Appendix C
Cost Estimate

FY: 2025
Project Title: Beattyville, KY FRM Project
Project No.: 498982
Location: Lee County, Kentucky

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1 INTRODUCTION

This Appendix presents the cost estimate that has been assembled for the Flood Risk Management (FRM) General Investigation (GI) Feasibility Study in Beattyville, KY. A discussion regarding cost, schedule, and risk is included in this Appendix which contains all appropriate feature accounts. What follows is a discussion regarding the methodology used to develop the first cost for the Recommended Plan.

The costs provided have undergone District Quality Control (DQC) Review by Louisville District and are pending Agency Technical Review (ATR) at the Walla Walla Cost Center of Expertise. These reviews will verify the reasonableness of total project costs, including the construction costs and calculated contingencies using the mandated Risk Analysis techniques.

2 REFRENCES

- ER 1110-1-1300, Cost Engineering Policy & General Requirements, 26 Mar 1993.
- ER 1110-2-1302, Civil Works Cost Engineering, 30 June 2016.
- ER 1110-2-1150, Engineering & Design for Civil Works Projects, 31 Aug 1999.
- ER 37-2-10 Change 89, Accounting and Reporting – Civil Works Activities, 31 Oct 2000.
- EC 11-2-187, Corps of Engineers Civil Works Direct Program: Program Development Guidance – Fiscal Year 2009, 30 Mar 2007.
- EP 1110-1-8 Volume 2, Construction Equipment Ownership and Operating Expense Schedule – Region II, July 2007.
- EC Bulletin No 2007-17, Application of Cost Risk Analysis Methods to develop Contingencies for Civil Works Total Project Costs, 10 Sep 2007.
- EM 1110-2-1304, Civil Works Construction Cost Index System (CWCCIS), 30 Sept 2021.
- EC 1105-2-410, Review of Decision Documents, 22 Aug 2008
- ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works, 30 Sept 2008.

3 METHODOLOGY

3.1 GENERAL

The cost estimate was prepared using the Micro-Computer Aided Cost Estimating System (MCACES) Second Generation (MII), version 4.4.3 for all feature accounts associated with construction. Applicable crews and equipment were applied in the estimate to correspond with the work being performed. Material prices were developed using the 2024 MII Cost Book and quotes were obtained from suppliers, when available. Cost which

are not construction related (Lands & Damages, Cultural Resources, PED, CM, etc.) rely on PDT input or are calculated based on percentage(s) of the construction cost, based on other project experience.

3.2 COST METHODOLOGY

3.2.1 Historical Unit Pricing

In some instances, historical cost information was referenced and documented accordingly. These historical references include past contract bid prices for projects of similar design and magnitude and recent government studies and cost estimates.

3.2.2 Quote-in-Place

In some instances, a quote from a subcontractor may have been received that included overhead and profit. In that case, no additional markups were included for subcontractor's overhead.

3.2.3 Detailed MII Cost Estimate

The MII estimating software was used to develop a construction sequence for each item of work and applying detailed line items and crews to perform the work. When appropriate, if information was unavailable from the Cost Book, crews were developed in correspondence with the work being performed and estimated productivities. Wage rates were taken from the local Davis Bacon rates. The latest MII equipment database was also used and adjusted for current fuel and energy costs. Material prices were obtained, as needed, through correspondence with vendors and internet suppliers.

A summary level report of the cost estimate, generated out of MII, for the Recommended Plan can be found in Attachment A of this Appendix.

3.3 DIRECT COSTS

Direct costs are based on anticipated equipment, labor, and materials necessary to construct this project. Following formulation of the direct cost, a determination is made as to whether the work would be performed by the prime contractor or a subcontractor.

3.3.1 Labor - Wage Determination

Wage rates were taken from the latest Davis-Bacon wage determination KY20250043, Building updated on https://www.sam.gov as recent as 02/07/2025. Recognizing that Davis Bacon rates for specific trades sometimes lag an update, possibly for years, a labor adjustment tool was utilized which references the Employment Cost Index: Wages and Salaries: Private Construction Workers: Construction (ECICONWAG) index put out by the Federal Reserve Economic Data (FRED) https://www.stlouisfed.org. This index allows labor rates to be escalated to be representative of anticipated growth of labor cost, since the last Davis Bacon update.

3.3.2 Equipment Costs

The 2024 Equipment database, based on EP 1110-1-8, Construction Equipment Ownership and Operation Expense Schedule, Region II, was used and adjusted for current, local fuel and energy costs per https://www.eia.gov as recent at 03/03/2025.

3.3.3 Vendor Quotes

Vendor quotes have been acquired and documented for the anticipated cost driving materials.

3.3.4 Crews

Project specific crews have been developed and applied to the detailed line items as appropriate. Crew members consist of selected complements of labor classifications and equipment pieces assembled to perform specific tasks. Productivity has been assigned to each crew reflective of the expected output per unit of measure for the specific activities listed in the cost estimate. A production rate has been assigned to each developed crew, based on expected output per unit of measure for the specific activity listed in the cost estimate.

3.3.5 Quantities

Quantities were developed by the Cost Engineer with assistance from the PDT. Based on the information collected about each structure, detailed quantities were developed based on details for each specific building. In leu of being able to inspect a structure, the quantities needed to develop cost were derived based on averages from the structures which were observed.

3.3.6 Direct Markups

The cost estimate includes an overall production adjustment of 90% considering the bulk of the work is similar in nature to renovation work and/or demolition. Given how tedious this work could potentially be, justifies the production adjustment.

No overtime has been included in this cost estimate.

3.4 INDIRECT COSTS

3.4.1 Contract Acquisition Strategy

Through discussion with the PDT, it is envisioned that the work will be performed in individual phases or contracts and likely be advertised to Small Business contractors. The acquisition method is reflected in the estimate as Small Business as the plan would be to create a voluntary program which property owners will identify and hire a contractor to perform the design/construction for their respective property, if they should choose to participate. The hired contractor would then be obligated to abide by criteria and

inspection, set forth by USACE. Once these criteria are met and the work is completed, the property owners would be reimbursed.

3.4.2 Prime Contractors Markups

3.4.2.1 Job Office Overhead (JOOH)

Job Office Overhead (JOOH) is currently estimated by a running percentage within the estimate for the Prime contractor. Because of the assumptions made regarding a Small Business Contractor performing much of the work, the estimate uses 20% and is based on similar-sized projects and would account for such items as project supervision, contractor quality control, contractor field office supplies, personal protective equipment, field engineering, and other incidental field overhead costs.

3.4.2.2 Home Office Overhead (HOOH)

For Home Office Overhead (HOOH) expense, because of the assumptions made regarding a Small Business Contractor performing much of the work, the estimate uses 10%. HOOH includes items such as office rental / ownership costs, utilities, office equipment ownership/maintenance, office staff (managers, accountants, clerical, etc.), insurance, and miscellaneous. The range of home office overhead can be quite broad and depends largely on the contractor's annual volume of work and the type of work that is generally performed by the contractor.

3.4.2.3 Profit

Profit was calculated based on ENR 1110-2-1302 Profit Weighted Guidelines to be 6.95% and was applied to the Prime contractor's self-performed work as well as subcontracted work.

3.4.2.4 Bonding

Bond was included as a running percentage of 1.5% (own work and subcontracted work).

3.4.3 Subcontractors

3.4.3.1 Overhead

All subcontractor overhead costs are set to 10% and 10% of direct cost to account their JOOH and HOOH costs, respectively. The exception is where a subcontractor has provided a quoted price including overhead. In that case, no additional markups have been included for subcontractor's overhead.

3.4.3.2 Profit

Sub Profit was included as a running percentage of 8% based on estimator judgement and other past project experience.

3.4.4 Escalation

The Estimated Cost from the MII software does not have escalation applied. Escalation is accounted for within the Total Project Cost Summary (TPCS) sheet, provided as Attachment C. The estimated cost will be escalated to the mid-point of construction in accordance with EM 1110-2-1304, Civil Works Construction Cost Index System

(CWCCIS) to account for potential inflation during construction. This escalation will be reflected in the TPCS file rather than the cost estimate in MII. A preliminary project schedule is included in Attachment D of this Appendix.

3.4.5 Contingency

An initial Cost & Schedule Risk Analysis (CSRA) was held in August 2024 based on the TSP, at that point in time. The contingency resulting from that initial meeting and applied within the TPCS was determined to be 50% contingency at the 80% confidence interval.

The CSRA was revisited in March 2025 based on the updates made to the estimate, post ADM, and other developments that had progressed since the Aug 2024 meeting. The results of that update some minor changes to previously identified risk and resulted in a 46% contingency, at an 80% confidence interval. More specific details, including the risk register, can be seen in Attachment B of this Appendix.

4 FINAL ARRAY OF ALTERNATIVES DEVELOPMENT

During the planning and screening process, a wide range of structural and non-structural alternatives were initially examined and hypothesized. The structural measures considered included floodwalls, pump stations, river rerouting, dredging of the Kentucky River, removal of downstream barriers, the creation of an upstream reservoir, or a combination thereof. However, hydrologic and hydraulic (H&H) modeling conducted by the Louisville District (LRL) Engineering team indicated that these structural solutions would result in comparatively high costs while providing minimal improvements in flood protection. Consequently, the team opted to move away from structural solutions and instead focused on evaluating potential non-structural alternatives.

The initial assessment of non-structural measures aimed to determine the level of protection that would yield the most favorable benefit-cost ratio (BCR). The alternatives generally consisted of common non-structural mitigation measures, including dry floodproofing, wet floodproofing, elevation-in-place, and the acquisition and demolition of structures within the floodway. The primary distinction among these alternatives was the selection criteria used to identify applicable structures, such as flood elevation thresholds or the significance of a given structure (e.g., essential facilities or historically significant buildings). Based on this evaluation, a final array of alternatives was developed and refined and consisted of:

		Project First Cost (FY24)
Alternative 1:	No Action	$ -
Alternative 3A:	Complete Nonstructural 672.2	$ 79,000,000
Alternative 4:	FWEEP	$ 2,900,000
Alternative 5A:	Incremental NS (FWEEP + FW AQ)	$ 10,700,000
Alternative 5B:	FWEEP + FW AQ + ES	$ 20,500,000
Alternative 5C:	FWEEP + FW AQ + ES + HS	$ 30,100,000

The costs for these alternatives were initially developed using approved tools and agreed-upon assumptions to estimate required quantities. A Rough Order of Magnitude (ROM) cost was generated for the constructible features and compiled into an Excel spreadsheet, where contingencies were applied, and additional feature account costs could be incorporated to provide a more comprehensive representation of the Total Project Cost for each alternative.

At that point of evaluation, the costs for other feature accounts were determined based on input from the Project Delivery Team (PDT). In cases where specific input was unavailable, costs were estimated using historical data from previous feasibility studies in relation to construction costs. For example, costs associated with Planning, Engineering, and Design (PED) and Construction Management (CM), corresponding to accounts 30 and 31, were typically estimated using historical benchmarks of 20% and 6.5%, respectively.

Contingency was then applied to the alternative cost estimates, but this application was not based on a risk-informed analysis as is typically required. The PDT is confident the outcome or selection of the TSP would have remained unchanged, had a risk analysis been performed. The primary reason for this is that cost was not a screening criterion for this study. The PDT is pursuing an NED waiver, which signifies that the Benefit-Cost Ratio (BCR) is not the main factor in plan selection. Further, the cost associated with Alternative 3A is so much larger than the others that had a BCR been considered, it never would have resulted favorably – essentially eliminating it from contention, regardless. Alternatives 4 and 5A-5C build upon each other and making any risk informed contingencies compound on each other and the difference between the alternative cost would likely have remained the same or similar.

Considering the scope of the alternatives in the final array (3A, 4, 5A, 5B, and 5C), the contingencies applied would likely have increased the overall cost similarly across all alternatives, given that their scopes are very similar, except for Alternative 4, which is a standalone FWEEP.

5 TENTATIVELY SELECTED PLAN (TSP) SELECTION

Of the alternatives from the Final Array, Alternative 5C was selected as the Tentatively Selected Plan (TSP) – not because of it's BCR, but rather the total net benefits, which includes increased resiliency of the community, it reduces recovery time from future flood events, and it offers the highest impact to the EQ account. Alternative 5C best represents Beattyville's vision for the floodplain while also celebrating and preserving its identity for long term resilience.

6 RECOMMENDED PLAN SELECTION

Following the Tentatively Selected Plan (TSP), the Vertical Team conducted a series of reviews and provided comments, leading to refinements and improvements to the plan. The Agency Decision Milestone (ADM) was then held, during which the Project Delivery Team (PDT) presented the modified TSP as the Recommended Plan. Upon receiving concurrence from decision-makers, the project advanced into what is referred to as "feasibility-level design."

The primary objective of this phase was to secure rights of entry for as many structures included in the Recommended Plan as possible and to document critical information to refine quantity development and improve the accuracy of cost estimates. This effort focused particularly on structures designated for floodproofing, as they comprise much of the planned project.

The data collection process involved documenting interior wall layouts, identifying and quantifying mechanical, electrical, and plumbing (MEP) equipment (both interior and exterior), assessing types of finishes, and noting any unique features that should be incorporated into the cost estimate. Of the 40 structures slated for wet or dry floodproofing, the team successfully accessed and documented the interior layouts of 18 structures and surveyed the exteriors of 32 buildings. Given that many of the structures share similar construction characteristics and functions, assumptions were made based on observed data to estimate quantities for those that could not be directly inspected.

7 PROJECT FEATURE ACCOUNTS AND ASSOCIATED SCOPE

7.1 (01) LANDS & DAMAGES

- This feature includes all costs of acquiring for the project (by purchase or condemnation) real property or permanent interests therein, including Government costs, damages, and costs of disposal of real estate. Government costs include planning expenses for the real estate portion of the General Design Memo and for the detailed Real Estate Memo; and project real estate office administration, surveys, and marking for land acquisition purposes and appraisals.
- The cost estimate for this account was provided by the Real Estate PDT member and inserted into the MII estimate. More information can be found in the RE Appendix.

7.2 (06) FISH & WILDLIFE FACILITIES

- This account includes all costs associated with conducting surveys for potential listed species within the project area, such as mussels, turtles, and salamanders. The cost estimate for those anticipated efforts was provided by the Biologist team member and includes expenses for the Environmental ECP Assessment required for any

demolished property. Additionally, costs have been included for general in-house expenses that may arise during the Design & Implementation (D&I) phase.

- Additionally, within Phase II of the Recommended Plan, Environmental restoration costs have been included within and adjacent to the recreational features planned and include such measures and grading and shaping of areas adjacent to the Kentucky River and planting native trees, shrubs, and grasses. These restoration activities will take place within the floodplain, in areas we are planning to acquire/demolish existing structures.

7.3 (14) RECREATION FACILITIES

- Included in the Recommended Plan, within Phase II, is a plan to provide recreational space along the Kentucky River which is envisioned to include features such as walking trails, a basketball court, pickleball courts w/ fencing, tennis courts w/ fencing, a pavilion (shelter), and a latrine. These recreation features will take be constructed within the floodplain; in areas we are planning to acquire/demolish existing structures.
- Supporting site plan was developed by LRL Engineering team member and is the basis for these cost in the estimate.

7.4 (18) CULTURAL RESOURCES PRESERVATION

- This account includes all costs incurred by the government for actions associated with historic preservation, including, but not limited to, the identification and treatment of historic properties, and the mitigation of adverse effects, will be included in construction costs.
- These costs were provided by the Archeological PDT member. Provided cost account for coordination efforts, in house field work, contract management, and mitigation expected during the D&I phase.

7.5 (19) BUILDINGS, GROUNDS, AND UTILITIES

- These costs account for the non-structural plan which will be composed of flood proofing, raising in place, or acquiring/demolishing existing structures. In summary the structures breakdown as follows:
    - (10) structures to be dry floodproofed
    - (30) structures to be wet floodproofed
    - (1) structure to be raised in place
    - (12) structures to be acquired / (7) demolished
- The detailed scope of work for wet and dry floodproof, as defined by the PDT can be found in Attachment E of this Appendix. A “template” based on the agreed upon scopes of work was built within the estimating software and then based on inspections & observations, quantities were determined and input into those templates – establishing cost for each structure impacted by the study.
- Cost for raising the (1) structure rely on a template developed and provided by the Cost Engineering POC(s) assigned to the Non-structural Committee.

- Individual “packages” for each structure were developed and are included as Attachment A in the main Engineering Appendix. Include there are the forms, rough floor plans (if inspected), and pictures for each structure.

7.6 (20) PERMENANT OPERATING EQUIPMENT

- This cost is meant to account for the Flood Warning and Emergency Evacuation Plan (FWEEP) which aims to create better flood preparedness and flood plain planning for the Beattyville community. The entirety of this work would take place is what is referred to a Phase I of the Recommended Plan.
- This would be measures such as inundation mapping, flood evacuation mapping, designing & installing a siren system, developing an emergency evacuation plan, and/or standing up a comprehensive flood plain management plan.
- Costs for these tasks are largely based on awarded contract for the Johnson County FRM project, Phase I. The level of effort in Beattyville is assumed to be significantly less as Johnson County was a county wide study. The siren system would only be installed on pole mounted speakers through the downtown Beattyville area.

7.7 (30) PLANNING, ENGINEERING, AND DESIGN

- The work covered under this account includes project management, project planning, preliminary design, final design, geotechnical and HTRW investigations, hydraulic modeling, preparation of plans & specifications, engineering during construction, adaptive management, coordination efforts, contract advertisement, opening of bids, and contract award.
- The cost for this account was estimated as percentage of the anticipated construction cost until a time in which the PDT can provide more accurate estimates for the D&I portion of the project.
- In-house cost to support the Real Estate team member during implementation are also captured here in this account.

