

REVIEW PLAN
for

CAP Section 205
Mad Creek Flood Risk Management Project, Phase II,
Muscatine, Iowa

Rock Island District

MSC Approval Date: August 3, 2011
Last Revision Date: March 7, 2012



**US Army Corps
of Engineers®**

**REVIEW PLAN
USING THE MVD MODEL REVIEW PLAN**

*CAP Section 205
Mad Creek Flood Risk Management Project, Phase II
Muscatine, Iowa*

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1. Purpose and Requirements

a. Purpose. This Review Plan defines the scope and level of peer review for the *CAP Section 205 Mad Creek Flood Risk Management Project, Phase II, Muscatine, Iowa* (Project) implementation documents. The *Final Detailed Project Report with Environmental Assessment, Section 205 Flood Damage Reduction Study, Mad Creek, Muscatine, Muscatine County, Iowa* dated November 2002 was approved in February 2003. The 2002 report represents the decision document for this project. The Phase I segment of the project consisted of Plans and Specifications and subsequent construction of floodwall and closure improvements downstream of 2nd Avenue. Phase I construction was completed in October 2010. Federal funding and non-Federal sponsor real estate acquisition timelines have resulted in the 8 plus year timeline from 2003 project approval to Phases I completion and Phase II implementation. Phase II was further delayed by non-Federal sponsor real estate permits with an adjacent railroad.

The Mad Creek Phase II items to be reviewed are:

- **Plans.** Mississippi River, Mad Creek, Muscatine, Iowa, Two-Foot Raise, Phase II Flood Risk Management Project
- **Specifications.** Two-Foot Raise, Phase II, Flood Risk Management Project, Mad Creek, Mississippi River, Muscatine, Iowa

Section 205 of the Flood Control Act of 1948, as amended, authorizes USACE to study, design and construct flood risk management (FRM) projects. This is a Continuing Authorities Program (CAP) which focuses on water resource related projects of relatively smaller scope, cost and complexity. Unlike the traditional Corps' civil works projects that are of wider scope and complexity, the CAP is a delegated authority to plan, design, and construct certain types of water resource and environmental restoration projects without specific Congressional authorization.

b. Applicability. This Review Plan satisfies the project review requirements contained in Engineering Circular 1165-2-209, Civil Works Review Policy, 31 January 2010.

c. References

- 1) Engineering Circular (EC) 1165-2-209, Civil Works Review Policy, 31 January 2010.
- 2) Director of Civil Works' Policy Memorandum #1, CECW-P, dated 19 January 2011.
- 3) EC 1105-2-412, Assuring Quality of Planning Models, 31 March 2010.
- 4) Engineering Regulation (ER) 1110-1-12, Quality Management, 30 September 2006.
- 5) ER 1105-2-100, Planning Guidance Notebook, Appendix F, Continuing Authorities Program, Amendment #2, 31 January 2007.
- 6) ER 1105-2-100, Planning Guidance Notebook, Appendix H, Policy Compliance Review and Approval of Decision Documents, Amendment #1, 20 November 2007.
- 7) *Final Detailed Project Report with Environmental Assessment, Section 205 Flood Damage Reduction Study, Mad Creek, Muscatine, Muscatine County Iowa*, November 2002.
- 8) Mad Creek Project Management Plan, April 2003, as revised, April 2011

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- 9) Project Partnership Agreement between the Department of the Army and the City of Muscatine, Iowa, 28 Sep 2008
- 10) USACE Quality Management System
- 11) District Quality Control Review, April 2011
- 12) EC 1105-2-410, Review of Decision Documents, CECW-CP, 22 August 2008
- 13) Sections 2034 and 2035 of the Water Resources Development Act of 2007, (P.L. 110-114)
- 14) Memorandum dated 14 January 2011, Subject: MVD Agency Technical Review on Implementation Documents.
- 15) USACE Institute for Water Resources Risk Management Center web site.
<https://kme.usace.army.mil/Centers/IWR/RMC/External/Quality/default.aspx>
- 16) 03501-MVD. MSC Review of Planning Products
- 17) 03502-MVD. Preparation and Approval of CAP Review Plans
- 18) 03502.1-MVD. MVD CAP Review Plan Checklist and Model Review Plans, 05 May 2011
- 19) 08502-MVD. Review Plans for Technical Products, 06 May 2011

