



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
SOUTH PACIFIC DIVISION, CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1399

5-Feb 2015

CESPD-DE

MEMORANDUM FOR Commander, US Army Corps of Engineers, Los Angeles District, (ATTN: CESPL-AM-CW, Mr. Phillip J. Serpa)

Subject: Cave Buttes Dam Modification Project, Auxiliary Outlet, Flood Control District of Maricopa County, 33 USC 408, Review Plan Approval

1. Cave Buttes Dam Modification Project, Auxiliary Outlet, Flood Control District of Maricopa County, 33 USC 408, Review Plan that is enclosed is in accordance with Engineering Circular (EC) 1165-2-214, Review of Decision Documents, dated 15 Dec 2012. The South Pacific Division, Planning and Policy Division, Regional Business Technical Division, and Los Angeles District Support Team have reviewed the Review Plan that has been submitted. The South Pacific Division approves the Cave Buttes Dam Modification Project, Auxiliary Outlet, 33 USC 408, Review Plan.

2. With MSC approval the Review Plan will be made available for public comment via the internet and the comments received will be incorporated into future revisions of the Review Plans. The Review Plan includes Independent External Peer Review Type II (SAR) that will be contracted and panel members will be selected by the Maricopa County Flood Control District (FCDMC), after coordination and approval by the USACE Risk Management Center (RMC).

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3. I hereby approve the Review Plan which is subject to change as study circumstances require. This is consistent with study and project development under the Project Management Business Process. Subsequent revisions to the Review Plan after public comment or during project execution will require new written approval from this office.

4. Points of contact for this action are Mr. Marc Goodhue, CESPD-RBT, 415-503-6568, marc.j.goodhue@usace.army.mil and Mr. Paul Bowers, CESPD-PDC, 415-503-6556, paul.w.bowers@usace.army.mil.

BUILDING STRONG and Taking Care of People!

Encl


R. MARK TOY
Brigadier General, USA
Commanding

**Review Plan
U.S. Army Corps of Engineers
South Pacific Division
Los Angeles District**

**CAVE BUTTES DAM MODIFICATION
PROJECT:
AUXILIARY OUTLET
Section 408 Permit Application**



**US Army Corps
of Engineers®**

ENCL

January 2015

REVIEW PLAN

Cave Buttes Dam Modification Project: Auxiliary Outlet Flood Control District of Maricopa County

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GLOSSARY

Agencies	Acronym	
Flood Control District of Maricopa County	FCDMC	Local sponsor and independent reviewer
United State Army Corps of Engineers, LA District	LA District	Local branch of Federal Regulatory Agency
Arizona Department of Water Resources	ADWR	Local reviewing and permitting agency
URS Corporation	URS	Technical Delivery Team
United States Army Corps of Engineers	USACE	National Federal Regulatory Agency

Terms	Acronym	
Technical Delivery Team	TDT	The team of professional performing and developing the design and specifications (i.e., URS).
Review Plan	RP	The document that defines the scope and level of quality management activities and peer review for the project.
Agency Technical Review Plan	ATR	This refers to the LA District and its required review under the Review Plan Document.
Quality Control Plan	QCP	This is the document of the quality control and quality assurance processes of FCDMC.
Quality Control/Quality Assurance	DQC	The District QC/QA process.
Quality Assurance and Quality Control	QA/QC	The document that specifies how the Technical Development Team and the Independent Technical Review Team will perform reviews of the design and specifications for the project.
Construction Quality Assurance	CQA	The FCDMC process for CQA.
Safety Assurance Review Plan	SAR	Documents the review process to determine the adequacy, appropriateness, and acceptably of the Design.
Safety Assurance Review Team	SAR Team	An independent team of Technical Experts who are not associated with the ITR, TDT, or the ATR.
Independent Technical Review	ITR	This refers to FCDMC performing independent reviews of the TDT's work.
Independent Technical Review Team	ITR Team	This refers to the members of FCDMC performing review of the TDT's work.

Terms	Acronym	
National Academies of Science	NAS	The NAS policy will be used when selecting reviewers for the SAR Team.
South Pacific Division	SPD	The USACE LA District falls under the regional SPD.
Independent External Peer Review	IEPR	The SAR Team will be preparing the IEPR

1. INTRODUCTION

a. Purpose

The intent of this Review Plan is to ensure quality of work performed on federally-authorized systems by local sponsors or owners covered under Section 408. This Review Plan was prepared in accordance with EC 1165-2-216, "Policy and Procedural Guidance for Processing Requests to Alter US Army Corps of Engineers Civil Works Projects Pursuant to 33 USC 408" (31 July 2014), and also in accordance with EC 1165-2-214, "Civil Works Review" (15 December 2012), and covers the process for the review of the proposal to modify the Cave Buttes Dam Auxiliary Outlet. The review of this proposal, which is being requested by the Maricopa County Flood Control District, will follow the nine-step Procedures listed in EC 1165-2-216 Section 7 and Appendix B. USACE Los Angeles District Dam Safety Officer (DSO) and Dam Safety Program Manager (DSPM) will be involved in the pre-coordination with the requester and are responsible to inform the requestor of any current dam safety modification studies and policies. The District DSO will review the ATR's recommendations and endorse approval or recommend denial of the proposed modifications. The dam senior oversight group (DSOG) will review the SPRA or higher level risk assessments information and a description of proposed alteration. This project should also be in compliance with other permits requirements. Standard permits, not covered by this review plan, have been identified as USACE Section 404, USACE Section 104, ADWR, SWPPP, Dust and Constructions permits.

b. Project Description and Information

The Cave Buttes Dam located north of Arizona State Route 101 and west of Cave Creek Road, interacts with flows from Cave Creek and small adjacent stream channels. These structures operate together to collect stormwater runoff from the north, and with time, allow it to continue south into Cave Creek Wash. Cave Buttes Dam was constructed by the United States Army Corps of Engineers (USACE) between 1977 and 1980.

