



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
2600 ARMY PENTAGON  
WASHINGTON, DC 20310-2600

DAEN

5 August 2024

SUBJECT: Baltimore Metropolitan, Baltimore City, MD, Coastal Storm Risk Management

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on coastal storm risk management recommendations for the Baltimore Metropolitan, Baltimore City, MD. It is accompanied by the report of the Baltimore District and North Atlantic Division Engineer. This study is an interim response to the Baltimore Metropolitan Water Resources authority, which was adopted by a resolution of the Committee on Public Works and Transportation of the United States House of Representatives on April 30, 1992. The authorization provided that the Secretary of the Army review the report of the Chief of Engineers on the Baltimore Metropolitan Area, Maryland, published as House Document 589, Eighty seventh Congress, Second Session, and the reports of the Chief of Engineers on Baltimore Harbor and Channels, Maryland, and Virginia, published as House Document 181, Ninety fourth Congress, First Session, and House Document 86, Eighty fifth Congress, First Session, and other pertinent reports, to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of flood control, hurricane protection, navigation, erosion, sedimentation, fish and wildlife, water quality, environmental restoration, recreation, and other related purposes. Preconstruction engineering and design (PED) activities will continue under the study authority cited above.

2. The reporting officers recommend authorizing a risk management system of features that will reduce the risk of damages from coastal storms to critical facilities. The Recommended Plan is the National Economic Development (NED) Plan. The Recommended Plan includes the following system of structural features:

- a. Floodwalls and closure structures at the southern approach of the Interstate (I)-95 Fort McHenry Tunnel and its supporting transportation critical facility (ventilation building).
- b. Floodwalls and closure structures at the southern approach of the I-895 Harbor Tunnel and its supporting transportation critical facility (ventilation building).

The floodwalls at each tunnel location can be implemented separately. In total, the Recommended Plan includes the construction of approximately 9,559 linear feet of fixed floodwalls with 6 closure structures. The design elevation is +12.5 ft NAVD88.

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3. The Maryland Transportation Authority (MDTA) is the non-federal cost sharing sponsor for the recommended project. In addition to the Recommended Plan, this study acknowledges and relies upon the non-federal sponsor's additional floodplain management responsibilities and emergency response actions in conjunction with state and Federal Emergency Management Agency (FEMA) related programs to mitigate the plan's residual risk including potential life loss and damages to critical infrastructure. Based on October 2023 price levels, the estimated project first cost is \$77,489,000. The project first cost includes the value of lands, easements, rights-of-way, relocations and dredged material placement area improvements (LERRD) estimated to be \$6,757,000. The current project plan requires Permanent Flood Protection Levee Easements for each tunnel and Temporary Work Area Easements for staging and work areas. Cost sharing is applied in accordance with the provisions of Section 103 of the Water Resources Development Act (WRDA) of 1986 (33 U.S.C. § 2213), as follows:

a. The federal share of the project first cost for initial construction is estimated at \$50,368,000 and the non-federal share, which includes cost of LERR, is estimated at \$27,121,000, which equates to 65 percent federal and 35 percent non-federal.

b. The additional annual cost of operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) for the Recommended Plan is estimated to be \$60,000 for the I-95 Fort McHenry tunnel and associated transportation critical facility and \$130,000 for the I-895 Harbor tunnel and the associated transportation critical facility. OMRR&R activities include maintenance and repair of the floodwalls, drainage, and closure structures. The non-federal sponsor will be responsible for 100 percent of the cost of project OMRR&R.

4. Based on a 2.75 percent federal discount rate (FY 24, October 2023 price levels) and a 50-year economic period of analysis, the equivalent average annual benefits are estimated at \$64,481,000 and equivalent average annual costs are estimated at \$3,092,000, with equivalent average annual net benefits of \$61,389,000 and a benefit-to-cost ratio (BCR) of 20.9 to 1. All project costs are allocated to the authorized purpose of coastal storm risk management.

5. The Recommended Plan has been formulated to reduce economic damages, reduce disruption to critical infrastructure, improve the resilience of critical infrastructure, and reduce risk to human health and safety. In turn, these objectives contribute to community and economic resilience and health in the face of changing conditions. The I-95 and I-895 tunnels are heavily utilized travel corridors in the Baltimore Metropolitan area and serve a critical role in the efficient transportation of goods, people, and services along the eastern seaboard of the United States. Interstate-95 is a direct link between the communities of South Baltimore and eastern Baltimore City and Baltimore County, as well as an important route for people to reach job centers further afield. Similarly, I-895 provides a direct link to eastern Baltimore City and Baltimore County with communities in South Baltimore separated from the rest of the city by the Middle Branch of the Patapsco River, as well as communities in northern Anne Arundel County.

