



Charlestown Navy Yard

RESILIENCE

Concept Plan | 2025



**BOSTON
HARBOR
NOW**

In Collaboration with:

Agency
Landscape + Planning

Arcadis

Childs Engineering



Photo Credit: Tom Klein 2016
Source: The Cultural Landscape Foundation

Foreword

December 17, 2025

The Charlestown Navy Yard stands as a powerful symbol of America's maritime heritage and resilience. As one of the original six naval yards established by the U.S. Navy in 1800, it has played a vital role in shaping our nation's naval strength, from the earliest efforts to protect our new nation through the global conflicts of the twentieth century. Today, it serves as home to USS Constitution, the oldest commissioned warship afloat, and a hub for public engagement through the National Parks of Boston and the Naval History & Heritage Command. Through careful preservation, the Navy Yard has remained a living monument, preserving the stories of those who served.

Yet, as we honor the past, we must also safeguard the future. The Navy Yard's waterfront location, once ideal for shipbuilding and defense, now faces a growing threat of coastal flooding and increasingly frequent, powerful storms. This project represents a bold and necessary step forward and an innovative vision that blends historic preservation with climate resilience. Through thoughtful design and collaboration, we are reimagining the Navy Yard as a place where history, community, and sustainability converge. Taking action now to protect the treasured resources from storm flooding and preserve public access to those resources will ensure that the stories anchored here continue to inspire generations to come.

Let this be a testament to our enduring responsibility: to protect the legacy we inherited and to build a future worthy of it.

Tarona Armstrong
Superintendent, National Parks Boston



Executive Summary

Protecting our Legacy

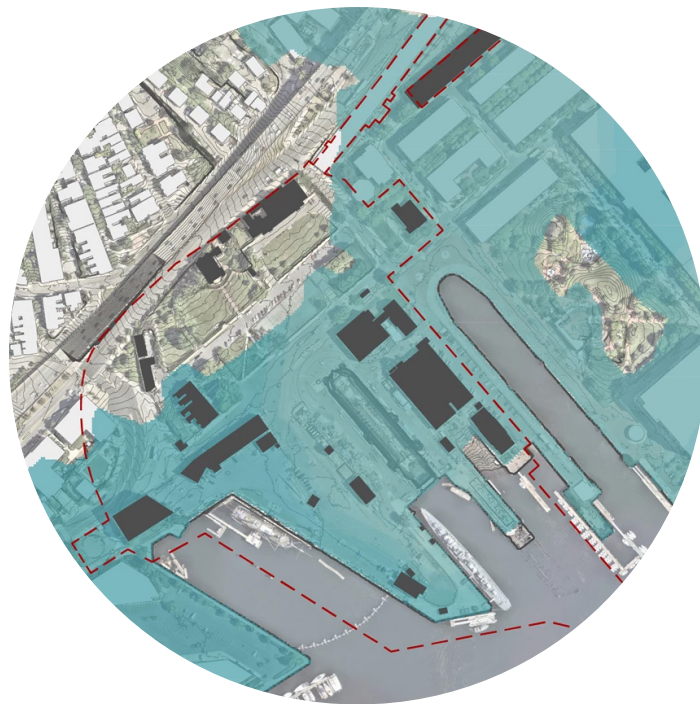
One of six original yards established by the US Navy in 1800, the Charlestown Navy Yard served as a center for building, servicing, and outfitting the nation's navy for nearly 175 years. Today, this National Historic Landmark is home to some of our most treasured historic resources, including America's Ship of State, *USS Constitution*. The Navy Yard is also the park headquarters for National Parks of Boston and home to Naval History and Heritage Command Detachment Boston.

The Navy Yard's harbor-front location makes its resources vulnerable to flooding and storm impacts. Flood resilience measures will provide protection to the historic resources, visitor and park facilities, *USS Constitution*, and critical infrastructure of the Navy Yard, while contributing to a landscape-scale strategy to protect the Charlestown neighborhood from future storms.

This concept plan envisions designs for a connected system of elevated walkways, public spaces, and resilience structures that will provide protection for the Navy Yard from coastal storms and flooding, while enhancing waterfront access, daily operations, and visitor experience. In addition to improving the connection of the Boston Harborwalk through the Navy Yard, the project will connect visitor amenities like the Gateway Center (the proposed future home of National Parks of Boston, Naval security operations, visitor orientation and the *USS Constitution* Museum) with multiple transportation modes, including commercial tour boats and buses, MBTA ferry and bus service, and pedestrian trails and bikeways along the Freedom Trail. The project is part of a larger effort to improve resilience along 47 miles of Boston waterfront, integrating directly with a City of Boston design project abutting the National Park Service's property to the east.



Naval Heritage and Critical Infrastructure at Risk: Flood waters pour into Dry Dock 1 during a record storm in 2018. Photo credit: National Park Service



Community Assets at Risk: Projected flooding from a 100-year storm in 2050 highlights the coastal vulnerability of key working and interpretive elements of the Yard. Diagram credit: National Park Service

A Unified Vision

National Parks of Boston is the National Park Service (NPS) unit that collectively manages the Boston Harbor Islands National and State Park, Boston National Historical Park, and the Boston African American National Historic Site as a single, integrated urban park system. This project directly supports NPS Boston's mission to protect shared resources while improving access, operations, and visitor experience across the waterfront. The project will formalize the connection of Boston's Harborwalk through the Navy Yard and activate the water's edge to offer opportunities to host neighborhood events, live music, public art, and visiting ships, while improving the interactive experience with museum ships *USS Constitution*, *USS Cassin Young*, and the park's other attractions.

Finally, the project will improve the Navy Yard's role as a gateway to the Boston Harbor Islands and downtown Boston, providing transportation connections to MBTA ferries, tour boats and buses, and walking and biking tours along the Freedom Trail.

A Connected Response

Flood resilience measures in the Charlestown Navy Yard are part of a city-wide effort to improve the resilience of Boston's 47 miles of coastline, building on the city's Climate Ready Boston and Coastal Resilience Solutions initiatives. Flood resilience planning projects are underway throughout the city, including active design and feasibility studies for improvements to Long Wharf in downtown Boston and for the Charlestown Navy Yard area extending from the National Park Service site to the head of Little Mystic Channel. Close coordination with the city's projects will ensure a connected, effective approach to protecting Boston's coastal neighborhoods.



The Concept Plan envisions actionable strategies to:

- Provide flood protection to the buildings, historic resources, and infrastructure of the Navy Yard from high-tide and storm flooding, storm surge, and destructive waves.
- Implement site use and visitor experience improvements that enhance mobility and access, create social spaces, and provide transportation connections to destinations beyond.
- Incorporate resilience planning into Navy Yard visioning to ensure park investments are effective, efficient, and future-ready.
- Establish the Navy Yard as a world-class destination worthy of America's Ship of State, as well as a gateway to experiencing Boston's history and the recreational and educational opportunities of the Boston Harbor Islands.

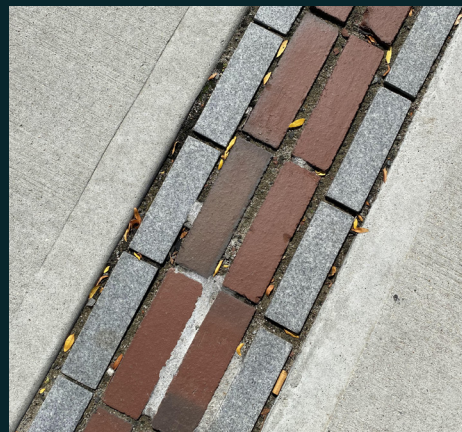
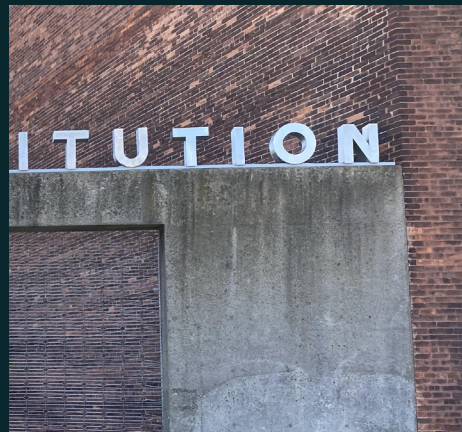


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INTRODUCTION

Image Source: Boston Digital Commonwealth

Shipyard for a Young Nation

Established in 1800 as one of the Navy's first shipyards, the Charlestown Navy Yard became a center for building and maintaining the nation's fleet. For nearly 175 years, its workers and facilities supported the Navy's mission. Today, the Yard remains a testament to the industrial innovation and craftsmanship that shaped the United States.

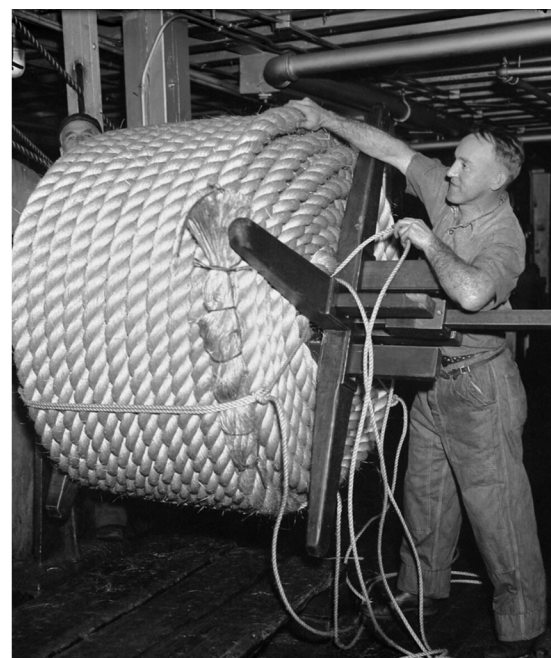
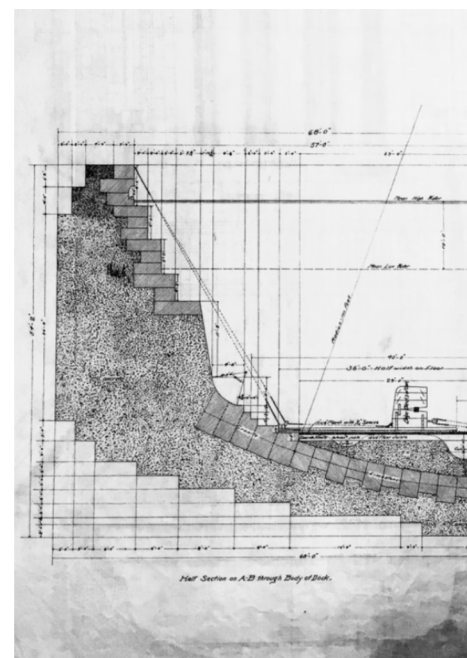
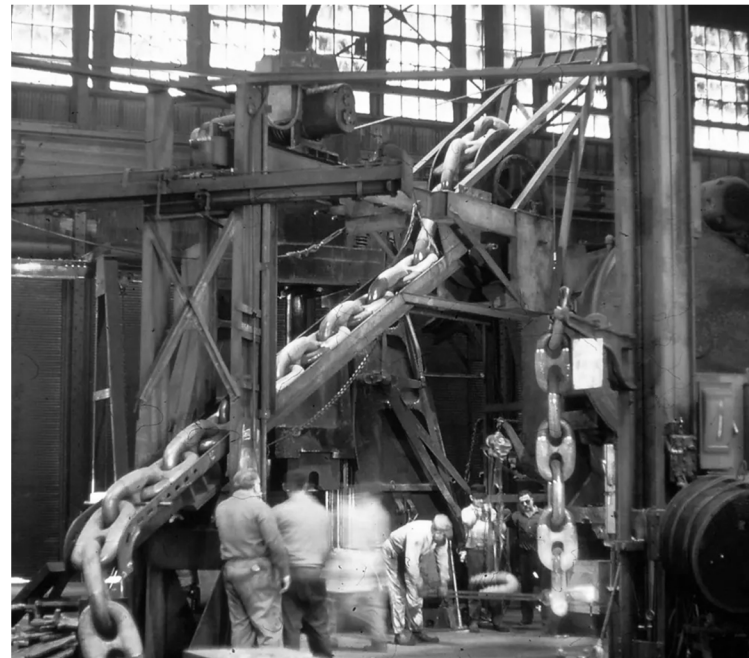


Image Sources: National Park Service and Boston Digital Commonwealth

A Legacy Site for Boston and America

This key site of American history welcomes over 1 million visitors every year to learn, experience, and engage with the Yard's unique stories. With connections to the Harborwalk, Freedom Trail, and multi-modal transit, it serves as a critical gateway to the Boston Harbor and the City of Boston.



Naval Heritage at Risk

Today, this National Historic Landmark is home to treasured historic resources, including America's Ship of State, *USS Constitution*. It is also the living and working quarters for active-duty Navy personnel and Naval History and Heritage Command Detail Boston, and headquarters for National Parks of Boston.