2. Review Management Organization (RMO) Coordination

The RMO is responsible for managing the overall peer review effort described in this Review Plan. The RMO for Section 205 levee and floodwall projects is the USACE Institute for Water Resources Risk Management Center (RMC). For the Mad Creek Phase II project, the RMC has delegated the primary RMO responsibilities to the Mississippi Valley Division (MVD). The MVD will coordinate and approve the Review Plan and manage the Agency Technical Review (ATR). The RMC will provide review oversight and concurrence on the Review Plan. The approved Review Plan will be available to the public as a supplement to the Project Fact Sheet.

The Mad Creek Phase II Project is a flood risk management project that represents a significant threat to life-safety if the project were to overtop or malfunction; with an expected loss of life values for the population at risk of 0.1 for residential, 0.3 for night-time workforce, and 0.1 for daytime workforce. As determined by the RMC, an Independent External Peer Review (IEPR) Type II – Safety Assurance Review (SAR) is required. The SAR will be co-managed by the District and the RMC.

3. Project Information

a. Study/Project Description. Phase II of the Project is being constructed along the right descending bank of Mad Creek, a tributary of the Mississippi River in Muscatine, Muscatine County Iowa. Mad Creek drains a watershed of approximately 17.3 square miles in the east/northeast sector of the city. The work to be completed in Phase II will raise the existing levee and flood wall system approximately 2 feet and will construct two new closures structures to replace the existing closure structures. Buttresses will be constructed on the landward side of the floodwall, to prevent overturning. This work is consistent with the Phase I construction.

The Phase II construction cost is at \$2,260,000. The Phase II construction contract is scheduled to be awarded in August 2011. Once construction of Phase II is complete, the FRM system protecting this industrial/commercial area adjacent to downtown Muscatine, Iowa will be complete.

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b. Factors Affecting the Scope and Level of Review. The following discussion focuses on those factors that are to be considered when defining the appropriate scope and level of review:

1. Project Background. The Project was originally designed to be built under a single construction contract. At the request of the City as the non-Federal Sponsor (NFS), the Project was divided into two phases. This request was approved by the District’s Chief of Engineering. Prior to the Project being divided into two phases, an Independent Technical Review (ITR) was conducted on the entire Project in accordance with prevailing USACE review policies. Construction of Phase II is a continuation of the work completed in Phase I.

Design of the Mad Creek, Phase II Project was completed in accordance with current USACE design standards. The following is a list of design standards referenced for this Project:

Design Document	Description
ER 1105-2-100	Planning Guidance Notebook
ER 1105-2-101	Risk-Based Analysis for Evaluation of Hydrology/Hydraulics, Geotechnical Stability, and Economics in Flood Damage Reduction Studies
ER 1110-2-1150	Engineering and Design of Civil Works Projects
ER 1110-2-1806	Earthquake Design and Evaluation For Civil Works Projects
EM 1110-2-1619	Risk-Based Analysis for Flood Damage Reduction Studies
EM 1110-2-1913	Design and Construction of Levees
EM 1110-2-2100	Stability Analysis of Concrete Structures
EM 1110-2-2102	Water Stops and Other Joint Material
EM 1110-2-2104	Strength Design for Reinforced Concrete Hydraulic Structures
EM 1110-2-2105	Design of Hydraulic Steel Structures
EM 1110-2-2502	Engineering and Design Retaining and Flood Walls
EM 1110-2-2705	Structural Design of Closure Structures for Local Flood Protection
EM 1110-2-2902	Conduits, Culverts and Pipes
EM 1110-2-2906	Design of Pile Foundations
EM 1110-2-6053	Earthquake Design and Evaluation of Concrete Hydraulic Structures
ETL 1110-2-571	Guidelines for Vegetation on Levees
AISC Steel Code 13th Ed	Steel Design Specification
ACI 318-08	Concrete Design Specification
ETL 1110-2-573	Construction Cost Estimating Guide for Civil Works

Review of the Project against these design standards included senior engineers checking the drawings and computations followed by a series of reviews that included the DQC, ATR, and BCOE. As a result, no technical consequences are anticipated. There are no innovative materials, techniques, or unique challenges associated with constructing Phase II.

