

EXHIBIT A

Scope of Work

Semi-Quantitative Risk Assessment (SQRA) for the National Flood Insurance Program (NFIP)

Clark Fork Area III Federal Levee Missoula, Montana

Title: National Flood Insurance Program (NFIP) Evaluation of the Clark Fork Area III Systems

Program: Accelerated levee system evaluation under Section 3014(b) of the Water Resources Reform and Development Act of 2014

BACKGROUND INFORMATION

PROJECT DESCRIPTIONS:

The Clark Fork Area III levee is a federally authorized and non-federally operated and maintained complete levee system located in Missoula, Montana. At approximately 3,800 feet, with 2,900 feet of embankment and 900 feet of floodwall, the upstream begins at the Madison Street Bridge with the downstream ending at the North Orange Street Bridge abutment. The project is located on the right bank of the Clark Fork River. Construction on the Clark Fork Area III levee began October 1965 and was completed in June 1966 under authority of the 1950 Flood Control Act. Currently, the project is operated and maintained by the City of Missoula. The Clark Fork Area III levee protects portions of downtown Missoula, MT, including commercial and residential property with a high density population due to the urban setting. With the majority of leveed area serving as a public park, parking lot area, and residential lands, there was an increase in population of 3.6% from 2000 to 2010 leading to an increase of risk if the area was to be inundated. The levee has not experienced significant flood loading and has never overtopped, breached, or had any major modifications or remedial measures during its lifetime.

The City of Missoula, MT is requesting to enter into a cost share agreement with the U.S. Army Corps of Engineers under Section 3014(b) of the Water Resources Reform and Development Act of 2014, to conduct a levee system evaluation and to provide a levee system accreditation recommendation for the purposes of mapping for the National Flood Insurance Program (NFIP).

To aid in preparation of this scope of work, the Project Delivery Team (PDT) has reviewed the requirements outlined in ER 1110-2-1156, Engineering and Design, Safety of Dams – Policy and Procedures, and in the Engineering & Construction Bulletin (ECB) No. 2019-11, *Transition Guidance for Levee System Evaluation for the National Flood Insurance Program (NFIP)*, Appendix B – *USACE Criteria for an NFIP Levee Accreditation Recommendation Using a SQRA or QRA*.

towards the ultimate goal of NFIP recommendation. If it is found that a positive NFIP recommendation is not likely, the PDT and the City of Missoula would decide a path forward to either put the risk assessment on hold to continue at a later date or terminate the effort altogether. If a positive outcome is determined, then the risk assessment can continue as scoped in this document, ultimately resulting in a final report which includes a levee accreditation recommendation.

The risk assessment will not make a determination regarding capacity of the interior drainage system. These efforts will need to be conducted by the local community as needed, in order to apply for accreditation. An evaluation of the levee sponsor's formally adopted Operations and Maintenance manual and Emergency Action Plan will be performed in conjunction with assessment of potentials failure modes and consequences.

SUMMARY OF TASKS TO BE PERFORMED

The proposed scope of work has been split into the following major tasks. The details for each task are presented below. In some instances, there may be sub-tasks associated with each task.

Task 1- PROJECT MANAGEMENT

- 1a Project Management
- 1b Work Plan Development
- 1c Review Plan Development and Approval
- 1d Cost Share Agreement- Sponsor Funding
- 1e Monthly Reporting

Task 2- DATA PREPARATION, REVIEW AND ANALYSIS

- 2a Assemble Existing Data
- 2b Review Existing Data
- 2c Prepare Background (Chapter 2)
- 2d Hydrologic Hazard Estimate (report Chapter 4)
- 2e Seismic Hazard Estimate (report Chapter 5)
- 2f Engineering Analysis
- 2g Prepare Draft Chapters for PFMA/SQRA
- 2h Site Visit
- 2i PFMA
- 2j Consequences- Run HEC-LifeSim (Chapter 6)

Task 3- RISK ASSESSMENT

- 3a Risk Assessment/Elicitation
- 3b Risk Calculation
- 3c Post SQRA District and RMC Vertical Team Briefing

