will have specialized experience in the analysis and assessment of the deficiencies and risk driver that were identified in the report.

4.1.3 ATR Requirements for IES Phase I & II Reports

ATR for Issue Evaluation Studies conducted using quantitative risk methodology will consist of a review of the technical products by an independent ATR team of USACE dam safety professionals who have past experience with dam safety projects and work products. The ATR Team Lead and ATR team shall be selected by the RMO.

Due to the diverse backgrounds and levels of experience of the cadres and PDT's preparing these reports, and the scope of the ATR team to ensure the quality and credibility of the government's scientific information, an independent panel of senior-level, highly experienced experts from USACE, other agencies, and private industry, shall supplement the ATR by performing a quality and consistency review (QCC) of the risk assessment findings for quantitative risk assessments. While the ATR Team is given wide latitude to confirm that the technical data, analysis, and methodology meets current agency and state of the practice standards, the scope of the QCC review is more focused and defined by providing written responses to very specific questions that convey the panels professional and technical opinions on the major findings and understandings, the estimated levels of risk and risk reduction, and the appropriateness of the recommendations. The QCC Review findings provide a technical basis to resolve differences of opinion between the PDT and ATR teams, and helps USACE ensure recommended actions are appropriate and applied consistently across the USACE national portfolio of dams. The ultimate decisions concerning the risks and appropriate actions remain with the USACE vertical team.

4.2 Documentation of ATR

4.2.1 Documentation of Hydrologic Hazards Review

Hydrologic Hazards review comments are documented in the form of a Word document or DrChecks, as specified below. After resolution of the comments, the reviewer will sign the ATR completion form and this is to be include in the Mississinewa Dam SQRA review documentation. This signature will ensure all comments have been addressed during ATR and signify concurrence.

4.2.2 Documentation of IES SQRA ATR

The ATR team shall document comments, concerns, and recommendations, in written format using Microsoft Word or DrChecksSM, and shall confirm comments have been adequately addressed in the report using approved back-checking procedures. Four-part comment structure should be used or comments should be provided in a similar manor as directed by the ATR Lead.

4.2.3 Documentation of IES Phase I and II ATR

Documentation of ATR for IES Phase I and Phase II studies will be performed using the requirements of EC 1165-2-217. This should include the four part comment structure and the use of DrChecksSM for comment collaboration, response, and back checking.

The scope of the QCC Panel, if applicable, is to review the draft documents, submit written draft comments that address a series of charge questions, attend a panel discussion with the PDT and ATR Lead to collaborate their major findings and understandings of the project, and submit updated responses to the charge questions following the panel discussion as a deliverable. Documentation of the review findings shall be in written format and in accordance with the A-E contract or Agency Scope of Work. The Panel's responses to the charge questions will be included in the final ATR documentation of the IES Report.

4.3 Products to Undergo ATR

As part of this IES, the IES Report/SQRA will undergo ATR. There are no in-kind contributions from the local sponsor. The MSC technical review will take place concurrent with the ATR (Consistency Review).

4.4 Required Team Expertise and Requirements

4.4.1 IES SQRA ATR Team

ATR teams will be established in accordance with EC 1165-2-217. The following disciplines will be required for ATR of the SQRA:

ATR Lead: The ATR team leader will be a senior USACE dam safety professional and will have experience leading and conducting ATR for similar projects and work products. The ATR lead will direct the scope and focus of the review efforts by each discipline. The ATR team leader will be from outside the home MSC and will 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.

Geotechnical Engineer - The geotechnical engineer will have experience in the design, construction, and evaluation of embankment dams, potential failure mode analysis, and dam safety risk analysis. The geotechnical engineer will have experience in subsurface investigations, rock and soil mechanics, internal erosion evaluation, slope stability evaluation, and earthwork construction.

Engineering Geologist - The engineering geologist will have experience in assessing the geologic setting, bedrock geology, unconsolidated deposits, and hydrogeology and correlating the performance of foundations with the significant engineering properties. The engineering geologist will have specialized experience with embankment dam founded on karstic formations.

Hydrology and Hydraulic (H&H) Engineer – The H&H engineer will have experience in the analysis and design of hydraulic structures for dams and will be knowledgeable and experienced with the routing of inflow hydrographs through multipurpose flood control reservoirs utilizing multiple discharge devices, evaluation of extreme flood events (e.g., PMF), development of the flood hazard/loading (i.e., stage-frequency and duration relationships), USACE hydrologic and hydraulic modeling, and breach and non-breach inundation for dam safety risk analysis.

Consequences (Economist) – The economist (or consequence specialist) will have experience evaluating flood risk management projects in accordance with ER 1105-2-100 and USACE models and techniques to estimate population at risk, life loss, and economic damages for dam safety risk analysis.