2030 1% Annual Chance of Flood

2070 1% Annual Chance of Flood

Naval History + Heritage Command (Building 24)

Dry Dock 1

Dry Dock 2

Naval Barracks + Offices (Buildings 4 + 5)

USS Cassin Young

Shipyards Galley (Building 10)

Historic Yard Infrastructure



USS Constitution

The Navy Yard's harbor-front location makes these historic resources vulnerable to flooding and storm impacts.

Community Assets at Risk

Critical community and visitor amenities, including the Visitor Center, USS Constitution Museum, the Boston Harborwalk, and the Freedom Trail are increasingly vulnerable to future flood risks.

2030 1% Annual Chance of Flood

2070 1% Annual Chance of Flood

USS Constitution Museum
(Buildings 22 + 28)

Building 125

Freedom Trail

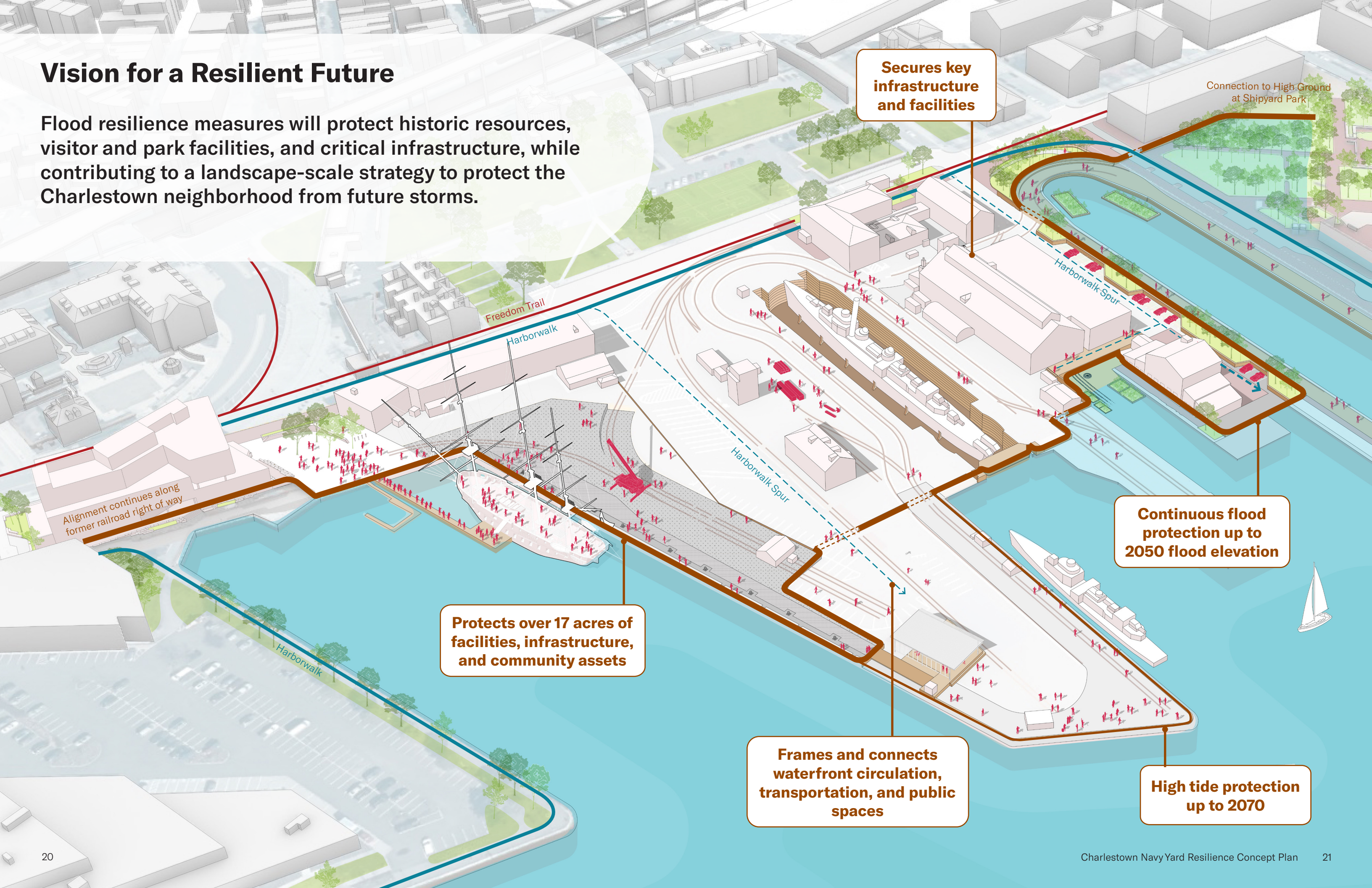
Harborwalk

Navy Yard
Visitor Area

Small Craft and Tour Boat Dock

Vision for a Resilient Future

Flood resilience measures will protect historic resources, visitor and park facilities, and critical infrastructure, while contributing to a landscape-scale strategy to protect the Charlestown neighborhood from future storms.



Secures key infrastructure and facilities

Connection to High Ground at Shipyard Park

Alignment continues along former railroad right of way

Protects over 17 acres of facilities, infrastructure, and community assets

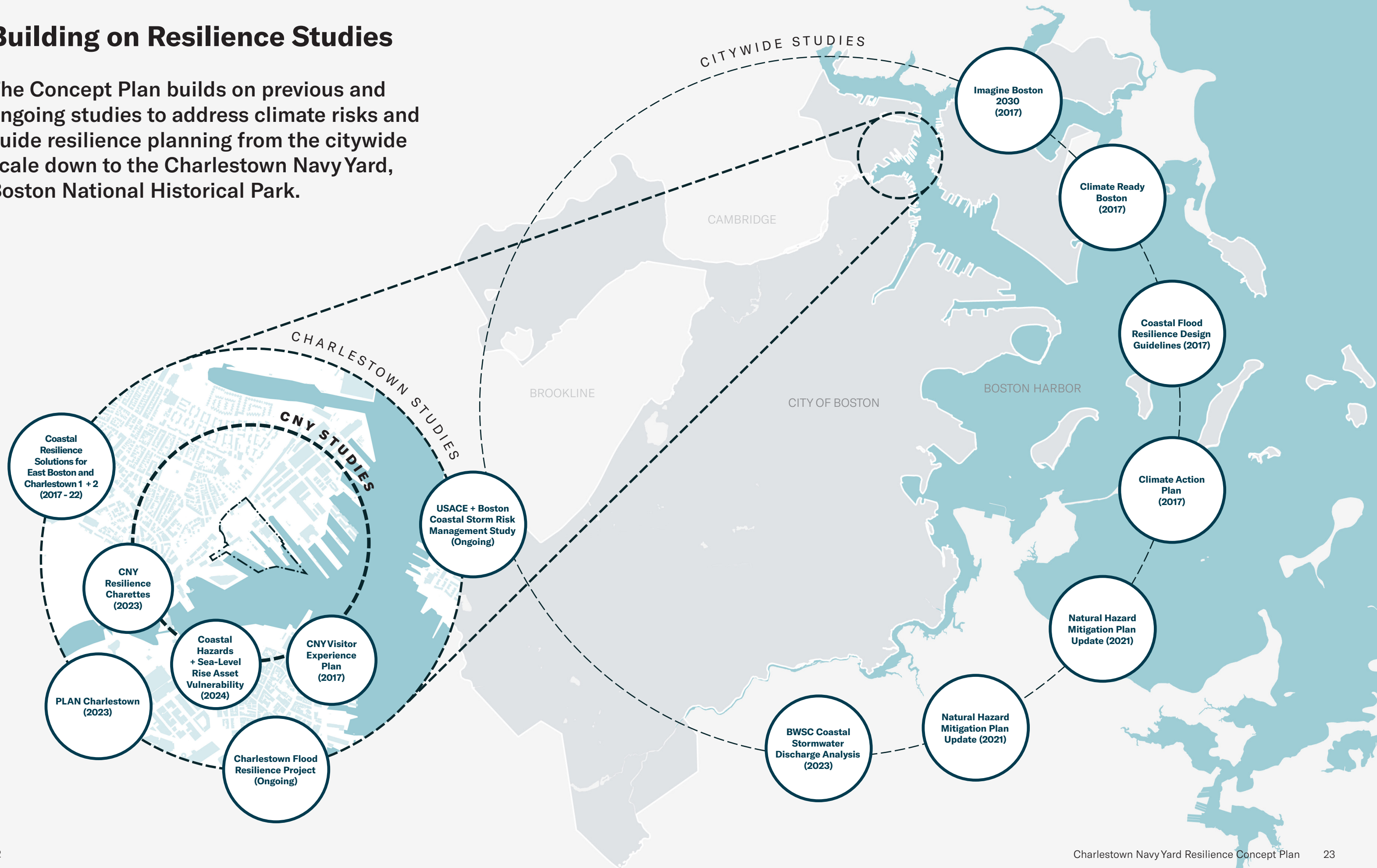
Continuous flood protection up to 2050 flood elevation

Frames and connects waterfront circulation, transportation, and public spaces

High tide protection up to 2070

Building on Resilience Studies

The Concept Plan builds on previous and ongoing studies to address climate risks and guide resilience planning from the citywide scale down to the Charlestown Navy Yard, Boston National Historical Park.



PROCESS + EXISTING CONDITIONS



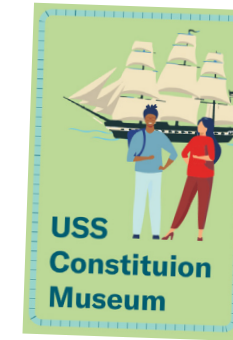
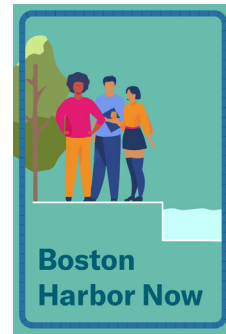
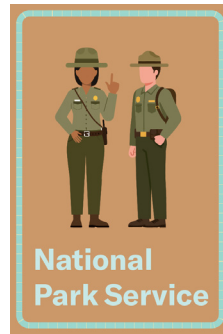
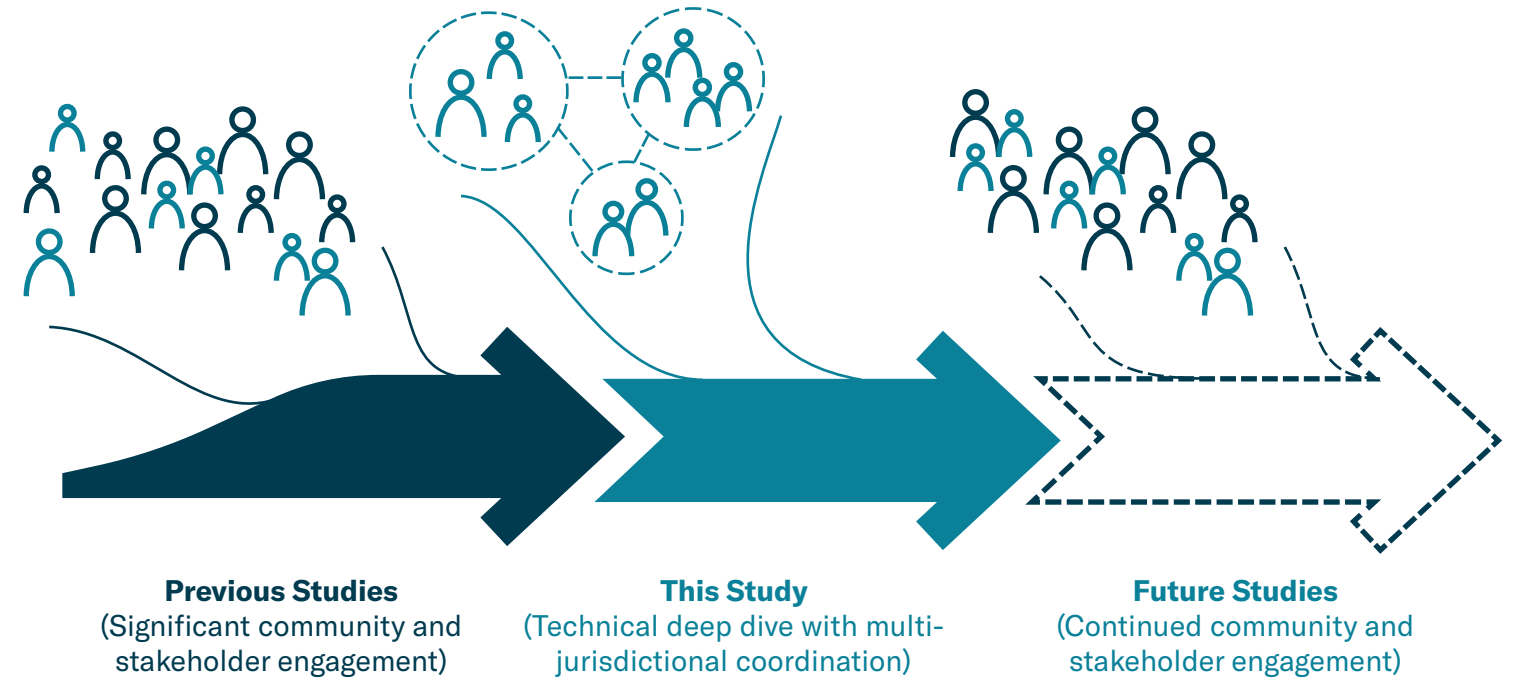
Process

Stakeholder Engagement

This process placed a strong emphasis on engaging the stakeholders who would be responsible for living with, operating, and implementing new flood protection infrastructure at the Yard. This focus reflects the practical and embedded nature of the effort, which centers on secure and efficient day-to-day operations while mitigating future risks to assets and facilities. Previous planning efforts, such as the Visitor Experience Plan, provide a foundation of community and visitor input. Building on that work, this plan concentrates on coordination with partners who have deep

technical understanding of the constraints, maintenance needs, and operational requirements of the site.

