# MIAMI-DADE COUNTY, FLORIDA

## Miami-Dade Back Bay

## COASTAL STORM RISK MANAGEMENT

### Final Integrated Feasibility Report and Environmental Assessment

### Cost Engineering

### Appendix A-2

**JULY 2024**

US Army Corps of Engineers®
Norfolk District

MIAMI-DADE COUNTY

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# 1 INTRODUCTION

## 1.1 Cost Narrative

The United States Corps of Engineers (USACE) cost estimates for planning purposes are prepared in accordance with the following guidance:

- Engineer Technical Letter (ETL) 1110-2-573, Construction Cost Estimating Guide for Civil Works, 30 September 2008
- Engineer Regulation (ER) 1110-1-1300, Cost Engineering Policy and General Requirements, 26 March 1993
- ER 1110-2-1302, Civil Works Cost Engineering, 15 September 2008
- ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999
- ER 1105-2-100, Planning Guidance Notebook, 22 April 2000, as amended.
- Engineer Manual (EM) 1110-2-1304 (Tables revised 30 March 2007), Civil Works Construction Cost Index System, 31 March 2013
- The Civil Works Planning Community of Practice (CECW-CP) Memorandum for Distribution, Subject: Initiatives to Improve the Accuracy of Total Project Costs in Civil Works Feasibility Studies Requiring Congressional Authorization, 19 September 2007
- The Chief of Engineering and Construction Division, Civil Works Directorate (CECW-CE) Memorandum for Distribution, Subject: Application of Cost Risk Analysis Methods to Develop Contingencies for Civil Works Total Project Costs, 3 July 2007
- Cost and Schedule Risk Analysis Guidance, 17 May 2009

The goals of the cost engineering for the Miami-Dade Back Bay Coastal Storm Risk Management (CSRM) Feasibility Study are to present a total project cost (construction and non-construction costs) for the Recommended Plan at the current price level to be used for project justification/authorization and to project costs forward in time for budgeting purposes. Costing efforts are intended to produce a final product, or cost estimate, that is reliable, accurate, and supports the definition of the government's and the non-federal sponsor's obligations.

## 1.2 Project Description

The feasibility study formulates, evaluates, and compares reasonable solutions to manage the risk of coastal storm damages to property and infrastructure and manage risk to public safety in the study area. The study area is located entirely in Miami-Dade County, Florida.

The project delivery team (PDT) considered several alternatives to accomplish the goals of managing the risk of coastal storm damages and manage risk to public safety. These alternatives consist of floodproofing and elevating of both critical and noncritical structures found throughout the study area.

## 1.3 Scope of Work

The 50-year CSRM plan, the Recommended Plan for the Miami-Dade Back Bay CSRM Project, includes the following civil works feature accounts:

- 01 Account – Lands and Damages: For both structural and nonstructural features of work, real estate costs due to construction impacts are assessed and provided by Norfolk District (NAO) Real Estate Division and are shown in **Table 2** for the Total Project Cost Summary (TPCS).
- 18 Account – Cultural Resource Preservation: The proposed project area has potential impacts on cultural resources that may require extensive archaeological mitigations. Since no surveys were done, areas that are currently considered significant sites may potentially have extensive impacts or none at all. A conservative approach was taken, assuming most sites are high-probability sites and will have substantial archaeological mitigations. The cost for archaeological mitigation was conservatively estimated and provided by NAO cultural resources PDT member.
- 19 Account – Buildings, Grounds and Utilities: The proposed project alignment shows elements of measures that include nonstructural flood risk management measures consisting of raising (to 12 feet above current ground elevation) and dry floodproofing (up to 4 feet above current ground elevation) of existing structures. Micro-Computer Aided Cost Estimating System (MCACES), Second Generation (MII) provided estimates of all costs associated with construction work for nonstructural flood risk management measures.
- 30 Account – Planning, Engineering, and Design (PED): PED costs include local cooperative agreements, environmental and regulatory activities, general design memorandum, preparation of plans and specifications, engineering during construction, architect-engineering (A/E) liability actions, cost engineering, construction and supply contract award activities, and project management. PED costs were estimated based on 28.5 percent of the total construction cost.
- 31 Account – Construction Management Supervision and Administration (S&A): Construction management costs include contract administration, review of shop drawings, inspection and quality assurance, project office operation, contractor-initiated claims and litigations, and government-initiated claims and litigations. S&A-related costs were estimated based on 14 percent of the total construction cost.

# 2 ALTERNATIVES

In addition to the Recommended Plan, the focused array of alternatives also included the following:

Alternative 1 – No Action

Alternative 2 – Critical Infrastructure Only

- Total of 27 structures

Alternative 3 – Residential and Nonresidential Elevations and Floodproofing

- Total of 2,057 elevations (to 12 feet above current ground elevation) and 403 floodproofing (up to 4 feet above current ground elevation) projects

Alternative 4 – Critical Infrastructure and Residential and Nonresidential Elevations and Floodproofing

- Combination of Alternative 2 and Alternative 3

Alternative 5 – Optimization of Critical Infrastructure and Residential and Nonresidential Elevations and Floodproofing

- Optimizes Alternative 4 for a total of 27 critical infrastructure improvements, 784 elevations (to 12 feet above current elevation) and 403 floodproofing (up to 4 feet) projects.

# 3 CONSTRUCTION COST ESTIMATE

## 3.1 Construction Cost Estimate Development/Basis of Estimate

The construction cost estimate was developed using MII using the appropriate work breakdown structure (WBS). These cost estimates were developed using cost resources such as RSMeans, MII Cost Libraries, and vendor quotations. The preferred labor, equipment, materials, and crew/production breakdown support the estimates to align with current construction methods. The PDT provided the quantities, and the cost engineer checked them.

The presented estimate is a class 4 cost estimate. A class 4 cost estimate is defined as a reflection of early conceptual technical information (5-10% design), which is still lacking technical information and scope clarity in some areas, resulting in major estimate assumptions in technical information and quantities, heavy reliance on cost engineering judgment, cost book, parametric, historical, and little specific crew-based costs. While certain construction elements can be estimated in detail, there is still a great deal of uncertainty relative to major construction components. Although Class 4 estimates may be more accurate than Class 5 estimates, they are based on a very limited technical information. Class 4 estimates typically have a contingency range of 30% - 100%.

The primary data used to develop the estimate consists of data provided by various member of the PDT. Parcel and building polygons were downloaded from Miami-Dade County's GIS portal site to assist with characterizing residential and nonresidential buildings for analysis. Data included addresses, property class description, occupancy type, total value, property use, dwelling year built, number of units, etc. The data is usually constantly updated in real-time when new information is made available to the County on a parcel-by-parcel basis. The data for this report was downloaded in January 2024 which was a snapshot in time**. Table 1** below provides an in-depth look at the type and number of structures per alternative, and **Table 2** below provides information on the averaged data obtained from the county's GIS portal.

**Table 1. Structures per Alternative**

| Buildings per Alternative | | | |
|---|---|---|---|
| **Alternative** | **Asset** | **Quantity (each)** | **Quantity (Total)** |
| 1 | CI FP[1] | 0 | 0 |
| | NR FP[2] | 0 | |
| | SFR EL[3] | 0 | |
| | MFR EL[4] | 0 | |
| 2 | CI FP | 27 | 27 |
| | NR FP | 0 | |
| | SFR EL | 0 | |
| | MFR EL | 0 | |
| 3 | CI FP | 0 | 2,460 |
| | NR FP | 403 | |
| | SFR EL | 1,731 | |
| | MFR EL | 326 | |
| 4 | CI FP | 27 | 2,487 |
| | NR FP | 403 | |
| | SFR EL | 1,731 | |
| | MFR EL | 326 | |
| 5 | CI FP | 27 | 1,214 |
| | NR FP | 403 | |
| | SFR EL | 460 | |
| | MFR EL | 324 | |

[1]CI FP = Critical Infrastructure Floodproofing

[2]NR FP = Nonresidential Floodproofing

[3]SFR EL = Single-family Residence Elevation

[4]MFR EL = Multifamily Residence Elevation

**Table 2. Average Asset Data from GIS Portal**

| Asset Data Used for Estimate Development | | | | |
|---|---|---|---|---|
| **Measure** | **Asset Type** | **Asset Quantity** | **Footprint Area (SF)** | **Perimeter (LF)** |
| Dry Floodproofing | Critical Infrastructure | 27 | 70,211 | 1,147 |
| | Nonresidential | 403 | 10,597 | 412 |
| Elevation | SFR | 1,731 | 1,812 | 184 |
| | MFR | 326 | 2,511 | 219 |

The provided data was used to produce multiple vital quantities used in the estimating templates provided by the USACE cost center of expertise at the USACE Walla Walla District (NWW). These templates are highly detailed however function primarily on many broad-based assumptions and typical industry methods.

Nonstructural cost estimates were compared to data provided by the National Nonstructural Committee (NNC) as well as data obtained from contractors as well as other state and federal agencies. Data from all sources are comparable.

Following is the methodology used to prepare the construction cost estimate for the Miami-Dade CSRM Study:

a. The estimate is in accordance with the guidance contained in ER 1110-2-1302.

b. The estimate is presented in Civil Works WBS.

c. The price level for the Recommended Plan estimate is in second quarter of fiscal year 2024.

d. Construction costs developed by Cost Engineering Section, Engineering Division, Norfolk District are based on a conceptual understanding of the elevation and floodproofing processes. Elevation and floodproofing estimating templates were used and reference drawings were used by NAO engineering to verify estimating approach. Unit costs are developed using the MCACES MII software containing the 2023 English Cost Book Library, which was used as a starting point. Historical cost data from similar projects are used for parametric estimate, and vendor quotes are used for non-Cost Book data. The estimate is documented with notes to explain the assumed construction methods, crews, productivity, and other specific information. The intent is to provide or convey a "fair and reasonable" estimate that depicts the local market conditions.

e. Labor costs are based on the national Labor Library, which is more conservative than local Davis-Bacon wage rates.

f. Bid competition: No contracting plan has been completed at this point. Bidding competition is assumed to be restricted due to the amount of work along with the availability and number of contractors specializing in this type of work. This type of work is typical to most coastal areas, and the massive size of the project will likely draw multiple, national-level, large size contractors to bid on the project, however it is unclear how many will be capable of executing this size of project. The Cost and Schedule Risk Analysis reflects this assessment.

g. Contract Acquisition Strategy: Acquisition strategy has not yet been determined at this point. However, to reflect a more conservative approach, the prime contractor is assumed to sub out all work.

h. Labor Shortages: It is assumed there will be a normal labor market.

i. Materials: Most material costs are from the 2023 Cost Book Library. Vendor quotes were used for certain non-Cost Book items and key items. Assumptions include:

    i. Rent materials will be part of the construction contract. No government-furnished materials are assumed. Quoted delivery charge is used for hauling cost.

    ii. Materials will be rented from the nearest local available sources.

j. Equipment: Rates used are based on the latest USACE EP-1110-1-8, Region 3. Adjustments are made for fuel and facility capital cost of money (FCCM). Judicious use of owned verses rental rates was considered based on typical contractor usage and local equipment availability. Full FCCM/cost of money rate is the latest available; MII program takes EP-recommended discount; no other adjustments have been made to the FCCM.

k. Fuels (gasoline, on- and off-road diesel) are based on local market averages for on-road and off-road fuels in Miami-Dade County, Florida. Since fuels fluctuate irrationally, an average was used.

l. Senior USACE estimators familiar with this type of work studied and developed the major crew and productivity rates. All the work is typical to the Jacksonville District. The crews and productivities were checked and compared with historical cost data. Major crews include elevation and excavation.

m. All crew work hours are assumed to be 10 hours per day and 5 days/week, which is typical to the area.

n. Mobilization and demobilization: Contractor mobilization and demobilization are based on the assumption that most of the contractors will take at least one month to mobilize and one month to demobilize. Contractors located within 500 miles from the project site using readily available, off-the-shelf construction equipment would do the work. Construction access would be by local streets. Mobilization and demobilization cost is estimated at 1 percent of construction cost per structure.

o. Field Office Overhead: Typically, civil works projects have field office overhead ranging from 9 to 11 percent. Fifteen percent was used for prime contractor job office overhead. Overhead assumptions may include superintendent, office manager, pickups, periodic travel, costs, communications, temporary offices (contractor and government), office furniture, office supplies, computers and software, as-built drawings and minor designs, tool trailers, staging setup, camp and kitchen maintenance and utilities, utility service, toilets, safety equipment, security and fencing, small hand and power tools, project signs, traffic control, surveys, a temporary fuel tank station, generators, compressors, lighting, and minor miscellaneous.

p. Home Office Overhead (HOOH): Fifteen percent was used for HOOH based upon estimating and negotiating experience, and consultation with local construction representatives.

q. Profit: Since the construction cost estimate is currently in a budgetary phase, profit is typically included at 10 percent for prime contractor. However, because of the large size of project and general expectation that there will be some competition, 10 percent profit was used for prime and prime's profit on subcontractor's work. Subcontractors' profits are mostly 10 percent.

r. Sales Tax: A combined sales tax rate of 7% was included in the estimate (6% state sales tax and 1% local sales tax).

s. Bond: Bond is calculated at 1.5 percent based upon estimating and negotiating experience, and consultation with local construction representatives.

t. Contingency: The estimated cost for each major subdivision or feature of the Recommended Plan includes an item for "contingencies." The contingency allowances used in the development of the cost estimate for the Recommended Plan were estimated as an appropriate percentage using Crystal Ball software for preparing risk analysis. A contingency of 52 percent was applied to the work to account for concerns about the level of design, weather delays, available funding available from the sponsor, and environmental mitigation requirements.

u. Escalation: No escalation to midpoint of construction according to tentative construction start dates is included in the MII estimate and non-MII estimates. Escalation will only be included in the TPCS to avoid duplication.

v. Hazardous, Toxic, and Radioactive Waste (HTRW): Contaminated material for HTRW was not included in the estimate since HTRW contamination is expected to be localized to older structures containing lead paint, asbestos, or storage tanks for heating oil.

w. Monitoring Costs: Monitoring costs include coastal, bay side, and environmental monitoring during initial construction and post-construction. The PED amount includes monitoring costs.

x. Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) costs are included in the PED amount.

## 3.2 Cost Benchmarking

### 3.2.1 Nonstructural Elevation

#### Overview of Available Data

Detailed house elevation historical costs have limited availability because of a number of factors (e.g., funding source, historically residential costs are single line item, and personally identifiable information risks, etc.). Typically, projects are either undertaken by individual homeowners or as part of a grant (e.g., Federal Emergency Management Agency [FEMA], Department of Housing and Urban Development [HUD], state). Historically, these projects have been constructed using a design-bid-build process and contractors have submitted bids for each building rather than using unit cost–based estimates that are typically associated with large infrastructure projects (e.g., roads, bridges, levees, etc.). Project costs for individual homeowners are typically not available, so historical cost data rely heavily upon grant project costs. Availability of these data typically requires knowledge of grant programs and contacting the grant applicant directly to request costs data (which is usually not publicly available).

Residential general contractors and elevation contractors usually only provide the cost to retrofit the entire building rather than the unit costs. Contractors are typically paid per structure completed rather than by a measured unit cost, so they are only willing to provide a cost for the entire building retrofit elevation. This protects their means and methods and is an approach to maintain a competitive advantage.

#### Summary of Research Conducted

Research on recent elevation grants for a total of 16 properties was obtained for locations in New Smyrna, Port Orange, and New Port Richey, Florida. These data represent residential elevation projects completed under FEMA and Florida Division of Emergency Management (FDEM) grants. The New Smyrna 9 projects were bid in October 2020. The single elevation project in New Port Richey was bid in January 2023. The Port Orange 6 projects were estimated in October 2023.