Task 4- DRAFT REPORT

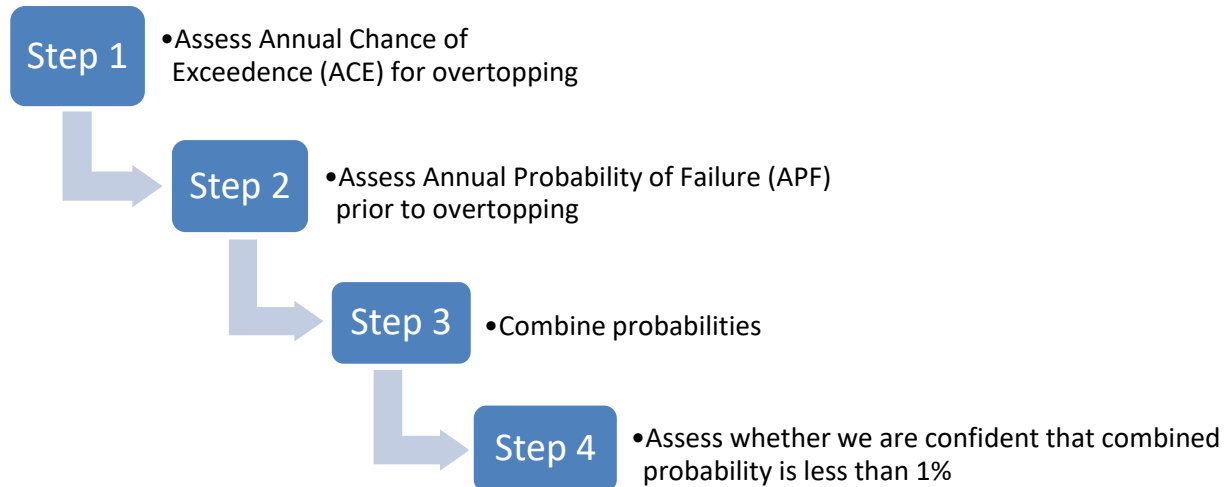
- 4a Risk Assessment Documentation

- 4b Summary and Findings
- 4c Appendices
- 4d Internal Team QC
- 4e Prepare Draft Levee Safety Oversight Group (LSOG) Presentation

Task 5- REVIEW AND APPROVAL

- 5a DQC/Advisor Review
- 5b Agency Technical Review (ATR) and Quality Assurance Review
- 5c Finalize Presentation and Report for LSOG Presentation
- 5d LSOG Meeting
- 5e Finalize Report
- 5f Report Approval

Figure 3. NFIP Evaluation Process



Task 1: Project Management

Includes all tasks related to control of the project from initiation through closeout. Includes monthly reporting and tracking of project expenditures as well as development and approval of all control documents such as the PMP, Work Plan, Review Plan and Cost Share documents.

Task 1a: Project Management

The NWS Project Manager will manage the government/sponsor funds and approvals for requested labor codes as well as create and obtain approval of the Review Plan. The District Lead Engineer will establish meetings and coordinate project completion with the PDT. The NWS Levee Safety Program Manager (LSPM) will coordinate with the RMC to ensure engagement throughout the process. The project manager will coordinate the reporting efforts with the LSPM,

Tech Lead, and Facilitator and will coordinate with the Risk Management Center (RMC).

Task 1b: Workplan Development

NWS Project Manager with input from the Cadre lead will develop and seek approval for a workplan outlining project tasks, timeline, budget, team membership and team roles/responsibilities.

Task 1c: Review Plan Development and Approval

The review plan will be prepared to ensure quality and proper scale and scope of anticipated reviews. The approval authority for this Review Plan is the Northwestern Division (NWD). The Commander's approval reflects vertical team input (involving the Seattle NWS District, NWD, RMC and HQUSACE members) as to the appropriate scope and level of review for the study and endorsement by the RMC.

Task 1d: Cost Share Agreement – Sponsor Funding

The risk assessment is cost-shared between the USACE Seattle District (NWS) and the City of Missoula, the local sponsor. A cost share agreement will be negotiated and executed. The cost share is 50/50 with funds from the local sponsor coming as cash.

Task 1e: Monthly Reporting

The project will require monthly reporting on status to the RMC and within the Seattle District. The Cadre may also have reporting requirements. Quarterly reporting to the local sponsor as part of the cost share is also anticipated.