As the project transitions into detailed planning, continued engagement with the surrounding community will become essential. Future phases will benefit from community perspectives on the desired look, feel, and experience of the multi-purpose flood infrastructure, helping to shape solutions that are both functional and aligned with the character and identity of the Navy Yard.



Role/Capacity

Project Lead Client

Client and Core Advisor

Advisory/Review

Advisory/Review

Advisory/Review

Groups Represented

National Parks Boston, Denver Service Center and Stormwater Upgrades Project Team

Leadership, Policy, and Planning

USS Constitution Ship Command, Naval History & Heritage Command Detachment Boston, Naval Facilities Engineering Systems Command

Leadership and Exhibition Staff

Office of Coastal Resilience, US Army Corps of Engineers Study Team, Charlestown East Waterfront Study Team

Input Focus

Core direction + visioning, coordination with ongoing projects and planning efforts

Core visioning, future funding and implementation partnerships

Operational + security requirements, engineering best practices and guidance

Visitor experience, historical and cultural resources

Implementation coordination with ongoing adjacent studies

Existing Conditions

Layers of Consideration

The analytical layers below provide a shared understanding for how flood protection can support the sites historical significance and what exists today, while evolving to meet future needs.

The Story of the Yard Cultural and Historical



The Yard's history is still evident in its cranes, rails, grit hoppers, dry docks, paving, and laydown area (where masts, yards, and various materials are stored) and other maritime artifacts. These elements narrate a story about the workers, technologies, and practices that shaped the waterfront over two centuries.

Future flood protection can reflect this story back to visitors by preserving and restoring artifacts where possible or by incorporating subtle interpretive elements, such as embedded graphics, wayfinding, or material cues.

The Physical Yard Environmental and Infrastructural



Safeguarding the site's cultural legacy also requires maintaining the systems that support it. Much of the landscape sits on filled land and low-lying piers, leaving key facilities infrastructure, utilities, stormwater networks, and marine edges vulnerable to flood impacts.

Integrating flood protection with infrastructural upgrades and retrofits, both future and ongoing, will strengthen resilience and extend the service life of critical assets well into the future.

The Working Yard Operational



Commanders, sailors, shipwrights, guides, historians, and shopkeepers are just a handful of the personnel and staff that live and work at the Yard every day. Far from a static historical archive, the Yard is an active workplace with real operational demands.

Any flood protection strategy must avoid unnecessary constraints on these functions. With thoughtful placement and design, new infrastructure can improve clarity of movement, strengthen security, and support more efficient operations. Protecting the people, assets, and activities that keep the site functioning is a central priority.

The Yard as a Destination Experiential



The Yard continues to capture the imagination of generations of visitors. School groups, families, passersby, and world travelers alike each come to experience this critical site of American history on the Boston waterfront.

Resilience measures can be more than vertical barriers, they can also enhance the public realm, providing spaces that invite visitors to sit, congregate, relax, look out, and experience the abundance of sights, sounds, stories, and activities at the Harbor's edge.

Layers of Consideration



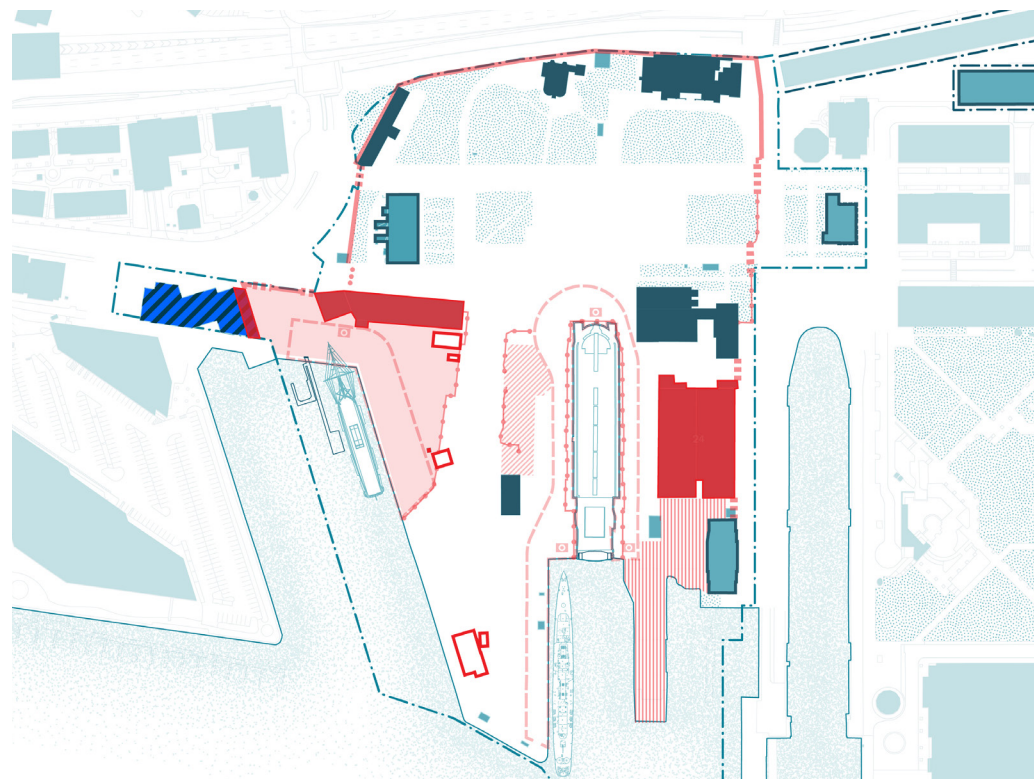
Ships + Large Artifacts

- 1 USS *Constitution*
- 2 USS *Cassin Young*
- 3 Steam Pipes
- 4 Grit Hopper
- 5 Dock Cranes
- 6 Caissons
- 7 Marine Railway
- 8 Floodlight Towers

Ground and Walls

- Historic Paving
- Supply Pile Area
- Railroad and Crane Tracks
- Freedom Trail
- Significant Walls

The Story of The Yard



Facilities

- Navy
- NPS
- For Lease
- USSCM

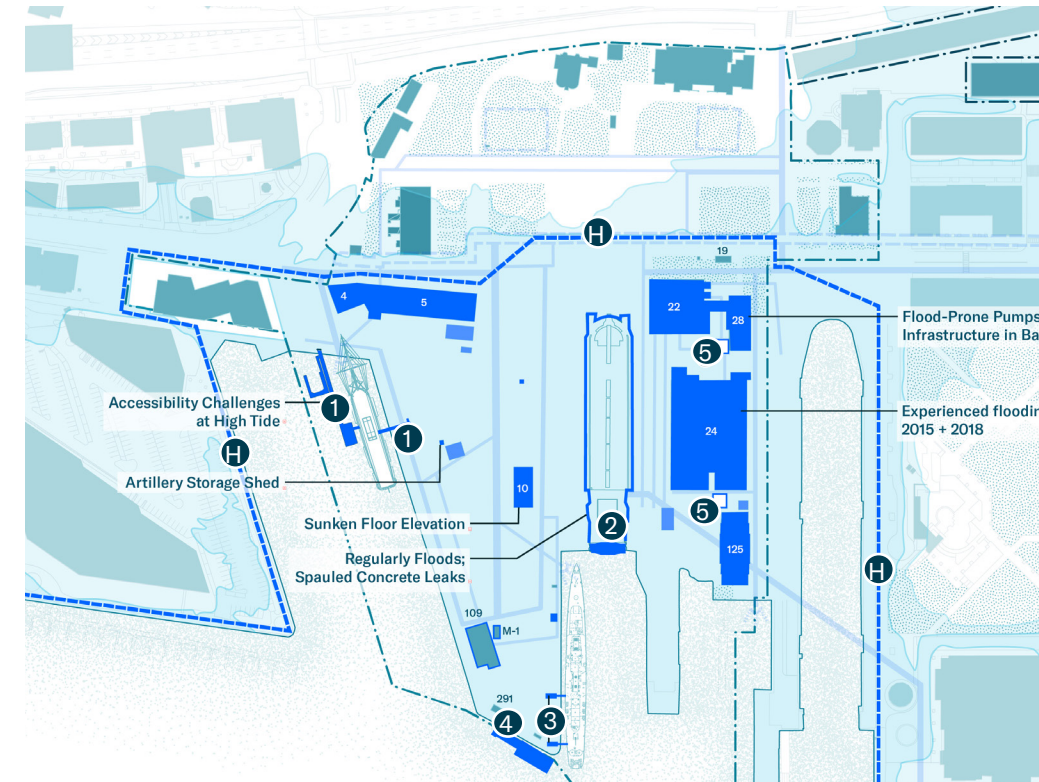
Security

- Fences
- Gates
- Perimeter Wall
- Navy Secure Area
- Restricted Access

Ship Maintenance

- NHCD Boston Repair Facility
- Supply Piles/Open Storage
- Mobile Crane Clear Zone
- Capstans

The Working Yard



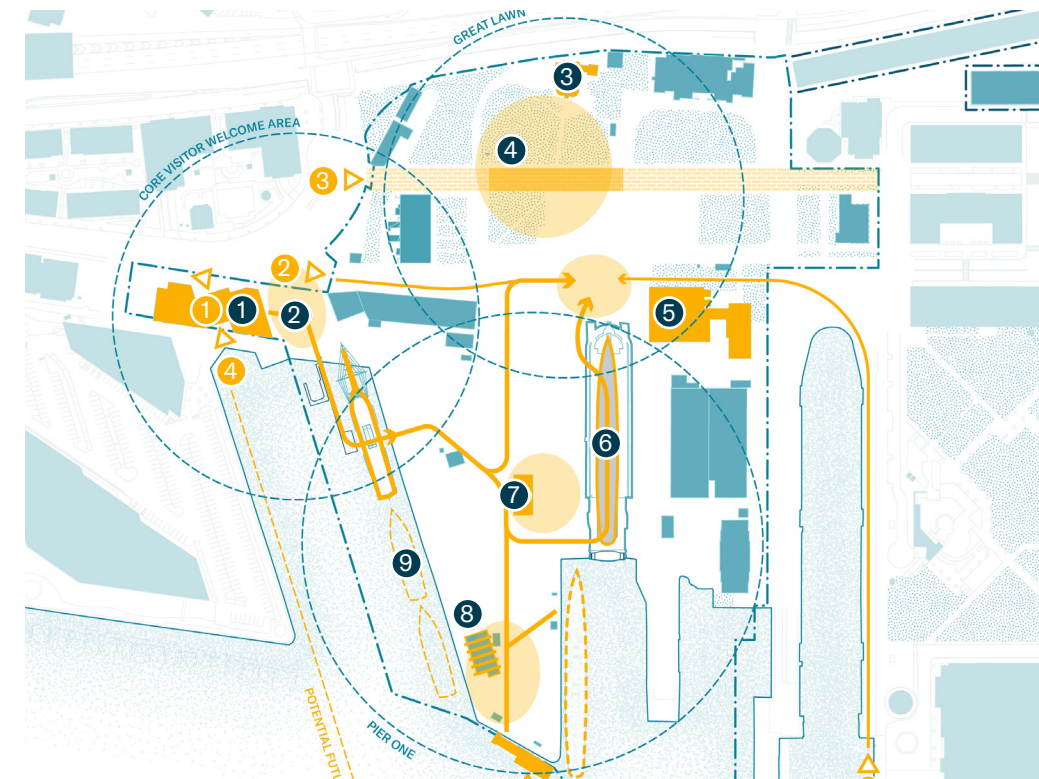
Key Facilities + Infrastructure

- H Harborwalk
- 1 Finger Pier and USSC Brows
- 2 Dry Dock and Caisson
- 3 USS *Cassin Young*
- 4 Ferry Dock and Shelter
- 5 Transformer and HVAC Units

