

REVIEW PLAN
For
ISABELLA LAKE DAM SAFETY PROJECT

ISABELLA LAKE DAM, KERN RIVER, CALIFORNIA

Design (PED) and Construction Activities



~~29 July~~ 26 August 2013

Sacramento District, South Pacific Division



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REVIEW PLAN CHANGE MANAGEMENT

Significant modifications to the Review Plan are summarized in a brief change description and documented in the table below. This change management starts with May 2, 2013 Review Plan.

REVISION SERIAL #	SERIALIZED CHANGE DESCRIPTION TITLE	DATE REVISED
1	RMC Comments (incorporate Chapter 22 of ER 1110-2-1156 into the Review Plan) Email from Tom Bishop dated 7June2013 is enclosed in Appendix H.	18 June 2013
2	SPK Routing Comments	19June 2013
3	SPD Comments from Rick Britzman	3 July 2013
<u>4</u>	<u>SPD Comments from Boni Bigornia and Rick Britzman</u>	<u>26 August 2013</u>

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REVIEW PLAN

**ISABELLA LAKE DAM SAFETY PROJECT
Design (PED) and Construction Activities**

Table of Contents

1. PURPOSE AND REQUIREMENTS..... 7

1.1. Purpose 7

1.2. References 8

2. PROJECT INFORMATION..... 8

2.1. Authority, Site Location, and Description 8

2.2. Decision Documents 10

2.2.1. Isabella Lake Dam Safety Modification Report (DSMR)..... 11

2.2.2. Environmental Impact Statement..... 13

2.2.3. Real Estate Design Memorandum..... 13

2.3. Project Non-Federal Sponsors 14

3. REVIEWS..... 14

3.1. On-Board Reviews 15

3.2. Project Quality Evaluations 15

3.3. In-Progress Reviews 16

3.4. Quality Assurance Review 16

3.5. District Quality Control Review 18

3.6. Agency Technical Review 19

3.7. Type II Independent External Peer Review 21

3.8. Constructability Evaluations and Construction Risk Review 23

3.9. Biddability, Constructability, Operability, Environmental, and Sustainability Review 24

3.10. Policy Compliance and Legal Review 24

3.11. Value Engineering..... 25

4. PRODUCTS AND REVIEW SCHEDULE..... 25

5. REVIEW TEAMS 26

5.1. Project Management and Project Delivery Teams 26

5.2. Agency Technical Review Team..... 26

5.3. Type II Independent External Peer Review Team..... 28

5.4. BCOES Review Team 29

5.5. Vertical Review Team 30

6. PUBLIC REVIEW..... 30

7. MODELS 30

8. REVIEW DOCUMENTATION 31

8.1. Comment Resolution 32

8.2. Technical and Policy Issue Resolution	32
8.3. Certification	32
8.3.1. DQC Certification	32
8.3.2. ATR Certification	32
8.3.3. SAR Certification.....	32
8.3.4. VE Certification.....	33
8.3.5. BCOES Certification.....	33
8.3.6. Legal and Policy Compliance Certification	33
9. POINTS OF CONTACTS	33
10. REVIEW PLAN APPROVAL.....	33
11. POST CONSTRUCTION PHASE	34
12. ANTICIPATED CHALLENGES	34

List of Appendices

- Appendix A Governance Structure
- Appendix B Project Delivery Team (PDT)
- Appendix C Agency Technical Review (ATR) Team
- Appendix D Safety Assurance Review (SAR) Team
- Appendix E BCOES Review Team
- Appendix F ATR Certification Template
- Appendix G Highway Relocation Quality Control Plan
- Appendix H Review Plan Comments and Coordination
- Appendix I Final Type I IEPR Report

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1. PURPOSE AND REQUIREMENTS

1.1. Purpose

The purpose of this Review Plan (RP) is to define the roles, responsibilities, and the accountability of the quality management activities for the design and construction efforts of the Isabella Lake Dam Safety Project. This review plan addresses review requirements of the project delivery team (PDT), District Quality Control (DQC), Agency Technical Review (ATR), Safety Assurance Review (SAR), and all other reviews needed for a Mega Project. ~~The Isabella Lake Dam Safety Project is currently in the early stages of pre-construction engineering and design (PED).~~ The Dam Safety Modification Report and Record of Decision (ROD) was approved and signed on December 18, 2012. This review plan is a living document and will be an appendix to the Project Management Plan (PMP). It will be amended and revised as necessary to reflect the latest design and construction activities.

The following design and construction activities will be included as part of this review plan and peer reviews:

1. Plans, specifications, design documentation report (DDR) and NEPA documentation for the following project technical elements:
 - a. Dams (Main Dam features, Auxiliary Dam features, Emergency Spillway, and Existing Spillway)
 - b. Relocations (highways, USFS and USACE facilities, and utilities)
 - c. Borel Outlet Works (tunnel and channel sections, tie-ins to existing features)
2. Construction of the Dam Modifications, Emergency Spillway, Existing Spillway, Relocations, and Borel Conduit/Tunnel.
- ~~3. Post Construction Activities~~

While restoring a dam to a fully functional condition so that it can meet its intended purpose is the ultimate goal, the more fundamental premise is that any modification undertaken must first do no additional harm to a structure (thereby increasing risks of failure). The PDT should never lose sight of the unique risks that might be present during the construction period and should remain diligent in monitoring and mitigating those risks. This will be assured through frequent instrumentation reading/analysis and on-site inspections throughout construction – particularly during high water periods. This will be accomplished using a combination of design, construction and/or operations personnel. Particular care and oversight will be given to activities such as dewatering; spillway/gate/outlet works modifications; excavating/blasting; drilling; and grouting. Analysis of the instrumentation data and inspection results as it relates to the expected behavior of the dam will be done by the DSM Lead Engineer or his designated PDT representative throughout the construction period.

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1.2. References

1. ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 Aug 1999
2. ER 1110-1-12, Engineering and Design Quality Management, 21 Jul 2006
3. ER 1110-2-1156, Safety of Dams – Policy and Procedure, dated October 28, 2011
4. EC 1165-2-214, Civil Works Review Policy, 15 Dec 2012
5. Army Regulation 15–1, Committee Management, 27 November 1992 (Federal Advisory Committee Act Requirements)
6. National Academy of Sciences, Background Information and Confidential Conflict Of Interest Disclosure, BI/COI FORM 3, May 2003
7. Engineering and Construction Bulletin (ECB), USACE Mega-Project Management: Additional Engineering and Construction Management Controls, 11 April 2013
8. Isabella Lake Dam Safety Modification Report, October 2012
9. Isabella Lake Environmental Impact Statement (EIS) and Record of Decision (ROD)
10. Interim Risk Reduction Measure Plan (IRRMP)
- ~~10-11.~~ [Quality Management Plan for Sacramento District](#)
- ~~11-12.~~ [ER 1110-1-12, Engineering and Design Quality Management](#)
- ~~12-13.~~ [ER 1110-1-8159, Engineering and Design Dr Checks](#)
- ~~13-14.~~ [ER 1110-2-1150, Engineering and Design for Civil Works](#)
- ~~14-15.~~ [ER 1105-2-100, Planning Guidance Notebook](#)
- ~~15-16.~~ [EC 1165-2-203, Implementation of Technical Policy Compliance Review](#)
- ~~16-17.~~ [CESPD R 1110-1-8, Quality Management Plan](#)
- ~~17-18.~~ [CESPK-ED, Quality Management Plan](#)
- ~~18-19.~~ [ER 1110-1-12, Quality Management for Engineering and Design](#)
- ~~19-20.~~ [ER 200-2-2, Procedures for Implementing NEPA](#)
- ~~20-21.~~ [ER 1165-2-501, Civil Works Ecosystem Restoration Policy](#)
- ~~21-22.~~ [EC 1165-2-214, Civil Works Review Policy](#)
- ~~22-23.~~ [ER 11-1-321, Value Engineering](#)
- ~~23-24.~~ [ER 415-1-11, Biddability, Constructability, Operability, Environmental, and Sustainability \(BCOES\) Review](#)
- ~~24-25.~~ [ER 415-1-13, Design and Construction Evaluation \(DCE\)](#)
- ~~25-26.~~ [ECB 2013-11, Engineering and Construction Bulletin](#)
- ~~26.~~

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2. PROJECT INFORMATION

2.1. Authority, Site Location, and Description

The existing Isabella Lake dams were authorized for construction by the Flood Control Act of 1944 (Public Law 78-534, Chapter 665, Section 10, page 901), December 22, 1944, and became fully operational in 1953. Currently, the reservoir is not fully able to provide the benefits for which it was authorized and constructed.