This Project was justified based a benefit to cost ratio of greater than 1. Other social effects and regional economic development were not considered when the recommended plan was selected. The Project’s location is shown on Figure 1.

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Figure 1. Mad Creek FRM Project Location

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2. Protected Area. As shown in Figure 2, the area behind the Mad Creek Levee and Floodwall System is comprised of commercial and industrial development. The employers in the protected area employ a total of approximately 1,300 personnel working three shifts with approximately 90% associated with a day-time shift. Additionally, there are 18 individuals residing in the protected area. No critical infrastructure is located in the protected area.

In 1961, construction was completed on the lower portion of the FRM system to protect the downtown area from Mississippi River backwater flooding and flooding along Mad Creek. This system of levees and floodwalls is 3,460 feet long. In 1983, the system was extended upstream to further reduce the flood risk from Mad Creek. During each of five floods along Mad Creek (1990, 1993, 1997, 2000, and 2011), the FRM system performed satisfactorily and no damage resulted.

Figure 3 defines the extent of inundation resulting from an overtopping of the final Mad Creek FRM system. This occurs at an elevation of 561.3 feet NAVD 88. As seen in this figure, the area of inundation is only several city blocks wide and covers approximately 18 acres of industrial and commercial land located landward of the Phase I and II reaches. Figure 3 also shows the critical infrastructure in the Project area. As shown, no critical infrastructure is located in the protected area.

3. Potential Failure Modes. Potential failure modes are a rainfall event exceeding the design storm and overtopping the levee; the City failing to properly install closure structures, or not installing closure structures in a timely manner; and a levee breach prior to overtopping.

Flooding along Mad Creek through the project reach is caused by either backwater flooding from the Mississippi River or rainfall flooding on the Mad Creek watershed. Mad Creek flooding provides limited warning time and the City of Muscatine has a flood warning system and response system to provide lead time for Project operations and flood notices. For a Mississippi River flooding scenario, there is adequate time to warn businesses and residents of a pending flood event.

4. Population at Risk/Threat to Human Life. For purposes of evaluating the threat to human life posed by the Mad Creek levee system, a procedure for estimating the population at risk and loss of life caused by dam failure was utilized to estimate the loss of life threat by an overtopping, breach or closure malfunction event on the Mad Creek levee system. The residential population at risk is 18. Night-time risks to human life are higher in flood events, especially for persons sleeping behind a levee were a catastrophic event to occur. The estimated loss of life in the event of catastrophic levee breach prior to overtopping is 0.4 lives.

c. In-Kind Contributions. Products and analyses provided by the NFS as in-kind services are subject to District Quality Control Review (DQC) and ATR, similar to any products developed by USACE. The City of Muscatine as the NFS will make no in-kind contributions.