Utility Corridors

- 1% Annual Chance Storm (2030)
- 1% Annual Chance Storm (2050)

The Physical Yard



Programs + Facilities

- 1 Gateway Center
- 2 Constitution Plaza
- 3 Commandant's House
- 4 Great Lawn Community Space
- 5 Educational, Youth Programming Offices, and Conference Center
- 6 Relocated *Cassin Young*
- 7 Interpretive Center
- 8 Shade Pavilion
- 9 Visiting Ships

Entrances + Arrival

- 1 Gateway Center
- 2 1st Ave
- 3 2nd Ave
- 4 Ferry Landings

The Yard as a Destination

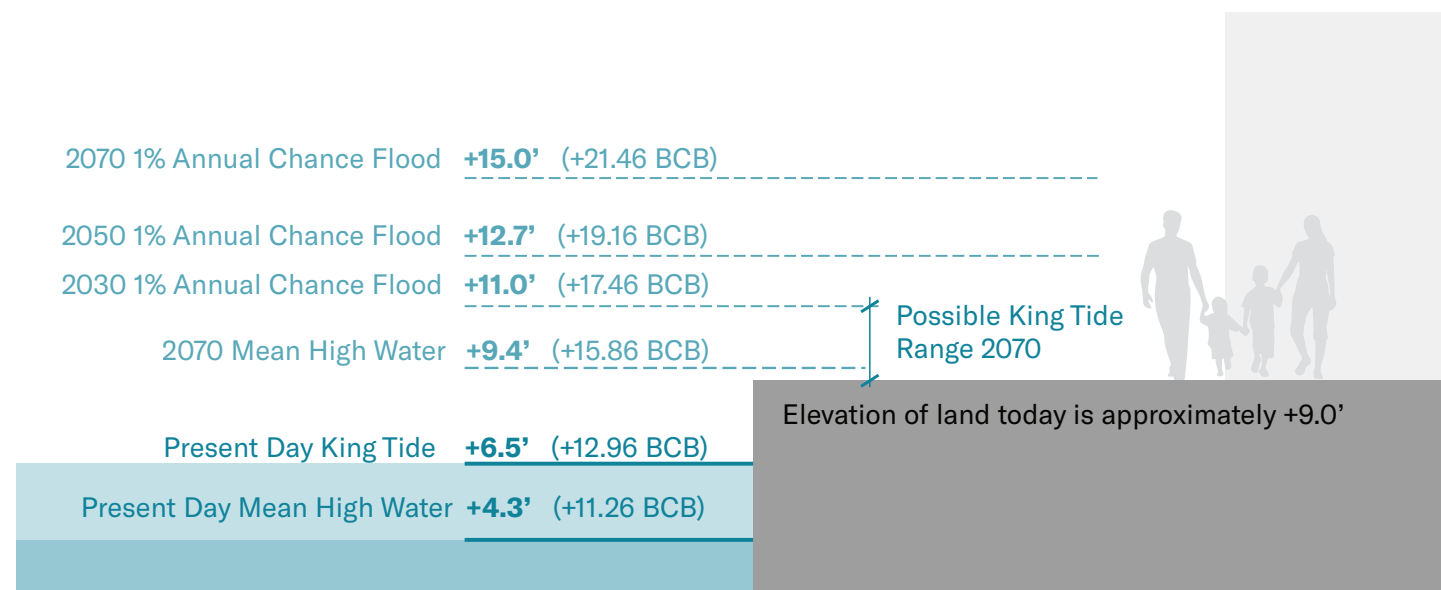
Resilience Targets and Design Principles

Design Flood Elevation

The Design Flood Elevations (DFEs) for this study are based on the Massachusetts Coastal Flood Risk Model (MC-FRM), which has been adopted by the City of Boston and informs the City's coastal resilience standards. DFEs were evaluated for present-day conditions and future horizons of 2030, 2050, and 2070 along the proposed alignment. Given anticipated timelines for design, permitting, and construction, the project uses 2050 DFEs as the baseline target, with the system designed to adapt to 2070 conditions.

The DFEs represent modeled water surface elevations and do not include freeboard or safety factors, which can be addressed in later design phases based on risk-tolerance. This approach aligns the project with adjacent City-led resilience planning while allowing flexibility to address increasing flood risk over time. Future studies will need to confirm or reconcile these DFEs with Department of Defense design standards, such as the Unified Facilities Criteria to balance feasibility, continuity, and viable funding pathways.

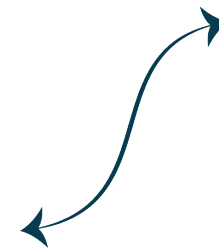
Note: A **King Tide** is a colloquial, non-scientific term referring to the highest tide recorded in a given year, measured by the High Tide Line. 7.5' aligns with values reported in parallel City of Boston studies at Long Wharf and the east Charlestown waterfront.



Design Approach

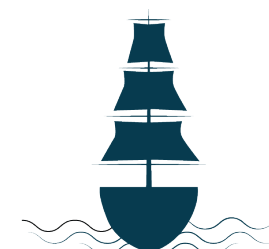
Flood protection must work with the site's history, infrastructure, and active operations. The approach prioritizes an alignment and design features that safeguard essential assets, respect the historic waterfront, and maintain the daily work of Navy, NPS, and USS Constituion Museum staff. It also improves the visitor experience by integrating interpretation, access, and public-realm enhancements into the protective system.

Flood protection at the Yard must be...



Continuous

Provide a **continuous line of flood defense** across the property, and tie into adjacent properites



Functional

Protect Naval, NPS, and civilian infrastructure while **allowing ongoing operational support of Naval facilities** and assets

Address freshwater flooding storage and marine structural capacity

Negotiate existing infrastructure with **minimal disturbance**



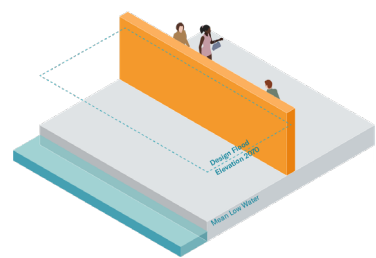
Multi-Benefit

Enhance visitor **experience** and understanding of the site's history

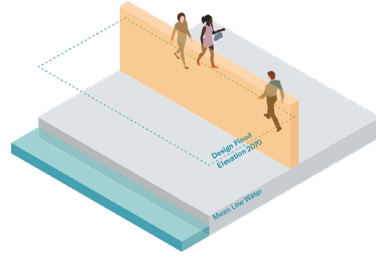
Facilitate **recreation and leisure** along Charlestown's harborfront

Multi-Benefit Infrastructure

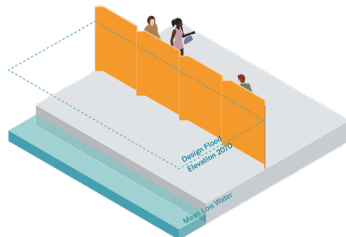
Walls



Solid

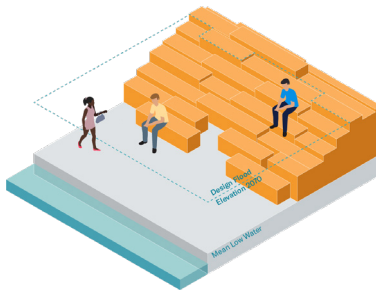


Glass

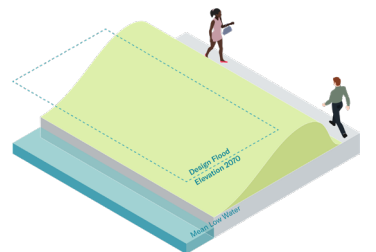


Deployable

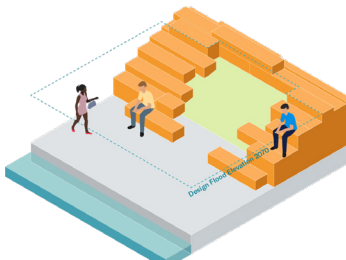
Berms



Stacked Granite "Drydock"

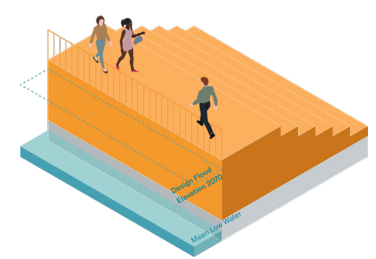


Planted

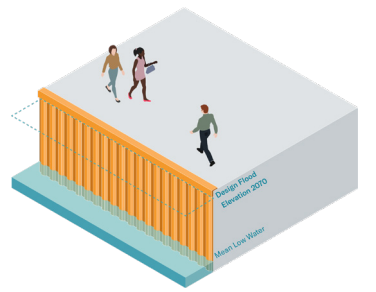


Planted with Stacked Granite

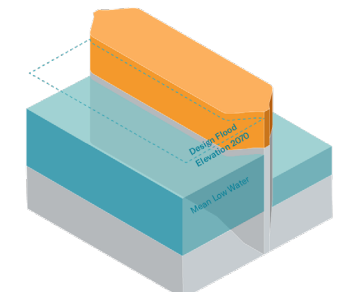
Raised Marine Edge



Raised Harborwalk

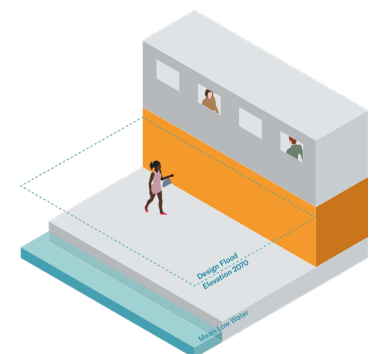


Raised Seawall

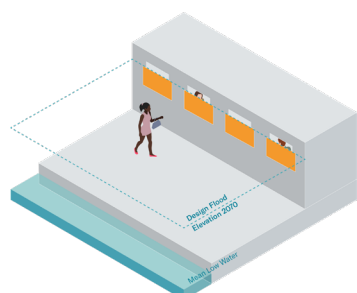


Raised Caisson

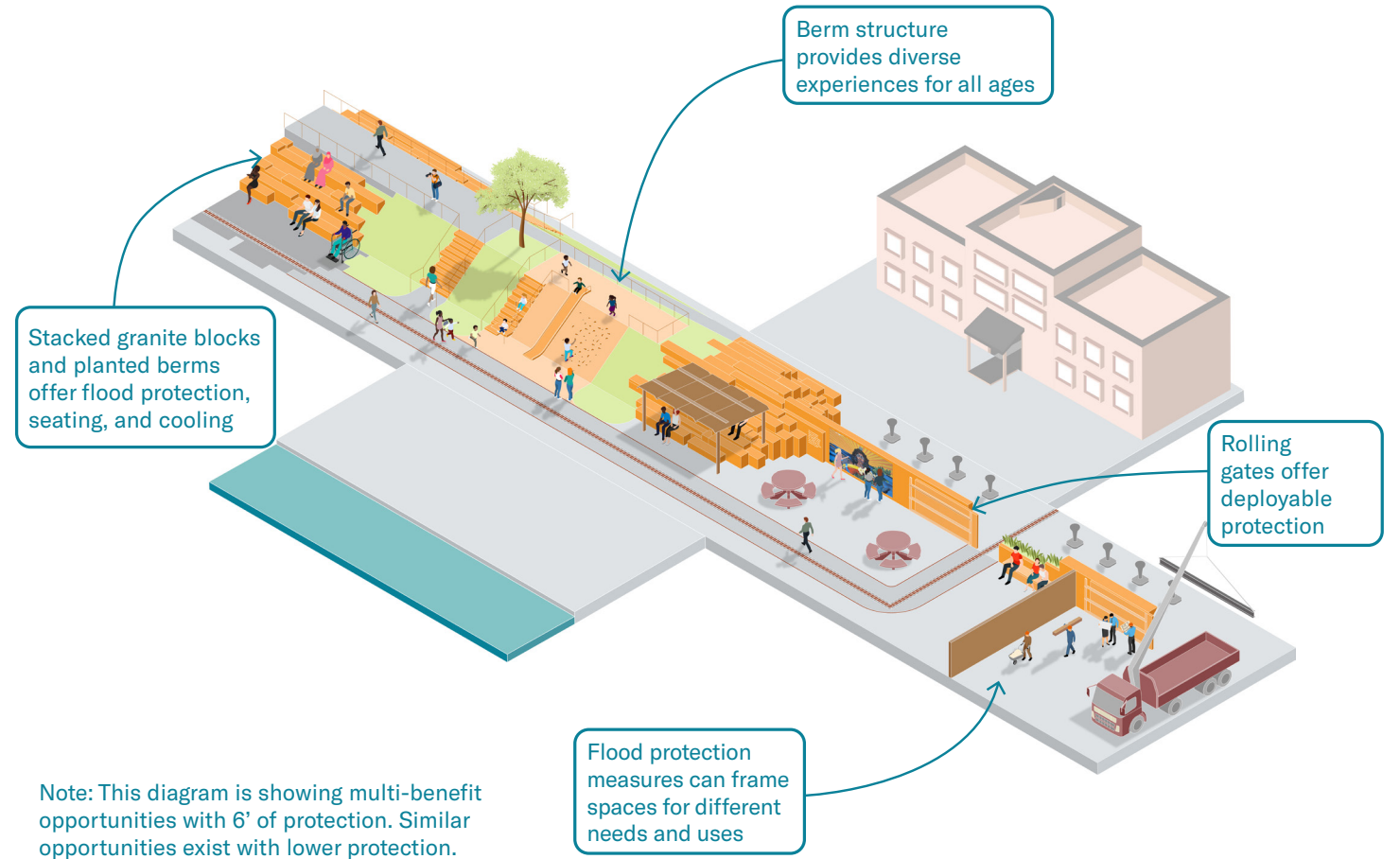
Building-level Protection



Raised Floor Elevation



Deployable Barricades for Window + Doors



Flood protection can be more than a vertical barrier. The resilience typologies at left illustrate how protective infrastructure can shift in character across the site, adapting to different needs for access, recreation, planting, and operational support.

