



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
US ARMY ENGINEER DIVISION, SOUTHWESTERN
1100 COMMERCE STREET, SUITE 831
DALLAS TX 75242-1317

CESWD-RBT-W

07 DEC 2012

MEMORANDUM FOR Commander, Fort Worth District

SUBJECT: Lewisville Lake Dam Safety Modification Report, Lewisville Lake, Lewisville, Texas (P2 # 139886) Review Plan Approval

1. References:

- a. EC 1165-2-209, Civil Works Review Policy, 31 Jan 2010; and Change 1, 31 January 2012.
 - b. Memorandum, CEIWR-RMC, 26 November 12, subject: Risk Management Center Endorsement – Lewisville Lake Dam Safety Modification Report Review Plan (Encl 1).
 - c. Final Review Plan (RP) for Lewisville Lake Dam Safety Modification Report (Encl 2).
2. In accordance with reference 1.a., I hereby approve the enclosed RP for the subject project study.
3. An Independent External Peer Review is required and public comments received will be incorporated into the plan as the study progresses.
4. Please post the final approved RP with a copy of this memorandum to the District's public internet website. Prior to posting to the District website, the names of USACE employees should be removed.
5. The SWD point of contact for this action is Mr. Michael Southern, CESWD-RBT-W, at 918-669-7148.

2 Encls

as

THOMAS W. KULA
Brigadier General, USA
Commanding

CF:

CESWF-EC-DG/ Vazquez (w/encls)



DEPARTMENT OF THE ARMY
RISK MANAGEMENT CENTER, CORPS OF ENGINEERS
13952 DENVER WEST PARKWAY SUITE 200
GOLDEN, CO 80401

REPLY TO
ATTENTION OF
CEIWR-RMC-WD

CEIWR-RMC

26 November 2012

MEMORANDUM FOR: Commander, Fort Worth District, ATTN: CESWF-EC

SUBJECT: Risk Management Center Endorsement - Lewisville Lake Dam Safety Modification Report Review Plan

1. The Risk Management Center (RMC) has reviewed the Review Plan (RP) for the Lewisville Lake DSMR dated 19 November 2012, and concurs that this RP provides for an adequate level of peer review and complies with the current peer review policy requirements outlined in EC 1165-2-209 "Civil Works Review Policy", dated 31 January, 2010.
2. This review plan was prepared by Fort Worth District, reviewed by Southwest Division and the RMC, and all review comments have been satisfactorily resolved. The RMC will be the RMO for this project.
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, a copy of the MSC Commander's approval memorandum, and a link to where the RP is posted on the District website to Tom Bishop, RMC Senior Review Manager (thomas.w.bishop@usace.army.mil).
4. Thank you for the opportunity to assist in the preparation of this RP. Please coordinate all future changes to this review plan, and all aspects of the Agency Technical Review efforts defined in the RP, including the composition of the ATR team with the RMC. For further information, please contact Tom Bishop at (303) 0963-4556.

Sincerely,

A handwritten signature in black ink, appearing to read "Colin W. Krumdieck".

COLIN W. KRUMDIECK, P.E.
Senior Review Manager
Risk Management Center

CF:
CEIWR-RMC-ZA (Mr. Snorteland)
CESWD-CE (Division Quality Manager)



US Army Corps of Engineers

LEWISVILLE LAKE, Lewisville, Texas

Dam Safety Modification Report - *Project Review Plan*

For Implementation Documents and Other Work Products Southwestern Division (SWD)

*Fort Worth District
U.S. Army Corps of Engineers
7 December 2012*



Project P2 Number 139886

Project Manager: ~~AWT & Co / SA * d }~~
Lead Engineer: ~~Pa ^ A U ^ { [c ^ a }~~
Review Plan SWF POC: Jason Vazquez
Review Plan SWD POC: Michael Southern