Currently, the Maricopa County Flood Control District (FCDMC) operates and maintains Cave Buttes Dam and its dikes in accordance with an Operation and Maintenance Agreement with the USACE. Cave Buttes Dam and the dikes have provided valuable flood protection for highways, commercial, and residential property within north and central Phoenix including the Arizona State Capital governmental complex. Flood protection has been provided by intercepting storm runoff from a large watershed of approximately 191 square miles.

Cave Buttes Dam, constructed as a zoned earthen embankment, has a length at the crest of approximately 2,275 feet and a maximum height of approximately 110 feet above the original streambed. The approximate flood storage capacity at spillway level is 46,000 acre-feet.

During the 1993 flood impoundment, seepage occurred at the downstream left abutment which prompted a series of studies commissioned by the FCDMC. These studies are: *2001 Failure Mode and Consequence Analysis (FMCA)*(KHA 2001), *2009 Risk Reduction Assessment (RRA) of Remedial Alternatives (GF 2009a)*, and *2012 Failure Modes and Effects Analysis (FMEA)*. Several potential failure modes were identified at the existing Cave Buttes Dam. The final list of Failure Modes can be found in Table 1 below and [Potential Failure Mode Descriptions](#) can be found by clicking the hyperlink. The 2012 FMEA was conducted in the similar fashion as PFMA. In result, the dam was assigned the **high hazard potential classification** due to the potential for structural flaws or mis-operation will cause loss of life is considered as creditable. FCDMC is currently working on a remediation project to mitigate these failure modes by installing auxiliary outlet through Dike No. 1 as Phase 1 and a filter drain system as Phase 2. These proposed designs will reduce reservoir drawdown time from 57 days to 25 days (emergency spillway crest to proposed outlet invert) and mitigate a potential seepage hazard. The proposed modifications to the structure consist of three main components:

- An additional outlet (tunnel) beneath Dike No. 1.
- Filter and drain at the abutments and bedrock contacts of the Main Dam, Dike No. 1, and the Right Abutment of Dike No. 2.
- Filter and drain within the alluvium beneath the Main Dam.

Alternatives were previously developed for the recommended designs of a filter-drain at the Main Dam, Dike No. 1, and Dike No. 2; and the recommended designs for the tunnel including the intake structure, tunnel, and outlet energy dissipation structure. Details of those alternatives are presented in the Design Recommendations Report prepared by URS and dated September 2013.

Since the project is a partnership between the FCDMC and the USACE, the design of the remediation project must meet both agencies and Arizona Department of Water Resources (ADWR) requirements for dam safety.

c. Description of Proposed Work

The Cave Buttes Dam Modification Project: Auxiliary Outlet project proposed a new auxiliary outlet under Cave Buttes Dam Dike No. 1. These major features of the project include a minimum 60-inch diameter steel lined tunnel through the dam foundation, portal excavations at the upstream and downstream ends of the tunnel, gated concrete intake structure located in the reservoir and a concrete impact stilling basin at the downstream end of the tunnel outlet. The tunnel is proposed to be excavated by Tunnel Boring Machine (TBM).

d. Levels of Review

408 Permit Application Reviews shall include:

- Quality Control and Assurance (QC/QA)
- Agency Technical Review.
- District DSO Review
- Type II Independent External Peer Review (IEPR)
- DSOG Review
- MSC and HQUSACE Policy Compliance Review

The levels of review listed above are in compliance with requirement in ER 1110-2-1156 Dated 31 March 2014.

e. Review Team

Review Management Office:

The USACE Risk Management Center (RMC) is the Review Management Organization (RMO) for Section 408 permit applications. Contents of this review plan have been coordinated with the RMC and the South Pacific Division, the Major Subordinate Command (MSC). Informal coordination with SPD will occur throughout the project. If the work is significant, the RMO will refer decision to the Dam Senior Oversight Group. In-Progress Review (IPR) team meetings with the RMC, SPD, and HQ will be scheduled on an "as needed" basis to discuss programmatic, policy, and technical matters. The SPD Dam Safety Program Manager will be the POC for vertical team coordination. This review plan will be updated for each new project phase.