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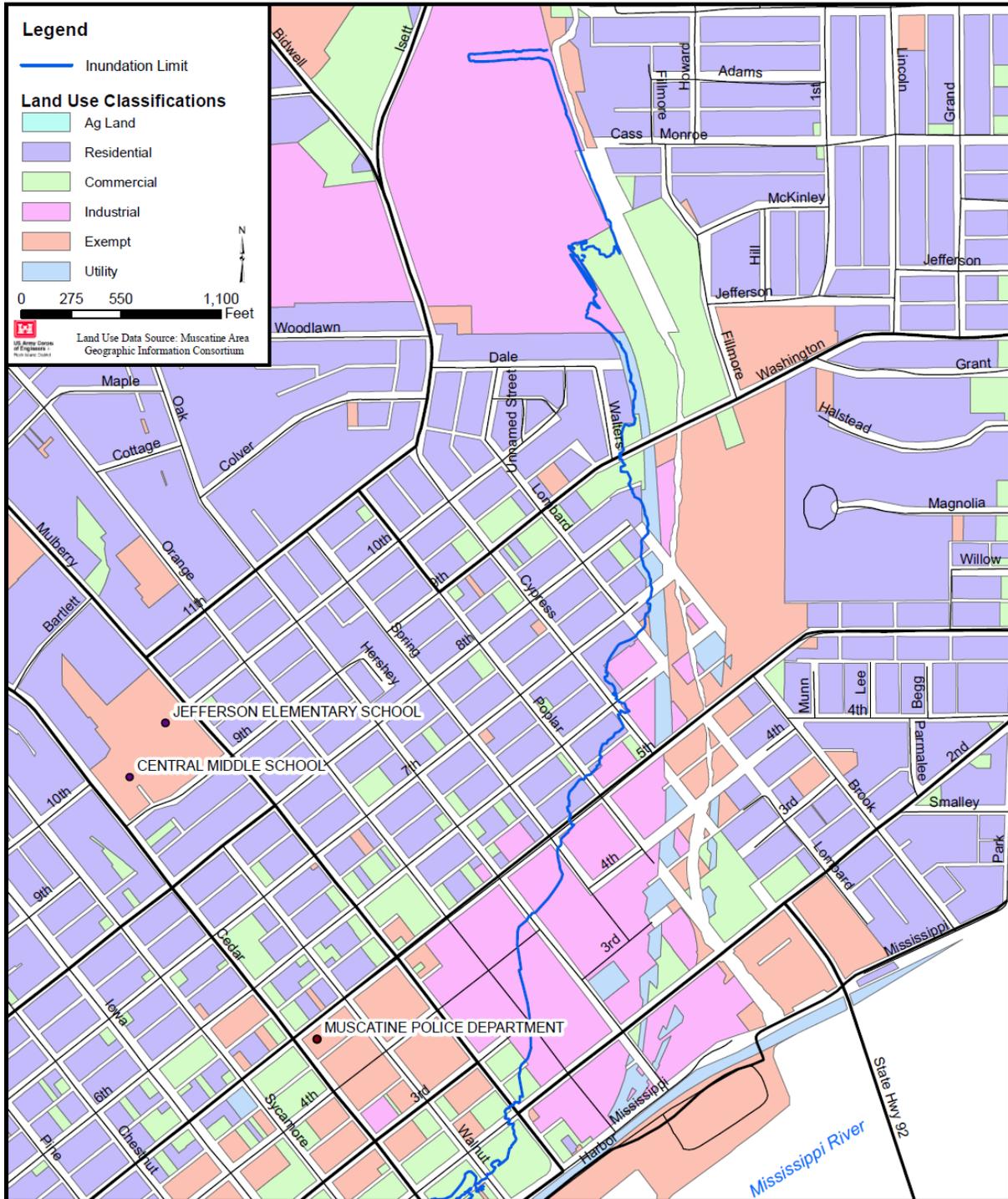