Other research included discussions with colleagues, academic research, discussions with trade groups, and references to past work on retrofit elevations. This information was assembled to provide comparisons and context for the grant data. The grant information reviewed were all for slab-on-grade residential properties. This indicates that other resources should be evaluated to determine costs for elevating houses with wood-framed floor systems, typically on crawl space foundations. Local costs for wood-framed floor systems in Florida are less common; there is a higher percentage of slab-on-grade houses. This suggests that other cost sources should be leveraged to address the variety of houses being considered for elevation for this project.

Jefferson Parish, Louisiana, provided some information on elevations conducted in the Parish. These elevations ranged from slab-on-grade to crawl space foundations with variations in the height of the elevations. Examples of as-built drawings were available for these projects and these data were helpful in informing the development of a list of common work items, which could improve the unit cost estimate development.

Academic research focused on the costs and benefits associated with flood mitigation efforts in Louisiana between 2005 and 2015. A doctoral dissertation paper titled Cost and Benefits of Flood Mitigation in Louisiana (Bilandi 2018) reviewed developing cost models using a linear regression approach that compared a series of 10 equations with cost data and selected an equation that best fit historic cost data that was adjusted to a baseline year. While this approach to estimating costs may be helpful as a future tool, more research is needed to understand how local cost factors and the baseline year would need to be adjusted to ensure that this method would be a reliable indicator of costs.

The International Association of Structural Movers is a trade organization that represents building movers and elevation contractors. This group provided information on the availability of contractors, what local factors impact costs, verification of assumptions (such as insurance costs), and information on the current state of practice, which could be a cost factor.

Other sources of data include cost estimates from previous projects and tools developed for FEMA building retrofit publications. Although the cost estimates are older, experience with elevation projects in Belhaven and Hyde County, North Carolina (1999 through 2001) and Atlanta, Georgia (2008) provided information on typical scope items that should be considered, specifically as it relates to wood-framed floor system elevations. Guidance developed for FEMA's Guidance for Applying ASCE 24 Engineering Standards to HMA Flood Retrofitting and Reconstruction Projects (2013) includes checklists on developing a cost estimate for elevating houses. **Table 3** is a summary of the scope items required during previous elevation projects and the FEMA guidance.

**Table 3. Typical Scope Items Associated with Elevation of a Wood-Framed Floor House**

| Category | Work Item |
|---|---|
| Insurance / Bonds | Insurance (General Liability/Workers Compensation/Auto) |

| Category | Work Item |
| --- | --- |
| | Insurance (Cargo / Riggers / Custody) |
| | Bonds (Bid / Performance / Payment / Supply / Warranty) |
| Permitting | Permitting |
| Mobilization / Site Preparation | Mobilization |
| | Tree Removal |
| | Removal and Replacement of Fencing |
| | Site Preparation / Erosion Control |
| Preparation of Building for Lifting | Demolition of Existing Walls and Footing |
| | Ductwork Removal |
| | Disconnection of Utilities |
| | Demolition of Carport |
| | Asbestos / Lead Paint Abatement |
| | Rotten / Damaged Wood Repair |
| | Elevation Cost |
| New Foundation Construction | New Footing |
| | 12-inch-thick Foundation Wall |
| | Flood Openings |
| | Columns / Piers |
| | Bond Beam |
| | Load Path Connectors |
| | Sill Replacement |
| Building Access | Porch Decking |
| | Porch Rail |
| | Porch Columns |
| | Stairs |
| | Ramps |
| | Lifts / Elevators |
| Masonry Work | Brick Removal |
| | Brick Replacement |
| | Chimney Removal |
| | Chimney Replacement |
| | Chimney Footing |
| Utility Connections | Ductwork Installation |
| | Air Conditioning Unit Elevation |
| | Water / Sewer Extension |
| | Gas Line Extension |
| | Electrical Extension |

| Category | Work Item |
|---|---|
| House Modifications | Framed Floor |
| | Door Removal / Replacement |
| | Replumbing of Bathroom / Laundry Room |
| | Interior Stairs Rework |
| | Garage Door |
| | Reframing of Walls |
| | Mechanical Room |
| | Rework of Covered Walkway |
| | Downspout Extension |
| Punchlist / Demobilization | Patch / Repair |
| | Punchlist / Demobilization |
| | Final Grading / Seeding |

### Summary of Cost Data Collected

Proposed residential home elevation bids provided by Ducky Recovery and T&T House Moving and Heavy Rigging for New Smyrna Beach (Florida) were used to validate residential home elevation cost estimates from MII. The bids were from October 2020 for slab-on-grade homes built between 1956 through 1972. The proposed home elevation for these structures were compliant with American Society of Civil Engineers (ASCE) 24-14 and the Florida Building Code (Residential) (2023). The elevations in Miami-Dade must meet the same requirements. **Table 4** summarizes the residential home elevation bids received. **Figure 1** provides a comparison of the area to the cost per square foot for the New Smyrna elevation costs. While the results from the low bid costs and the high bid costs indicate a similar trend, there is only a general trend in the relationship between the cost per square foot and the area of the house. This general trend suggests that small houses cost proportionally more to elevate. The increase cost per square foot for houses between 1,100 and 1,300 square feet, however, deviates from this trend and indicates that size is the only factor. Since most of the houses were elevated 8 feet, the elevation component of the cost is not a factor in evaluating this trend, which is further indicated by the building elevated by 10 feet not having a higher cost per square foot to elevate. A regression analysis of the data indicates that a factor besides house size is influencing the trend in elevation costs. All of these houses were slab-on-grade, and the structures were concrete block and stucco, so the type of structure or floor system is not influencing the trend in cost per square foot for the analysis.

**Table 4. New Smyrna, Florida, House Elevation Cost Data (October 2020)**

| Year Built | Square Footage | Feet Elevated | Low Bid | High Bid |
|---|---|---|---|---|
| 1956 | 1,018 | 8 | $213,187 | $251,454 |
| 1957 | 784 | 8 | $182,716 | $236,355 |
| 1958 | 1,183 | 8 | $249,255 | $254,677 |
| 1958 | 1,280 | 8 | $281,200 | $293,437 |
| 1959 | 1,384 | 8 | $242,804 | $279,489 |
| 1959 | 1,526 | 8 | $283,431 | $289,018 |
| 1960 | 1,305 | 10 | $239,578 | $256,121 |
| 1962 | 1,218 | 8 | $267,916 | $273,241 |
| 1972 | 1,136 | 8 | $223,456 | $254,142 |

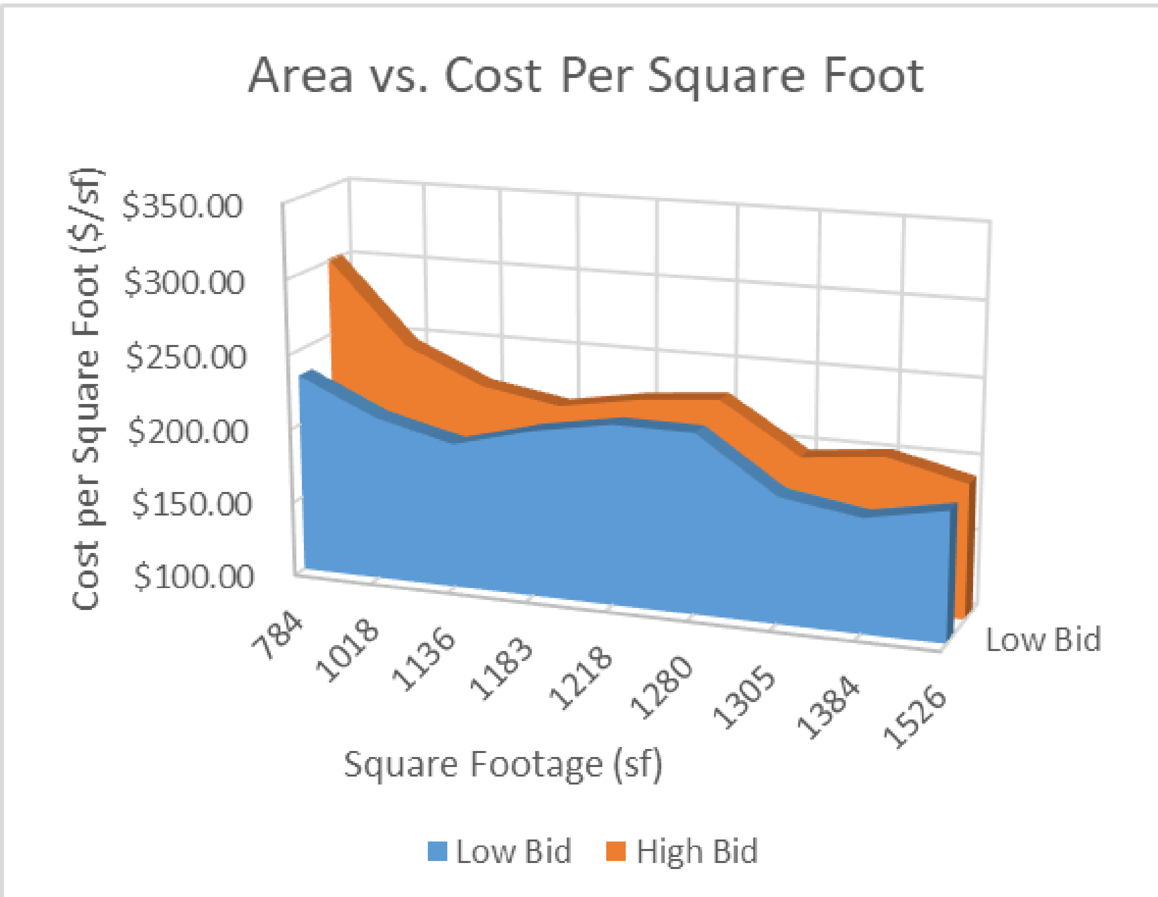



**Figure 1. Comparison of Bid Cost per Square Foot with the Building Area (New Smyrna, Florida – October 2020)**

Additional cost estimates for six residential home elevations in Port Orange, Florida, were provided to the PDT from FDEM for validation and consideration; however, specific details of these data could not be included in this report. Price per square foot for elevation of these homes ranged from $160 per square foot to $255.12 per square foot. House sizes ranged from 902 square feet to 1,894 square feet.

The homes were built between 1957 and 1973. Bid estimates ranged from $144,320 to $372,480. The cost data were compared with the building area for these houses since all the buildings were to be elevated the same amount. A similar trend emerged that there was little correlation between the building area and the cost of elevation. The overall trend with this data, however, indicated that largest and smallest houses in the project had the lowest costs and houses in the middle range of building size had higher costs. Again, no equation could be fit to this data set to compare the size of buildings with the cost to elevate.

The cost data overall suggest that unit cost estimates should consider several factors such as the building characteristics (e.g., foundation type, building shape, structure wall type) and other factors such as lot size, access, and flood zone. Estimates such as the ones for New Smyrna do provide a data point against which a developed cost estimate can be compared.

### 3.3 Schedule

The project schedule for the Recommended Plan was developed using Primavera P6 and is currently assumed to be 140 months. The construction schedule was based on various pieces of data obtained from the PDT, the MII file, and conversations with industry contractors. For nonstructural elevations, it is assumed that a single contractor can elevate around 400 hundred structures per year, and most can increase staffing levels to meet this large-scale project.

Attachment 1 to this Cost Engineering Appendix provides the schedule for the Recommended Plan.

### 3.4 Contingency

The goal in contingency development is to identify the uncertainties associated with an item of work or task, forecast the cost/risk relationship, and assign a value to this task that would limit the cost risk to an acceptable degree of confidence. Consideration must be given to the details available at each stage of planning, design, or construction for which a cost estimate is being prepared.

A Cost & Schedule Risk Analysis (CSRA) was conducted in March 2024 in accordance with the procedures outlined in the manual entitled Cost and Schedule Risk Analysis Guidance, dated 17 May 2009. Members of the Norfolk District PDT participated in a cost risk analysis brainstorming session to identify risks associated with the project. The risk analysis used the “LOW RISK” category because the project involves typical construction with possible life safety issues. Assumptions were made to the likelihood and impact of each risk item, as well as the probability of occurrence and magnitude of the impact if it were to occur. Adjustments were made to the analysis upon review by the PDT and the final contingencies were established.

The project contingency determined by the PDT during the CSRA is 52 percent at the 80% confidence level.

Attachment 2 to this Cost Engineering Appendix provides the CSRA report.

### 3.5 Planning, Engineering, and Design

Costs for PED have been included based on the standard percentage included in the TPCS. The TPCS includes the percentage breakout.

### 3.6 Construction Management (S&A)

Costs for construction management (S&A) have been included based on the standard percentage included in the TPCS. The TPCS includes the percentage breakout.

### 3.7 Total Project Cost Summary

The TPCS addresses the inflation through project completion accomplished by escalation to the midpoint of construction. The TPCS includes federal and non-federal costs for all construction features of the project, PED, and S&A, along with the appropriate contingencies and escalation associated with each of these activities. The TPCS is formatted according to the Civil Works Work Breakdown Structure. The TPCS was prepared using the MCACES/MII cost estimate, contingencies developed by the CSRA, the project design and construction schedule, and estimates of PED and S&A prepared by others.

Attachment 3 to this Cost Engineering Appendix provides the Certified TPCS for the Recommended Plan.

## 4 REFERENCES

American Society of Civil Engineers (ASCE) / Structural Engineering Institute (SEI). 2014. ASCE 24-14, Flood Resistant Design and Construction. https://sp360.asce.org/personifyebusiness/Merchandise/Product-Details/productId/233129242

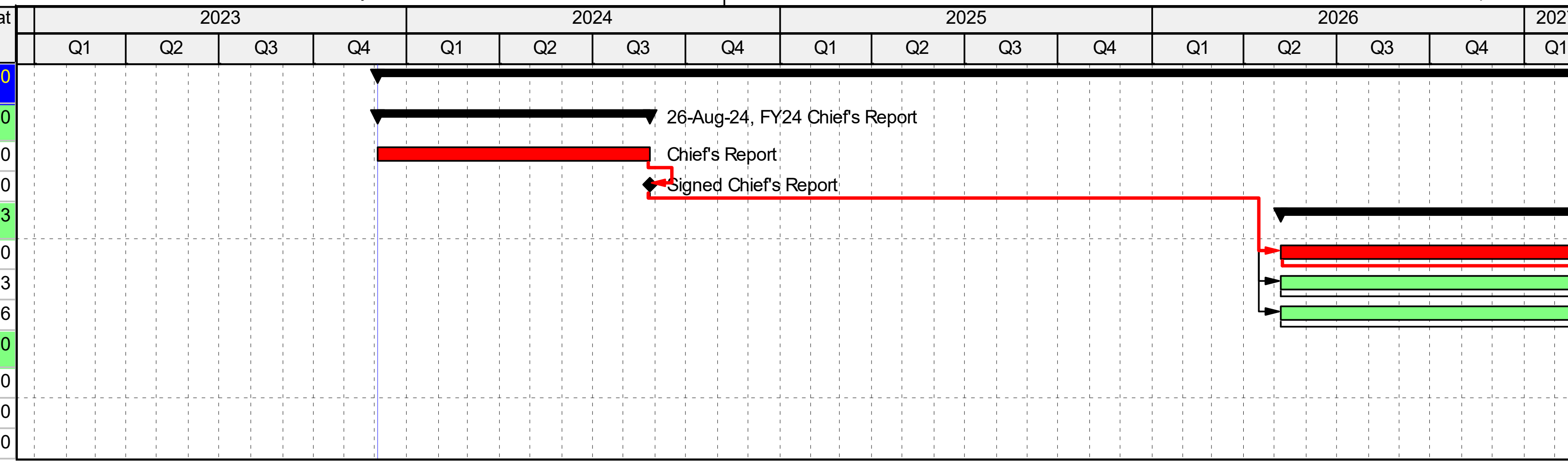
Bilandi, Arash. 2018. Costs and Benefits of Flood Mitigation on Louisiana, Louisiana State University.

