



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: Stillhouse Hollow Dam, Texas, Issue Evaluation Study 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, 28 November 12, subject: Risk Management Center Endorsement – Stillhouse Hollow Dam, TX - IES Review Plan (Encl 1).
- c. Final Review Plan (RP) for Stillhouse Hollow Dam Issue Evaluation Study (Encl 2).

2. In accordance with reference 1.a., I hereby approve the enclosed RP for the subject project study.

3. 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.

4. 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

27 November 2012

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

SUBJECT: Risk Management Center Endorsement – Stillhouse Hollow Dam, TX - IES Review Plan

1. The Risk Management Center (RMC) has reviewed the Review Plan (RP) for the Stillhouse Hollow Dam, dated 20 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 the Fort Worth District, reviewed by the Southwestern Division and the RMC, and all review comments have been satisfactorily resolved.
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 aspects of the Agency Technical Review. For further information, please do not hesitate to contact me at (303) 963-4556.

Sincerely,

THOMAS W. BISHOP, P.E.
Senior Review Manager
Risk Management Center

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



US Army Corps of Engineers



Stillhouse Hollow Dam IES Review Plan

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

*Fort Worth District
U.S. Army Corps of Engineers
20 November 2012*



Project P2 Number

Project Manager: Michael Kingston
Lead Engineer: [redacted]
Review Plan SWF POC: Jason Vazquez
Review Plan SWD POC: Michael Southern

MSC Approval Date: 7 December 2012

Last Revision Date: _____



US Army Corps
of Engineers ®

REVIEW PLAN

Stillhouse Hollow Dam, Texas Issue Evaluation Study

TABLE OF CONTENTS

1. INTRODUCTION	2
A. PURPOSE	2
B. STUDY/PROJECT DESCRIPTION	2
C. FACTORS AFFECTING THE SCOPE AND LEVEL OF REVIEW	4
D. LEVELS OF REVIEW	5
E. REVIEW TEAM	5
F. MINIMUM QUALIFICATIONS	7
2. REQUIREMENTS.....	7
A. REVIEWS.....	7
B. APPROVALS	8
3. GUIDANCE AND POLICY REFERENCES	9
4. SUMMARY OF REVIEWS AND APPROVALS.....	9
5. MODEL CERTIFICATION AND APPROVAL.....	10
A. REGULATION	10
B. MODELS	10
6. REVIEW SCHEDULES AND COSTS	11
7. PUBLIC PARTICIPATION.....	11
8. EXECUTION.....	12
A. GENERAL	12
B. DR. CHECKS:	13
C. ATR REVIEW AND CONTROL.....	13
D. DOCUMENTATION OF ATR	13
E. CERTIFICATION OF ATR	14
9. REVIEW PLAN POINTS OF CONTACT	14
ATTACHMENT 1: TEAM ROSTERS.....	15
ATTACHMENT 2: SAMPLE STATEMENT OF TECHNICAL REVIEW FOR DECISION DOCUMENTS	17
ATTACHMENT 3: REVIEW PLAN REVISIONS.....	18
ATTACHMENT 4: ACRONYMS AND ABBREVIATIONS	19



1. INTRODUCTION

a. Purpose

This Review Plan is intended to ensure a quality-engineering Dam Safety Issue Evaluation Study developed by the Corps of Engineers. ER 1110-2-1156, "Dam Safety Policy and Procedures" dated 28 Oct 2011, Chapter 8 describes the Issue Evaluation Study (IES) Plan development, review, and approval process. This Review Plan has been developed for Stillhouse Hollow Dam. This Review Plan was prepared in accordance with EC 1165-2-209, "Civil Works Review Policy", and covers the review process for the Stillhouse Hollow Dam Phase 1 IES Report.

The IES is a study that may lead to additional studies, modeling, or NEPA consultation. NEPA compliance would occur during the Dam Safety Modification Study Phase. Because the Phase 1 IES is used to justify a Phase 2 Issue Evaluation Studies and potentially Dam Safety Modification (DSM) studies, it is imperative that the vertical teaming efforts are proactive and well coordinated to assure collaboration of the report findings, conclusions, and recommendations, and that there is consensus at all levels of the organization with the recommended path forward.

b. Study/Project Description

Stillhouse Hollow Dam was screened by a national risk cadre on 1 May 2008 as part of the FY08 Screening for Portfolio Risk Analysis (SPRA). The dike was screened separately during the SPRA because its associated consequences are not the same as the main project. Based on the results of this risk screening, the dam was categorized as Dam Safety Action Class (DSAC) II (Very High Risk).