When these elements are combined and aligned with circulation, gathering spaces, and programs, they become multi-benefit infrastructure. The system provides reliable

protection while also helping clarify use zones, organizing circulation, supporting interpretation of the site's history, and creating new opportunities for shade, seating, and experiencing the waterfront. In this way, resilience can strengthen both the working landscape and the public realm.

Concept Alternatives

The team began by evaluating alignments proposed during the 2023 Resilience Charettes. Several relied on in-water structures or large flood gates, which were determined to be too complex and costly to permit, install, maintain, and operate. The team then refined three land-based alternatives that follow a similar overall alignment and protect the most critical infrastructure. Each varies in how different flood-barrier types are used. All assume the Dry Dock 1 caisson would need to be adapted or reconstructed to a higher elevation.

1 Multipurpose Barrier

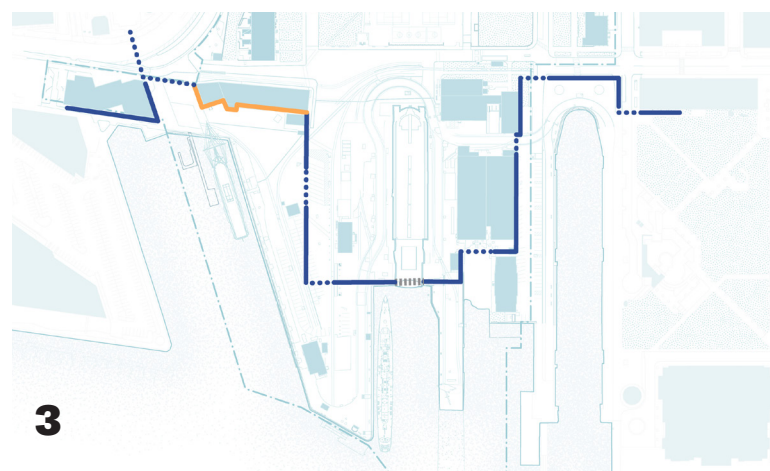
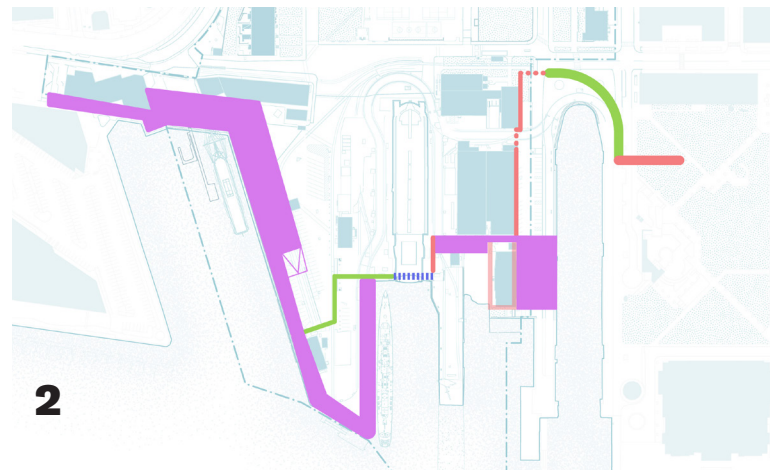
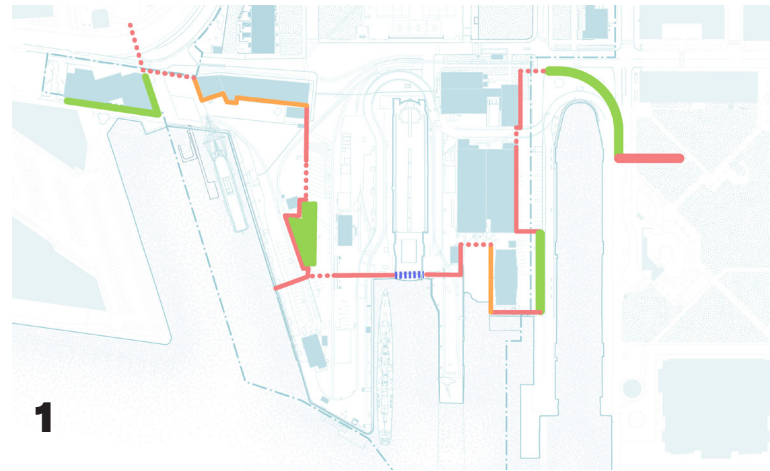
This approach uses a combination of walls, berms, deployable gates, and targeted building adaptations. The end of Pier 1 and USS *Constitution* secure area remain flexible, intentionally floodable zones.

2 Elevate the Pier

This alternative raises key areas of the waterfront, especially around Pier 1, to create more functional operational space around USS *Constitution* and maintain access during flood events.

3 Establish the Path

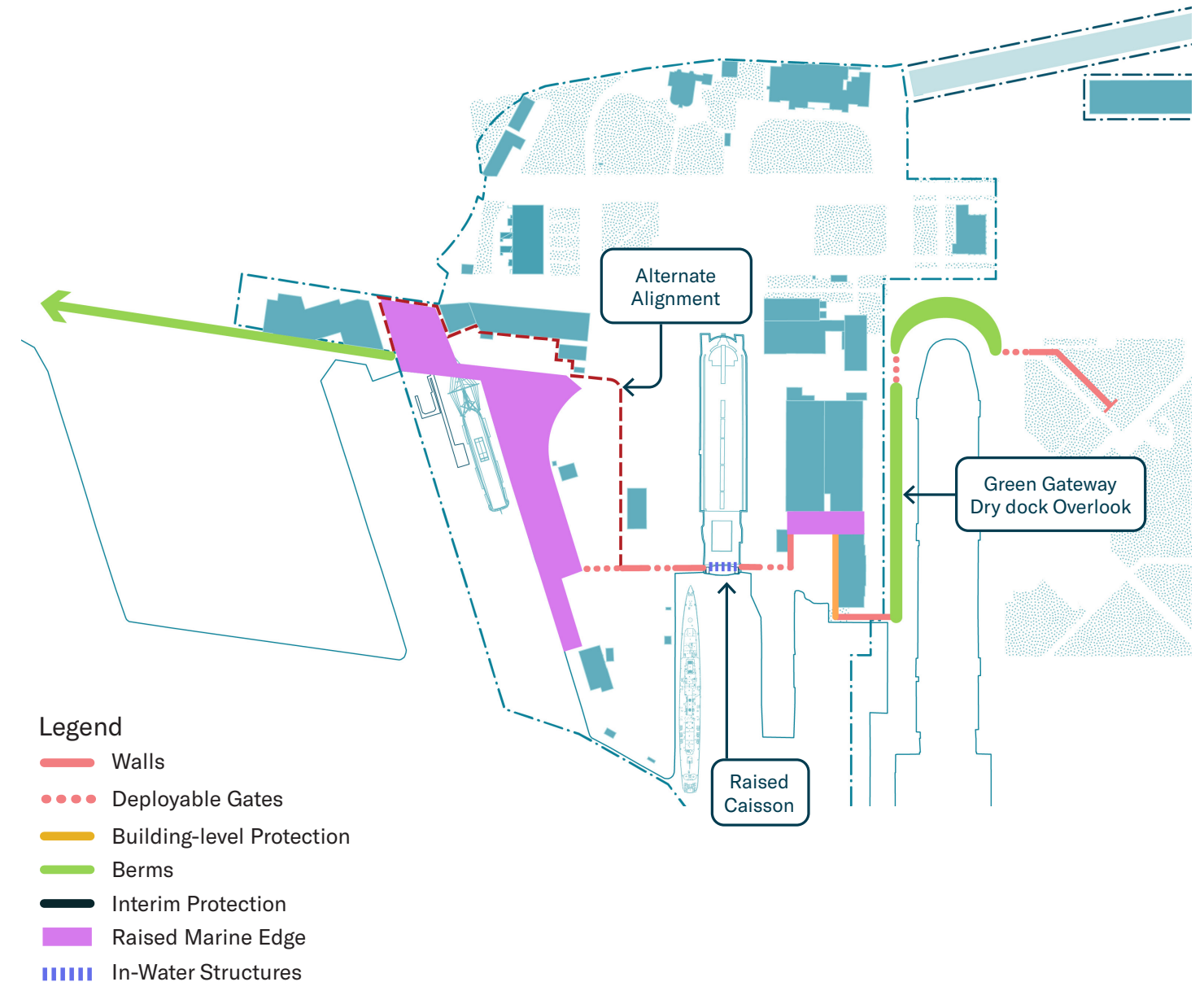
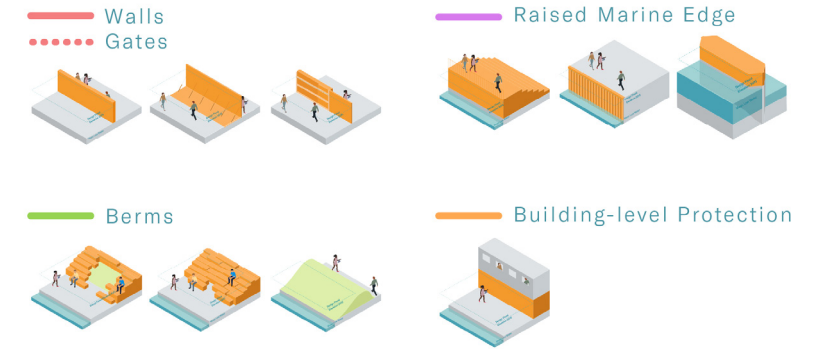
A tactical, near-term approach using prefabricated walls, furniture, planters and site elements installed at a lower design flood elevation. This provides interim protection while longer-term infrastructure is advanced.



Final Concept Alignment

The selected alignment blends elements of the Multi-Purpose Barrier and Elevate the Pier alternatives to balance visitor experience, operational needs, and ship safety. Rather than relying on short-term interventions designed for 2030 conditions, the plan targets a baseline design flood elevation for 2050 (approximately 13 to 14 feet), with the ability to adapt the system for projected 2070 conditions.