Table 1 Potential Failure Modes Evaluation

2012 FMEA Potential Failure Mode ⁽³⁾		2001 FMCA Potential Failure Mode		Failure Mode Category		Comments
No.	Description	No.	Description	2001 FMCA	2012 FMEA	
1A	Internal Erosion (IE) along Dam cutoff trench/bedrock contact	--	See Comment	See Comment	II	IE by scour along cutoff trench/bedrock contact was not specifically addressed in PFM-1 (2001 FMCA), and is now added as PFM-1A (2012 FMEA).
1B	Internal Erosion along Dam abutment/bedrock contact	1	Failure from piping (seepage erosion) of embankment into joints and through joints in the dam foundation – main dam	I	I	IE along dam abutment/bedrock contact was addressed in PFM-1 (2001 FMCA), and is carried forward and updated as PFM-1B (2012 FMEA).
1C	Internal erosion along Dike No. 1 bedrock contact	--	See Comment	See Comment	I	IE along Dike No. 1 bedrock contact initiates and continues as backwards erosion piping (BEP) in PFM-8 (2001 FMCA); in PFM-1C (2012 FMEA) IE initiates as a concentrated leak and continues as scour.
1D	Internal erosion along Dike No. 2 right abutment/bedrock contact	--	See Comment	See Comment	I	IE along Dike No. 2 right abutment contact initiates and continues as BEP in PFM-2 (2001 FMCA); in PFM-1D (2012 FMEA) IE initiates as a concentrated leak and continues as scour.
2A	Piping from Dam cutoff trench into bedrock foundation joints	4	Failure from piping material from the main dam into the foundation through open joints	II	IV	Piping from dam into bedrock abutment joints initiates and continues as BEP in PFM-1 (2001 FMCA); in PFM-2A (2012 FMEA) the process initiates and continues as BEP.
2B	Piping from Dam into bedrock foundation abutment(s)	--	See Comment	See Comment	II	Piping from dam into abutment joints initiates and continues as BEP in PFM-1 (2001 FMCA) along or near the bedrock contact; in PFM-2B (2012 FMEA) the process initiates and continues as BEP, with eroded material transported into foundation joints. Low Category II ⁽⁴⁾ .
2C	Piping of Dike No. 1 into bedrock foundation	8	Failure from piping of Zone II material into the foundation – Dike No. 1	II	II	Pipe from dam into bedrock joints was addressed in PFM-8 (2001 FMCA), and is carried forward and updated as PFM-2C (2012 FMEA). Low Category II ⁽⁴⁾ .
2D	Piping of Dike No. 2 into bedrock foundation	2	Failure from piping Zone II soil into foundation Dike No. 2	I	II	Piping from dam into bedrock joints was addressed in PFM-2 (2001 FMCA), and is carried forward and updated as PFM-3 (2012 FMEA). Low Category II ⁽⁴⁾ .
3	Piping from Dam into alluvial foundation	3	Failure from piping Zone II soil from Dam into alluvium at cutoff trench – main Dam	II	II	Piping from dam into alluvial foundation was addressed in PFM-3 (2001 FMCA), and is carried forward and updated as PFM-3 (2012 FMEA). Low Category II ⁽⁴⁾ .
4	Piping from Dam cutoff trench into bedrock foundation joints	4	Failure from piping material from the main Dam into the foundation through open joints	II	IV	See PFM-2A. PFM-4 (2012 FMEA) is included in the PFM-2A through PFM-2D series, which groups together PFMs relating to piping into the foundation from the dam and dikes.
5	Internal erosion through Dam along outlet works	5	Failure from piping along outlet works – main Dam	II	II	IE through dam along outlet works was addressed in PFM-5 (2001 FMCA), and is carried forward and updated as PFM-5 (2012 FMEA)

Table 1 Potential Failure Modes Evaluation

2012 FMEA Potential Failure Mode ⁽³⁾		2001 FMCA Potential Failure Mode		Failure Mode Category		Comments
No.	Description	No.	Description	2001 FMCA	2012 FMEA	
6A ⁽²⁾	Internal Erosion through Dam or Dikes due to cracking associated with geometry/differential Settlement	6	Failure from cracking due to geometry/settlement/shrinkage-main dam abutments and dike No. 1 at Station 35+60 and Dike No. 2 at Station 50+16	II	IV	IE through dam due to cracking associated with geometry/differential settlement was addressed in PFM-6 (2001 FMCA), and is carried forward and updated as PFM-5 (2012 FMEA), with the exception that shrinkage is addressed in PFM-6B (2012 FMEA) as desiccation cracking.
6B ⁽²⁾	Internal Erosion through Dam or Dikes associated with desiccation cracking high in the Dam and Dikes	--	See Comment	See Comment	II	IE through dam associated with desiccation cracking high in the dam was not specifically addressed in PFM-6 (2001 FMCA), and is now added as PFM-6B (2012 FMEA). Low Category II ⁽¹⁾
6C ⁽²⁾	Piping through Dam or Dikes associated seepage through Dam or Dikes	--	See Comment	See Comment	IV	Piping through dam associated with unfiltered exits at Zone I/II interface and Zone II/III interface was not specifically addressed in PFM-6 (2001 FMCA), and is now added as PFM-6C(2012 FMEA).
6D	Internal Erosion through Dike No. 2 associated with foundation collapse-induced differential settlement of dike	--	See Comment	See Comment	II	IE through dike associated with desiccation cracking in the dike at stations including Zone II material and in the dike at stations without Zone II material unfiltered exits at Zone I/II interface and Zone II/III interface, which was not specifically addressed in PFM-6 (2001 FMCA), and is now added as PFM-6C (2012 FMEA). Low Category II ⁽¹⁾ .
7	Uncontrolled release of flood pool because of emergency spillway erosion	7	Failure from emergency spillway Erosion	II	II	PFM-7 not considered in 2012 FMEA because it is considered to be of remote likelihood.
8	Piping of Dike No. 1 into the bedrock foundation	8	Failure from piping of zone II Material into the foundation – Dike No. 1	II	See PFM No. 2C	See PFM-2C. PFM-8 (2012 FMEA) is included in the PFM-2A through PFM-2D series, which groups together PFMs relating to IE into the foundation for the dam and dikes.
9	Piping through Dam and Dikes associated with internal instability of Zone II and/or Zone III Material	9	Failure from Internal Instability of zone II Materials – Dike No. 1	II	See PFM No. 6C	Internal instability of Zone II and III is captured in other applicable PFMs. Covered by 6C.
10	Internal Erosion through Dike No. 2 foundation associated with subsidence-related fissure	10	Failure from potential fissure from subsidence – Dike No. 2	II	See Comment	PFM-10 not considered in 2012 FMEA because it will be addressed by monitoring.
11	Internal Erosion through Dike No. 2 along existing utility crossings at Cave Creek Road	11	Failure from potential piping from utility crossings at Cave Creek Road – Dike No. 2	II	See Comment	PFM-11 not considered in 2012 FMEA because it will be addressed by monitoring.
12	Piping through Dike No. 2 alluvial foundation	--	See Comment	See Comment	II	PFM-12 was not addressed in the 2001 FMCA. BEP and seepage through foundation alluvium. Low Category II ⁽¹⁾ .
See Comment		13-17	See 2001 FMCA Report	III & IV	See Comment	Category III and IV PFMs from the 2001 FMCA not considered in the 2012 FMEA.

