



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

4 May 2018

MEMORANDUM FOR Commander, U.S. Army Corps of Engineers, Huntington District,
502 Eighth Street, Huntington, WV 25701-2070

SUBJECT: Tappan Dam Semi-Qualitative Risk Assessment (SQRA) Consolidated Review Plan,
Harrison County, Ohio – Great Lakes and Ohio River Division Commander (LRD) Approval

1. References:

a. Memorandum, CELRH-PM-PP, dated 27 February 2018, Subject: Review Plan for Tappan Dam, Semi-Qualitative Risk Assessment (SQRA).

2. The attached Review Plan was prepared in accordance with Engineer Circular (EC) 1165-2-214 dated 15 December 2012, and Engineering and Construction Bulletin (ECB) 2016-9 dated 4 March 2016.

3. I approve the enclosed subject Review Plan. The District is authorized to post Review Plan on the Huntington District public website.

4. The point of contact for the MSC's approval is [REDACTED]

BUILDING STRONG and Taking Care of People!

Encl

[REDACTED]

[REDACTED]
Brigadier General, USA
Commanding

CF:
CELRH-PM-PP (Moore)



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
HUNTINGTON DISTRICT, CORPS OF ENGINEERS
502 EIGHTH STREET
HUNTINGTON, WV 25701

CELRH-PM-PP

27 Feb 2018

MEMORANDUM FOR Commander, U.S. Army Corps of Engineers, Great Lakes and Ohio River Division [REDACTED], 550 Main Street Cincinnati, Ohio 45202-3222

SUBJECT: Review Plan for Tappan Dam, Semi-Qualitative Risk Analysis (SQRA)

1. Submitted for review and approval is a consolidated review plan outlining the peer review requirements for the Semi-Qualitative Risk Analysis (SQRA) for Tappan Dam, in Harrison County, Ohio.
2. Pursuant to EC 1165-2-214, the Huntington District has prepared a Review Plan for the study which outlines the various levels of review required and the manner in which they will be completed.
3. All questions regarding the subject project and corresponding review plan can be directed to the Tappan Dam SQRA Project Manager [REDACTED]

A large black rectangular redaction box covering the signature area, with a faint red scribble visible within the redaction.

Colonel, Corps of Engineers
Commanding



DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
RISK MANAGEMENT CENTER
12596 WEST BAYAUD AVE., SUITE 400
LAKEWOOD, CO 80228

REPLY TO
ATTENTION OF

CEIWR-RMC

27 February 2018

MEMORANDUM FOR: Commander, Huntington District, ATTN: CELRH-PM-PP

SUBJECT: Risk Management Center Endorsement – Tappan Dam, Semi-Quantitative Risk Assessment, Review Plan

1. The Risk Management Center (RMC) has reviewed the Review Plan (RP) for – Tappan Dam, Semi-Quantitative Risk Assessment, dated 26 February 2018, and concurs that this RP complies with the current peer review policy requirements outlined in EC 1165-2-214 “Civil Works Review Policy”, dated 15 December, 2012.
2. This review plan was prepared by Huntington District, reviewed by the RMC, and all RMC review comments have been satisfactorily resolved. For this project an IEPR will not be performed.
3. The RMC endorses this document to be approved by the MSC Commander. Upon approval of the RP, please provide a copy of the approved RP and a copy of the MSC Commander’s approval memorandum to the RMC Senior Review Manager (rmc.review@usace.army.mil).
4. Thank you for the opportunity to assist in the preparation of this RP. Please coordinate all aspects of the Agency Technical Review efforts defined in the RP. For further information, please contact me at [REDACTED]

Sincerely,

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Review Manager
Risk Management Center

CF:

CEIWR-RMC [REDACTED]

CELRD-DQM [REDACTED]

Review Plan
U.S. Army Corps of Engineers
Huntington District
Great Lakes and Ohio River Division

