



DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SOUTH ATLANTIC DIVISION
60 FORSYTH STREET SW, ROOM 10M15
ATLANTA GA 30303-8801

CESAD-RBT

06 JUL 2015

MEMORANDUM FOR COMMANDER, WILMINGTON DISTRICT

SUBJECT: Approval of Review Plan for Plans and Specifications and Design Documentation Report for Philpott Dam Headgate Bay Repairs, Henry County, Virginia

1. References:

a. Memorandum, CESAW-ECP-E, 2 June 2015, subject: Approval of Review Plan for Plans and Specifications and Design Documentation Report (DDR) for Philpott Dam Headgate Bay Repairs, Henry County, Virginia (Encl).

b. EC 1165-2-214, Civil Works Review, 15 December 2012.

2. The enclosed Review Plan (RP) for the Plans and Specifications for the Philpott Dam Headgate Bay Repairs has been reviewed by this office. The enclosed RP is hereby approved in accordance with reference 1.b above.

3. We concur with the conclusion of the District Chief of Engineering that Type II Independent External Peer Review (Type II IEPR) is not required for this repair effort. The primary basis for our concurrence that a Type II IEPR is not required is the determination that of the headgate hoist bay repair will not pose a significant threat to human life.

4. The District should post the approved RP to its web site and provide a link to CESAD-RBT. Before posting to the web site, the names of Corps/Army employees should be removed. Subsequent significant changes, such as scope or level of review changes, to this RP, should they become necessary, will require new written approval from this office.

5. The SAD point of contact is [REDACTED], CESAD-RBT, 404-562-5121.

Encl


C. DAVID TURNER
Brigadier General, USA
Commanding

CF:
CESAW-ECP-E/Mr. Greg Williams
CESAW-ECP-E /Mr. Douglas Wall
CESAW-ECP-EG /Mr. John Hughes



REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

CESAW-ECP-E

2 June 2015

MEMORANDUM FOR Commander, US Army Corps of Engineers, South Atlantic Division (CESAD-RBT), ATTN: [REDACTED], CESAD-RBT, Rm 10M15, 60 Forsyth Street, SW, Atlanta, Georgia 30303-8801

SUBJECT: Approval of Review Plan for Plans and Specifications and Design Documentation Report (DDR) for Philpott Dam Headgate Hoist Bay Repairs, Henry County, Virginia.


1. Reference

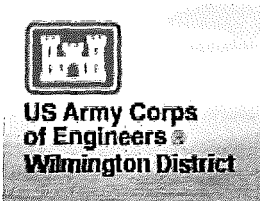
EC 1165-2-214, Civil Works Review Policy, 15 Dec 2012

2. I hereby request approval of the enclosed Review Plan for the Plans and Specifications and Design Documentation Report (DDR) for Philpott Dam Headgate Hoist Bay Repairs, Henry County, Virginia. The Review Plan complies with applicable policy and includes our DQC and ATR plans for this project. Also, SAW-Dam Safety Officer and Chief of Engineering agree with the Review Plan as submitted.

3. The District will post the Corps of Engineers, South Atlantic Division (CESAD) approved Review Plan to its website and provide a link to the CESAD for its use. Names of Corps/Army employees are withheld from the posted version, in accordance with guidance.

Encl


KEVIN P. LANDERS SR.
COL, EN
Commanding



Review Plan

For

**Philpott Dam Headgate Hoist Bay Repairs,
– Implementation Documents**

**Henry County, Virginia
P2 #: 111649**

**U.S. Army Corps of Engineers
Wilmington District
Wilmington, North Carolina**

May 14, 2015

THE INFORMATION CONTAINED IN THIS REVIEW PLAN IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PREDISSEMINATION REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY THE U.S. ARMY CORPS OF ENGINEERS, WILMINGTON DISTRICT. IT DOES NOT REPRESENT AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY.

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1. PURPOSE AND REQUIREMENTS

1.1 Purpose

This Review Plan defines the scope and level of review activities for design and construction of the Philpott Dam Headgate Hoist Bay Repairs, located in Henry County, VA. The documents to be reviewed will consist of plans, specifications and a scope of work for the installation of horizontal anchor rods to stabilize a headgate track for one of the two main penstocks and for making a vertical diamond wire saw cut to relieve lateral pressures causing monolith displacement. All work on the concrete dam will occur at elevations above the normal lake pool elevation, and even if a sudden, extreme weather event caused the lake pool to rise into the construction zone there is no effect on the integrity or safety of the dam. The review activities consist of District Quality Control (DQC) and Agency Technical Review (ATR). The project is in the design study phase and the related documents are Plans and Specifications (P&S), Design Documentation Report (DDR) and a Scope of Work (SOW) for structural repairs. Upon approval, this review plan will be included into the Project Management Plan.