Stillhouse Hollow Dam is located about five miles southwest of Belton, Texas, at river mile 16 on the Lampasas River. The Flood Control Act approved 3 September 1954 (PL 83-780) (HD 535/81/2) authorized the construction of the Stillhouse Hollow Dam for the primary purposes of flood control, water supply and recreation. The project consists of a rolled earth fill embankment with a rock fill upstream toe, a dike located in the right abutment, a gated outlet works, and an uncontrolled broadcrested weir spillway. Construction began in July 1962 and was completed in May 1968.

The main embankment is a rolled earth fill with an upstream rock toe and a downstream drainage blanket. The embankment is 8,070 feet long and has a maximum height of 200 feet above the streambed, a crest width of 42 feet, and a total volume of about 11,221,100 cubic feet. The earth fill section consists of an impervious core, and upstream and downstream impervious shells. A vertical drain adjacent to the core and a downstream drainage blanket provide for embankment seepage control. A foundation cutoff trench with a base of 40 feet and 1 vertical on 2 horizontal (1V:2H) side slopes was constructed with a minimum of 2 feet into unweathered material between Stations 0+00 and 77+00.

The embankment foundation in the floodplain consists of up to 34 feet of overburden overlying the primary material. The overburden consists of an upper clay stratum overlying a basal granular stratum. The upper clay stratum varies in thickness from 10 to 34 feet. Laboratory tests indicated that this material had a low undrained shear strength and high settlement potential. Consequently, this material was removed within the limits of the embankment from about Stations 34+00 to 57+00. The basal granular stratum consists of sands and gravels that usually have high shear strength. The Walnut formation underlies the overburden to considerable depth in the floodplain. This foundation consists of hard, calcareous shale containing numerous shelly limestone and shell conglomerate layers. An old alluvial terrace is located adjacent to the right abutment.



This terrace consists of several feet of clayey gravel, about 15 feet of moderately plastic clay, 10 feet of clayey gravel, about 15 feet of moderately plastic clay, 10 feet of granular soil, and 5 feet of moderate to high plasticity clay. These materials are generally stronger than the floodplain clays and were not removed from the foundation. The primary underlying the terrace overburden soils are as described for the floodplain. The primary limestone formation which makes up the abutments is covered with up to 5 feet of clay overburden containing weathered limestone fragments.

The outlet works is located near embankment station 37+00. It consists of an unpaved approach structure, a dry well gate control tower; a 12-foot inside diameter cut and cover conduit, and a stilling basin. The approach structure is a 30-foot wide by 26-foot long U-frame with 90-degree wing walls extending out 60 feet. The channel has 1V:2H side slopes protected with 48 inches of rock fill on 12-inch spalls a distance of 25 feet upstream from the approach channel walls. The reinforced concrete U-frame approach walls extend 27 feet upstream from the intake and reach a maximum height of 38'-8" at the tower.

The spillway is located in a saddle on the right abutment. It consists of structures of an unpaved approach channel, an uncontrolled broadcrested weir, a concrete sill, and an unpaved discharge channel. The approach channel extends upstream a horizontal distance of 100 feet from the crest, then slopes downstream at a uniform grade of 1% to natural ground. The weir is 1,650 feet long with side slopes of 4V:1H. The concrete sill is located at elevation 666 along the crest of the weir section. It is 2.5 feet wide and 10 feet deep. The unpaved discharge channel empties into the Lampasas River. The entire spillway was excavated into the Edwards formation limestone.

A homogeneous, impervious, rolled earth filled dike was constructed on the right abutment. It is 6,004 feet long and contains about 91,498 cubic yards of compacted fill. The upstream slope protection consists of a grass cover. Foundation excavation other than stripping was not required and no drainage blanket was provided. Materials for the dike were obtained from a borrow area located upstream from the dike. The material consisted of sandy clays (CL), limestone gravels (GC), and limestone sands (SM-SC and SC).

A baseline risk estimate had not been developed for the project. A preliminary screening-level risk analysis was performed as part of the FY08 Screening for Portfolio Risk Analysis (SPRA). Based on the results of this risk screening, the dam was categorized as Dam Safety Action Class (DSAC) II with respect to the following Potential Failure Modes (PFM's).