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It also provides relief for congestion on I-95. If these transportation assets were damaged by a coastal storm, recovery is expected to be costly and time consuming. Loss of these transportation corridors could lead to disruption in emergency services, recovery operations, and nearby community recovery and resilience, in addition to the massive impact to the transportation of people and goods along the east coast of the USA.

6. The Recommended Plan proposes reducing the coastal flood risk to the assets of the I-95 and I-895 tunnels. The Recommended Plan aligns with current Administration goals of improving the resilience of critical infrastructure.

7. The study report fully describes coastal storm risk to structures and life safety associated with coastal storms. The Recommended Plan would greatly reduce, but not eliminate future damages and residual risk would remain. The recommended plan reduces expected annual damages by approximately 52 percent relative to the without project conditions. The residual risk, along with the potential consequences, has been communicated to the non-federal sponsor and will become a requirement of any communication and evacuation plan. The Recommended Plan would reduce the risk of flood loss, and minimize the impacts of floods on human safety, health, and welfare. The only certain method to prevent loss of life is by residents and visitors following existing local evacuation plans and leaving the study area prior to significant storm events.

8. The USACE investigated environmental records and prepared a hazardous, toxic and radioactive waste (HTRW) investigation report, included in Appendix G. Contaminated soils may be present in construction areas for the I-95 and I-895 tunnels. Further investigations during PED would be necessary to determine if contaminated soils are present. Presence of contaminated soils may require modification to the design of project elements. This could increase project cost and has been added as an assumption as part of the cost schedule risk analysis (CSRA).

9. The Recommended Plan would be implemented in partnership with MDTA. The Recommended Plan would improve the resilience of critical infrastructure, provide risk reduction and the highest net benefit.

10. The study evaluated potential impacts of sea level change in formulating and designing the recommended plan. To address this uncertainty, project performance was assessed at the intermediate rate of sea level rise as it offered the best balance between equally likely scenarios (i.e., the historic rate of sea level rise continuing indefinitely and the high rate including accelerated rates of change caused by warming temperatures and accelerated ice melt). The Recommended Plan was evaluated for performance against Sea Level Change (SLC) over the 50-year economic period of analysis (year 2080) and beyond to the planning adaptation horizon of 100 years (years 2031-2130). The Recommended Plan level of performance of +12.5 feet NAVD88, equivalent to the 100-year or 1 percent annual exceedance probability (AEP) storm

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event, is anticipated to reduce coastal storm risk under the intermediate SLC scenario up to and beyond the year 2110 and under the low SLC scenario up to year 2130. Adaptation capacity has been evaluated in the final feasibility-level design and the structural components could be adapted to maximize the overall usefulness of the system over the economic period of analysis life of the project by including redundancy and robustness in the design, so they are adaptable to future conditions including high-rate sea level change. USACE will continue to monitor local conditions and determine if the intermediate scenario of sea level change is reasonably representative of observed conditions. If observed conditions significantly exceeding the intermediate projection are identified, reevaluation of project's design and performance will be needed through further study.

11. All compliance with required applicable environmental laws and regulations has been completed.

12. In accordance with USACE policy on the review of decision documents, all technical, engineering, and scientific work underwent an open, dynamic, and rigorous review process. The comprehensive review process included District Quality Control Review, Agency Technical Review, Independent External Peer Review (IEPR), and Policy and Legal Compliance review to confirm the planning analyses, alternative design and safety, and the quality of decisions. Washington-level review indicates that the plan recommended by the reporting officers complies with all essential elements of the U.S. Water Resources Council's Economic and Environmental Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies, as well as other administrative and legislative policies and guidelines. The views of interested parties, including federal, state, and local agencies, were considered and all comments from public reviews have been addressed and incorporated into the final report documents where appropriate.

13. There is limited geotechnical data available for the project. Geotechnical modeling and analysis has been deferred to the PED phase, at which time foundation assumptions will be confirmed. The cost risk was included in the CSRA and conservative estimates were used for materials.