Tappan Dam(OH00010)
Semi-Quantitative Risk Assessment

Contents

1. Introduction	1
a. Purpose	1
b. Applicability	1
c. References	1
2. Project Background	1
3. Review Management Organization (RMO)	2
4. Reviews and Execution Plan	3
a. District Quality Control/Quality Assurance (DQC)	3
b. Agency Technical Review (CR)	3
c. Independent External Peer Review (IEPR)	Error! Bookmark not defined.
d. Policy and Legal Compliance Review	6
e. Cost Engineering Mandatory Center of Expertise (MCX) Review	6
5. Models	7
6. Public Posting of Review Plan	7
7. Approval and Updates	7
8. Review Schedules and Cost Estimates	8
a. Hydrologic Loading Development Review Schedule	Error! Bookmark not defined.
b. SQRA Report Review Schedule	8
9. Points of Contact	8

1. Introduction

a. Purpose

This Review Plan (RP) was prepared for the Tappan Semi-Quantitative Risk Assessment (SQRA) to ensure quality and proper scale and scope of anticipated reviews. In accordance with Chapter 8 of Engineer Regulation (ER) 1110-2-1156 dated 31 March 2014, an SQRA is required prior to an Issue Evaluation Study (IES) for Tappan Dam, as the Dam Safety Action Class (DSAC) for this project was determined by Screening for Portfolio Risk Analysis (SPRA). The risk cadre and District will conduct the SQRA to re-evaluate the SPRA derived DSAC rating, justify the need for a Phase I IES, and identify the significant failure modes that will be used to determine the existing flood risk as part of the Phase I quantitative risk assessment. This RP was prepared in accordance with Engineer Circular (EC) 1165-2-214 dated 15 Dec 2012. Although this EC expired on 15 Dec 2014, Engineering and Construction Bulletin (ECB) 2016-9 dated 4 Mar 2016 allows for its continued use until 4 Mar 2018.

b. Applicability

This RP is applicable to the SQRA Report, and supporting technical analysis.

c. References

- ER 5-1-11, USACE Business Process
- EC 1165-2-214, Civil Works Review Policy, 15 December 2012
- ER 1110-2-1156, Safety of Dams – Policy and Procedure, 31 March 2014
- ER 1110-1-12, Quality Management, 31 March 2011
- LRD Regional Business Processes Manual, Section 08504 LRD – QC / QA Procedures for Civil Works, Engineering and Design Products
- ECB 2013-28, Use of Certified Engineering and Construction (E&C) Community of Practice (CoP) Members for Agency Technical Reviews (CRs) 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

2. Project Background

Tappan Dam is located northeast Ohio in Harrison County on Little Stillwater Creek, a tributary of Stillwater Creek on the Tuscarawas River which empties into the Muskingum River, 170.4 miles above the mouth of the Muskingum. The project was initially authorized for flood risk reduction on the Tuscarawas and Muskingum Rivers.

The project was later included in the “Comprehensive Flood Control Plan for Ohio and Lower Mississippi Rivers”, Seventy-fifth Congress, First Session, Committee on Flood Control- House of Representatives, Com. Doc No. 1, Published by the US GPO Washington, 1937. In addition to flood control, other major purposes are general recreation and fish and wildlife conservation. Major communities located downstream are Dennison and Uhrichsville (8-9 miles, populations 5,413 and 2,655) and Coshocton (59 miles, population 11,216).

Construction of the project began in December 1934 and was completed in October 1936. The dam consists of an embankment, an outlet works, and an uncontrolled saddle spillway. The embankment is a rolled earthfill structure with a maximum height of 52 feet and a length of 1,550 feet. Maximum storage capacity of the reservoir under original design is 61,600 acre-feet.