Original Approval Date: 7 December 2012

SWF Revision Date: _____

SWD Approval Date: _____



REVIEW PLAN

**Lewisville Lake, Texas
Dam Safety Modification Study**

TABLE OF CONTENTS

1. PURPOSE AND REQUIREMENTS2

2. REVIEW MANAGEMENT ORGANIZATION (RMO) COORDINATION2

3. STUDY INFORMATION3

4. DISTRICT QUALITY CONTROL (DQC)8

5. AGENCY TECHNICAL REVIEW (ATR).....9

6. INDEPENDENT EXTERNAL PEER REVIEW (IEPR)10

7. POLICY AND LEGAL COMPLIANCE REVIEW12

8. MSC APPROVAL.....12

9. COST ENGINEERING DIRECTORY OF EXPERTISE (DX) REVIEW AND CERTIFICATION12

10. MODEL CERTIFICATION AND APPROVAL12

11. REVIEW SCHEDULES AND COSTS.....14

12. PUBLIC PARTICIPATION14

13. REVIEW PLAN APPROVAL AND UPDATES.....14

14. REVIEW PLAN POINTS OF CONTACT15

ATTACHMENT 1: TEAM ROSTERS16

ATTACHMENT 2: SAMPLE STATEMENT OF TECHNICAL REVIEW FOR DECISION DOCUMENTS.....18

ATTACHMENT 3: REVIEW PLAN REVISIONS.....19

ATTACHMENT 4: ACRONYMS AND ABBREVIATIONS20

1. PURPOSE AND REQUIREMENTS

a. **Purpose.** This Review Plan defines the scope and level of peer review for the Lewisville Lake, Texas, Dam Safety Study and Dam Safety Modification Report.

b. **References:**

- (1) Engineering Circular (EC) 1165-2-209, Civil Works Review Policy, 31 Jan 2010
- (2) EC 1105-2-412, Assuring Quality of Planning Models, 31 Mar 2011
- (3) Engineering Regulation (ER) 1110-1-12, Quality Management, 30 Sep 2006
- (4) ER 1105-2-100, Planning Guidance Notebook, Appendix H, Policy Compliance Review and Approval of Decision Documents, Amendment #1, 20 Nov 2007
- (5) Lewisville Lake, Texas, Dam Safety Modification Study, Project Management Plan, 17 June 2010
- (6) ER 1110-2-1156, Safety of Dams – Policy and Procedures, Chapter 9, 28 October 2011

c. **Requirements.** This review plan was developed in accordance with EC 1165-2-209, 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 1165-2-209) and planning model certification/ approval (per EC 1105-2-412). The RMC will certify that the risk assessment was completed in accordance with the USACE current guidelines and best risk management practices.

As per ER 110-2-1156, a Quality Control and Consistency (QCC) review will be conducted including the district, MSC, and RMC. The district and the risk assessment cadre present the risk assessment, findings, conclusions, and recommendations for review to the QCC panel. After resolution of ATR and QCC review comments, the MSC and HQUSACE will complete quality assurance and policy compliance review. Then the district will present the report findings and recommendations to the Senior Oversight Group (SOG). Once any SOG comments are resolved the district DSO, MSC DSO, and the SOG Chair will sign a joint memorandum approving the findings and recommendations of the report.

2. REVIEW MANAGEMENT ORGANIZATION (RMO) COORDINATION

The RMO is responsible for managing the overall peer review effort described in this Review Plan. The RMO for this decision document is the Risk Management Center (RMC). The RMO will coordinate with the Cost Engineering Directory of Expertise (DX) 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.** The intent of this document is approval to initiate risk reduction actions for the Lewisville Lake Dam.

In December 2008, the Lewisville Dam was rated a Dam Safety Action Class (DSAC) classification of DSAC 2, based on the Screening Portfolio Risk Assessment conducted on 12 July 2005. A dam with this classification is considered to have very high risk. Since no additional authorization by Congress is required to address the dam safety issues a Dam Safety Modification (DSM) Report will be prepared in accordance with ER 1110-2-1156.

The district DSO shall submit the DSM report package including a cover letter requesting policy compliance review in preparation for approval to the MSC DSO, Risk Management Center, and HQUSACE. The Risk Management Center will review the risk estimate and verify that the risk estimate is in compliance with the current policy for dam safety risk estimates. The Risk Management Center will review the risk management recommendations and verify the estimated risk reductions.