Figure 2. City of Muscatine Land Use Map

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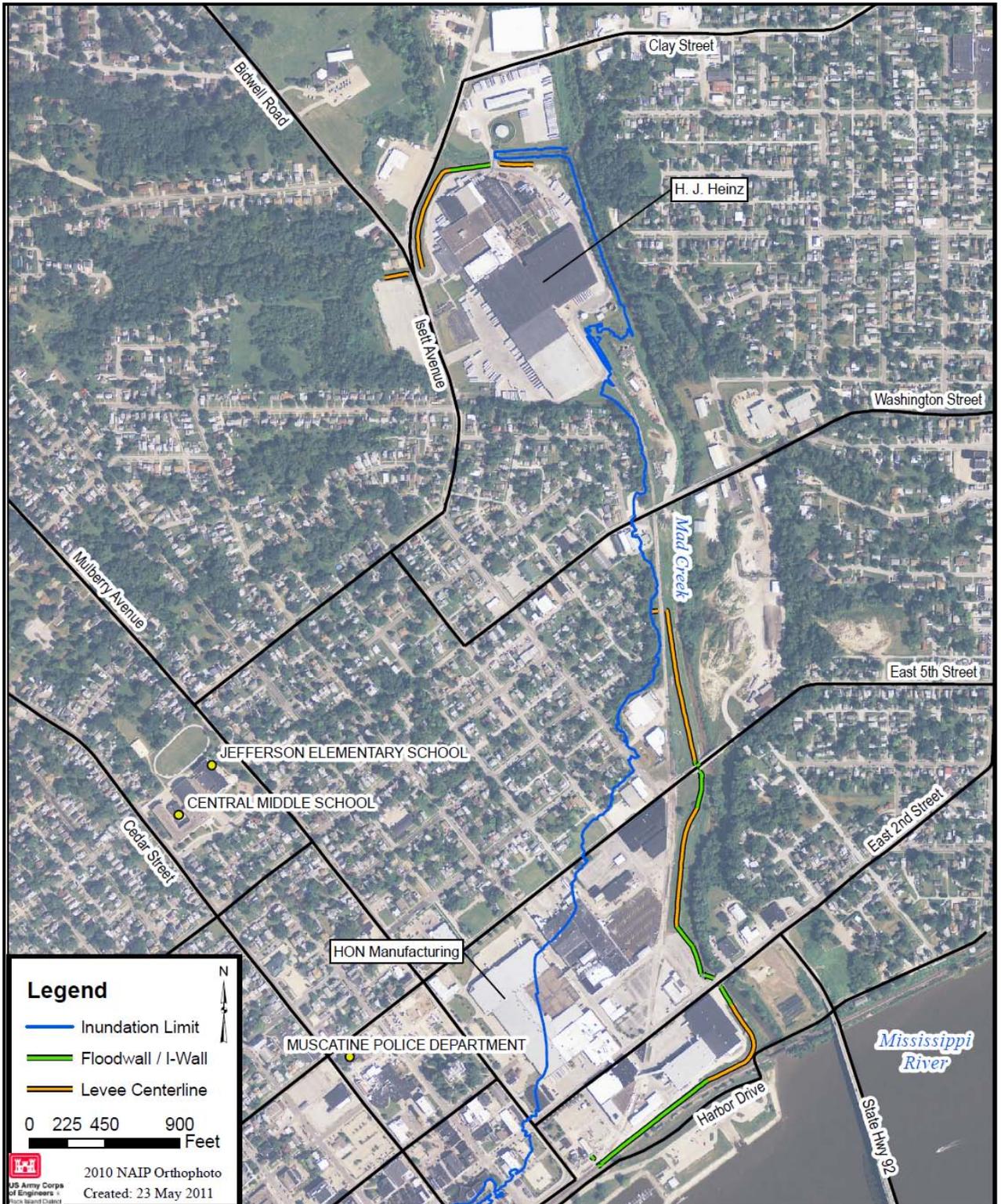


Figure 3. Area of Inundation Below New Top-of-Levee Flood Elevations

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4. District Quality Control Review (DQC)

All implementation documents (including supporting data, analyses, environmental compliance documents, etc.) shall undergo DQC. DQC is an internal review process of basic science and engineering work products focused on fulfilling the quality requirements defined in the Project Management Plan (PMP). The Rock Island District (MVR) managed the DQC for the Phase II implementation documents. The DQC review was conducted in accordance with the process outlined in the MVR PMP for Mad Creek. In summary, the highlights of the DQC are:

- **Purpose:** Review of science and engineering work products
- **Managed by:** Design Manager
- **Performed by:** MVR Technical Team Members
- **Required for:** All work products, reports, evaluations, and assessments
- **Documentation:** DrChecks

The DQC was completed on May 25, 2011.

5. Agency Technical Review (ATR)

a. ATR Requirements. ATR is mandatory for all implementation documents that are non-routine in nature; including the Mad Creek Phase II Plans and Specifications. The objective of ATR is to ensure consistency with established criteria, guidance, procedures, and policy. An ATR will assess whether the Plans and Specifications are technically correct and comply with published USACE guidance. An ATR is managed within USACE by the designated RMO and is conducted by a qualified team from outside the home division that was not involved in the day-to-day production of the Project. In summary, the ATR will:

- **Purpose:** Ensure the quality and credibility of the government's scientific information.
- **Managed by:** ATR Leader, from outside the MVD MSC
- **Performed by:** Senior Technical Team Members from outside the MVR; preferably recognized subject matter experts
- **Required for:** Plans and Specifications.
- **Documentation:** DrChecks and Agency Technical Review Report
- **RMO:** RMC as delegated to MVD and MVR.