1.2 References

- ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 Aug. 1999
- ER 1110-1-12, Engineering and Design Quality Management, 31 March 2011
- ER 415-1-11, "Biddability, Constructability, Operability, Environmental, and Sustainability (BCOES) Review", 1 January 2013
- EC 1165-2-214, Civil Works Review, 15 Dec. 2012
- ER 1110-2-1156, Safety of Dams – Policy and Procedures, 31 March 2014
- Quality Control Plan
- Project Management Plan

1.3 Requirements

This review plan was developed in accordance with EC 1165-2-214, which establishes an accountable, comprehensive, life-cycle review strategy for Civil Works products by providing a seamless process for review of all Civil Works projects from initial planning through design, construction, and Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R). The EC provides the procedures for ensuring the quality and credibility of U.S. Army Corps of Engineers (USACE) decision, implementation, and operations and maintenance documents and other work products. The EC outlines four applicable levels of review for implementation documents: District Quality Control, Agency Technical Review, BCOES, and Independent External Peer Review.

1.4 Review Management Organization (RMO).

The South Atlantic Division is designated as the RMO for this effort.

2. PROJECT INFORMATION AND BACKGROUND

2.1 Project Description

Philpott Lake Dam is located in Henry and Franklin Counties, Virginia at Latitude 36° 46' 50", Longitude 80° 1' 40". The dam is on the Smith River about 44.3 miles above the mouth of the river and forms the boundary between Henry and Franklin Counties. The National Inventory of Dams (NID) number for Philpott Lake Dam is VA08901 and the hazard potential classification is high. The dam site is in the Roanoke River Basin and is approximately 7-river miles north of Bassett, Virginia.

Philpott Dam consists of a mass concrete gravity structure having two non-overflow sections, a power intake section and a spillway section (see sheet 5, file GC 201 B-0). The dam is 892-ft long. Vertical construction joints separate the dam into 22 independent monoliths, which were cast in place in 5-ft deep lifts. The right non-overflow section consists of Monoliths 1 through 9, which vary in height from about 17-ft to 214-ft. The left non-overflow section consists of Monoliths 13 through 22, which vary in height from about 31-ft to 214-ft. The widths of the monoliths are all 40-ft, except Monoliths 8 and 9, which are 46-ft wide. The ungated spillway section is located at Monoliths 10, 11 and 12. The spillway crest is at EL 985-ft (msl) and has a clear opening 120-ft wide by 31-ft high. The top of dam is at EL 1016-ft and the parapet walls along the non-overflow sections are at EL 1018.05-ft. The top of the dam ties into the left and right abutments, but the parapet walls do not connect to the abutments. Three sluiceways, 5-ft 8-in. wide by 10-ft high, run through spillway Monoliths 10, 11 and 12. Each sluice has a bell-mouthed entrance and is equipped with one service gate and one emergency gate. A 120-ft-wide stilling basin extends downstream about 187-ft from the heel of the spillway. The elevation of the bottom of the stilling basin is EL 790-ft and the elevation of the end sill is EL 806-ft. The power plant has two units with a rated generating capacity of 6,750 kW each and a station unit with a capacity of 600 kW.

The authorized project purposes include flood risk management, hydroelectric power, recreation, fish and wildlife enhancement, and augmentation of low flows for purposes of pollution abatement and water-quality control in the Roanoke River Basin. There are no non-Federal sponsors and all the operation and maintenance, repair, replacement and rehabilitation (OMRR&R) responsibilities are performed by USACE.

Philpott Dam is rated as a Dam Safety Action Class (DSAC) 3 dam.



Figure 1. Aerial photo of Philpott Dam.

