

CITY OF VIRGINIA BEACH

COASTAL STORM RISK MANAGEMENT FEASIBILITY STUDY



Public Webinar
January 2026



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COASTAL STORM RISK MANAGEMENT FEASIBILITY STUDY

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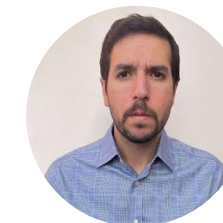
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Real Estate



Mike Tippin
City of Virginia Beach, Stormwater Engineering Center Administrator



Justine Woodward
Environmental



Andrew Lobo
Economics



Nicole Miller
Planning



Scan the QR code to visit the project website for more information and to check for future announcements.
(<https://www.nao.usace.army.mil/About/Projects/VBCSRM>)

COASTAL STORM RISK MANAGEMENT FEASIBILITY STUDY

AGENDA

- Study Background
- Future Without Project
- Risk Management Measures
- Public Engagement
- Question & Answer Session (Q&A)

Please use chat to:

- Ask questions
- Share ideas

***This Microsoft TEAMS Meeting is being recorded and will be posted on the study website in the coming weeks.**



COASTAL STORM RISK MANAGEMENT FEASIBILITY STUDY

STUDY INFORMATION

AUTHORIZATION

The study was authorized by Section 1201 of the America’s Water Infrastructure Act of 2018. It is authorized to identify long-term solutions to minimize risk attributable to coastal storms through the potential project’s 50-year economic period of analysis.

SCOPE

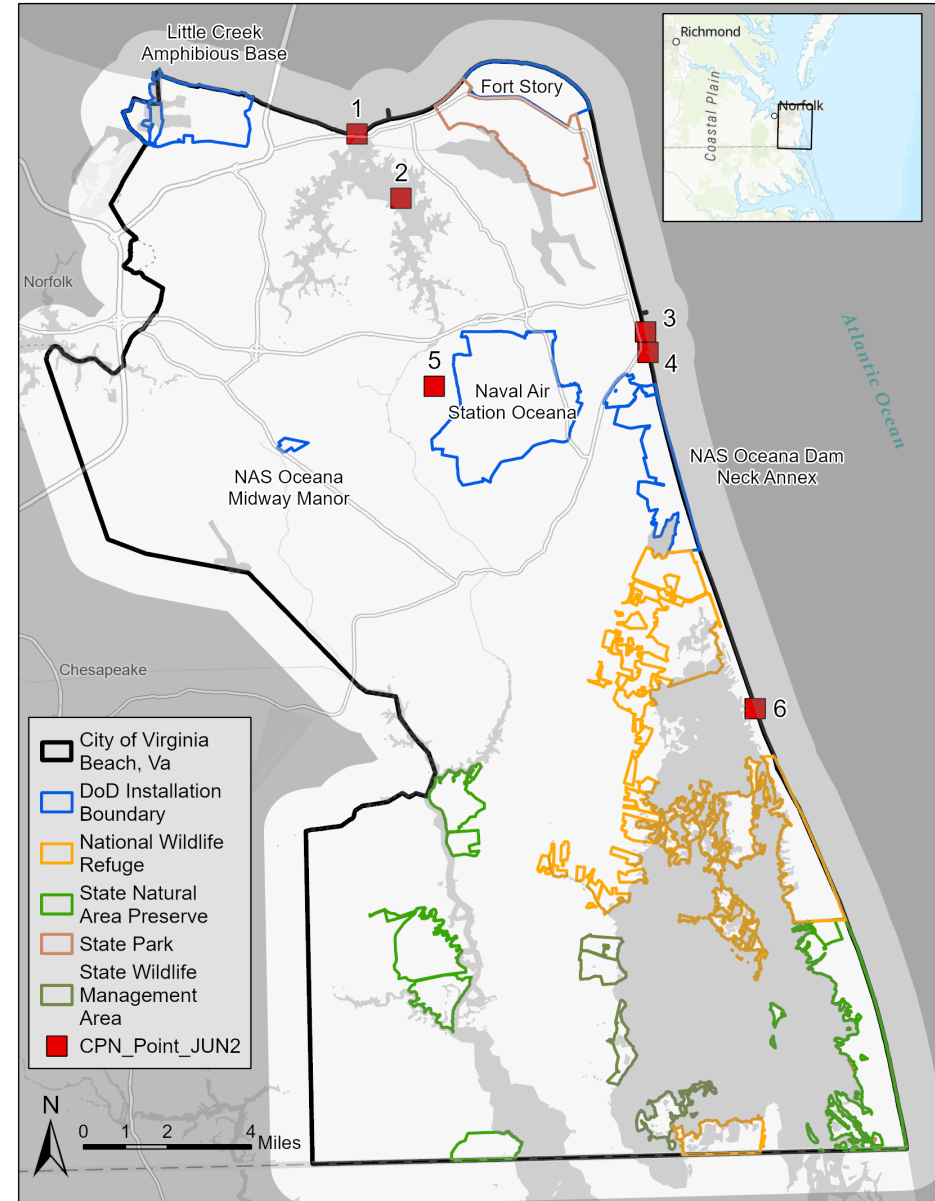
Single purpose coastal storm risk management study initiated in 2022.

The study focuses on:

1. Reducing direct and indirect risks to human life, health, and safety caused by coastal storms.
2. Reducing structural damages caused by coastal storm events.

NON-FEDERAL SPONSOR

City of Virginia Beach 



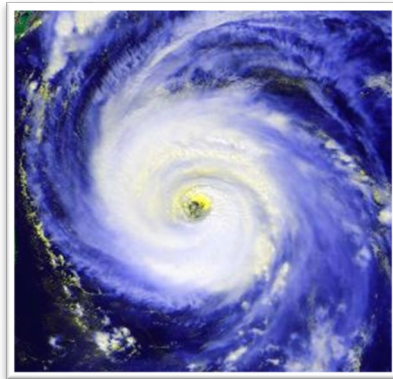
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Feasibility Phase Process

Decision & Product Milestones

- ◆ = Decision Milestone
- = Product Milestone
- ★ = NEPA Public Comment Period



**Study Duration:
5 Years 11 Months**



	MILESTONE	Date
◆	Alternatives Milestone	November 2022
★	Notice of Intent	Spring 2026
◆	Tentatively Selected Plan (TSP)	Fall 2026
★ ■	Public Release of Draft Report	Winter 2026
◆	Command Validation Milestone	Spring 2027
■	Final Report Submittal	Fall 2027
■	Signed Chief's Report	Spring 2028