Task 2: Data Preparation

Data collection and organization from the local sponsor, Seattle District and the Cadre will be required for a successful risk analysis and report approval. The NWS team will lead the effort to assemble and make available for the Cadre all existing materials necessary to support a risk analysis and elicitation for the project. This task includes all actions leading up to the risk assessment including a site visit, all technical analysis, preliminary development of the report outline, the PFMA and completion of initial consequence modeling.

Task 2a: Assemble Existing Data

- The purpose of this task is to locate, assemble and organize existing data for the project and prepare the information needed to perform the risk assessment. The primary source for most of the information will be taken from risk assessment guidance, prior periodic inspections, design memorandums and construction documents. Data available for use may include:
 - Historic photographs
 - Design documents

- Record drawings
- Standard operating procedures
- Emergency action plan
- Instrumentation records
- Previous risk assessments
- Periodic inspections
- Levee Penetration Inspections
- Previous hydrologic, hydraulic, or seismic study documents
- Previous geotechnical or geologic data collection documents
- Previous floodwall study documents
- Geotechnical, hydrologic, and structural instrumentation and monitoring data
- Previous flood reports and photos
- Reports/videos from conduit inspections

Since a large part of the design and construction of the levee was carried out by the Non-Federal sponsor the above referenced data should be requested from and provided by the Non-Federal sponsor before initiation of the assessment. This task includes effort and funds to gather, collect, and inventory any existing data and if necessary, digitize it.

Task 2b: Review Existing Data

This task allows the project team time to review all data assembled in Task 2a. The Seattle District, Cadre and RMC Advisors will review the materials provided in support of the risk assessment and evaluate whether adequate information exists to continue with the PFMA and preparations for risk assessment.

A specific review of hydraulic and hydrologic data will include all previous and pertinent design documentation and analysis from the recently conducted a Flood Inundation Mapping (FIM) project on the Clark Fork. This mapping will include a review of all relevant models for use in the Missoula Risk Assessment.

Task 2c: Prepare Background

After the team has completed a review of existing data, the team will prepare a draft background chapter (Chapter 2 of the RA Report) summarizing and documenting key investigation, design, construction and performance data that will inform the team during the risk assessment.

Task 2d: Hydrologic Hazard Estimate

The hydrologic hazard will include the development of water surface profiles to compare to the levee profile, flow and stage-frequency curves to estimate the frequency of loading, stage-duration curves to estimate the duration of loading, and pertinent Hydrologic & Hydraulic (H&H) data relevant to the system. The team will review to ensure adequate information is available to continue with the risk assessment. If critical information is not available, a decision would be made

to move to a quantitative risk assessment requiring new data collection or terminate the project. This task also includes time to prepare a draft of the Hydrologic and Hydraulic (chapter 4) section of the report.

The H&H section of the report include the following tasks.

- A review and finalization of the existing HEC-RAS model of the Clark Fork River through Missoula to better suit the data needs of the risk assessment.
- Identifying of levee overtopping locations.
- Development of flow frequency curves, water surface profiles and stage-frequency curves.
- Determination of system overtopping capacity

Task 2e: Seismic Hazard Estimate

The seismic hazard will include the development of a site classification based on existing data. If site specific data is not available to determine a site classification, the team will estimate one using engineering judgement. A seismic hazard curve will be developed using the latest USGS seismic hazard information to help inform the probability of a seismic-related breach.

Task 2f: Engineering Analyses

This task includes performing a variety of engineering analysis (e.g. seepage, stability, erosion, etc.) to help inform the risk assessment. The analyses may include RMC toolboxes, WinDAM, Geoslope, or other applicable software and will utilize existing data. These analyses will be scaled to the level of study (SQRA versus QRA). H&H engineering analysis will build upon the existing modeling done for previous work on the Clark Fork. Ongoing support will be needed for utilizing existing HEC-RAS modeling for risk assessment.

Additionally, sediment and/or erosion analysis to assess levee stability may be needed.

Task 2g: Prepare Draft Chapters for PFMA/SQRA

Initial outline and background information will be drafted as part of other activities. This task compiles those efforts and establishes a framework for the risk assessment chapters to facilitate the PFMA/SQRA and post risk assessment report writing. The Cadre will lead the report development task. The Seattle District will support Chapter 2 preparation and support data/graphic details as needed at this initial stage. Final draft report preparation will occur after the SQRA.