Federal Emergency Management Agency. 2013. Guidance for Applying ASCE 24 Engineering Standards to HMA Flood Retrofitting and Reconstruction Projects. https://www.fema.gov/sites/default/files/documents/fema_asce-24-hma-guidance.pdf

Florida Building Commission, Building Codes and Standards Office. 2023. Florida Building Code – Residential – Eighth Edition. Chapter 2 Definitions: Definitions, Florida Building Code 2023 | UpCodes.

## Exhibit 1. Chief's Report, PED, and Construction Schedule

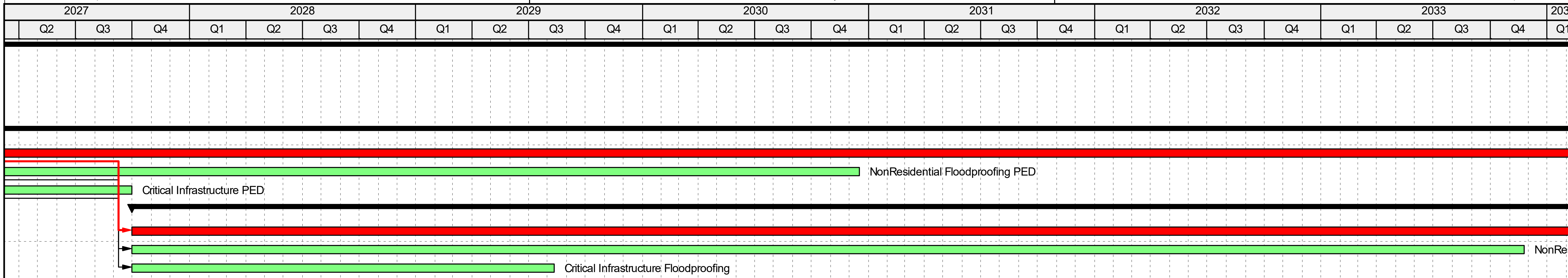
| Activity ID | Activity Name | Planned Duration | Start | Finish | Total Float |
|---|---|---|---|---|---|
| **MDBB FY24 Report** | | 7067 | 04-Dec-23 | 03-May-40 | 0 |
| **FY24 Chief's Report** | | 314 | 04-Dec-23 | 26-Aug-24 | 0 |
| CR1010 | Chief's Report | 314 | 04-Dec-23 | 26-Aug-24 | 0 |
| CR1020 | Signed Chief's Report | 0 | | 26-Aug-24 | 0 |
| **PED** | | 2464 | 07-May-26 | 17-Oct-35 | 423 |
| PED1010 | Residential Elevations PED | 2464 | 07-May-26 | 17-Oct-35 | 0 |
| PED1020 | NonResidential Floodproofing PED | 1204 | 07-May-26 | 18-Dec-30 | 653 |
| PED1030 | Critical Infrastructure PED | 365 | 07-May-26 | 30-Sep-27 | 1646 |
| **CONSTRUCTION** | | 4928 | 30-Sep-27 | 03-May-40 | 0 |
| CON1050 | Residential Elevations Construction | 4928 | 30-Sep-27 | 03-May-40 | 0 |
| CON1040 | NonResidential Floodproofing Construct | 2409 | 30-Sep-27 | 25-Nov-33 | 980 |
| CON1030 | Critical Infrastructure Floodproofing | 730 | 30-Sep-27 | 11-Aug-29 | 2470 |




Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone



TASK filter: All Activities




Actual Work
Critical Remaining Work
Summary
Remaining Work
Milestone



TASK filter: All Activities

## Exhibit 2. Cost and Schedule Risk Analysis (CSRA) Report

**US Army Corps of Engineers®**

# Miami-Dade CSRM Feasibility Study

# Project Cost and Schedule Risk Analysis Report

*Prepared for:*

U.S. Army Corps of Engineers,
Norfolk District

*Prepared by:*

U.S. Army Corps of Engineers
Norfolk District – Cost Engineering Section

June 2024

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## EXECUTIVE SUMMARY

The US Army Corps of Engineers (USACE), Norfolk District, presents this cost and schedule risk analysis (CSRA) report regarding the risk findings and recommended contingencies for the Collier County CSRM Feasibility Study project. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a *Monte-Carlo* based risk analysis was conducted by the Project Development Team (PDT) on remaining costs. The purpose of this risk analysis study is to present the cost and schedule risks considered, those determined and respective project contingencies at a recommended 80% confidence level of successful execution to project completion.

The Miami-Dade County Coastal Storm Risk Management (CSRM) Feasibility Study is a study conducted by the U.S. Army Corps of Engineers, Norfolk District and the Local Sponsor, Miami-Dade County, to reduce the area's risk of coastal storm damages and impacts.

The combination of low elevations and being surrounded by water place a significant percentage of Miami-Dade County at risk of coastal and tidal flooding from high tides, hurricanes, and other storms. Exacerbating the flooding is the phenomenon of relative sea level rise.

The Miami-Dade County CSRM Feasibility Study addresses potential non-structural solutions in terms of mitigating the impacts of flooding. These solutions include elevating residential structures and floodproofing critical infrastructure structures as well as nonresidential structures.

The current project base cost for the Miami-Dade County CSRM Feasibility Study Project estimate is approximately $1.6B excluding contingency and expressed in FY 2024 dollars. This CSRA study included all estimated construction costs, Planning, Engineering, Design and Construction Management costs. Based on the results of the analysis, the Cost Engineering Mandatory Center of Expertise for Civil Works (MCX located in Walla Walla District) recommends a contingency value of $853M, or approximately 52% of base project cost at an 80% confidence level of successful execution.

Cost estimates fluctuate over time. During this period of study, minor cost fluctuations can and have occurred. For this reason, contingency reporting is based in cost and per cent values. Should cost vary to a slight degree with similar scope and risks, contingency percent values will be reported, cost values rounded.

### Table ES-1. Cost Contingency Results

**Cost Contingency Analysis**

| Base Estimate | | $1,641,455,529 | |
|---|---|---|---|
| | | | |
| **Confidence Level** | **Contingency Value** | **Contingency** | **Cost with Contingency** |
| 50% | $804,313,209 | 49% | $2,445,768,739 |
| **80%** | **$853,556,875** | **52%** | **$2,495,012,405** |
| 90% | $886,385,986 | 54% | $2,527,841,515 |

### Table ES-2. Schedule Contingency Results

**Schedule Contingency Analysis**

| Base Schedule Duration | | 140.9 Months | |
|---|---|---|---|
| | | | |
| **Confidence Level** | **Contingency Value** | **Contingency** | **Duration with Contingency** |
| 50% | 91.6 Months | 65% | 232.5 Months |
| **80%** | **101.5 Months** | **72%** | **242.4 Months** |
| 90% | 105.7 Months | 75% | 246.6 Months |

## KEY FINDINGS/OBSERVATIONS/ASSUMPTIONS & RECOMMENDATIONS

The PDT worked through the risk register in March 2024. The key risk drivers identified through sensitivity analysis suggest a cost contingency of approximately $853M and schedule risks adding a potential 101 months; all at an 80% confidence level.

**Recommendations**: The CSRA study serves as a “road map” towards project improvements and reduced risks over time. The PDT must include the recommended cost and schedule contingencies and incorporate risk monitoring and mitigation on those identified risks. Further iterative study and update of the risk analysis throughout the project life-cycle is important in support of remaining within an approved budget and appropriation.

# MAIN REPORT

## 1.0 PURPOSE

Within the authority of the US Army Corps of Engineers (USACE), Norfolk District, this report presents the efforts and results of the cost and schedule risk analysis for the Miami-Dade CSRM Feasibility Study project. The report includes risk methodology, discussions, findings and recommendations regarding the identified risks and the necessary contingencies to confidently administer the project, presenting a cost and schedule contingency value with an 80% confidence level of successful execution.

## 2.0 BACKGROUND

The Miami-Dade County Coastal Storm Risk Management (CSRM) Feasibility Study is a study conducted by the U.S. Army Corps of Engineers, Norfolk District and the Local Sponsor, Miami-Dade County, to reduce the area's risk of coastal storm damages and impacts.

The combination of low elevations and being surrounded by water place a significant percentage of Miami-Dade County at risk of coastal and tidal flooding from high tides, hurricanes, and other storms. Exacerbating the flooding is the phenomenon of relative sea level rise.

The Miami-Dade County CSRM Feasibility Study addresses potential non-structural solutions in terms of mitigating the impacts of flooding. These solutions include elevating residential structures and floodproofing critical infrastructure structures as well as nonresidential structures.

The current project base cost for the Miami-Dade County CSRM Feasibility Study Project estimate is approximately $1.6B excluding contingency and expressed in FY 2024 dollars. This CSRA study included all estimated construction costs, Planning, Engineering, Design and Construction Management costs. Based on the results of the analysis, the Cost Engineering Mandatory Center of Expertise for Civil Works (MCX located in Walla Walla District) recommends a contingency value of $853M, or approximately 52% of base project cost at an 80% confidence level of successful execution.

Cost estimates fluctuate over time. During this period of study, minor cost fluctuations can and have occurred. For this reason, contingency reporting is based in cost and per cent values. Should cost vary to a slight degree with similar scope and risks, contingency percent values will be reported, cost values rounded.

## 3.0 REPORT SCOPE

The scope of the risk analysis report is to identify cost and schedule risks with a resulting recommendation for contingencies at the 80 percent confidence level using the risk analysis processes, as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for cost risks for construction features. The CSRA does not include consideration for life cycle costs.

### 3.1 Project Scope

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register. The analysis process evaluated the Micro Computer Aided Cost Estimating System (MCACES) cost estimate, project schedule, and funding profiles using Crystal Ball software to conduct a *Monte Carlo* simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

The project technical scope, estimates and schedules were developed and presented by the District. Consequently, these documents serve as the basis for the risk analysis.

The scope of this study addresses the identification of concerns, needs, opportunities and potential solutions that are viable from an economic, environmental, and engineering viewpoint.

### 3.2 USACE Risk Analysis Process

The risk analysis process for this study follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering MCX. The risk analysis process reflected within this report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analysis should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, this risk analysis was performed to meet the requirements and recommendations of the following documents and sources:

- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering MCX.
- Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008.
- Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

## 4.0 METHODOLOGY / PROCESS

The Cost Engineering MCX performed the Cost and Schedule Risk Analysis, relying on local District staff to provide expertise and information gathering. The District PDT conducted initial risk identification via meetings in March 2024. The initial risk identification meeting also included qualitative analysis to produce a risk register that served as the draft framework for the risk analysis.

Participants in the risk identification meeting March 2024 included:

| Name | Office | Role |
|---|---|---|
| Bryan Adkins | USACE - NAO | Facilitator/Cost Engineer |
| Abbe Preddy | USACE - NAO | Project Manager |
| Robin Williams | USACE - NAO | Technical Lead |
| Drew Gebler | USACE – NAO | Architect |
| Faraz Ahmed | USACE – NAO | Lead Planner |
| Norman Thomas | USACE – NAO | Real Estate |
| Justine Woodward | USACE – NAO | Environmental |
| Jeff Gaeta | USACE – NAD | Cost Engineering |
| Lauren Klonsky | CDM Smith | AE Support |
| Adam Reeder | CDM Smith | AE Support |
| Trent Elder | USACE – NAO | Geotechnical Engineer |

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve the desired level of cost confidence. Per regulation and guidance, the P80 confidence level (80% confidence level) is the normal and accepted cost confidence level. District Management has the prerogative to select different confidence levels, pending approval from Headquarters, USACE.

In simple terms, contingency is an amount added to an estimate to allow for items, conditions or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost MCX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk averse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level. The selection of contingency at a particular confidence level is ultimately the decision and responsibility of the project's District and/or Division management.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results are provided in Section 6.

### 4.1 Identify and Assess Risk Factors

Identifying the risk factors via the PDT is considered a qualitative process that results in establishing a risk register that serves as the document for the quantitative study using the Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

A formal PDT meeting was held with the District office and project owners for the purposes of identifying and assessing risk factors. The meeting included capable and qualified representatives from multiple project team disciplines and functions, including project management, cost engineering, design, environmental compliance, real estate, construction, contracting and representatives of the sponsoring agencies.

The initial formal meetings focused primarily on risk factor identification using brainstorming techniques, but also included some facilitated discussions based on risk factors common to projects of similar scope and geographic location. Additionally, numerous conference calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

### 4.2 Quantify Risk Factor Impacts

The quantitative impacts (putting it to numbers of cost and time) of risk factors on project plans were analyzed using a combination of professional judgment, empirical data and analytical techniques. Risk factor impacts were quantified using probability distributions (density functions) because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involved multiple project team disciplines and functions. However, the quantification process relied more extensively on collaboration between cost engineering and risk analysis team members with lesser inputs from other functions and disciplines. This process used an iterative approach to estimate the following elements of each risk factor:

- Maximum possible value for the risk factor
- Minimum possible value for the risk factor
- Most likely value (the statistical mode), if applicable
- Nature of the probability density function used to approximate risk factor uncertainty
- Mathematical correlations between risk factors
- Affected cost estimate and schedule elements

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

### 4.3 Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT.

Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the baseline cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

## 5.0 PROJECT ASSUMPTIONS

The following data sources and assumptions were used in quantifying the costs associated with the project.

a. The District provided estimate files electronically. The files transmitted and resulting independent review, served as the basis for the final cost and schedule risk analyses.

b. The cost comparisons and risk analyses performed and reflected within this report are based on design scope and estimates that are at the feasibility level of design.

c. Schedules are analyzed for impact to the project cost in terms of delayed funding, uncaptured escalation (variance from OMB factors and the local market) and unavoidable fixed contract costs and/or languishing federal administration costs incurred throughout delay.

d. The Cost Engineering MCX guidance generally focuses on the eighty-percent level of confidence (P80) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (P80) was used. It should be noted that the use of P80 as a decision criteria is a moderately risk averse approach, generally resulting in higher cost contingencies. However, the P80 level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to capture actual project costs.

e. Only high and moderate risk level impacts, as identified in the risk register, were considered for the purposes of calculating cost contingency. Low level risk impacts should be maintained in project management documentation, and reviewed at each project milestone to determine if they should be placed on the risk “watch list”.