- Notes: 1) PFMs identified as a "Low Category II" during 2012 FMEA Workshop due to short duration of storage and likelihood of deep cracking to occur (which may not be necessary to repair even if cracks are identified).
 2) The Dam Dike No. 1 and Dike No. 2 were evaluated separately during the 2012 FMEA Workshop and were determined to each have the same PFM categorization.
 3) See Section 7.0 of Design Recommendations Report for a discussion of the 2012 FMEA Workshop.

2. REQUIREMENTS

a. *Reviews*

The review of all work products will be in accordance with the requirements of EC 1165-2-216, section 7 the nine steps process by following the guidelines established within this review plan. Step 1 "Pre-Coordination" has been completed and Step 2 "Written Request" has been initiated. Currently, the review process is at step 3 "Required Documentation" and followed by Step 4 "ATR", Step 5 "Summary of Findings", Step 6 "Division Review", Step 7 "HQUSACE Review", Step 8 "Notification" and Step 9 "Post-Permission Oversight..

i. Quality Control and Assurance (QC/QA)- TDT

All engineering and design products will undergo Quality Control Reviews to ensure the quality and credibility of the information is in accordance with EC 1165-2-214 "Civil Works Review. Appendix C District Quality Control and Agency Technical Review." And ensure compliance with all pertinent USACE guidance in order to achieve adequate quality early in the review process. QC/QA is the review of basic science and engineering work products focused on fulfilling the project quality requirements. QC/QA will be performed for all 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. Since a contractor working with a local sponsor is completing the work products, the contractor is required to submit their Applicant Review Plan showing they meet the QA/QC requirements, which are described in EC 1165-2-214 "Civil Works Review. Appendix C District Quality Control and Agency Technical Review" under section "Architect-Engineer (AE) or Sponsor Work."

ii. Independent Technical Review (ITR) – Sponsor

Independent technical reviewers will have expertise in all of the same technical disciplines required on the Technical Development Team for the preparation of the products. The Flood Control District's Project Manager will coordinate between the TDT and the Flood Control District's ITR team. As each product is completed, copies will be provided by the FCDMC to the Corps of Engineers for their review. The Flood Control ITR team will review each product and provide comments to the TDT team. The TDT team will revise the products accordingly. The written comments and responses for all ITRs will be included in DrChecks as appendices to the reports. After the ITR is completed, the reviewers will sign a certification form indicating completion of their reviews and satisfactory resolution of their comments. The FCDMC will serve as gatekeeper and maintain the documents.

Reviewers shall be registered professional engineers in the United States with engineering degrees and a minimum of 20 years' experience in the each of three fields to be reviewed; Geotechnical Engineering, Structural Engineering, Civil Engineering and Construction. Flood Control District engineers with the experience listed above will perform the Independent Technical Review.

iii. Agency Technical Review (ATR)

ATR is an in-depth review, managed within USACE, and conducted by a qualified team 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. The ATR team will make the determination of whether the proposed alteration would impair the usefulness of the Federal project, whether it would be injurious to the Public Interest, and whether the proposal meets all legal and policy requirements

iv. Independent External Peer Review (IEPR)

IEPR is the most independent level of review, and is applied in cases that meet certain criteria. This section 408 permit is not a decision document and does not cover work requiring a Type I IEPR (EC 1165-2-214). In accordance with EC 1165-2-214, a Type II IEPR (SAR) is required for the following reasons: The project includes design and construction activities for a flood risk management project, where potential hazards pose a significant threat to human life. In addition, the project also contains unique construction techniques, such as tunnel boring machine (TBM) tunneling method and Construction Manager at Risk (CMAR) contract delivery method. Construction Manager at Risk allows an owner to select a Construction Manager (CM) based on qualifications to deliver a project within a Guaranteed Maximum Price (GMP). Under this delivery method the CM becomes a collaborative member of the project team by acting as a consultant to the owner during the design phase of the project. The CM will then manage the procurement of subcontractors to perform the construction activities and act as the general contractor during construction to control construction costs to stay within the GMP.

Panel members made up of independent, recognized experts from outside of the engineering firm that designed the project. Four panel members have been chosen to represent a balance of expertise including Geotechnical, Construction management, Structural, and H&H, which suitable for the review being conducted. Panel selection criteria is using the National Academies of Science (NAS) policy for selecting reviewers. The reviewers shall consider the adequacy, appropriateness, and acceptability of the design and construction activities for the purpose of assuring that current science, engineering practice standards are applied to enhance the public health, safety, and welfare factors of the project. The IEPR panel has been selected by the Maricopa County Flood Control District (FCDMC), and the panel members have been reviewed and approved by the RMC 408 permit review coordinator. Completed members' background information are provided in Appendix B.

v. Review Plan Approval and Updates

The MSC for this permit application is the South Pacific Division. The MSC Commander is responsible for approving this Review Plan. The Commander's approval

reflects vertical team input (involving the Los Angeles District, MSC, RMC and HQUSACE members) as to the appropriate scope and level of review for the study and 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 Commander's approval memorandum, will be posted on the District's webpage and linked to the HQUSACE webpage:

<http://www.spl.usace.army.mil/Missions/CivilWorks/ReviewPlans.aspx>.

3. GUIDANCE AND POLICY REFERENCES

- ER 5-1-11, USACE Business Process
- EC 1165-2-214, Civil Works Review Policy, 15 December 2012
- ER 1110-1-12, Quality Management, 31 Mar 2011
- EC 1165-2-216, Policy and Procedural Guidance for Processing Requests to Alter U.S. Army Corps of Engineers Projects Pursuant to 33 USC § 408., 31 July 2014.

4. MODELS

The use of certified or approved models for all planning activities is required by EC 1105-2-407. The EC defines planning models 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. Planning models are not used in permit applications.

The EC does not cover engineering models. Engineering software is addressed under the Engineering and Construction (E&C) Science and Engineering Technology (SET) initiative. Until an appropriate process that documents the quality of commonly used engineering software is developed through the SET initiative, engineering type models will not be reviewed for certification and approval. The responsible use of well-known and proven USACE developed and commercial engineering software will continue and the professional practice of documenting the application of the software and modeling results will be followed.