7.8 (31) CONSTRUCTION MANAGEMENT (S&A)

- This feature includes such functions as inspection, supervision, project office administration, and distributive costs of area office and general overhead charged to the project. Costs for Office of the Chief of Engineers CE and Division Office Executive Direction and Management are not charged to Construction, General but to the General Expenses appropriation title.
- The cost for this account were estimated with input from the project manager and historical S&A rates from other similar-sized projects.

8 PROJECT SCHEDULE & DURATION

The current project schedule shows the Chief’s Report being signed for this study on 12

DEC 2025. It is assumed that funding will be provided in parts based on previous projects and based on the Implementation Plan, Appendix G, the following work would be prioritized and broken into separate contracts or phases:

1. FWEEP (Contract #1)
2. Acquisitions in the floodway (Contract #2)
3. Recreation & Ecosystem (Contract #2)
4. Dry floodproof, wet floodproof Essential and community anchor structures (Contract #3)
5. Dry floodproof, wet floodproof, elevate (residential) Historic structures (Contract #4)

The actual overall schedule and durations are highly dependent on property owner's participation, with the developed schedule assuming 100% participation. Should there be little interest or willingness from property owners to participate the overall project cost and duration could be dramatically less than depicted.

A rough order of magnitude schedule has been developed for each contract or phase and can be seen in Attachment D. The respective midpoints for construction and non-construction related activities were utilized in the Total Project Summary Sheet (TPCS) to accurately apply escalation.

9 TOTAL PROJECT COST SUMMARY (TPCS)

The cost estimate for the Recommend Plan (TSP) at the Fiscal Year 2026 price level, known as the Project First Cost, is $33,829,000. This estimate reflects the most up-to-date refinements since the TSP meeting and excludes expenses incurred during the Feasibility Study. To account for escalation over the implementation schedule, a Fully Funded Cost estimate has been developed, bringing the total project cost to $39,870,000. The detailed Total Project Cost Summary (TPCS) is provided in Attachment B of this Appendix.

ATTACHMENT A

MII SUMMARY REPORT

498982 - Beattyville, KY - FRM - Recommended Plan - Class III Estimate

P2#: 498982

Location(s): Beattyville, KY
Lee County, KY

Solicitation Type: Full & Open (Assumed)
Solicitation #: TBD
Procurement: Design-Bid-Build (Assumed)

Files located at <O:\ED\Public\MCACES\ED-M-C\0 Civil\FY24\498982 - Beattyville KY FRM (GI) Feasibility Study\03 - ADM_Recommended Plan>

EXISTING SITE CONDITIONS:

In March of 2021, the City of Beattyville (Beattyville) in Lee County, Kentucky suffered a severe flood event, estimated to be a 50-year or 2% annual exceedance probability (AEP) event (cresting at approximately 666.5 feet, impacting significant portions of the downtown area. Due to the configuration of Beattyville and its proximity to the Kentucky River, most of the businesses are in a high-risk flood area and many are located in the floodway. The recurrent flooding threatens life, causes loss of access to certain areas downtown, and has lasting adverse economic impacts for this already disadvantaged area. Additionally, frequent flooding creates a negative impact on the community structure and its identity, damages essential structures and infrastructure, and serves as a repetitive hazard to recreational facilities, activities, and tourism. Specific to the March of 2021 event, though there were no fatalities, most if not all businesses in downtown Beattyville suffered water damage and were closed for some time after the event. The flooding threat to human life, property damage, and economic loss for government, local businesses, and residents is substantial.

The compounded effects of Beattyville's location near the convergence of three forks of the Kentucky River (the North, Middle, and South Forks) and the increase in frequency and intensity of precipitation predicted for the area support the need for a flood risk management investigation in Beattyville. In response, the purpose of this study is to evaluate the flooding concerns in the area and identify potential alternatives which yield a positive impact on flood risk management.

SCOPE OF WORK for Tentativley Selected Plan (TSP):

Using the USACE Planning Processes, multiple alternatives (structural and non-structural) have been considered and eliminated with the tentatively selected plan (TSP) being a non-structural plan taking into consideration or prioritizing the structures within Beatyville deemed "essential" by the non-federal sponsor + historic structures + Flood Warning Emergency Evacuation Plan (FWEEP). Non-structural refering to actions taken to protect individual structures during future flood events (residential raising in-place, dry floodproofing, or wet floodproofing) or acquisition/demolition if a structure already existing within the flood plain.

Additionally on lands acquired within the flood plain, beneficial (recreational and environmental) re-use of those areas is planned through the installation of features such trails, picnic tables, historical markers, and planting native grasses, shrubs, and trees, as well as relocating an existing play ground.

Estimated by Neal Ralston, PE, TCCE
Designed by
Prepared by Neal Ralston, PE, TCCE
Preparation Date 4/2/2025
Effective Date of Pricing 10/1/2024
Estimated Construction Time Days
Reviewed by: Jacob Dehn, Cost Engineer, LRL

Date	Author	Note
11/9/2023 12:24:45 PM	Markups	**MARK-UPS:** Contractor Mark-Ups · Prime Contractor o PRIME JOOH: 20.0% o PRIME HOOH: 15.0% o PRIME PROFIT: 10.00% o BOND: 1.0% · Subcontractor Mark-Ups (General) o JOOH:10% o HOOH: 10% o Profit: 6.95% (PWG) · Direct Mark-Ups o PRODUCTIVITY: 90% o Overtime: N/A o SALES TAX - 6% (Lee County, KY) o 2024 MII COST BOOK INFLATION MARKUP (MAT): 2.99% - to mark material cost up from January 2024 (Effective Price Date of the Cost Book) - per ENR Material Index January 2024 (6151) to October 2024 (6335), with Oct 2024 being the Effective Price Date of the MII Estimate
7/24/2024 1:21:38 PM	Implementation	Properties containing structures located in the floodplain (identified as acquisitions) will be mandatory acquisitions. Structures identified as dry floodproof, wet floodproof or raise in place will be voluntary. The Recommended Plan will occur over a phased implementation period of approximately 5-10 years. However, the scale of the project is highly dependent upon the participation rate for implementation and the amount of funding allocated in any given year. If a structure owner does not want to participate in the project, USACE and the non-Federal Sponsor would defer any further action on that structure until such time as the structure owner elects to participate or until the period of eligibility ends. However, USACE reserves the right to determine whether a structure may be included in the nonstructural implementation after a structure owner has previously declined participation, and if allowed to participate, the timing and scheduling of such participation will not adversely impact the project. As funds are appropriated, scope would progress in the following order: 1.FWEEP (Contract #1) 2.Acquisitions in the floodway (Contract #2) 3.Recreation (Contract #2) 4.Dry floodproof, wet floodproof Essential and community anchor structures (Contract #3) 5.Dry floodproof, wet floodproof, elevate (residential) Historic structures (Contract #4)
3/5/2025 7:14:45 AM	Profit	**Degree of Risk:** 0.09 **Relative Difficulty of Work:** 0.075 **Size of Job:** 0.03 **Period of Performance:** 0.12 **Contractor's Investment:** 0.07 **Assistance by Government:** 0.075 **Subcontracting:** 0.042

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	SubCMU	CostToPrime	PrimeCMU	ProjectCost
Project Cost Summary Report			**3,851,101**	**101,142**	**2,307,172**	**1,294,447**	**7,726,652**	**15,280,514**	**2,099,139**	**11,517,653**	**6,760,783**	**24,140,435**
Alternative 5c - Essential / Historic Non-Structural Focus + FWEEP	**1.00**	**LS**	**3,851,101**	**101,142**	**2,307,172**	**1,294,447**	**7,726,652**	**15,280,514**	**2,099,139**	**11,517,653**	**6,760,783**	**24,140,435**
Contract/Phase #1 - FWEEP	**1.00**	**LS**	**624,483**	**3,941**	**0**	**90,329**	**431,000**	**1,149,752**	**26,342**	**745,095**	**437,365**	**1,613,460**
Lands and Damages	**1.00**	**LS**	**0**	**0**	**0**	**0**	**106,000**	**106,000**	**0**	**0**	**0**	**106,000**
Fish and Wildlife Facilities	**1.00**	**LS**	**0**	**0**	**0**	**0**	**10,000**	**10,000**	**0**	**0**	**0**	**10,000**
Cultural Resource Preservation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**10,000**	**10,000**	**0**	**0**	**0**	**10,000**
Permanent Operating Equipment	**1.00**	**LS**	**624,483**	**3,941**	**0**	**90,329**	**0**	**718,752**	**26,342**	**745,095**	**437,365**	**1,182,460**
Planning, Engineering and Design	**1.00**	**LS**	**0**	**0**	**0**	**0**	**224,000**	**224,000**	**0**	**0**	**0**	**224,000**
Construction Management	**1.00**	**LS**	**0**	**0**	**0**	**0**	**81,000**	**81,000**	**0**	**0**	**0**	**81,000**
Contract/Phase #2 - Flood Plain Acquisition/Demolition with Recreation & Environmental Restoration	**1.00**	**LS**	**281,855**	**59,671**	**314,334**	**290,183**	**2,104,273**	**3,050,315**	**274,133**	**1,451,448**	**851,990**	**4,176,438**
Lands and Damages	**1.00**	**LS**	**0**	**0**	**0**	**0**	**1,076,000**	**1,076,000**	**0**	**0**	**0**	**1,076,000**
Fish and Wildlife Facilities	**1.00**	**LS**	**60,730**	**14,901**	**18,855**	**22,792**	**150,000**	**267,278**	**34,491**	**151,769**	**89,088**	**390,857**
Recreation Facilities	**1.00**	**LS**	**162,864**	**15,441**	**295,479**	**0**	**227,073**	**700,856**	**176,709**	**877,565**	**515,125**	**1,392,689**
Cultural Resource Preservation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**15,000**	**15,000**	**0**	**0**	**0**	**15,000**
Buildings, Grounds, & Utilities	**1.00**	**LS**	**58,262**	**29,328**	**0**	**267,391**	**4,200**	**359,181**	**62,933**	**422,114**	**247,778**	**669,892**
Planning, Engineering and Design	**1.00**	**LS**	**0**	**0**	**0**	**0**	**467,000**	**467,000**	**0**	**0**	**0**	**467,000**
Construction Management	**1.00**	**LS**	**0**	**0**	**0**	**0**	**165,000**	**165,000**	**0**	**0**	**0**	**165,000**
Contract/Phase #3 - Essential Structures - Dry/Wet Floodproof	**1.00**	**LS**	**1,453,755**	**18,410**	**1,025,772**	**466,423**	**2,398,404**	**5,362,764**	**889,998**	**4,599,762**	**2,700,029**	**8,952,791**
Lands and Damages	**1.00**	**LS**	**0**	**0**	**0**	**0**	**182,000**	**182,000**	**0**	**0**	**0**	**182,000**
Fish and Wildlife Facilities	**1.00**	**LS**	**0**	**0**	**0**	**0**	**10,000**	**10,000**	**0**	**0**	**0**	**10,000**
Cultural Resource Preservation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**15,000**	**15,000**	**0**	**0**	**0**	**15,000**
Buildings, Grounds, & Utilities	**1.00**	**LS**	**1,453,755**	**18,410**	**1,025,772**	**466,423**	**745,404**	**3,709,764**	**889,998**	**4,599,762**	**2,700,029**	**7,299,791**
Planning, Engineering and Design	**1.00**	**LS**	**0**	**0**	**0**	**0**	**992,000**	**992,000**	**0**	**0**	**0**	**992,000**
Construction Management	**1.00**	**LS**	**0**	**0**	**0**	**0**	**454,000**	**454,000**	**0**	**0**	**0**	**454,000**
Contract/Phase #4 - Historic Structures - Dry/Wet Floodproof, Raise In Place	**1.00**	**LS**	**1,491,009**	**19,119**	**967,067**	**447,512**	**2,792,975**	**5,717,682**	**908,665**	**4,721,348**	**2,771,399**	**9,397,746**
Lands and Damages	**1.00**	**LS**	**0**	**0**	**0**	**0**	**374,000**	**374,000**	**0**	**0**	**0**	**374,000**
Fish and Wildlife Facilities	**1.00**	**LS**	**0**	**0**	**0**	**0**	**10,000**	**10,000**	**0**	**0**	**0**	**10,000**
Cultural Resource Preservation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**15,000**	**15,000**	**0**	**0**	**0**	**15,000**
Buildings, Grounds, & Utilities	**1.00**	**LS**	**1,491,009**	**19,119**	**967,067**	**447,512**	**887,975**	**3,812,682**	**908,665**	**4,721,348**	**2,771,399**	**7,492,746**
Planning, Engineering and Design	**1.00**	**LS**	**0**	**0**	**0**	**0**	**1,040,000**	**1,040,000**	**0**	**0**	**0**	**1,040,000**
Construction Management	**1.00**	**LS**	**0**	**0**	**0**	**0**	**466,000**	**466,000**	**0**	**0**	**0**	**466,000**

ATTACHMENT B

COST & SCHEDULE RISK ANALYSIS (CSRA)

Cost & Schedule Summary for Risk Register Development

Project: Kentucky River, Beattyville, KY - Flood Risk Management (FRM) Feasibility Study
Project Development Phase: Feasibility (CWRB) - For Milestone #4
Meeting Date: 8/14/2024

Schedule Start: November 2026 *Month/Year*
Schedule Finish: September 2036 *Month/Year*
Duration: 117.7 Months

Schedule Contingency Duration: 67.1 Months
Schedule Contingency: 57%
Schedule with Contingency (80% Confidence): 184.9 Months
Finish Date with Contingency (80% Confidence): April 2042

	CW WBS	Feature of Work	Base Cost	80% Confidence	80% Confidence ($)	80% Total
	Risk Not Included In CSRA					
	01 - LANDS AND DAMAGES	Civil Works only; not included on MILCON Projects.	$1,738,000	28.1%	$488,378	$2,226,378
	Risk Included In CSRA					
1	06 - FISH AND WILDLIFE FACILITIES	Contract #1 - Environmental Contract Management	$10,000	37%	$3,700	$13,700
2	18 - CULTURAL RESOURCE PRESERVATION	Contract #1 - Cultural Resource Preservation	$10,000	37%	$3,700	$13,700
3	20 - PERMANENT OPERATING EQUIPMENT	Contract #1 - Flood Warning & Emergency Evacuation Plan (FWEEP)	$1,182,460	37%	$437,510	$1,619,970
4			$0	0%	$0	$0
5	06 - FISH AND WILDLIFE FACILITIES	Contract #2 - Environmental Contract Management	$10,000	37%	$3,700	$13,700
6	06 - FISH AND WILDLIFE FACILITIES	Contract #2 - Environmental ECP Assessments	$140,000	37%	$51,800	$191,800
7	06 - FISH AND WILDLIFE FACILITIES	Contract #2 - Ecosystem Restoration	$240,857	37%	$89,117	$329,974
8	14 - RECREATION FACILITIES	Contract #2 - Recreation Facilities	$1,392,689	37%	$515,295	$1,907,984
9	18 - CULTURAL RESOURCE PRESERVATION	Contract #2 - Cultural Resource Preservation	$15,000	37%	$5,550	$20,550
10	19 - BUILDINGS, GROUNDS, AND UTILITIES	Contract #2 - Acquired Bldg Demolition - 7 structures	$669,892	37%	$247,860	$917,752
11			$0	0%	$0	$0
12	06 - FISH AND WILDLIFE FACILITIES	Contract #3 - Environmental Contract Management	$10,000	37%	$3,700	$13,700
13	18 - CULTURAL RESOURCE PRESERVATION	Contract #3 - Cultural Resource Preservation	$15,000	37%	$5,550	$20,550
14	19 - BUILDINGS, GROUNDS, AND UTILITIES	Contract #3 - Dry Floodproofing - 8 structures	$3,155,831	37%	$1,167,657	$4,323,488
15	19 - BUILDINGS, GROUNDS, AND UTILITIES	Contract #3 - Wet Floodproofing - 8 structures	$4,143,960	37%	$1,533,265	$5,677,225
16			$0	0%	$0	$0
17	06 - FISH AND WILDLIFE FACILITIES	Contract #4 - Environmental Contract Management	$10,000	37%	$3,700	$13,700
18	18 - CULTURAL RESOURCE PRESERVATION	Contract #4 - Cultural Resource Preservation	$15,000	37%	$5,550	$20,550
19	19 - BUILDINGS, GROUNDS, AND UTILITIES	Contract #4 - Dry Floodproofing - 2 structures	$994,897	37%	$368,112	$1,363,009
20	19 - BUILDINGS, GROUNDS, AND UTILITIES	Contract #4 - Wet Floodproofing - 22 structures	$6,214,198	37%	$2,299,253	$8,513,451
21	19 - BUILDINGS, GROUNDS, AND UTILITIES	Contract #4 - Raise Structure in Place - 1 structure	$283,651	37%	$104,951	$388,602
22			$0	0%	$0	$0
23	30 - PLANNING, ENGINEERING, AND DESIGN	Civil Works only; not included on MILCON Projects.	$2,724,000	37%	$1,007,880	$3,731,880
24	31 - CONSTRUCTION MANAGEMENT	Civil Works only; not included on MILCON Projects.	$1,166,000	37%	$431,420	$1,597,420
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)				$0	$0

TOTALS				
Risk Not Included In CSRA	$1,738,000	28%	$488,378	$2,226,378
Total Construction Estimate	$18,513,435	37%	$6,849,971	$25,363,406
Total Planning, Engineering & Design	$2,724,000	37%	$1,007,880	$3,731,880
Total Construction Management	$1,166,000	37%	$431,420	$1,597,420
Total EXCLUDING Risk Not Included In CSRA	**$22,403,435**	**37%**	**$8,289,271**	**$30,692,706**
Total INCLUDING Risk Not Included In CSRA	**$24,141,435**	**36%**	**$8,777,649**	**$32,919,084**
PROGRAMMED AMOUNT (IF KNOWN)				

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analysis. Must include justification. Does not allocate to Real Estate.