14. USACE decision documents recognize cost risk and uncertainty surrounding implementation. All cost estimates will carry a degree of uncertainty. The estimated total project first cost for the Recommended Plan at the 80% confidence interval is estimated at \$77,489,000. This project carries a degree of uncertainty such that if the main drivers described below are realized, the first cost for the Recommended Plan could increase to approximately \$92,413,000. The recommended plan has various construction and non-construction components. These components range from 10 to 60 percent in project definition. The overall recommended plan is at 15 percent design. Based on the recommended project design of the construction components and scope definition of the non-construction components, the total project cost is designated as a Class 3 estimate. The project first cost includes a contingency value of \$21,755,000,

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which is approximately 39 percent of the estimated base project cost of \$55,734,000. The cost contingencies are intended to cover cost and schedule increases due to the identified project risks and their probability of occurrence. Changes to assumptions or the basis of design can result in additional risks not currently identified. For the Recommended Plan project first costs, the currently known major uncertainty drivers are the following: 1) contaminated soils may be present around construction areas for the I-95 and I-895 tunnels. Further investigation during PED may be needed; 2) limited geotechnical data. Drilling and testing will occur during the PED phase, at which time site specific data on soils, foundations, and contamination will be updated; 3) variation in major material costs and bid assumptions; 4) project scope may change once design is developed with more data and analysis; 5) acquisitions and easements may be difficult and time consuming to obtain, particularly on railroad properties; and 6) any changes to assumptions on productivity, construction sequencing due to funding allocations and future market conditions can affect overall project cost. As the project moves into the next phases, USACE will focus risk management and mitigation on the primary cost and other significant risk drivers to the extent within USACE control. However, there still exists the potential for other unanticipated and uncontrollable changes in environmental or economic conditions that could further increase the total project first cost beyond the current estimate and/or necessitate changes in the project's design.

15. In full consideration of the risks as documented in the preceding paragraphs in this report, I concur in the findings, conclusions, and recommendation of the reporting officers. Accordingly, I recommend that coastal storm risk management improvements in Baltimore City, MD be authorized in accordance with the reporting officers' Recommended Plan at an estimated cost of \$77,489,000 for initial construction, with such modifications as in the discretion of the Chief of Engineers may be advisable. Federal implementation of the project for coastal storm risk management includes, but is not limited to, the following items of local cooperation to be undertaken by the non-federal sponsor in accordance with applicable federal laws, regulations, and policies:

a. Provide 35 percent of construction costs, as further specified below:

1. Provide, during design, 35 percent of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;

2. Provide all lands, easements, rights-of-way, and placement areas and perform all relocations determined by the Federal government to be required for the project;

3. Provide, during construction, any additional contribution necessary to make its total contribution equal to at least 35 percent of construction costs;

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b. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the level of coastal storm risk reduction the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;

c. Inform affected interests, at least yearly, of the extent of risk reduction afforded by the project; participate in and comply with applicable Federal floodplain management and flood insurance programs; prepare a floodplain management plan for the project to be implemented not later than one year after completion of construction of the project; and publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with the project;

d. Operate, maintain, repair, rehabilitate, and replace the project or functional portion thereof at no cost to the Federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal laws and regulations and any specific directions prescribed by the Federal government;

e. Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project to inspect the project, and, if necessary, to undertake work necessary to the proper functioning of the project for its authorized purpose;

f. Hold and save the Federal government free from all damages arising from design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project, except for damages due to the fault or negligence of the Federal government or its contractors;

g. Perform, or ensure performance of, any investigations for HTRW that are determined necessary to identify the existence and extent of any HTRW regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, and any other applicable law, that may exist in, on, or under real property interests that the Federal government determines to be necessary for construction, operation and maintenance of the project;

h. Agree, as between the Federal government and the non-Federal sponsor, to be solely responsible for the performance and costs of cleanup and response of any HTRW regulated under applicable law that are located in, on, or under real property interests required for construction, operation, and maintenance of the project, including the costs of any studies and investigations necessary to determine an appropriate response to the contamination, without reimbursement or credit by the Federal government;

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j. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, (42 U.S.C. 4630 and 4655) and the Uniform Regulations contained in 49 C.F.R Part 24, in acquiring real property interests necessary for construction, operation, and maintenance of the project including those necessary for relocations, and placement area improvements; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

16. The recommendation contained herein reflects the information available at this time and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the Executive Branch. Consequently, the recommendation may be modified before it is transmitted to the Congress as a proposal for authorization and implementation funding. However, prior to transmittal to Congress, the non-federal sponsor, interested federal agencies, and other parties will be advised of any significant modifications and will be afforded an opportunity to comment further.

A handwritten signature in black ink, appearing to read "Scott A. Spellmon". The signature is fluid and cursive, with a large initial "S" and "A" and a distinct "Spellmon" at the end.

SCOTT A. SPELLMON  
Lieutenant General, USA  
Chief of Engineers