5. REVIEW SCHEDULE

The applicant has submitted a review schedule, which is provided in Appendix C. The 60 percent Plans and Specs package will be developed based on the best-proposed tunnel alignment and will be reviewed by IEPR and ATR. The Water Control Manual will be submitted for ATR review as part of the Hydrology and Hydraulics system performance analysis package. The 90 percent Plans and Specs submittal will be reviewed by ATR to ensure the comments for 60 percent submittal are addressed and conform to USACE guidance and regulations and the decision document is expected from USACE for the 408 permit. The applicant can pursue early decision on 408 with rational as why needed earlier but no construction will be allowed until 100 percent Plans & Specs are approved. The decision document will be sent to MSC and HQUSACE for Policy Compliance Review. The final 100 percent Plans and Specs will be back checked for completeness. The key milestones are listed in the table below.

Table 1: Review Milestone Schedule

Task Description	Review Start	Review Finish
QC/QA Review, 60% plans & specs (by applicant)	3/23/2015	10/2/2015
ATR Review, Water Control Manual	8/31/2015	9/25/2015
ATR Review, 60% plans & specs	7/6/2015	7/31/2015
IEPR Review, 60% plans & specs	8/31/2015	9/18/2015
Submittal of 90% package	10/5/2015	12/4/2015
MSC and HQUSACE Policy Compliance Review	12/5/2015	2/1/2016
Submittal of 100% package	3/14/2016	9/30/2016
DSOG Review	TBD	TBD

6. COST ESTIMATE

The estimated costs for the required reviews are listed below. Estimates for costs borne by the local sponsor are not included.

Table 2: Review Cost Estimate

Task Description	Review Start	Review Cost
ITR Review	TBD	Local sponsor cost
ATR Review	7/6/2015	TBD
IEPR Review	8/31/2015	Local sponsor cost
SOG Review	TBD	TBD

7. EXECUTION PLAN

a. Quality Control and Assurance

i. General

The local sponsors' contractor will conduct QC/QA after completion of the final document. QC/QA may require both supervisory oversight and technical experts. The performing entity will conduct a robust QC/QA in accordance with EC 1165-2-214, Civil Works Review Policy, the District or performing entity's Quality Management Plan, and ER 1110-2-12, Quality Management.

ii. QC/QA Review and Control

QC/QA Review will be conducted on the completed documents including all Sections and Appendixes and will include comments, back check and document revisions.

b. Agency Technical Review

i. General

The Risk Management Center (RMC) is responsible for coordinating and managing agency technical review of the permit application in accordance with EC 1165-2-216.

ii. ATR Team Required Expertise

The ATR team has been selected based on each individual's qualifications and experience with similar projects and individual must also be Corps of Engineers

Reviewer Certification and Access Program (CERCAP) certified. Each discipline's qualification requirements are listed below.

Dam Safety. Dam Safety Program Manager should have 15 or more years of experience in Dam Safety related projects and be familiar with all USACE guidance and review procedures.

Hydraulic Engineer. The team member should have 15 or more years of experience in conducting and evaluating hydrologic and hydraulic analyses for flood risk management projects. Experience with all aspects of hydraulic engineering including: flood plain analysis, hydraulic design of conduits, energy dissipation and scour.

Geotechnical Engineering. The team member should have 15 or more years of experience in geotechnical engineering. Team member must demonstrate significant experience in the geotechnical aspects of analysis, design and construction of tunnels through rock and open cut excavation in bedrock. Experience with subsurface investigations also required.

Structural Engineer. The team member should have 15 or more years of experience in structural engineering. The team member must have experience with gated intake structures and energy dissipation structures.

Geologist. The team member should have 15 or more years of experience in Geology. The team member must have knowledge with tunneling in both rock and alluvium, open excavation in bedrock, gated intake structures and energy dissipation structures.

Real Estate. The team member should have 10 or more years of experience in real estate evaluation and familiar with State of Arizona real estate regulations.

Environmental Specialist. The team member should have 15 or more years of experience in Environmental resources related projects.

Archeologist. The team member should have 15 or more years of experience in Cultural resources related projects.

Reservoir Regulation/Water Control. The team member should have 15 or more years of experience in water control and reservoir operations.

Tunnel Expert. The team member should have 15 or more years of experience in tunnel design, construction, and rehabilitation related projects.

ATR Team Leader. The ATR Team Leader should have 15 or more years' experience with Civil Works Projects and have performed ATR Team Leader duties on complex civil works projects.

iii. ATR Review and Control

Reviews will be conducted in a fashion, which promotes dialogue regarding the quality and adequacy of the permit application. The ATR team will review the documents provided. Comments should be limited to those that are required to ensure the adequacy of the product. The RMC in conjunction with the MSC will prepare the charge to the reviewers, containing instructions regarding the objective of the review and the specific advice sought. A kick off meeting was conducted between November 13 and 14, 2014 to assist key members of the ATR team to familiarize the project site, the construction contract delivery method and construction techniques.. ATR comments and responses will be managed by using DrChecks and included in a final ATR report.

The four key parts of a review comment will normally include:

- (1) The review concern – identify the product's information deficiency or incorrect application of policy, guidance, or procedures.
- (2) The basis for the concern – cite the appropriate law, policy, guidance, or procedure that has not been properly followed.
- (3) The significance of the concern – indicate the importance of the concern with regard to its potential impact on the plan selection, recommended plan components, efficiency (cost), effectiveness (function/outputs), implementation responsibilities, safety, Federal interest, or public acceptability.
- (4) The probable specific action needed to resolve the concern – identify the action(s) that the PDT must take to resolve the concern.