Kentucky R ver Beattyv e KY F ood R sk Management FRM) Feas b ty Study Feas b ty CWRB For M estone #4
Apr 2023

					Project Cost			Project Schedu e		Other n ormat on				Cost mpacts			Schedu e mpacts			Cost rom Schedu e mpacts			Event R sk nfo		Cost R sk Mode ng					Schedu e R sk Mode ng		Add t ona Documentat on	
REF	Risk Type	Risk/Opportunity Event	Risk Event Description	Team Discussions on Impact and Likelihood	Likelihood	Impact (C)	Risk Level (C)	Impact ($)	Risk Level ($)	Cost Variance Distribution	Schedule Variance Distribution	Correlation to Other(s)	Responsibility/ POC	Affected Project Component	Low Variance (C)	Likely (C)	High Variance (C)	Low Variance ($)	Likely ($)	High Variance ($)	Low Variance (CS)	Likely (CS)	High Variance (CS)	TWO STEP (Cost & Schedule)	Event Prob (PCS)	Low Variance (TC)	Likely (TC)	High Variance (TC)	Cost Risk	Simulated Cost Cost Risk x PCS	Schedule Risk	Simulated Schedule Schedule Risk x PCS	Risk Quantification Discussions	Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
1	3 - Ability to Execute (AB)	Funding Delays	Following the Chief's Report, any delays in securing funding may result in an impact on the baseline schedule	It is anticipated that funding may not proceed as planned due to the project's potentially lower economic benefits compared to other nationally competing Flood Risk Management (FRM) projects. With reduced economic benefits, the project may not be prioritized for Congressional funding. However, support from Congressman Hal Rogers' office may provide additional leverage or influence to enhance the project's funding prospects. It is important to recognize that this project is competing on a national level, where many other projects demonstrate a higher Benefit-Cost Ratio (BCR) and are thus more likely to secure funding. The risk of delay could arise during any phase of the project. A delay occurring later in the overall schedule would likely be less detrimental than one occurring earlier.	Likely	Significant	High	Critical	High	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Project Management	Project Cost & Schedule				0.00 MO	0.00 MO	24.00 MO	$0	$0	$1,411,952	100%	1	$0	$0	$1,411,952	$0	$0	0.00 MO	0.00 MO	Delays in funding would keep the project in a holding pattern. While not directly affecting the scope/cost there would be cost from schedule impacts in the form of additional escalation, assumed for each month that the project experienced a delay beyond it's baseline schedule. LV: Assumes the baseline schedule proceeds as planned with no cost from schedule impacts. L: Assumes the baseline schedule proceeds as planned with no cost from schedule impacts. HV: Assumes an 24 month slip due to how WRDA bills are funded on two year cycles; Impacts reflected as additional escalation with the project having sat, untouched.	Accept/Mitigate: With the project likely not competing at a program level (low BCR) the odds of the project not being funded, this cycle, are likely. The best mitigation strategy would be to ensure the local federal representative is tracking, in favor of, and actively lobbying for this project to be included - meaning it's mostly an issue that is out of the hands of the PDT.
2	4 - External Risks (EX)	Escalation Rate deviates from CWCCIS	If the actual escalation rate between now and the time the project goes out for bid differs from currently published CWCCIS rates, then there could be cost impacts	Currently, the TPCS relies on the CWCCIS for published indices, with escalation typically ranging from 2%-3% per year. However, alternative sources, such as the Engineering News Record (ENR), indicate an inflation trend closer to 8.5% over the past three years, suggesting that the TPCS method for calculating escalation may fall short of actual rates. While it is expected that escalation will eventually return to typical levels, this may not be feasible in the short term (2-3 years). If escalation continues to deviate from the CWCCIS index, the TPCS and fully funded cost estimates may ultimately be insufficient. Risk revised during ATR due to clarification that escalation should only be a risk consideration if: 1 - local area expects higher than national average (CWCCIS) inflation 2 – project is seeking a long term fully funded request. If project doesn't fall into one of those two risk categories above, project 902 funding limit will get updated yearly with actual inflation (CWCCIS historic inflation is actual, future escalation is OMB-ish projects) and yearly funding requests can be update for inflation. Modeling previously applied has been removed.	Possible	Marginal	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Select From List	Select From List											100%	1	$0	$0	$0	$0	$0		0.00 MO	See "Escalation Variance" Tab - Average escalation per year were backed into an Phase, based on assumed midpoint and rates applied in the TPCS spreadsheet. Those average rates were then applied with an escalation calculation based on the assumed LV and HV, with the likely remaining in line with the baseline estimate. The overall average, or Most Likely, escalation is then based on rates from CWCCIS, or 2.92% per year LV: Optimistically assumes an average escalation rate less than CWCCIS, at 2% per year, resulting in a slight savings to the project L: Assumes the rates from CWCCIS and included in the TPCS are realistic with no cost to the project added/ reduced from escalation HV: Assumes a escalation rate higher than the calculated annual rate of 5% per year, resulting in added cost to the project	Accept/Mitigate: Similar to Market Conditions, this risk is something which will be tracked over time as factual or not. As the project and design progress over time, new more up to date rates will be published and the overall impacts of escalation variances will go down towards the end of the project. Between now (feasibility) and then this will be a persistent risk that cannot be mitigated.
3	14 - Estimate and Schedule Risks (ES)	Consideration for Contract Modifications/Claims	There is inherent risk of post-award contract changes due to differing conditions, user directed changes, design deficiencies, and/or claims.	Modifications and claims are an inherent component of construction contracts, especially with the anticipated segmentation of the project into multiple phases. While the sponsor is expected to compensate property owners and subsequently seek federal reimbursement, the overall project impact remains unchanged. The Project Delivery Team (PDT) advises using a percentage of the construction cost, approximately 6% to 10%, as a basis for estimating potential cost impacts. Considering the uncertainties inherent to the project's scope and based on historical data, the probability and magnitude of modifications are expected to be significant.	Very Likely	Significant	High	Moderate	High	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Project Management	Contract Cost & Schedule	$56,009	$588,090	$1,120,172	0.00 MO	3.00 MO	6.00 MO		$300,000	$600,000	100%	1	$56,009	$888,090	$1,720,172	$0	$0	0.00 MO	0.00 MO	Based on the discussions during the meeting and how the PDT rated the potential cost/schedule impacts, the Low, High, and Likely variances below were established: LV: Assumes an increase of 2.5% of the Construction cost; No schedule impacts envisioned as some modifications can be absorbed into the critical path, without causing delays to the baseline schedule L: Assumes the direct cost impacts live between the LV and HV; Similarly, potential schedule impacts are thought to be between the LV & HV HV: Assumes an increase of 5% of the Construction cost; Schedule impact of 6 month assumed with cost from schedule growth reflective of additional IOOH which captures indirect cost associated with increasing the construction duration	Accept/Mitigate: Being as contract modifications or claims typically arise from some "unknown" pre-existing condition, little can be done to actively mitigate this risk. While there is no way to completely mitigate this risk, it is possible to some extent to try and minimize the likelihood and impact. Some mitigation strategies during design and construction could include: 1. Developing a detailed scope of work 2. Regular/Clear lines of communication 3. Thorough review processes
4	2 - Scope and Objectives (SC)	Scope & Cost of Non-Structural Work Misunderstood	Due to the unfamiliarity with non-structural work, if the baseline cost or assumption are flawed then there could be cost and/or schedule	Risk would revolve around how likely the PDT feels that there are errors with the baseline estimate/schedule. Given the nature of what all could be included for floodproofing an anticipated/general scope has been determined by the PDT based on the understanding of requirements via FEMA documentation. Actual scope will vary, possibly dramatically, from structure to structure and an effort has been made during the feasibility study to look at individual structures. However, continued finding and the PDT's unfamiliarity with the nature of the work leaves the assumed scopes of work vulnerable to errors and ommissions. Cost and scope assumed could be overestimated or underestimated.	Likely	Significant	High	Moderate	Medium	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Project Management	Contract Cost & Schedule	-$739,627	$0	$1,479,254	0.00 MO	0.00 MO	6.00 MO	$0	$0	$352,988	100%	1	-$739,627	$0	$1,832,242	$0	$0	0.00 MO	0.00 MO	Cost impacts are restricted to the wet/dry floodproofing cost only, assuming they could go up or down as the project moves into design and implementation. LV: Assumes the cost of the wet/dry floodproofing could go down by 5% and no deviation from the baseline schedule L: Assume no deviations from the baseline cost or schedule HV: Assumes the cost of the wet/dry floodproofing could go up by 10% with a 6 month schedule impact with accompanying additional escalation	Accept/Mitigate: During the feasibility stage, some level of cost and schedule uncertainty is unavoidable due to the preliminary nature of the estimates. The team will monitor and revisit the risk as the project progresses into the implementation phase, where more accurate data will be available. Until then, or when implementation comes, increasing the PDT's familiarity with non-structural work by studying FEMA documentation or other USACE projects would be an added benefit for this project. Also not a bad idea considering non-structural solutions appear to be more prevalent at this time across the enterprise.
5	3 - Ability to Execute (AB)	Impacts from Forthcoming Guidance	Existing versus Forthcoming Guidance could change the anticipated plan proposed during Feasibility which may set back our anticipated completion date for the study	There is guidance coming out during this feasibility study from HQ USACE and the Non-Structural committee which may change some of the underlying assumptions or plans made during the feasibility study. An example of this is that guidance came after our TSP meeting which we were directed to change our Real Estate Appendix to comply with. This change actually reduced the cost of the anticipated Real Estate scope by eliminating reembursement of relocation cost, but with more and more of a focus shifting to non-structural the PDT is assuming that more nad more guidance will continue to come out. If a schedule slip were to occur the currently assumed baseline schedule would shift to the right, incurring at least additional escalation with the potential for additional in-house funds being needed to make changes to the plan, re-write portions of the report, update documents, etc.	Possible	Significant	Medium	Moderate	Medium	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Project Management	Project Cost & Schedule	-$1,120,172	$0	$2,240,344	0.00 MO	0.00 MO	3.00 MO	$0	$0	$176,494	100%	1	-$1,120,172	$0	$2,416,837	$0	$0	0.00 MO	0.00 MO	Cost and Schedule impacts are relatively unknown and based on the assignments from the PDT during the CSRA meeting or an anticipated change as a percentage: LV; Assumes due to any released guidance, the scope/requirements for the project become less stringenct and favorably impact the project with a reduction in cost; No schedule impacts assumed L: Assumes no impacts/deviations from the baseline cost or schedule HV: LV; Assumes due to any released guidance, the scope/requirements for the project become more stringenct and favorably impact the project with a reduction in cost; No schedule impacts assumed	Accept/Mitigate: Given the prevalence of non-structural solutions across the enterprise, it appears that more and more guidance continues to be coming down the pipe-line. Meaning by the time this project were to get to implementation, certain requirements could likely. Staying informed, across PDT disciplines, about changes and best practices would likely be the best path forward.
6	21 - Environmental & Cultural/Historical Resources (EC)	HTRW found in Restoration Areas	Results of Phase 1 Assessments could result of a clean up effort for properties plan as demolition/restoration (Phase 2)	Phase 1 Assesments would look to confirm there are not hazardous soils or materials present on any of the properties. If discovered, the cost of clean up would fall on the Non-Federal Sponsor. and not be at the expense of the government or even cost shared. At a minimum the schedule would be greatly impacted while the issue was worked out and resolved. Depending on the circumstance or property, exclusion of the property may not be an Option without impacting or derailing the intent of the project, affecting benefits most notably. There is a known brown field in the middle of town and some underground tanks which were initially discovered. However those are thought to be avoidable, at this time. This risk is focusing on the likelihood/impact of an issues coming up where we have planned for ecosystem restoration/recreational features. To the PDT's knowledge, those known potential issues are in town and not in these planned areas	Possible	Significant	Medium	Significant	Medium	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Environmental Compliance	Contract Cost & Schedule	$0	$0	$750,000	0.00 MO	6.00 MO	12.00 MO	$0	$36,093	$72,185	100%	1	$0	$36,093	$822,185	$0	$0	0.00 MO	0.00 MO	Impacts are assumed to affect the Phase II work as the area(s) in question pertain to properties being acquire and/or locations where we recreation/environmental features are planned. LV: Assumes no variance from the baseline estimate or schedule L: Assume no variance from the baseline estimate, however a 6 month delay would be likely, should the risk occur with accompanying additional escalation HV: Assumes an added (Significant) cost based on input from the PDT with up to 12 months of schedule delay with the associated additional escalation to the Phase II work	Avoid/Transfer: This issue, should it arise, can likely be avoided by slightly modifying the bounds to which we are currently assuming work would take place. In either case, the responsibility for HTRW clean up falls on the NFS. Though technically a cost to the project, it is not an expense with which the government would pay for.
7	21 - Environmental & Cultural/Historical Resources (EC)	HTRW found in Structures	Results of Phase 1 Assessments could result of a clean up effort for properties plan as demolition/restoration (Phases 3 & 4)	Similar to the risk above (REF 7) for structures identified as wet/dry flood proofed, the thought would be that some issues arise with one or more structures. The cost would still fall on the Non-Federal to clean up but there is an opportunity to move on to other structures or exclude that particular structure from the work; If HTRW, such as lead-based paint or asbestos, is found that would be disturbed by the construction of nonstructural measures, the landowner would have to remove it at their own expense, impacting schedule and potentially participation	Possible	Marginal	Low	Marginal	Low	N/A -Not Modeled	N/A -Not Modeled		Select From List	Select From List										100%	1	$0	$0	$0		$0		0.00 MO	Low Risk item, not modeled	Low Risk item, not modeled
8	21 - Environmental & Cultural/Historical Resources (EC)	Tree/Shrub Replantings	Tree/Shrub Planting Do not meet success criteria	Current assumption within in the estimate is trees and shrubs are planted at a density of 302 per acre. Success has not yet been defined but if some unacceptable attrition rate or die off of plantings were to occur (at no fault of the KTK) then additional planting may be required	Possible	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Select From List	Select From List										100%	1	$0	$0	$0		$0		0.00 MO	Low Risk item, not modeled	Low Risk item, not modeled
9	9 - Lands and Damages Risk (RE)	Additional Acquisitions required	If additional real estate acquisitions were needed, beyond those already included it is possible that cost and schedule impacts could be realized	Proposed construction limits proposed during feasibility do not allow for intended design and are not discovered as an issue until implementation. This would result in a change to the currently assumed plan or require more properties to be taken; if clean up required getting into unplanned areas or even Crystal Creek then there would be added cost in the form of the clean up itself, RE, and potential environmental; Due to length of time for the permitting may be a minimum of 90 days	Possible	Marginal	Low	Moderate	Medium	N/A -Not Modeled	N/A -Not Modeled		Real Estate	Contract Schedule				0.00 MO	0.00 MO	3.00 MO		$0	$300,000	100%	1	$0	$0	$300,000	$0	$0	0.00 MO	0.00 MO	Direct cost risk not modeled as the Real Estate Cost provided include an approximate 30% contingency and is assumed to account for this already; However the additional time impacts to the schedule are captured here, including cost from schedule impacts. LV: No direct cost impacts; Schedule assumed to be maintained as laid out in the baseline schedule L: LV: No direct cost impacts; Schedule assumed to be maintained as laid out in the baseline schedule HV: No direct cost impacts; Schedule assumed to slip by 3 months with associated escalation (cost from schedule)	Accept/Mitigate: Some form of mitigation is already taking place by the Real Estate team member accounting for contingency. This risk modeling is accounting for that being insufficient or due to other compounding reasons, is still not enough.
10	2 - Scope and Objectives (SC)	Restoration Work below the OHM	If work associated with the restoration areas was required below the Ordinary High Water (OHW) mark, then additional time and effort would be needed on the front end to properely document/permit work	Restoration work does not currenlty assume any work below the ordinary high water level. If work was needed below this point, additional permitting, report writing, etc. would be required; May even require formal consultation with USFW which has a 6 month duration; Shcedule impacts assumed to be Marginal-Moderate	Possible	Negligible	Low	Moderate	Medium	N/A -Not Modeled	Triangular (LV, ML, 80%)		Environmental Compliance	Contract Schedule				0.00 MO	2.00 MO	6.00 MO	$0	$200,000	$600,000	100%	1	$0	$200,000	$600,000	$200,000		2.00 MO	2.00 MO	No direct cost implications expected however, should it be determined or the scope be modified to show work below the OHWM then new coordination efforts with various other agencies could trigger schedule delays. LV: No direct cost impacts; Schedule assumed to be maintained as laid out in the baseline schedule L: Should the risk be realized it's likely that a 2 month delay would be expected and associated additional JOOH cost would occur HV: Worst case, it's thought that coordination with those other agencies could result in a 6 month delay with cost from schedule impacts	Mitigate/Accept: Should this risk come in to play, there is a good chance that it could be mitigated by slightly altering the planned work, most likely by changing the grading plan
11	21 - Environmental & Cultural/Historical Resources (EC)	Unanticipated Archaelogical Finds	If unknown conditions arise, through later achaelogical surveys, which turn up significant sites or remain then additional time would be needed	While not thought to be likely, if archaeological surveys identify unknown archaeological sites or human remains, there may be additional time for consultation with SHPO and Tribes.	Unlikely	Negligible	Low	Moderate	Low	N/A -Not Modeled	Triangular (LV, ML, 80%)		Planning	Project Schedule										100%	1	$0	$0	$0		$0		0.00 MO	Low Risk item, not modeled	Low Risk item, not modeled
12	~~B - Lands and Damages Risk (RE)~~	~~Ability to Acquire Properties~~	~~Contract/Real Estate Acquisitions~~	~~The willingness and/or ability of the NFS to acquire properties or respond to request in a timely manner could cause schedule disruptions or force the government into a position of using eminant domain to acquire a needed property, for the TSP- The NFS is aware and in support of the plan as it currently is; However responses and coordination often have take longer than anticipated Upon updating the CSRA, from the original sitdown with the PDT, this risk was determined to no longer be a factor and thus has been removed from the model, but left in the register for tracking purposes~~	~~Possible~~	~~Moderate~~	~~Medium~~	~~Significant~~	~~Medium~~	~~N/A -Not Modeled~~	~~N/A -Not Modeled~~		~~Project Management~~	~~Project Cost & Schedule~~				~~0.00 MO~~	~~6.00 MO~~	~~12.00 MO~~	~~$0~~	~~$352,988~~	~~$705,976~~	~~100%~~	~~1~~	~~$0~~	~~$352,988~~	~~$705,976~~	~~$0~~	~~$0~~	~~0.00 MO~~	~~0.00 MO~~	Upon updating the CSRA, from the original sitdown with the PDT, this risk was determined to no longer be a factor and thus has been removed from the model, but left in the register for tracking purposes	Upon updating the CSRA, from the original sitdown with the PDT, this risk was determined to no longer be a factor and thus has been removed from the model, but left in the register for tracking purposes
13	17 - Geotechnical / Geology (GG)	Geotechnical Information Needed	Geotechnical Sampling Possibly needed for some of the Constructable Work	Particularly during phases which involve dry floodproofing, because of the nature of the work, its possible that some geotechnical information would need to be collected. At a minimum there may be some borings which need to be taken through out town or at multiple properties;	Possible	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Select From List	Select From List										100%	1	$0	$0	$0		$0		0.00 MO	Low Risk item, not modeled	Low Risk item, not modeled
14	3 - Ability to Execute (AB)	Non-Federal Sponsor's Ability to Pay	If the non-federal sponsor were to have difficulties obtaining funds for their cost share portion, it could affect the overall schedule	If project cost were to be higher than anticipated, for example due to higher than anticipated escalation or scope/cost ballooning during implementation, it may affect the sponsors ability to pay their cost portion, which could result is some schedule impacts while they seek additional methods or resources to support their funding needs. See REF 2 above, this risk is somewhat related but has been teased out and is considered as a seperate risk as one risk is not necessarily related to each other. The non-federal sponsor has indicated in the past that having funds available would be an issue for them and it is thought that they would seek assistance through grants and other programs to contribute funds or work-in-kind credit.	Possible	Moderate	Medium	Significant	Medium	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Project Management	Project Schedule				0.00 MO	6.00 MO	12.00 MO	$0	$352,988	$705,976	100%	1	$0	$352,988	$705,976	$331,751	$331,751	6.00 MO	6.00 MO	No direct cost implications expected however, over the life of the project, it's possible that the sponsor runs into challenges obtaining the funds (cash, grants, etc.) to pay for their portion, which impacts one or multiple phases of the planned work. LV: Assumes no deviation from the baseline schedule L: Assumes a 6 month schedule slip which impacts the execution of one or more phases, therefore introducing additional cost from schedule in the form of escalation HV: Worst case assumption of 12 months worth of schedule slip with accompanying additional associated escalation	Accept: Given the sponsor's ability to pay responsibilty rest with them, solely there is little the PDT could likely due to mitigate this risk.
15	9 - Lands and Damages Risk (RE)	Relocation Availability Delays	If replacement housing in Beattville is limited, then acquisitions may be delayed, and relocation costs could increase.	The project will displace 5 owner occupied mobile homes and 8 businesses. There is limited availability of replacement business sites in the downtown Beattyville area. Finding suitable replacement business locations may be challenging, leading to cost/schedule delays. Relocating the mobile homes will likely not pose a significant challenge unless many more are moved on site between now and implementation.	Possible	Moderate	Medium	Moderate	Medium	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Real Estate	Project Cost & Schedule	$0	$0	$334,946	0.00 MO	3.00 MO	6.00 MO	$0	$18,046	$36,093	100%	1	$0	$18,046	$371,039	$0	$0	0.00 MO	0.00 MO	LV: Assumes no variance from the baseline estimate or schedule L: Assumes no cost variance from the baseline estimate but a 3 month delay to the schedule while additional location(s) are sought out/approved - impacts are to Phase II work only HV: Assumes a 5% increase to the acquisition portion of Phase II along with a 6 month schedule delay. Cost from schedule would also be incurred	Accept/Mitigate: Little could likely be done at this point to mitigate for this risk. During implementation, close coordination with Real Estate, Engineering, and the NFS would ensure that road blocks are identified early and then coordinated so as not to hang up the overall project.