2.2 Project Background

Alkali-silica reaction (ASR) is present in the concrete at Philpott Dam and is causing significant cracking and monolith displacement to occur in the vicinity of the head gate hoist bay at the two nine foot diameter penstocks. USACE Engineer Research and Development Center (ERDC) confirmed the presence of ASR in the concrete in 2004. In 2009 SAW brought in world renowned concrete expert Dr. Robin Charlwood to look at the dam. Dr. Charlwood is an Independent Consulting Engineer focusing on dam safety and security, hydroelectric plant rehabilitation and particularly ageing structures and those with alkali-aggregate reactions (alkali-aggregate reactions include alkali-silica reactions and alkali-carbonate reactions). He is the Chair of the International Committee On Large Dams (ICOLD) Committee on Concrete Dams and is the Past Vice-President and Director of the United States Society on Dams (USSD). SAW then brought in HDR Engineering, Inc to propose remedial improvements. HDR proposed that horizontal and vertical anchor rods be installed to stabilize this area of the dam where the penstock head gates must be able to function properly. Subsequent to the HDR technical memorandum, SAW has had divers map cracks below the waterline and NAP map cracks above the waterline.

In February 2015 SAW was provided O&M Budget Increment 4 funds by SAD designated for remedial repair work in the Headgate Hoist Bay. In order to utilize these funds and improve the cracking and monolith displacement problem at Philpott Dam as quickly as possible, the district sought suggestions from RMC-EAST. RMC-EAST referred SAW to the Lakes and Rivers Division Dam Safety Production Center (LRD-DSPC) who had successfully addressed similar ASR problems on other USACE Dams. SAW charged LRD-DSPC to 1) produce construction documents based on HDR's recommendations, 2) to evaluate the conditions in the dam for themselves, taking into account the additional cracking documentation which SAW has accomplished since HDR made their recommendations, and 3) to recommend repairs which would be in the best interest of the dam. LRD-DSPC will produce the required construction documents for the work.

LRD-DSPC agreed to evaluate HDR's repair concept, evaluate additional information gathered since HDR proposed their repair concept and to produce construction plans, specifications and a Scope of Work for contractor-level set of documents for a repair that is in the best interest of the dam with the funds SAW currently has available.

HDR recommended the installation of horizontal and vertical anchor rods in the headgate hoist bay area (Monoliths 8 and 9) with the goal being to stabilize the concrete in the vicinity of the tracks of the two nine foot diameter penstock headgates so that they can continue to function properly. LRD-DSPC concurs with HDR's recommendation for the installation of horizontal anchor rods. Cracking has now been documented to be so extensive near the Monolith 8/9 interface that LRD-DSPC recommended that the vertical anchor rods as proposed by HDR not be installed (HDR did not have the benefit of this more recent crack mapping information when they made their repair recommendations). After reviewing HDR's report and Dr. Charlwood's findings, LRD-DSPC determined that the concrete growth and lateral displacement was very similar to the issues at Center Hill Dam, Nashville District. Center Hill Dam is similar in geometry to Philpott Dam with the exception of a gated spillway and spillway bridge. However,

the monoliths adjacent to the spillway at both projects were exhibiting movement towards the spillway. After briefly studying the extensive finite element modeling at Center Hill, with and without a saw cut relief slot, it was determined that Philpott was behaving very similar to Center Hill and that similar remedial measures would be prudent. Due to the limited amount of funds currently available to SAW to stabilize the concrete in the vicinity of the penstock headgate tracks, it was determined that it would be in the best interest of the project to proceed with physical construction of the remedial measures without expending resources on numerical modeling and studies. The saw cut relief would be solely based on proven technology and satisfactory results noted at Center Hill. The LRD-DSPC determined that in-lieu of vertical anchors, a saw cut would add little to no risk to the project and has the highest probability of satisfying the projects needs with the currently available funding. Therefore, it was recommended that the most feasible remedial measures would include installing horizontal anchor rods at the HDR recommended locations in Monolith 8 and then to make a vertical diamond wire saw cut at the Monolith 6/7 interface from the top of the dam to a depth below the spillway crest elevation to relieve the lateral pressures causing monolith displacement. All work is proposed to take place above the normal waterline. It should also be noted that the vertical saw cut is only a temporary solution. The structure will need to be monitored in the future and a long term remedial plan will be developed. If additional funding becomes available in the future, SAW could focus on modeling the monoliths in question and the effects of the saw cut relief slot.

3. DISTRICT QUALITY CONTROL

District Quality Control (DQC) and Quality Assurance activities for implementation documents (DDRs and P&S) are stipulated in ER 1110-1-12, Engineering & Design Quality Management. The subject project DDR P&S, and SOW for structural repairs will be prepared by the Wilmington District using the SAW procedures and will undergo DQC. DQC Certification will be verified by the Agency Technical Review Team.