The District DSO, CESWD DSO and the Chairman, HQUSACE Dam Safety Senior Oversight Group will sign the approval memorandum once all policy compliance review comments are resolved. This approval memorandum will state that all agency requirements, certifications, and reviews have been completed and the Environmental Assessment and signed Finding of No Significant Impact been satisfactorily completed and signed.

The DSM Report will then be sent to the HQUSACE DSO for concurrence, approval and transmittal to the Assistant Secretary of the Army for Civil Works indicating that the design phase of the project will be initiated.

- b. **Study/Project Description.** In the River and Harbor Act of 2 March 1945 (Public Law 79-14, 79th Congress, 1st Session), Congress authorized the first elements of the comprehensive program for the development of the water resources of the Trinity River basin consisting of four multiple-purpose lakes and two floodway projects, one of which was the design, construction and implementation of the Lewisville Dam. The primary purposes of the project are flood control (now referred to as flood risk management), water supply, recreation and non-Federal hydropower. The Project Business Line is Flood Damage Reduction (FDR).

Construction of the embankment began in December 1948, and closure was started in June 1954. The dam was completed in August 1955. Deliberate impoundment began in November 1954 and conservation pool (elevation 515) was first attained in May 1957. All elevations mentioned in this document are expressed in feet, NGVD. The additional storage provided by Roberts Dam upstream, the conservation pool of Lewisville Dam was raised from elevation 515 to 522 on 30 November 1988. The spillway has been engaged 6 times during flood events that occurred in the following years: 1957 (same year when conservation pool of 515 was attained), 1981, 1982, 1989, 1990, and 2007. The pool of record was established on 4 May 1990 when the reservoir reached elevation 536.73 (4.73 feet above the crest of the uncontrolled spillway).

The project includes an earthen embankment with gated outlet works and an uncontrolled concrete ogee weir spillway. The 32,328 feet long Earthfill Embankment has a maximum height of 125 feet, to elevation 560.0 feet (all elevations mentioned in this document are given in feet NGVD), and consists of approximately 13,208,400 cubic yards of Alluvial Clay and Clay Shale materials with the following features and modifications. General Dam Overview provided as Plate 1 and Typical Embankment Sections provided as Plate 2.

- (1) Drainage Blanket – 3 feet of Filter material (C33 Sand) that extends 200 feet upstream (U/S) from the downstream (D/S) toe between STA 79+07 and 177+70 and between STA 210+70 and 241+30.
- (2) Inspection Trench – 1H:1V slope U/S of the centerline to the primary foundation material with controlled backfill for cutoff of floodplain from STA 79+00 to 163+70.
- (3) Embankment Modifications – Constructed between July 1979 and April 1984 on both upstream and downstream slopes from STA 168+50 to 277+90. This consisted of flattening U/S and D/S slopes to 4H:1V to minimize shallow sliding known to occur on U/S and D/S embankment slopes.
- (4) Seepage Control Modifications – Relief Wells and Seepage Collection Systems have been installed in all 3 known seepage areas to monitor and control seepage occurring through the overburden.

Lewisville Dam was assessed by a National Risk Cadre in July 2005 for the SPRA and subsequently assigned a Dam Safety Action Classification (DSAC) of II (High Risk), in 2008 with respect to the following Potential Failure Modes (PFM's).

- (1) Foundation Seepage and Piping considered Probably Inadequate under Normal-Unusual-Extreme loading conditions based on foundation pressures projected from instrumentation and current seepage and uplift conditions being monitored.
- (2) Spillway – Erodibility considered Probably Inadequate under Extreme loading conditions based on observed structural distress from soil loading, as well as the erodibility of the foundation in the weathered Clay Shale.
- (3) Embankment Foundation Stability considered Probably Inadequate under Extreme loading conditions based on existing stability and seepage conditions.

The objective of the DSM Study is to reduce risk at Lewisville Lake to below tolerable risk guidelines or as low as reasonably practicable and to provide adequate information to determine what permanent dam modifications are necessary for the Corps to operate Lewisville Lake for the foreseeable future. Structural and non-structural risk reduction measures will be identified and used to formulate and evaluate alternatives for varying degrees of permanent risk reduction; and to ultimately recommend a cost effective, technically feasible alternative that minimizes adverse environmental, economic and social effects, which will allow the project to operate for the foreseeable future as originally authorized within tolerable risk guidelines. Primary evaluation factors of annual probability of failure, life safety tolerable risk guidelines, As Low As Reasonable Practicable considerations, and essential USACE guidelines form the basis for plan selection. This study will incorporate where available Corps methodology to confirm these findings.