## 6.0 RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

### 6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis. The actual risk register is provided in Exhibit A. The complete risk register includes low level risks, as well as additional information regarding the nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

### 6.2 Cost Contingency and Sensitivity Analysis

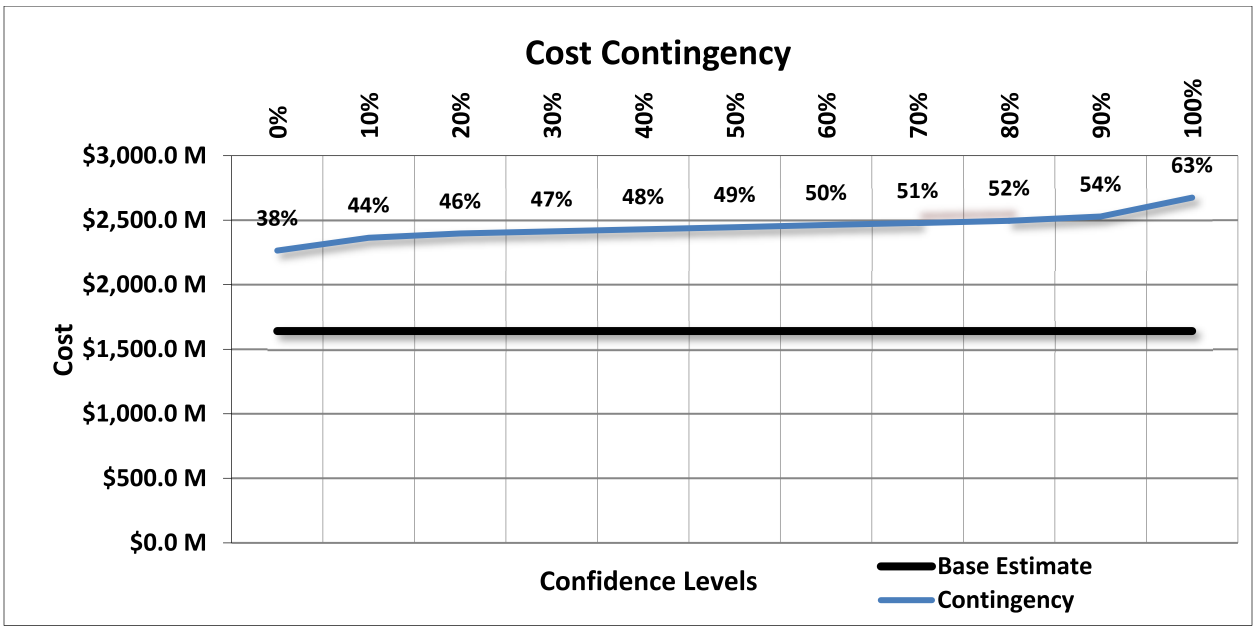
The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project cost at intervals of confidence (probability).

Table 1 provides the construction cost contingencies calculated for the P80 confidence level and rounded to the nearest thousand. The construction cost contingencies for the P5, P50 and P90 confidence levels are also provided for illustrative purposes only.

**Table 1. Construction Cost Contingency Summary**

Cost Contingency Analysis

| Base Estimate | | $1,641,455,529 | |
|---|---|---|---|
| | | | |
| Confidence Level | Contingency Value | Contingency | Cost with Contingency |
| 0% | $623,753,101 | 38% | $2,265,208,631 |
| 10% | $722,240,433 | 44% | $2,363,695,962 |
| 20% | $755,069,544 | 46% | $2,396,525,073 |
| 30% | $771,484,099 | 47% | $2,412,939,628 |
| 40% | $787,898,654 | 48% | $2,429,354,183 |
| 50% | $804,313,209 | 49% | $2,445,768,739 |
| 60% | $820,727,765 | 50% | $2,462,183,294 |
| 70% | $837,142,320 | 51% | $2,478,597,849 |
| **80%** | **$853,556,875** | **52%** | **$2,495,012,405** |
| 90% | $886,385,986 | 54% | $2,527,841,515 |
| 100% | $1,034,116,984 | 63% | $2,675,572,513 |




## 6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

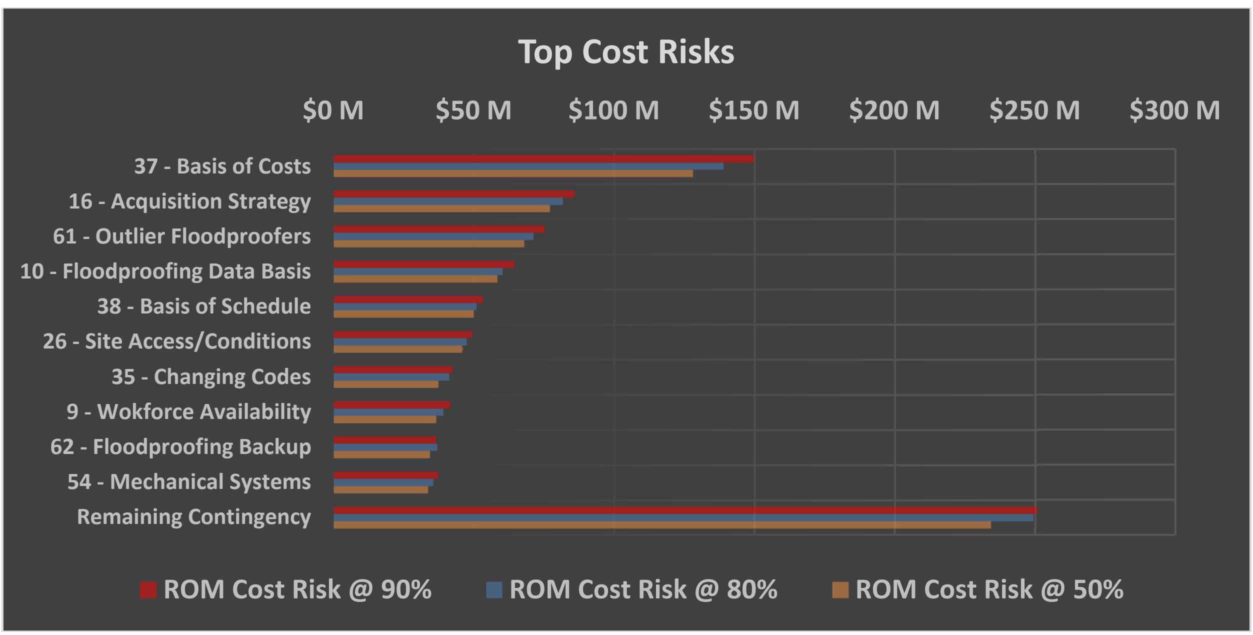
Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle.  Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

### 6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers and the respective value variance are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to project cost.

Figure 1 presents a sensitivity analysis for cost growth risk from the high level cost risks identified in the risk register.  Likewise, Figure 2 presents a sensitivity analysis for schedule growth risk from the high-level schedule risks identified in the risk register.

**Figure 1.  Top Cost Risks**



### 6.3 Schedule and Contingency Risk Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project duration at intervals of confidence (probability).

Table 2 provides the schedule duration contingencies calculated for the P80 confidence level. The schedule duration contingencies for the P50 and P90 confidence levels are also provided for illustrative purposes.

These contingencies were used to calculate the projected residual fixed cost impact of project delays that are included in the Table 1 presentation of total cost contingency. The schedule contingencies were calculated by applying the high level schedule risks identified in the risk register for each option to the durations of critical path and near critical path tasks.

The schedule was not resource loaded and contained open-ended tasks and non-zero lags (gaps in the logic between tasks) that limit the overall utility of the schedule risk analysis. These issues should be considered as limitations in the utility of the schedule contingency data presented. Schedule contingency impacts presented in this analysis are based solely on projected residual fixed costs.

**Table 2. Schedule Duration Contingency Summary**

**Schedule Contingency Analysis**

| Base Schedule Duration | | 140.9 Months | |
|---|---|---|---|
| | | | |
| **Confidence Level** | **Contingency Value** | **Contingency** | **Duration with Contingency** |
| 0% | 67.6 Months | 48% | 208.6 Months |
| 10% | 78.9 Months | 56% | 219.8 Months |
| 20% | 83.1 Months | 59% | 224.1 Months |
| 30% | 86.0 Months | 61% | 226.9 Months |
| 40% | 88.8 Months | 63% | 229.7 Months |
| 50% | 91.6 Months | 65% | 232.5 Months |
| 60% | 94.4 Months | 67% | 235.3 Months |
| 70% | 97.2 Months | 69% | 238.2 Months |
| **80%** | **101.5 Months** | **72%** | **242.4 Months** |
| 90% | 105.7 Months | 75% | 246.6 Months |
| 100% | 121.2 Months | 86% | 262.1 Months |

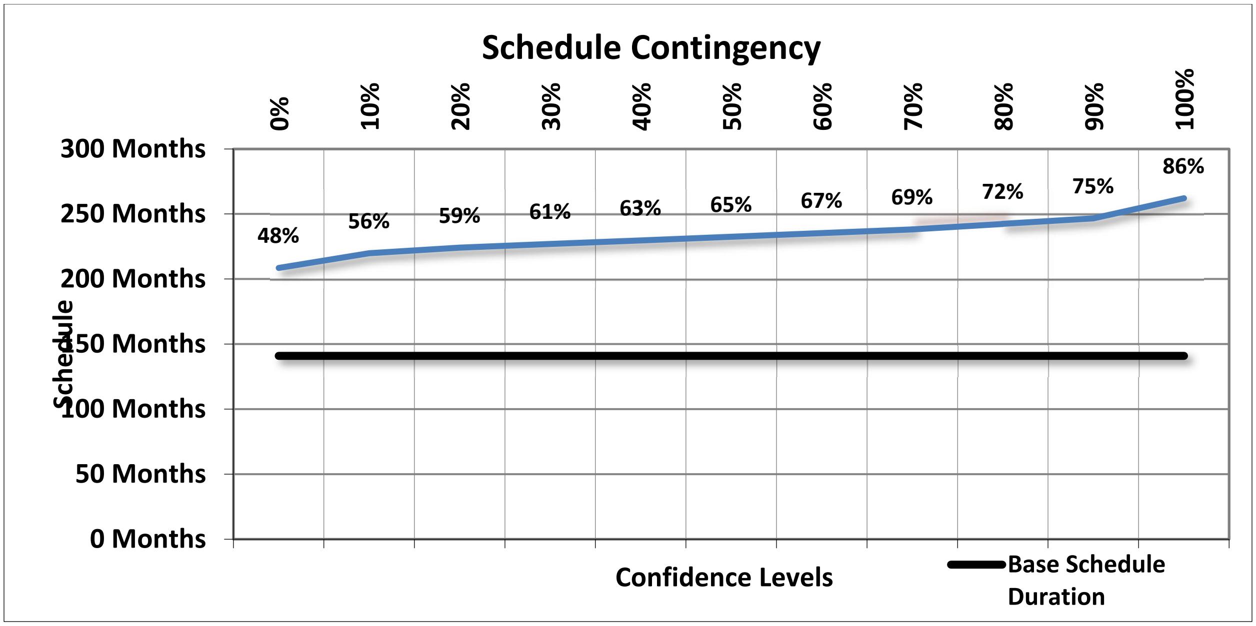
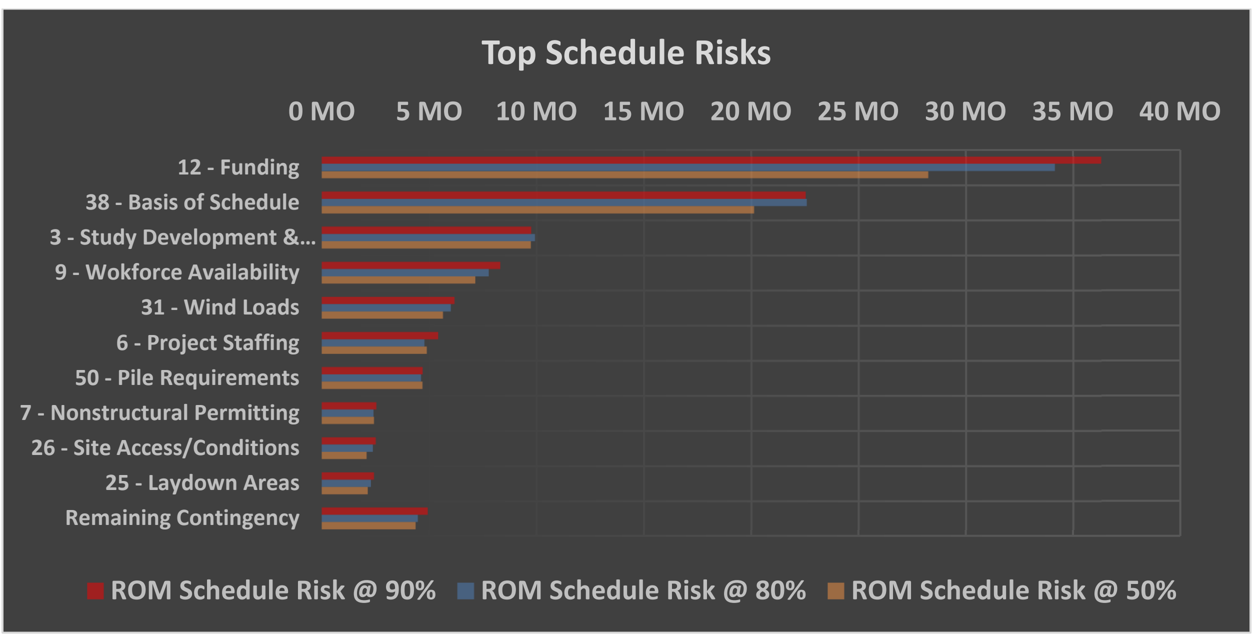



**Figure 2. Top Schedule Risks**




## 7.0 MAJOR FINDINGS/OBSERVATIONS/RECOMMENDATIONS

This section provides a summary of significant risk analysis results that are identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted.

### 7.1 Major Findings/Observations

Project cost and schedule comparison summaries are provided in Table 1 and Table 2 respectively. Additional major findings and observations of the risk analysis are listed below.

The PDT worked through the risk register in March 2024. The key risk drivers identified through sensitivity analysis suggest a cost contingency of approximately $650M and schedule risks adding a potential 99 months; all at an 80% confidence level.

**Recommendations**: The CSRA study serves as a “road map” towards project improvements and reduced risks over time. The PDT must include the recommended cost and schedule contingencies and incorporate risk monitoring and mitigation on those identified risks. Further iterative study and update of the risk analysis throughout the project life-cycle is important in support of remaining within an approved budget and appropriation.

### 7.2 Recommendations

Risk Management is an all-encompassing, iterative, and life-cycle process of project management. The Project Management Institute’s (PMI) *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, *4th edition*, states that “project risk management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project.” Risk identification and analysis are processes within the knowledge area of risk management. Its outputs pertinent to this effort include the risk register, risk quantification (risk analysis model), contingency report, and the sensitivity analysis.

The intended use of these outputs is implementation by the project leadership with respect to risk responses (such as mitigation) and risk monitoring and control. In short, the effectiveness of the project risk management effort requires that the proactive management of risks not conclude with the study completed in this report.

The Cost and Schedule Risk Analysis (CSRA) produced by the PDT identifies issues that require the development of subsequent risk response and mitigation plans. This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all inclusive and should not substitute a formal risk management and response plan.

The CSRA study serves as a “road map” towards project improvements and reduced risks over time. The PDT must include the recommended cost and schedule contingencies and incorporate risk monitoring and mitigation on those identified risks. Further iterative study and update of the risk analysis throughout the project life-cycle is important in support of remaining within an approved budget and appropriation.

Risk Management: Project leadership should use of the outputs created during the risk analysis effort as tools in future risk management processes. The risk register should be updated at each major project milestone. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings.

Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk's likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

# EXHIBIT A

# Cost & Schedule Summary for Risk Register Development

**Project:** Miami-Dade CSRM Feasibility Study
**Project Development Phase:** Feasibility (CWRB) - For Milestone #4
**Meeting Date:** 3/18/2024

| | | | | |
|---|---|---|---|---|
| Schedule Start: | December 2026 *Month/Year* | | Schedule Contingency Duration: | 101.5 Months |
| Schedule Finish: | September 2038 *Month/Year* | | Schedule Contingency: | 72% |
| Duration: | 140.9 Months | | Schedule with Contingency (80% Confidence): | 242.4 Months |
| | | | Finish Date with Contingency (80% Confidence): | February 2047 |

| | 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.** | **$117,491,926** | **40%** | $46,996,771 | $164,488,697 |
| | | | **$0** | **0%** | $0 | $0 |
| | | | **$0** | **0%** | $0 | $0 |
| | | | **$0** | **0%** | $0 | $0 |
| | **Risk Included In CSRA** | | | | | |
| 1 | **18 - CULTURAL RESOURCE PRESERVATION** | **Cultural Resource Preservation (*10% of base construction)** | **$104,718,056** | **52%** | $54,453,389 | $159,171,445 |
| 2 | **19 - BUILDINGS, GROUNDS, AND UTILITIES** | **Critical Infrastructure Floodproofing** | **$45,311,481** | **52%** | $123,917,857 | $169,229,338 |
| 3 | **19 - BUILDINGS, GROUNDS, AND UTILITIES** | **NonResidential Floodproofing** | **$238,303,572** | **52%** | $397,054,064 | $635,357,636 |
| 4 | **19 - BUILDINGS, GROUNDS, AND UTILITIES** | **Residential Elevations** | **$763,565,508** | **52%** | $397,054,064 | $1,160,619,572 |
| 5 | | | **$0** | **0%** | $0 | $0 |
| 6 | | | **$0** | **0%** | $0 | $0 |
| 7 | | | **$0** | **0%** | $0 | $0 |
| 8 | | | **$0** | **0%** | $0 | $0 |
| 9 | | | **$0** | **0%** | $0 | $0 |
| 10 | | | **$0** | **0%** | $0 | $0 |
| 11 | | | **$0** | **0%** | $0 | $0 |
| 12 | | | **$0** | **0%** | $0 | $0 |
| 13 | | | **$0** | **0%** | $0 | $0 |
| 14 | | | **$0** | **0%** | $0 | $0 |
| 15 | | | **$0** | **0%** | $0 | $0 |
| 16 | | | **$0** | **0%** | $0 | $0 |
| 17 | | | **$0** | **0%** | $0 | $0 |
| 18 | | | **$0** | **0%** | $0 | $0 |
| 19 | | | **$0** | **0%** | $0 | $0 |
| 20 | | | **$0** | **0%** | $0 | $0 |
| 21 | | | **$0** | **0%** | $0 | $0 |
| 22 | | | **$0** | **0%** | $0 | $0 |
| 23 | **30 - PLANNING, ENGINEERING, AND DESIGN** | **Civil Works only; not included on MILCON Projects.** | **$328,291,106** | **52%** | $170,711,375 | $499,002,481 |
| 24 | **31 - CONSTRUCTION MANAGEMENT** | **Civil Works only; not included on MILCON Projects.** | **$161,265,806** | **52%** | $83,858,219 | $245,124,025 |
| XX | **FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)** | | | | $0 | $0 |

| **TOTALS** | Base Cost | 80% Confidence | 80% Confidence ($) | 80% Total |
|---|---|---|---|---|
| Risk Not Included In CSRA | $117,491,926 | 40% | $46,996,771 | $164,488,697 |
| Total Construction Estimate | $1,151,898,617 | 52% | $598,987,281 | $1,750,885,898 |
| Total Planning, Engineering & Design | $328,291,106 | 52% | $170,711,376 | $499,002,482 |
| Total Construction Management | $161,265,806 | 52% | $83,858,220 | $245,124,026 |
| **Total EXCLUDING Risk Not Included In CSRA** | **$1,641,455,529** | **52%** | **$853,556,877** | **$2,495,012,406** |
| **Total INCLUDING Risk Not Included In CSRA** | **$1,758,947,455** | **51%** | **$900,553,648** | **$2,659,501,103** |
| **PROGRAMMED AMOUNT ( IF KNOWN)** | | | | |

# WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

# COST AGENCY TECHNICAL REVIEW CONDITIONAL CERTIFICATION STATEMENT

## PN 476677 SAJ – Miami Dade Back Bay Coastal Storm Risk Management Feasibility Study

The Miami Dade Back Bay CSRM Project, as presented by the Norfolk District, has received a **Conditional** Cost Agency Technical Review Certification (Cost ATR).

The referenced project has undergone a Cost ATR under the supervision of the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies.

Areas of concern resulting in a Conditional Certification and which must be addressed in the future include:

> Non-Structural Measures developed to a Class 4 level. Per ER 1110-2-1302 Class 3 (greater level of design and estimate definition) or greater is required for Cost Certification.

As of June 17, 2024, the Cost MCX conditionally certifies the estimated total project cost:

| | |
|---|---|
| FY24 Project First Cost: | $2,659,500,000 |
| Fully Funded Amount: | $3,352,512,000 |

Note: Cost Certification assumes Efficient Implementation (Funding). Cost ATR was devoted to remaining work. It did not review spent costs, which requires an audit process. It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management through the period of Federal participation.

**Michael P. Jacobs, PE, CCE**
**Chief, Cost Engineering MCX**
**Walla Walla District**

## Design Maturity Determination for Cost Certification

Date: 6/10/24
P2 Designation/Project Name: P2 Number 476677 / Miami-Dade Back Bay CSRM Feasibility Study (2024 Chiefs Report)

The Chief of Engineering is responsible for the technical content and engineering sufficiency for all engineering products produced by the command. As such, I have performed the Management Control Evaluation per Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works Projects, Appendix H, Internal Management Control Review Checklist.

The current design DOES require HQ approval (i.e., engineering waivers), requiring a deviation from mandatory requirements and mandatory standards, as defined in ERs, Engineering Manuals, Engineering Technical letters, and Engineering Circulars.

The current hydrology and hydraulics modeling is at 35*% design maturity, per reference (h) below.
*Current effort is for CI and NS only, no structural measures are proposed. If proposing structural measures, the H&H design maturity would be considered to be approximately 10%.

The current geotechnical data and subsurface investigations are at 10% design maturity, per reference (h) below. Subsurface investigations shall also include investigations of potential borrow and spoil areas.

The current survey data is at 0% design maturity, per reference (h) below.

Other major technical and/or scope assumptions and risks include the following, which will be refined as the design progresses.

The recommended plan for the Miami-Dade Back Bay CSRM Feasibility Study consists of non-structural measures, including Critical Infrastructure floodproofing (27 assets), Residential Elevations (1728 single-family structures and 324 multi-family structures), and Non-Residential Floodproofing (403 structures). Primary risk involves application of parametric estimates to critical infrastructure and non-structural measures. Site-specific designs will not be completed during this feasibility effort. (Risk register from CSRA is attached.)

The aggregate for all features is 10% design maturity. Therefore, per the CECW-EC memorandum dated 05-June-2023, I certify that the design deliverables used to generate the cost products for this project and the estimate meet the requirements for a CLASS 4 estimate, as per reference (a) below. Design risks, impacts and remaining efforts are summarized on page 2.

Considering risks and assumptions noted above, along with all other concerns documented in the Risk Register, the Cost and Schedule Risk Analysis has developed a contingency of 52% at the 80% confidence level for the defined project scope.

Chief of Engineering & Construction

Aaron Edmonson, PE, PMP

Printed Name

EDMONSON.AARON.GLENN.1046220133 Digitally signed by EDMONSON.AARON.GLENN.1046220133 Date: 2024.06.17 16:07:06 -04'00'

Signature

## Design Maturity Determination for Cost Certification, Remaining Work

### If an engineering waiver is required, list the risks and remaining design work needed to mitigate this issue in the current design. Identify remaining effort to complete the design required for 100% design.

Remaining effort would include site investigations and design development for each Critical Infrastructure asset (27 assets), and each Non-Structural property (2,455 structures). Real estate, environmental, and cultural resource impacts would also need to be identified. The estimated engineering effort to complete 100% design is approximately 19% (28.5% total) of the anticipated construction cost. This breaks down into 11% for PED, and 8% for Engineering during Construction.

In order to produce a class 3 estimate, available technical information, including designs, project definition and scope will be improved to further advance design maturity. Improved site-specific data will be obtained to strengthen and improve current parametric assumptions. Greater confidence in project planning and scope, construction elements and quantity development will be obtained. Base estimate will be improved to rely less on generic cost book items and have a greater reliance on quotes and site-specific/project specific crews. Even more attention will be given to high-level risk items and major cost drivers previously identified. Project items especially sensitive to change will also receive more attention. CSRA will be updated to target appropriate class 3 estimate contingency range of 20% - 50%. See attached CSRA.

### Identify remaining effort to complete geotechnical design effort required for 100% design. List the risks and cost and schedule impacts needed to mitigate this issue in the current design.

Geotechnical information has been included for the study area in the Engineering Appendix. This data has been used to inform the study and the risk register. Additional investigation may be required for each asset/property during PED; site specific geotechnical investigation has not been completed at this time. The degree of geotechnical analysis may vary based on the selected method for floodproofing and/or house elevating each asset. Regional geology indicates the presence of karst limestone in the study area. Additional risks are discussed in the Geotechnical Sub-Appendix, along with foundation recommendations.

### Identify remaining effort required to complete H&H required for 100% design. List the risks and cost and schedule impacts needed to mitigate this issue in the current design.

H&H has been completed in a manner sufficient to further the economic analysis through inundation (2D HEC-RAS), which includes identifying the affected CI and NS. The inundation mapping would need to be updated with surveyed topographic/bathymetric data to refine the DEM. For this study, it is determined that the current level of H&H modeling is sufficient as there are no structural measures (flood walls, levees, surge barriers, etc.) proposed in the recommended plan, and this level of modeling supports the economic analysis. If structural measures were proposed, we would need to advance Interior Drainage and perform Hydrodynamic (water quality and sediment transport) and wave and surge modeling to support Environmental Compliance and engineering design.

### Identify remaining effort needed to complete survey data required for 100% design. List the risks and cost and schedule impacts needed to mitigate this issue in the current design.

Site-specific surveys would be required for each asset/property. Topographic/Bathymetric information would need to be incorporated into the DEM to support calibration of the H&H inundation modeling. The DEM for this study was developed using regional LIDAR data and hydrographic survey points. Further discussion on the DEM and data sources is provided in the HH&C Sub-Appendix.

### If the project is anticipated to be executed in parts, provide a design assessment (percent complete) of each part/phase below.

Per the Non-Structural Implementation Plan, a phasing plan will be required to be developed during PED for prioritization and scheduling of non-structural projects.


<u>References</u>:

a. ER 1110-2-1302 – Civil Works Cost Engineering
b. CECW-EC memorandum dated 05-June-2023MFR, Guidance on Cost Engineering Products update for Civil Works Projects in accordance with Engineer Regulation 1110-2-1302 – Civil Works Cost Engineering
c. ER 1165-2-217 – Civil Works Review Policy
d. ER 1110-2-1150 – Engineering and Design for Civil Works Projects
e. ER 1110-3-12 – Quality Management
f. ER 1110-345-700 – Design Analysis, Drawings and Specifications
g. EM 5-1-11 – Project Delivery Business Process (PDBP)
h. Engineering and Construction Bulletin (ECB) 2023-9 – Civil Works Design Milestone Checklists

## <u>Design Maturity Determination for Cost Certification – Instructions</u>

Paragraph 1 – Design Date: Use the drop-down menu to populate the date of the design.

Paragraph 1 – Project Information: Enter the P2 Project number and Project name.

Paragraph 3 – Engineering Waivers: Use the drop-down menu to populate this field with either "Does," or "Does not." If an engineering waiver is needed, or anticipated to be needed, provide the specific waiver required for the Project. A waiver is any deviation from current mandatory standards, as indicated.

Paragraph 4 – Hydrology and Hydraulics: Populate this field with the % design maturity.

Paragraph 5 – Geotechnical Information: Populate this field with the % design maturity.

Paragraph 6 – Survey Data: Populate this field with the % design maturity.

Paragraph 7 – Other Technical Assumptions and/or Scope: Enter any other major technical assumptions or scope assumptions here. Only include assumptions that pertain to design. Template discussion fields are provided as a courtesy. Please include additional pages as necessary.

Paragraph 8 – Signature: Print the name and title and provide the signature for the District's Chief of Engineering. This authority cannot be delegated; however, the Deputy Chief of Engineering and Design may sign the form in the absence of the Chief of Engineering. All fillable fields must be populated (use N/A if not applicable) in order for the document to be signed.

Page 2 – Remaining Work: Identify the current baseline design assumptions and the remaining design effort and risks to complete 100% design for the authorized project. If the project is to be broken into parts or phases, provide details on the aggregate design level of each phase and anticipated timeline for completion.

# Cost & Schedule Summary for Risk Register Development

**Project:** Miami-Dade CSRM Feasibility Study
**Project Development Phase:** Feasibility (CWRB) - For Milestone #4
**Meeting Date:** 3/18/2024

| | | | | |
|---|---|---|---|---|
| **Schedule Start:** | December 2026 | *Month/Year* | **Schedule Contingency Duration:** | 101.5 Months |
| **Schedule Finish:** | September 2038 | *Month/Year* | **Schedule Contingency:** | 72% |
| **Duration:** | 140.9 Months | | **Schedule with Contingency (80% Confidence):** | 242.4 Months |
| | | | **Finish Date with Contingency (80% Confidence):** | February 2047 |

| | 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. | $117,491,926 | 40% | $46,996,771 | $164,488,697 |
| | | | $0 | 0% | $0 | $0 |
| | | | $0 | 0% | $0 | $0 |
| | | | $0 | 0% | $0 | $0 |
| | **Risk Included In CSRA** | | | | | |
| 1 | 18 - CULTURAL RESOURCE PRESERVATION | Cultural Resource Preservation (*10% of base construction) | $104,718,056 | 52% | $54,453,389 | $159,171,445 |
| 2 | 19 - BUILDINGS, GROUNDS, AND UTILITIES | Critical Infrastructure Floodproofing | $45,311,481 | 52% | $123,917,857 | $169,229,338 |
| 3 | 19 - BUILDINGS, GROUNDS, AND UTILITIES | NonResidential Floodproofing | $238,303,572 | 52% | $397,054,064 | $635,357,636 |
| 4 | 19 - BUILDINGS, GROUNDS, AND UTILITIES | Residential Elevations | $763,565,508 | 52% | $397,054,064 | $1,160,619,572 |
| 5 | | | $0 | 0% | $0 | $0 |
| 6 | | | $0 | 0% | $0 | $0 |
| 7 | | | $0 | 0% | $0 | $0 |
| 8 | | | $0 | 0% | $0 | $0 |
| 9 | | | $0 | 0% | $0 | $0 |
| 10 | | | $0 | 0% | $0 | $0 |
| 11 | | | $0 | 0% | $0 | $0 |
| 12 | | | $0 | 0% | $0 | $0 |
| 13 | | | $0 | 0% | $0 | $0 |
| 14 | | | $0 | 0% | $0 | $0 |
| 15 | | | $0 | 0% | $0 | $0 |
| 16 | | | $0 | 0% | $0 | $0 |
| 17 | | | $0 | 0% | $0 | $0 |
| 18 | | | $0 | 0% | $0 | $0 |
| 19 | | | $0 | 0% | $0 | $0 |
| 20 | | | $0 | 0% | $0 | $0 |
| 21 | | | $0 | 0% | $0 | $0 |
| 22 | | | $0 | 0% | $0 | $0 |
| 23 | **30 - PLANNING, ENGINEERING, AND DESIGN** | Civil Works only; not included on MILCON Projects. | $328,291,106 | 52% | $170,711,375 | $499,002,481 |
| 24 | **31 - CONSTRUCTION MANAGEMENT** | Civil Works only; not included on MILCON Projects. | $161,265,806 | 52% | $83,858,219 | $245,124,025 |
| XX | **FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)** | | | | $0 | $0 |