The Isabella Main and Auxiliary Dams are located on the Kern River, approximately one mile downstream of the confluence of the north and south forks of the Kern River in Kern County, California. The original project consists of a 185-foot-high rolled earth fill Main Dam across the Kern River, and a 100-foot-high rolled earth fill Auxiliary Dam across Hot Springs Valley located approximately one-half mile east of the Main Dam. The Main Dam has a maximum height of 185 feet, a crest length of 1,695 feet, and a top width of 20 feet. The spillway consists of an un-gated concrete ogee section located at the left abutment of the main dam. The auxiliary dam has a maximum height of 100 feet, a crest length of 3,257 feet, and a top width of 20 feet.

A screening-level portfolio risk assessment was completed by HQUSACE on 26 July 2005 which classified Isabella Project as a Dam Safety Action Classification (DSAC) I (highest risk) dam due to a combination of seismic, hydrologic (inadequate spillway capacity), and seepage issues, with the combination of a large population at risk (PAR) located downstream within the dam failure inundation zone. As a result of the screening, a dam safety modification study (DSMS) was initiated, see paragraph 2.2.1.



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Figure 2-1: Original Project Features at Isabella Dam

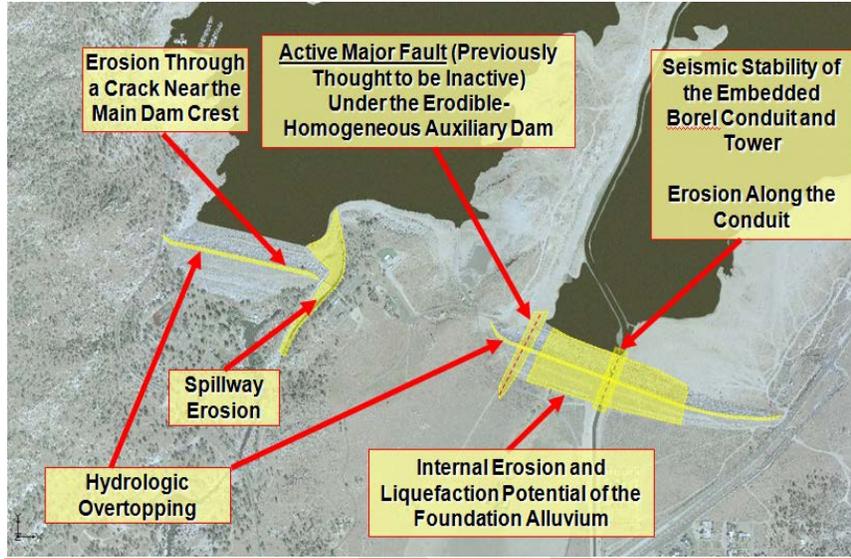


Figure 2-2: Significant Potential Failure Modes at Isabella Dam (DSAC1)

2.2. Decision Documents

2.2.1. Potential Failure Modes

Two Potential Failure Modes Analysis (PFMA) workshops were completed (August 2009 and December 2009) where 26 of the developed 63 potential failure modes were evaluated to determine the level of risk they posed on the project. The failure modes described below are considered credible and significant as a result of the PFMA and baseline risk assessment. Failure modes were developed and evaluated by a LRL Cadre and SPK team utilizing the completed, investigations, studies, analyses, and instrumentation data through multiple EOE meetings:

- *PFM5: Overtopping of the Main Dam*
- *PFM25: Transverse Cracking due to Cross Valley Differential Settlement*
- *PFM 37: Transverse Cracking due to an Earthquake*
- *PFM 4: Overtopping of the Auxiliary Dam*
- *PFM12: Foundation Seepage and Piping along the Borel Conduit at the Native Soil/Conduit Backfill Interface*
- *PFM13: Backward Erosion Piping in the Confined Aquifer in the Foundation*
- *PFM17: Backward Erosion Piping in the Foundation near the Right Abutment*
- *PFM33: Transverse Cracking due to Cross Valley Differential Settlement*
- *PFM35: Seismic Crest Deformation*
- *PFM38/44: Transverse Cracking due to an Earthquake*

- ~~PFM41: Continuous Gap along the Conduit due to the Seismic Response of the Embankment and the Outlet Works~~
- ~~PFM47: Transverse Crack due to Fault Rupture~~
- ~~PFM51: Shearing of the Tower~~
- ~~PFM2/3/61: Large Flood Event results in Erosion of Spillway Channel~~

~~PFM8: Debris Blockage~~

~~2.2.2. Interim Risk Reduction Measures (IRRM)s~~

~~In response to a seepage study conducted in 2005—2006, the Corps initiated an emergency deviation from the Water Control Plan on April 27, 2006, to reduce the foundation pressures. The deviation consisted of reducing the previous lake capacity (gross pool level) from 2,609.26 feet NAVD 88 to a restricted elevation not to exceed 2,589.26 feet NAVD 88 during the flood-control off season, from April through September of each year, as an IRRM until a more permanent solution could be implemented. This restricted elevation reduced the maximum storage capacity of the lake by approximately 37 percent.~~

~~In addition to the restricted pool elevation, the IRRM Plan included several other significant measures, which are still in effect:~~

- ~~New inundation maps and evacuation plan for the downstream affected area;~~
- ~~Additional dam safety training to applicable personnel;~~
- ~~Increased inspection and monitoring of the dams;~~
- ~~Installation and operation of early warning sirens in the town of Lake Isabella;~~
- ~~Installation and use of remote control cameras;~~
- ~~Improved communications;~~
- ~~Increased emergency response equipment and supplies;~~
- ~~Frequent and ongoing communication with the public;~~
- ~~Installation of a manhole for monitoring the tower drain pipe~~
- ~~Table Top with the Kern County OES; and~~
- ~~Restoration of the left crest of the Auxiliary Dam to elevation 2,637.26 feet~~

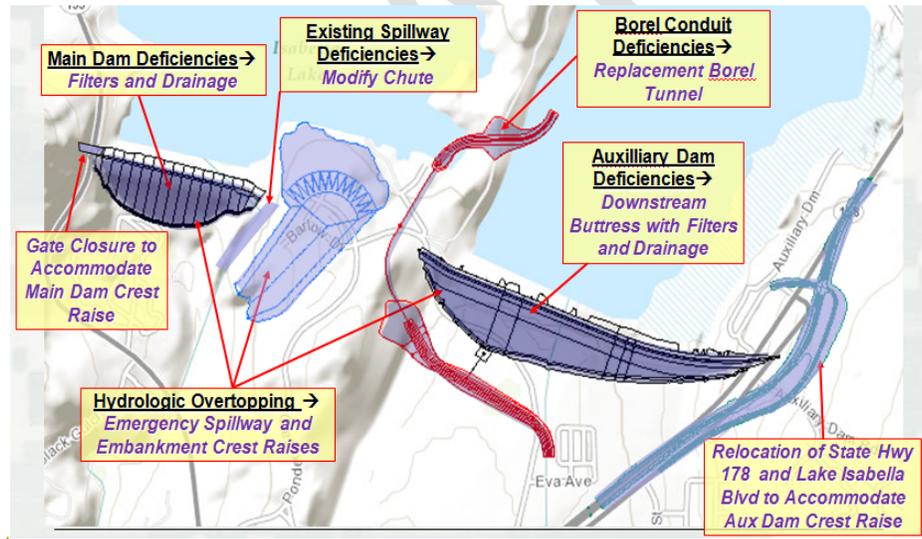
~~2.2.3-2.2.1. Isabella Lake Dam Safety Modification Report (DSMR)~~

~~A Dam Safety Modification Study was conducted in accordance with the latest Engineering Regulation ER 1110-2-1156 dated October 28, 2011. The purpose of the study was to address the significant potential failure modes that drive the DSAC I classification, to reduce the associated risk to meet tolerable risk guidelines, and to identify what measures would need to be undertaken so that the dam would meet U.S. Army Corps of Engineers essential guidelines. Risk reduction measures were identified and incorporated into non-structural and structural risk reduction plans. The plans were compared against the baseline condition, and then against one another. A recommended plan was selected based on life safety, the long term reduction in risk at Isabella Dam associated with the construction of Life Safety Plan 4 and the economic~~

~~feasibility, Life Safety Plan 4 was recommended.~~ The study was approved on 18 December 2012 by the HQUSACE Dam Safety Officer and the selected plan (Life Safety Plan 4) is described below.