Task 2h: Site Visit

A one-day site visit will be conducted by the PDT to familiarize members with the system layout, configuration, etc., and to visit potential sites of interest related to potential risk-driving failure modes.

Task 2i: Potential Failure Mode Analysis (PFMA)

Following the site visit, the NWS, Cadre and RMC advisors will convene to discuss potential failure modes. The discussion will include use of all pertinent data encountered on the site visit and discovered during the background review.

Task 2j: Consequences

The development of the consequences will include breach and non-breach scenarios modeled in HEC-RAS and HEC-LifeSim. The modeling will follow the standard operating procedure (SOP) outlined by the Mapping, Modeling, and Consequence Production Center (MMC).

Task 3: Risk Assessment/Elicitation

The Risk Facilitator, District Personnel, and the Local Sponsor representatives will meet to conduct the Risk Assessment. The PDT will consist of an approved RMC facilitator, Risk Cadre, NWS District personnel and Non-Federal Sponsor representatives.

Task 3a: Risk Assessment/Elicitation

This effort will involve discussing the overtopping failure mode and any additional risk-driving failure modes. Should the overtopping failure exceed tolerable risk levels, the project may require additional H&H analysis to determine failure at various loading levels. This will depend on the first decision point after completion of Task 2. The additional failure modes will follow the SQRA format by eliciting probabilities of failure based on a critical loading to obtain order of magnitude estimates. The team will also estimate the magnitude of consequences related to each of these failure modes and will estimate the confidence in the estimates.

Task 3b: Risk Calculation

This effort will involve using RMC-QRAcalcs to calculate the annual probability of inundation. The results will be compiled and presented in the Post-RA Brief. If this study continues to the Quantitative Risk Assessment (QRA) phase, RMC-QRAcalcs will be used to estimate Total Risk and annual probability of inundation.

Task 3c: Post-Risk Assessment Brief

Following the RA session for the levee system, the team will brief the RA findings to the USACE vertical team consisting of District, Division, RMC, and HQUSACE personnel within 30 days of the RA. The team will receive feedback on the findings and recommendations from the risk assessment and get concurrence or guidance on the path forward. In the event of a potentially unfavorable recommendation, a decision point will be offered to the Sponsor to continue.

Task 4: Draft Report

This task includes finalizing the background chapters (Chapters 2, 4, 5 & 6) and completing Chapters 1 (Findings and Recommendations), 7 (Risk Assessment), the Executive Summary and all appendices of the final report.

Task 4a: Risk Assessment Documentation

This task includes writing the risk assessment chapter (Chapter 7) for the overall report. This section includes the write-ups for risk driving failure modes to include background information, a likelihood determination, and estimated consequences.

Task 4b: Summary and Findings

For this task, an executive summary and findings and recommendations chapter will be drafted within the overall draft report. These chapters include a detailed summary of the outcome of the risk assessment as well as detail any major findings and recommendations for the levee systems.

Task 4c: Appendices

The appendices will include excluded failure modes, pertinent photos and drawings, supporting calculations for analysis, and the risk estimate calculations. The team's effort will be primarily writing the excluded failure modes. There will be a minor effort to compile all of the calculation documents.

Task 4d: Quality Control of Draft Report

This task is for a short review of the report prior to entering the review and approval phase. Review of the various chapters will take place as they develop. This task is to ensure that the draft is complete and formatted for the review phase. Advisor and peer to peer review of report sections for technical adequacy, coherence, and case made to support risk assessment.

Task 4e: Preparation of Draft Levee Safety Senior Oversight Group (LSOG) Presentation

This task includes the initial development of the presentation which will be presented to LSOG. It is a required element as part of the submittal for Agency Technical Review. The presentation will include all elements found in the report and follow the current RMC provided template.

Task 5: Review & Approval

Reviews include District personnel providing the District Quality Control (DQC) review, RMC personnel providing Agency Technical Review (ATR), and Northwestern Division (NWD) personnel providing a Quality Assurance (QA) review. All review comments will be included as an appendix to the main report. Design Review and Checking System (DrChecks) will be utilized for DQC and ATR comment and response tracking. All comments will follow the 4-part comment structure as delineated in current Civil Works review policy. The reviews will include the reports and appendices for both levee systems.