Legend



Legend

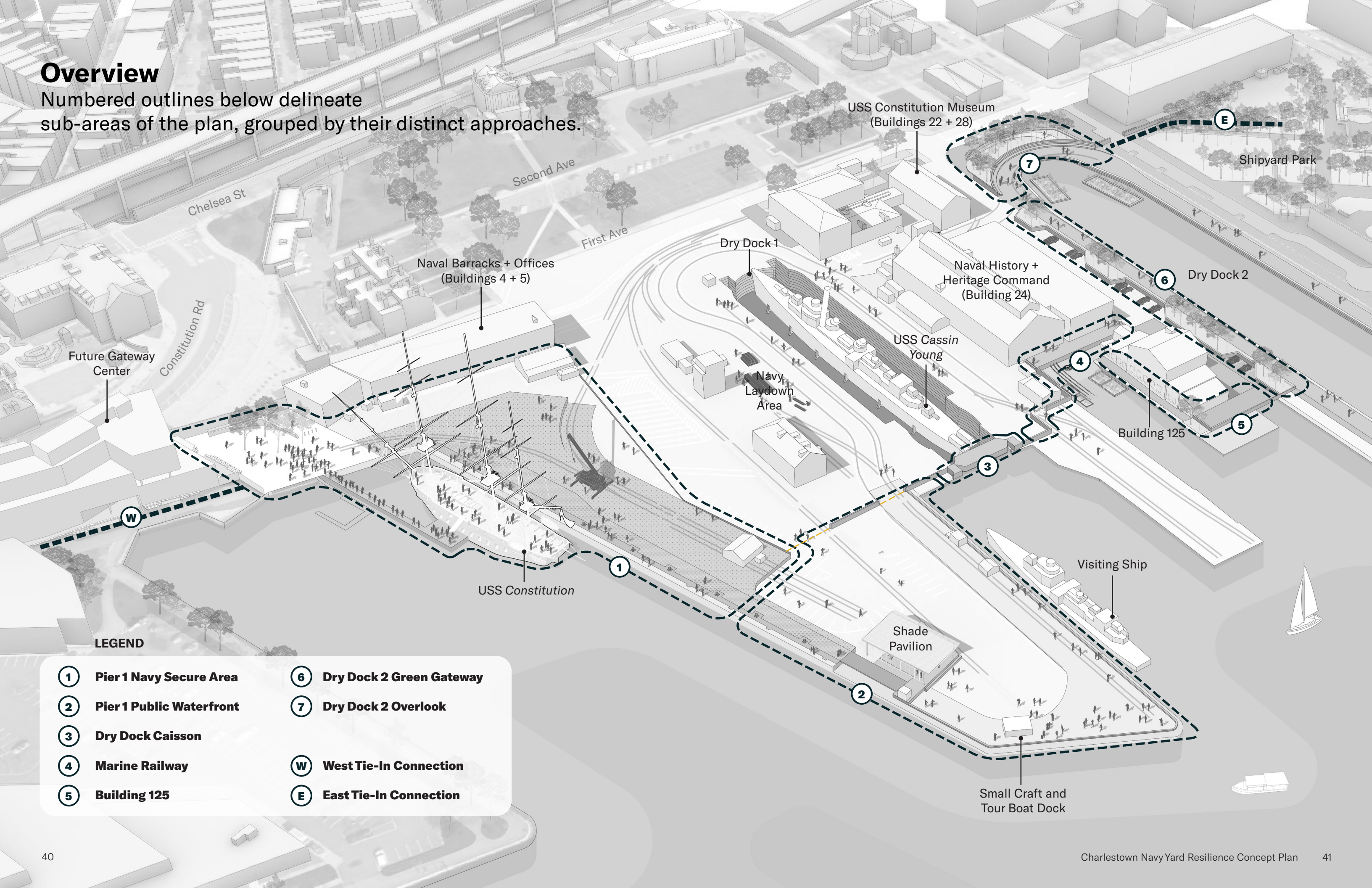


CONCEPT PLAN



Overview

Numbered outlines below delineate sub-areas of the plan, grouped by their distinct approaches.



LEGEND

- ① Pier 1 Navy Secure Area**
- ② Pier 1 Public Waterfront**
- ③ Dry Dock Caisson**
- ④ Marine Railway**
- ⑤ Building 125**
- ⑥ Dry Dock 2 Green Gateway**
- ⑦ Dry Dock 2 Overlook**
- W West Tie-In Connection**
- E East Tie-In Connection**

Pier 1 Approaches

Proposed Alternates

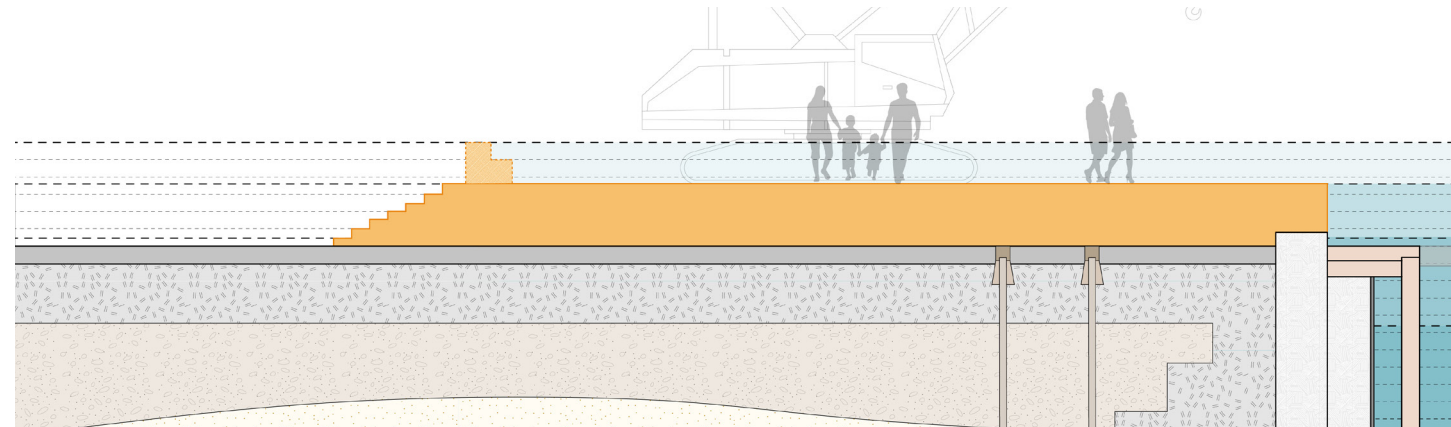
Consensus is still needed at the Naval secure area around *Constitution*. This is among the most critical areas for maintaining Naval operations. Accordingly, the plan outlines two options for continued consideration among NPS, the Navy, and the Naval Facilities Engineering Systems Command.

1 - Elevated Pier

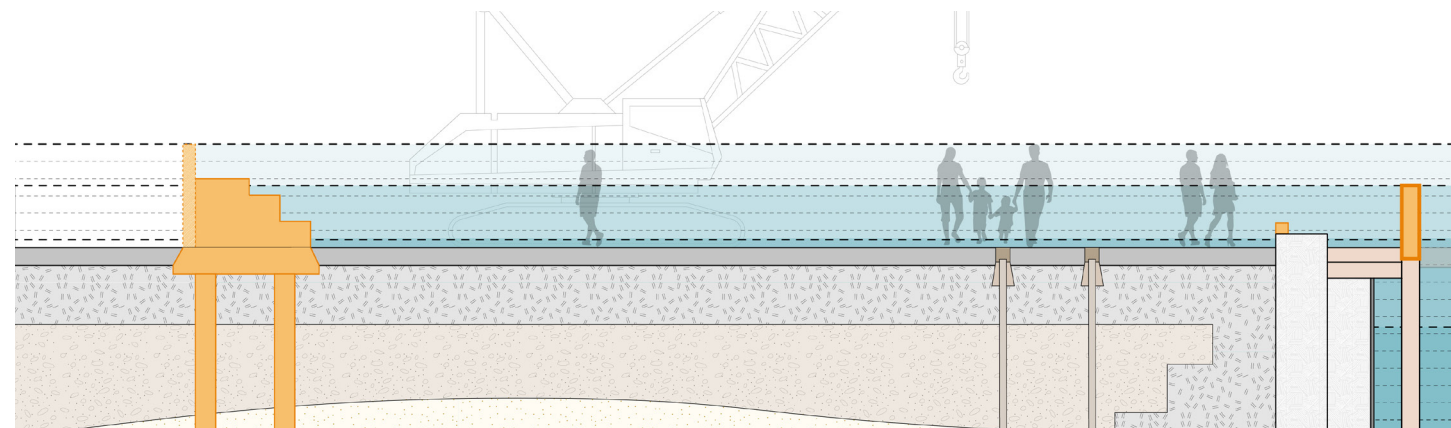
The baseline approach offers the highest level of operational security, flexibility, and continuity for the Navy by elevating the working zone of the Pier up to 2050 projected flood levels. This allows a generous unobstructed area to operate

the mobile crane around *Constitution*, along with a gentle ramp that facilitates access both for the crane and visitors within the secure perimeter. The mooring hardware, capstans, and historic granite paving would also be salvaged and raised to the upper elevation for continued mooring functionality.

This approach requires reconstruction of the seawall along the berth by driving new sheet pile outshore of the existing wall, and filling up to the raised elevation with concrete and lightweight fill material. With proper compaction and footings, this approach can accommodate an additional seatwall in the future to protect up to 2070 projected flood elevations.



Option 1: Elevated Pier



Option 2: Multi-purpose Barrier

2 - Multi-Purpose Barrier

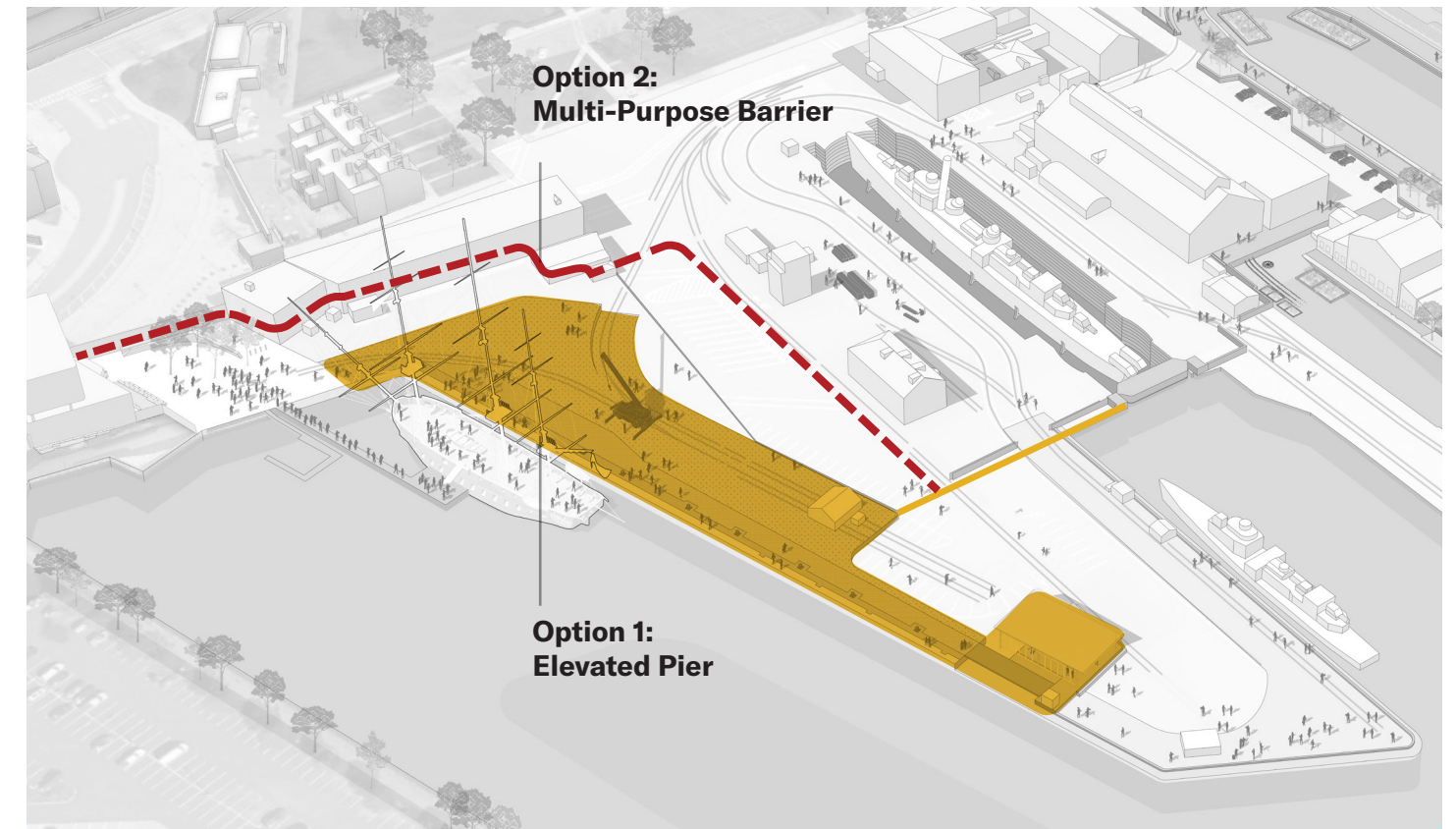
This approach prioritizes minimal interventions to safeguard the Ship and maintain existing conditions, operations, and circulation patterns within the Naval secure area, while protecting other critical buildings and zones.

At *Constitution's* berth, this entails raising or extending the bumper piles to prevent her from overtopping the pier during a flood event. The Navy expressed concern over locating any additional vertical obstacles within the *Constitution's* mooring area, so a minimal 6" curb provides protection from future high tides, while a taller wall is located further inland along the

remnant steam pipes. This approach also relies on retrofit adaptations of Buildings 4 and 5 and the Curtain Gate for protection. This configuration assumes that Pier 1 is allowed to flood during critical storm events, though the Navy command previously highlighted "wet feet" during flooding as a primary operational concern.

Future Considerations

Future dialogue between the Navy, Naval Facilities Engineering Systems Command, and NPS can determine the preferred design approach for Pier One based on the right balance of operational support, flood protection priorities, anticipated costs, and resilience best practices or lessons learned from the Navy Yard in Portsmouth, New Hampshire.