- (1) Embankment - Erosion of the Crest, Downstream Slope, and Toe. For the extreme loading, embankment erosion was rated Inadequate. The maximum pool elevation of the PMF is 695.53 is 2.47 feet below the crest of the dam at elevation 698.0. Analysis indicates required free board of 5.8 feet.
- (2) Outlet Works and Conduits – Embankment Piping at Conduit. For the normal, unusual and extreme loadings, seepage and piping around the conduit was rated as Probably Inadequate. Seepage presently exists at normal to high water levels.
- (3) Embankment – Foundation Seepage and Piping. For unusual and extreme loadings, seepage and piping through the foundation was rated as Inadequate.
- (4) Embankment – Abutment Seepage and Piping. For the unusual and extreme loadings, abutment seepage and piping was rated Probably Inadequate and Inadequate, respectively.



The objective of an IES is to evaluate risk at Stillhouse Hollow Dam in relation to the USACE tolerable risk guidelines by focusing on all significant potential failure modes related to the performance, maintenance, and operational concerns and determine if further action is justified either through interim measures, formal study, or both.

c. Factors Affecting the Scope and Level of Review

- (1) The Potential Failure Mode Analysis (PFMA) for Stillhouse Hollow Dam was conducted 17-20 May 2011. The following PFMs were determined to be credible failure modes by the team:
 - (a) PFM # 1/2A/2B: Outlet Works and Conduits – Embankment Piping at Conduit. Seepage presently exists at normal to high water levels. Long duration events could potentially increase the size of the existing seepage paths, and introduce new seepage paths which could lead to additional loss of foundation and embankment soils around the conduit.
 - (b) PMF # 5/42: Embankment – Seepage and Piping along the contact with the fault zone.
 - (c) PFM # 7/16/17/41: Embankment – Foundation Seepage and Piping. Seepage presently exists at normal to high water levels. Long duration events could potentially increase the size of the existing seepage paths, and introduce new seepage paths which could potential lead to additional loss of foundation and embankment soils.
 - (d) PFM # 8: Erosion of the Embankment Crest, Downstream Slope and Toe. Currently some portions of the dam are below the design elevation. The maximum pool elevation of the PMF is below the crest of the dam (elevation 698.0 feet). Wave action at the PMF event will likely cause erosion of the crest and downstream slope causing loss of the embankment.
 - (e) PFM # 10: Embankment stability due to high foundation pore pressures in the clay shale.
 - (f) PFM # 14: Piping through the core by internal erosion of the clay core because of filter incompatibilities.
 - (g) PFM # 18/19: Embankment – Seepage presently exists at normal to high water levels. Long duration of these loading conditions could potentially increase the size of the existing seepage paths, and introduce new seepage paths which could potential lead to additional loss of foundation and embankment soils.
- (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) There are risks associated with the evaluation of the seepage and piping problems. The methods used to investigate and analyze the known areas in the Issue Evaluation Study could be controversial and have impacts to the project design, cost estimates, and schedule.

- (4) Stillhouse Hollow Dam is not located in a seismically active region. 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. Levels of Review

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:

- (1) District Quality Control/Quality Assurance (DQC)
- (2) Agency Technical Review (ATR)
- (3) Independent External Peer Review (IEPR)
- (4) Policy and Legal Compliance Review.

As per ER 110-2-1156, a Quality Control and Consistency (QCC) review will be conducted in conjunction with the ATR including the district, MSC, and RMC. The RMC will certify that the risk assessment was completed in accordance with the USACE current guidelines and best risk management practices.

Independent External Peer Review (IEPR) is applied in cases that meet certain criteria. This IES is not a decision document and does not cover work requiring a Type I or Type II IEPR. Issue Evaluation Studies are used to justify Dam Safety Modification Studies. If this project requires a Dam Safety Modification Study, both Type I and Type II IEPR will be conducted.

e. Review Team

The USACE Risk Management Center (RMC) is the Review Management Organization (RMO) for dam safety related work, including this IES. Contents of this review plan have been coordinated with the RMC and the Southwestern Division, the Major Subordinate Command (MSC). Informal coordination with SWD will occur throughout the IES development, including briefings to the SWD Dam Safety Committee and Program Review Board updates. In-Progress Review (IPR) team meetings with the RMC, SWD, and HQ will be scheduled on an “as needed” basis to discuss programmatic, policy, and technical matters. The SWD Dam Safety Program Manager will be the POC for vertical team coordination. This review plan will be updated for each new project phase.