Structural measures to be considered are upstream to downstream embankment and filter replacement, downstream embankment replacement, and anchors in the spillway monoliths.

The estimated cost to reduce risk at the Lewisville Lake Dam within tolerable risk guidelines to allow continued operation in the foreseeable future as originally authorized could be in the range of \$50 to \$100M.

c. Factors Affecting the Scope and Level of Review

- (1) A facilitated Potential Failure Mode Assessment (PFMA) was conducted on 23-27 February 2009 at the Trinity Regional Project Office adjacent to Lewisville Lake Dam. The following significant PFMs were identified with respect to the project condition and the potential downstream consequences.
 - (a) PFM#4 – Internal Erosion of Foundation (Seepage/Piping). Foundation Seepage with potential Internal Erosion (piping) through the sandy overburden materials is a serious concern for known areas throughout the embankment. This piping could initiate in one of the three known seepage areas with pervious sand deposits overlying the bedrock beneath the embankment. This material has historically been the pathway through which clear seepage and undesirable uplift pressures have occurred at the toe of the dam embankment.
 - (b) PFM#9 – Global Stability of the Embankment. The Stability of the Embankment and Foundation may not be adequate under extreme loading conditions as a result of seepage pressures developed beneath the dam embankment.
 - (c) PFM#7 – Instability of Spillway Weir. Extremely high water releases over the spillway would cause erosion of the spillway channel downstream of the spillway concrete chute and could potentially shift the apron panels.
- (2) The following factors will affect the project study and level of review
 - (a) Hydrology/Hydraulics
 - (b) Soil Properties
 - (c) Environmental/Societal Impact
 - (d) Development of Remedial Measures
 - (e) Probabilistic versus Deterministic Design
 - (f) Non-Failure Risks
- (3) Environmental, health and safety, economic, societal and recreational impacts, while expected to be minimal, are yet to be determined pending decision on the nature and scope of the modification. This review plan is a living document and will be updated whenever possible throughout the decision document cycle.
- (4) The study has local, state and Federal interest. The reservoir is owned and managed by the Fort Worth District of the Corps of Engineers.
- (5) The project presents a threat to human life/safety because of its high risk of failure under an extreme event and the population downstream.
- (6) The project has potential for public controversy due to reservoir management for water supply agreement, flood control, and recreation.

- (7) There are risks associated with the evaluation of the seepage and piping problems. The methods used to investigate and analyze these two areas in the Dam Safety Modification Study could be controversial and have impacts to the project design, cost estimates, and schedule.
- (8) Lewisville Lake is not located in a seismically active region, historically. However, recent activity in the region requires further evaluation. Due to water supply and flood risk mitigation purposes of the dam, the sequencing of construction operations and preparation of the subsurface during construction shall be thoroughly reviewed.

- d. In-Kind Contributions.** Products and analyses provided by non-Federal sponsors as in-kind services are subject to DQC, QCC, ATR, and IEPR. No in-kind products or analyses will be provided by the non-Federal sponsor(s).

The Cities of Dallas and Denton have water supply storage contracts dated May 1953 and December 1953 for storage below elevation 515 feet. Additional authorized September 1980 entitle the water suppliers additional storage between elevations 515 feet and 522 feet.

The city of Denton installed a hydropower facility, connected to the Brazos River Authority distribution network, at Lewisville Dam on October 23, 1991. The Run-of-river facility is capable of producing 2,892 Kilowatts, when downstream water supply and small flood releases are used to generate power.