4.4.2 IES Phase I & II ATR Team

ATR teams will be established in accordance with EC 1165-2-217. The following disciplines will be required for ATR of the IES:

ATR Lead: The ATR team leader will be a senior USACE dam safety professional and will have experience leading and conducting ATR for similar projects and work products. The ATR lead will direct the scope and focus of the review efforts by each discipline. The ATR team leader will be from outside the home MSC and will 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.

Geotechnical Engineer - The geotechnical engineer will have experience in the design, construction, and evaluation of embankment dams, potential failure mode analysis, and dam safety risk analysis. The geotechnical engineer will have experience in subsurface investigations, rock and soil mechanics, internal erosion evaluation, slope stability evaluation, and earthwork construction.

Engineering Geologist - The engineering geologist will have experience in assessing the geologic setting, bedrock geology, unconsolidated deposits, and hydrogeology and correlating the performance of foundations with the significant engineering properties. The engineering geologist will have specialized experience with embankment dams founded on glacial outwash and alluvium.

Hydrology and Hydraulic (H&H) Engineer – The H&H engineer will have experience in the analysis and design of hydraulic structures for dams and will be knowledgeable and experienced with the routing of inflow hydrographs through multipurpose flood control reservoirs utilizing multiple discharge devices, evaluation of extreme flood events (e.g., PMF), development of the flood hazard/loading (i.e., stage-frequency and duration relationships), USACE hydrologic and hydraulic modeling, and breach and non-breach inundation for dam safety risk analysis. (This may be two separate reviewers and will be split if needed)

Consequences (Economist) – The economist (or consequence specialist) will have experience evaluating flood risk management projects in accordance with ER 1105-2-100 and USACE models and techniques to estimate population at risk, life loss, and economic damages for dam safety risk analysis.

4.4.3 IES Phase I and II QCC Panel

The panel will consist of Senior Technical Experts from A-E firms and/or Technical Specialists from USACE. It is anticipated that three to four panel members from any of these groups will be selected by the RMC to review each project report. The panel members selected for each specific project will be referred to as the QCC Panel for that project. The ATR Lead will be invited to attend the QCC review.

4.5 Statement of Technical Review Report

4.5.1 IES SQRA Review Report

All comments and their resolutions, along with a review certification sheet, will be added to the review documentation appendix of the IES SQRA report. If there were any significant issues the ATR lead will document those in the comments. A copy of each approved report accompanied by ATR documentation and certification will be provided to the MSC as they are completed.

4.5.2 IES Phase I and II Review Report

At the conclusion of each ATR effort, the ATR team will prepare a Statement of Technical Review Report with a completion and certification memo. The report will be prepared in accordance with EC 1165-2-217. At the conclusion of the QCC, the review facilitator will prepare a memo for RMC Directors Signature that summarizes what issues must be addressed prior to presentation to DSOG.

4.6 ATR Schedule and Estimated Cost

The preliminary ATR schedule is listed in Table 2. The cost for the ATR is approximately \$30,000.

| Project Phase/Submittal | Review Start Date | Review End Date |
|-------------------------|-------------------|-----------------|
| ATR | November 2018 | December 2018 |

Table 2 ATR Schedule

4.7 MSC Dam Safety Quality Assurance Review

The MSC has the primary role to verify that quality control was performed appropriately by the PDT and ATR is certified as prescribed in the applicable MSC quality manuals and USACE guidance. This includes specific procedures for selection of DQC team members, the conduct of DQC including documentation requirements that require inclusion of comments and responses, and maintenance of associated records for internal audits to check for proper DQC and ATR implementation. The MSC also assures the adequacy and capability of the DQC team. The SQRA will be provided to LRD for review with documentation and certification of DQC. At the completion of the MSC review, the SQRA will be approved for release to HQUSACE and presentation to the DSOG. The MSC Quality Assurance Review will take place concurrent with ATR.

Disciplines required for this review will be determined by the MSC. The MSC Dam Safety Program Manager will serve as the Review Lead and will see to the coordination of all aspects of the review including certification.

Section 5

DSOG Review

5.1 Requirements

All IES work products will undergo a review by the Dam Safety Senior Oversight Group (DSOG). The DSOG is provided an advanced copy of the final report approximately four weeks prior to the DSOG Panel Discussion. The PDT will prepare DSOG Briefing Slides summarizing the project Risk, the report findings and recommendations. These slides will be reviewed by the Program Manager prior to presentation to DSOG for clarity and conciseness.

