US Army Corps of Engineers®

Prepared by:

Mississippi Valley Division
St Louis District

Review Plan: Melvin Price Locks and Dam Main Lock Lift Gate Replacement

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Last Revision Date: *None*

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Section 1
Introduction

1.1 Purpose

This Review Plan (RP) for Melvin Price Locks and Dam, Main Lock Lift Gate Replacement will help ensure a quality-engineering project is developed by the Corps of Engineers in accordance with EC 1165-2-217, "Review Policy for Civil Works" and ER 1110-1-12 "Quality Management". This RP establishes an accountable, comprehensive, life-cycle review strategy for Civil Works products and lays out a value added process and describes the scope of review for the current phase of work. The EC outlines five general levels of review: District Quality Control/Quality Assurance (DQC), Agency Technical Review (ATR), Biddability, Constructability, Operability, and Sustainability (BCOES) Review, Independent External Peer Review (IEPR), and Policy and Legal Compliance Review. Additionally, the ER outlines procedures for quality checks and reviews, PDT reviews; Biddability, Constructability, Operability, Environmental, and Sustainability (BCOES) review; and quality control certification. Further, additional requirement of the BCOES review will be per ER 415-1-11 This RP will be provided to the Project Delivery Team (PDT), DQC, ATR, and BCOES. The technical review efforts addressed in this RP, DQC and ATR, are to augment and complement the policy review processes. The St. Louis District Chief of Engineering and Construction Division has assessed that the life safety risk of this work to design and fabricate the replacement lift gate for the main lock at Melvin Price Locks and Dam is not significant; therefore a Type II IEPR/Safety Assurance Review (SAR) will not be required, see Section 7.

1.2 References

- EC 1165-2-217, Review Policy For Civil Works, 20 February 2018
- ER 1110-1-12, Quality Management, 31 Mar 2011
- ER 415-1-11, Biddability, Constructability, Operability, Environmental and Sustainability (BCOES) Reviews, 1 January, 2013
- MVD Quality Management Plan (QMS100.1-MVD) and MVS Supplement (QMS100.1–MVS)
- ER 1110-1-8159, Dr. Checks

1.3 Review Management Organization

The USACE Inland Navigation Design Center (INDC) is the Review Management Organization (RMO) for this project. The RMO is responsible for managing the ATR described in this RP.

Section 2
Project Description

The Lock and Dam 26 Replacement, later renamed Melvin Price Locks and Dam, was constructed two miles downstream from the original Lock and Dam No. 26. The replacement consisted of three stages of construction each with its own cofferdam system. The first stage and second stage cofferdams, adjacent to the Missouri bank, included construction of seven Tainter gate dam monoliths and the main 1200-ft lock, respectively; construction of the first stage was finished in 1985 and the second stage was finished in 1989. During the first stage and second stage construction period, the original Lock and Dam 26 functioned normally and river traffic was allowed to pass the cofferdams, at original Dam 26 lower pool, adjacent to the Illinois bank. The third and final stage cofferdam included construction of two additional Tainter gate dam monoliths and an auxiliary 600-ft lock. The third stage cofferdam was constructed adjacent to the Illinois bank and connected to the already-constructed main lock monoliths. The third stage cofferdam along with the completed portion the replacement lock and dam was designed to retain the Lock and Dam 26 upper pool, thus allowing the original lock and dam to be decommissioned prior to the opening of the replacement lock and dam. However, during the relatively short period of time for construction of the cofferdam itself for the third stage cofferdam, it was necessary for river traffic to transit the replacement main 1200-ft lock. Since upper pool was not yet achievable at the replacement lock, there would be insufficient clearance for traffic at the upper gate sill at the original lock lower pool level. Thus, the plan of three low-height lift gate leaves, along with a reduced-height upper sill, was developed to allow river traffic to clear the lift gate and sill during this short period of time. Once the third stage cofferdam was complete and upper pool was retained at the replacement lock site, the construction plan called for the main lock to be closed for a period to raise the main lock upper sill and to install an elevated gate rest for the upstream lift gate leaf.

The existing three leaf lift gate system will be replaced with a two leaf lift gate system. The project consists of design and fabrication of the replacement lift gate only. The replacement lift gate will be installed with another contract. The replacement lift gate leaves will be modernized and detailing will be improved to minimize fatigue and fracture concerns. Detailing of the replacement lift gate leaves will improve the ability to inspect and repair the structure. The new design will incorporate material and fabrication requirements consistent with current guidance.