4. AGENCY TECHNICAL REVIEW

Agency Technical Review (ATR) is undertaken to "ensure the quality and credibility of the government's scientific information" in accordance with EC 1165-2-214 and ER 1110-1-12. An ATR will be performed on the Plans and Specifications and Design Documentation Report.

ATR will be conducted by individuals and organizations that are external to the Wilmington District (SAW). The ATR Team Leader will be a Corps of Engineers employee outside the South Atlantic Division. The required disciplines and experience are described below.

4.1 ATR Team Expertise

As stipulated in ER 1110-1-12, ATR members will be sought from the following sources: appointed subject matter experts (SME) from other districts; senior level experts from other districts; Center of Expertise staff; appointed SME or senior level experts from the responsible district; experts from other U.S. Army Corps of Engineers Districts; contractors; academic or other technical experts; or a combination of the above. The ATR Team will be comprised of the following disciplines; knowledge, skills and abilities; and experience levels.

ATR Team Leader. The ATR lead will be a senior professional with experience in structural concrete dam safety matters and conducting ATR. The lead will also have the necessary skills and experience to lead a virtual team through the ATR process. The ATR lead will also review and provide comments.

Structural Engineering. Team member will be a registered professional engineer and have experience with structural repair design and construction that includes concrete gravity dams.

Geologist. Team member will be experienced with the process of drilling in concrete dams for the purpose of installing structural members or sensors.

4.2 Documentation of ATR

DrCheckssm review software will be used to document all ATR comments, responses, and associated resolutions accomplished throughout the review process. Comments are expected to be limited to those that are required to ensure adequacy of the product. The four key parts of a quality review comment will normally include:

- (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; and
- (4) The probable specific action needed to resolve the concern- identify the action(s) that the reporting officers 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 in DrCheckssm will 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:

- Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;

- Include an overview for the project information in which the ATR members were charged to reviewer;
- Describe the nature of their review and their findings and conclusions; and
- Include a verbatim copy of each reviewer's comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and dissenting views.

The ATR may be certified when all ATR concerns are either resolved or referred to U.S. Army Corps of Engineers South Atlantic Division (CESAD) for resolution and the ATR documentation is complete. Certification of ATR should be completed, based on work reviewed for the 95% plans & specifications. A sample certification is included in this Review Plan (see attachment 2).

5. INDEPENDENT EXTERNAL PEER REVIEW (WRDA 2007 Section 2035 Safety Assurance Review)

EC 1165-2-214 provides implementation guidance for both Sections 2034 and 2035 of the Water Resources Development Act (WRDA) of 2007 (Public Law (P.L.) 110-114). The EC addresses review procedures for both the Planning and the Design and Construction Phases (also referred to in USACE guidance as the Feasibility and the Pre-construction, Engineering and Design Phases). The EC defines Section 2035 Safety Assurance Review (SAR), Type II Independent External Peer Review (IEPR). The EC also requires Type II IEPR be managed and conducted outside the Corps of Engineers.

5.1 Type I IEPR

A Type I IEPR is associated with decision documents. No decision documents are addressed/covered by this Review Plan. A Type I IEPR is not applicable to the implementation documents covered by this Review Plan.

5.2 Type II IEPR, Determination

This dam repair project does not trigger WRDA 2007 Section 2035 factors for Safety Assurance Review (termed Type II IEPR in EC 1165--2-214) and therefore, a Type II IEPR review under Section 2035 and/or EC 1165-2-214 is not required. The factors in determining whether a review of design and construction activities of a project is necessary, as stated under Section 2035 and EC 1165-2-214 along with this review plans' applicability statement which follows.

- (1) The failure of the project would pose a significant threat to human life.

The repair of the headgate hoist bay will reduce the threat to human life. All proposed repairs will take place at elevations above the normal lake pool elevation, and even if a sudden, extreme weather event caused the lake pool to rise into the construction zone there is no effect on the integrity or safety of the dam. Therefore, there is no increase risk to human life during the repair effort. The existing dam will be more stable, overall reducing risks of threats to humans when

the repair effort is complete. Construction will incorporate existing engineering standards/methods and will not lead to short term increases in probability of dam failure.

(2) The project involves the use of innovative materials or techniques.

The proposed repairs have been successfully accomplished on other concrete dams similar to Philpott Dam.