~~The objective of the current work is to design and construct the selected risk reduction plan (Life Safety Plan 4) from the Dam Safety Modification Study. Life Safety Plan 4 consists of the following features:~~

- An emergency (auxiliary) spillway with a 16-foot raise of both dams to add additional capacity to pass the Probably Maximum Flood (PMF);
- Buttress with a filter and drainage system and foundation treatments at the auxiliary dam to increase seismic stability and seepage concerns;
- Filter and drain system on the downstream slope of the main dam to increase stability;
- Modifications to the existing spillway to raise and anchor the spillway walls, anchor the ogee crest for the additional head during operation and line the chute with concrete to mitigate for plucking and erosion;
- Realignment of the Borel canal to a right abutment tunnel and abandonment of the existing tower and conduit to reduce seepage and piping risks.
- Realignments of Highways 155 and 178



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Figure 2-3: Selected Plan for the Isabella Dam Safety Modification Study

The design and construction of the recommended structural features will be divided into phases, as follows:

1. Phase 1: Highway 155 and 178 relocations.

2. Phase 2: Site development: Work involves constructing haul routes, laydown areas, utility preparation, instrumentation relocations, construction of construction project field offices, relocation of the temporary USACE and permanent USFS field offices, and real estate acquisitions and relocations.
3. Phase 3: Modifications to the main and auxiliary dams, existing spillway, and main dam control tower; construction of the emergency labyrinth spillway; the 16-foot dam raise on main and auxiliary dams.
4. Phase 4: Realignment of the Borel Canal.
5. Phase 5: Post construction site remediation, construction of the permanent USACE field office, and project closeout.

2.2.4.2.2.2. Environmental Impact Statement

An Environmental Impact Statement (EIS) was developed for the Isabella Lake Dam Safety Modification Study as a “stand-alone” document and the Draft EIS distributed to the public during February 2012 for review and comment. Comments were received from the public were answered, made a part of the public record, and incorporated in the Final EIS. The ROD was signed by the HQUSACE Dam Safety Officer on December 18, 2012.

2.2.5.2.2.3. Real Estate Design Memorandum

A Real Estate Design Memorandum (REDM) was developed for the Isabella Lake Dam Safety Modification Study as a “stand-alone” document. The REDM was part of the Isabella Lake DSMR which was signed by the HQUSACE Dam Safety Officer on December 18, 2012.

2.3. Recommended Plan

~~The objective of the current work is to design and construct the recommended risk reduction plan (Life Safety Plan 4) from the Dam Safety Modification Study. Life Safety Plan 4 consists of the following features:~~

- ~~• An emergency (auxiliary) spillway with a 16 foot raise of both dams to add additional capacity to pass the Probably Maximum Flood (PMF);~~
- ~~• Buttress with a filter and drainage system and foundation treatments at the auxiliary dam to increase seismic stability and seepage concerns;~~
- ~~• Filter and drain system on the downstream slope of the main dam to increase stability;~~
- ~~• Modifications to the existing spillway to raise and anchor the spillway walls, anchor the ogee crest for the additional head during operation and line the chute with concrete to mitigate for plucking and erosion;~~
- ~~• Realignment of the Borel canal to a right abutment tunnel and abandonment of the existing tower and conduit to reduce seepage and piping risks.~~

Realignments of Highways 155 and 178

~~The design and construction of the recommended structural features will be divided into phases, as follows:~~

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- ~~1. Phase 1: Highway 155 and 178 relocations.~~
- ~~2. Phase 2: Site development: Work involves constructing haul routes, laydown areas, utility preparation, instrumentation relocations, construction of construction project field offices, relocation of the temporary USACE and permanent USFS field offices, and real estate acquisitions and relocations.~~
- ~~3. Phase 3: Modifications to the main and auxiliary dams, existing spillway, and main dam control tower; construction of the emergency labyrinth spillway; the 16-foot dam raise on main and auxiliary dams.~~
- ~~4. Phase 4: Realignment of the Borel Canal.~~
- ~~5. Phase 5: Post construction site remediation, construction of the permanent USACE field office, and project closeout.~~

~~2.4.2.3.~~ **Project Non-Federal Sponsors**

The non-Federal Sponsors are North Kern Water Storage District, Buena Vista Water Storage District, Tulare Lake Basin Water Storage District, and Hacienda Water District. The Water Districts have a contract from the original dam construction with the Department of the Interior (Bureau of Reclamation). That contract must be modified or a new contract must be written to repay the cost of the modification to the Department of Interior within a 50 year period. The Water Districts are responsible for 15% of the original 21.7% for a total reimbursement percentage of 3.255%. The team has received approval for this reimbursement arrangement from the ASA (CW) through the DSMR approval of 18 December 2012.

3. REVIEWS

The RP was developed in accordance with EC 1165-2-214 (dated 15 Dec 2012), which establishes the procedures for ensuring the quality and credibility of U.S. Army Corps of Engineers (USACE) decision and implementation documents through independent review. The RP describes the scope of review for PED, final design, and construction for the Isabella Dam Safety Modification Project. ~~All appropriate~~ Levels of reviews considered include the following: ~~for Mega Projects including:~~ On-Board Reviews, PQE (Project Quality Evaluation), In-Progress Reviews, Quality Assurance Reviews, DQC (District Quality Control), IPR (In-Progress Reviews), ATR (Agency Technical Review), Type II IEPR (also known as Safety Assurance Review (SAR)), ~~), Constructability Evaluations and Construction Risk Reviews, Constructability Review Biddability, Constructability, Operability, Environmental, and Sustainability (BCOES) Review, Value Engineering (VE) study, and Policy Compliance and~~ Legal Reviews, ~~and Value Engineering (VE)~~ are addressed in this document. Any level of review found inapplicable will require documentation in the RP of the risk-informed decision not to undertake that level of review. Each of the above reviews types will be discussed individually.

~~The Risk Management Center (RMC), Major Subordinate Command (MSC), and Dam Safety Modification Mandatory Center of Expertise (DSMMCX) will fill a vital part of the overall Quality Assurance (QA) function for Headquarters (HQ) in this project. While the day-to-day~~

~~execution of a project remains the responsibility of the Sacramento District (SPK); the RMC, MSC, and DSMMCX are able to bring an agency wide perspective to the project to ensure uniformity and adoption of best practices from across the U.S. Army Corps of Engineers (USACE). Their early and continual involvement as part of the Project Delivery Team (PDT) is essential. Involving all elements from the inception of a project will ensure the failure modes are identified, the correct alternatives are evaluated, and that the best project solution is chosen.~~

3.1. On-Board Reviews

The purpose of the on-board review is to facilitate a rapid exchange of information between the PDT and the Review Team. PDT members will prepare presentations ~~relative-pertinent~~ to their disciplines for presentation ~~at the on-board review meeting to the review team.~~ Review Team members should be prepared with questions and look for resolution ~~on outstanding to~~ issues ~~directly~~ from PDT members. At the conclusion of ~~the each~~ on-board review, the Review Team Lead should ensure that formal comments are added to the Dr. Checks system for evaluation and closure. Significant comments that were resolved during the on-board review should be noted in the Final Review Report prepared by the Review Team Lead. On-board reviews for multiple required reviews such as ATR and SAR may be held concurrently in order to maximize efficiency so long as each review panel is independently led, understands its distinct review charge, and provides an independent report of findings related to its review charge.

A review conference will be held with all applicable PDT and ~~the on-board Review-review Team team~~ members present. Reviews should be held at an offsite location and independently facilitated in order to focus both the project team and the review team(s) for the specific review. Reviews will be coordinated and scheduled between the Project Manager, Engineering Lead, and Review Team Lead. Duration and scope of the review conference should be commensurate with the scale of scope of the material being reviewed. Review dates will be specifically identified as milestones in the Project Master Schedule. The Engineering Lead will coordinate a review package and distribute it to the Review Team Lead/Team two weeks prior to the scheduled review.