Task 5a: DQC/Advisor Review

The DQC review will be performed by personnel from NWS that were not involved in the development of the risk assessment report. The advisor will provide review of the overall report concurrently with the DQC. The review is estimated to require a 6-week duration for comments and responses to be incorporated within the report.

Task 5b: Agency Technical Review & Quality Assurance Review

The ATR will consist of a qualified multidisciplinary team provided by the RMC. Concurrently with the ATR, NWD will provide a QA review. These reviews will require approximately 2 months duration.

Task 5c: LSOG Briefing

Following the reviews, the completed assessments will be presented to the Levee Safety Oversight Group (LSOG). The presentation will conclude with LSOG discussion, which will include LSOG concurrence on the NFIP recommendation and of the results of the risk assessment.

Task 5d: Finalize Report

In order to finalize the report, revisions may have to be made following the LSOG briefing. Once revisions are made and approved, a final Risk Characterization memo will be signed and provided to the team.

Task 5e: Report Approval

This task represents the final completion and approval for the documented assessment and recommendations.

OTHER DIRECT COSTS AND CONTINGENCY

The Clark Fork Area III levee risk assessment is a 50/50 cost-shared effort between the USACE-Seattle District and the City of Missoula. Contingency costs at a rate of 10% are included in the overall budget to account for variables and risks associated with the project. In addition to contingency and labor costs, the project includes other direct costs (ODC) to cover travel, vehicles, per diem and other project related expenses required to complete the risk assessment. Both contingency and ODC are included in the budget estimate.

PROJECT DELIVERY TEAM COMPOSITION

Role	Discipline	Name	Org	Phone
Seattle District PDT				
District LSPM	Geologist	Charles Ifft	G3L0DF0	(206) 764-6938
District Eng (Tech) Lead	Geotechnical Eng	Sailish Koirala	G3L0DF0	(206) 316-3355
District PM	Project Mgr	Jeff Dillon	G3H4G00	206 764 6174

District Economist	Economist	TBD	G3H4T00	
District Geologist	Geotechnical Eng	Brian Stenejiem	G3L0DF0	(206) 316-3951
District Hydrologist	Hydraulic Engineer	Courtney Moore	G3L0W00	(206) 316-3005
District Structural	Structural Eng	Jacob McCarty	G3L0DA1	206-764-3364

Role	Discipline	Name	Org	Phone
NWD-W Risk Cadre				
Cadre Lead	Hydraulic Eng	Sharon Schulz	CENWP-ENC-HY	503-913-8778
Cadre Co-Lead	Geologist	Amy LeFebvre	CENWS-ENT-G	(206) 764-7209
Cadre Geotech	Geotech Eng	Nick Barbato	CENWP-ENC-DG	(503) 808-4982
Cadre Structural	Structural Eng	Carl Harris	CENWP-ENC-DS	(503) 808-3751
Cadre Consequences Specialist	Economist	Ricky Oskey	CESPK-PDW-E	(916) 557-7496
Cadre H&H	Hydraulic Engineer	Reuben Sasaki	CESPL-ED-HH	(213) 452-3672

Role	Discipline	Name	Org	Phone
RMC Risk Cadre				
RMC Advisor	Geologist	Damien Gonsman	CEIWR-RMC-W	(303) 963-4552
RMC Regional Hydrology Lead	Hydraulic Engineer	Carolyn Pearson	CEIWR-RMC-WD	303-963-4531

Budget and Schedule

The NFIP Evaluation for Area III levee is estimated to cost \$386,000 and take approximately 29 months to complete. Federal funding is needed over a period of three fiscal years, FY21 through FY23. As required by Federal law and in accordance with Section 3014(b) of the Water Resources Reform and Development Act of 2014, the study cost would be divided 50% Federal and 50% non-Federal Sponsor. Sponsor contributions will be via cash. The study cost estimate, list of activities and schedule are provided in Table 1.