Kentucky R ver Beattyv e KY F ood R sk Management FRM) Feas b ty Study Feas b ty CWRB For M estone #4

Apr 2025

						Pro ect Cost		Pro ect Schedu e		Other n ormat on				
REF	Risk Type	Risk/Opportunity Event	Risk Event Description	Team Discussions on Impact and Likelihood	Likelihood	Impact (C)	Risk Level (C)	Impact (S)	Risk Level (S)	Cost Variance Distribution	Schedule Variance Distribution	Correlation to Other(s)	Responsibility/ POC	Affected Project Component
16	9 - Lands and Damages Risk (RE)	Non-Standard Estate Requires Approval	If a new standard estate is not approved, then HQ-RE approval for a non-standard estate will be required.	Depending on the type of real estate involvement if we had to deviate from those "standards" then the approval for such has to go to HQ USACE. Forthcoming guidance may establish a new standard estate but if not, then one would need to be created and approved by HQ USACE, which could affect the overall schedule/timing.	Possible	Negligible	Low	Moderate	Medium	N/A -Not Modeled	Triangular (LV, ML, 80%)		Real Estate	Project Schedule
17	1 - Project & Program Management (PM)	Less than 100% Participation	If participation rates for the non-structural dry/wet floodproofing scope were less than 100%, then the overall project cost and schedule would be reduced	It is very likely that once the project begins implementation that participation will not be 100%; There are many factors which might contribute with one of the bigger items being non-reembursable cost; This includes temporary relocations and structural repairs addressign pre-existing conditions; The propery owners would be responsible for making repairs, should they be needed, at their own expenses, aside from the floodproofing scope of work which might be planned. You can not model potential opportunity savings of lower participation. Planning guidance states to assume 100% participation. Economic benefits are based on 100% of all properties. We can't budget (baseline or contingency) for less.	Unrated	Critical	Unrated	Significant	Unrated	N/A -Not Modeled	N/A -Not Modeled		Select From List	Select From List
18	14 - Estimate and Schedule Risks (ES)	Tariffs Affect Material Pricing	If tariffs are applied there may be long term (material cost) implications for this project	Currently (April 2025) tariffs are being implemented by the current administration for imports from China, Mexico, & Canada. There is a possibility that the tariffs could be rolled back or removed prior to this project being implemented or, similar to have price increases were realized from COVID, the material cost could go up and not as quickly come back down. As it currently stands, the material cost accounts for approx 23% of the overall construction related cost and an increase of say 25% could add an additional $950k to the project; The PDT is of the mind, however, that by the time this project reaches implementation the tariffs will have have gone away or their impacts will have dimished, rankingthe likelihood as Possible.	Possible	Moderate	Medium	Negligible	Low	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Cost Engineering	Contract Cost
19	Select From List				Select From List	Select From List	Unrated	Select From List	Unrated	Select From List	Select From List		Select From List	Select From List
20	Select From List				Select From List	Select From List	Unrated	Select From List	Unrated	Select From List	Select From List		Select From List	Select From List

	Cost mpacts			Schedu e mpacts			Cost rom Schedu e mpacts			Event R sk n o		Cost R sk Mode ng					Schedu e R sk Mode ng		Add t ona Documentat on	
REF	Low Variance (C)	Likely (C)	High Variance (C)	Low Variance (S)	Likely (S)	High Variance (S)	Low Variance (CS)	Likely (CS)	High Variance (CS)	TWO STEP (Cost & Schedule)	Event Prob (PCS)	Low Variance (TC)	Likely (TC)	High Variance (TC)	Cost Risk	Simulated Cost Cost Risk x PCS	Schedule Risk	Simulated Schedule Schedule Risk x PCS	Risk Quantification Discussions	Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
16				0.00 MO	3.00 MO	6.00 MO	$0	$176,494	$352,988	100%	1	$0	$176,494	$352,988	$0	$0	0.00 MO	0.00 MO	No direct cost impacts model, however, there may be some schedule implications should this risk be realized: LV: Assume no cost or schedule deviations from the baseline documents L: Assume no cost impacts, however a 3 month schedule slip could be realized with associated cost from schedule impacts HV: Assume no cost impacts, however a 6 month schedule slip could be realized with associated cost from schedule impacts	Accept: Given that this decision is forthcoming there is little to be done until that has happened. Risk modeling takes into consideration the potential "what-if" and is about the only form of mitigation that can occur until some future point in time.
17										100%	1	$0	$0	$0		$0		0.00 MO	Cannot model risk as planning guidance requires us to assume 100% participation	Cannot model risk as planning guidance requires us to assume 100% participation
18	$0	$0	$363,347							100%	1	$0	$0	$363,347	$0	$0		0.00 MO	Cost Impacts modeled by evaluating the overall materials included in the Phase 3 and 4 contracts as those consist of material most likely to be impacted by tariffs. See tab "Tariff Effects" for specific calculations L: Assumes no variance from the baseline estimate LV: Assumes no variance from the baseline estimate H: Assumes of the material cost in the PHase 3 and 4 estimate, 50% of those see a 25% cost increase	Accept/Mitigate: Little could be done to mitigate for this potential impact short of carrying contingency for it, which is what the CSRA is allowing for. As regular updates are made, new quotes should be obtained thereby transfering this risk, over time and as needed, into the baseline estimate.
19										100%	1	$0	$0	$0		$0		0.00 MO		
20										100%	1	$0	$0	$0		$0		0.00 MO		

Project Contingency

Kentucky River, Beattyville, KY - Flood Risk Management (FRM) Feasibility Study

April 2025

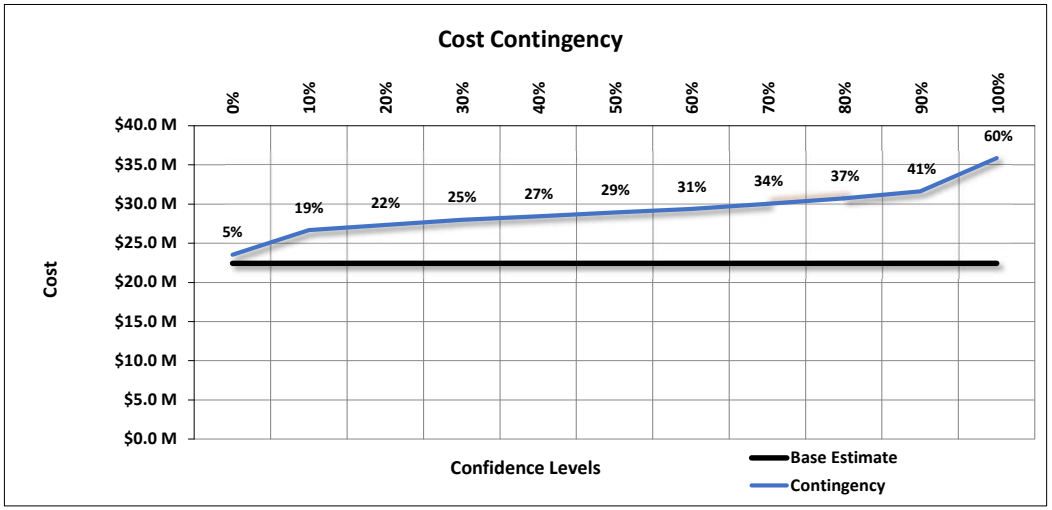
Contingency on Base Estimate	80% Confidence Project Cost	
Base Estimate	$22,403,435	
Estimate Contingency	$8,289,271	37%
Base Estimate w/ Contingency (80% Confidence)	$30,692,706	

Contingency on Base Schedule	80% Confidence Project Schedule	
Base Schedule Start Date	November 13, 2026	
Base Schedule Finish Date	September 5, 2036	
Base Schedule Duration	117.7 Months	
Schedule Contingency Duration	67.1 Months	57%
Base Schedule w/ Contingency (80% Confidence)	184.9 Months	
Base Finish Date w/ Contingency (80% Confidence)	April 9, 2042	

PROJECT COST CONTINGENCY DEVELOPMENT

Cost Contingency Analysis

Base Estimate	$22,403,435		
Confidence Level	Contingency Value	Contingency	Cost with Contingency
0%	$1,120,172	5%	$23,523,607
10%	$4,256,653	19%	$26,660,088
20%	$4,928,756	22%	$27,332,191
30%	$5,600,859	25%	$28,004,294
40%	$6,048,927	27%	$28,452,362
50%	$6,496,996	29%	$28,900,431
60%	$6,945,065	31%	$29,348,500
70%	$7,617,168	34%	$30,020,603
80%	**$8,289,271**	**37%**	**$30,692,706**
90%	$9,185,408	41%	$31,588,843
100%	$13,442,061	60%	$35,845,496



Project Contingency

Kentucky River, Beattyville, KY - Flood Risk Management (FRM) Feasibility Study

April 2025

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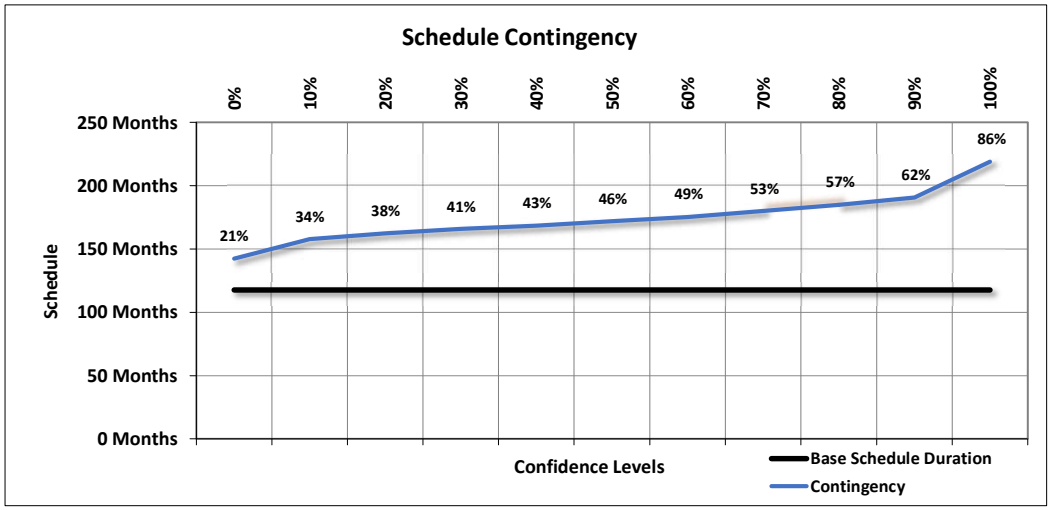
- PROJECT SCHEDULE CONTINGENCY (DURATION) DEVELOPMENT

Schedule Contingency Analysis

Base Schedule Duration	117.7 Months		
Confidence Level	Contingency Value	Contingency	Duration with Contingency
0%	24.7 Months	21%	142.5 Months
10%	40.0 Months	34%	157.8 Months
20%	44.7 Months	38%	162.5 Months
30%	48.3 Months	41%	166.0 Months
40%	50.6 Months	43%	168.4 Months
50%	54.2 Months	46%	171.9 Months
60%	57.7 Months	49%	175.4 Months
70%	62.4 Months	53%	180.1 Months
90%	73.0 Months	62%	190.7 Months
100%	101.3 Months	86%	219.0 Months



Sensitivity Charts

Kentucky River, Beattyville, KY - Flood Risk Management (FRM) Feasibility Study

April 2025

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- Top Cost Risk Drivers by Confidence Levels -

- Top Schedule Risk Drivers by Confidence Levels -

Sensitivity Charts

Kentucky River, Beattyville, KY - Flood Risk Management (FRM) Feasibility Study

April 2025

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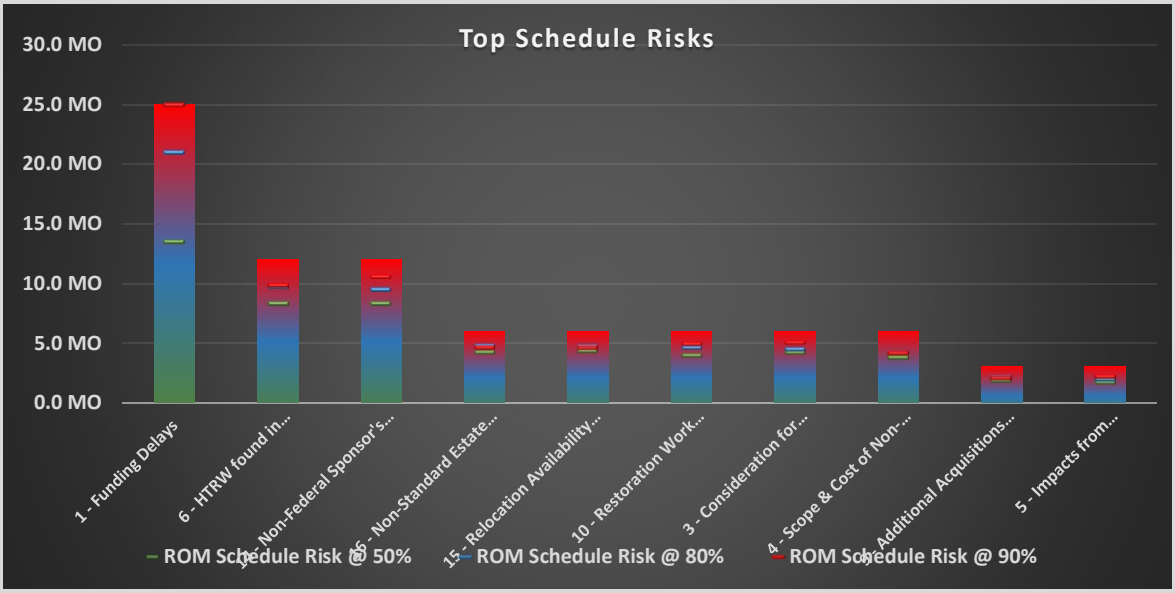
- Top Cost Risk Drivers & Ranges -