3.2. Project Quality Evaluations

Project Quality Evaluations (PQE's, formerly Design and Construction Evaluations) shall encompass all phases of the project, identify quality Management failures, and provide the basis for improvements through feedback and distribution of evaluation information. PQE's will be conducted in accord with ER 415-1-13 to independently ~~ascertain-determine~~ quality of project execution. PQE teams will be organized by HQUSACE and assigned the task to perform reviews of selected mega-projects. The PQE teams will be multi-discipline and will evaluate procurement, engineering, construction, and project management processes for compliance with USACE policy and their effectiveness in achieving desired project outcomes. PQE teams will meet with the appropriate customer, prime contractor(s) and stakeholder(s) to obtain a 360 degree perspective of the project. ~~For mega-projects, these~~ PQEs will be conducted at a minimum on a twice a year basis, and are intended to provide regional and HQUSACE senior

staff with a second “line of sight” for critical project decisions, and ensuring that USACE products and services are technically excellent, on schedule and within budget . PQEs will also be planned in advance of critical project milestones, such as:

- 6 months in advance of any design or construction contract award
- Semi-annually after award of any major constriction contract, until substantial completion is achieved
- During the formative stages of any request for funding or schedule increase

~~While restoring a dam to a fully functional condition so that it can meet its intended purpose is the ultimate goal, the more fundamental premise is that any modification undertaken must first do no additional harm to a structure (thereby increasing risks of failure). The PDT should never lose sight of the unique risks that might be present during the construction period and should remain diligent in monitoring and mitigating those risks. This will be assured through frequent instrumentation reading/analysis and on-site inspections throughout construction—particularly during high water periods. This will be accomplished using a combination of design, construction and/or operations personnel. Particular care and oversight will be given to activities such as dewatering, spillway/gate/outlet works modifications, excavating/blasting, drilling, and grouting. Analysis of the instrumentation data and inspection results as it relates to the expected behavior of the dam will be done by the DSM Lead Engineer or his designated PDT representative throughout the construction period.~~

3.3. In-Progress Reviews

The Project Senior Executive will establish the format and timing and will chair IPRs. These reviews will serve as both information and decision-making forums. Meeting minutes will be provided to the Director of Civil Works after each CW mega-project IPR respectively. PQE team input, if it exists, will also be briefed at these reviews. IPRs will be conducted on a quarterly basis at a minimum or on an “As Needed” basis.

3.4. Quality ~~Control~~ & Assurance ~~Review~~

Quality ~~control~~assurance is defined as the evaluation of technical products and processes to ensure that they comply with applicable laws, Corps planning, engineering and construction regulations and policies, sound technical practices, and customer requirements and expectations. Commensurate with the high profile and risk (consequences of failure) associated with the Isabella Dam Safety Modification Project, review of the implementation documents and critical design features will receive a high level of technical quality verification by each discipline. Products will be reviewed to ensure that the following objectives are met:

1. The plan is economically and technically feasible and environmentally acceptable; is compatible with existing projects; and will be safe, functional, and meet the project’s authorized purpose and customer requirements.

2. The engineering concepts, assumptions and methods are appropriate and valid, and analyses are correct.
3. The design complies with engineering policy and accepted engineering practice both within the Corps and industry-wide.
4. The cost estimate, including escalation and contingencies, is reasonable.
5. The Schedule, including contingencies, is reasonable and coordinated with the cost estimate

The Risk Management Center (RMC), Major Subordinate Command (MSC), and Dam Safety Modification Mandatory Center of Expertise (DSMMCX) will fill a vital part of the overall Quality Assurance (QA) function for Headquarters (HQ) in this project. While the day-to-day execution of a project remains the responsibility of the Sacramento District (SPK); the RMC, MSC, and DSMMCX are able to bring an agency-wide perspective to the project to ensure uniformity and adoption of best practices from across the U.S. Army Corps of Engineers (USACE). Their early and continual involvement as part of the Project Delivery Team (PDT) is essential. Involving all elements from the inception of a project will ensure the failure modes are identified, the correct alternatives are evaluated, and that the best project solution is chosen.

~~In general, the following guidance will be followed for the technical review:~~

- a. ~~Quality Management Plan for Sacramento District~~
- b. ~~ER 1110 1 12, Engineering and Design Quality Management~~
- c. ~~ER 1110 1 8159, Engineering and Design Dr Checks~~
- d. ~~ER 1110 2 1150, Engineering and Design for Civil Works~~
- e. ~~ER 1105 2 100, Planning Guidance Notebook~~
- f. ~~EC 1165 2 203, Implementation of Technical Policy Compliance Review~~
- g. ~~CESPD R 1110 1 8, Quality Management Plan~~
- h. ~~CESPK ED, Quality Management Plan~~
- i. ~~ER 1110 1 12, Quality Management for Engineering and Design~~
- j. ~~ER 200 2 2, Procedures for Implementing NEPA~~
- k. ~~ER 1165 2 501, Civil Works Ecosystem Restoration Policy~~
- l. ~~EC 1165 2 214, Civil Works Review Policy~~
- m. ~~ER 11 4 321, Value Engineering~~
- n. ~~ER 415 1 11, Biddability, Constructability, Operability, Environmental, and Sustainability (BCOES) Review~~
- o. ~~ER 415 1 13, Design and Construction Evaluation (DCE)~~
- p. ~~ECB 2013 11, Engineering and Construction Bulletin~~

Dams with safety deficiencies have a high potential for loss of life, a risk of significant property damage, potential significant costs to the Government, and negative political impacts. Therefore, the Isabella dam safety project is considered of such critical nature that, to the extent practicable,

quality assurance shall be performed directly by USACE forces. This includes, but is not limited to, performing inspection of all contract-related construction operations, materials testing, equipment factory inspection, survey control, and foundation testing. Inspection or testing by private consultants should be utilized only in situations where it is impractical for USACE to perform the inspection or testing, or the work is of such a specialized nature that USACE is not capable of performing it. Use of third parties to provide quality assurance should be limited to noncritical items/features. All quality assurance processes shall be in accordance with ER 1180-1-6.

Engineering representatives from RMC, DSMMCX, and MSC office are an integral part of the vertical team and thus should be continually advised of construction progress in order to permit participation by personnel from those offices in field inspections at critical construction stages in accordance with the requirements of ER 1110-2-112. This involvement, along with Design Construction E inspections, is a vital part of the QA role associated with MSC/HQ on dam safety modification projects. This includes their participation in the latter stages of construction (prior to final acceptance). This shall be accomplished through a regular project update prepared by the Project Manager and distributed to the entire vertical/horizontal team. This project update shall include updates on construction progress to include charts, photographs, graphs that depict current status, progress for the current month, issues (both funding and technical), and a 30 to 90 day look-ahead. Summaries of field tests, trials, and status of IRRM shall be included. The frequency of the project update will be agreed upon at the time of initiation of construction.

3.5. District Quality Control Review

District Quality Control (DQC) is an internal district level review of the basic science and engineering work products focused on fulfilling the project quality requirements defined in the Project Management Plan (PMP). Basic quality control tools include a Quality Management Plan providing for seamless review, quality checks and reviews, supervisory reviews, and Project Delivery Team (PDT) reviews throughout the life of the PED phase of the project. It is managed in the home district. Quality checks may be performed by staff responsible for the work, such as supervisors, work leaders, team leaders, designated individuals from the senior staff, or other qualified personnel. However, it should not be performed by the same people who performed the original work, including managing/reviewing AE contract. During the DQC process the PDT is responsible for a complete reading of reports and accompanying appendices prepared by or for the PDT to assure the overall coherence and integrity of the report, technical appendices, and the recommendations before approval by the District Commander. The Major Subordinate Command (MSC)/District Quality Management Plans address the conduct and documentation of this fundamental level of review.

All work products, reports, evaluations, and assessments shall undergo the necessary and appropriate District Quality Control/Quality Assurance (DQC). DQC will be conducted prior to ATR and Biddability, Constructability, Operability and Environmental (BCOE) reviews. The

DQC requires several fields of expertise for the review activities. These fields include geotechnical, geology, materials, environmental engineering, hydraulic, hydrology, structural, water management, construction, civil engineering, environmental engineering, cost engineering, environmental planning, and real estate.

3.5.1. Products for Review and Schedule

The products that will undergo DQC review include of the design documentation report (DDR), plans and specifications, NEPA documentation, and the cost estimate. Below is a schedule of the DQC reviews:

<u>Review Items</u>	<u>Schedule to Begin DQC Review</u>
Engineering Considerations and Information for Field Personnel (ECIFP)	September 2013
Quality Assurance Plan (QAP)	September 2013
Draft Rock Material Disposal Management Plan at Engineers Point	September 2013
Habitat Mitigation/Restoration Plan	September 2013
50% DDR	September 2013
Highway Relocation EA	August 2013
Real Estate EA	October 2013
Recreation EA	March 2014
Real Estate Design Memo	November 2013
Dams 35% Design Review	September 2013
90% DDR	June 2014
Dams 65% Design Review	September 2014
Dams 95% Design Review	September 2015
Borel 35% Design	June 2015
Borel 65% Design	May 2016
Borel 95% Design	July 2017

3.6. Agency Technical Review

Agency Technical Review (ATR) ensures the proper application of clearly established criteria, regulations, laws, codes, principles and professional practices. The ATR team review assures that all the parts fit together in a coherent whole. ATR teams are comprised of senior USACE subject matter experts with the appropriate technical expertise such as Regional Technical Specialists (RTSs), and outside experts as appropriate. The ATR Team Lead shall be from outside the home Major Subordinate Command (MSC). The disciplines represented on the ATR team will reflect the significant disciplines involved in the planning, engineering, design, and construction effort. These disciplines may include, but are not limited to, civil, geology, structural, hydraulics and hydrology, construction, operations, and environmental.