Table 1. Cost Estimate, List of Activities and Schedule

Tasks	Activities	Budget	Schedule
-------	------------	--------	----------

Project Management		\$41,359	NOV 2020-MAR 2023
1a	Project Management	\$21,794	
1b	Work Plan Development	\$6,930	
1c	Review Plan Development and Approval	\$2,075	
1d	Cost Share Agreement- Sponsor Funding	\$2,479	
1e	Monthly Reporting	\$8,081	
Data Preparation		\$152,379	NOV 2020-JAN 2022
2a	Assemble Existing Data	\$3,752	
2b	Review Existing Data	\$20,207	
2c	Prepare Background (Chapter 2)	\$11,026	
2d	Hydrologic Hazard Estimate (Chapter 4)	\$8,809	
2e	Seismic Hazard Estimate (Chapter 5)	\$2,322	
2f	Engineering Analysis	\$29,919	
2g	Prepare Draft Chapters for PFMA/SQRA	\$12,857	
2h	Site Visit	\$28,588	
2i	PFMA	\$27,388	
2j	Consequences Estimate- Run HEC-LifeSim (Chapter 6)	\$7,509	
Risk Assessment		\$49,281	JAN 2022-APR 2022
3a	Risk Assessment/Elicitation	\$36,324	
3b	Risk Calculation	\$9,224	
3c	Post Risk Assessment Brief	\$3,732	
Draft Report		\$42,870	APR 2022-JUL 2022
4a	Risk Assessment Documentation	\$7,557	
4b	Summary and Findings	\$5,644	
4c	Appendices	\$6,523	
4d	Internal Team QC	\$16,472	
4e	Prepare draft Levee Safety Oversight Group (LSOG) Presentation	\$6,674	
Review and Approval		\$49,104	JUL 2022-MAR 2023
5a	DQC/Advisor Review	\$21,849	
5b	Agency Technical Review (ATR) and Quality Assurance Review	\$11,188	
5c	Finalize Rpt for LSOG Presentation	\$6,872	
5d	LSOG Meeting	\$2,432	
5e	Finalize Report	\$5,570	
5f	Report Approval	\$1,193	
ODC/Contingency		\$52,749	

	Travel and Misc	\$16,400	
	Project Contingency	\$35,139	
Total		\$386,528	29 Months

Federal/Non-Federal Funds Allocation (Rounded)

Funding Source	FY21 (55%)	FY22 (40%)	FY23 (5%)	Total Project Cost
Federal	\$106,425	\$77,400	\$9,675	\$193,500
Non-Federal	\$106,425	\$77,400	\$9,675	\$193,500
Total	\$212,850	\$154,800	\$19,350	\$387,000

ASSUMPTIONS AND RISKS

The following conditions were assumed:

- A decision to change the path forward at any point in the process will result in a change to the budget and schedule. Any changes from the above described tasks will be coordinated through the PDT, LSPM, PM and Non-Federal sponsor.
- There is an understood risk of this approach to obtain an NFIP Recommendation that the Local Sponsor may have to address issues either through further investigation or remediation before a Risk Assessment can be used to inform the NFIP recommendation. The risk assessment may identify risk driving failure modes that would require further investigation and/or possible remediation.
- Sponsor will provide all known existing information at the outset of the study.
- Data recovered at an interim point during the RA may change the recommended path forward.

LIST OF ACRONYMS

ACE	Annual Chance Exceedance
APF	Annual Probability of Failure
ATR	Agency Technical Review
RMC-QRAcalcs	Risk Analysis Engine
DQC	District Quality Control
DrChecks	Design Review and Checking System
HEC-FDA	Hydrologic Engineering Center's Flood Damage Reduction Analysis
HEC-RAS	Hydrologic Engineering Center's River Analysis System
H&H	Hydrologic & Hydraulic
HEC-LifeSim	Life loss and direct damage estimation software
LSOG	Levee Safety Senior Oversight Group
MCLD	Monarch-Chesterfield Levee System

MMC	Mapping, Modeling, and Consequence Production Center
NWD	Northwestern Division
NWS	Seattle District (i.e., U.S. Army Corps of Engineers, Seattle District)
NFIP	National Flood Insurance Program
PDT	Project Delivery Team
PFMA	Potential Failure Mode Analysis
QRA	Quantitative Risk Assessment
RA	Risk Assessment
RMC	Risk Management Center
SQRA	Semi-Quantitative Risk Assessment