Section 3
Documentation of Issues/Risks

3.1 Description of Issues

The existing three leaf lift gate system experiences frequent operation issues and has inherent issues with the overall design of the system. The low profile requirement for the three lift gate leaves resulted in a non-optimal span-to-depth ratio for supporting vertical hydraulic loads and results in extremely high deflections under normal loading and operation. The low profile nature of

the existing lift gate leaves makes it necessary to operate a minimum of two leaves for every lockage and under certain river levels all three leaves must be operated with very little overlap of the individual leaves. This complication of gate operation requires unreasonable precision by the lock control system and instrumentation and makes the entire system more susceptible to lock outages from gate leaf separation and/or other operational interlocks.

The fundamental issues with the original concept of the original three leaf system are compounded by very poor design of members and connections for fatigue and fracture resistance. Due to poor fatigue detailing, extensive fatigue cracking has occurred in the existing lift gate leaves. Some of the fatigue cracks in critical areas of the existing lift gate leaves are unable to be repaired or inspected to monitor fatigue crack growth due to lack of access to these critical areas. Additionally, the wire rope connections must be inspected only with great difficulty from underneath the gate leaves when the lock is in a dewatered condition.

3.2 Risks Associated with Failure

Catastrophic failure of the lift gate or lift gate wire ropes would render the lift gate inoperable and result in the lengthy closure of the main lock. A lengthy closure of the main lock would have significant economic consequences to the navigation industry.

Additionally, the existing lift gate has the added function of passing ice and debris to clear the upper approach to the main lock. With lower pool in the main lock chamber, the existing downstream leaf is submerged 5 feet below upper pool with the downstream miter gate in the recess position. Failure of the lift gate leaves during this operation would result in the uncontrolled flow through the main chamber

3.3 DQC/ATR Review Level

Due to the importance of the project to the St. Louis District's navigation mission, District Quality Control (DQC) Review and Agency Technical Review (ATR) will be performed on product deliverables (P&S and DDR) at a 35% Level, a 65% Level, and on the Final Package. See Section 5 for details regarding DQC Review. See Section 6 for details regarding ATR.

3.4 Risk Register

Documentation of the risks identified in the course of the design and construction will be maintained in a Risk Register, which will be kept on file in the ProjectWise folder setup for this project.

Section 4
Project Delivery Team

The PDT will have discipline leads with extensive professional and technical experience in their assigned areas of responsibility. Additional, PDT members with lesser experience may be assigned to project but will perform the design under the guidance of the discipline lead. Should future requirements require the application of different skills or experience than initially planned, appropriate additional personnel will be added to the PDT.

See Attachment 1, Table 5 for the PDT member list.

Section 5
District Quality Control

5.1 Requirements

All implementation documents (including plans, specifications, design document report, supporting data, analyses, reports, environmental compliance documents, water control manuals, etc.) shall undergo DQC in accordance with EC 1165-2-217 and ER 1110-1-12. MVS will manage the Structural and Electrical DQC reviews while MVR will manage the Mechanical DQC Reviews. The DQC reviews shall be performed in accordance with the MVD Quality Management Plan (QMS100.1-MVD) and the MVS Supplement (QMS100.1–MVS). Both documents are stored on the USACE Quality Management System (QMS) Portal. In addition to this, red dot checking or equivalent method will be used to check all documents per guidance EC 1165-2-217.

See Attachment 1, Table 6 for the DQC Lead, reviewers, and reviewer's disciplines.

5.2 Documentation of DQC

Documentation of project DQC activities is required and will be implemented by the processes referenced in paragraph 5.1. At the conclusion of the DQC effort, the Technical Lead will prepare a DQC certification memo. The final quality report will be prepared in accordance with EC 1165-2-217 and included in the DDR. The certificate templates for project DQC are located in Attachment 3.

5.3 DQC Schedule and Estimated Cost

Although DQC is always seamless, the following milestone reviews are scheduled in Table 1. The cost for the DQC is approximately $25,000.

Project Phase/Submittal	Review Start Date	Review End Date
DQC 35% P&S/DDR Review	7/7/20	7/13/20

DQC 65% P&S/DDR Review	10/14/20	10/23/20
DQC Final P&S/DDR Review	3/1/21	3/7/21

Table 1 DQC Schedule

5.4 Products to Undergo DQC

Products that will undergo DQC include the Plans, Specifications, and DDR.

Section 6
Agency Technical Review

6.1 Requirements

All implementation documents (including supporting data, analyses, reports, environmental compliance documents, water control manuals, etc.) shall undergo ATR in accordance EC 1165-2-217. ATR reviews will occur seamlessly, including early involvement of the ATR team for validation of key design decisions, and at the scheduled milestones as shown in Section 6.6. An ATR team site visit will only be scheduled as deemed necessary and be evaluated for each discipline to determine if an in-person review of current site conditions, features, and assessment of life safety is required to ensure the quality and credibility of the government's scientific information. Additional data required by the ATR team will be gathered by PDT members and will be disseminated to the ATR team.