ATR review comments, responses, and associated resolution of comments will be documented in DrChecks. The ATR documentation in DrChecks includes ATR comments, the PDT responses,

comment resolution, and backcheck. The ATR team will prepare a report which includes a summary of each unresolved issue. Each unresolved issue will be raised to the vertical team for resolution. The Review Report will be considered an integral part of the ATR documentation.

ATR shall be certified when all ATR comments are either resolved or referred to HQUSACE for resolution and the ATR documentation is complete. Certification of ATR shall be completed for each phase of work. Refer to Appendix F for sample statement of technical review for design documents – completion of Agency Technical Review.

The nature of the Isabella Dam safety Modification Project requires several fields of expertise for ATR review activities. These fields include geotechnical, geology, materials, environmental engineering, hydraulic, hydrology, structural, water management, construction, civil engineering, environmental engineering, cost engineering, environmental planning, and real estate, which will be performed at the appropriate design reviews. Consistency checks between planning, environmental and engineering concerns/documents will be included in all reviews by the ATR and will be a responsibility of the review members. The ATR will also examine relevant DQC records and provide written comment on the adequacy of the DQC effort.

During project development, seamless review by the ATR team is encouraged for all aspects of the project. The PDT members will initiate seamless reviews at appropriate times in order to reach a common understanding with their ATR counterparts, thereby minimizing significant comments/impacts during final ATR. Although several of the technical disciplines working on the Isabella Dam safety Modification Project are assigned to the other projects, the Section Chiefs representing each of the technical disciplines will provide in-progress design checks, advice, and supervisory review (as well as Quality Assurance) of the products.

3.6.1. Products, Schedule, and Costs

The ATR teams will review the feature specific DDRs, including plans and specifications, for the Dams and Borel Outlet Works. Review and approval of P&S by the California Department of Transportation will constitute ATR for the Highway relocation work. Major design review milestones, the tentative associated schedule, and estimated costs, are listed in the table below. Funds have been budgeted for ATR review activities as outlined. Hydraulic physical models of the emergency spillway will be built and tested, with their development and results undergoing ATR reviews.

<u>Review Items</u>	<u>Schedule to Begin ATR Review</u>	<u>Cost</u>
Engineering Considerations and Information for Field Personnel (ECIFP)	August 2014	TBD
Quality Assurance Plan (QAP)	August 2014	TBD
Draft Rock Material Disposal Management Plan at Engineers Point	August 2014	TBD

Habitat Mitigation/Restoration Plan	August 2014	TBD
90% DDR	August 2014	TBD
Highway Relocation EA	September 2013	TBD
Real Estate EA	December 2013	TBD
Recreation EA	August 2013	TBD
Highways 35% Design	July 2013	TBD
Highways 65% Design	October 2013	TBD
Real Estate Design Memo	December 2013	TBD
Highways 95% Design	April 2014	TBD
Dams 65% Plans & Specs	December 2014	TBD
Dams 95% Plans & Specs	July 2015	TBD
Borel 35% Design	July 2015	TBD
Borel 65% Design	July 2016	TBD
Borel 95% Design	August 2017	TBD

3.7. Type II Independent External Peer Review

Type II Independent External Peer Review (~~IEPR~~(SAR) is the ~~most independent~~highest level of review, and is applied in cases where the risk and magnitude of the proposed project warrants a critical examination by a qualified team outside of USACE. ~~IEPR is divided into~~There are two types ~~of Independent External Peer Reviews, Type I and Type II,~~ Type I ~~which is~~ generally ~~applies to~~ ~~for~~ decision documents and Type II ~~is~~ generally ~~applies to~~ ~~for~~ implementation documents ~~and design~~.

~~A Type I IEPR review is conducted on project studies.~~ Type I IEPR ~~has already been~~was ~~previously~~ conducted and covered ~~the entire decision documents, which was~~ the Isabella Lake Dam Safety Modification Report (DSMR) and Environmental Impact Statement (EIS). ~~The final report documenting these review comments and responses can be found in Appendix I-~~ Since a Type II IEPR (Safety Assurance Review) ~~was~~ anticipated during ~~project implementation~~design (PED) of the ~~project, project;~~ safety assurance was also addressed during the Type I IEPR as required in EC 1165-2-214.

A Type II IEPR, also known as Safety Assurance Review (SAR), ~~shall be~~is conducted on design and construction activities for hurricane and storm risk management and flood risk management projects, as well as other projects where potential hazards pose a significant threat to human life. This applies to new projects and to the major repair, rehabilitation, replacement, or modification of existing facilities. External panels review the design and construction activities prior to initiation of physical construction and periodically thereafter until construction activities are completed. The review ~~shall be~~is intended on a regular schedule sufficient to inform the Chief of Engineers on the adequacy, appropriateness, and acceptability of the design and construction activities, ~~for the purpose of~~ assuring that good science, sound engineering, and public health, safety, and welfare are the most important factors that determine ~~the~~a project's fate. SAR will be conducted for the implementation of the Isabella Dam Safety Project.

The SAR ~~shall consider~~ the adequacy, appropriateness, and acceptability of the design and construction activities in assuring public health, safety, and welfare. The SAR team is an independent external panel that conducts reviews at various work phases, and is to be reviewed by the Review Management Organization (RMO), which is currently the Risk Management Center (RMC). The final approval authority is the SPD Commander. Factors to consider for conducting a Type II review of a project or components of a project are:

1. The project involves the use of innovative materials or techniques where the engineering is based on novel methods, presents complex challenges for interpretations, contains precedent-setting methods or models, or presents conclusions that are likely to change prevailing practices.
2. The project design requires redundancy, resiliency, and robustness.
3. Redundancy is the duplication of critical components of a system with the intention of increasing reliability of the system, usually in the case of a backup or failsafe.
4. Resiliency is the ability to avoid, minimize, withstand, and recover from the effects of adversity, whether natural or manmade, under all circumstances of use.
5. Robustness is the ability of a system to continue to operate correctly across a wide range of operational conditions (the wider the range of conditions, the more robust the system), with minimal damage, alteration or loss of functionality, and to fail gracefully outside of that range.
6. The project has unique construction sequencing or a reduced or overlapping design construction schedule; for example, significant project features accomplished using the Design-Build or Early Contractor Involvement (ECI) delivery systems.

The Sacramento District Chief of Engineering is responsible for coordinating with the RMO, attending SAR review panel meetings, communicating with the agency or contractor that is selecting panel members, and for coordinating the approval of the final report with the MSC Chief of Business Technical Division.

After receiving the report from the SAR review panel, the District Chief of Engineering, with full coordination with the Chiefs of Construction and Operations, shall consider all comments contained in the report and prepare a written response for all comments and note concurrence and subsequent action or non-concurrence with an explanation. The District Chief of Engineering shall submit the panel's report and the District's responses to the MSC for final MSC Commander's approval. The report and responses will be made available to the public on the District's website.

A SAR will be conducted for all ~~phases of design and construction~~~~the features that are associated with Life Safety Plan~~. This panel will review the DDR, plans, and specifications for the 65% and the 95% design packages, including review of on-going and planned construction operations. The most recent design activities with assumptions and preliminary conclusions will be

presented to the SAR for review and comment. These reviews will be conducted as on-board reviews and will run concurrent with the on-board ATR for 65% and 95% design. Reviews shall be cumulative with each subsequent review focusing on the new information presented rather than a complete review of the project. Hydraulic, Structural, Geotechnical/Geological, and Civil Engineering disciplines shall be represented on the SAR Team.