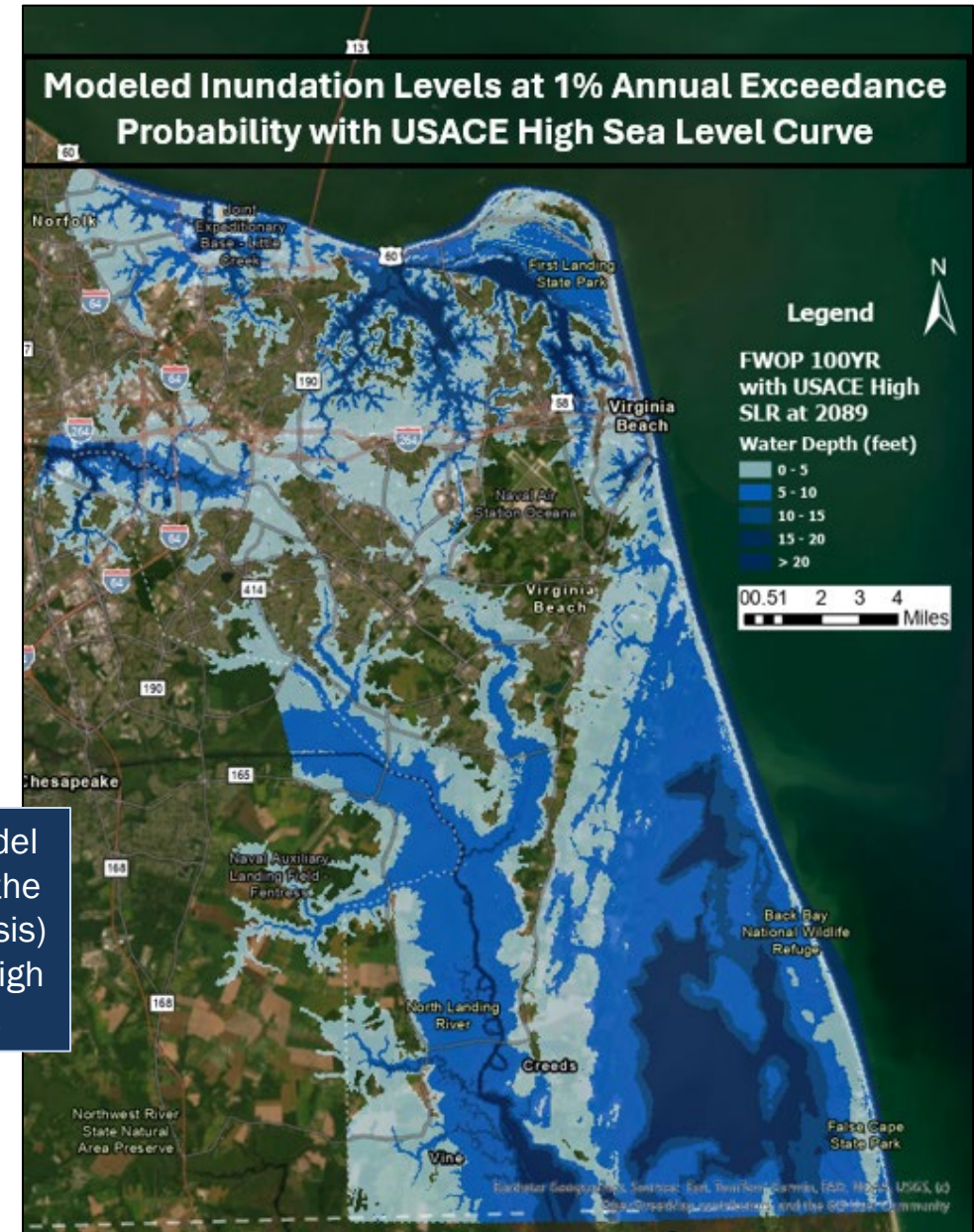
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DEFINING THE FUTURE WITHOUT PROJECT CONDITION

Modeling predicted storm surge inundation:

- U.S. Army Corps of Engineers River Analysis System (HEC-RAS) developed by the Hydrologic Engineering Center.
- HEC-RAS is used to develop the water surface profiles for the 50-year period of economic analysis.
- Considers the USACE High Sea Level Curve.

The map displays the model output in the year 2089 (the end of the period of analysis) and includes the USACE high sea level change curve.

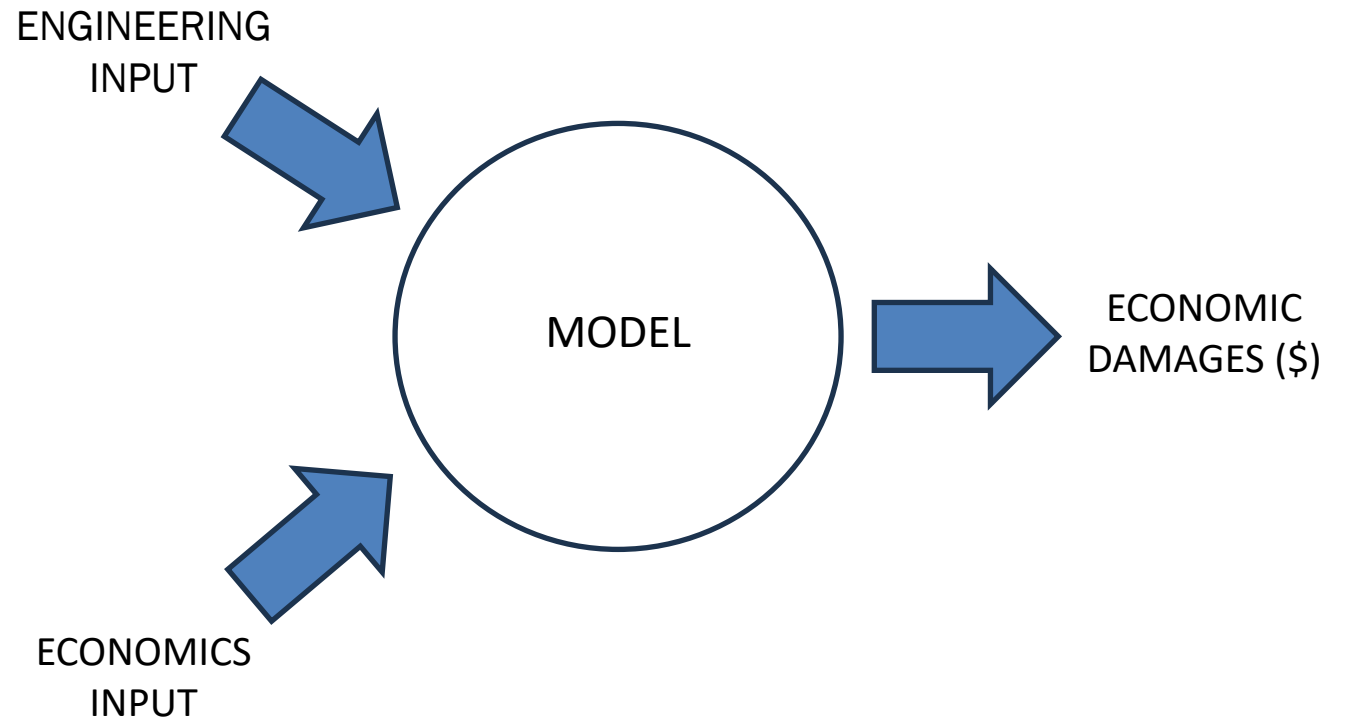


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DETERMINING ECONOMIC DAMAGES (\$)



- Economic models are used to calculate the estimated damages under a Future Without Project Condition.
- **Beach-*fx*** is used to evaluate structure damage caused by coastal storm inundation, waves, and erosion/land loss in beachfront areas.
- **G2CRM** is used to evaluate structure damage caused by coastal storm surge flooding in tidally influenced areas that are not beachfront.