- e. Required Experience.** Based on the project and known site conditions, the following disciplines will be needed for the Project Delivery Team (PDT) and subsequent review efforts.
- (1) Geotechnical Engineer - Shall have experience in the field of geotechnical engineering, analysis, design, and construction of earthfill embankment dams. The geotechnical engineer shall have experience in subsurface investigations, rock and soil mechanics, internal erosion (seepage and piping), slope stability evaluations, erosion protection design, and earthwork construction. The geotechnical engineer shall have knowledge and experience in the forensic investigation of seepage, settlement, stability, and deformation problems associated with high head dams and appurtenances constructed on rock and soil foundations.
 - (2) Engineering Geologist - Shall have experience in assessing internal erosion (seepage and piping) and stability of earthfill embankment dams constructed on Shale and Clay Shale formations. The engineering geologist shall be familiar with identification of geological hazards, exploration techniques, field and laboratory testing, and instrumentation. The engineering geologist shall be experienced in the design of grout curtains and must be knowledgeable in grout theology, concrete mix designs, and other materials used in foundation seepage barriers.
 - (3) Hydrologist – Shall have experience in water management especially with managing water outflows from a reservoir. As well as with characterizing surface water flows in a watershed using inundation mapping software, HEC-HMS, HEC-ResSim, and other water-flow scenario techniques.
 - (4) Hydraulic Engineer – Shall have experience in the analysis and design of hydraulic structures related to dams including the design of hydraulic structures (e.g., spillways, outlet works, and stilling basins) with Flo-2D models and HEC-RAS. The hydraulic engineer shall be knowledgeable and experienced with the routing of inflow hydrographs through multipurpose flood control reservoirs utilizing multiple discharge devices, Corps application of risk and uncertainty analyses in flood damage reduction studies, and standard Corps hydrologic and hydraulic computer models used in drawdown studies, dam break inundation studies, hydrologic modeling and analysis for dam safety investigations.

- (5) Structural Engineer – Shall have experience and be proficient in performing stability analysis, finite element analysis, seismic time history studies, and external stability analysis including foundations on high head mass concrete dams. The structural engineer shall have specialized experience in the design, construction and analysis of concrete dams and project components.
- (6) Civil Engineer – Shall have experience and expertise in utility relocations, positive closure requirements, civil design, and non-structural flood damage reduction.
- (7) Environmentalist (or Planning Specialist) – Shall have experience and understand the requirements for decision documents and NEPA documentation.
- (8) Economist (or Consequence Specialist) – Shall be knowledgeable of policies and guidelines of ER 1110-2-1156 as well as experienced in analyzing flood risk management projects in accordance with ER 1105-2-100, the Planning Guidance Notebook. The economist shall be knowledgeable and experienced with standard Corps computer models and techniques used to estimate population at risk, life loss, and economic damages.
- (9) Cost Engineer – Shall have experience in the application of scientific principles and techniques to problems of cost estimating, cost control, business planning and management science, profitability analysis, project management, and planning and scheduling.
- (10) Mechanical/Electrical Engineer – Shall have experience in machine design, machine rehabilitation and familiarity with design of mechanical gates and controls for flood control structures.
- (11) Maintenance Engineer – Shall have experience with project operations and maintenance conditions and procedures.
- (12) Real Estate Specialist – Shall have experience with assessing government property with respect to legal rights and responsibilities.

f. Minimum Qualifications. To ensure the technical adequacy and adherence to criteria for the Risk Management actions developed for the DSMS, all technical resources shall have the following minimum qualifications. Licensed Professionals shall be used for all review efforts when applicable with relevant experience with Dam Safety/Risk Management principles and practice.

Review Disciplines / Required Experience (Yrs)	DQC	ATR	IEPR I
Geotechnical Engineering	10	15	20
Engineering Geologist	5	10	15
Structural Engineering	10	15	20
Hydrology	5	*	*
Hydraulic Engineering	10	15	20
Civil Engineering	5	**	**
Planning/Environmental	5	***	***
Consequences/Economics	10	15	20
Cost Engineering	5	****	****

* Hydrology review shall be conducted by Hydraulic Engineer.