- Top Schedule Risk Drivers & Ranges -



Sensitivity Charts

Kentucky River, Beattyville, KY - Flood Risk Management (FRM) Feasibility Study

April 2025

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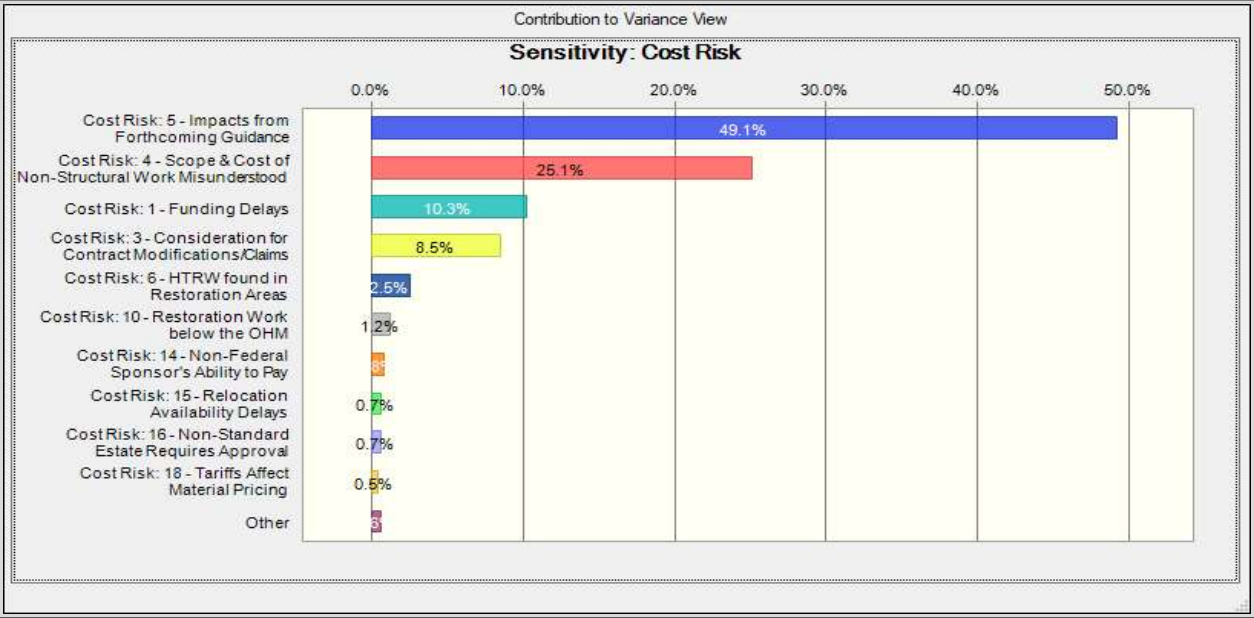
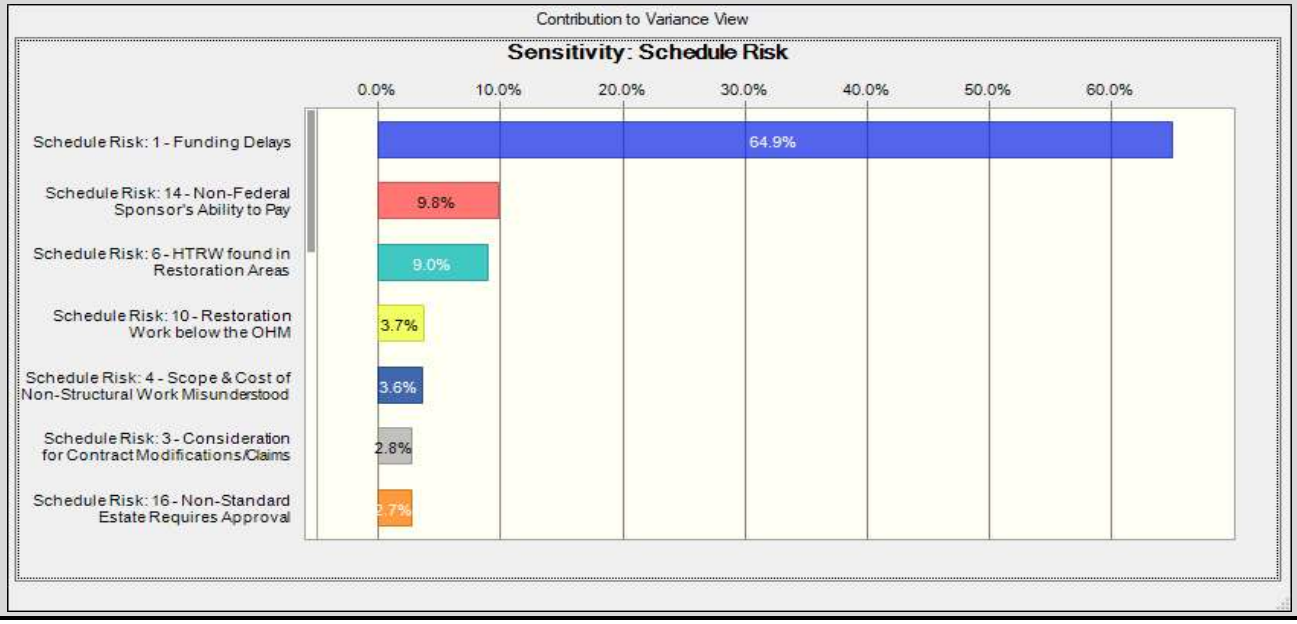
- Cost Sensitivity Chart -



- Schedule Sensitivity Chart -



Cost Risk Dashboard

Project: Kentucky River, Beattyville, KY - Flood Risk Management (FRM) Feasibility Study
Location: Beattyville, KY (Lee County)

Contingency on Base Estimate	80% Confidence Project Cost	
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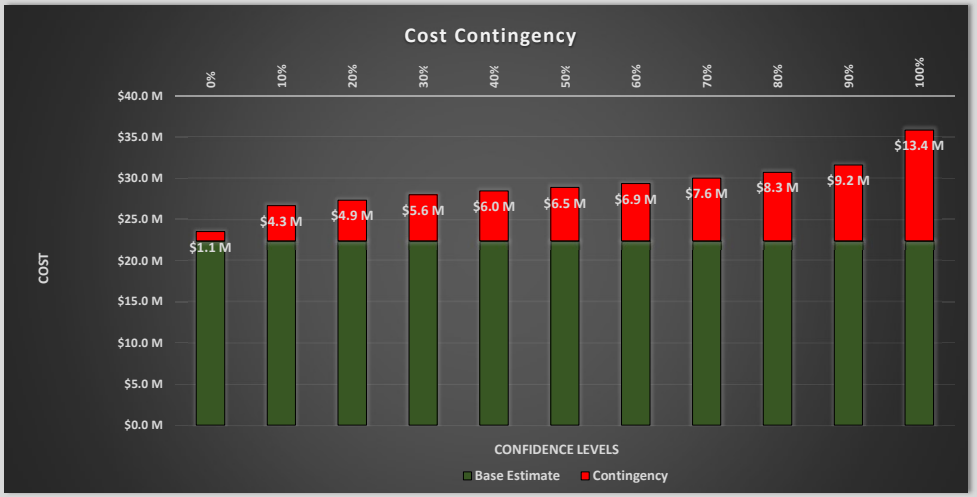

TOP COST RISKS

	Risk/Opportunity Event	Risk Event Description	Team Discussions on Impact and Likelihood	Responsibility/ POC	Risk Level		Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
					Cost	Schedule	
5	Impacts from Forthcoming Guidance	Existing versus Forthcoming Guidance could change the anticipated plan proposed during Feasibility which may set back our anticipated completion date for the study	There is guidance coming out during this feasibility study from HQ USACE and the Non-Structural committee which may change some of the underlying assumptions or plans made during the feasibility study. An example of this is that guidance came after our TSP meeting which we were directed to change our Real Estate Appendix to comply with. This change actually reduced the cost of the anticipated Real Estate scope by eliminating reembursement of relocation cost, but with more and more of a focus shifting to non-structural the PDT is assuming that more nad more guidance will continue to come out.	Project Management	Medium	Medium	Accept/Mitigate: Given the prevalence of non-structural solutions across the enterprise, it appears that more and more guidance continues to be coming down the pipe line. Meaning by the time this project were to get to implementation, certain requirements could change. Staying informed, across PDT disciplines, about changes and best practices would likely be the best path forward.
3	Consideration for Contract Modifications/Claims	There is inherent risk of post-award contract changes due to differing conditions, user directed changes, design deficiencies, and/or claims.	Modifications and claims are an inherent component of construction contracts, especially with the anticipated segmentation of the project into multiple phases. While the sponsor is expected to compensate property owners and subsequently seek federal reimbursement, the overall project impact remains unchanged. The Project Delivery Team (PDT) advises using a percentage of the construction cost, approximately 6% to 10%, as a basis for estimating potential cost impacts. Considering the uncertainties inherent to the project's scope and based on historical data, the probability and magnitude of modifications are expected to be significant.	Project Management	High	High	Accept/Mitigate: Being as contract modifications or claims typically arise from some "unknown" pre-existing condition, little can be done to actively mitigate this risk. While there is no way to completely mitigate this risk, it is possible to some extent to try and minimize the likelihood and impact. Some mitigation strategies during design and construction could include: 1. Developing a detailed scope of work 2. Regular/Clear lines of communication 3. Thorough review processes
4	Scope & Cost of Non-Structural Work Misunderstood	Due to the unfamiliarity with non-structural work, if the baseline cost or assumption are flawed then there could be cost and/or schedule	Risk would revolve around how likely the PDT feels that there are errors with the baseline estimate/schedule. Given the nature of what all could be included for floodproofing an anticipated/general scope has been determined by the PDT based on the understanding of requirements via FEMA documentation. Actual scope will vary, possibly dramatically, from structure to structure and an effort has been made during the feasibility study to look at individual structures. However, continued flooding and the PDT's unfamiliarity with the nature of the work leaves the assumed scopes of work vulnerable to errrors and ommissions. Cost and scope assumed could be overestimated or underestimated.	Project Management	High	Medium	Accept/Mitigate: During the feasibility stage, some level of cost and schedule uncertainty is unavoidable due to the preliminary nature of the estimates. The team will monitor and revisit the risk as the project progresses into the implementation phase, where more accurate data will be available. Until then, or when implementation comes, increasing the PDT's familiarity with non-structural work by studying FEMA documentation or other USACE projects would be an added benefit for this project. Also not a bad idea considering non-structural solutions appear to be more prevalent at this time across the enterprise.

Cost Risk Dashboard

Project: Kentucky River, Beattyville, KY - Flood Risk Management (FRM) Feasibility Study
Location: Beattyville, KY (Lee County)

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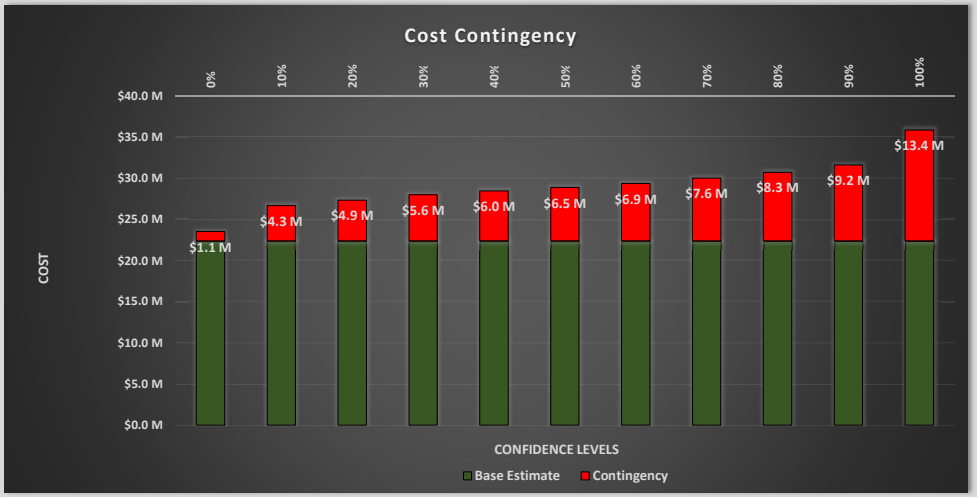

TOP COST RISKS

	Risk/Opportunity Event	Risk Event Description	Team Discussions on Impact and Likelihood	Responsibility/ POC	Risk Level		Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
					Cost	Schedule	
1	Funding Delays	Following the Chief's Report, any delays in securing funding may result in an impact on the baseline schedule	It is anticipated that funding may not proceed as planned due to the project's potentially lower economic benefits compared to other nationally competing Flood Risk Management (FRM) projects. With reduced economic benefits, the project may not be prioritized for Congressional funding. However, support from Congressman Hal Rogers' office may provide additional leverage or influence to enhance the project's funding prospects. It is important to recognize that this project is competing on a national level, where many other projects demonstrate a higher Benefit-Cost Ratio (BCR) and are thus more likely to secure funding. The risk of delay could arise during any phase of the project. A delay occurring later in the overall schedule would likely be less detrimental than one occurring earlier.	Project Management	High	High	Accept/Mitigate: With the project likely not competing at a program level (low BCR) the odds of the project not being funded, this cycle, are likely. The best mitigation strategy would be to ensure the local federal represenative is tracking, in favor of, and actively lobbying for this project to be included - meaning it's mostly an issue that is out of the hands of the PDT.
6	HTRW found in Restoration Areas	Results of Phase 1 Assessments could result of a clean up effort for properties plan as demolition/restoration (Phase 2)	Phase 1 Assesments would look to confirm there are not hazardous soils or materials present on any of the properties. If discovered, the cost of clean up would fall on the Non-Federal Sponsor. and not be at the expense of the government or even cost shared. At a minimum the schedule would be greatly impacted while the issue was worked out and resolved. Depending on the circumstance or property, exclusion of the property may not be an Option without impacting or derailing the intent of the project, affecting benefits most notably. There is a known brown field in the middle of town and some underground tanks which were initially discovered. However those are thought to be avoidable, at this time. This risk is focusing on the likelihood/impact of an issues coming up where we have planned for ecosystem restoration/recreational features. To the PDTs knowledge, those known potential issues are in town and not in these planned areas	Environmental Compliance	Medium	Medium	Avoid/Transfer: This issue, should it arise, can likely be avoided by slightly modifying the bounds to which we are currently assuming work would take place. In either case, the responsibility for HTRW clean up falls on the NFS. Though technically a cost to the project, it is not an expense with which the government would pay for.
14	Non-Federal Sponsor's Ability to Pay	If the non-federal sponsor were to have difficulties obtaining funds for their cost share portion, it could affect the overall schedule	If project cost were to be higher than anticipated, for example due to higher than anticipated escalation or scope/cost ballooning during implementation, it may affect the sponsors ability to pay their cost portion, which could result is some schedule impacts while they seek additional methods or resources to support their funding needs. See REF 2 above, this risk is somewhat related but has been teased out and is considered as a seperate risk as one risk is not necessarily related to each other. The non-federal sponsor has indicated in the past that having funds available would be an issue for them and it is thought that they would seek assistance through grants and other programs to contribute funds or work-in-kind credit.	Project Management	Medium	Medium	Accept: Given the sponsor's ability to pay responsibilty rest with them, solely there is little the PDT could likely due to mitigate this risk.