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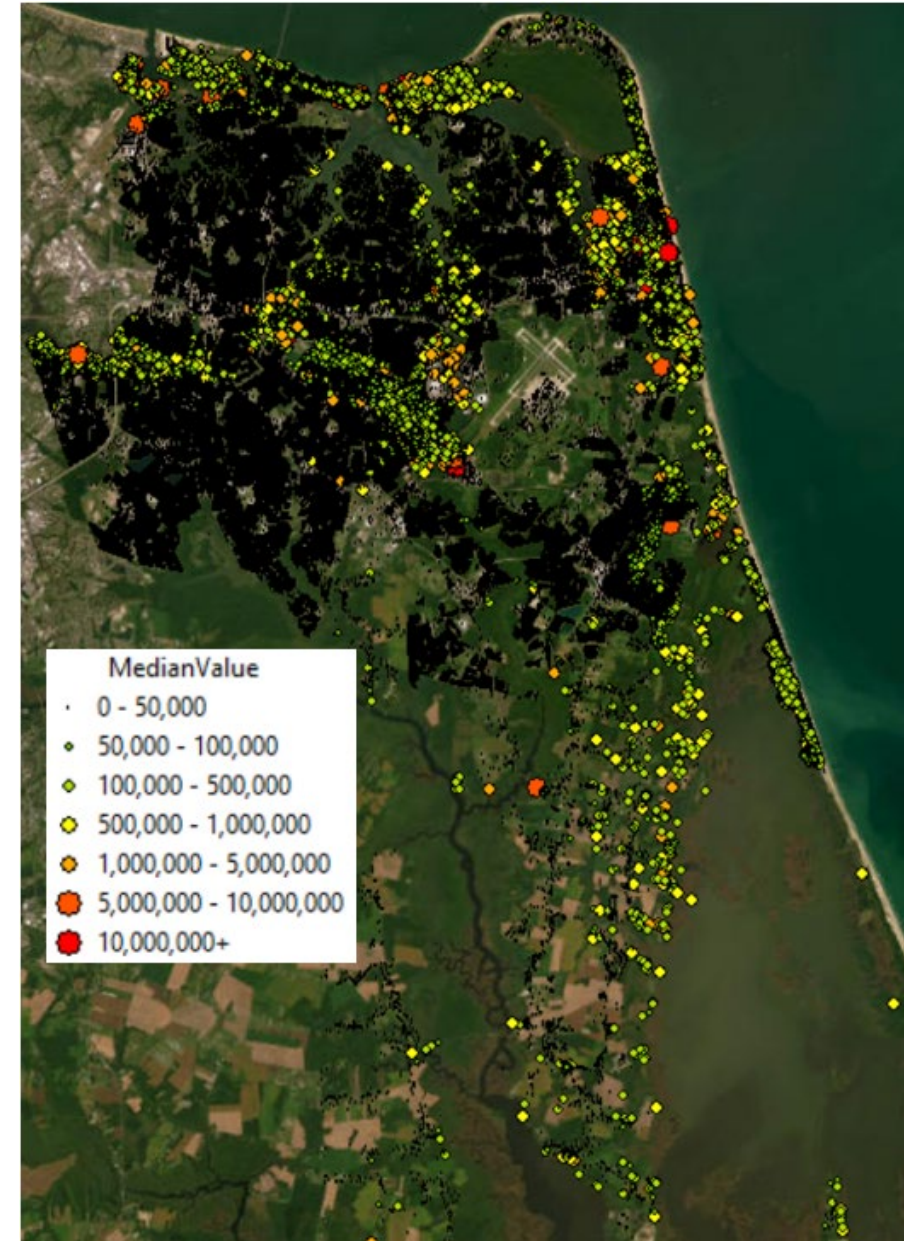
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INITIAL FUTURE WITHOUT PROJECT RESULTS

Future Without Project (FWOP) Conditions

- Asset inventory of approximately 150,000 structures, including 131 identified critical infrastructure assets.
- Damages (\$) include structure and content losses.
- Other benefit categories: life safety risk, recreation, agriculture loss.

Planning Area	Structure Count
Little Creek	12,521
Lynnhaven Inlet	63,100
Elizabeth River	17,135
Southern Rivers	32,920
Back Bay	11,418
Sandbridge	1,524
Rudee Inlet	5,945

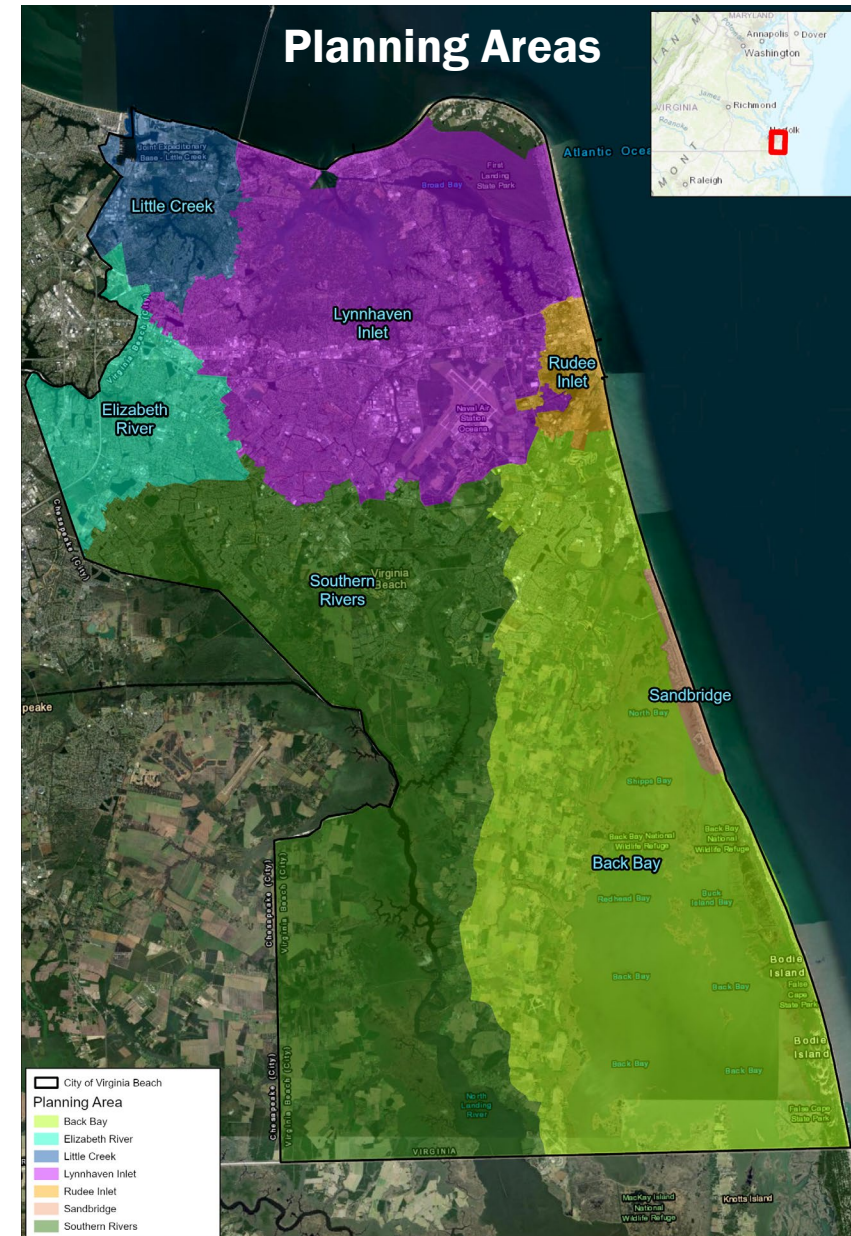


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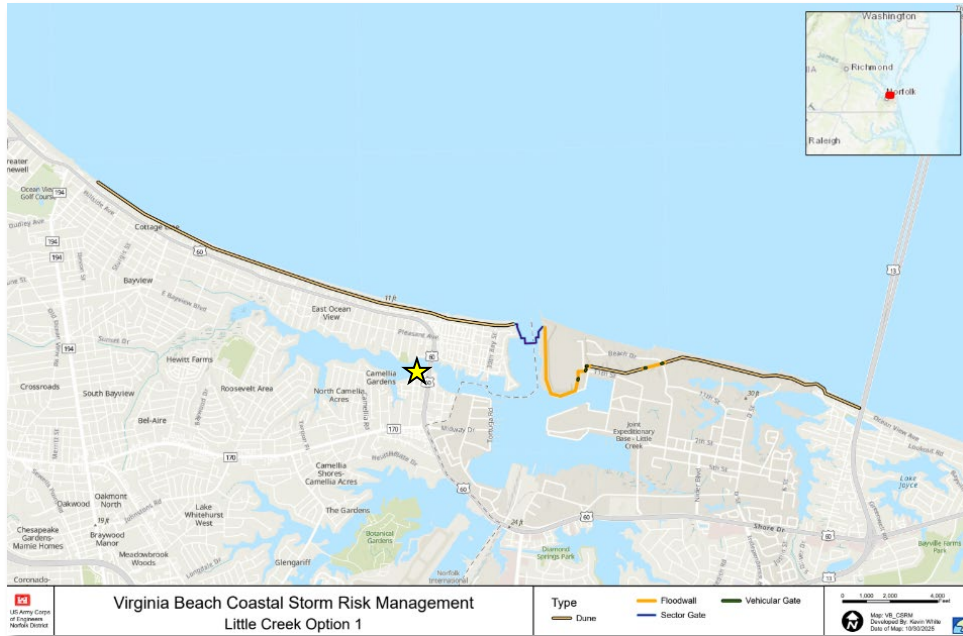
STRUCTURAL MEASURES OVERVIEW

- Conceptual engineered defenses were presented in the City of Virginia Beach's Sea Level Wise Adaptation Strategy (March 2020) for each of the watersheds.
 - This included storm surge barrier concepts for Lynnhaven Inlet, Rudee Inlet, and the Eastern Branch of the Elizabeth River.
 - Served as a starting point in the development of structural measures for consideration.
- Planning is an iterative process. Measures become more specific and better defined as the planning process progresses. They are refined and screened throughout the process, based on factors such as the study objectives, constraints, and stakeholder feedback.
- Individual structural measures have been combined into "structural alignments" by planning area.
 - Proposed alignments do not infer support from all stakeholders.** The structural alignments being considered will continue to be evaluated through the study process, and further screening/refinements may occur.