6.2 Documentation of ATR

Documentation of ATR will occur using the requirements of EC 1165-2-217. This includes the four part comment structure and the use of DrChecksSM. ATR may be certified when all ATR concerns are either resolved or referred to HQUSACE for resolution and the ATR documentation is complete. Certification of ATR should be completed, based on work reviewed to date, for the Design Documentation Report (DDR).The certificate templates for project DQC are located in Attachment 3.

6.3 Products to Undergo ATR

Products that will undergo ATR include the Plans, Specifications, and DDR.

6.4 Required Team Expertise and Requirements

ATR teams will be established in accordance with EC 1165-2-217. All ATR members should be registered with CERCAP as a reviewer, unless approved separately, with qualifications matching the project requirements and their perspective roles. To assure independence, the leader of the ATR team will be outside the MSC. The ATR team shall have expertise related inland navigation to include the design and fabrication of navigation lock

components and hydraulic steel structures (HSS). See Attachment 1, Table 7 for the list of ATR reviewers. The following disciplines will be required for ATR of this project:

ATR Lead: The ATR team lead shall be a senior professional engineer outside the home MSC with extensive experience in preparing Civil Works documents and conducting ATRs. The lead has the necessary skills and experience to lead a virtual team through the ATR Process. The ATR lead may also serve as a reviewer for a specific discipline. The ATR team lead will have an extensive background in hydraulic steel structures and inland navigation projects.

Electrical Engineer: Reviewer shall be a senior level engineer with extensive experience in cathodic protection of hydraulic steel structures. The reviewer shall have a minimum of 10 years of experience.

Hydraulics Engineer: Reviewer shall be a senior level engineer with extensive experience in hydraulic analysis of inland navigation projects. The reviewer shall have a minimum of 10 years of experience.

Mechanical Engineer: Reviewer shall be a senior level engineer with extensive experience in mechanical components of hydraulic steel structures. The reviewer shall have a minimum of 10 years of experience.

Structural Engineer: Reviewer shall be a senior level engineer with extensive experience in the design of hydraulic steel structures and shall have specialized experience in the design, fabrication and analysis of hydraulic steel structures. The reviewer shall have a minimum of 10 years of experience.

Welding/Fabrication SME: Reviewer shall be a senior level structural engineer, with extensive experience in welding and fabrication of large hydraulic steel structures. The reviewer shall have a minimum of 10 years of experience.

6.5 Statement of Technical Review Report

At the conclusion of the ATR effort, the ATR team will prepare a review report with a completion and certification memo. The report will be prepared in accordance with EC 1165-2-217.

6.6 ATR Schedule and Estimated Cost

Although ATR is always seamless, the preliminary ATR milestone schedule is listed in Table 2. The cost for the ATR is approximately $50,000.

Project Phase/Submittal	Review Start Date	Review End Date
ATR 35% P&S/DDR Review	7/20/20	7/26/20
ATR 65% P&S/DDR Review	11/2/20	11/15/20
ATR Final P&S/DDR Review	3/22/21	4/4/21

Table 2 ATR Schedule

Section 7
Independent External Peer Review (IEPR)

7.1 Decision on Type II IEPR (SAR)

The following evaluations indicate whether or not a Type II IEPR (SAR) is recommended for the contracts within the project currently in the PED Phase. The MVS Chief of Engineering and Construction has made a risk-informed-decision that this work does not pose a significant threat to human life (public safety). Therefore, a SAR will not be required for the work included in this effort.

(1) Does failure of the project pose a significant threat to human life or is the project justified by life safety?

This work involves the design and fabrication of replacement lift gate. Sudden failure of the lift gate would affect the operability of the lock, but does not pose a significant threat to human life, nor is the project justified by life safety.

(2) Does the project involve the use of innovative materials or techniques?

Construction and fabrication of the lift gate will utilize standard methods and procedures used by the Corps of Engineers on other similar work.

(3) Does the project design require redundancy, resiliency, or robustness?

The project design requires appropriate levels of fracture toughness resiliency and robustness that are required by ETL 1110-2-584, Design of Hydraulic Steel Structures.

(4) Does the project have a unique construction sequencing or a reduced or overlapping design construction schedule?

The design is not innovative and is not using design or construction techniques that are precedent setting; nor is the project using unique construction scheduling or ECI delivery systems.

Based upon the assessment above, a Type II IEPR (SAR) will not be required. The signed memo justifying the rationale not to conduct a Type II IEPR (SAR) is shown in Attachment 2.