Cost Risk Dashboard

Project: Kentucky River, Beattyville, KY - Flood Risk Management (FRM) Feasibility Study
Location: Beattyville, KY (Lee County)

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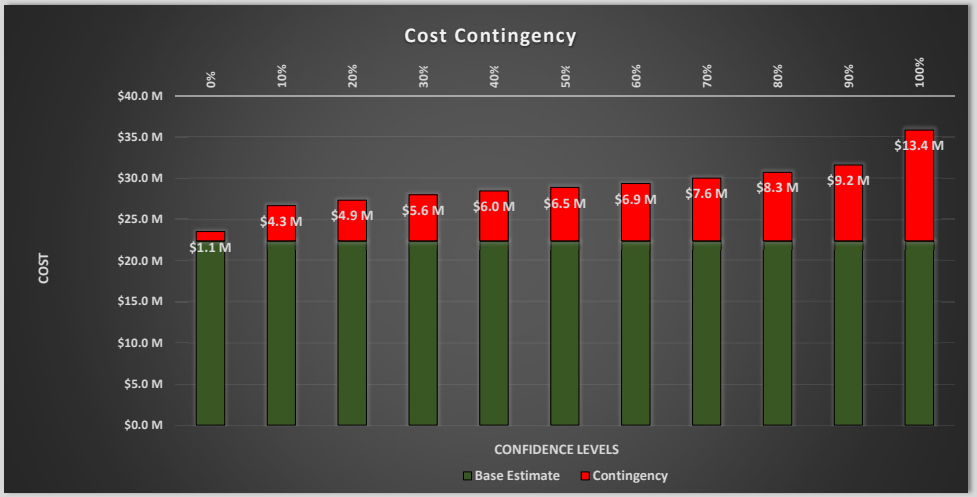


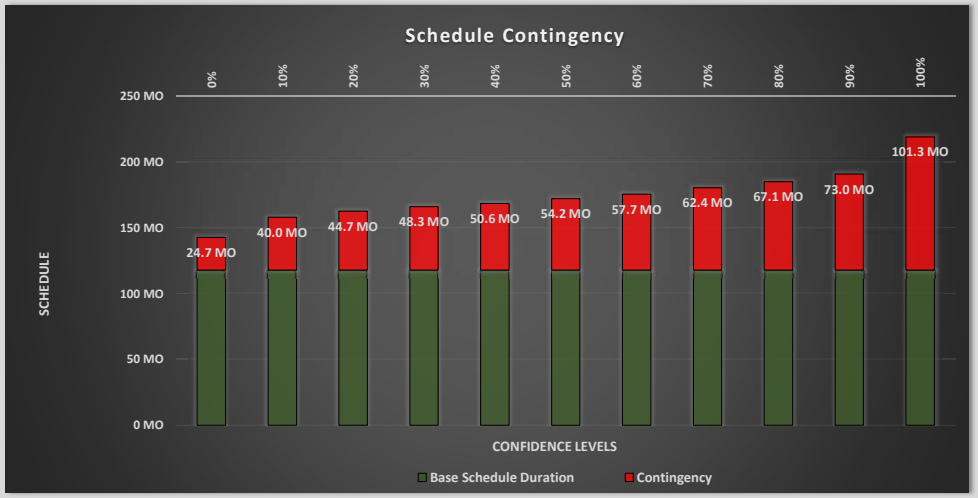
TOP COST RISKS

Risk/Opportunity Event		Risk Event Description	Team Discussions on Impact and Likelihood	Responsibility/ POC	Risk Level		Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
					Cost	Schedule	
10	Restoration Work below the OHM	If work associated with the restoration areas was required below the Ordinary High Water (OHW) mark, then additional time and effort would be needed on the front end to proporely document/permit work	Restoration work does not currenlty assume any work below the ordinary high water level. If work was needed below this point, additional permitting, report writing, etc. would be required; May even require formal consultation with USFW which has a 6 month duration; Shcedule impacts assumed to be Marginal-Moderate	Environmental Compliance	Low	Medium	Mitigate/Accept: Should this risk come in to play, there is a good chance that it could be mitigated by slightly altering the planned work, most likely by changing the grading plan
16	Non-Standard Estate Requires Approval	If a new standard estate is not approved, then HQ-RE approval for a non-standard estate will be required.	Depending on the type of real estate involvement if we had to deviate from those "standards" then the approval for such has to go to HQ USACE. Forthcoming guidance may establish a new standard estate but if not, then one would need to be created and approved by HQ USACE, which could affect the overall schedule/timing.	Real Estate	Low	Medium	Accept: Given that this decision is forthcoming there is little to be done until that has happened. Risk modeling takes into consideration the potential "what-if" and is about the only form of mitigation that can occur until some future point in time.
15	Relocation Availability Delays	If replacement housing in Beattville is limited, then acquisitions may be delayed, and relocation costs could increase.	The project will displace 5 owner occupied mobile homes and 8 businesses. There is limited availability of replacement business sites in the downtown Beattyville area. Finding suitable replacement business locations may be challenging, leading to cost/schedule delays. Relocating the mobile homes will likely not pose a significant challenge unless many more are moved on site between now and implementation.	Real Estate	Medium	Medium	Accept/Mitigate: Little could likely be done at this point to mitigate for this risk. During implementation, close coordination with Real Estate, Engineering, and the NFS would ensure that road blocks are identified early and then coordinated so as not to hang up the overall project.
18	Tariffs Affect Material Pricing	If tariffs are applied there may be long term (material cost) implications for this project	Currently (April 2025) tariffs are being implemented by the current administration for imports from China, Mexico, & Canada. There is a possibility that the tarriffs could be rolled back or removed prior to this project being implemented or, similar to have price increases were realized from COVID, the material cost could go up and not as quickly come back down. As it currently stands, the material cost accounts for approx 23% of the overall construction related cost and an increase of say 25% could add an additional $950k to the project; The PDT is of the mind, however, that by the time this project reaches implementation the tariffs will have have gone away or their impacts will have dimished, rankingthe likelihood as Possible.	Cost Engineering	Medium	Low	Accept/Mitigate: Little could be done to mitigate for this potential impact short of carrying contingency for it, which is what the CSRA is allowing for. As regular updates are made, new quotes should be obtained thereby transfering this risk, over time and as needed, into the baseline estimate.

Schedule Risk Dashboard

Project: Kentucky River, Beattyville, KY - Flood Risk Management (FRM) Feasibility Study
Location: Beattyville, KY (Lee County)

Contingency on Base Schedule	80% Confidence Project Schedule	
Base Schedule Start Date	November 13, 2026	
Base Schedule Finish Date	September 5, 2036	
Base Schedule Duration	117.7 Months	57%
Schedule Contingency Duration	67.1 Months	
Base Schedule w/ Contingency (80% Confidence)	184.9 Months	
Base Finish Date w/ Contingency (80% Confidence)	April 9, 2042	



TOP SCHEDULE RISKS

	Risk/Opportunity Event	Risk Event Description	Team Discussions on Impact and Likelihood	Responsibility/ POC	Risk Level		Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
					Cost	Schedule	
1	Funding Delays	Following the Chief's Report, any delays in securing funding may result in an impact on the baseline schedule	It is anticipated that funding may not proceed as planned due to the project's potentially lower economic benefits compared to other nationally competing Flood Risk Management (FRM) projects. With reduced economic benefits, the project may not be prioritized for Congressional funding. However, support from Congressman Hal Rogers' office may provide additional leverage or influence to enhance the project's funding prospects. It is important to recognize that this project is competing on a national level, where many other projects demonstrate a higher Benefit-Cost Ratio (BCR) and are thus more likely to secure funding. The risk of delay could arise during any phase of the project. A delay occurring later in the overall schedule would likely be less detrimental than one occurring earlier.	Project Management	High	High	Accept/Mitigate: With the project likely not competing at a program level (low BCR) the odds of the project not being funded, this cycle, are likely. The best mitigation strategy would be to ensure the local federal represenative is tracking, in favor of, and actively lobbying for this project to be included - meaning it's mostly an issue that is out of the hands of the PDT.
6	HTRW found in Restoration Areas	Results of Phase 1 Assessments could result of a clean up effort for properties plan as demolition/restoration (Phase 2)	Phase 1 Assesments would look to confirm there are not hazardous soils or materials present on any of the properties. If discovered, the cost of clean up would fall on the Non-Federal Sponsor. and not be at the expense of the government or even cost shared. At a minimum the schedule would be greatly impacted while the issue was worked out and resolved. Depending on the circumstance or property, exclusion of the property may not be an Option without impacting or derailing the intent of the	Environmental Compliance	Medium	Medium	Avoid/Transfer: This issue, should it arise, can likely be avoided by slightly modifying the bounds to which we are currently assuming work would take place. In either case, the responsibility for HTRW clean up falls on the NFS. Though technically a cost to the project, it is not an expense with which the government would pay for.
14	Non-Federal Sponsor's Ability to Pay	If the non-federal sponsor were to have difficulties obtaining funds for their cost share portion, it could affect the overall schedule	If project cost were to be higher than anticipated, for example due to higher than anticipated escalation or scope/cost ballooning during implementation, it may affect the sponsors ability to pay their cost portion, which could result is some schedule impacts while they seek additional methods or resources to support their funding needs. See REF 2 above, this risk is somewhat related but has been teased out and is considered as a seperate risk as one risk is not necessarily related to each other. The non-federal sponsor has indicated in the past that having funds available would be an issue for them and it is thought that they would seek assistance through grants and other programs to contribute funds or work-in-kind credit.	Project Management	Medium	Medium	Accept: Given the sponsor's ability to pay responsibilty rest with them, solely there is little the PDT could likely due to mitigate this risk.
16	Non-Standard Estate Requires Approval	If a new standard estate is not approved, then HQ-RE approval for a non-standard estate will be required.	Depending on the type of real estate involvement if we had to deviate from those "standards" then the approval for such has to go to HQ USACE. Forthcoming guidance may establish a new standard estate but if not, then one would need to be created and approved by HQ USACE, which could affect the overall schedule/timing.	Real Estate	Low	Medium	Accept: Given that this decision is forthcoming there is little to be done until that has happened. Risk modeling takes into consideration the potential "what-if" and is about the only form of mitigation that can occur until some future point in time.

Schedule Risk Dashboard

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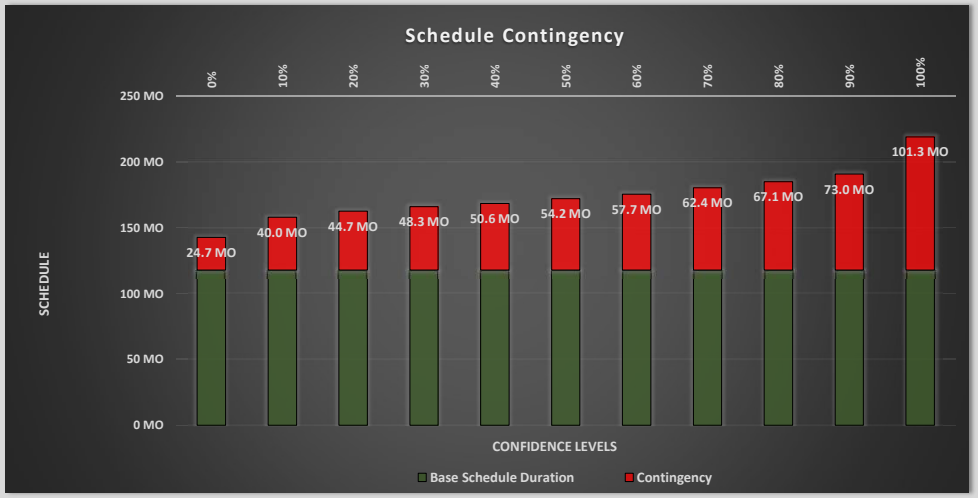

TOP SCHEDULE RISKS

Risk/Opportunity Event		Risk Event Description	Team Discussions on Impact and Likelihood	Responsibility/ POC	Risk Level		Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
					Cost	Schedule	
15	Relocation Availability Delays	If replacement housing in Beattville is limited, then acquisitions may be delayed, and relocation costs could increase.	The project will displace 5 owner occupied mobile homes and 8 businesses. There is limited availability of replacement business sites in the downtown Beattyville area. Finding suitable replacement business locations may be challenging, leading to cost/schedule delays. Relocating the mobile homes will likely not pose a significant challenge unless many more are moved on site between now and implementation.	Real Estate	Medium	Medium	Accept/Mitigate: Little could likely be done at this point to mitigate for this risk. During implementation, close coordination with Real Estate, Engineering, and the NFS would ensure that road blocks are identified early and then coordinated so as not to hang up the overall project.
10	Restoration Work below the OHM	If work associated with the restoration areas was required below the Ordinary High Water (OHW) mark, then additional time and effort would be needed on the front end to proporely document/permit work	Restoration work does not currenlty assume any work below the ordinary high water level. If work was needed below this point, additional permitting, report writing, etc. would be required; May even require formal consultation with USFW which has a 6 month duration; Shcedule impacts assumed to be Marginal-Moderate	Environmental Compliance	Low	Medium	Mitigate/Accept: Should this risk come in to play, there is a good chance that it could be mitigated by slightly altering the planned work, most likely by changing the grading plan
3	Consideration for Contract Modifications/Claims	There is inherent risk of post-award contract changes due to differing conditions, user directed changes, design deficiencies, and/or claims.	Modifications and claims are an inherent component of construction contracts, especially with the anticipated segmentation of the project into multiple phases. While the sponsor is expected to compensate property owners and subsequently seek federal reimbursement, the overall project impact remains unchanged. The Project Delivery Team (PDT) advises using a percentage of the construction cost, approximately 6% to 10%, as a basis for estimating potential cost impacts. Considering the uncertainties inherent to the project's scope and based on historical data, the probability and magnitude of modifications are expected to be significant.	Project Management	High	High	Accept/Mitigate: Being as contract modifications or claims typically arise from some "unknown" pre-existing condition, little can be done to actively mitigate this risk. While there is no way to completely mitigate this risk, it is possible to some extent to try and minimize the likelihood and impact. Some mitigation strategies during design and construction could include: 1. Developing a detailed scope of work 2. Regular/Clear lines of communication 3. Thorough review processes
4	Scope & Cost of Non-Structural Work Misunderstood	Due to the unfamiliarity with non-structural work, if the baseline cost or assumption are flawed then there could be cost and/or schedule	Risk would revolve around how likely the PDT feels that there are errors with the baseline estimate/schedule. Given the nature of what all could be included for floodproofing an anticipated/general scope has been determined by the PDT based on the understanding of requirements via FEMA documentation. Actual scope will vary, possibly dramatically, from structure to structure and an effort has been made during the feasibility study to look at individual structures. However, continued flooding and the PDT's unfamiliarity with the nature of the work leaves the assumed scopes of work vulnerable to errrors and ommissions. Cost and scope assumed could be overestimated or underestimated.	Project Management	High	Medium	Accept/Mitigate: During the feasibility stage, some level of cost and schedule uncertainty is unavoidable due to the preliminary nature of the estimates. The team will monitor and revisit the risk as the project progresses into the implementation phase, where more accurate data will be available. Until then, or when implementation comes, increasing the PDT's familiarity with non-structural work by studying FEMA documentation or other USACE projects would be an added benefit for this project. Also not a bad idea considering non-structural solutions appear to be more prevalent at this time across the enterprise.
9	Additional Acquisitions required	If additional real estate acquisitions were needed, beyond those already included it is possible that cost and schedule impacts could be realized	Proposed construction limits proposed during feasibility do not allow for intended design and are not discovered as an issue until implementation. This would result in a change to the currently assumed plan or require more properties to be taken; If clean up required getting into unplanned areas or even Crystal Creek then there would be added cost in the form of the clean up itself, RE, and potential environmental; Due to length of time for the permitting may be a minimum of 90 days	Real Estate	Low	Medium	Accept/Mitigate: Some form of mitigation is already taking place by the Real Estate team member accounting for contingency. This risk modeling is accounting for that being insufficient or due to other compounding reasons, is still not enough.

Schedule Risk Dashboard

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Location: Beattyville, KY (Lee County)

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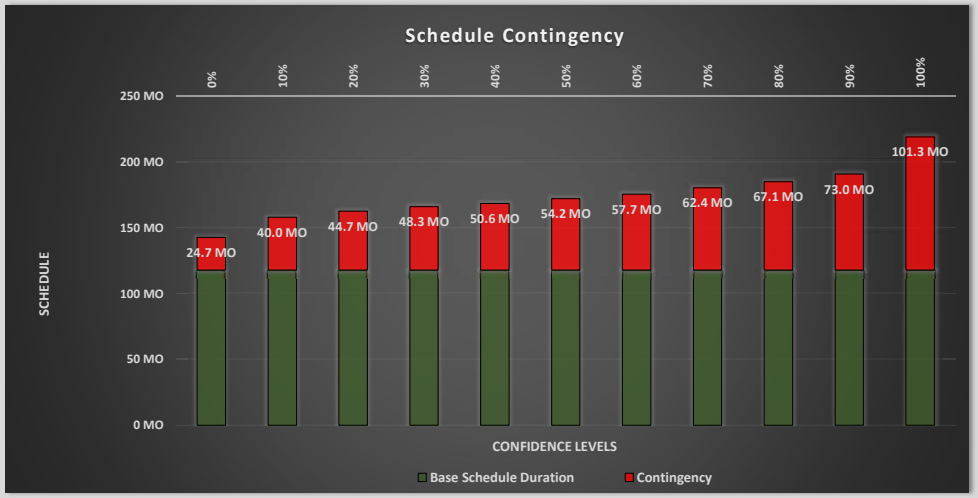

TOP SCHEDULE RISKS

Risk/Opportunity Event		Risk Event Description	Team Discussions on Impact and Likelihood	Responsibility/ POC	Risk Level		Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
					Cost	Schedule	
5	Impacts from Forthcoming Guidance	Existing versus Forthcoming Guidance could change the anticipated plan proposed during Feasibility which may set back our anticipated completion date for the study	There is guidance coming out during this feasibility study from HQ USACE and the Non-Structural committee which may change some of the underlying assumptions or plans made during the feasibility study. An example of this is that guidance came after our TSP meeting which we were directed to change our Real Estate Appendix to comply with. This change actually reduced the cost of the anticipated Real Estate scope by eliminating reembursement of relocation cost, but with more and more of a focus shifting to non-structural the PDT is assuming that more nad more guidance will continue to come out. If a schedule slip were to occur the currently assumed baseline schedule would shift to the right, incurring at least additional escalation with the potential for additional in-house funds being needed to make changes to the plan, re-write portions of the report, update documents,etc.	Project Management	Medium	Medium	Accept/Mitigate: Given the prevalence of non-structural solutions across the enterprise, it appears that more and more guidance continues to be coming down the pipe line. Meaning by the time this project were to get to implementation, certain requirements could change. Staying informed, across PDT disciplines, about changes and best practices would likely be the best path forward.