The required areas of expertise for the Mad Creek Phase II Plans and Specifications ATR are as follows:

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ATR Team Members/Disciplines	Expertise Required
ATR Lead	The ATR Lead is a senior professional with experience in preparing Section 205 plans and conducting ATR. The lead should also have the necessary skills and experience to lead a virtual team through the ATR process. Typically, the ATR lead will also serve as a reviewer for a specific discipline. THE ATR LEAD MUST BE FROM OUTSIDE THE MVR.
Hydrology & Hydraulic Engineering	The hydraulic engineering reviewer will be an expert in the field of hydraulics and have a thorough understanding of open channel dynamics, application of levees and flood walls, and computer modeling techniques that will be used such as HEC-RAS.
Geotechnical Engineering	The geotechnical engineering reviewer will be an expert in the field of geotechnical engineering with particular emphasis on the design and construction of levees floodwalls and related components and will have a working knowledge of construction techniques and methods.
Civil Engineering	The civil engineering reviewer will be an expert in the field of civil engineering with particular emphasis on the design and construction of levees floodwalls and related components and will have a working knowledge of construction techniques and methods.
Structural Engineering	The structural engineering reviewer will be an expert in the field of structural engineering with particular emphasis on the design and construction of levees concrete floodwalls and related components including closure structures.

b. ATR Team Selection. Based upon prevailing MVD ATR guidance in February 2011, the MVR Design Branch Chief contacted the Chicago District (LRC) about providing ATR support on the Muscatine Mad Creek P&S review for Phase II. The LRC was contacted based on known past experience with FRM levee improvement projects in the metro-Chicago area that involved levees, floodwalls, and closure structures on streams and rivers that provided limited advance warning similar to the Mad Creek Project. Additionally, the LRC has been actively engaged in the St. Paul District’s Devil’s Lake FRM project serving as the ATR lead and providing several ATR team members; and MVP has been complimentary of the responsive and relevant reviews provided.

Upon selection, the LRC Design Branch Chief responded that LRC could serve as the ATR lead and would determine the extent to which it could properly fill the ATR team disciplines: structural, civil, cost/plans and specifications, geotechnical, and hydrology and hydraulics. From this point forth, the Design Branch Chief coordinated within LRC for the proper staffing to meet the Project’s ATR needs.

c. ATR Charge. A formal ATR charge was not prepared. E-mails and telephone discussions relayed pertinent Project information and review needs from MVR to LRC. Key considerations included:

- the Project meets the customer’s scope; intent and quality objectives as defined in the PMP;
- concepts and Project costs are valid;
- all relevant engineering and scientific disciplines have been effectively integrated;
- appropriate computer models and methods of analysis were used and basic assumptions are valid and used for the intended purpose;
- the source; amount; and level of detail of the data used in the analysis are appropriate for the complexity of the Project;

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- the Project complies with accepted practice within USACE; and
- Project documentation is appropriate and adequate for the Project phase.

d. ATR Execution. The ATR was completed and certified by the ATR team lead on July 12, 2011. Subject matter experts and engineers from the USACE Chicago District, Lakes and Rivers Division who have experience in FRM levee and floodwall projects conducted the ATR. The ATR reviewers were approved by MVD. Selections were based on expertise, experience, and skills, including specialists from multiple disciplines as necessary to ensure comprehensive review.

The District provided the reviewers with sufficient information, including background information about the Project, to enable them to understand the data, analytic procedures, and assumptions.

The Project was reviewed against published guidance, including ERs; ECs; Engineering Manuals; Engineering Technical Letters; Engineering Construction Bulletins; Policy Guidance Letters; implementation guidance; Project guidance memoranda; and other formal guidance memoranda issued by HQUSACE.

DrChecks was used to document the ATR comments, conduct evaluations, and back check comments. Each review comment was succinct and enabled timely resolution of the concern. Comments were limited to those that are required to ensure adequacy of the product. The four key parts of a quality review comment include:

- the review concern – identify the product's information deficiency or incorrect application of policy, guidance, or procedures;
- the basis for the concern – cite the appropriate law or Assistant Secretary of the Army (Civil Works) or USACE policy, guidance, or procedure that has not been properly followed;
- the significance of the concern – indicate the importance of the concern with regard to its potential impact on the construction cost, effectiveness (function/outputs), implementation responsibilities and safety; and/or
- the probable specific action needed to resolve the concern – identify the action(s) that must be taken to resolve the concern.