** Civil review shall be conducted by Geotechnical/Structural Engineers.

*** Planning/Environmental review shall be conducted by Consequences/Economics Specialist.

**** Costs shall be considered and reviewed by all disciplines.

g. Products to Undergo DQC, ATR/QCC, and IEPR:

- (1) Baseline Risk Assessment Report
- (2) Baseline Risk Technical Appendices
- (3) Dam Safety Modification Report
- (4) Dam Safety Modification Report Appendices
- (5) MCACES and Risk Based Cost Estimates
- (6) Draft Environmental Assessment for interim Water Control Plan
- (7) Draft Environmental Assessment for the Recommended Risk Reduction Measure Plans
- (8) Plans and Specifications for Alternative Risk Reduction Measures
- (9) Screening Level Cost Estimates of Alternative Risk Reduction Measure Plans
- (10) Geotechnical Reports
- (11) Final Draft Environmental Assessment

h. Dr. Checks: DrChecks review software will be used to document all review comments, responses and associated resolutions accomplished throughout the review process.

- (1) 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:
 - (a) The review concern – identify the product’s information deficiency or incorrect application of policy, guidance, or procedures;
 - (b) The basis for the concern – cite the appropriate law, policy, guidance, or procedure that has not been properly followed;
 - (c) 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
 - (d) The probable specific action needed to resolve the concern – identify the action(s) that the reporting officers must take to resolve the concern.
- (2) In some situations, especially addressing incomplete or unclear information, comments may seek clarification in order to then assess whether further specific concerns may exist.

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 shall be in accordance with the Quality Manual of the District and the Southwestern Division.

Documentation of DQC. The DQC will be managed by the Fort Worth District in accordance with ER 1110-1-12 and the Southwestern Division/Fort Worth District Quality Management Plans. The DQC will be documented using Dr Checks. The DQC roster is provided in Attachment 1.

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. Documentation of ATR.

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.

- (1) 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:
 - (a) Identify the document(s) reviewed and the purpose of the review;
 - (b) Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
 - (c) Include the charge to the reviewers;
 - (d) Describe the nature of their review and their findings and conclusions;
 - (e) Identify and summarize each unresolved issue (if any); and
- (5) 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.
- (6) 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 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.

b. Quality Control and Consistency (QCC) Review. In conjunction with the ATR review, the RMC shall facilitate a QCC discussion for the district and the risk assessment cadre to present the baseline risk assessment, risk management alternatives considered, and the recommended risk management plan for review by a panel of Dam Safety professionals.

c. Policy Compliance Review. The MSC and HQ will conduct agency policy compliance review. The Risk Management Center will review the risk estimate and verify that risk estimate is in compliance with the current policy for dam safety risk estimates. The Risk Management Center will review the risk management recommendations and verify the estimated risk reductions.

d. Senior Oversight Group (SOG) Review. Upon completion of any QCC amendments, the district presents the baseline risk assessment, risk management alternatives considered, and the recommended risk management plan to the dam safety senior oversight group (SOG) prior to the IEPR.

6. INDEPENDENT EXTERNAL PEER REVIEW (IEPR)

IEPR may be required for decision documents under certain circumstances. IEPR is the most independent level of review, and is applied in cases that meet certain criteria where the risk and magnitude of the proposed project are such that a critical examination by a qualified team outside of USACE is warranted. A risk-informed decision, as described in EC 1165-2-209, 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:

- a. 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 1165-2-209.
- b. Type II IEPR.** Type II IEPR, or Safety Assurance Review (SAR), are managed outside the USACE and are conducted on design and construction activities for hurricane, storm, and flood risk management projects or other projects where existing and potential hazards pose a significant threat to human life. Type II IEPR panels will conduct reviews of the design and construction activities prior to initiation of physical construction and, until construction activities are completed, periodically thereafter on a regular schedule. The reviews shall consider the adequacy, appropriateness, and acceptability of the design and construction activities in assuring public health safety and welfare.
- a. Decision on IEPR.** Based on factors from EC 1165-2-209 (see Table 2 below), Type 1 IEPR is required for the Lewisville Lake Dam Safety modification project.