The embankment is a rolled earth-fill embankment consisting predominantly of primarily lean clay impervious fill. The embankment crest has a maximum height of 52 feet (El. 922.0 ft-NGVD29), length of 1550 feet, and crest width of 25 feet. The dam is approximately 500 feet wide at the base. The downstream and upstream embankment slopes vary from 2H: 1V near the crest to a 6H:1V slope at the downstream random berm. A 6-ft. deep exploration trench was excavated into the foundation along the axis of the dam and was backfilled with the impervious embankment material. A pervious shale upstream stability berm lies adjacent to the upstream rock toe. The downstream rock toe is keyed into the natural impervious blanket and is overlain by a zone of random fill. The embankment is primarily founded on 150 feet plus of lacustrine deposits overlain by more recent alluvium and colluvium. Embankment abutments consist of Pennsylvanian-aged, cyclic, horizontally bedded sandstone and shale with small amounts of limestone, coal, and fire clay.

3. Review Management Organization (RMO)

The USACE Risk Management Center (RMC) is the Review Management Organization (RMO) for dam or levee safety studies. Huntington District (LRH) 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 LRD. Coordination with LRD will occur throughout the SQRA, including briefings to LRD Dam Safety and Program Review Board (PRB) updates. In-Progress Review (IPR) team meetings with the RMC, LRD, and HQUSACE will be scheduled on to discuss programmatic, policy, and technical matters. The LRD Dam Safety Program Manager (DSPM) will be the point-of-contact for vertical team coordination.

4. Reviews and Execution Plan

EC 1165-2-214 describes four general levels of review: District Quality Control/Quality Assurance (DQC), Agency Technical Review (ATR), Independent External Peer Review (IEPR) Type I and Type II, and Policy and Legal Compliance Review. In addition to these levels of review, decision documents are subject to cost engineering review and certification. The following sections describe how all the reviews will be accomplished and documented.

a. District Quality Control/Quality Assurance (DQC)

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.

b. Agency Technical Review (ATR)

The objective of the ATR is to ensure the proper application of established criteria, regulations, laws, codes, principles and professional practices. The ATR will assess whether the analyses presented are technically correct and comply with published USACE guidance and that the documents clearly and coherently explain the analyses

and results. ATR is managed within USACE by the 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 work products. The RMO(RMC) will assign an ATR team comprised of USACE personnel with expertise and experience with similar projects and work products to ensure a comprehensive, independent technical review. The ATR Team should have early involvement where appropriate to facilitate a seamless review process.

Products to Undergo ATR: As part of this SQRA, the SQRA Report and Appendices will undergo ATR.

Required ATR Team Expertise: The ATR team will be comprised of senior personnel from the disciplines listed below and will be appropriate for the work product being reviewed. All EC reviewers will be certified in CERCAP and will be assigned by the USACE Risk Management Center.

- **ATR Team Leader:** The ATR team leader will be a senior USACE dam/levee safety professional and will have experience leading and conducting CR for similar projects and work products. The ATR team leader may also serve as a reviewer for a specific 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.
- **Geotechnical:** The geotechnical engineer will have experience in the design, construction, and evaluation of embankment dams and levees, potential failure mode analysis, and dam and levee 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. The geotechnical engineer will review the SQRA Report.
- **Engineering Geology:** 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 and levees founded on glacial outwash and alluvium. The engineering geologist will review the SQRA Report.
- **Hydraulics and Hydrology:** The hydraulic engineer will have experience in the analysis and design of hydraulic structures for dams and levees. The hydraulic engineer 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., Probable Maximum Flood - 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 and levee safety risk analysis. The hydraulic engineer will review the SQRA Report.

- Structures: The structural engineer will have experience evaluating the design, construction, and evaluation of hydraulic structures for dams and levees (including pump stations, gates/closure structures, flood walls, and penetrations), potential failure mode analysis, and dam and levee safety risk analysis. The structural engineer will review the SQRA Report.
- Consequences: 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 and levee safety risk analysis. The economist will review the SQRA Report.

The hydrologic loading will undergo an additional QC review by the Hydrologic Hazards Team (HHT). The QC review is managed by the HHT, and a hydraulic engineer will be assigned by the HHT Program Manager. Ideally, this reviewer will be the same as the CR team member for the SQRA Report. An advanced review of this work product is essential to avoid unnecessary delays related to the quality of this critical information needed for the risk analysis.