In some situations, especially addressing incomplete or unclear information, comments may seek clarification in order to then assess whether further specific concerns may exist. The ATR documentation must include the text of each ATR concern, the PDT response, a brief summary of the pertinent points in any discussion, including any vertical coordination, and lastly the agreed upon resolution. The ATR team will prepare a Review Report, which includes a summary of each unresolved issue; each unresolved issue will be raised to the vertical team for resolution. Review Reports will be considered an integral part of the ATR documentation and shall also:

- (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 prepared by the RMC in accordance with EC 1165-2-214, 7c.
- (3) Describe the nature of their review and their findings and conclusions.
- (4) Include a verbatim copy of each reviewer's comments and the PDT's responses.

ATR may be certified when all ATR concerns are either resolved or referred to HQUSACE for resolution and the ATR documentation is complete. Certification of ATR should be completed, based on work reviewed to date, for the final report. A draft certification is included in **Appendix A**.

c. Independent External Peer Review (IEPR)

i. Requirements

Risk Management Center (RMC) has determined Dam Senior Oversight Group (DSOG) will review the dam alteration. RMC will inform the Division to prepare the DSOG review within the approval memorandum, in accordance with EC 1165-2-214, for the Requester Review Plan to the district.

ii. Approval Level

All Requester-generated review plans for Type II IEPRs will be approved by the Division Commander.

iii. IEPR Reviewers

IEPR Team members shall be registered professional engineers in the United States with engineering degrees and a minimum of 20 years' experience in the each of the following fields to be reviewed; Geotechnical Engineering, Structural Engineering, Civil Engineering and Construction.

8. REVIEW PLAN POINTS OF CONTACT

Name/Title	Organization	Email/Phone
Huma Nisar, LAD Permit Coordinator	CESPL-ED-DB	Huma.M. Nisar@usace.army.mil , 213-452-3665
Richard Leifield, LAD DSO	CESPL-ED	Richard.J.Leifield@usace.army.mil , 213-452-3629
Stephen Vaughn, 408 Permit Coordinator	CESPL-ED-DB	Stephen.H.Vaughn@usace.army.mil , 213-452-3654
Paul Bowers, MSC	CESPD-PDC	Paul.W.Bowers@usace.army.mil