EC 1165-2-209 Criteria	Lewisville Dam Safety Modification
Is there a significant risk to human life?	The project has the potential to pose a significant threat to human life.
Is the total project cost more than \$45M?	The estimated project cost is more than \$45M.
Has the Governor requested a Type 1 IEPR?	The Governor has not requested a Type 1 IEPR.
Has the head of a Federal or State agency charged with reviewing the project study requested a Type 1 IEPR?	Yes, per USACE ER 1165-2-209 a Type 1 IEPR has been requested.
Will there be a significant public controversy as to the size, nature, or effects of the project?	Yes, the project has potential for public controversy.
Will there be a significant public controversy as to the economic or environmental cost or benefit of the project?	Yes, the project has potential for public controversy regarding the economic and environmental cost/benefit of the project.
Will the study be based on information from novel methods, present complex challenges or interpretation, contain precedent-setting methods or models, or present conclusions that are likely to change prevailing practices?	The study will not be based on information from novel methods; however the study may present complex challenges or interpretation, and also may contain precedent setting methods or models.

- b. **Type 1 IEPR members** will be provided with ATR documentation and significant public comments made during public meetings and on the products under review. Arising issues between PDT and reviewers should be resolved with face-to-face resolution.
- c. **Documentation of Type I IEPR.** The IEPR panel will be selected and managed by an Outside Eligible Organization (OEO) per EC 1165-2-209, Appendix D. The IEPR will be documented using DrChecks. 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.
- a. 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.

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. MSC APPROVAL

The MSC is Southwestern Division (SWD); SWD is responsible for approving the review plan. Approval is by the MSC commander or his designated representative. The commander's approval should reflect vertical team input (involving district, MSC, RMC, PCX, 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. Changes to the review plan should be approved by following the process used for initially approving the plan. In all cases the MSC will review the decision on the level of review and any changes made in updates to the project.

9. COST ENGINEERING DIRECTORY OF EXPERTISE (DX) REVIEW AND CERTIFICATION

All decision documents shall be coordinated with the Cost Engineering DX, located in the Walla Walla District. The DX 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 DX will also provide the Cost Engineering DX certification. The RMO is responsible for coordination with the Cost Engineering DX.

10. 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).

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.

c. **Planning Models.** The following models are anticipated to be used in the development of the decision document:

Model Name	Model Description	Model Type
HEC-FIA	Economic model used to calculate estimated economic damages and loss of life corresponding to floodplain mapping.	Planning
HEC-HMS By applying this model the PDT is able to:	<ul style="list-style-type: none"> a. Define the watersheds' physical features b. Describe the metrological conditions c. Estimate parameters d. Analyze simulations e. Obtain GIS connectivity 	Engineering
HEC-ResSim	<p>This model predicts the behavior of reservoirs and to help reservoir operators plan releases in real-time during day-to-day and emergency operations. The following describes the major features of HEC-ResSim</p> <ul style="list-style-type: none"> a. Graphical User Interface b. Map-Based Schematic c. Rule-Based Operations 	Engineering
HEC-RAS	Unsteady 1-dimensional flow model used to simulate the channel hydraulics	Engineering
FLO-2D	Unsteady 2-dimensional flow model used to simulate wide alluvial fan floodplain inundation, and produce corresponding floodplain mapping.	Engineering
Groundwater Modeling System (GMS)	This model is used to conduct seepage analysis	Engineering
SLOPEW	This model is used to conduct slope stability analysis	Engineering
FLAC-UBCSAND	This is a numerical deformation model used for seismic stability and deformation analysis	Engineering
SEEPW for seepage	This is a finite element model used analyses for earth embankments and foundations.	Engineering
DAMRAE (Dam Safety Risk Analysis Engine)	This is a generalized event tree analysis tool that includes a graphical interface for developing and populating an event tree, and a tool for calculating and post-processing an event tree risk model for dam safety risk assessment.	Engineering
MCACES or MII	These are cost estimating models. This is a cost estimating model that was developed by Building Systems Design Inc. Crystal Ball risk analysis software will also be used.	Cost Estimating

11. REVIEW SCHEDULES AND COSTS

DSMS Activity	Start Date	End Date	Est. Cost
RMC / DQC Peer Review	16-Jun-14	8-Aug-14	\$90,000
ATR/QCC Agency Review	11-Aug-14	30-Sep-14	\$135,000
MSC/HQ Policy Review	1-Oct-14	24-Oct-14	\$30,000
SOG Risk Management Review	6-Oct-14	31-Oct-14	\$35,000
District and MSC DSO and SOG Approval	3-Nov-14	12-Dec-14	-
IEPR Type I Review	17-Nov-14	16-Jan-15	\$410,000
Final Report	19-Jan-15	13-Mar-15	-
ASA/CW Concurrence	13-Apr-15	29-May-15	-

12. PUBLIC PARTICIPATION

Upon MSC approval, this Review Plan will be posted on the Fort Worth District SharePoint site to support public awareness and participation: <https://kme.usace.army.mil/swd/swf/dsp/default.aspx>.