| **TOTALS** | Base Cost | 80% Confidence | 80% Confidence ($) | 80% Total |
|---|---|---|---|---|
| Risk Not Included In CSRA | $117,491,926 | 40% | $46,996,771 | $164,488,697 |
| Total Construction Estimate | $1,151,898,617 | 52% | $598,987,281 | $1,750,885,898 |
| Total Planning, Engineering & Design | $328,291,106 | 52% | $170,711,376 | $499,002,482 |
| Total Construction Management | $161,265,806 | 52% | $83,858,220 | $245,124,026 |
| **Total EXCLUDING Risk Not Included In CSRA** | **$1,641,455,529** | **52%** | **$853,556,877** | **$2,495,012,406** |
| **Total INCLUDING Risk Not Included In CSRA** | **$1,758,947,455** | **51%** | **$900,553,648** | **$2,659,501,103** |
| **PROGRAMMED AMOUNT ( IF KNOWN)** | | | | |

| Miami-Dade CSRM Feasibility Study - Feasibility (CWRB) - For Milestone #4 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| March 2024 | | | | | | Project Cost | | | Project Schedule | |
| 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) |
| 1 | 1 - Project & Program Management (PM) | Participation Rates | Participation rates could vary from 100% assumption. | Study is assuming 100% participation by default. When implementation begins, actual participation rates could vary wildly. More realistic would be 30%-50%. This variance could be based on upfront costs for Homeowner and opportunity to make use of new elevated space.<br><br>This item will result mostly in savings for the overall total project cost, however will not be modelled. | Very Likely | Significant | High | | Significant | High |
| 2 | 14 - Estimate and Schedule Risks (ES) | Basis of estimate for SFR vs. MFR and fluctuation | Are the baseline assumptions appropriate? | Baseline assumptions for both SFR & MFR elevations are the same. The same estimating template has been used for both. Will similar approaches be used for each in implementation? MFRs are typically larger than SFRs, and possibly more complex due to multple households residing in a single structure. | Possible | Moderate | Medium | | Moderate | Medium |
| 3 | 1 - Project & Program Management (PM) | Study Development & Accelerated Schedule | Study schedule has been accelerated | Study schedule has been accelarated to meet deadlines. In some instances, "rounding up" has been done, such as for elevation height and averages used to develop estimates. Cost impact will be modeled in ESXXX in later section. Scope and schedule is still evolving so schedule is highly sensitive at this point in time. Any minor or major changes could greatly impact the overall schedule. | Possible | Marginal | Low | | Significant | Medium |
| 4 | 1 - Project & Program Management (PM) | Project Handover & Implementation | Study District will not be implementation district | NAO is performing study on behalf of SAJ, however SAJ will takeover for implementation. With multiple large scale studies/projects going on and potentially entering implementation at the same time, will SAJ be prepared or able to take on another large effort. SAJ has been involved throughout process so hopefully negative impacts will be limited. | Possible | Marginal | Low | | Marginal | Low |
| 5 | 5 - Contract Acquisition Risks (CA) | Implementation Approach | Implementation/Execution approach could vary from baseline | Baseline total project cost currently indicates that USACE will performing PED & CM in implementation. Current TPCS includes approxaimtely $300M for PED and CM, however team is concerned as to how these nonstructural efforts will be implemented. Extremes range from 100% homeowner implemented to USACE constract administration. | Possible | Negligible | Low | | Moderate | Medium |
| 6 | 1 - Project & Program Management (PM) | Project Staffing | Will Implementation district be able to support? | SAJ currently has multiple large scale efforts approaching implementation. Will they be able to support all these efforts Will current staffing be sufficient or will SAJ need to "staff-up" prior to starting of project. | Likely | Moderate | Medium | | Marginal | Medium |
| 7 | 1 - Project & Program Management (PM) | Nonstructural Permitting | How will county/Local sponsor handle permitting? | Project will potentially require thousands of permits for nosntructural alternatives. Will these need to be issued on an individual basis or will a "blanket" permit be issued. PDT is unsure of how this will be handled. Cost impact is not expected, however schedule impact is. | Likely | Negligible | Low | | Marginal | Medium |

| Miami-Dade CSRM Feasibility Study - Feasibility (CWRB) - For Milestone #4 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| March 2024 | | | | | | Project Cost | | Project Schedule | |
| **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)** |
| **8** | 2 - Scope and Objectives (SC) | Current Project Scope | Could scope change | Current scope includes elevating/floodproofing approxiamtely 2400 structures. At this point in time, only decreases in total quantities (elevations/FP) could occur but not likely. Alternative 5 (optimized alternative) can change based on CSRA results and/or cost changes. | Possible | Marginal | **Low** | Negligible | **Low** |
| **9** | 13 - Construction (CO) | Wokforce Availability | Will an existing workforce be available to fully support during construction? | With 2400 structures requiring elevation and/or floodproofing, does an existing workforce exist that can fully support? Basis of Construction schedule assumes 50 structures to be worked on consecutively. | Possible | Moderate | **Medium** | Moderate | **Medium** |
| **10** | 2 - Scope and Objectives (SC) | Floodproofing Data Basis | Level of confidence in floodproofing approach. | Floodproofing currently does not have the same level of detail to back it up or support it that elevations do. There are no reference or historical designs/specifications. The cost template from NWW has been used to develop a class 5 estimate. | Possible | Moderate | **Medium** | Moderate | **Medium** |
| **11** | 14 - Estimate and Schedule Risks (ES) | Floodproofing Structure complexity | Variance in structure complexities | Current dataset for critical infrastructure floodproofing reflects major "outliers" which will be much more complex and difficult to floodproof as compared to the "cookier cutter" approach used in the cost template. This could have a significant impact on cost and potentially on cost. | Select From List | Select From List | **Unrated** | Select From List | **Unrated** |
| **12** | 4 - External Risks (EX) | Funding | Sponsor Funding | Sponsor will be responsible for $625M (35%) of total project cost. PDT is concerned that sponsor will not be able to product this level of funding. If sponsor could not pay their 35% any year, then construction would stop until they could. Mostly schedule impact on this item. 5% minimum will be required annually to keep project moving. | Possible | Marginal | **Low** | Moderate | **Medium** |
| **13** | 4 - External Risks (EX) | Homeowner Expectation Management | Will homeowners be content when they return home? | There is some concern that homeowners could potentially not be satisfied with or not approve of finished product when they return home. | Unlikely | Negligible | **Low** | Negligible | **Low** |
| **14** | 4 - External Risks (EX) | Sea Level Rise | Sea Level Rise has been accounted for. | Sea level rise has been accounted for in the H&H modeling. | Unlikely | Negligible | **Low** | Negligible | **Low** |
| **15** | 13 - Construction (CO) | Adverse Weather | Adverse weather during construction | PDT is concerned how an adverse or large storm event would impact construction. Construction could be delayed significantly if a severe event occurred during construction. | Possible | Marginal | **Low** | Significant | **Medium** |

| Miami-Dade CSRM Feasibility Study - Feasibility (CWRB) - For Milestone #4 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| March 2024 | | | | | | Project Cost | | Project Schedule | |
| **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)** |
| **16** | 5 - Contract Acquisition Risks (CA) | Acquisition Strategy | Concern on what acquisition strategy could be used | Nonstructural Elevations and Flood proofing will likely be accomplished via Task Orders from a MATOC of 8(a) and Small Business contractors. MEDIUM Cost Uncertainty.<br><br>How efficient can one contracting approach be vs. another? Would it take days or weeks to award a contract, etc..... | Likely | Moderate | **Medium** | Moderate | **Medium** |
| **17** | 5 - Contract Acquisition Risks (CA) | Bidding Climate | Will there be a competitive bidding climate? | Depending on potential nonstructural programs and bidder interest, bidding climate could be competetive vs. not so competitive. Availiabilty of competent and experienced contractors will come into play.<br><br>Cost risk modeled in Item 16. | Likely | Moderate | **Medium** | Negligible | **Low** |
| **18** | 7 - General Technical Risk (TR) | Study specific designs | Study specific designs have not been developed | To date, reference designs and documents from other projects/studies have been used to support cost estimate. No study specific designs have been developed. | Select From List | Select From List | **Unrated** | Select From List | **Unrated** |
| **19** | 7 - General Technical Risk (TR) | Design Maturity | Design maturity could impact cost certification | Current estimate class of 4 does not meet requirement of class 3, therefore a conditional cost certification will more than likely be issued. Once a conditional cert is issued, PDT will have a certain timeframe to meet the requirements of a class 3 to recertify. This could affect funding mechanisms along with project timeline. | Possible | Marginal | **Low** | Marginal | **Low** |
| **20** | 9 - Lands and Damages Risk (RE) | Participation | 100% participation assumed | RE has asssume 100% participation thus far and current RE costs reflect 100% participation. | Unrated | Select From List | **Unrated** | Select From List | **Unrated** |
| **21** | 10 - Relocations (RL) | Relocation Benefits | Relocation benefits only go to "dwellers" | Relocation benefits only go to dwellers and not owners in instances where dwellers are renters. Overall Miami-Dade census data of 51% renter has been used. Team questions the accuracy of this andhow it relates directly to our study area. | Unrated | Select From List | **Unrated** | Select From List | **Unrated** |
| **22** | 9 - Lands and Damages Risk (RE) | Utility Relocations | Uncertain about utility relocations | Baseline estimate includes small-scall utility disconnect/reconnect, however it is uncertain whether or not any large-scale utility relocations will be required. | Unrated | Select From List | **Unrated** | Select From List | **Unrated** |
| **23** | 9 - Lands and Damages Risk (RE) | Financial Assistance | Financial Assistance to homeowners | There will be some areas/communities that might not be able to fund even small amounts towards home inprioviements or elevations. Other programs might be available (HUD) to help such areas make minimum repairs to be eligible for elevation. | Unrated | Select From List | **Unrated** | Select From List | **Unrated** |
| **24** | 9 - Lands and Damages Risk (RE) | Relocation Duration | Construction Schedule could drive relocation duration | Any slips or delays in construction schedule could greatly impact relocation duration/benefits. | Unrated | Select From List | **Unrated** | Select From List | **Unrated** |

| Miami-Dade CSRM Feasibility Study - Feasibility (CWRB) - For Milestone #4 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| March 2024 | | | | | | Project Cost | | | Project Schedule | |
| 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) | |
| 25 | 13 - Construction (CO) | Laydown Areas | Staging areas and site access for dense urban and residential areas is a concern. | Residential House Elevations have larger properties which may allow for temporary staging on an on-site basis (as opposed to entire neighborhood at time).<br>Staging & Laydown areas have been included in the real estate estimate provided by the appraiser.<br><br>Ideal circumstances would involved elevating an entire block simultaneously and using road as laydwon,.<br><br>RE can start developing laydown area costs if provided with parcel information. | Likely | Moderate | Medium | Marginal | Medium | |
| 26 | 13 - Construction (CO) | Site Access/Conditions | Site access will be "tight" | Site access and working area will be tight in urban areas. Houses within 10 feet of each other don't provide much space for equipment and/or material to pass through. Special equipment could be required and potentially longer construction durations could be seen.<br><br>Contractors will require significant traffic controls, limited laydown areas, difficult parking, just in time deliveries, and reduced productivities due to work areas. | Very Likely | Moderate | High | Marginal | Medium | |
| 27 | 13 - Construction (CO) | ADA Access Requirements | Some homes might have ADA requirements | Average elevation height in base estimate is 12 feet. Standard ADA ramp slop is 1/12, so for a 12' high structure, a 144' ramp would be required. Elevators or lifts might be more accommodating especially when homes don't have very large yards. Small percentage of structures would require. Homeowners would have to "prove" need prior to implementation. | Likely | Select From List | Unrated | Select From List | Unrated | |
| 28 | 13 - Construction (CO) | ADA requirements | ADA exemption | Potential local "exemption" to bypass blanket upgrade to ADA. | Select From List | Select From List | Unrated | Select From List | Unrated | |
| 29 | 13 - Construction (CO) | Nonstructural Outlier Structures | Concern that some targeted elevation structures might cost more | There are many structures in close proximity to each other that greatly vary in construction cost ($80/SF vs $250/SF) This could directly impact the total cost to elevate and finsh certain structures "in kind". | Select From List | Select From List | Unrated | Select From List | Unrated | |
| 30 | 13 - Construction (CO) | Elevation Height | Uncertiainty in Elevation Height | Baseline estimate currently includes elevating all residential homes to 12 feet above ground based on hydraulics and economic modeling. Team is somewhat unsure of what actual codes will need to be met during implementation and how new/updated codes could impact elevation height. | Possible | Moderate | Medium | Negligible | Low | |
| 31 | 19 - Structural (SD) | Wind Loads | Elevated Homes Could experience higher wind loads | Elevating homes will subject them to higher windload, typically 1% more per foot raised. 12 foot elevations will be exposed to approximately a 12% higher windload. Countering windloads could require "wind retrofits" and/or more robust foundations. This could impact cost significantly. | Likely | Moderate | Medium | Moderate | Medium | |

| REF | Risk Type | Risk/Opportunity Event | Risk Event Description | Team Discussions on Impact and Likelihood | Likelihood | Project Cost: Impact (C) | Project Cost: Risk Level (C) | Project Schedule: Impact (S) | Project Schedule: Risk Level (S) |
|---|---|---|---|---|---|---|---|---|---|
| 32 | 11 - Architectural and Interior (AI) | Unique Requirements | Some homes might have more unique requirements than others | Based on what community/HOA/area some homes are in, they could have different or more complex requirements or guidelines to meet as compared to others. This could impact cost. | Possible | Moderate | Medium | Marginal | Low |
| 33 | 13 - Construction (CO) | Construction Work Windows and schedule | Noise & Dust Control in Residential Areas | Large Heavy construction will be occurring in densely populated urban and residential areas. It is likely work will be restricted to only daytime working hours and potentially only workdays (and not weekends). Constrained windows will limit contractors flexibility and ability to make up lost time (cannot work multiple shifts).<br>Multiple alignments would need to be worked simultaneously in order to meet program schedule<br>Schedule assumes 10hr shifts, 5 days per week.<br>Per Miami-Dade website: The city allows construction to take place Monday - Saturday from 8AM to 6PM. If you need to work outside of these hours or on a Sunday or a holiday, you must get this waiver. When public safety concerns require an exception, the city grants a special permit. | Likely | Moderate | Medium | Marginal | Medium |
| 34 | 13 - Construction (CO) | Tree Removal | Trees may need to be removed to gain access to some properties | Due to tight site conditions, trees may need to be removed to gain or permit access in some instances. Depending on the type of tree, it might have to be removed during the timeframe from april 16th and december 31st. | Possible | Marginal | Low | Marginal | Low |
| 35 | 7 - General Technical Risk (TR) | Changing Codes | ASCE Code is expected to change in near future | ASCE 7-22 Supplement 2 was published in May 2022 and ASCE 24-24 should be published in early 2025. These standards will increase flood design considerations to the 500-yr flood elevation and 7-22 considers sea level rise. This could increase design requirements if the standard are adopted either through Federal requirements or though code adoption. We are expecting the 2027 I-Codes to reflect these standards. It is unknown when the Florida Building Code will reflect the change. This has potential implications on elevation requirements as well as dry floodproofing measures for non-residential buildings as several changes are expected in Chapter 6 of ASCE 24. | Possible | Significant | Medium | Marginal | Low |
| 36 | 13 - Construction (CO) | Warranty Period | Warranty Period Considerations | It is currently unclear what type of warranty period, if any, would be applicable to these elevation and floodproofing measures. What would be covered? Who would be responsible? Etc...... | Select From List | Select From List | Unrated | Select From List | Unrated |
| 37 | 14 - Estimate and Schedule Risks (ES) | Basis of Costs | Basis of Cost Estimate | Current basis of estimate consists of nonstructural cost templates from the cost MCX. Averaged square footages, perimeters and heights all go into these cost templates to produce a $1B construction estimate. Conglomerate cost classificiation is a class 4, which does not meet the class 3 requirement. | Likely | Significant | High | Marginal | Medium |