Pier 1

Pier 1, Constitution, and Building 4

Key Design Strategies

Multiple options are shown in this area for future consideration and consensus among NPS, Navy, and Naval Facilities Engineering Systems Command. Both options preserve day-to-day security and operational requirements for the Navy, but differ in cost and operational capacity during flood events and long-term tidal flooding.

Option 1 - Elevated Pier:

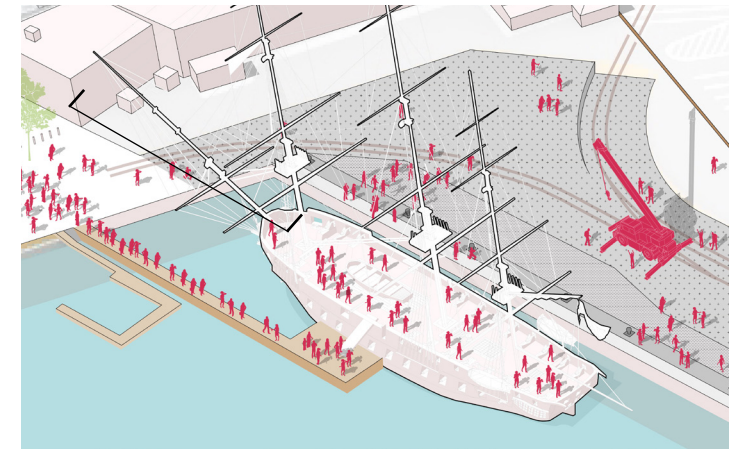
- Protects Buildings 4 and 5 while preserving full operational capacity within the Navy's secure zone and access to *Constitution* during flood events.
- Raised marine edge prevents *Constitution* from overtopping the seawall during flood events.
- Elevated waterfront provides robust visitor experience and views

Option 2 - Multi-purpose Barrier:

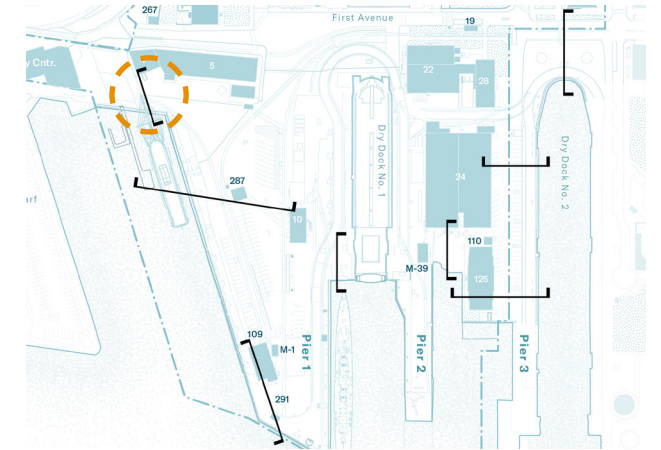
- Minimizes additional fill and structures at the marine edge
- Low curb protects Navy secure zone from periodic nuisance flooding projected for 2070

Technical Considerations

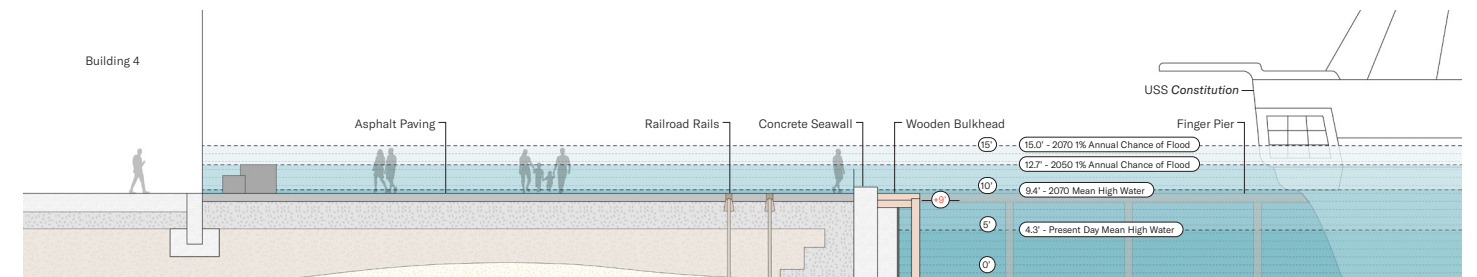
- Further structural and geotechnical analysis is needed to confirm the capacity of seawalls and pier structures to support additional loads
- During flood events, the area between *Constitution* and the protection would be inundated in Option 2. Option 1 protects that area from "wet feet" up to the 2050 DFE.
- Option 2 is more cost-efficient, but offers less operational flexibility in the Navy secure zone



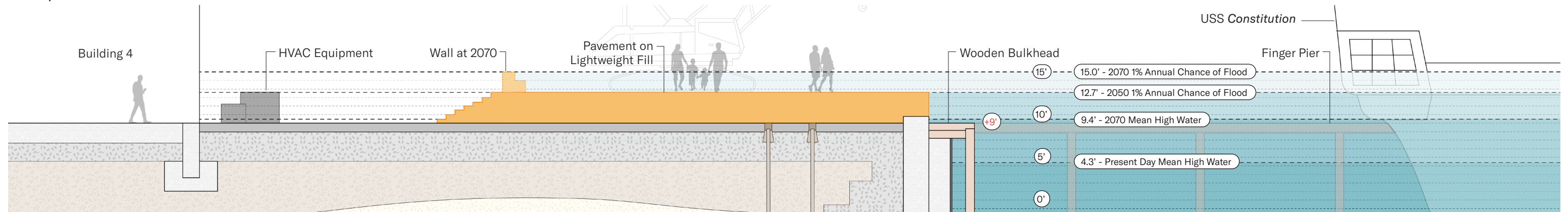
Study Area



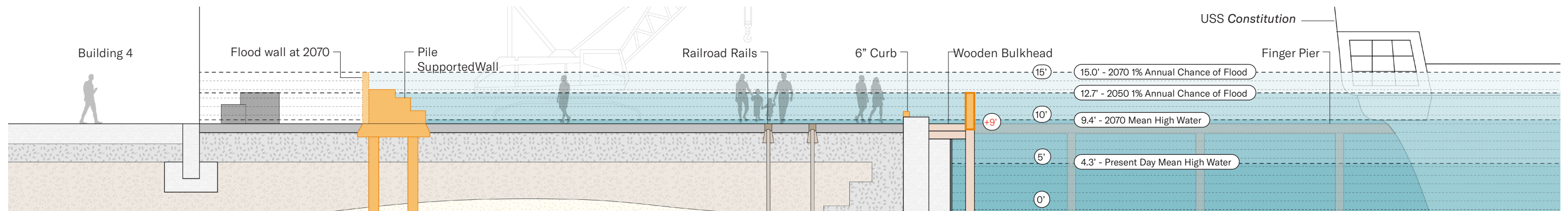
Key Plan



Existing



Option 1 - Elevated Pier



Option 2 - Multi-purpose Barrier



Pier 1, Constitution, and Building 10

Key Design Strategies

Multiple options are shown in this area for future consideration and consensus among NPS, Navy, and Naval Facilities Engineering Systems Command.

Option 1 - Elevated Pier:

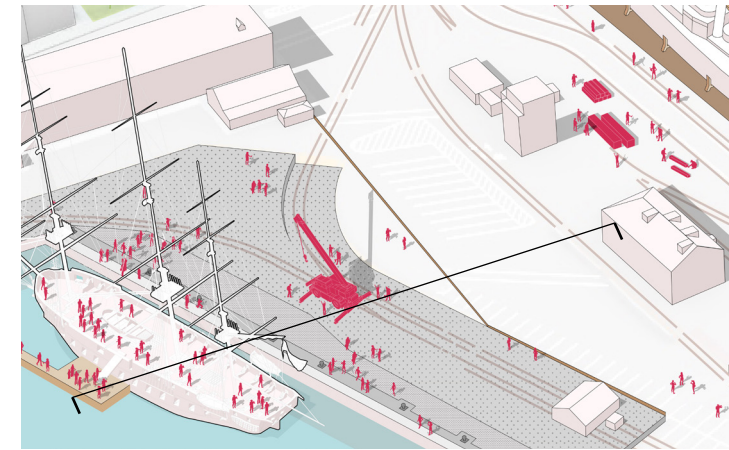
- Raised seawall protects *Constitution* from overtopping the seawall during flood events
- Elevated waterfront provides robust visitor experience and views
- Elevated berth provides ample room for maneuvering the mobile crane around *USS Constitution* and facilitates mooring operations with raised mooring hardware
- Raised edge improves brow accessibility to *Constitution*. The finger pier can be raised to achieve the same on the other side

Option 2 - Multi-purpose Barrier:

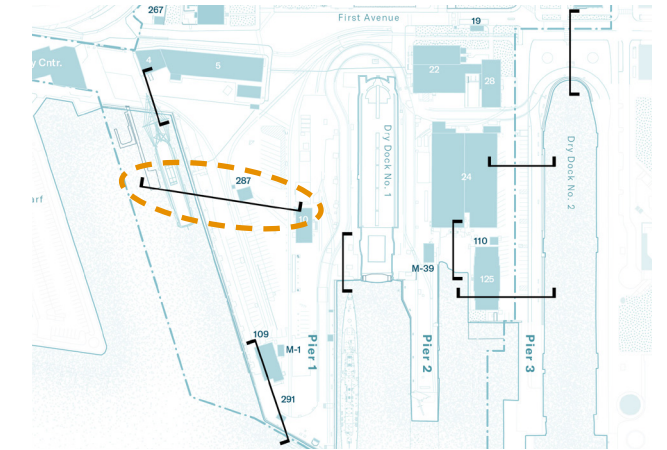
- Minimizes additional fill and structures at the marine edge
- Low curb protects Navy secure zone from tidal flooding projected for 2070
- Extended bumper piles protect *Constitution* from overtopping the Pier during flood events

Technical Considerations

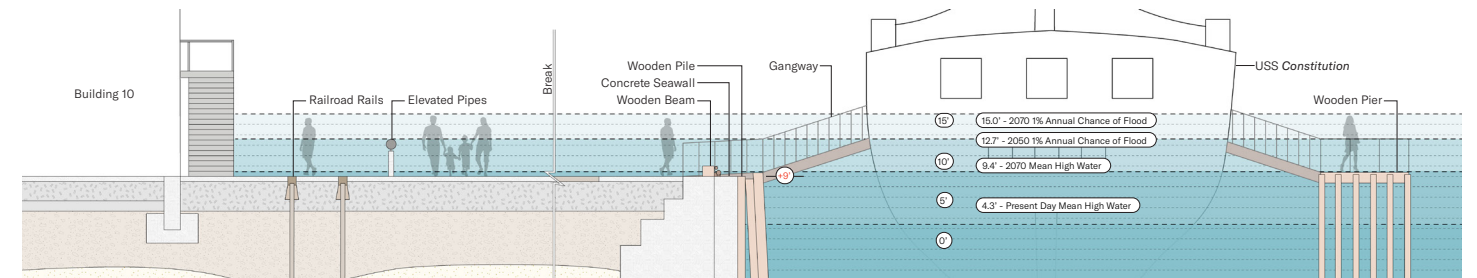
- Option 2 is more cost-efficient, but offers less operational flexibility in the Navy secure zone. The area between *Constitution* and the flood protection would have “wet feet” during flood events