Agency Technical Review Team:

ATR Lead: The ATR team is a senior professional with extensive experience in preparing Civil Works documents and conducting ATRs (or ITRs). The lead has 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, in this case, (List: Structural Engineering, Geotechnical Engineering, etc.)

Required ATR Team Expertise: The ATR team will be chosen based on each individual’s qualifications and experience with similar projects. 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. Will also have experience with characterizing surface water flows in a watershed using inundation mapping software, HEC-HMS, HEC-ResSim, and other water-flow scenario development 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.
- (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) Mechanical/Electrical Engineer – Shall have experience in machine design, machine rehabilitation and familiarity with design of mechanical gates and controls for flood control structures.
- (10) Maintenance Engineer – Shall have experience with project operations and maintenance conditions and procedures.



f. Minimum Qualifications

To ensure the technical adequacy and adherence to criteria for the IES assessment, 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
Geotechnical Engineering	10	15
Engineering Geologist	5	10
Structural Engineering	10	15
Hydrology	5	*
Hydraulic Engineering	10	15
Civil Engineering	5	**
Planning/Environmental	5	***
Consequences/Economics	10	15

* 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.

2. REQUIREMENTS

a. Reviews

The review of all work products will be in accordance with the requirements of EC 1165-2-209 by following the guidelines established within this review plan. All engineering and design products will undergo District Quality Control Reviews.

(1) District Quality Control (DQC)

DQC is the review of basic science and engineering work products focused on fulfilling the project quality requirements. DQC will be performed for all district engineering products by staff not involved in the work and/or study. Basic quality control tools include a plan providing for seamless review, quality checks and reviews, supervisory reviews, Project Delivery Team (PDT) reviews, etc.

(2) Agency Technical Review (ATR)

ATR is an in-depth review, managed within USACE, and conducted by a qualified team outside of the home district that is not involved in the day-to-day production of the project/product. The purpose of this review is to ensure the proper application of clearly established criteria, regulations, laws, codes, principles and professional practices. The ATR team reviews the various work products and assure that all the parts fit together as a coherent whole.

ATR teams will be comprised of senior USACE personnel (Regional Technical Specialists, etc.), and may be supplemented by outside experts as appropriate. To assure independence, the leader of the ATR team shall be from outside the home Major Subordinate Command (MSC).



(3) 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.

(4) 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.

(5) 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).

(6) Independent External Peer Review (IEPR)

IEPR is the most independent level of review, and is applied in cases that meet certain criteria. This IES is not a decision document and does not cover work requiring a Type I or Type II IEPR. Issue Evaluation Studies are used to justify Dam Safety Modification Studies. If this project requires a Dam Safety Modification Study, both Type I and Type II IEPR will be conducted.

(7) Policy and Legal Compliance Review

Policy and Legal Compliance Review is required for decision documents. Since this IES is not a decision document it does not require a Policy and Legal Compliance Review. If this project requires a Dam Safety Modification Study, a Policy and Legal Compliance Review will be conducted.

(8) Peer Review of Sponsor In-Kind Contributions

There will be no in-kind contributions for this IES.

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.

b. Approvals

(1) Review Plan Approval and Updates

The MSC for this IES is the Southwestern Division. The MSC Commander is responsible for approving this Review Plan. The Commander's approval reflects vertical team input (involving the Fort Worth District, MSC, RMC and HQUSACE members) as to the appropriate scope and level of review for the study and endorsement by the RMC. Like the PMP, the Review Plan is a living document and may change as the study progresses.



The District is responsible for keeping the Review Plan up to date. Minor changes to the review plan since the last MSC Commander approval will be documented in an Attachment to this plan.

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

(2) IES Report

The IES Report shall undergo a DQC and formal ATR. After the ATR, the PDT will present the IES to the Quality Control and Consistency (QCC) Panel for review. The district and the risk assessment cadre present the IES risk assessment, IES findings, conclusions, and recommendations for review.