The ATR leader prepared a Review Report that:

- disclosed the names of the reviewers, their organizational affiliations, and included a short paragraph on both the credentials and relevant experiences of each reviewer;
- addressed the charge to the reviewers, as applicable;
- described the nature of their review and their findings and conclusions; and
- included 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.

Written responses to the ATR Review Report will be prepared to explain the agreement or disagreement with the views expressed in the report, the actions undertaken or to be undertaken in response to the report, and the reasons those actions are believed to satisfy the key concerns stated in

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the report (if applicable). The revised Phase II Plans and Specifications will be provided to the RMO with the District ATR Review Report response and all other materials related to the review.

The ATR leader has submitted a Completion of Agency Technical Review statement for the Mad Creek Phase II Plans and Specifications.

e. Documentation of ATR. DrChecks review software was used to document all ATR comments, responses and associated resolutions accomplished throughout the review process.

6. Independent External Peer Reviews (IEPR)

a. IEPR Type I. IEPR reviews may be required on USACE projects for both the decision (feasibility) and implementation (plans and specifications) documents. IEPR Type I reviews are conducted on decision documents and as the *Final Detailed Project Report* for Mad Creek was fully approved under pre-EC-1165-2-209 review policies, a Type I review was not conducted on the feasibility decision document as part of the approval process in 2003 and is not applicable to this Review Plan.

b. IEPR Type II – Safety Assurance Review (SAR). IEPR Type II, or SAR, reviews are conducted on implementation documents for flood risk management projects such as the Mad Creek levee and floodwall project. On projects where potential hazards created by the project pose a significant threat to human life, the EC 1165-2-209 review policy requirement for conducting an SAR is mandatory. The SAR review is conducted by a panel of experts that are external from the USACE that have design and construction expertise in levee safety projects. The SAR review shall consider the adequacy, appropriateness and acceptability of the design and construction activities in assuring health, safety and welfare. This SAR requirement is based on Section 2035 of WRDA 2007, the OMB Peer Review Bulletin and other USACE policy considerations.

c. Decision on IEPR Type II -SAR. As the Mad Creek Phase II Plans and Specifications, when implemented through a construction contract, pose a potential flood related hazard to protected interior areas where there is population at risk if the project were to overtop or otherwise malfunction, an SAR has been determined to be required by the RMC.

d. IEPR Type II –SAR Scope. The SAR shall be managed by the RMC as delegated to MVD and the District. The SAR shall be scalable based on the size and complexity of the project. The Mad Creek Phase II Project is being undertaken under the USACE's small projects Continuing Authorities Program. There is an existing flood risk management project, and the Phase II improvements do not involve complex designs, innovative measures, or unusual construction activities. Due to the limited scale, scope and lack of complexity, a one-person SAR will be utilized for the Mad Creek IEPR. This individual will have broad civil, geotechnical and structural engineering expertise in levee and floodwall FRM projects. The SAR reviewer's experience shall be at the Level 2 expertise level with at least 15 years experience and shall be a licensed professional engineer in the State of Iowa. Per guidance, the SAR shall be targeted to cost between 0.9% and 1.5% of the Phase II project cost, or \$20,300 to \$33,900.

The SAR panel member will be tasked with reviewing the Phase II Plans and Specifications and other pertinent project documents they determine to be applicable. The SAR panel shall conduct one site visit to Muscatine to view the completed Phase I construction that is of similar nature to Phase II, or during the initiation of construction activities on Phase II. The SAR should focus on unique features

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and changes from the assumptions made and conditions that formed the basis for the design during the decision document phase. The SAR panel should also address each of the following evaluation factors for each of the questions listed below:

- Has the USACE overlooked any critical items?
- Is the direction of the project appropriate?
- Does the panel have any other observations to add?