(3) The project design requires redundancy, resiliency and robustness.

The repairs will increase the stability of the current dam. During construction, the stability of the current dam will not be reduced and the dam will operate as normally required with full functionality. All proposed repairs will take place at elevations above the normal lake pool elevation, and even if a sudden, extreme weather event caused the lake pool to rise into the construction zone there is no effect on the integrity or safety of the dam.

(4) The project has unique construction sequencing or a reduced or overlapping design construction schedule.

The project design will not require unique construction sequencing, or a reduced or overlapping design construction schedule. The construction sequence has been used successfully by the Corps of Engineers on other similar works.

As indicated above, this project does not pose a significant threat to human life, and does not trigger any of the EC 1165-2-214 factors for Type II IEPR. Therefore, the District Chief of Engineering, as the Engineer in Responsible Charge has determined that a Type II IEPR of these implementation documents (, P&S and DDR) is not needed.

6. BIDDABILITY, CONSTRUCT ABILITY, OPERABILITY, ENVIRONMENTAL, AND SUSTAINABILITY (BCOES) REVIEW

The repairs will be implemented utilizing methods other than open bid therefore no BCOES review will be conducted.

7. MODEL CERTIFICATION AND APPROVAL

Models are not necessary for the Plans and Specifications and the Design Documentation Report.

8. ESTIMATED COSTS AND SCHEDULE

8.1 Project Milestones

District Quality Control	18 May 2015
ATR	18 May 2015
Construction Start	TBD

8.2 ATR Schedule and Cost

The ATR will be conducted in May 2015. It is envisioned that each reviewer will be afforded 28 hours review plus 4 hours for coordination. It is envisioned that the ATR Leader will be allowed 40 hours if also serving as a reviewer. The estimated cost range is \$15k - \$20k. The ATR schedule follows. The dates are based on the 95% draft plans and specifications completion date of May 18, 2015.

ATRT Selected and Resourced (ATR Start)	15 May 2015
ATR Kickoff and ATR Start	18 May 2015
ATRT Completes Comments	22 May 2015
PDT Completes Evaluations	29 May 2015
ATRT Completes Back Checks	29 May 2015
ATR Certification	29 May 2015

9. POINTS OF CONTACT

Per guidance, the names of the following individual will not be posted on the Internet with the Review Plan. Their titles and responsibilities are listed below.

Wilmington District POCs:

Review Plan, ATR and QM Process,

[REDACTED]
910-251-4440
[REDACTED]

Dam Safety Program Manager

[REDACTED]
910-251-4704
[REDACTED]

Project Manager (PM):

[REDACTED]
910-251-4853
[REDACTED]

Chief of Engineering Branch:
Dam Safety Officer for SAW:

[REDACTED]
910 251-4767
[REDACTED]

South Atlantic Division POC:

[REDACTED]
404-562-5121
[REDACTED]

10. MSC APPROVAL

The MSC that oversees the home district is the South Atlantic Division and it is responsible for approving the review plan. Approval will be provided by the MSC Commander. The commander's approval should reflect vertical team input (involving district, MSC, and HQUSACE members) as to the appropriate scope and level of review for the pre-construction and engineering design phase of this effort. Like a PMP, the Review Plan (RP) is a living document and may change as work progresses. Significant changes to the RP should be approved by following the process used for initially approving the RP. In all cases the MSCs will review the decision on the level of review and any changes made in updates to the project scope.

Attachment 1

ACRONYMS AND ABBREVIATIONS

ATR – Agency Technical Review
BCOE – Biddability, Constructability, Operability and Environmental
CESAD – U.S. Army Corps of Engineers South Atlantic Division
DCP – District Control Plan
DDR – Design Documentation Report
DQC – District Quality Control
EC – Engineer Circular
EIS – Environmental Impact Statements
ER – Engineer Regulations
HQUSACE – Headquarters U.S. Army Corps of Engineers
IEPR – Independent External Peer Review
MSC – Major Subordinate Command
PDT – Project Delivery Team
PMP – Project Management Plan
P&S – Plans and Specifications
RMC – USACE Risk Management Center
RMO – Review Management Organization
RP – Review Plan
RTS – Regional Technical Specialists
SAD – South Atlantic Division
SAW – Wilmington District
SAR – Safety Assurance Review
SME – Subject Matter Expert
USACE – U.S. Army Corps of Engineers
WRDA – Water Resources Development Act