Section 8
BCOES Review

8.1 Requirements

The Technical Lead is the review leader for all BCOES reviews and, as such, is responsible for managing all BCOES reviews and assuring all DrChecks comments are resolved and closed. BCOES reviews are done during design for a project using design-bid-build (D-B-B) method. The BCOES review will be performed in accordance with ER 415-1-11 and ER 1110-1-12 on all implementation documents (including supporting data, analyses, reports, environmental compliance documents, water control manuals, etc.) to ensure:

(1) Clarity of the acquisition documents, the soundness of the government's evaluation and selection criteria for negotiated acquisitions, and the ease of bidders or proposers to understand the government's requirements, allowing the submission of a competitive bid or proposal that is responsive to the government's requirements.

(2) Ease of constructing a specified or designed project according to the government's requirements, including the proposed construction duration, and the ease of understanding and administering the contract documents during their execution.

(3) Ability to efficiently operate and maintain a facility or facilities over their life cycle when the facility or facilities are built according to the project's plans and specifications.

(4) Ability to best achieve stewardship of air, water, land, animals, plants, and other natural resources when constructing and operating the project, and complying with the Environmental Impact Statement or Assessment or other environmental related project requirements. The USACE Environmental Operating Principles (EOPs) in ER 200-1-5 provide direction on achieving synergy between the environment and the execution of projects. The Environmental part of a BCOES review shall address all EOPs including compliance with all applicable local, state, and Federal environmental requirements.

(5) The design is using methods, systems, and materials that optimize incorporation of a site's natural land, water, and energy resources as integral aspects of the development and minimize or avoid harm to the air, water, land, energy, human ecology and nonrenewable resources on- and off-site of the project.

See Attachment 1, Table 8 for the list of BCOES reviewers.

8.2 Documentation

Engineering Considerations and Instructions (ECIs) will be included with the documents reviewed during BCOES. The designer will resolve comments from the BCOES review. All comments and comment resolutions will be performed and documented in DrChecks as per ER 1110-1-8159.

The BCOES review, incorporating all required facets, will occur after all ATR comments are resolved and the ATR is completed and certified. The start of the final BCOES review is currently scheduled for April 2021. Upon completion of a BCOES review and prior to final approval of the P&S, the Technical Lead will document all comments, resolutions and identify the actual personnel who performed the BCOES review. A BCOES certification will be completed in accordance with ER 415-1-11. The certificate template is located in Attachment 3.

Section 9

Value Based Design Charrette

A Value Based Design Charrette, which was coordinated through the INDC, was completed for the project in October 2019. There were a total of nine proposals recommended by the Value Based Design Charrette Team, six of which involve the replacement of the lift gate. MSC concurrence for rejection of individual proposals was obtained as required.

Section 10

Public Posting of Review Plan

As required by EC 1165-2-217, the approved RP will be posted on the District public website (https://www.mvs.usace.army.mil/Missions/Programs-Project-Management/Plans-Reports/). This is not a formal comment period and there is no set timeframe for the opportunity for public comment. If and when comments are received, the PDT will consider them and decide if revisions to the RP are necessary.

Section 11

Review Plan Approval and Updates

The MSC Commander, or delegated official, is responsible for approving this RP. The Commander's approval reflects vertical team input (involving the District, MSC, and INDC) as to the appropriate scope, level of review, and endorsement by the INDC. The RP is a living document and should be updated in accordance with EC1165-2-217 and ER 1110-12. All changes made to the approved RP will be documented in Attachment 4, Table 9 RP Revisions. The latest version of the RP, along with the Commanders' approval memorandum, will be posted on the District's webpage and linked to the HQUSACE webpage. The approved RP should be provided to the RMO.

Section 12
Engineering Models

The use of certified, validated, or agency approved engineering models is required for all activities to ensure the models are technically and theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions. 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. 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, BCOES, policy and legal review, and SAR (if required). Where such approvals have not been completed, appropriate independent checks of critical calculations will be performed and documented. The following engineering models, software, and tools are anticipated to be used.

Software/Model/Tool Name	Model Description	Model Type
Microstation V8i SS4	CADD	Engineering
STAAD Pro SS6	Structural Analysis and Design	Engineering
MathCad Prime 3.1	Computational Analysis	Engineering
Autodesk Inventor 2019	CADD	Engineering
AutoCAD 2020	CADD	Engineering
Microsoft Excel	Computational Analysis	Engineering

Table 3 Models and Status

Section 13
Review Plan Points of Contact

Title	Organization	Phone
Review Manager	CEMVS-EC	314-331-8281

Table 4 RP POC