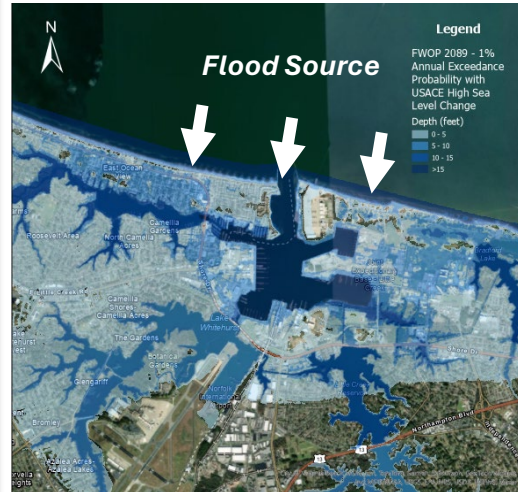


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Little Creek Structural Measures



The flood source for the Little Creek planning area is the Chesapeake Bay (denoted with white arrows on the inundation map).



Map: Future Without Project Inundation
 1% Annual Exceedance Probability (100yr) at year 2089 with USACE High Sea Level Change



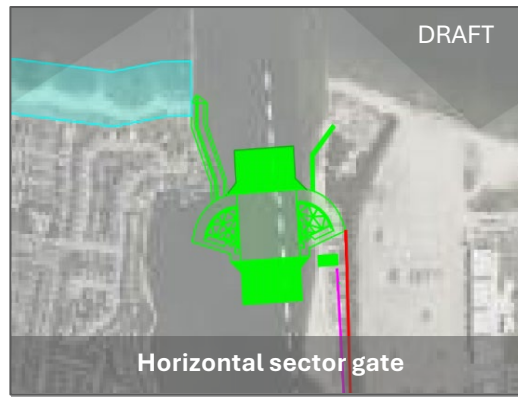
- ### What has changed since February 2025?
- Adjustments to the Little Creek 1 alignment to minimize impacts to naval operations and mission readiness.
 - Necessary tie-ins for storm surge barrier revised.
 - Structural alignments Little Creek 2 and Little Creek 3 screened from further evaluation.



Little Creek Structural Alignment 1 (LC1)

- One structural alignment for Little Creek will be carried forward for further evaluation.
- Includes a storm surge barrier comprised of a horizontal sector gate across Little Creek Inlet and associated floodwall and sand dune fortification along the bay front.

★ Note: Norfolk CSRM Project currently includes a proposed storm surge barrier at Pretty Lake (future phase of the project).

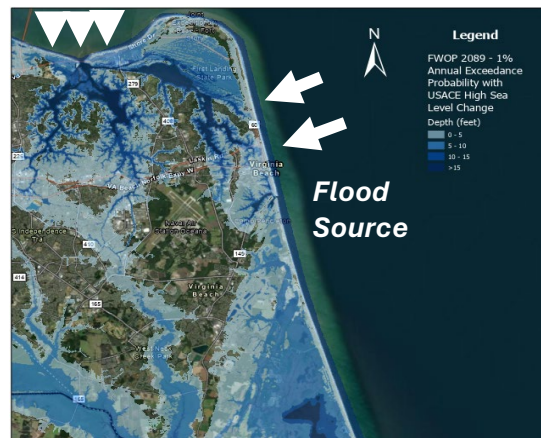


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Lynnhaven Structural Measures



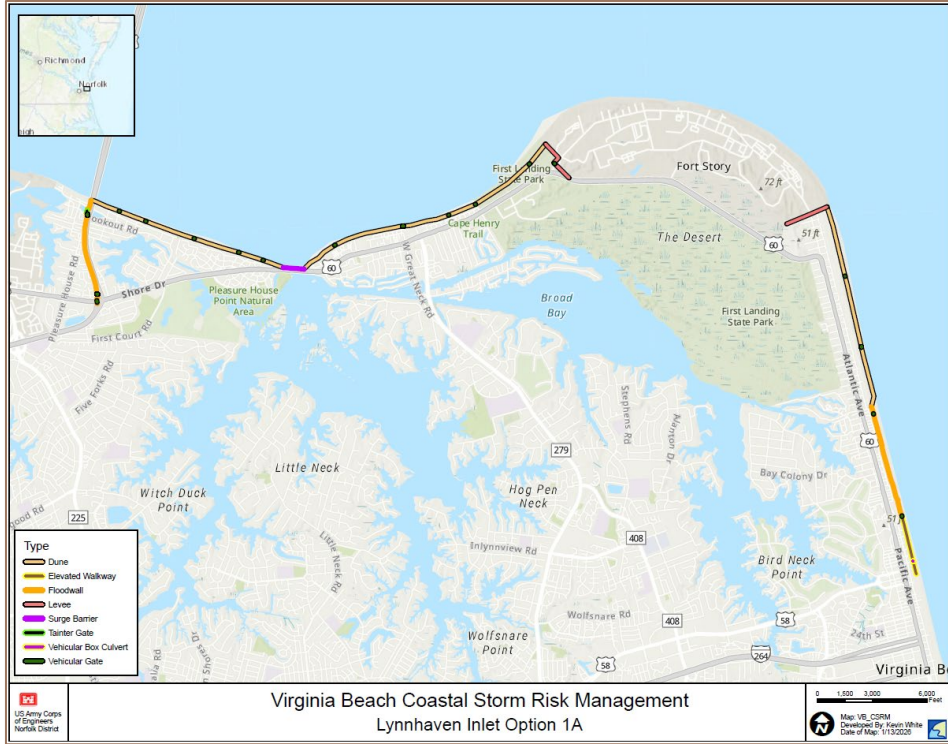
The flood sources for the Lynnhaven planning area are the Chesapeake Bay and the Atlantic Ocean (denoted with white arrows on the inundation map).