The charge questions to the SAR panel shall be:

- Do the assumptions made during the decision document phase for hazards remain valid through the completion of design as additional knowledge is gained and the state-of-the-art evolves?
- Do the project features adequately address redundancy, resiliency or robustness with an emphasis on interfaces between structures, materials, members, and project phases?
- Do the project features and/or components effectively work as a system?
- Do the assumptions made during design remain valid through construction?

The SAR panel shall prepare a final report per IEPR Type II – SAR guidance and as detailed in the SAR scope of work. After receiving the report, the Rock Island District Engineering and Construction (EC) Chief 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 EC Chief shall submit the SAR panel’s report and the District’s responses to the MVD for final Commander approval.

7. Policy and Legal Compliance Review

USACE projects are reviewed throughout the project process for their compliance with law and policy. Guidance for policy and legal compliance reviews is addressed in Appendix H, ER 1105-2-100. These reviews culminate in determinations that the recommendations in the reports and the supporting analyses and coordination comply with law and policy, and warrant approval or further recommendation to higher authority by the MVD Commander. DQC and ATR augment and complement the policy review processes by addressing compliance with pertinent published Army policies, particularly policies on analytical methods and the presentation of findings in decision documents. The Mad Creek Phase II plans and specification implementation documents underwent a policy and legal compliance review by the District’s Office of Council and have been certified as policy and legal compliant on June 29, 2011.

8. Model Certification and Approval

Approval of planning models under EC 1105-2-412 is not required for CAP projects. The MVD Commander remains responsible for assuring the quality of the analyses used in these projects. The ATR process is used to ensure that models and analyses are compliant with Corps policy, theoretically sound, computationally accurate, transparent, described to address any limitations of the model or its use, and documented in study reports.

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9. Review Schedules and Costs

a. Schedule. The authorizing decision document for the Project is the Mad Creek DPR, which was approved on February 24, 2003. The Phase 1 Construction Contract was awarded on January 8, 2010, and the Notice to Proceed was issued on January 25, 2010. Construction of Phase I improvements were substantially complete in October 2010. These actions occurred prior to the implementation of EC 1165-2-209. There is no unique construction scheduling associated with construction of the Project including the remaining Phase II work. The remaining Project Phase II schedule is as follows:

Milestone	Scheduled Completion Date
Mad Creek Phase II Construction	
Complete DQC	May 25, 2011
Complete ATR	Jun 12, 2011
Complete BCOE	Jun 15, 2011
FedBizOps	Jun 20, 2011
Phase II RE Acquired	Jun 25, 2011
Solicitation	Jul 1, 2011
ATR Certification	Jul 12, 2011
Bid Opening	Aug 2, 2011
Award Contract	Aug 15, 2011
Notice to Proceed	Aug 29, 2011
Phase II Construction Complete	Jun 29, 2012
Physical Close Out	Jul 27, 2012
Fiscal Closeout	Nov 12, 2012
Final Accounting/Project Closeout	Dec 12, 2012
IEPR Type II - SAR	
Prepare SAR Scope of Work and Charge	Sep 1, 2011
Request SAR Contract Proposal	Sep 12, 2011
Award SAR Contract	Sep 19, 2011
SAR Panel submits Quality Management Plan	Oct 6, 2011
Corps / SAR Panel Kick-off Meeting / Site Visit	Oct 31, 2011
SAR Panel Comments to Corps	Dec 30, 2011
District SAR Written Responses	Jan 30, 2012
Final SAR Coordination with MVD and RMC	Feb 29, 2012

b. Review Costs. The cost to conduct the SAR is not to exceed \$25,000

10. Review Plan Approval and Updates

MVD is responsible for approving this Review Plan based upon feedback and endorsement from the RMC. The Review Plan is a living document and may change as the project progresses. The District is responsible for keeping the Review Plan up to date. Significant changes to the Review Plan (such as changes to the scope and/or level of review) should be reapproved by MVD following the process used for initially approving the plan. Significant changes may result in MVD determining that use of the 08502-MVD Review Plans for Technical Products is no longer appropriate. In these cases, a project-specific review plan process will be prepared and approved in accordance with EC 1165-2-209. The approved Review Plan will be available to the public as a supplement to the Project Fact Sheet.