3.7.1. Products, Schedule, and Costs

~~The Type II IEPR (SAR) review will include the feature specific DDRs, and plans and specifications, for the Dams and Borel Outlet Works. Major design review milestones, tentative associated schedule, and estimated costs, are listed in the table below. Hydraulic physical models of the emergency spillway will be built and tested, with their development and results undergoing SAR review.~~

<u>Review Items</u>	<u>Schedule to Begin SAR Review</u>	<u>Costs</u>
90% DDR	August 2014	TBD
65% Plans & Specs	December 2014	TBD
95% Plans & Specs	July 2015	TBD
Borel 65% Design	July 2016	TBD
Borel 95% Design	August 2017	TBD

3.8. Constructability Evaluations and Construction Risk Reviews

To ensure dam safety risks are adequately addressed by the designs and that all construction-related risks are fully identified and mitigated to an acceptable level, the ATR team will ~~evaluate~~ perform a Constructability, Evaluations, and Construction Risk (CECR) review covering the constructability, the schedule, and the cost estimate at the alternative development phase and at the 65 percent plans and specifications during PED. A construction risk assessment involving event tree preparation and risk estimation may be required if potential failure modes introduced by construction activities are perceived to introduce significant risk. If a construction risk assessment is required, it would be performed as a part of the constructability evaluation. The DSM Lead Engineer/PDT may need to brief the ATR team on the potential failure modes mitigated by construction and on potential failure modes that may be present during construction activities.

A Constructability Evaluations (CE) ~~were~~ was performed at the alternative development phase and will be performed at the 65% design during PED. The CE process will utilize ATR members often from outside the geographic district while the BCOES is primarily a district PDT function. CE reviews the risks posed by construction alternatives while BCOES covers bidability, constructability, operability, environmental, and sustainability concerns of a completed design. CE is an ATR process while BCOES is a DQC process. CE will be performed much earlier in the process than BCOES reviews. CE can provide input into other efforts to include the VE process and Engineering Considerations and Instructions to Field

Personnel (ECIFP). The following constructability issues should be evaluated and discussed, if applicable, by the ATR:

- Borrow, staging, and processing area locations, sizes, ownerships, and accesses
- Borrow, staging, and processing areas with respect to flooding
- Borrow materials characteristics in relation to processing requirements
- In situ moisture conditions
- Unwatering and dewatering requirements
- Foundation characteristics in relation to excavation and drilling operations
- Waste and stockpile issues
- Zoning
- Protection of work from flooding and inundation from reservoir
- Reservoir operations/restrictions during construction
- Specialized Quality Control/Quality Assurance requirements
- Instrumentation monitoring and associated restrictions on Construction
- Reservoir operations and associated construction constraints
- Availability of equipment and materials, delivery times, and their sources
- User deliveries and special needs
- Climatic effects on construction schedules
- Available right of way
- Expected acquisition times
- Road relocations
- Material utilization

3.9. Biddability, Constructability, Operability, Environmental, and Sustainability COES Review

Constructability review will be incorporated into each level of review as a precursor to the final BCOES review required in accordance with ER 415-1-11, Biddability, Constructability, Operability, Environmental, and Sustainability (BCOES) Review.

~~3.9.1. Products and Schedule~~

~~The products that will undergo BCOES Review consist of the final design and specifications for the dams and spillways and the final design and specifications for the Borel Relocation.~~

<u>Review Items</u>	<u>Schedule to Begin BCOES Review</u>
100% P&S Dams and Spillways	October 2015
Highways 95% Design Review	December 2015
100% P&S Borel Relocation	September/October 2017

3.10. Policy Compliance and Legal Review

The Isabella Dam Safety Modification Project NEPA documents, plans, and specifications will be reviewed for compliance with law and policy by the Corps legal and policy teams.

<u>Review Items</u>	<u>Schedule to Begin Review</u>
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Highway Relocation EA	September 2013
Real Estate EA	September 2013
Recreation EA	December 2013
SPD Real Estate Design Memorandum	January 2014
HQ Real Estate Design Memorandum	February 2014

3.11. Value Engineering

Value engineering (VE) studies will be conducted on the project as required by ER 11-1-321. The VE studies will be completed for the 90% DDR and 35% Plans and Specs as shown in the table below.

<u>Review Items</u>	<u>Schedule to Begin Review</u>
90% DDR	August/September 2014
35% Plans & Specs	July/August 2015

4. PRODUCTS AND REVIEW SCHEDULE

The products that will undergo Review are presented in the table below. The costs have not been determined at this time and the review plan will be updated once the scopes of work and costs are complete.

<u>Products to be Reviewed</u>	<u>Schedule to Begin DQC Review</u>	<u>Schedule to Begin ATR Review</u>	<u>Schedule to Begin SAR Review</u>	<u>Schedule to Begin BCOES Review</u>	<u>Schedule to Begin Policy Compliance and Legal Review</u>	<u>Schedule to Begin Value Engineering</u>
50% DDR	Sep-13	Oct-13	Oct-13	N/A	N/A	Nov-13
Highway Relocation EA	Sep-13	Oct-13	N/A	N/A	Sep-13	N/A
Real Estate EA	Sep-13	Oct-13	N/A	N/A	Sep-13	N/A
Recreation EA	Mar-14	N/A	N/A	N/A	Dec-14	N/A
Real Estate Design Memo	Apr-14	N/A	N/A	N/A	Jan-14	N/A
Dams 35% Design Review	Sep-13	Oct-13	Oct-13	N/A	N/A	Nov-13
Highway Design 95%	Nov-13	N/A	N/A	N/A	N/A	N/A
90% DDR	Jun-14	Nov-14	Nov-14	N/A	N/A	N/A
Dams 65% Design Review	Sep-14	Nov-14	Nov-14	N/A	N/A	N/A
Dams 95% Design Review	Sep-15	Oct-15	Oct-15	N/A	N/A	N/A
100% P&S Dams and Spillways	N/A	N/A	N/A	Oct-15	N/A	N/A
Borel 35% Design	Jun-15	Jul-15	N/A	N/A	N/A	N/A
Borel 65% Design	May-16	Jul-16	Jul-16	N/A	N/A	N/A
Borel 95% Design	Jul-17	Aug-17	Aug-17	N/A	N/A	N/A
100% P&S Borel Relocation	N/A	N/A	N/A	Oct-17	N/A	N/A
Water Control Manual	Jul-19	Sep-19	N/A	N/A	N/A	N/A

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4.5. REVIEW TEAMS

4.1.5.1. Project Management and Project Delivery Teams

The Project Management Team and is provided in Appendix A, and the Project Delivery Team is provided in Appendix B. The Governance Structure and Project Management Team were specifically developed according to ECB 2012-2 Additional Engineering and Construction Management Controls for USACE Mega-Projects. The PDT lead engineer, in consultation with the project manager and design leads, is ultimately responsible for any engineering/design scopes of work. The planning coordinator, in consultation with the project manager, will be responsible for any planning scopes of work.

4.2. — Seamless Reviews

~~During project development, seamless review by the ATR is encouraged for all aspects of the project. The PDT members will initiate seamless reviews at appropriate times in order to reach a common understanding with their ATR counterparts, thereby minimizing significant comments/impacts during final ATR. Although several of the technical disciplines working on the Isabella Dam safety Modification Project are assigned to the other projects, the Section Chiefs representing each of the technical disciplines will provide in progress design checks, advice, and supervisory review (as well as Quality Assurance) of the products.~~

4.3.5.2. Agency Technical Review Team

The Agency Technical Review (ATR) team members will be listed in Appendix C. EC1165-2-214 states, “ATR teams will be comprised of senior USACE personnel, preferably recognized subject matter experts with the appropriate technical expertise such as regional technical specialists, and may be supplemented by outside experts as appropriate. ATR will be conducted by a qualified team outside of the home district that is not involved in the day-to-day production of a project/product.” The ATR will be coordinated by the ATR Lead, ~~Scott Shewbridge~~, from the Risk Management Center in Denver, CO. ATR members will be selected from outside the district and will represent disciplines that have a major part in the design of the project features. Dr. Checks will be used for managing and documenting the ATR comments, evaluations, and back checks as well as the resolution of controversial comments, if any.

- (1) **Review Team Members.** The ATR reviewers must have a minimum of ten years of experience in the discipline, have a professional license or equivalent qualifying experience, and not be involved in the design or supervision of the project. For the disciplines that play a crucial part in the project, Subject Matter Experts (SMEs) are preferred for filling the ATR roster. The following disciplines will be represented on the ATR: geotechnical, geology, concrete materials, civil, environmental, hydraulic, structural, construction, and cost engineering. The review members will be needed ~~at~~ ~~phases~~ during PED and will only be utilized on an on needed basis. For example, the environmental reviewer will not be needed during the hydraulic design review of the

physical model. A list of the ~~The~~-ATR ~~roster~~-team members will be provided in Appendix C and will be updated, as necessary, to reflect any changes.