Map: Future Without Project Inundation
1% Annual Exceedance Probability (100yr) at year 2089 with USACE High Sea Level Change

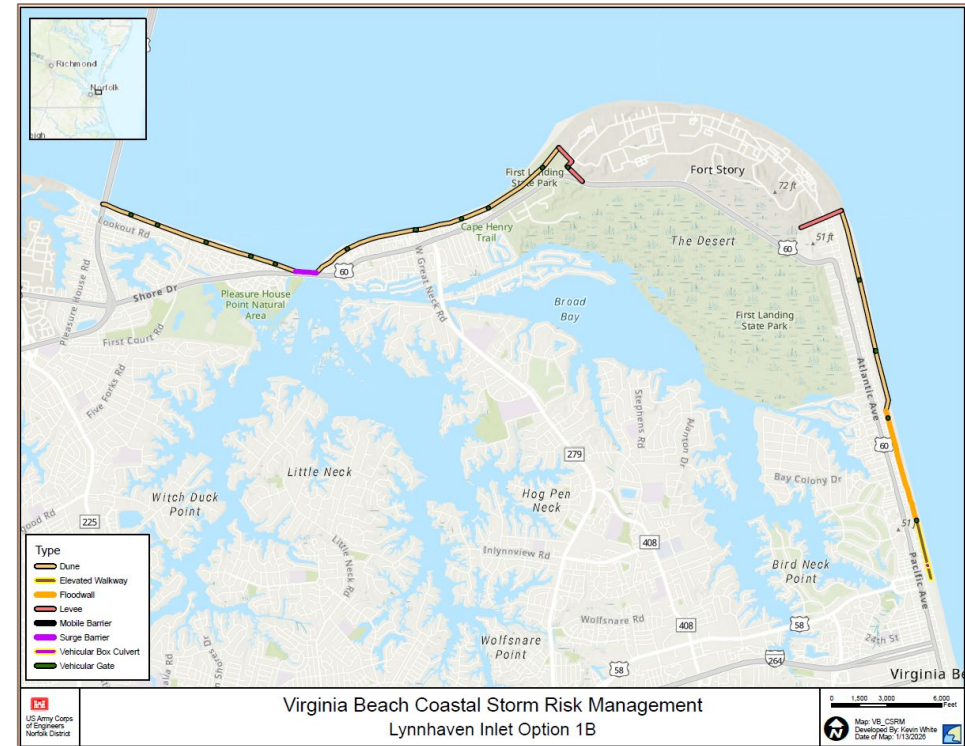
What has changed since February 2025?

- Other structural alignments screened due to constructability concerns.
- Study team is also evaluating storm surge barrier with a lock concept.



Lynnhaven Structural Alignment 1A (LI1A)

- Includes a surge barrier comprised of a rising sector gate and Tainter gates across Lynnhaven Inlet.
- Additional features, such as a jetty, may be required in association with the surge barrier.
- The alignment also includes floodwalls and sand dune fortification along both the bay and ocean fronts.

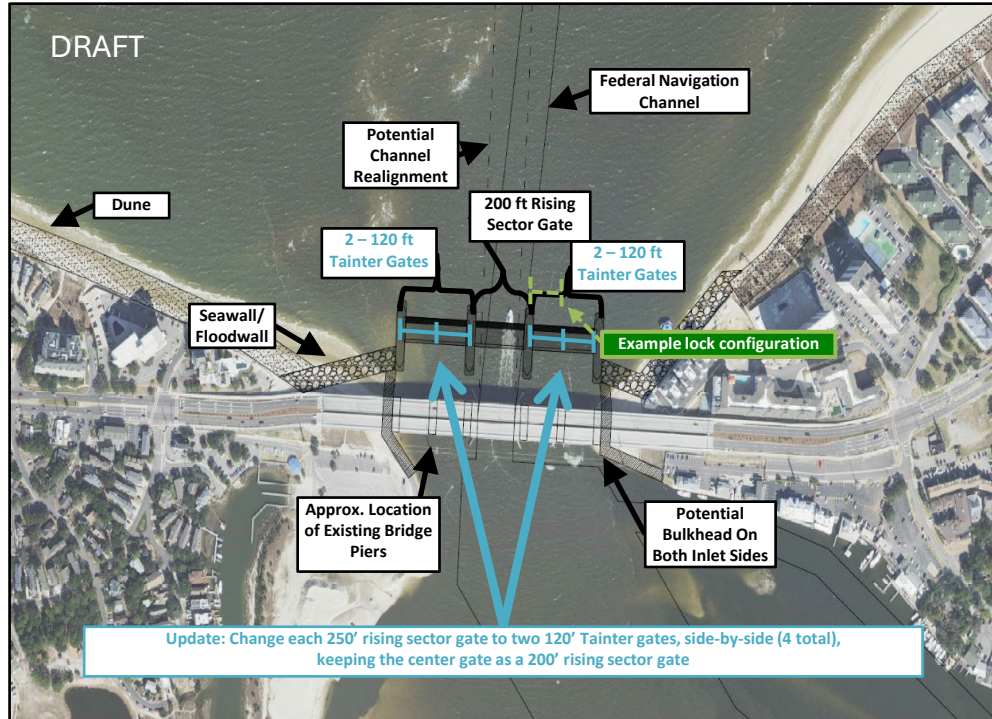


Lynnhaven Structural Alignment 1B (LI1B)

- LI1B is the same as LI1A, but does not include the floodwall along Northampton Blvd.
- Must be paired with LC1 alignment.

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Lynnhaven Inlet Storm Surge Barrier Concept



Benefits of Tainter Gates



Approximately 50% less expensive than unrestricted vertical clearance gates, such as rising sector gates.



Lifecycle costs for Operations & Maintenance (O&M) are less expensive.
(Non-Federal Sponsor is responsible for 100% of O&M)



Tainter gates are a better option if a lock system is implemented.
(An additional Tainter gate may be added in front of another to allow for a lock system)



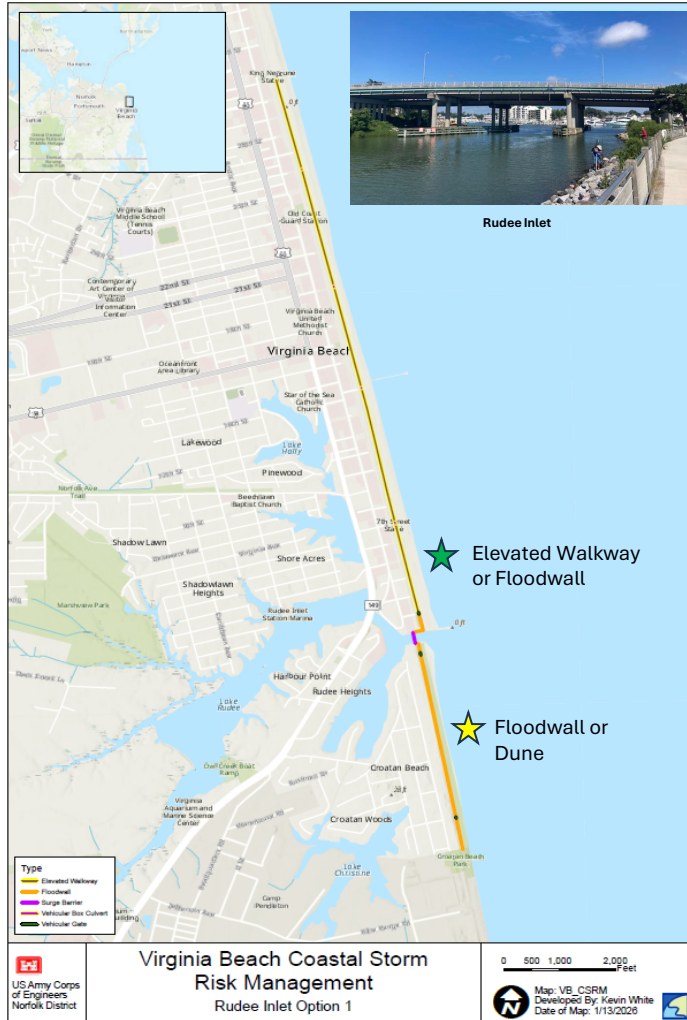
Example of existing Tainter gates at Fox Point Hurricane Barrier in Providence, Rhode Island



Example of existing rising sector gates at the Thames Barrier in London

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Rudee Structural Measures



Rudee Inlet

The flood source for the Rudee planning area is the Atlantic Ocean (denoted with white arrows on the inundation map).



Map: Future Without Project Inundation
1% Annual Exceedance Probability (100yr) at year 2089 with USACE High Sea Level Change

What has changed since February 2025?

- Structural alignment with a storm surge barrier will be carried forward for further evaluation.
- Resort Beach: Considering elevated walkway or floodwall options.
- Croatan Beach: Considering floodwall or dune options.

Rudee Inlet 1 and 3 (RI1 and RI3)

- Same concept, except for a floodwall and gate along the southern end, through Lake Christine (RI3).
- Horizontal sector gate as the proposed storm surge barrier across Rudee Inlet.