| Miami-Dade CSRM Feasibility Study - Feasibility (CWRB) - For Milestone #4 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| March 2024 | | | | | | Project Cost | | Project Schedule | |
| 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) |
| 38 | 14 - Estimate and Schedule Risks (ES) | Basis of Schedule | Basis of construction schedule | Current construction schedule has been developed based assumptions which include simultaneous structures being elevated/floodrproofed. Current schedule is the average of the least aggressive and most aggressive models.<br><br>Current critical path of baseline schedule is residential elevations. Current assumptions are based on 60-90 day duration, which seems to be quite aggressive. Team is very concerned based on conversations with district members currently going through the elevation process that this assumption might be on the low end. Duration could potentially be 4-6 months(120days-180days). | Likely | Marginal | Medium | Critical | High |
| 39 | 14 - Estimate and Schedule Risks (ES) | Schedule Start | Schedule Start Date | With a program year of FY24, PDT agrees that a two year timeframe from signed chief's report and start of PED is acceptable, with a 1 year period between start of PED and construction start. Baseline schedule to be updated to reflect this so no modeling necessary. | Unrated | Select From List | Unrated | Select From List | Unrated |
| 40 | 21 - Environmental & Cultural/Historical Resources (EC) | Cultural Mitigation | Cultural Mitigation Cost | Current Cost estimate includes 10% (approximately $87M) of total construction cost for cultural mitigation. There is currently not a lot of information to go on and the PDT is comfortable with this base assumption. Structures built minimum 45 years prior to PED would be the primary target of cultural/historical mitigation. Detailed list of historic structures will need to be developed and reviewed in future. PED lasting for several years will cause "target years" to change. Standard 5 year buffer might not be adequate for all strucutres. After analyzing the nonstructural inventory, approximately 80% of the structures are considered historic. | Possible | Moderate | Medium | Marginal | Low |
| 41 | 21 - Environmental & Cultural/Historical Resources (EC) | HTRW | Lead Paint and Asbestos are the likely largest HTRW concerns for Nonstructural.<br>No other HTRW impacts are noted for the projects. | Elevations may have minimal Lead Paint or Asbestos exposures. Would require lawful disposal but costs would be minimal.<br>Phase 1 environmental site assessments during PED.<br>There are currently no known large industrial/commercial properties that would have HTRW concerns.<br><br>There is concern that lead paint and/or asbestos will be encountered during elevation/floodproofing. It should be caught preconstruction during site investigations, however will add to overall cost and schedule if/when found. | Possible | Moderate | Medium | Moderate | Medium |
| 42 | 21 - Environmental & Cultural/Historical Resources (EC) | Wetlands | Wetlands Impacts | No expected wetland impact during nonstructural implentation. | Unrated | Select From List | Unrated | Select From List | Unrated |
| 43 | 21 - Environmental & Cultural/Historical Resources (EC) | Endangered Species/Vegetation | Endangered Species/Vegetations encounter | It is unlikely that any endangered species or vegetation will be encountered during nonstructural implementation. | Unlikely | Negligible | Low | Negligible | Low |
| 44 | 21 - Environmental & Cultural/Historical Resources (EC) | Migratory Birds | Presence of Migratory Birds | Presence of migratory birds can delay/hault construction. Monitors may be needed during key timeframes. | Possible | Marginal | Low | Marginal | Low |

Miami-Dade CSRM Feasibility Study - Feasibility (CWRB) - For Milestone #4

March 2024

| REF | Risk Type | Risk/Opportunity Event | Risk Event Description | Team Discussions on Impact and Likelihood | Likelihood | Project Cost: Impact (C) | Project Cost: Risk Level (C) | Project Schedule: Impact (S) | Project Schedule: Risk Level (S) |
|---|---|---|---|---|---|---|---|---|---|
| 45 | 18 - Hydraulics / Hydrology (HH) | RAS Modeling | Dataset used could be off | RAS modeling is only as good as the data that is used for the model. The team is confident that good data has been used and that the current modeling is accurate and sufficient. | Unlikely | Negligible | Low | Negligible | Low |
| 46 | 17 - Geotechnical / Geology (GG) | Geotechnical Data | Lack of Geotechnical Data | No Geotechnical exploration or investigations will be done during feasibility study. Better geotechnical data would help refine current assumptions. These investigations will be conducted during PED. Primary cost risk will be tied to foundation types/robustness. | Possible | Moderate | Medium | Marginal | Low |
| 47 | 19 - Structural (SD) | Structural Assumptions | Structural Assumptions include CMU block foundation | Current baseline estimate assumes elevation of slab on grade foundations to a raised CMU foundation wall across the board. Will this be the case 100% of the time? Will there be unique or special structures which have different requirements?<br><br>Will additional finishing be required? Painting/stucco. | Likely | Moderate | Medium | Negligible | Low |
| 48 | 19 - Structural (SD) | Structural Design | Will major redesigns be needed? | Assuming a "cookie-cutter" approach will be used for most structures, how often will a major design be required to accommodate elevation? | Possible | Marginal | Low | Marginal | Low |
| 49 | 12 - Civil/Site Design (CV) | Site Drainage | Will new foundation system change existing drainage system? | With extensive site work/access and foundation work on all structures, will existing drainage systems need to be redesigned/rerouted? Most yards will be small and drainage system will most likely be easily altered. | Possible | Marginal | Low | Marginal | Low |
| 50 | 19 - Structural (SD) | Pile Requirements | Will piles be required often? | Baseline estimate does not include any type of piles for structural/foundation work. How often will piles be required and what type? | Likely | Moderate | Medium | Moderate | Medium |
| 51 | 19 - Structural (SD) | Existing Foundations | Reinforced vs. unreinfroced | Baseline estimate assumes that all existing foundations are reinfroced slab on grade and can be elevated in place. If unreinforced slab on grades are encountered, additional work will be required to accommodate. This could involve building a new elevated floor system. | Likely | Moderate | Medium | Marginal | Medium |
| 52 | 19 - Structural (SD) | Condition of Existing Structure | What is the condition of existing structures? | What if a structure requires major repairs prior to elevation/floodproofing? Will it be ruled ineligible? Who will be responsible for those repair costs? Will owner need to make repairs prior to be eligible for elevation/floodproofing effort? | Unlikely | Negligible | Low | Negligible | Low |

| Miami-Dade CSRM Feasibility Study - Feasibility (CWRB) - For Milestone #4 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| March 2024 | | | | | | Project Cost | | Project Schedule | | |
| 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) |
| 53 | 15 - Electrical (EE) | Electrical Code | Are structures up to code | Most homes were built decades ago, and while they were up to code at the time of their construction, will they be up to code now? It's our understanding that these structures will be "grandfathered" into eligibility as long as they are safe and habitable. No cost or schedule contingency to be modeled. | Unlikely | Negligible | Low | Negligible | Low |
| 54 | 16 - Mechanical (ME) | Mechanical Systems | Current location of mechanical systems | Mechanical systems (ductwork/piping) cannot be left below the minimum elevation when a home is elevated. All of these systems will need to be elevated as well, or potentially rerouted through a new mechanical room.<br><br>Mechanical lines/systems need to be above BFE+1. | Likely | Moderate | Medium | Negligible | Low |
| 55 | 19 - Structural (SD) | Attached Garages | Does an attached garage get elevated with primary structure? | It's unclear at this point whether attached garages would automatically be elevated with a home. This is majorly dependent on roof framing system, and how difficult it would be to detach or elevate the additional structure. These will need to be analyzed on a case by case basis. | Possible | Marginal | Low | Marginal | Low |
| 56 | 32 - Commissioning/Certification (CC) | Residential Commissioning & Turnover | Commissioning & Turnover Process is unknown at this time | The idea is that a checklist will be developed and used during the turnover process. Homeowner, contractor and sponsor/USACE will be involved and held accountable during process. | Unlikely | Negligible | Low | Negligible | Low |
| 57 | 26 - Utilities (UT) | Utility Relocations | Major Utility Relocations | See Item 22 Above. It is unexpected that any major utilities will need to be relocated for nonstructural implementation. | Unrated | Select From List | Unrated | Select From List | Unrated |
| 58 | 26 - Utilities (UT) | Existing Systems | Existing Propane tanks and similar | It's unclear whether existing utilities such as propane tanks will need to be elevated, or possible buried during implementation. | Possible | Negligible | Low | Negligible | Low |
| 59 | 28 - Complexity/Financial Risk (CF) | Foundation Assumptions | Could current foundation assumptions be wrong? | Baseline estimate assumes that all foundations are slab on grade, however there is some uncertainty whether or not this is accurate. It's estimated that approximately 15% of the structures are crawl space type. | Select From List | Select From List | Unrated | Select From List | Unrated |
| 60 | 28 - Complexity/Financial Risk (CF) | Nonstructural Database | How accurate is the nonstructural database? | Nonstructural database has not been validated by actual site data or site visits. Database could be outdated and inaccurate. | Possible | Moderate | Medium | Negligible | Low |
| 61 | 14 - Estimate and Schedule Risks (ES) | Outlier Floodproofers | Several outlier floodproofers could cost drastically more | Floodproofing costs have been developed using cost template from NWW. This model addresses more typical/reasonable structures. There are several structures in critical infrastructure category which could cost drastically more than the typical one. | Likely | Significant | High | Negligible | Low |
| 62 | 7 - General Technical Risk (TR) | Floodproofing Backup | There is little to no backup for floodproofing | There is still a learning curve when it comes to floodproofing alternatives. USACE has not historically done a lot of these, therefore there could be a lot of risk involved with the current assumptions used in the base estimate. Methods could change during implementation. Item modelled with item 61 above. | Likely | Moderate | Medium | Marginal | Medium |

## Exhibit 3. Certified Total Project Cost Summary (TPCS)

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

**PROJECT:** **Miami-Dade Back Bay CSRM Feasibility Study FY24 Report**
PROJECT NO: P2 476677
LOCATION: Miami-Dade County - Miami, FL

**DISTRICT:** **NAO District**
**POC:** **CHIEF, COST ENGINEERING, NAO**

**PREPARED:** **5/29/2024**

This Estimate reflects the scope and schedule in report; FY24 Chief's Report

| Civil Works Work Breakdown Structure | | ESTIMATED COST | | | | PROJECT FIRST COST (Constant Dollar Basis) | | | | | | TOTAL PROJECT COST (FULLY FUNDED) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Program Year (Budget EC): 2024<br>Effective Price Level Date: 1 OCT 23 | | | | | | | | | |
| WBS NUMBER | Civil Works Feature & Sub-Feature Description | COST ($K) | CNTG ($K) | CNTG (%) | TOTAL ($K) | ESC (%) | COST ($K) | CNTG ($K) | **TOTAL ($K)** | Spent Thru: **1-Oct-23** ($K) | **TOTAL FIRST COST** ($K) | INFLATED (%) | COST ($K) | CNTG ($K) | FULL ($K) |
| ***A*** | ***B*** | ***C*** | ***D*** | ***E*** | ***F*** | ***G*** | ***H*** | ***I*** | ***J*** | | ***K*** | ***L*** | ***M*** | ***N*** | ***O*** |
| | **Alternative 4** | | | | | | | | | | | | | | |
| | **Recommended Plan** | | | | | | | | | | | | | | |
| | #N/A | $0 | $0 | - | $0 | - | $0 | $0 | $0 | $0 | $0 | - | $0 | $0 | $0 |
| **18** | CULTURAL RESOURCE PRESERVATION | $104,718 | $54,453 | 52.0% | $159,171 | 0.0% | $104,718 | $54,453 | $159,171 | $0 | $159,171 | 24.7% | $130,615 | $67,920 | $198,534 |
| **19** | BUILDINGS, GROUNDS & UTILITIES | $1,047,181 | $544,534 | 52.0% | $1,591,714 | 0.0% | $1,047,181 | $544,534 | $1,591,714 | $0 | $1,591,714 | 24.7% | $1,306,146 | $679,196 | $1,985,341 |
| | #N/A | $0 | $0 | - | $0 | - | $0 | $0 | $0 | $0 | $0 | - | $0 | $0 | $0 |
| | #N/A | $0 | $0 | - | $0 | - | $0 | $0 | $0 | $0 | $0 | - | $0 | $0 | $0 |
| | #N/A | $0 | $0 | - | $0 | - | $0 | $0 | $0 | $0 | $0 | - | $0 | $0 | $0 |
| | #N/A | $0 | $0 | - | $0 | - | $0 | $0 | $0 | $0 | $0 | - | $0 | $0 | $0 |
| | #N/A | $0 | $0 | - | $0 | - | $0 | $0 | $0 | $0 | $0 | - | $0 | $0 | $0 |
| | **CONSTRUCTION ESTIMATE TOTALS:** | $1,151,899 | $598,987 | | $1,750,886 | 0.0% | $1,151,899 | $598,987 | $1,750,886 | $0 | $1,750,886 | 24.7% | $1,436,760 | $747,115 | $2,183,876 |
| **01** | LANDS AND DAMAGES | $117,491 | $46,996 | 40.0% | $164,487 | 0.0% | $117,491 | $46,996 | $164,487 | $0 | $164,487 | 26.3% | $148,400 | $59,360 | $207,761 |
| **30** | PLANNING, ENGINEERING & DESIGN | $328,291 | $170,711 | 52.0% | $499,002 | 0.0% | $328,291 | $170,711 | $499,002 | $0 | $499,002 | 28.7% | $422,477 | $219,688 | $642,166 |
| **31** | CONSTRUCTION MANAGEMENT | $161,266 | $83,858 | 52.0% | $245,124 | 0.0% | $161,266 | $83,858 | $245,124 | $0 | $245,124 | 30.0% | $209,678 | $109,032 | $318,710 |
| | **PROJECT COST TOTALS:** | $1,758,946 | $900,553 | 51.2% | $2,659,500 | | $1,758,946 | $900,553 | **$2,659,500** | $0 | **$2,659,500** | 26.1% | $2,217,316 | $1,135,196 | $3,352,512 |

**ESTIMATED TOTAL PROJECT COST:** **$3,352,512**

_____________________ **CHIEF, COST ENGINEERING, NAO**

_____________________ **PROJECT MANAGER, NAO**

_____________________ **CHIEF, REAL ESTATE, NAO**

_____________________ **CHIEF, PLANNING, NAO**

_____________________ **CHIEF, ENGINEERING, NAO**

_____________________ **CHIEF, OPERATIONS, NAO**

_____________________ **CHIEF, CONSTRUCTION, NAO**

_____________________ **CHIEF, CONTRACTING,NAO**

_____________________ **CHIEF, PM-PB, NAO**

_____________________ **CHIEF, DPM, NAO**

Filename: TPCS_MDBB Alt.4_v5.29.2024
TPCS

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

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

PROJECT: Miami-Dade Back Bay CSRM Feasibility Study FY24 Report
LOCATION: Miami-Dade County - Miami, FL
This Estimate reflects the scope and schedule in report; FY24 Chief's Report