ATTACHMENT C

TOTAL PROJECT COST SUMMARY SHEET (TPCS)

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: **Beattyville_KY - Flood Risk Management (FRM) - Feasibility Study**
PROJECT NO: 498892
LOCATION: Beattyville, KY (Lee County)

DISTRICT: **Louisville District, LRL** **PREPARED:** **3/3/2025**
POC: **CHIEF, COST ENGINEERING, Jim Vermillion, TCCC**

This Estimate reflects the scope and schedule in report; Beattyville Feasibility Report_FOR_DQC

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25									
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	**TOTAL ($K)** *J*	Spent Thru: **1-Oct-24** ($K)	**TOTAL FIRST COST** ($K) *K*	INFLATED (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
06	FISH & WILDLIFE FACILITIES	$421	$156	37.0%	$577	2.7%	$432	$160	$592	$0	$592	7.1%	$463	$171	$634
14	RECREATION FACILITIES	$1,393	$515	37.0%	$1,908	2.7%	$1,430	$529	$1,960	$0	$1,960	9.4%	$1,565	$579	$2,144
18	CULTURAL RESOURCE PRESERVATION	$55	$20	37.0%	$75	2.7%	$56	$21	$77	$0	$77	11.9%	$63	$23	$87
19	BUILDINGS, GROUNDS & UTILITIES	$15,462	$5,721	37.0%	$21,184	2.7%	$15,881	$5,876	$21,756	$0	$21,756	20.1%	$19,070	$7,056	$26,126
20	PERMANENT OPERATING EQUIPMENT (FWEEP)	$1,182	$438	37.0%	$1,620	2.7%	$1,214	$449	$1,664	$0	$1,664	6.0%	$1,287	$476	$1,763
	CONSTRUCTION ESTIMATE TOTALS:	$18,513	$6,850		$25,363	2.7%	$19,014	$7,035	$26,049	$0	$26,049	18.1%	$22,448	$8,306	$30,754
01	LANDS AND DAMAGES	$1,738	$488	28.1%	$2,226	2.7%	$1,785	$501	$2,286	$0	$2,286	9.4%	$1,956	$546	$2,501
30	PLANNING, ENGINEERING & DESIGN	$2,724	$1,008	37.0%	$3,731	3.1%	$2,808	$1,039	$3,847	$0	$3,847	19.9%	$3,367	$1,246	$4,613
31	CONSTRUCTION MANAGEMENT	$1,166	$431	37.0%	$1,598	3.1%	$1,202	$445	$1,647	$0	$1,647	21.5%	$1,461	$541	$2,002
	PROJECT COST TOTALS:	$24,141	$8,777	36.4%	$32,918		$24,809	$9,020	**$33,829**	$0	**$33,829**	17.9%	$29,232	$10,638	$39,870

ESTIMATED TOTAL PROJECT COST: **$39,870**

_____ **CHIEF, COST ENGINEERING, Jim Vermillion, TCCC**

_____ **PROJECT MANAGER, Jacob Sinkhorn, PE**

_____ **CHIEF, REAL ESTATE, Ashley Klimaszewski**

_____ **CHIEF, PLANNING, Nate Moulder**

_____ **CHIEF, ENGINEERING, Ian Mitchel, PE**

_____ **CHIEF, OPERATIONS, Waylon Humphrey**

_____ **CHIEF, CONSTRUCTION, Kevin Jefferson**

_____ **CHIEF, CONTRACTING, Misty Bock**

_____ **CHIEF, PM-PB, Matt Schueler**

_____ **CHIEF, DPM, John Bock, PE**

**** CONTRACT COST SUMMARY ****

PROJECT: Beattyville_KY - Flood Risk Management (FRM) - Feasibility Study
LOCATION: Beattyville, KY (Lee County)
This Estimate reflects the scope and schedule in report; Beattyville Feasibility Report_FOR_DQC

DISTRICT: Louisville District, LRL
POC: CHIEF, COST ENGINEERING, Jim Vermillion, TCCC
PREPARED: 3/3/2025

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 3-Mar-25 Effective Price Level: 1-Oct-24				Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Contract/Phase #1 - FWEEP													
06	FISH & WILDLIFE FACILITIES	$10	$4	37.0%	$14	2.7%	$10	$4	$14	2027Q2	3.3%	$11	$4	$15
14	RECREATION FACILITIES	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
18	CULTURAL RESOURCE PRESERVATION	$10	$4	37.0%	$14	2.7%	$10	$4	$14	2027Q2	3.3%	$11	$4	$15
19	BUILDINGS, GROUNDS & UTILITIES	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
20	PERMANENT OPERATING EQUIPMENT (FWEEP)	$1,182	$438	37.0%	$1,620	2.7%	$1,214	$449	$1,664	2028Q2	6.0%	$1,287	$476	$1,763
	CONSTRUCTION ESTIMATE TOTALS:	$1,202	$445	37.0%	**$1,647**		$1,235	$457	$1,692			$1,308	$484	$1,792
01	LANDS AND DAMAGES	$106	$30	28.3%	$136	2.7%	$109	$31	$140	2028Q1	5.3%	$115	$32	$147
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$12	$4	37.0%	$16	3.1%	$12	$5	$17	2027Q3	4.7%	$13	$5	$18
0.5%	Planning & Environmental Compliance	$6	$2	37.0%	$8	3.1%	$6	$2	$8	2027Q3	4.7%	$6	$2	$9
10.0%	Engineering & Design	$120	$44	37.0%	$165	3.1%	$124	$46	$170	2027Q3	4.7%	$130	$48	$178
1.0%	Reviews, ATRs, IEPRs, VE	$12	$4	37.0%	$16	3.1%	$12	$5	$17	2027Q3	4.7%	$13	$5	$18
1.0%	Life Cycle Updates (cost, schedule, risks)	$12	$4	37.0%	$16	3.1%	$12	$5	$17	2027Q3	4.7%	$13	$5	$18
1.0%	Contracting & Reprographics	$12	$4	37.0%	$16	3.1%	$12	$5	$17	2027Q3	4.7%	$13	$5	$18
1.0%	Engineering During Construction	$12	$4	37.0%	$16	3.1%	$12	$5	$17	2027Q3	4.7%	$13	$5	$18
1.0%	Planning During Construction	$12	$4	37.0%	$16	3.1%	$12	$5	$17	2027Q3	4.7%	$13	$5	$18
0.5%	Adaptive Management & Monitoring	$6	$2	37.0%	$8	3.1%	$6	$2	$8	2027Q3	4.7%	$6	$2	$9
0.0%	Project Operations	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Real Estate (All Federal Labor)	$20	$7	37.0%	$27	3.1%	$21	$8	$28	2027Q3	4.7%	$22	$8	$30
31	CONSTRUCTION MANAGEMENT													
5.7%	Construction Management	$69	$25	37.0%	$94	3.1%	$71	$26	$97	2027Q3	4.7%	$74	$27	$101
0.0%	Project Operation:	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Management	$12	$4	37.0%	$16	3.1%	$12	$5	$17	2027Q3	4.7%	$13	$5	$18
	CONTRACT COST TOTALS:	$1,613	$588		$2,201		$1,658	$604	**$2,262**			$1,752	$638	**$2,390**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

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LOCATION: Beattyville, KY (Lee County)
This Estimate reflects the scope and schedule in report; Beattyville Feasibility Report_FOR_DQC

DISTRICT: Louisville District, LRL
POC: CHIEF, COST ENGINEERING, Jim Vermillion, TCCC
PREPARED: 3/3/2025

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A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Contract/Phase #2 - Flood Plain Acquisition/Demolition with Recreation & Enviornmental Restoration													
06	FISH & WILDLIFE FACILITIES	$391	$145	37.0%	$535	2.7%	$401	$149	$550	2028Q3	6.6%	$428	$158	$587
14	RECREATION FACILITIES	$1,393	$515	37.0%	$1,908	2.7%	$1,430	$529	$1,960	2029Q3	9.4%	$1,565	$579	$2,144
18	CULTURAL RESOURCE PRESERVATION	$15	$6	37.0%	$21	2.7%	$15	$6	$21	2028Q3	6.6%	$16	$6	$23
19	BUILDINGS, GROUNDS & UTILITIES	$670	$248	37.0%	$918	2.7%	$688	$255	$943	2029Q1	8.0%	$743	$275	$1,018
20	PERMANENT OPERATING EQUIPMENT	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	(FWEEP)	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$2,468	$913	37.0%	**$3,382**		$2,535	$938	$3,473			$2,753	$1,019	$3,771
01	LANDS AND DAMAGES	$1,076	$335	31.1%	$1,411	2.7%	$1,105	$344	$1,449	2028Q3	6.7%	$1,178	$367	$1,545
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$25	$9	37.0%	$34	3.1%	$25	$9	$35	2028Q1	6.3%	$27	$10	$37
0.5%	Planning & Environmental Compliance	$12	$5	37.0%	$17	3.1%	$13	$5	$17	2028Q1	6.3%	$14	$5	$19
10.0%	Engineering & Design	$247	$91	37.0%	$338	3.1%	$254	$94	$349	2028Q1	6.3%	$271	$100	$371
1.0%	Reviews, ATRs, IEPRs, VE	$25	$9	37.0%	$34	3.1%	$25	$9	$35	2028Q1	6.3%	$27	$10	$37
1.0%	Life Cycle Updates (cost, schedule, risks)	$25	$9	37.0%	$34	3.1%	$25	$9	$35	2028Q1	6.3%	$27	$10	$37
1.0%	Contracting & Reprographics	$25	$9	37.0%	$34	3.1%	$25	$9	$35	2028Q1	6.3%	$27	$10	$37
1.0%	Engineering During Construction	$25	$9	37.0%	$34	3.1%	$25	$9	$35	2029Q3	11.3%	$28	$10	$39
1.0%	Planning During Construction	$25	$9	37.0%	$34	3.1%	$25	$9	$35	2029Q3	11.3%	$28	$10	$39
0.5%	Adaptive Management & Monitoring	$12	$5	37.0%	$17	3.1%	$13	$5	$17	2029Q3	11.3%	$14	$5	$19
0.0%	Project Operations	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Real Estate (All Federal Labor)	$47	$17	37.0%	$64	3.1%	$48	$18	$66	2028Q4	8.8%	$53	$19	$72
31	CONSTRUCTION MANAGEMENT													
5.7%	Construction Management	$141	$52	37.0%	$193	3.1%	$145	$54	$199	2029Q3	11.3%	$161	$60	$221
0.0%	Project Operation:	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Management	$25	$9	37.0%	$34	3.1%	$25	$9	$35	2029Q3	11.3%	$28	$10	$39
	CONTRACT COST TOTALS:	$4,176	$1,482		$5,659		$4,292	$1,523	**$5,815**			$4,637	$1,646	**$6,283**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Beattyville_KY - Flood Risk Management (FRM) - Feasibility Study
LOCATION: Beattyville, KY (Lee County)
This Estimate reflects the scope and schedule in report; Beattyville Feasibility Report_FOR_DQC

DISTRICT: Louisville District, LRL
POC: CHIEF, COST ENGINEERING, Jim Vermillion, TCCC
PREPARED: 3/3/2025

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 3-Mar-25 Effective Price Level: 1-Oct-24				Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Contract/Phase #3 - Essential Structures - Dry/Wet Floodproof													
06	FISH & WILDLIFE FACILITIES	$10	$4	37.0%	$14	2.7%	$10	$4	$14	2031Q4	15.9%	$12	$4	$16
14	RECREATION FACILITIES	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
18	CULTURAL RESOURCE PRESERVATION	$15	$6	37.0%	$21	2.7%	$15	$6	$21	2031Q4	15.9%	$18	$7	$24
19	BUILDINGS, GROUNDS & UTILITIES	$7,300	$2,701	37.0%	$10,001	2.7%	$7,497	$2,774	$10,271	2031Q4	15.9%	$8,692	$3,216	$11,908
20	PERMANENT OPERATING EQUIPMENT	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	(FWEEP)	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$7,325	$2,710	37.0%	**$10,035**		$7,523	$2,783	$10,306			$8,721	$3,227	$11,948
01	LANDS AND DAMAGES	$182	$41	22.5%	$223	2.7%	$187	$42	$229	2029Q4	10.1%	$206	$46	$252
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$73	$27	37.0%	$100	3.1%	$76	$28	$103	2031Q4	19.1%	$90	$33	$123
0.5%	Planning & Environmental Compliance	$37	$14	37.0%	$50	3.1%	$38	$14	$52	2031Q4	19.1%	$45	$17	$62
5.0%	Engineering & Design	$366	$136	37.0%	$502	3.1%	$378	$140	$517	2031Q4	19.1%	$450	$166	$616
1.0%	Reviews, ATRs, IEPRs, VE	$73	$27	37.0%	$100	3.1%	$76	$28	$103	2031Q4	19.1%	$90	$33	$123
1.0%	Life Cycle Updates (cost, schedule, risks)	$73	$27	37.0%	$100	3.1%	$76	$28	$103	2031Q4	19.1%	$90	$33	$123
0.5%	Contracting & Reprographics	$37	$14	37.0%	$50	3.1%	$38	$14	$52	2031Q4	19.1%	$45	$17	$62
3.0%	Engineering During Construction	$220	$81	37.0%	$301	3.1%	$227	$84	$310	2031Q4	19.1%	$270	$100	$370
0.5%	Planning During Construction	$37	$14	37.0%	$50	3.1%	$38	$14	$52	2031Q4	19.1%	$45	$17	$62
0.5%	Adaptive Management & Monitoring	$37	$14	37.0%	$50	3.1%	$38	$14	$52	2031Q4	19.1%	$45	$17	$62
0.0%	Project Operations	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Real Estate (All Federal Labor)	$40	$15	37.0%	$55	3.1%	$41	$15	$56	2029Q4	12.1%	$46	$17	$63
31	CONSTRUCTION MANAGEMENT													
5.7%	Construction Management	$418	$154	37.0%	$572	3.1%	$430	$159	$590	2031Q4	19.1%	$513	$190	$702
0.0%	Project Operation:	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.5%	Project Management	$37	$14	37.0%	$50	3.1%	$38	$14	$52	2031Q4	19.1%	$45	$17	$62
	CONTRACT COST TOTALS:	$8,953	$3,286		**$12,239**		$9,201	$3,377	**$12,578**			$10,700	$3,929	**$14,629**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Beattyville_KY - Flood Risk Management (FRM) - Feasibility Study
LOCATION: Beattyville, KY (Lee County)
This Estimate reflects the scope and schedule in report; Beattyville Feasibility Report_FOR_DQC

DISTRICT: Louisville District, LRL
POC: CHIEF, COST ENGINEERING, Jim Vermillion, TCCC

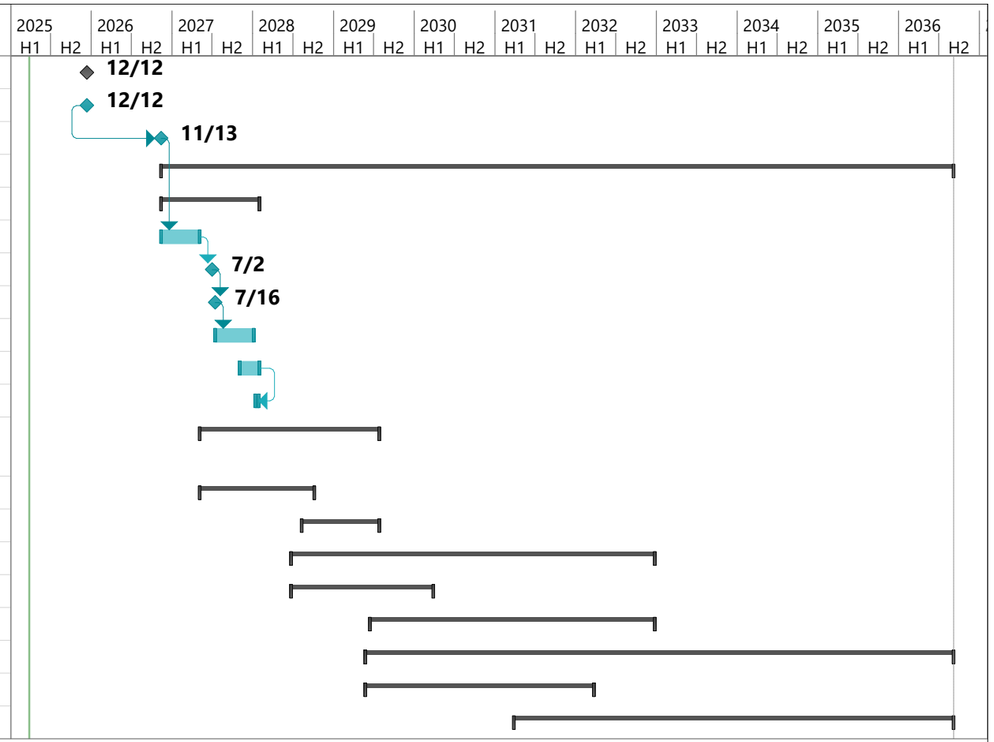
PREPARED: 3/3/2025

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			3-Mar-25	Program Year (Budget EC):			2026					
		Effective Price Level:			1-Oct-24	Effective Price Level Date:			1 OCT 25	FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Contract/Phase #4 - Historic Structures - Dry/Wet Floodproof, Raise In Place													
06	FISH & WILDLIFE FACILITIES	$10	$4	37.0%	$14	2.7%	$10	$4	$14	2032Q4	18.9%	$12	$5	$17
14	RECREATION FACILITIES	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
18	CULTURAL RESOURCE PRESERVATION	$15	$6	37.0%	$21	2.7%	$15	$6	$21	2032Q4	18.9%	$18	$7	$25
19	BUILDINGS, GROUNDS & UTILITIES	$7,493	$2,772	37.0%	$10,265	2.7%	$7,695	$2,847	$10,543	2034Q4	25.2%	$9,636	$3,565	$13,201
20	PERMANENT OPERATING EQUIPMENT	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	(FWEEP)	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$7,518	$2,782	37.0%	**$10,299**		$7,721	$2,857	$10,578			$9,666	$3,576	$13,243
01	LANDS AND DAMAGES	$374	$82	21.9%	$456	2.7%	$384	$84	$468	2032Q4	18.9%	$457	$100	$557
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$75	$28	37.0%	$103	3.1%	$78	$29	$106	2034Q4	30.4%	$101	$37	$139
0.5%	Planning & Environmental Compliance	$38	$14	37.0%	$51	3.1%	$39	$14	$53	2034Q4	30.4%	$51	$19	$69
5.0%	Engineering & Design	$376	$139	37.0%	$515	3.1%	$388	$143	$531	2034Q4	30.4%	$505	$187	$693
1.0%	Reviews, ATRs, IEPRs, VE	$75	$28	37.0%	$103	3.1%	$78	$29	$106	2034Q4	30.4%	$101	$37	$139
1.0%	Life Cycle Updates (cost, schedule, risks)	$75	$28	37.0%	$103	3.1%	$78	$29	$106	2034Q4	30.4%	$101	$37	$139
0.5%	Contracting & Reprographics	$38	$14	37.0%	$51	3.1%	$39	$14	$53	2034Q4	30.4%	$51	$19	$69
3.0%	Engineering During Construction	$226	$83	37.0%	$309	3.1%	$233	$86	$319	2034Q4	30.4%	$303	$112	$416
0.5%	Planning During Construction	$38	$14	37.0%	$51	3.1%	$39	$14	$53	2034Q4	30.4%	$51	$19	$69
0.5%	Adaptive Management & Monitoring	$38	$14	37.0%	$51	3.1%	$39	$14	$53	2034Q4	30.4%	$51	$19	$69
0.0%	Project Operations	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Real Estate (All Federal Labor)	$63	$23	37.0%	$86	3.1%	$65	$24	$89	2032Q4	22.8%	$80	$30	$109
31	CONSTRUCTION MANAGEMENT													
5.7%	Construction Management	$429	$159	37.0%	$587	3.1%	$442	$163	$605	2034Q4	30.4%	$576	$213	$789
0.0%	Project Operation:	$0	$0	37.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.5%	Project Management	$38	$14	37.0%	$51	3.1%	$39	$14	$53	2034Q4	30.4%	$51	$19	$69
	CONTRACT COST TOTALS:	$9,398	$3,421		**$12,819**		$9,658	$3,516	**$13,174**			$12,144	$4,424	**$16,568**