After the QCC meeting, the Risk Cadre and RMC will certify that the risk estimate was completed in accordance with the Corps' current guidelines and risk management best practices. The IES will then be presented to the Senior Oversight Group (SOG). The SOG generally consists of the following members:

- Special Assistant for Dam Safety (Chair)
- Geotechnical CoP Leader
- Materials CoP Leader
- Structural CoP Leader
- Hydraulics and Hydrologic CoP Leader

Regional representatives determined by Special Assistant for Dam Safety; Corps Business Line & Program Representatives to include DSPM, Flood Damage Reduction, Navigation, Programs, and Director, Risk Management Center; and any other Representatives determined by the Special Assistant for Dam Safety. The District Dam Safety Officer (DSO), the MSC DSO, and the SOG Chairman will jointly approve the final IES after all comments are resolved.

3. GUIDANCE AND POLICY 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 5-1-11, USACE Business Practices
- (5) ER 1105-2-100, Planning Guidance Notebook, Appendix H, Policy Compliance Review and Approval of Decision Documents, Amendment #1, 20 Nov 2007
- (6) ER 1110-2-1156, Safety of Dams – Policy and Procedures, Chapter 9, 28 October 2011

4. SUMMARY OF REVIEWS AND APPROVALS

The dam safety program follows the policy review process described in EC1165-2-209, Civil Works Review Policy. The RMC will be the review management office for the ATR, and the RMC must certify that the risk assessment was completed in accordance with the USACE current guidelines and best risk management practices.



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A Quality Control and Consistency (QCC) review will be conducted including the district, MSC, and RMC. The district and the risk assessment cadre will present the IES risk assessment, IES findings, conclusions, and recommendations for review. After resolution of QCC review comments, the MSC and HQUSACE will complete quality assurance and policy compliance review.

The IES Report will be approved by the District Dam Safety Officer after completion of all DQC, ATR and QCC reviews. The DSM report will then be submitted to the MSC, the Risk Management Center, and HQUSACE for concurrent Policy Compliance Review. The results of the IES will be presented to Senior Oversight Group (SOG) to determine if further risk reduction actions are warranted.

5. MODEL CERTIFICATION AND APPROVAL

a. Regulation

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.

b. 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:	a. Define the watersheds' physical features b. Describe the metrological conditions c. Estimate parameters d. Analyze simulations e. Obtain GIS connectivity	Engineering



Model Name	Model Description	Model Type
HEC-ResSim	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 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

6. REVIEW SCHEDULES AND COSTS

IES Milestone	Start Date	End Date	Est. Cost
Draft Rprt. Complete	12/06/13	01/17/14	-
RMC Peer Review / DQC	01/24/14	02/24/14	\$50,000
ATR/QCC	02/25/14	04/07/14	\$51,000
SOG	TBD	TBD	\$30,000
Report Complete	TBD	TBD	-

7. 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>.

Public and stakeholder coordination has been performed to inform interested parties about the DSAC II rating and ongoing IES, as follows.



Date	Visit/Meeting
3-4 Nov 10	Congressional Visit/Stakeholder Meetings
23-Nov-10	Media Release
26-Oct-11	Congressional Visit

Findings of the Final IES will also be shared with appropriate stakeholders. If this project results in a Dam Safety Modification Study (DSMS), future public coordination will occur for NEPA compliance.

8. EXECUTION

a. General

ER 1110-2-1156, Chapter 8 describes the purpose, process, roles and responsibilities for an IES in addition to the submittal, review, and approval process. The Risk Management Center (RMC) is responsible for coordinating and managing agency technical review of the IES Report in accordance with EC 1165-2-209. The ATR Lead will be an RMC team member unless otherwise approved by the RMC Director. The ATR Lead in cooperation with the PDT, MSC, and vertical team will determine the final make-up of the ATR team.

Subject matter experts from within USACE will conduct the ATR. ATR reviewers shall be approved by the Risk Management Center (RMO). Selections will be based on expertise, experience, and skills, including specialists from multiple disciplines as necessary to ensure comprehensive review. ATR teams will be composed of senior USACE personnel, preferably recognized subject matter experts with the appropriate technical expertise, and may be supplemented by outside experts as appropriate. To assure independence, the leader of the ATR team shall be from outside the home MSC and the ATR team shall be from outside the Fort Worth District.