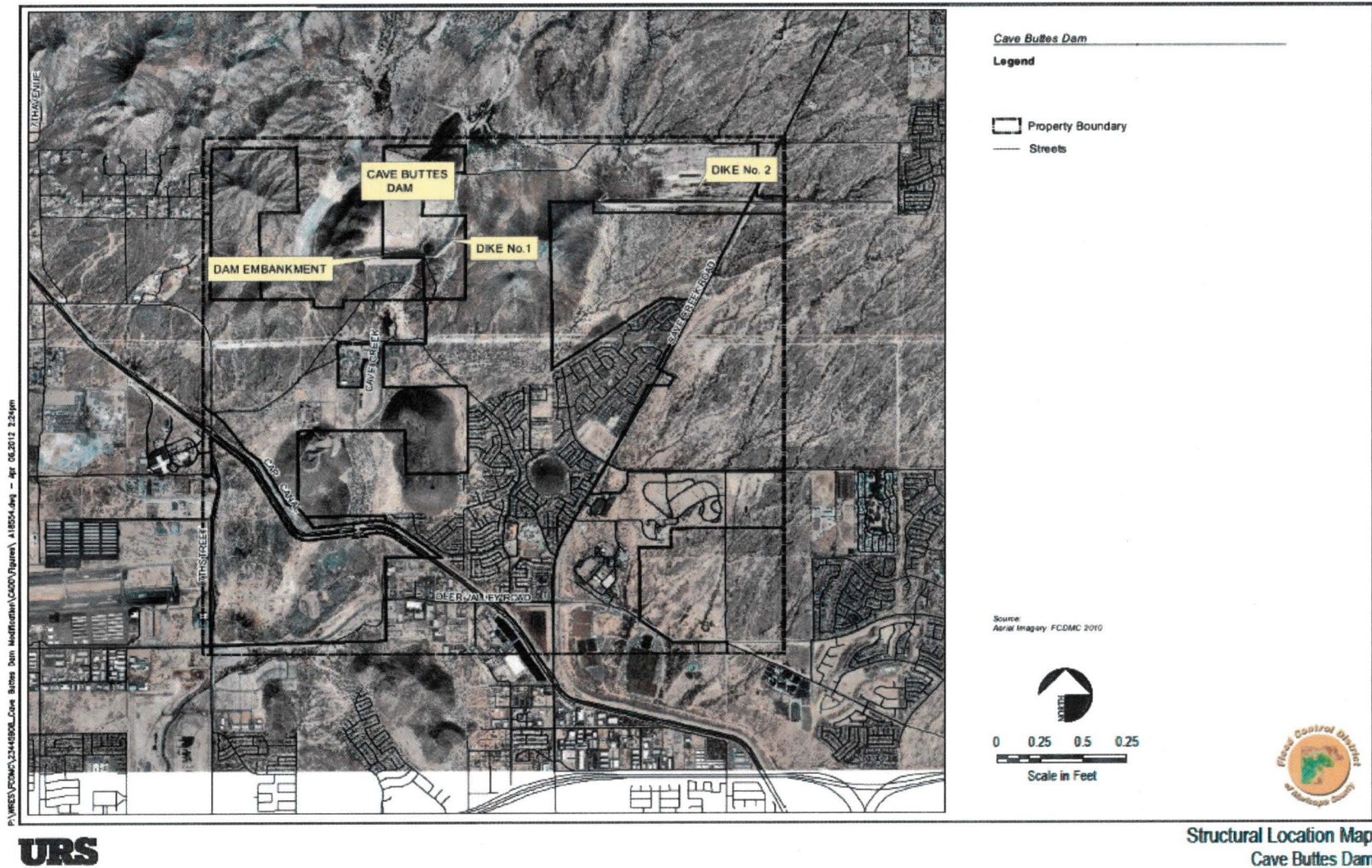


Figure 1: Location Map

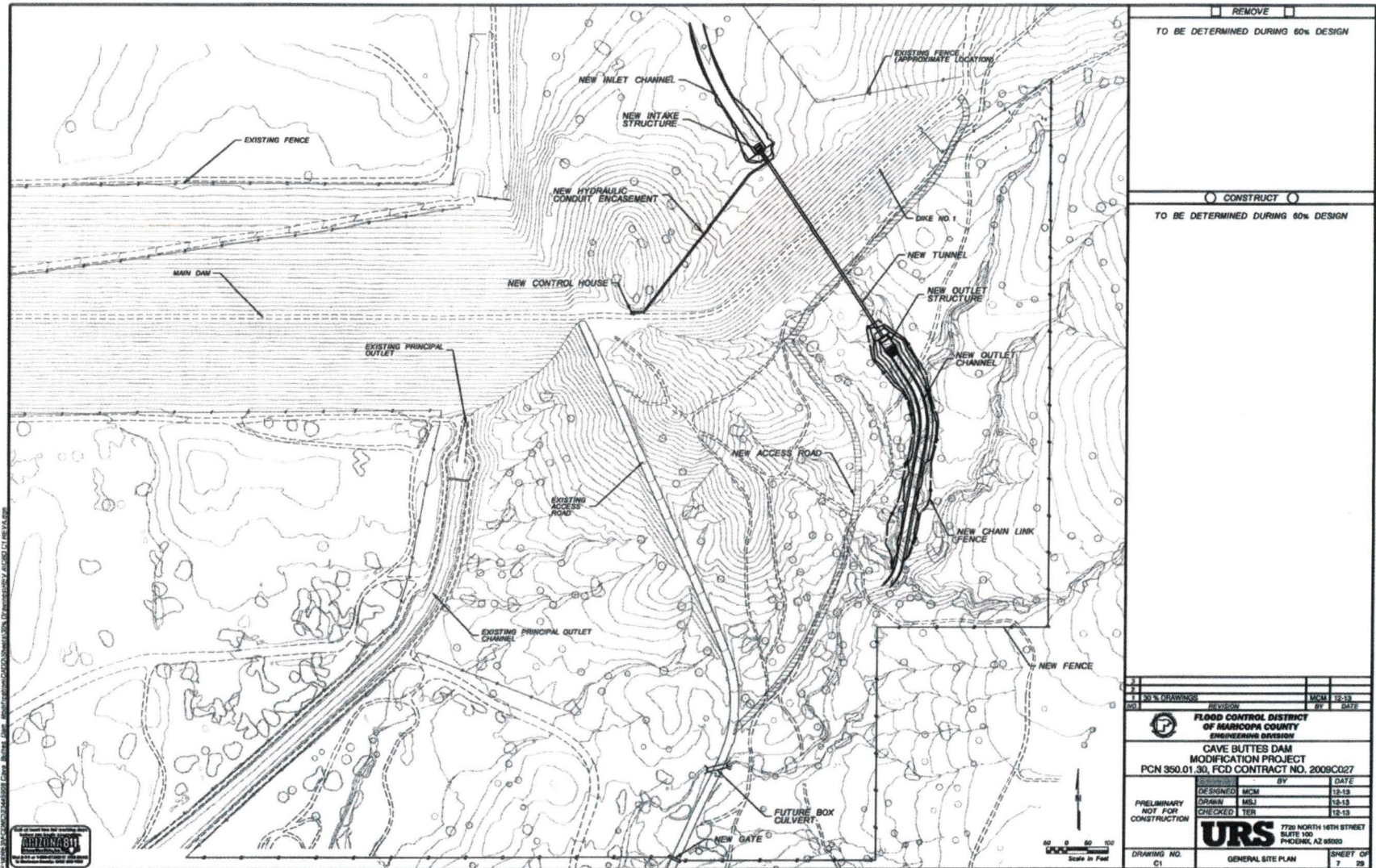


Figure 2: General Site Plan

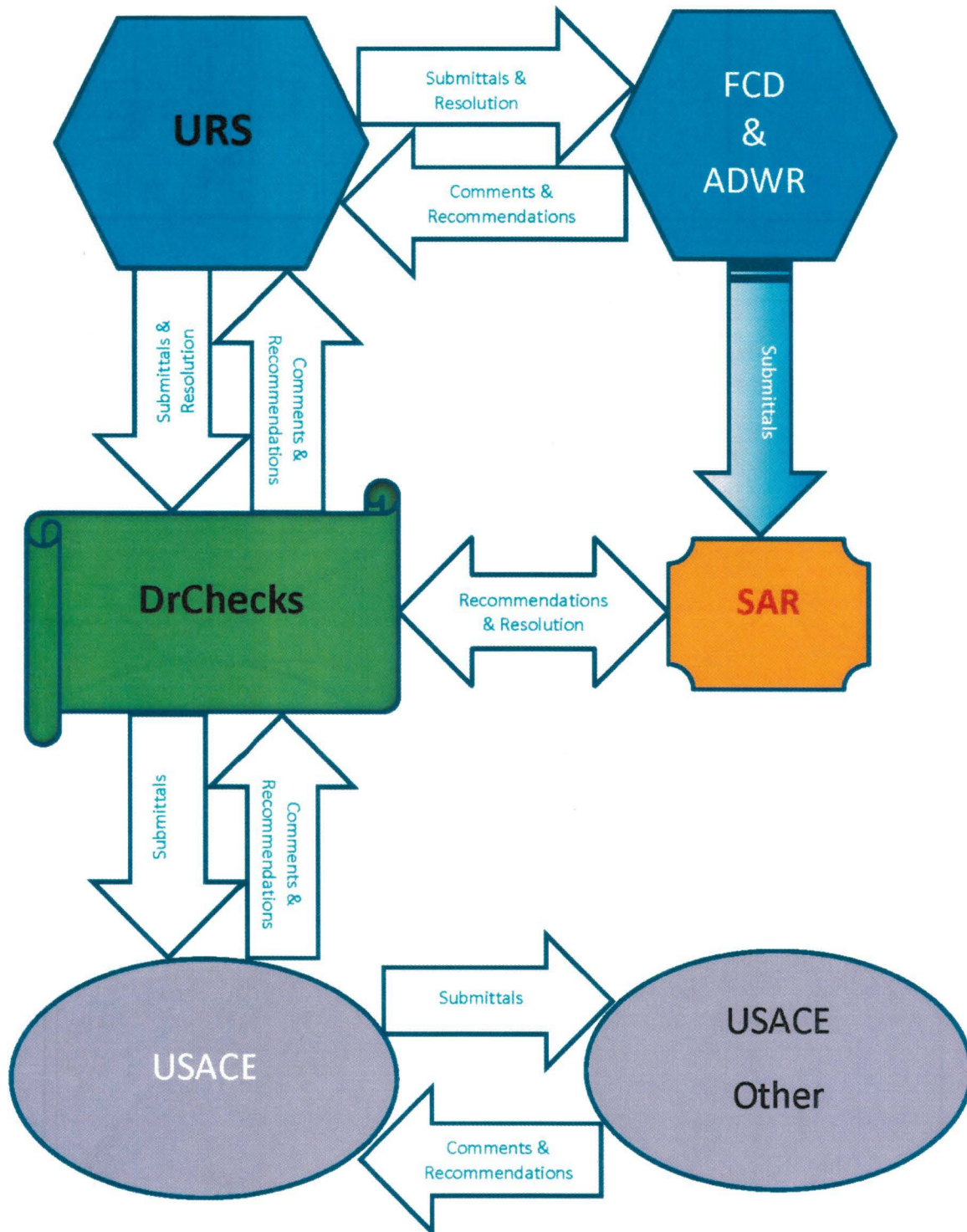


Figure 3: Review Plan Flowchart

APPENDIX A: ATR Certification sample

COMPLETION OF AGENCY TECHNICAL REVIEW

The Agency Technical Review (ATR) has been completed for the Section 408 Review of the Cave Buttes Dam Modification Project for the Maricopa County, Arizona. The ATR was conducted as defined in the project's Review Plan to comply with the requirements of EC 1165-2-214. 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.

Julia Yang, P.E.
ATR Team Leader
CESPL-ED-GD

Date

Phillip J. Serpa
Project Manager
CESPL-AM-CW

Date

Nathan Snorteland, P.E.
Director, 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.

Richard J. Leifield, P.E.
Chief, Engineering Division &
Dam Safety Officer
CESPL-ED

Date

APPENDIX B

SAR Team Background Information and Confidential

(double click on the bio form to open the PDF file)

Edwin C. Rossillon, P.E.
Page 3

- Gross Dam, Denver Water Department, Colorado, 1997
- Williams Fork Dam, Denver Water Department, Colorado, 1998
- Stagecoach Dam, Upper Yampa Conservancy District, Colorado, 1999

Project Manager/Senior Civil Engineer, Goodson and Associates, Inc., Lakewood, Colorado, 1984 to 1988 - Responsible for performing safety evaluation of existing dams (SEED) examinations for the U.S. Bureau of Reclamation. Tasks involved onsite examinations of concrete and embankment dams, review of instrumentation data, review of geologic and hydrologic considerations, and preparation of safety evaluation report. Evaluated the safety of over 50 dams, including the following major dams:

- Glen Canyon Dam, Arizona (710-foot-high concrete dam)
- Grand Coulee Dam, Washington (550-foot-high concrete dam)
- Hoover Dam, Arizona (726-foot-high concrete dam)
- Owyhee Dam, Oregon (420-foot-high concrete dam)
- Wild Horse Dam, Nevada (110-foot-high concrete dam)