Upon satisfactory completion of the ATR and certification and MSC reviews, the SQRA Report will then be finalized for the Dam Senior Oversight Group (DSOG) meeting. The District will ensure that the MSC DSO and DSPM also receive a copy of the final report approximately four weeks prior to the DSOG meeting along with a prebrief of the report. District will forward the DSOG schedule so that the MSC has the opportunity to participate either via webinar or attend the presentation. All revisions resulting from the DSOG review will be completed and forwarded to the MSC.

5.2 Documentation

At the conclusion of the DSOG briefing, a memo will be prepared by the DSOG Chairperson that summarizes the risk characterization of the dam, confirms or adjusts the recommended DSAC, proposes Dam Safety and Operations and Maintenance (O&M) actions to reduce risk, and is signed by the Headquarters Dam Safety Officer.

5.3 DSOG Review Schedule and Estimated Cost

The preliminary DSOG Review schedule is listed in Table 3. The cost for the DSOG Review is approximately \$25,000.

| Project Phase/Submittal | Review Start Date | Review End Date |
|-------------------------|-------------------|-----------------|
| SQRA DSOG Review | December 2018 | January 2019 |

Table 3 DSOG Review Schedule

The SQRA Report will first undergo a DQC review (including QC by the HHT for the H&H analysis), then an ATR. A copy of the ATR certification will be provided to the MSC for review when completed.

The RMC will certify that the risk estimate was completed in accordance with USACE guidelines and risk management practices. A copy of the certification will be provided to the MSC when completed.

The District DSO, MSC DSO, and DSOG Chairman will jointly recommend USACE DSO approval of the SQRA Report via a signed cover letter.

Section 6

Policy and Legal Compliance Review

All IES products will be reviewed throughout the study process for their compliance with policy. Guidance for policy compliance reviews is addressed in Appendix H, ER 1105-2-100 and Chapter 8 of ER 1110-2-1156. These reviews culminate in determinations that the recommendations in the reports and the supporting analyses and coordination comply with 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.

Section 7

Public Posting of Review Plan

As required by EC 1165-2-217, the approved Review Plan will be posted on the District public website (<http://www.xxx.usace.army.mil/pm/pmPeerReview.html>). 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.

Section 8

Review Plan Approval and Updates

The MSC Commander or delegated SES Director is responsible for approving this RP. The MSC Commander's approval reflects vertical team input (involving LRH, LRD Dam Safety, RMC and HQUSACE members) as to the appropriate scope and level of review for the work products and endorsement by the RMC. This RP is a living document and may change as the SQRA progresses. All changes made to the approved RP will be documented in Attachment 3, Table 13 RP Revisions. This RP will be updated for each new project phase and as needed otherwise. The District is responsible for keeping the RP up to date. Minor changes to the RP since the last MSC Commander approval will be documented in an Attachment to this RP. Significant

changes to the RP (such as changes to the scope and/or level of review) will be re-endorsed by the RMC and re-approved by the MSC Commander following the process used for initially approving the RP. The latest version of the RP, along with the MSC Commander's approval memorandum, will be posted on the District's webpage and linked to the HQUSACE webpage. The approved RP should be provided to the RMO.

Section 9

Engineering Model Certification and Approval

The use of certified or approved engineering models is required for all activities to ensure the models are technically and theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions. 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. 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 and ATR. Where such validations have not been completed, appropriate independent checks of critical calculations will be performed and documented as part of DQC. The following engineering models, software, and tools are anticipated to be used:

| Model | Status |
|--|------------------------|
| HEC-RAS | HH&C CoP preferred |
| HEC-ResSim | HH&C CoP preferred |
| RMC-RFA | H&H CoP preferred |
| HEC-LifeSim | Not evaluated |
| RockWorks | GG&M CoP allowed |
| GeoStudio Seep/W | GG&M CoP recommended |
| GeoStudio Slope/W | GG&M CoP allowed |
| CWALSHT | GG&M CoP recommended |
| CI-Wall | Not evaluated |
| USACE risk analysis spreadsheet tool | Validation in progress |
| USACE internal erosion spreadsheet tools | Validation in progress |
| DAMRAE | Validation in progress |

Table 4 Models and Status

Section 10

Review Plan Points of Contact

| Title | Organization | Email/Phone |
|-------|--------------|-------------|
| | CELRL-PM-C | |
| | CELRD-RBT | |
| | CEIWR-RMC | |

Table 5 RP POC's

ATTACHMENT 1
Team Rosters (FOUO)
(To be Removed Prior to Posting on
District Website)

| Discipline/Role | Team Member |
|---------------------------------------|--------------------|
| Project Manager | |
| Lead Engineer | |
| LRL Dam Safety Program Manager | |
| LRD Dam Safety Program Manager | |
| LRD Business Technical Division Chief | |
| Geotechnical Engineer | |
| Geologist | |
| Hydraulic Engineer | |
| Consequences | |
| Structural Engineer | |