Stakeholders and the general public have been and will continue to be kept informed of the DSMS process and progress. Beginning in late 2010 the U.S. Army Corps of Engineers (USACE) Fort Worth District began a campaign to inform the local public about the USACE Dam Safety program and the risks associated with Lewisville Dam, as listed below.

Visit/Meeting	Date
Congressional/Stakeholders Brief	24-Aug-10
Media Event for General Public	1-Sep-10
Quarterly Stakeholders Meeting	7-Dec-10
Quarterly Stakeholders Meeting	8-Mar-11
Congressional Visit	9-Nov-11
Quarterly Stakeholders Meeting	10-Nov-11
Quarterly Stakeholders Meeting	17-May-12

Public participation will continue to occur as part of the NEPA process. Public comments will be consolidated in a matrix and addressed, if needed. A summary of the comments and resolutions will be included in the document.

13. REVIEW PLAN APPROVAL AND UPDATES

The Southwestern 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 are 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.

14. REVIEW PLAN POINTS OF CONTACT

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

- .Michael Kingston, Project Manager, Fort Worth District, Michael.j.kingston@usace.army.mil , (817) 886-1438.

ATTACHMENT 1: TEAM ROSTERS

1. **Lewisville Product Delivery Team (PDT)** The current risk assessment teams conducting the base line risk assessment at the dams include: **Names Removed**

Project Title	Name	Organization
Dam Safety Program Manager		SWF
Lead Project Engineer		SWD DSPC
Lead Structural		SWD DSPC
Lead H&H		SWF
Lead Planner		SWF
Project Manager		SWF
Geotechnical Engineer		SWF
Geotechnical Engineer		SWF
Geotechnical Engineer		SWF
Geotechnical Engineer		SWF
Engineering Geologist	TBD	TBD
GIS		SWF
Environmental		SWF
Lead Cost Engineer		SWF
Real Estate		SWF

2. **District Quality Control (DQC) Team Roster**

Project Title	Name	Organization
Geotechnical Engineer	TBD	TBD
Engineering Geologist	TBD	TBD
Structural Engineer	TBD	TBD
Hydrologist	TBD	TBD
Hydraulic Engineer	TBD	TBD
Civil Engineer	TBD	TBD
Planning/Environmental	TBD	TBD
Consequences/Economics	TBD	TBD
Cost Engineer	TBD	TBD
Real Estate	TBD	TBD

***-confirmed**

3. Agency Technical Review (ATR) Team Roster

Position	Name	Organization
Geotechnical Engineer	TBD	TBD
Engineering Geologist	TBD	TBD
Structural Engineer	TBD	TBD
H&H Engineer	TBD	TBD
Consequences/Economics	TBD	TBD
Real Estate	TBD	TBD

4. Type I Independent External Peer Review Panel. (A&E Contractual Services)

Discipline	Name	Years of Experience/ Credentials
Geotechnical Engineer	TBD	
Engineering Geologist	TBD	
Structural Engineer	TBD	
H&H Engineer	TBD	
Consequences/Economics	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 Dam Safety Modification Study for Lewisville Lake, Lewisville, Texas. 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 DrCheckssm.

SIGNATURE

ATR Team Leader

Date

SIGNATURE

Project Manager
CESWF-PM-C

Date

SIGNATURE

Lead Engineer
CESWD-DSPC@SWF

Date

SIGNATURE

Director Risk Management Center
CEIWR-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

ATTACHMENT 3: REVIEW PLAN REVISIONS

Revision Date	Description of Change	Page / Paragraph Number

ATTACHMENT 4: ACRONYMS AND ABBREVIATIONS

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