ATTACHMENT D

CONSTRUCTION SCHEDULE

ID	Task Mode	Task Name	Duration	Start	Finish
1		**Feasibility Phase**	**0 days**	**Fri 12/12/25**	**Fri 12/12/25**
2		Chief's Report Signature	0 days	Fri 12/12/25	Fri 12/12/25
3		Project Partnership Agreement (PPA) Signed & Executed	0 days	Fri 11/13/26	Fri 11/13/26
4		**Design & Implementation Phase**	**2468 days**	**Fri 11/13/26**	**Fri 9/5/36**
5		**Contract/Phase #1 - FWEEP**	**307 days**	**Fri 11/13/26**	**Tue 2/1/28**
6		D/B RFP Development	6 mons	Fri 11/13/26	Thu 5/6/27
7		Contract Award to A/E Design Firm	0 days	Fri 7/2/27	Fri 7/2/27
8		Notice to Proceed (NTP) Issued	0 days	Fri 7/16/27	Fri 7/16/27
9		Design Phase	6 mons	Fri 7/16/27	Wed 1/5/28
10		Real Estate Acquisitions	3 mons	Fri 11/5/27	Tue 2/1/28
11		Construction Phase (Installation of Sirens)	88.89 hrs	Wed 1/12/28	Fri 1/28/28
12		**Contract/Phase #2 - Flood Plain Acquisition/Demolition with Recreation & Enviornmental Restoration**	**560.81 days**	**Fri 5/7/27**	**Fri 7/27/29**
13		**Pre-Construction**	**359 days**	**Fri 5/7/27**	**Thu 10/5/28**
16		**Construction Related Tasks**	**241.81 days**	**Thu 8/10/28**	**Fri 7/27/29**
47		**Contract/Phase #3 - Essential Structures - Dry/Wet Floodproof**	**1131 days**	**Fri 6/23/28**	**Fri 12/24/32**
48		**Pre-Construction**	**442 days**	**Fri 6/23/28**	**Thu 3/28/30**
51		**Construction Related Tasks**	**885 days**	**Fri 6/15/29**	**Fri 12/24/32**
70		**Contract/Phase #4 - Historic Structures - Dry/Wet Floodproof, Raise In Place**	**1830 days**	**Fri 5/25/29**	**Fri 9/5/36**
71		**Pre-Construction**	**706 days**	**Fri 5/25/29**	**Tue 3/23/32**
74		**Construction Related Tasks**	**1371 days**	**Fri 3/28/31**	**Fri 9/5/36**



Project: Beattyville_KY - FRM Fe
Date: Wed 3/26/25

Task	Project Summary	Manual Task	Start-only	Deadline	
Split	Inactive Task	Duration-only	Finish-only	Progress	
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress	
Summary	Inactive Summary	Manual Summary	External Milestone		

ATTACHMENT E

ASSUMED SCOPES OF WORK FOR FLOODPROOFING

1 OVERVIEW OF WET FLOODPROOFING SCOPE OF WORK

The scope of work for "wet floodproofing" involves the selective demolition, renovation, and floodproofing of an existing structure, with a strong emphasis on wet floodproofing techniques to enhance resilience against flooding events. The modifications adhere to industry best practices as outlined in FEMA guidelines, ASCE 24-14 ("Flood Resistant Design and Construction"), and International Building Code (IBC) flood provisions.

1.1 INTERIOR DEMOLITION

The demolition process involves the removal of non-flood resilient interior components to prepare the structure for upgrades that will meet flood resilience requirements. Key elements include:

1.1.1 Flooring & Wall Finishes:

Removal of existing non-flood resilient floor coverings and wood-based trim down to the structural substrate. This step ensures that new materials, including flood damage-resistant flooring and wall systems, can be installed.

1.1.2 Insulation & Wallboard:

Removal of existing insulation and replacement with closed-cell spray foam or rigid flood-resistant insulation, per FEMA Technical Bulletin 2 (TB-2), "Flood Damage-Resistant Materials Requirements".

Non-resistant gypsum board will be replaced with a water-resistant wallboard installed with a horizontal break at the 8 feet above finished floor, allowing for easier post-flood drying and replacement if necessary.

1.1.3 Electrical, Plumbing, and HVAC Demolition:

Electrical components, including outlets, panelboards, and wiring that are within 8 feet of the finished floor, will be removed and replaced with waterproof outlets or all circuits would be placed on GFCI circuits to cut off the electric if and when exposed to water.

Water heaters will be removed and relocated to a location 8 feet above finished floor.

HVAC ductwork and furnaces will be removed and relocated to an elevation above 8 feet above finished floor, in compliance with ASCE 24-14, Section 7.1, which requires mechanical equipment to be above DFE or designed to withstand flood exposure.

1.2 INTERIOR WET FLOODPROOFING UPGRADES

Wet floodproofing is a mitigation strategy that allows water to enter and exit non-habitable spaces while minimizing damage to structural and interior components. The following actions align with FEMA TB-7 ("Wet Floodproofing Requirements") and ASCE 24-14, Chapter 6:

1.2.1 Installation of Flood-Resistant Materials:

All materials below 8 feet AFF will comply with FEMA's Class 4 or Class 5 flood damage-resistant materials as per FEMA TB-2. This includes:

- Water-resistant gypsum board (such as cement board) instead of standard drywall.
- Non-porous flooring (e.g., sealed concrete or tile) instead of wood or carpet.
- Closed-cell spray foam insulation, which resists moisture absorption.

1.2.2 Flood-Resistant Doors:

Interior solid-core wood doors with waterproof coatings will be installed.

Exterior-grade metal doors with marine-grade finishes will be used to minimize flood damage.
All door hardware and fasteners below the flood level will be corrosion-resistant (stainless steel or galvanized materials), in accordance with ASCE 24-14, Section 6.2.

1.2.3 Installation of Engineered Flood Vents:

Smart Vents will be installed in the foundation walls to facilitate automatic equalization of hydrostatic pressure. These vents comply with FEMA TB-1 ("Openings in Foundation Walls and Walls of Enclosures") and 44 CFR 60.3(c)(5), which require at least one square inch of net opening for every square foot of enclosed space.
The vents will be positioned at or below the base flood elevation to allow floodwaters to enter and exit freely, preventing structural failure due to water pressure differentials.

1.2.4 Sump Pump & Drainage System:

A sump pump system will be installed in the lowest level of the structure to help remove floodwaters quickly post-event.

The system will include a battery backup in case of power loss, per FEMA P-312 ("Homeowner's Guide to Retrofitting") recommendations.

1.3 UTILITY & MECHANICL SYSTEM FLOODPROOFING

Utility systems are highly vulnerable to flood damage, so the following modifications align with ASCE 24-14, Chapter 7, which mandates that mechanical, electrical, and plumbing (MEP) systems must either be elevated above BFE or designed to withstand flood exposure.

1.3.1 Electrical System Elevation & Waterproofing:

The electrical metering/panel (exterior) and main electrical panel (interior) will be relocated to an elevation 8' above finished floor to maintain functionality during a flood event.
Ground-floor outlets will be replaced with ground-fault circuit interrupter (GFCI) outlets to reduce electrical hazards in wet conditions.

1.3.2 HVAC System Relocation & Protection:

The HVAC compressor (exterior) and furnace (interior) will be elevated on a flood-resistant platform or relocated to a higher floor to prevent inundation.

Ductwork below the flood level will be relocated to an elevation 8' above finished floor

1.3.3 Plumbing System Backflow Prevention:

A backwater valve will be installed on the main sewer line to prevent floodwater from backing up into the structure. This measure follows FEMA P-348 ("Protecting Building Utility Systems from Flood Damage").

1.4 FINAL IMPLEMENTATION & COMPLIANCE MEASURES

1.4.1 Obtaining Permits for Flood Mitigation Work

All necessary permits will be secured to comply with FEMA, NFIP, and local building codes.

1.4.2 Conducting Inspections & Verifying Compliance

Structural engineers and floodplain management officials will inspect installations for compliance with:

- ASCE 24-14 (Flood Resistant Design and Construction).
- NFIP floodplain regulations (44 CFR Part 60).
- FEMA Technical Bulletins (TB-1, TB-2, TB-7).

1.4.3 Documentation for NFIP Compliance

Completion of a Floodproofing Certificate (FEMA Form 086-0-34) if required, ensuring eligibility for flood insurance reductions under NFIP guidelines.

2 OVERVIEW OF DRY FLOOD PROOFING SCOPE OF WORK

This scope of work includes selective demolition, renovation, and floodproofing of existing structures to enhance resilience against flood events. The modifications will align with industry best practices when envisioning "dry floodproofing" as outlined in FEMA guidelines, ASCE 24-14 (Flood Resistant Design and Construction), and the International Building Code (IBC) flood provisions.

2.1 WET FLOODPROOFING SCOPE OF WORK (UP TO 6" AFF)

Since no structure can be made entirely watertight, wet floodproofing measures will involve the removal of non-flood-resistant materials up to 6 inches above the finished floor. The following modifications will be implemented:

2.1.1 Flooring & Trim Finishes

Removal of existing flooring materials that are not flood-damage-resistant and replacement with water-resistant flooring per FEMA Technical Bulletin 2 (TB-2).

Removal of wood-based trim and replacement with water-resistant materials.

2.1.2 Insulation & Wallboard

Removal of existing insulation and replacement with closed-cell spray foam or rigid flood-resistant insulation, per FEMA TB-2.

Replacement of non-flood-resistant gypsum board with water-resistant wallboard to facilitate drying and post-flood repair.

2.1.3 Sump Pump & Drainage System

Installation of a sump pump(s) at the lowest level to expedite floodwater removal.

Inclusion of a battery backup system per FEMA P-312 (Homeowner’s Guide to Retrofitting).

2.2 EXTERIOR DRY FLOODPROOFING SCOPE OF WORK (UP TO 3' ABOVE FINISHED FLOOR)

Dry floodproofing measures will be applied to exterior walls and openings up to 3 feet above the finished floor to prevent floodwater infiltration. The following modifications will be implemented:

2.2.1 3-Foot Brick Wainscot & Foundation Extension

A 3-foot-tall brick wainscot will be installed to improve water resistance. The construction will follow Figure 7-8 of FEMA's Homeowner's Guide to Retrofitting and will include:

1. Removal of hardscaping around the existing building perimeter/foundation (as needed).
2. Excavation and exposure of the existing foundation.
3. Installation of reinforcement and formwork for the foundation extension.

4. Pouring of new concrete foundation extension.
5. Application of a waterproof coating to existing masonry.
6. Installation of a new masonry veneer, including anchors, weeps, and rowlocks.

7. Backfilling around the updated foundation and masonry veneer.
8. Restoration of hardscaping to pre-construction conditions.

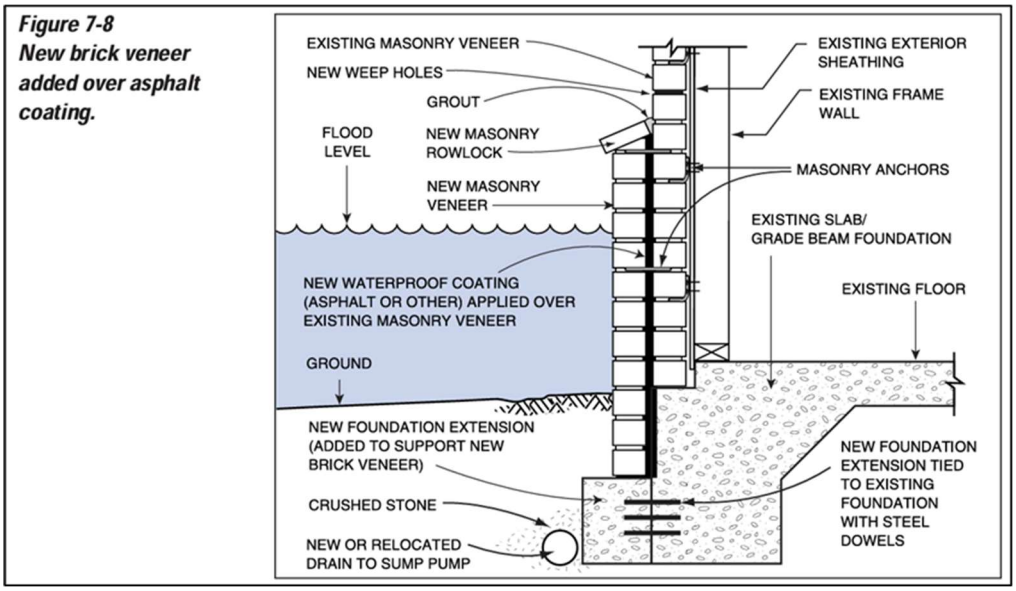


Figure 7-8: FEMA "Homeowners Guide to Retrofitting", Ch. 7, Method for sealing masonry

2.3 FLOOD BARRIERS FOR DOORS & WINDOWS

Removable flood barriers will be installed at all door openings up to 3 feet (plus some allowable freeboard) above the finished floor. Windows are assumed to be protected by barriers from the bottom of the existing window opening, up 24 inches (which takes into consideration the bottom of a given window opening is likely

already above the finished floor elevation.

2.3.1 Floodproofing of Exterior Doors:

1. Standard Exterior Door (up to 3' Width) – Channel/clamping trim and a grooved threshold for easy installation of a 48” tall removable barrier. See image below for representative example of proposed solution.

2. Oversized/Double Door (6' Width) – Includes an intermediate drop-in post for a dual-panel system, not unlike the single door solution from above (2 x 36” wide x 48” tall flood barrier).

3. Garage Door (Up to 12' Width) – Includes three intermediate drop-in supports to accommodate a four-panel system (4 x 36” flood barrier). Also includes the channel/track system and threshold needed for a complete barrier system. See image below for representative example of proposed solution.

2.3.2 Floodproofing of Exterior Windows:

1. Standard Window (4' Width) – Channel/clamping trim installed on the sides and bottom to allow easy installation of a removable 24” flood barrier. See image below for representative example of proposed solution.

2.4 UTILITY & MECHANICAL SYSTEM FLOODPROOFING

Per ASCE 24-14, Chapter 7, all mechanical, electrical, and plumbing (MEP) systems will be either elevated above the Design Flood Elevation (DFE) or protected against flood exposure.

2.4.1 Electrical System Elevation & Waterproofing

Relocation of the main exterior electrical panel/meter to 8 feet above finished floor

2.4.2 HVAC System Relocation & Protection

Elevation of the exterior HVAC equipment (heat pump) on a flood-resistant platform.

2.4.3 Plumbing System Backflow Prevention

Installation of a backwater valve on the main sewer line per FEMA P-348 (Protecting Building Utility Systems from Flood Damage).

2.5 FINAL IMPLEMENTATION & COMPLIANCE MEASURES

2.5.1 1. Obtaining Permits for Flood Mitigation Work

All necessary permits will be secured to comply with FEMA, NFIP, and local building codes.

2.5.2 2. Conducting Inspections & Verifying Compliance

Structural engineers and floodplain management officials will inspect installations for compliance with:

- ASCE 24-14 (Flood Resistant Design and Construction).
- NFIP floodplain regulations (44 CFR Part 60).
- FEMA Technical Bulletins (TB-1, TB-2, TB-7).

2.5.3 3. Documentation for NFIP Compliance

Completion of a Floodproofing Certificate (FEMA Form 086-0-34) if required, ensuring eligibility for flood insurance reductions under NFIP guidelines.