The group of qualified reviewers shall be formed into panels that are sufficiently broad and diverse to fairly represent the relevant scientific and engineering perspectives and fields of knowledge. RMO shall ensure that reviewers who are Federal employees (including special government employees) comply with applicable Federal ethics requirements. In selecting reviewers who are not Federal government employees, the National Academy of Sciences' policy for committee selection with respect to evaluating the potential for conflicts (e.g., those arising from investments; agency, employer, and business affiliations; grants, contracts and consulting income) shall be adopted or adapted.

The RMO shall coordinate the review teams with Communities of Practice, other relevant Centers of Expertise, and other relevant offices to ensure that a review team with appropriate expertise is assembled and a cohesive and comprehensive review is accomplished.

The RMO shall provide reviewers with sufficient information, including background information about the project, to enable them to understand the data, analytic procedures, and assumptions. Reviewers shall be informed of applicable access, objectivity, reproducibility and other quality standards under the federal laws governing information access and quality.

The products will be reviewed against published guidance, including Engineering Regulations, Engineering Circulars, Engineering Manuals, Engineering Technical Letters, Engineering Construction Bulletins, Policy Guidance Letters, implementation guidance, project guidance memoranda, and other formal guidance memoranda issued by HQUSACE. Any justified and approved waivers should have been obtained from HQUSACE for any deviations from USACE guidance.



b. 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.

c. ATR Review and Control

Reviews will be conducted in a fashion which promotes dialogue regarding the quality and adequacy of the IES and baseline risk assessment necessary to achieve the purposes of the IES. The ATR team will review the IES report which includes supporting risk and stability analysis documentation. A QCC of the baseline risk estimate and supporting documentation will be performed under the leadership of the RMC. Therefore, the level of effort for each ATR reviewer is expected to be between 16 and 32 hours.

d. Documentation of ATR

- (1) 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.

- (2) 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.

e. Certification of ATR

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.

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

9. 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

- Stillhouse Hollow Product Delivery Team (PDT)** The current risk assessment teams conducting the base line risk assessment at the dams include:

Project Title	Name	Organization
Dam Safety Program Manager		SWF
RMC Sen. Advisor		IWR
RMC Technical Advisor		IWR
IES Cadre Lead		MVS
Project Manager		SWF
Program Analyst		SWF
Geotechnical Engineer		SWF
Geotechnical Engineer		SWF
Hydra & Hydro (Lead)		SWF
Geologist	<i>TBD</i>	TBD
Environmental (Lead)		SWF
Geospatial Systems		SWF
Geospatial Survey		SWF
Structural		SWF
Civil Design		SWF
Operations (Lead)		SWF
Operations (Lake)		SWF

2. District Quality Control (DQC) Team Roster

Project Title	Name	Organization
Geotechnical Engineer	<i>TBD</i>	<i>TBD</i>
Engineering Geologist	<i>TBD</i>	<i>TBD</i>
Structural Engineer	<i>TBD</i>	<i>TBD</i>
Hydrologist	<i>TBD</i>	<i>TBD</i>
Hydraulic Engineer	<i>TBD</i>	<i>TBD</i>
Civil Engineer	<i>TBD</i>	<i>TBD</i>
Planning/Environmental	<i>TBD</i>	<i>TBD</i>
Consequences/Economics	<i>TBD</i>	<i>TBD</i>

***-confirmed**



3. Agency Technical Review (ATR) Team Roster

Position	Name	Organization
Geotechnical Engineer	<i>TBD</i>	<i>TBD</i>
Engineering Geologist	<i>TBD</i>	<i>TBD</i>
Structural Engineer	<i>TBD</i>	<i>TBD</i>
H&H Engineer	<i>TBD</i>	<i>TBD</i>
Consequences/Economics	<i>TBD</i>	<i>TBD</i>



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 Issue Evaluation 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
CESWF-EC-GDL

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 of 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/MS	The District or MSC responsible for the preparation of the decision document	RMC	Risk Management Center
HQUSACE	Headquarters, U.S. Army Corps of Engineers	RMO	Review Management Organization
IEPR	Independent External Peer Review	RTS	Regional Technical Specialist
ITR	Independent Technical Review	SAR	Safety Assurance Review
LRR	Limited Reevaluation Report	USACE	U.S. Army Corps of Engineers
MSC	Major Subordinate Command	WRDA	Water Resources Development Act