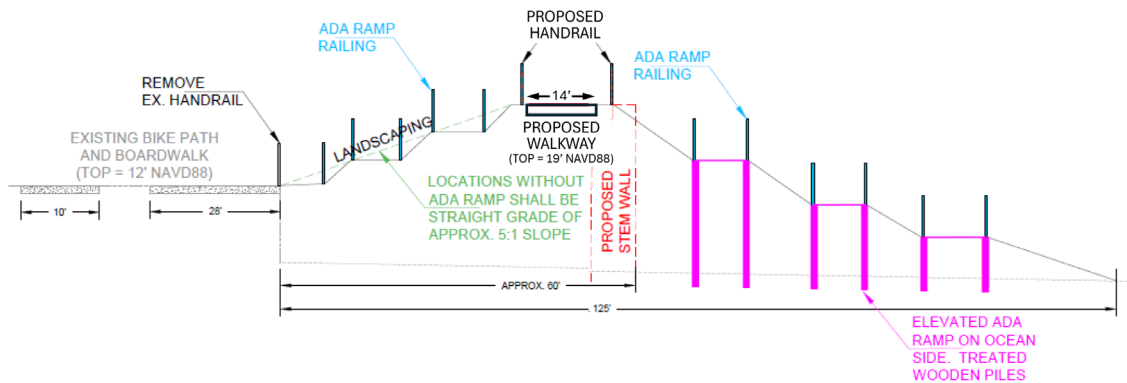
Example Horizontal Sector Gate

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Resort Beach Conceptual Design Options

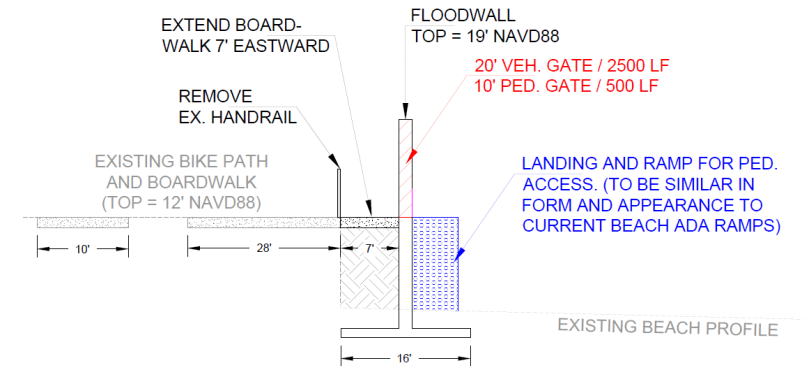
Draft concept drawings of what it could look like...

Elevated Walkway Concept



Not to Scale

Floodwall Concept



Not to Scale

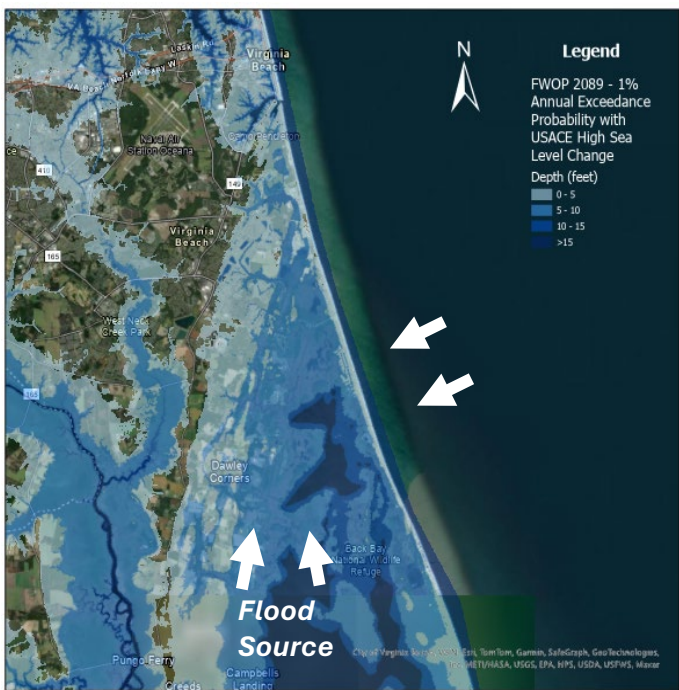
Note: Proposed ultimate floodwall top of 19' NAVD88 shown. Adaptable option with an initial top of 16' NAVD88 is being considered.

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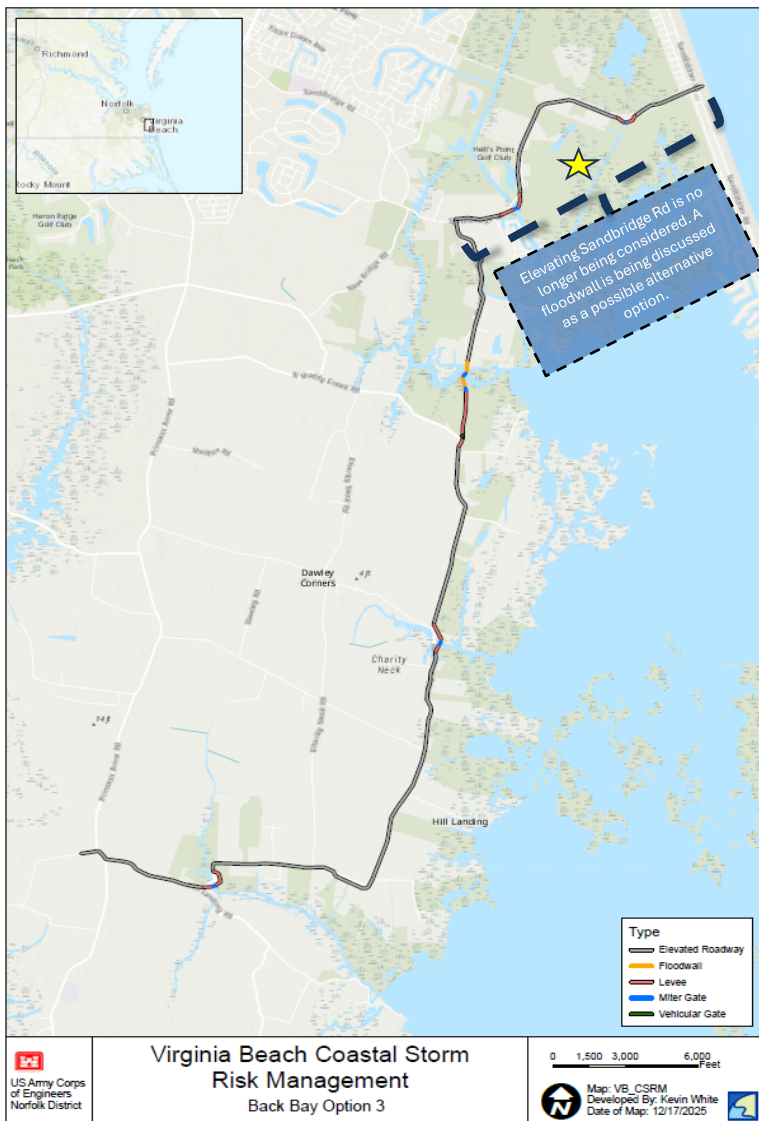
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Back Bay Structural Measures

The **flood source** for the Back Bay planning area is flooding that propagates northward from Back Bay and the Atlantic Ocean (denoted with white arrows on the inundation map).



Map: Future Without Project Inundation
1% Annual Exceedance Probability (100yr) at year 2089 with USACE High Sea Level Change



Virginia Beach Coastal Storm Risk Management
Back Bay Option 3

0 1,500 3,000 6,000 Feet

Map: VB_CSRM
Developed By: Kevin White
Date of Map: 12/17/2025

What has changed since February 2025?

- Structural measures were screened from further consideration in the Sandbridge area.
- Structural alignments that include the elevation of Sandbridge Road have been screened out.