DISTRICT: NAO District
POC: CHIEF, COST ENGINEERING, NAO
PREPARED: 5/29/2024

| Civil Works Work Breakdown Structure | | ESTIMATED COST | | | | PROJECT FIRST COST (Constant Dollar Basis) | | | | TOTAL PROJECT COST (FULLY FUNDED) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Estimate Prepared: 25-Apr-24 | | | | Program Year (Budget EC): 2024 | | | | | | | | |
| | | Effective Price Level: 1-Oct-23 | | | | Effective Price Level Date: 1 OCT 23 | | | | | | | | |
| 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* |
| | **Critical Infrastructure Floodproofing** | | | | | | | | | | | | | |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| **18** | CULTURAL RESOURCE PRESERVATION | $4,531 | $2,356 | 52.0% | $6,887 | 0.0% | $4,531 | $2,356 | $6,887 | 2028Q3 | 12.6% | $5,101 | $2,652 | $7,753 |
| **19** | BUILDINGS, GROUNDS & UTILITIES | $45,311 | $23,562 | 52.0% | $68,873 | 0.0% | $45,311 | $23,562 | $68,873 | 2028Q3 | 12.6% | $51,007 | $26,524 | $77,531 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | **CONSTRUCTION ESTIMATE TOTALS:** | $49,843 | $25,918 | 52.0% | **$75,761** | | $49,843 | $25,918 | $75,761 | | | $56,108 | $29,176 | $85,284 |
| **01** | LANDS AND DAMAGES | $601 | $240 | 40.0% | $841 | 0.0% | $601 | $240 | $841 | 2028Q3 | 12.4% | $675 | $270 | $945 |
| **30** | PLANNING, ENGINEERING & DESIGN | | | | | | | | | | | | | |
| *1.0%* | Project Management | $498 | $259 | 52.0% | $758 | 0.0% | $498 | $259 | $758 | 2027Q1 | 10.1% | $549 | $285 | $834 |
| *1.0%* | Planning & Environmental Compliance | $498 | $259 | 52.0% | $758 | 0.0% | $498 | $259 | $758 | 2027Q1 | 10.1% | $549 | $285 | $834 |
| *11.0%* | Engineering & Design | $5,483 | $2,851 | 52.0% | $8,334 | 0.0% | $5,483 | $2,851 | $8,334 | 2027Q1 | 10.1% | $6,037 | $3,139 | $9,176 |
| *1.0%* | Reviews, ATRs, IEPRs, VE | $498 | $259 | 52.0% | $758 | 0.0% | $498 | $259 | $758 | 2027Q1 | 10.1% | $549 | $285 | $834 |
| *1.0%* | Life Cycle Updates (cost, schedule, risks) | $498 | $259 | 52.0% | $758 | 0.0% | $498 | $259 | $758 | 2027Q1 | 10.1% | $549 | $285 | $834 |
| *1.0%* | Contracting & Reprographics | $498 | $259 | 52.0% | $758 | 0.0% | $498 | $259 | $758 | 2027Q1 | 10.1% | $549 | $285 | $834 |
| *8.0%* | Engineering During Construction | $3,987 | $2,073 | 52.0% | $6,061 | 0.0% | $3,987 | $2,073 | $6,061 | 2028Q3 | 15.3% | $4,596 | $2,390 | $6,986 |
| *1.5%* | Planning During Construction | $748 | $389 | 52.0% | $1,136 | 0.0% | $748 | $389 | $1,136 | 2028Q3 | 15.3% | $862 | $448 | $1,310 |
| *2.0%* | Adaptive Management & Monitoring | $997 | $518 | 52.0% | $1,515 | 0.0% | $997 | $518 | $1,515 | 2030Q3 | 22.4% | $1,220 | $634 | $1,855 |
| *1.0%* | Project Operations | $498 | $259 | 52.0% | $758 | 0.0% | $498 | $259 | $758 | 2027Q1 | 10.1% | $549 | $285 | $834 |
| **31** | CONSTRUCTION MANAGEMENT | | | | | | | | | | | | | |
| *9.5%* | Construction Management | $4,735 | $2,462 | 52.0% | $7,197 | 0.0% | $4,735 | $2,462 | $7,197 | 2028Q3 | 15.3% | $5,458 | $2,838 | $8,296 |
| *2.0%* | Project Operation: | $997 | $518 | 52.0% | $1,515 | 0.0% | $997 | $518 | $1,515 | 2028Q3 | 15.3% | $1,149 | $597 | $1,746 |
| *2.5%* | Project Management | $1,246 | $648 | 52.0% | $1,894 | 0.0% | $1,246 | $648 | $1,894 | 2028Q3 | 15.3% | $1,436 | $747 | $2,183 |
| | **CONTRACT COST TOTALS:** | $71,626 | $37,174 | | $108,800 | | $71,626 | $37,174 | **$108,800** | | | $80,834 | $41,952 | **$122,786** |

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

**** CONTRACT COST SUMMARY ****

PROJECT: Miami-Dade Back Bay CSRM Feasibility Study FY24 Report
LOCATION: Miami-Dade County - Miami, FL
This Estimate reflects the scope and schedule in report; FY24 Chief's Report

DISTRICT: NAO District
POC: CHIEF, COST ENGINEERING, NAO

PREPARED: 5/29/2024

| Civil Works Work Breakdown Structure | | ESTIMATED COST | | | | PROJECT FIRST COST (Constant Dollar Basis) | | | | TOTAL PROJECT COST (FULLY FUNDED) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Estimate Prepared: | | | 25-Apr-24 | Program Year (Budget EC): | | | 2024 | | | | | |
| | | Effective Price Level: | | | 1-Oct-23 | Effective Price Level Date: | | | 1 OCT 23 | | | | | |
| 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* |
| | **NonResidential Floodproofing** | | | | | | | | | | | | | |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| 18 | CULTURAL RESOURCE PRESERVATION | $23,830 | $12,392 | 52.0% | $36,222 | 0.0% | $23,830 | $12,392 | $36,222 | 2030Q4 | 19.3% | $28,422 | $14,779 | $43,201 |
| 19 | BUILDINGS, GROUNDS & UTILITIES | $238,304 | $123,918 | 52.0% | $362,221 | 0.0% | $238,304 | $123,918 | $362,221 | 2030Q4 | 19.3% | $284,218 | $147,793 | $432,011 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | **CONSTRUCTION ESTIMATE TOTALS:** | $262,134 | $136,310 | 52.0% | **$398,444** | | $262,134 | $136,310 | $398,444 | | | $312,640 | $162,573 | $475,212 |
| 01 | LANDS AND DAMAGES | $8,967 | $3,587 | 40.0% | $12,553 | 0.0% | $8,967 | $3,587 | $12,553 | 2030Q4 | 19.1% | $10,680 | $4,272 | $14,952 |
| 30 | PLANNING, ENGINEERING & DESIGN | | | | | | | | | | | | | |
| *1.0%* | Project Management | $2,621 | $1,363 | 52.0% | $3,984 | 0.0% | $2,621 | $1,363 | $3,984 | 2028Q4 | 16.1% | $3,045 | $1,583 | $4,628 |
| *1.0%* | Planning & Environmental Compliance | $2,621 | $1,363 | 52.0% | $3,984 | 0.0% | $2,621 | $1,363 | $3,984 | 2028Q4 | 16.1% | $3,045 | $1,583 | $4,628 |
| *11.0%* | Engineering & Design | $28,835 | $14,994 | 52.0% | $43,829 | 0.0% | $28,835 | $14,994 | $43,829 | 2028Q4 | 16.1% | $33,491 | $17,415 | $50,907 |
| *1.0%* | Reviews, ATRs, IEPRs, VE | $2,621 | $1,363 | 52.0% | $3,984 | 0.0% | $2,621 | $1,363 | $3,984 | 2028Q4 | 16.1% | $3,045 | $1,583 | $4,628 |
| *1.0%* | Life Cycle Updates (cost, schedule, risks) | $2,621 | $1,363 | 52.0% | $3,984 | 0.0% | $2,621 | $1,363 | $3,984 | 2028Q4 | 16.1% | $3,045 | $1,583 | $4,628 |
| *1.0%* | Contracting & Reprographics | $2,621 | $1,363 | 52.0% | $3,984 | 0.0% | $2,621 | $1,363 | $3,984 | 2028Q4 | 16.1% | $3,045 | $1,583 | $4,628 |
| *8.0%* | Engineering During Construction | $20,971 | $10,905 | 52.0% | $31,875 | 0.0% | $20,971 | $10,905 | $31,875 | 2030Q4 | 23.3% | $25,866 | $13,450 | $39,316 |
| *1.5%* | Planning During Construction | $3,932 | $2,045 | 52.0% | $5,977 | 0.0% | $3,932 | $2,045 | $5,977 | 2030Q4 | 23.3% | $4,850 | $2,522 | $7,372 |
| *2.0%* | Adaptive Management & Monitoring | $5,243 | $2,726 | 52.0% | $7,969 | 0.0% | $5,243 | $2,726 | $7,969 | 2034Q4 | 58.2% | $8,294 | $4,313 | $12,607 |
| *1.0%* | Project Operations | $2,621 | $1,363 | 52.0% | $3,984 | 0.0% | $2,621 | $1,363 | $3,984 | 2028Q4 | 16.1% | $3,045 | $1,583 | $4,628 |
| 31 | CONSTRUCTION MANAGEMENT | | | | | | | | | | | | | |
| *9.5%* | Construction Management | $24,903 | $12,949 | 52.0% | $37,852 | 0.0% | $24,903 | $12,949 | $37,852 | 2030Q4 | 23.3% | $30,716 | $15,972 | $46,688 |
| *2.0%* | Project Operation: | $5,243 | $2,726 | 52.0% | $7,969 | 0.0% | $5,243 | $2,726 | $7,969 | 2030Q4 | 23.3% | $6,466 | $3,363 | $9,829 |
| *2.5%* | Project Management | $6,553 | $3,408 | 52.0% | $9,961 | 0.0% | $6,553 | $3,408 | $9,961 | 2030Q4 | 23.3% | $8,083 | $4,203 | $12,286 |
| | **CONTRACT COST TOTALS:** | $382,508 | $197,828 | | $580,336 | | $382,508 | $197,828 | **$580,336** | | | $459,353 | $237,582 | **$696,935** |

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

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

PROJECT: Miami-Dade Back Bay CSRM Feasibility Study FY24 Report
LOCATION: Miami-Dade County - Miami, FL
This Estimate reflects the scope and schedule in report; FY24 Chief's Report

DISTRICT: NAO District
POC: CHIEF, COST ENGINEERING, NAO

PREPARED: 5/29/2024

| **Civil Works Work Breakdown Structure** | | **ESTIMATED COST** | | | | **PROJECT FIRST COST (Constant Dollar Basis)** | | | | **TOTAL PROJECT COST (FULLY FUNDED)** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Estimate Prepared: | | | **25-Apr-24** | Program Year (Budget EC): | | | 2024 | | | | | |
| | | Effective Price Level: | | | 1-Oct-23 | Effective Price Level Date: | | | 1 OCT 23 | | | | | |
| 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* |
| | **Residential Elevations** | | | | | | | | | | | | | |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| **18** | CULTURAL RESOURCE PRESERVATION | $76,357 | $39,705 | 52.0% | $116,062 | 0.0% | $76,357 | $39,705 | $116,062 | 2033Q2 | 27.2% | $97,092 | $50,488 | $147,580 |
| **19** | BUILDINGS, GROUNDS & UTILITIES | $763,566 | $397,054 | 52.0% | $1,160,620 | 0.0% | $763,566 | $397,054 | $1,160,620 | 2033Q2 | 27.2% | $970,920 | $504,879 | $1,475,799 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | #N/A | $0 | $0 | 0.0% | $0 | 0.0% | $0 | $0 | $0 | 0 | 0.0% | $0 | $0 | $0 |
| | **CONSTRUCTION ESTIMATE TOTALS:** | $839,922 | $436,759 | 52.0% | **$1,276,682** | | $839,922 | $436,759 | $1,276,682 | | | $1,068,013 | $555,367 | $1,623,379 |
| **01** | LANDS AND DAMAGES | $107,923 | $43,169 | 40.0% | $151,093 | 0.0% | $107,923 | $43,169 | $151,093 | 2033Q2 | 27.0% | $137,045 | $54,818 | $191,863 |
| **30** | PLANNING, ENGINEERING & DESIGN | | | | | | | | | | | | | |
| *1.0%* | Project Management | $8,399 | $4,368 | 52.0% | $12,767 | 0.0% | $8,399 | $4,368 | $12,767 | 2030Q2 | 21.5% | $10,202 | $5,305 | $15,507 |
| *1.0%* | Planning & Environmental Compliance | $8,399 | $4,368 | 52.0% | $12,767 | 0.0% | $8,399 | $4,368 | $12,767 | 2030Q2 | 21.5% | $10,202 | $5,305 | $15,507 |
| *11.0%* | Engineering & Design | $92,391 | $48,044 | 52.0% | $140,435 | 0.0% | $92,391 | $48,044 | $140,435 | 2030Q2 | 21.5% | $112,218 | $58,353 | $170,572 |
| *1.0%* | Reviews, ATRs, IEPRs, VE | $8,399 | $4,368 | 52.0% | $12,767 | 0.0% | $8,399 | $4,368 | $12,767 | 2030Q2 | 21.5% | $10,202 | $5,305 | $15,507 |
| *1.0%* | Life Cycle Updates (cost, schedule, risks) | $8,399 | $4,368 | 52.0% | $12,767 | 0.0% | $8,399 | $4,368 | $12,767 | 2030Q2 | 21.5% | $10,202 | $5,305 | $15,507 |
| *1.0%* | Contracting & Reprographics | $8,399 | $4,368 | 52.0% | $12,767 | 0.0% | $8,399 | $4,368 | $12,767 | 2030Q2 | 21.5% | $10,202 | $5,305 | $15,507 |
| *8.0%* | Engineering During Construction | $67,194 | $34,941 | 52.0% | $102,135 | 0.0% | $67,194 | $34,941 | $102,135 | 2033Q2 | 33.0% | $89,354 | $46,464 | $135,818 |
| *1.5%* | Planning During Construction | $12,599 | $6,551 | 52.0% | $19,150 | 0.0% | $12,599 | $6,551 | $19,150 | 2033Q2 | 33.0% | $16,754 | $8,712 | $25,466 |
| *2.0%* | Adaptive Management & Monitoring | $16,798 | $8,735 | 52.0% | $25,534 | 0.0% | $16,798 | $8,735 | $25,534 | 2041Q2 | 115.3% | $36,165 | $18,806 | $54,971 |
| *1.0%* | Project Operations | $8,399 | $4,368 | 52.0% | $12,767 | 0.0% | $8,399 | $4,368 | $12,767 | 2030Q2 | 21.5% | $10,202 | $5,305 | $15,507 |
| **31** | CONSTRUCTION MANAGEMENT | | | | | | | | | | | | | |
| *9.5%* | Construction Management | $79,793 | $41,492 | 52.0% | $121,285 | 0.0% | $79,793 | $41,492 | $121,285 | 2033Q2 | 33.0% | $106,108 | $55,176 | $161,284 |
| *2.0%* | Project Operation: | $16,798 | $8,735 | 52.0% | $25,534 | 0.0% | $16,798 | $8,735 | $25,534 | 2033Q2 | 33.0% | $22,339 | $11,616 | $33,955 |
| *2.5%* | Project Management | $20,998 | $10,919 | 52.0% | $31,917 | 0.0% | $20,998 | $10,919 | $31,917 | 2033Q2 | 33.0% | $27,923 | $14,520 | $42,443 |
| | **CONTRACT COST TOTALS:** | $1,304,812 | $665,552 | | **$1,970,364** | | $1,304,812 | $665,552 | **$1,970,364** | | | $1,677,129 | $855,662 | **$2,532,791** |