- Davis Dam, Arizona (200-foot-high embankment dam)

Private Consulting Engineer, Wheat Ridge, Colorado, 1984 to Present:

- Board of Consultants for U.S. Bureau of Reclamation, Ridges Basin Dam, Animas LaPlata Project, Colorado (250-foot-high embankment dam).
- Board of Consultants for U.S. Bureau of Reclamation, Spring Creek Debris Dam, California (200-foot-high embankment dam).
- Board of Consultants for U.S. Bureau of Reclamation, North and Pinto Dams, Washington (150-foot-high embankment dams).
- Peer reviewer for design of Twin Lakes Dam, Sheridan, Wyoming.
- Design Team Member, Feasibility Design of Broomfield Reservoir, Broomfield County, Colorado

Project Manager/Senior Civil Engineer, Goodson and Associates, Inc. 1984 to 1988 Performed technical review of the hydraulic structures for New Waddell Dam, Arizona (350-foot-high rockfill dam). Hydraulic structures included spillway, diversion channel, outlet works, and outlet tunnels.

Senior Civil Engineer, U.S. Bureau of Reclamation, 1983 to 1984 - Planned and directed the development of technical policies and standards for the design and construction of hydraulic structures, including dams, spillways, outlet works, canals, penstocks, and pipelines.

Chief of Dams Branch, Division of Design, U.S. Bureau of Reclamation, 1981 to 1983 - Administratively and technically directed approximately 150 professional engineers and technicians engaged in preliminary and final designs for large embankment and concrete dams and their appurtenant structures.

Section Head, Concrete Dams, Spillways, and Outlet Works, U.S. Bureau of Reclamation, 1976 to 1981 - Planned, organized, and directed a staff of approximately 65 engineers and technicians in the design of arch and gravity concrete dams, and

APPENDIX C: URS Quality Control Plan (double click on picture to open the PDF file)



QUALITY CONTROL PLAN

CONTRACT FCD 2009C027

CAVE BUTTES DAM MODIFICATION PROJECT

June 2010

URS Project No. 23445909

Prepared by

URS

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