Back Bay Option 3 (BB3)

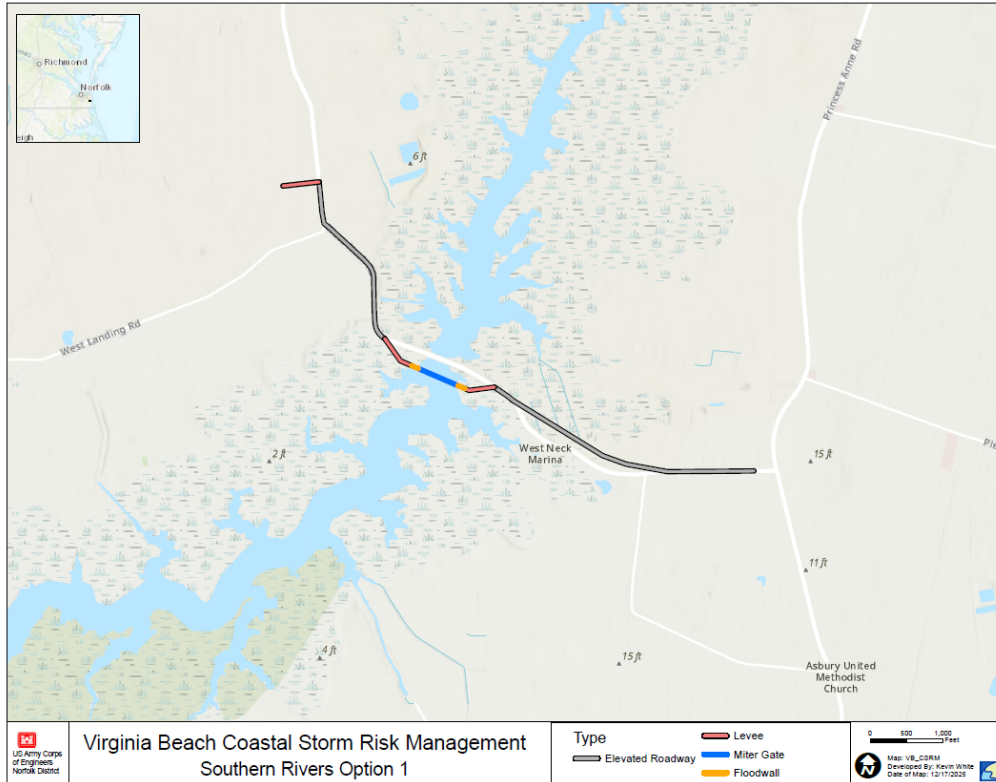
- Original concept includes the elevation of Sandbridge Road and Muddy Creek Road; however, the elevation of Sandbridge Road has been screened out.
- ★ A floodwall along Sandbridge Road is being considered as a possible option.
- The alignment would also include miter gates with associated floodwall/levee tie-ins across waterways. Additional features, such as dunes, may be included to prevent wrap around flooding.

Note: Proposed alignment does not infer support from all stakeholders.

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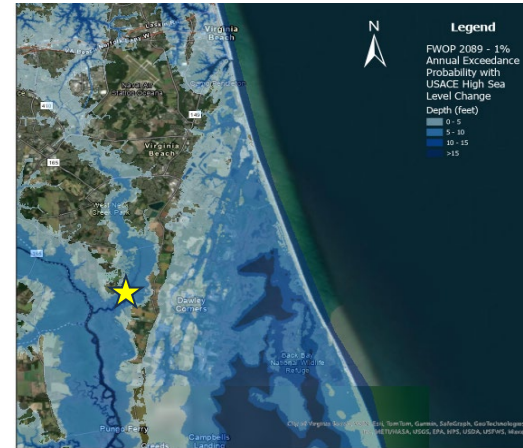
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Southern Rivers Structural Measures

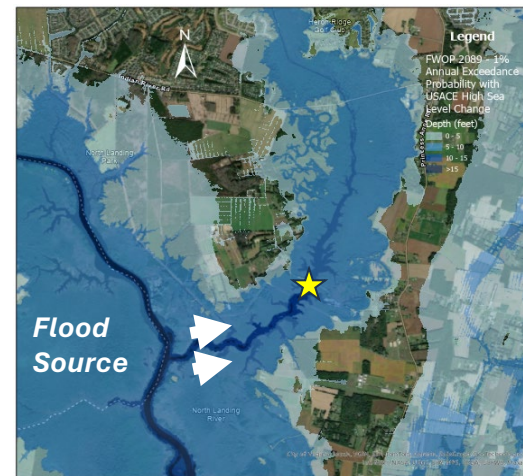


Southern Rivers Alignment 1 (SR1)

- Alignment includes elevated roadway and an in-water gate adjacent to West Neck Creek bridge.
- Includes a levee section at the northern terminus to complete the line of protection and mitigate against wrap around flooding.



The flood source for the Southern Rivers is the North Landing River (denoted with white arrows on the inundation map).



Map: Future Without Project Inundation
1% Annual Exceedance Probability (100yr) at year 2089 with USACE High Sea Level Change



What has changed since February 2025?

- Structural alignment with a storm surge barrier will be carried forward for further evaluation.

★ Denotes approximate location of the West Neck Creek Bridge.

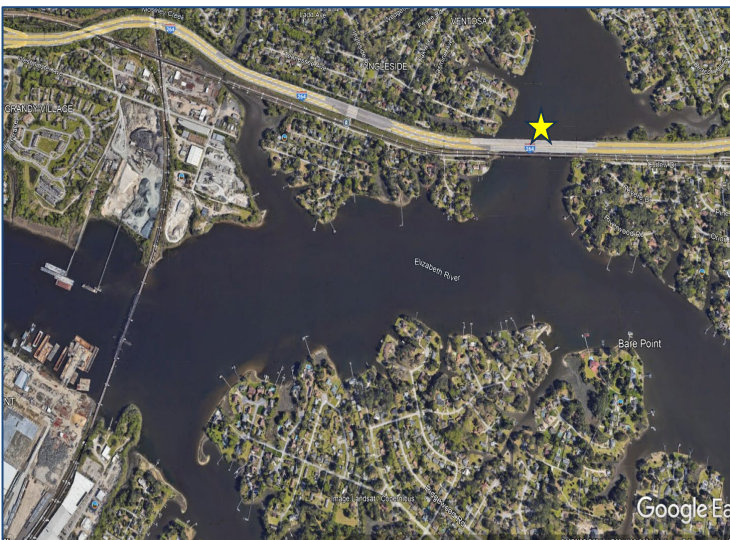
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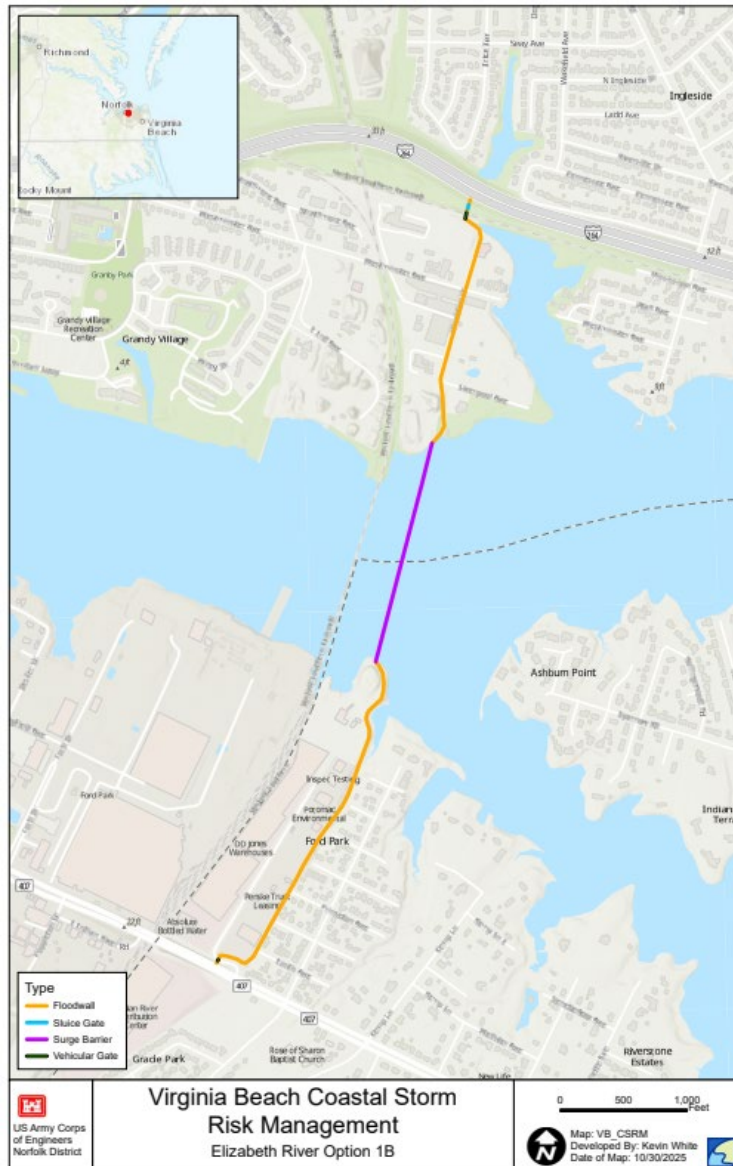
Elizabeth River Eastern Branch Structural Measures