Table 6 PDT

| Role | Team Member |
|----------------------------------|--------------------|
| Cadre Lead/Engineering Geologist | |
| Geotechnical Engineer | |
| Hydraulic Engineer | |
| Geotechnical Engineer | |
| Geotechnical Engineer | |

Table 7 Risk Cadre

| Role | Team Member |
|-----------------------|--------------------|
| RMC Senior Advisor | |
| RMC Technical Advisor | |

Table 8 RMC Advisors

| Role | Team Member |
|----------------------------------|--------------------|
| HHT QC, Hydraulics and Hydrology | |

Table 9 H&H ATR

| Role | Team Member |
|---------------------------------------|--------------------|
| Geotechnical/DQC Review Lead | |
| Geology | |
| Structural | |
| Hydraulics and Hydrology | |
| Economist (or Consequence Specialist) | |

Table 10 DQC Reviewers

| Role | Team Member |
|---------------------------------------|--------------------|
| Geotechnical | |
| Geology | |
| Structural | |
| Hydraulics and Hydrology | |
| Economist (or Consequence Specialist) | |

Table 11 SQRA Report ATR Team

* See Table 12 below for a complete list of CERCAP approved Consistency Reviewers (ATR Reviewers). The ATR team will be chosen from members of this list. Upon determination of actual ATR members, these names will be populated in this table.

| Role | Team Member |
|--------------------------|-------------|
| Geotechnical | |
| Geology | |
| Structural | |
| Hydraulics and Hydrology | |
| Hydraulics and Hydrology | |

| | |
|---------------------------------------|--|
| Hydraulics and Hydrology | |
| Economist (or Consequence Specialist) | |

Table 12 CERCAP Approved Consistency Reviewers (ATR Reviewers)

| Role | Team Member |
|---|--------------------|
| LRD Dam Safety Program Manager, MSC Dam Safety Review Lead | |
| LRD Business Technical Division Chief | |

Table 13 SQRA Report MSC Dam Safety Quality Assurance Review

ATTACHMENT 2

Project Risk Information (FOUO)

(To be Removed Prior to Posting on District Website)

The following is from the Periodic Assessment (PA) report from 2014 and contains a summary of the most recent risk assessment:

Mississinewa Dam is currently categorized as a DSAC 3 (moderate urgency) based on the results of the 2009 Screening Portfolio Risk Analysis (SPRA). It was primarily due to foundation seepage and piping due to karstic rock beneath the dam, abutment seepage and piping on the left side beyond the cutoff trench (Sta. 75+00), and embankment slope stability or liquefaction of the right side of the dam. Karstic rock beneath the dam and the recent upstream crest settlement was the focus of this periodic assessment. The presence of the cutoff wall in the deep valley and right abutment generally enhances the integrity of the structure and hinders the potential failure progression; however degree of crest settlement observed after the completion of the cutoff wall is unprecedented and alarming. In addition, the cutoff wall does not extend over into the left abutment, which is similar in geometry and geology to the right abutment; however, a 30 foot wide cutoff trench was incorporated into the design and there was some treatment of the left abutment rock during initial construction. Based on the results of this risk assessment, the PA team is fairly confident that the risks associated with the project are moderate considering the recent crest settlement and the potential untreated defects that may still exist in the foundation beneath the cutoff wall and at the minimally treated left abutment. In addition, the downstream consequences that would result from a dam breach are significant (between 100 and 1000 fatalities). For these reasons, the PA team recommends that the dam be reclassified as a DSAC 2.

The following is a summary of current risk information that is being developed under the current Issue Evaluation Study (IES):

Mississinewa is currently categorized as DSAC 2 based on the results of the 2014 PA. The primary reasons were concentrated leak erosion (CLE) of the embankment material into solution features (e.g., cavities or channels) within the limestone foundation rock, supported by the recent crest settlement observed after the completion of the cutoff wall and the potential untreated defects that may still exist in the foundation beneath the cutoff wall and at the minimally treated left abutment. Past primary concerns (internal erosion into/through rock defects) were reevaluated and resulted in lower incremental risk due to additional instrumentation monitoring and geotechnical exploration data and analyses. However, spillway erosion (which was previously a non-risk driver) was evaluated and resulted in the risk driver with the highest incremental risk. Based on the results of this risk assessment, the total incremental risk has decreased, and the SQRA team recommends that the dam be reclassified as DSAC 4.

ATTACHMENT 3

Review Plan Revisions

| Revision Date | Description of Change | Page/Paragraph Number |
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Table 13 RP Revisions