- Geotechnical and/or geological engineering specialist(s) will possess a minimum 15 years of experience in design, inspection and construction of dam projects. The member(s) shall be registered Professional Engineers (PE) and preferably a registered Geotechnical Engineers (GE), or equivalent qualifying experience, with a minimum of 2 completed dam projects.
- Civil/construction engineer(s) with significant experience with civil works construction quality assurance and control with a minimum 10 years of experience in flood control projects, including dams. The member(s) shall have significant experience in the construction and/or remediation of dams. The member shall be a registered Professional Engineer (PE) or equivalent qualifying experience.
- Hydraulic engineering specialist(s) with a minimum 10 years of experience in designing spillways and hydraulic structures for flood control projects on major river systems. The member(s) shall have experience in the design and analysis of Labyrinth weirs including the use of physical and 3-D numerical modeling. The member(s) shall be a registered Professional Engineer (PE) or equivalent qualifying experience.
- A senior structural engineer(s) with a minimum 10 years of experience in design of hydraulic structures for large and complex civil works projects including dam outlet works structures such as control towers, intakes, and spillways. The member(s) shall be a registered Professional Engineer (PE) with extensive experience in finite element analysis and dynamic analysis of these structures as well as seismic and detailing.
- Concrete materials specialist(s) with a minimum 10 years experience in evaluating and developing materials for heavy civil projects, with a minimum of 3 completed dam projects.
- Environmental planner with a minimum of 5 years of experience in dealing with NEPA documents such as Environmental Assessments and Environmental Impact Statements. This review team member also needs to have a solid background in the habitat types found in California's Central Valley, specifically in the Lower San Joaquin Valley in Kern County, understand the factors that influence reestablishment of native species of plants and animals, and understands the requirements for NEPA/CEQA documentation.
- Construction Manager/Specialist with significant experience with civil works construction quality assurance and control with a minimum 5 years of experience in flood control projects, including dams. The member(s) shall have significant experience in the construction and/or remediation of dams. The member shall be a registered Professional Engineer (PE) or equivalent qualifying experience.
- Cost Engineering with significant experience in preparing cost estimates for civil works construction projects, including dam remediation. The member(s) shall have a

minimum of 5 years of experience in preparing cost estimates for Civil Works Mega Project for the US Army Corps of Engineers.

(2) Review Team Leader.

- a) The ATR team leader is responsible for assembling the team – which will be exclusive of SPK and may include AE contractors for specific disciplines or tasks, as necessary – as well as coordinating all activities of the review. The review team leader will communicate with the ATR team members to make sure they know their responsibilities and objectives.
- b) The ATR team leader will monitor the products and ATR comments, the PDT responses, and the reviewer's back-check of responses. The ATR team leader will eliminate any conflicting comments and will consolidate similar or related comments. In the event of a disagreement on a comment or issue that cannot be resolved between the reviewer and the designer, the ATR team leader and the PDT design lead will review the situation and determine the fate of the comment.
- c) The ATR Team Leader will prepare the ATR report for each phase of review and submit it to the PM, Technical Lead, and RMO for approval and inclusion in the official record. A current template for the ATR Report can be obtained from the RMO.
- d) The ATR Team Leader will participate in monthly PDT meetings via conference call or in person in order to stay current on project status and challenges and better ensure seamless review of the project.
- e) The ATR Team is provided in Appendix C.

A-E Firms and Outside Design Agencies. In order to maintain design responsibility, outside ~~design organizations such as~~ A-E firms will be responsible for the QC of their own work. Each organization's work products will be independently-reviewed under their respective QC procedures, and each organization will provide QC certification for their respective sub-products to the Lead Engineer (~~Mike Ruthford for the Dam Embankment contracts and Roger Henderson for the Highway Relocation contracts~~) for the Corps' Engineering Division, or to ~~Marei Jackson,~~ the Lead Planning Coordinator for the Corps' Planning Division. The A-E Quality Control Plans will be submitted and approved prior to commencing design work. Dr. Checks will be used to manage and document QC comments. The Corps will make Dr. Checks available to A-E Firms and outside design agencies for the reviews.

The Quality Control Plan for URS (Highway Design) is included in Appendix G.

4.4.5.3. Type II Independent External Peer Review Team

The Type II IEPR Team will be established, in consultation with the RMC, through one of four contractors maintained by the Louisville District. The appropriateness, in composition and scope, of the Type II IEPR ultimately falls under the Review Management Organization (RMO). The

review team will be selected based on their technical qualifications and experience. Once the team is selected Appendix D will be updated to include the names of the SAR Review Team.

The Engineering Lead responsible for the specific design element will coordinate the input all of the SAR team member's comments into Dr. Checks after the review conference.

The SAR team shall be composed of licensed engineers with experience in dam design and large construction projects. The members will represent the following disciplines (at a minimum). The final make-up, in size and composition, will be established by the contractor.

- Geotechnical or geological engineering specialist(s) will possess a minimum 25 years of experience in design, inspection and construction of levee or dam projects. The member(s) shall be registered Professional Engineers (PE) and preferably a registered Geotechnical Engineers (GE), or equivalent qualifying experience, with a minimum of 3 completed dam projects.
- Civil/construction engineer(s) with significant experience with civil works construction quality assurance and control with a minimum 20 years of experience in flood control projects, including dams or levees. The member(s) shall have significant experience in the construction and/or remediation of dams. The member shall be a registered Professional Engineer (PE) or equivalent qualifying experience.
- Hydraulic engineering specialist(s) with a minimum 20 years of experience in hydraulic and hydrological modeling for flood control projects on major river systems. The member(s) shall have experience in design and analysis of Labyrinth weirs including the use of physical and 3-D numerical modeling. The member(s) shall be a registered Professional Engineer (PE) or equivalent qualifying experience.
- Senior structural engineer(s) with a minimum 20 years of experience in design of hydraulic structures for large and complex civil works projects including dam outlet works structures such as control towers, intakes, and spillways. The member(s) shall be a registered Professional Engineer (PE) with extensive experience in finite element analysis and dynamic analysis of these structures as well as seismic design and detailing, with expertise in post-tensioned and passive structural anchors.
- Concrete materials specialist(s) with a minimum 20 years experience in evaluating and developing materials for heavy civil projects, with a minimum of 3 completed dam projects.

A list of the SAR team members is included as Appendix D.

4.5.5.4.BCOES Review Team

The BCOES review team is an independent review to minimize potential change orders and schedule delays during construction by improving the constructability, biddability, and efficiency of the proposed construction. These reviews focus on large strategic issues to affect a more

efficient construction process and shorter construction duration. The BCOES team members are listed in Appendix E.

4.6.5.5 Vertical Review Team

The Vertical Review Team consists of the RMC, Regional Integration Team (RIT) at HQUSACE and the District Support Team at SPD. The vertical team supports, schedules, and conducts PQE (formerly DCE) and IPRs. A list of the team members is attached as Appendix ~~BA~~ along with the governance structure.

5.6. PUBLIC REVIEW

To ensure that the review approach is responsive to the wide array of stakeholders and customers, both within and outside the Federal Government, this Review Plan will be published on the district's public internet site following approval by SPD at <http://www.spk.usace.army.mil/>. The opportunity for public comment remains open as there is no formal comment period and no set closure date at this time. If and when comments are received, the PDT will consider them and decide if revisions to the review plan are necessary. The public is invited to review and submit comments on the plan as described on the web site.

6.7. MODELS

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. 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. The following models will be used for the design of the Isabella Dam Safety Project.

Microstation (V8 XM version 08.09.04.88) and InRoads (V8 XM version 08.09.03.06).	This model/software will be used to design the main dam embankment raise, the emergency spillway excavation and roadway realignment. The programs help prepare the digital terrain model (DTM) which is necessary for developing plan, profile, section and quantity estimate. The DTM is also necessary for other hydraulic and geotechnical analyses.
Hydraulics Physical Model	This model will be used to design the hydraulics and size for the emergency spillway
FLAC	This model will be used for seepage and seismic analysis for the main and auxiliary dam modifications.
Structural Finite Element Models for the Main	A one-dimensional stick model is used to

Dam Control Tower Raise/Retrofit	compute the seismic demands such as bending moments and shear forces on the tower using the free-field deformation approach. Three-dimensional models of the tower will be developed beyond 35% design to accurately capture any significant in-plane distortions of the structure.
Structural Finite Element Models for the Main Dam Spillway Modifications	Two-dimensional finite element models of the raised spillway walls are analyzed for the post-tensioned anchored wall alternative and the massive gravity wall alternative to compute vertical and principal stresses in concrete, taking into account the effects of post-tensioning forces when applicable. Three-dimensional models of the raised spillway walls will be developed beyond 35% design to account for the spatial distribution of post-tensioned anchors. Two-dimensional finite element models of the modified spillway ogee are also analyzed to evaluate global stability and to compute vertical and principal stresses in concrete.
Structural Finite Element Models for the Labyrinth Weir	Three-dimensional finite element models of the labyrinth weir are analyzed to evaluate global stability of the structure and to compute the moment and shear demands on the walls and base slab.