What has changed since February 2025?

- Adjustments to Structural Alignment 1, now Alignment 1B, to minimize impacts to nearby communities, oyster reefs, and the railroad.
- Structural alignment locations 1A, 2, and 3 screened from further evaluation.



Note: Norfolk CSRM Project currently includes a proposed storm surge barrier at Broad Creek (future phase of the project).



Elizabeth River Structural Alignment 1B (ER1B)

- One structural alignment for Elizabeth River Eastern Branch will be carried forward for further evaluation.
- Includes a surge barrier comprised of a series of five Tainter gates for navigation. Sluice gate banks for auxiliary flow on either end of the Tainter gates, along with associated floodwalls.
- Requires coordination with cities of Norfolk and Chesapeake.



Example of Sluice gates



Example of existing Tainter gates at Fox Point Hurricane Barrier in Providence, Rhode Island

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OVERVIEW

- Addresses flood risk at the hyper-local scale – property by property.
- Measures may include building elevation and floodproofing.
- Initial focus areas include those with highest risk to storm surge flooding and are socio-economically vulnerable.

FLOODPROOFING

Benefits of Dry Floodproofing:

- Relatively cost-effective option.
- Prevents structural damages.
- Preservation of aesthetics: floodproofing does not significantly alter the building's exterior.

ELEVATING BUILDINGS

Benefits of Elevating Buildings:

- Can help manage risk from compound flooding hazards including storm surge and groundwater, tidal, or stormwater flooding.
- Manages longer-term risks from flooding exacerbated by sea level change.
- Participation is **voluntary**.
- Expanded community education and engagement efforts for the program during the design and construction phases.

Nonstructural Measures

What does “nonstructural” mean?

Nonstructural measures are permanent or contingent measures applied to a building and/or its contents that prevent or provide resistance to damage from flooding. The type, age, and size of building, among other factors determines what type of measure is most appropriate.

Nonstructural measures differ from structural measures in that they focus on reducing the consequences of flooding instead of physically blocking or preventing the flooding, i.e., reducing the probability of flooding for a given area.

“Living with Water”



Deployable stop logs to protect vulnerable entryways



Temporary flood panels



Temporary flood panels



Elevated critical equipment



Elevating a couple feet above ground can reduce damages



Building elevation in process



In coastal areas with more wave action, homes may be elevated higher

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Investigating Natural and Hybrid Infrastructure

- The study team is evaluating Natural and Hybrid Infrastructure (NHI) to mitigate some coastal storm risk.
- Current efforts are focused on Back Bay and Lynnhaven watersheds.
- Collaboration with the University of Virginia's Natural Infrastructure Laboratory and the USACE Engineering with Nature® Program to identify and evaluate NHI solutions.



What is Natural and Hybrid Infrastructure?

The intentional alignment of natural processes, engineering design, and protective infrastructure—both soft and hard — to mitigate the impacts of natural hazards on critical infrastructure and the broader landscape, while enhancing system resilience and ecological function.



Co-Benefits of NHI

Restores and enhances aquatic ecosystem habitats	Increases resilience
Promotes recreation and other social benefits	Supports risk management adaptation strategies

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PUBLIC ENGAGEMENT

Additional virtual and in-person engagement opportunities:

Virtual Meeting Dates/Times:

January 27: 6p-730p

In Person Meeting Dates (Open House):

January 26: Kempsville High School, 6-8p

January 28: Kellam High School, 6-8p

January 29: W.T. Cooke Elementary School, 6-8p

Stay tuned to the project website for additional engagement opportunities:

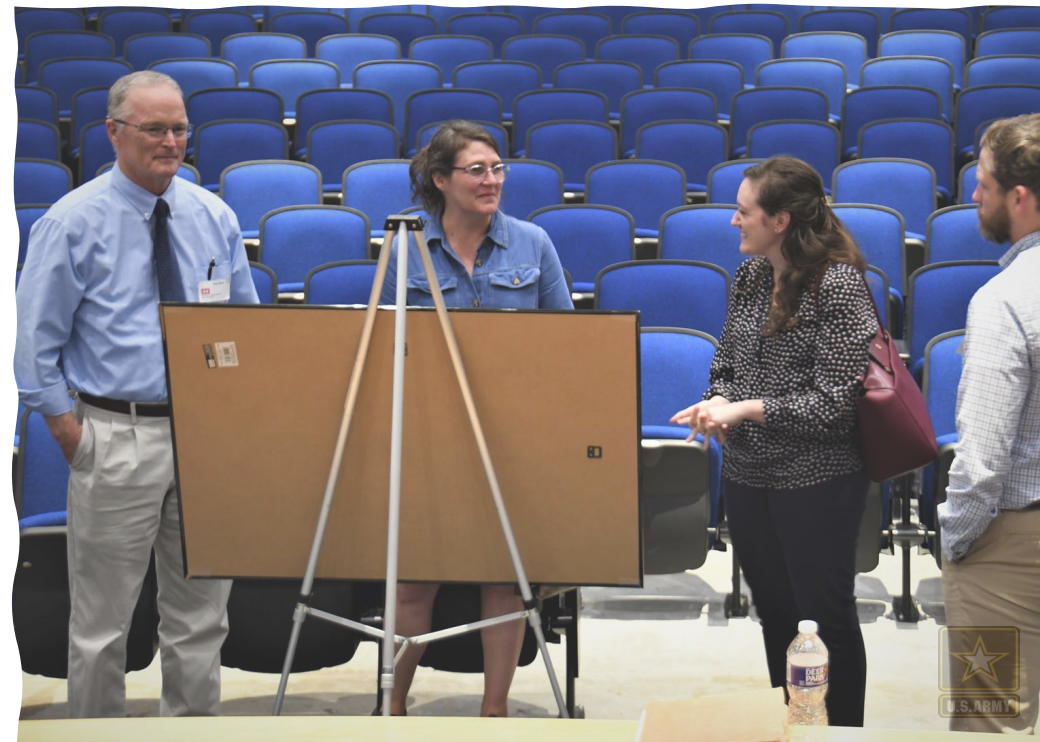
<https://www.nao.usace.army.mil/About/Projects/VBCSRM>

(Current and previous public engagement materials are available on the website)



For general inquiries regarding the project, or to provide input, please contact the team: vbcsrm@usace.army.mil

If your neighborhood or community group is interested in receiving a presentation in the future, please email the team with your request.



Q&A SESSION