ATR Documentation: The PDT in conjunction with the RMO will prepare the “charge” to the reviewers which will contain instructions regarding the objective of the review and the specific advice sought. All ATR review comments and responses will be documented. 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:

- The review concern – identify the product’s information deficiency or incorrect application of policy, guidance, or procedures;
- The basis for the concern – cite the appropriate law, policy, guidance, or procedure that has not been properly followed;
- 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
- The probable specific action needed to resolve the concern – identify the action(s) that the reporting officers must take to resolve the concern.

In situations where information is incomplete or unclear, comments may seek clarification in order to then assess whether further specific concerns may exist. The ATR documentation will include the text of each ATR concern, the PDT response, a

brief summary of the pertinent points of any discussion including any vertical coordination, and lastly the agreed upon resolution.

The ATR team will prepare a Review Report which includes a summary of each unresolved issue, which will be raised to the vertical team for resolution. Review Reports will be considered an integral part of the CR documentation and will also:

- (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. The ATR will 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 documentation of the completion and certification of ATR(in accordance with EC 1165-2-214). It will certify that the issues raised by the ATR team have been resolved or elevated to the vertical team. The completion and certification will be based on the work reviewed to date for the project. A copy of each approved report accompanied by CR documentation and certification will be provided to the MSC as they are completed.

c. SQRA Policy and Legal Compliance Review

Policy and Legal Compliance Review is required for decision documents. A MSC Policy and Legal Compliance Review will occur after DQC prior to moving forward to Dam Senior Oversight Group (DSOG) review.

d. Cost Engineering Mandatory Center of Expertise (MCX) Review

Since a cost estimate is not generated by an SQRA, review and certification of cost estimates are not applicable.

5. Models

Validation of engineering software is being addressed under the Engineering and Construction (E&C) Science and Engineering Technology (SET) initiative. Until an appropriate process that documents the quality of commonly used engineering software is developed through the SET initiative, engineering type models will not be reviewed for certification and approval. The responsible use of well-known and proven USACE developed and commercial engineering software and spreadsheet tools will continue, and the professional practice of documenting the application of the software and modeling results will be followed. The RMC has begun the process of validating internally developed software and tools used to support risk analysis in accordance with Enterprise Standard (ES) 08101 used by the Hydrology, Hydraulics, and Coastal Community of Practice (HH&C CoP). Where such validations have not been completed, appropriate independent checks of critical calculations will be performed and documented as part of DQC. The following software and tools are expected to be used to develop the work products:

Model	Certification/Acceptance Status
HEC-RAS	HH&C CoP preferred
HEC-ResSim	HH&C CoP preferred
RMC-RFA	H&H CoP preferred
HEC-LifeSim	H&H CoP preferred

6. Public Posting of Review Plan

This RP will be posted on the District's website:

<http://www.lrh.usace.army.mil/Missions/Public-Review/>. Public awareness, risk communication, and stakeholder engagement will continue as risk management activities as appropriate during the SQRA process. If this project warrants a DSMS, future public coordination will occur for NEPA compliance during that phase.

7. Approval and Updates

The MSC Commander 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. 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.

8. Review Schedules and Cost Estimates

a. SQRA Report Review Schedule

Type of Review	Review Start	Review Complete	Estimated Cost
DQC Review	4/16/2018	5/9/2018	\$40,000
ATR Review	5/14/2018	7/13/2018	\$40,000
LRD DS Review	7/16/2018	8/16/2018	\$20,000
Dam Senior Oversight Group (DSOG) Review	9/2018	11/2018	\$25,000

The SQRA Report will first undergo a DQC review, then an ATR. A copy of the SQRA report accompanied by ATR certification will be provided to the MSC when completed.

Upon satisfactory completion of the ATR and certification and MSC reviews, the SQRA Report will then be finalized for the DSOG meeting. The District will ensure the MSC DSO and DSPM are prebriefed at least two weeks prior to DSOG meeting. 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.

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.

9. Points of Contact

The point of contact for this review plan is [REDACTED]

[REDACTED]