7.8. REVIEW DOCUMENTATION

The work products will be reviewed using an interdisciplinary team approach. The products will be reviewed for scope and adequate level of detail; compliance with guidelines, policy, and customer needs; and consistency, accuracy, and comprehensiveness. Review comments will be identified with author and affiliation, and are expected to be constructive and relevant to the product. Review comments will contain the following elements: (a) a clear statement of the concern, (b) the basis for the concern, (c) the significance of the concern, and (d) the specific actions needed to resolve the concern. Reviewers must identify any significant deficiency; however, comments should be limited to those required to ensure adequacy of the product in meeting the stated objectives. Typographic errors and other minor stylistic changes should not be part of the formal technical review comments. Such comments will be provided separately to the PDT for their use and to the ATR team leader. A partial checklist for reviewers to consider is as follows:

- a) Constructability versus actual site conditions;
- b) Maintainability by USACE and USFS;
- c) Accuracy and reasonableness test of computations;
- d) Compliance with governing policies, criteria, and project requirements;
- e) Seamless review (discussions and agreements with PDT counterparts); and
- f) Product review comment/response/actions taken are documented in Dr. Checks.

7.1.8.1. Comment Resolution

Review comments do not necessarily have to be complied with, but each comment must be addressed and resolved. If a PDT member disagrees with a comment, the PDT member will try to resolve the comment through discussions with the Review team member. The Review team leader will help facilitate those discussions as needed. When this does not result in resolution, the issue will be elevated through the PDT member's chain of command as necessary. If this level of interaction does not resolve the issue, the responsible Functional Chief will make the final decision. The Functional Chief may consult with the Branch Chief, the CESP (Corps of Engineers South Pacific Division) staff, SMEs, or other appropriate sources. Resolution of disputes will be documented in Dr. Checks as appropriate.

7.2.8.2. Technical and Policy Issue Resolution

Issues involving technical and policy interpretation shall be brought to the attention of the chief of the functional element for resolution. In some cases the chief of the responsible functional element may request that CESP hold an issue resolution conference to resolve major policy or technical issues. CESP may also arrange for HQUSACE participation in the issue resolution conference.

7.3.8.3. Certification

7.3.1.8.3.1. DQC Certification

For final products, a certification will be signed stating that issues raised by the DQC team have been resolved. The DQC certification will be signed by the A-E (if appropriate), the PDT Discipline Lead, the DQC Reviewer, and the Engineering Division Lead Engineer. Current standard Corps certification forms will be used.

7.3.2.8.3.2. ATR Certification

For final products, a certification will be signed stating that issues raised by the ATR team have been resolved. The ATR certification will be signed by: the A-E (if appropriate), the Engineering Division Lead Engineer, the Planning Division Chief (as appropriate), the ATR team leader, the Project Manager (PDT Leader), other functional chiefs at the Section and Branch levels (as appropriate), the Chief of Engineering Division, the Office of Counsel, and the District Commander. Current standard Corps certification forms will be used.

7.3.3.8.3.3. SAR Certification

The review team will prepare a review report. All review panel comments shall be entered as team comments that represent the group and be non-attributable to individuals. All comments in the report will be finalized by the panel prior to their release to USACE for each review plan milestone. After receiving a report on a project from the review team, the District Chief of Engineering, with full coordination with the Chiefs of Construction and Operations, shall consider all comments contained in the report and prepare a written response for all comments and note concurrence and subsequent action or non-concurrence with an explanation. The District Chief of Engineering shall submit the panel's report and the Districts responses to the MSC Chief of Business Technical Division for final review and concurrence. The final report is then presented to the MSC Commander for approval. After MSC Commander approval, the report and responses shall be made available to the public on the District's website.

~~7.3.4~~8.3.4. **VE Certification**

A statement that appropriate VE actions have been completed should accompany the Biddability, Constructability, Operability, Environmental, and Sustainability (BCOES) document. The statement shall read: "I, (the PM), certify that this procurement action has completed the Value Engineering process. A VE study was (completed/waived) on (date). All VE proposals indicating potential savings over \$1,000,000 have been resolved with approval of the MSC and Engineering Center Commander."

~~7.3.5~~8.3.5. **BCOES Certification**

Certification as per ER 415-1-11, Appendix A

~~7.3.6~~8.3.6. **Legal and Policy Compliance Certification**

All final products undergoing legal review shall receive a Legal and Policy Compliance Certification from the SPK OC prior to vertical team approval or public release.

8.9. POINTS OF CONTACTS

Questions about this Review Plan may be directed to the applicable District Project Delivery Team, Lead Engineer, Mike Ruthford (916) 557-7302, or to the Project Manager, John Menniti, (916) 557-7761. The Chief, Engineering Division, is Rick Poeppelman, (916) 557-7301.

9.10. REVIEW PLAN APPROVAL

The Sacramento District requests that the Risk Management Center (RMC) endorse the above recommendations described in this Review Plan and as described in Appendix B of EC 1165-2-214. The approval from the South Pacific Division ~~Commander is also requested~~required once RMC endorsement is received.

10.11. POST CONSTRUCTION PHASE

~~Many important lessons, both positive and negative can be learned from dam safety projects.~~ Near the end of construction (or as each phase of work is completed), the PDT (including all vertical and horizontal members) shall ~~assemble and conduct a brainstorming session in order to~~ meet as necessary to capture lessons learned from both the design and construction phases of the project. The DSM Lead Engineer and Resident Engineer shall ensure these lessons learned are officially entered into DrChecks, the Dam Safety CoP site on the Technical Excellence Network (TEN), or another accepted forum. These lessons should then be built into the official design/construction checklists (typically part of a Design Quality Management Plan) so that future projects can reap the benefits. The district shall organize and facilitate such brainstorming sessions. Typical subjects of discussion can be found in ER 1110-2-1156, Chapter 22, Section 22.4.1.

As required in ER 1110-1-1901, the Project Geotechnical and Concrete Materials Completion Report for Major USACE Projects, ~~requires documentations shall be complied, documenting of~~ the as-constructed geologic, geotechnical and concrete materials aspects ~~of all major, complex and unique engineered projects constructed by USACE of the project,~~ including all subsequent modifications. It is imperative that the report be all encompassing and records the geologic conditions encountered, solutions of problems, methods used, and experiences gained. ~~It is imperative that should contain~~ data such as observations, notes, and photographs be collected and maintained during construction, describing procedures, conditions encountered, and the results of each major operation. This is particularly important for features representing departures from the anticipated conditions. This report shall be identified, scheduled, and resourced in the Project Management Plan (PMP). The information and data in this document shall be presented and discussed with the sponsor/owner. The report provides significant information potentially needed by the sponsor, USACE technical staff, and other team members to become familiar with the project. The report shall facilitate accurate, timely inspections and performance assessments, and serve as the basis for developing and implementing appropriate and effective modifications, and emergency and/or remedial actions to prevent flood damage, or required as a result of unanticipated conditions or unsatisfactory performance. The report will be written by a qualified USACE professional engineer or engineering geologist that was involved with the construction or modification of the dam.

A Post Implementation Risk Assessment is required once construction is complete. A team from the District and RMC will review and update the DSM study risk assessment after implementation of the risk management remedial measures are in place. The dam will be evaluated to determine if the risk management objectives were achieved.

11.12. ANTICIPATED CHALLENGES

The list below describes some of the anticipated challenges:

- Acquiring real estate in a timely manner
- ~~Uncertainty of spillway layout could impact what electrical utilities need to be relocated and~~ where they need to be relocated.

- No authority to move or design for the impacted USFS facilities
- USACE Operations and Construction Support design of temporary office space in trailer park
- Extra Space may be need to house the USFS Operation during construction
- Model results could change the current design parameters and conceptual layouts
- Uncertainty associated with the buyout of the Borel Canal by Isabella Partners

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**Appendix A – Governance Structure (Org Chart) and
Vertical Team**

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Appendix B – Project Delivery Team

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Appendix C – Agency Technical Review (ATR) Team

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Appendix D – Safety Assurance Review (SAR) Team

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Appendix E – BCOES Team

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Appendix F – ATR Certification Template

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Appendix G – Highway Relocations QCP

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Appendix H – Review Plan Comments and Coordination

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