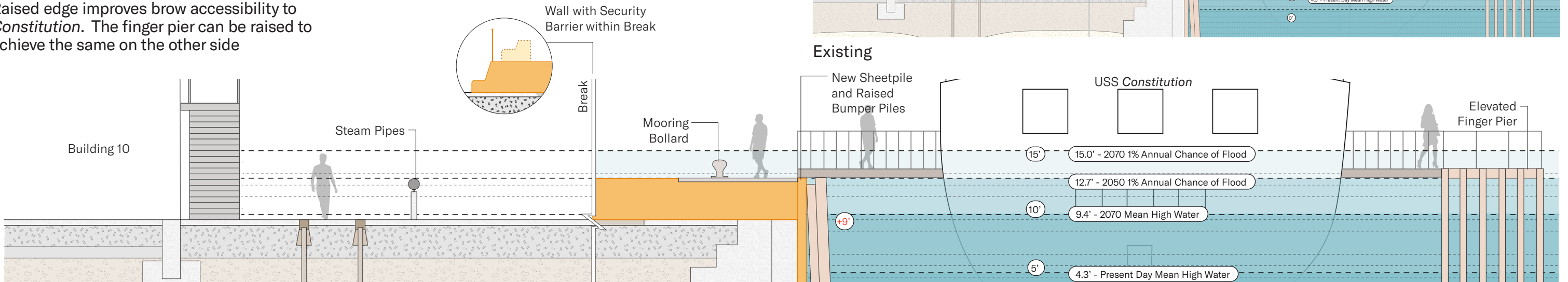
Study Area



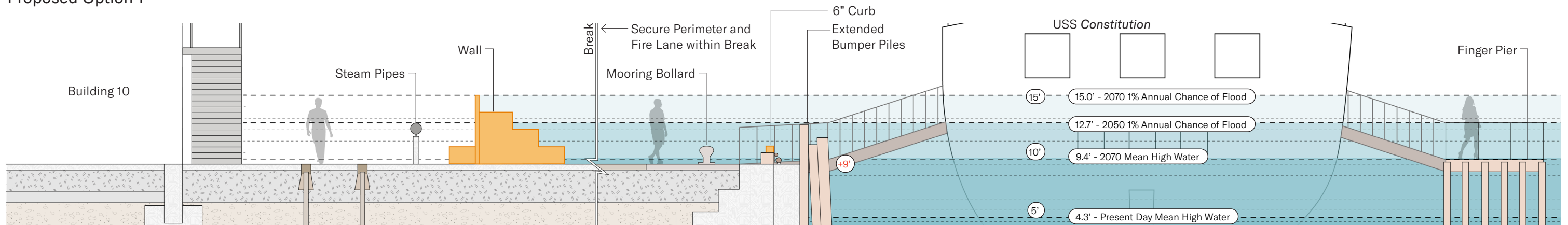
Key Plan



Existing



Proposed Option 1



Proposed Option 2



Pier 1 Harbor Edge

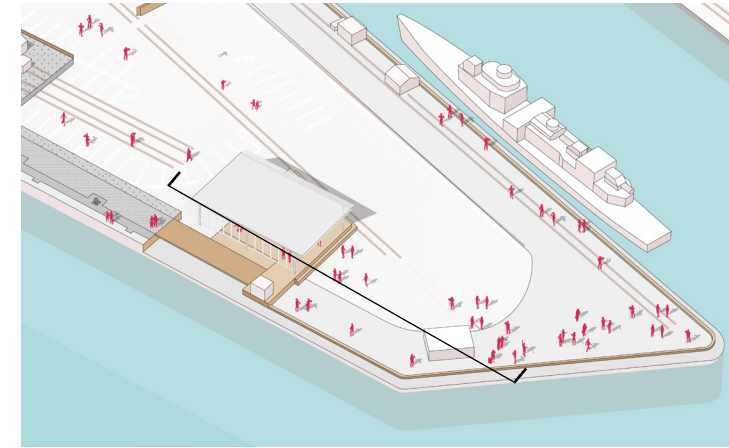
Key Design Strategies

- Incorporates shade and visitor amenity pavilion in place of building 109 per the Visitor Experience Plan
- Low curb at the outer edge of the pier protects from 2070 projected tidal flooding
- Protects and maintains access to fire main pump and distribution system up to 2050 DFE

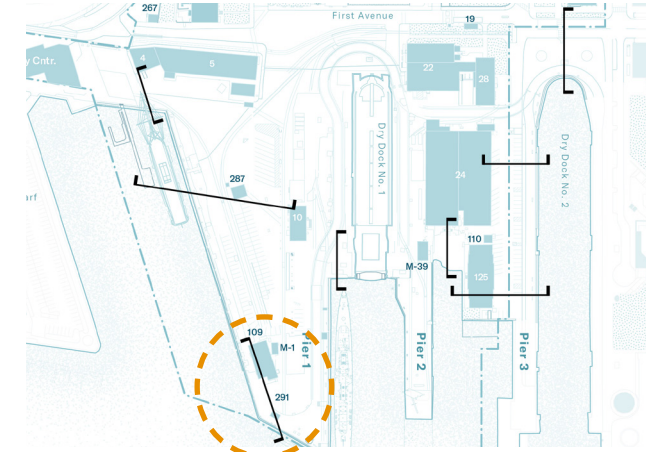
Technical Considerations

Proposed Option:

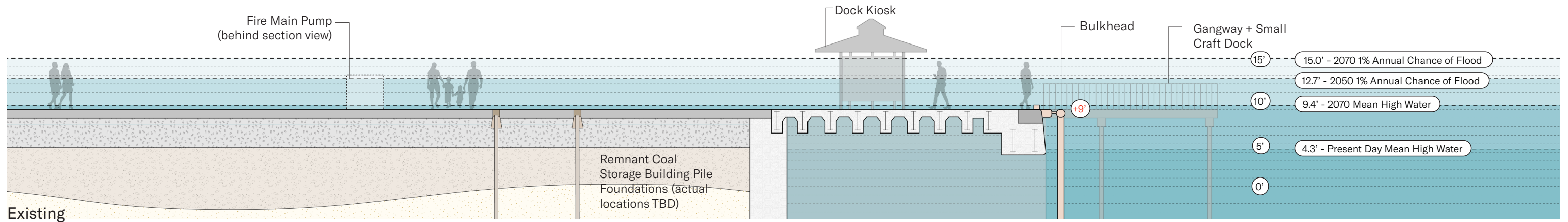
- More structural investigation needed to determine exact location and bearing capacity of remnant foundations from the former Pier 1 coal storage facility



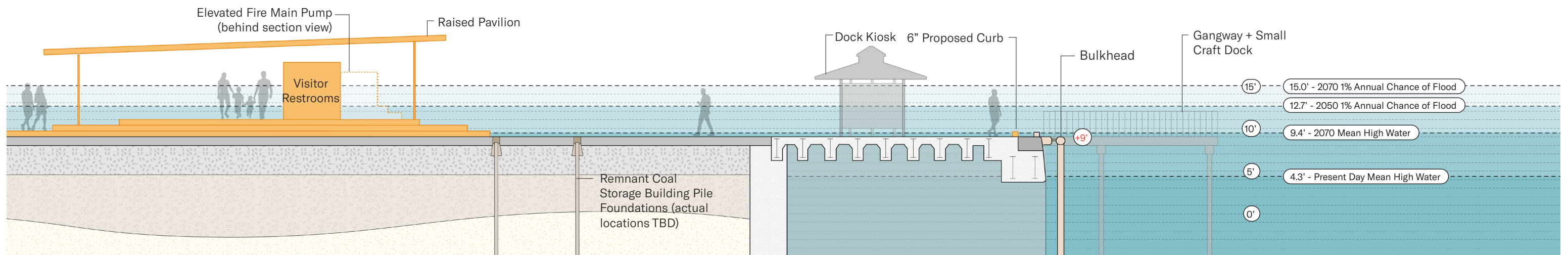
Study Area



Key Plan



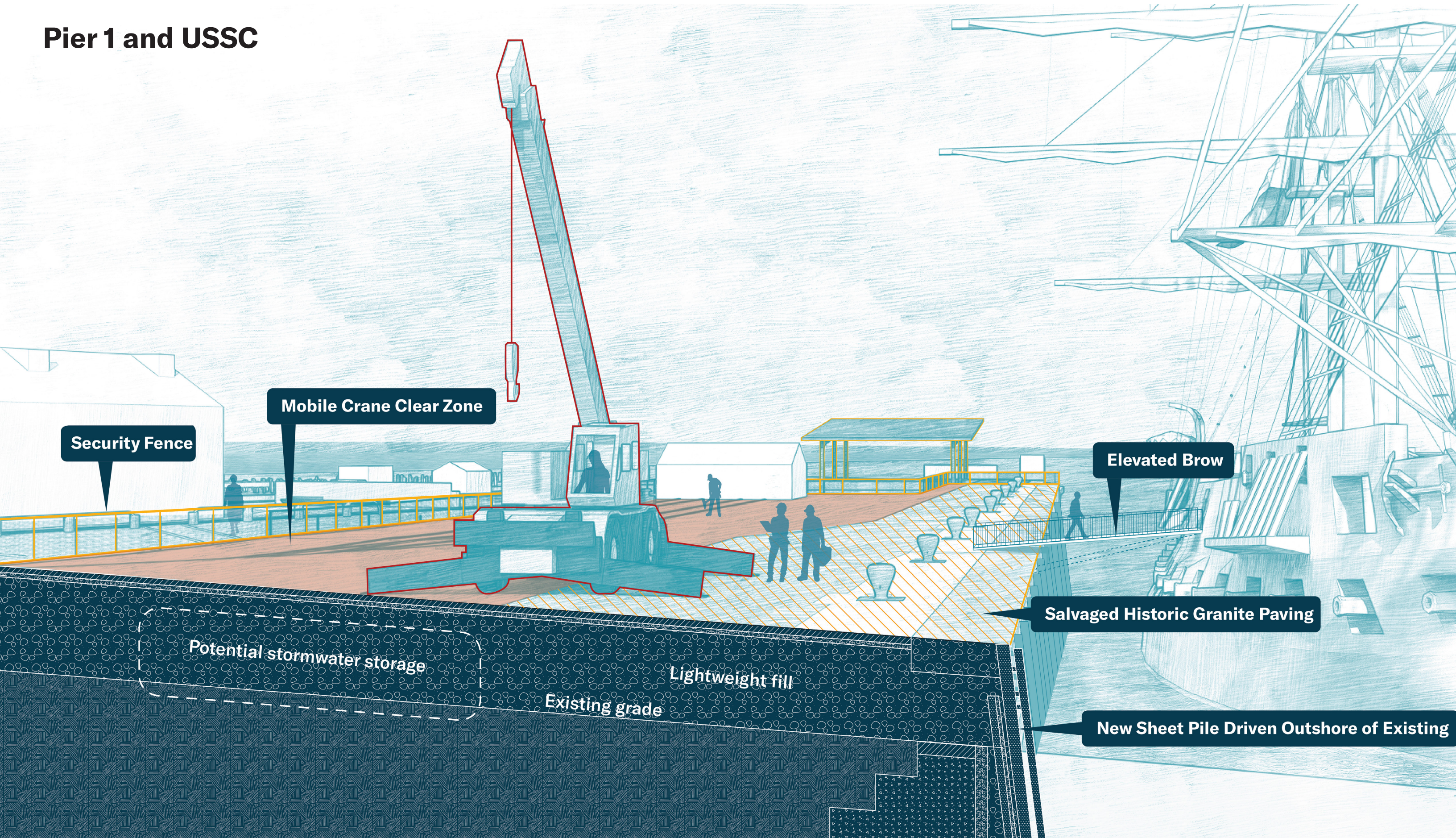
Existing



Proposed



Pier 1 and USSC



Security Fence

Mobile Crane Clear Zone

Elevated Brow

Salvaged Historic Granite Paving

New Sheet Pile Driven Outshore of Existing

Potential stormwater storage

Lightweight fill

Existing grade

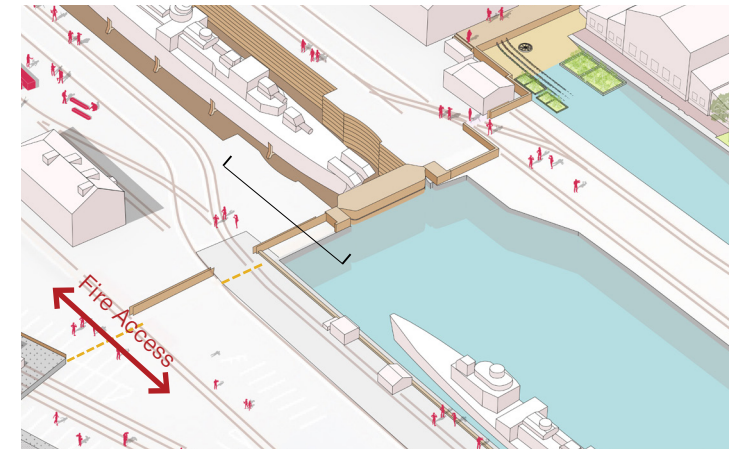
Dry Dock 1

Key Design Strategies

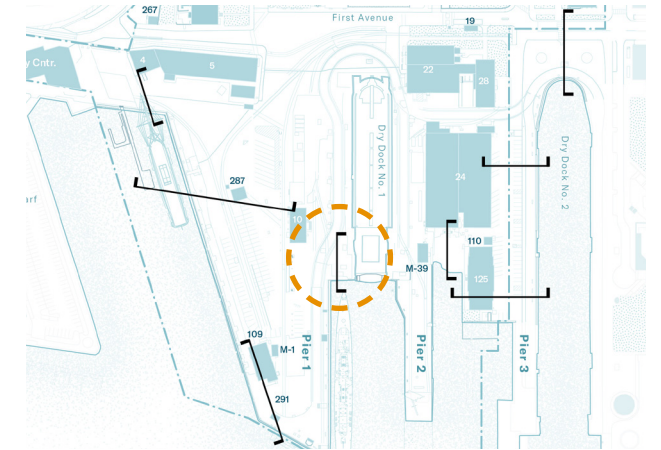
- Wall up to 2050 preserves critical view to harbor from Pier 1 and the head of Dry dock 1
- Preserves firetruck access to the end of Pier 1
- Preserves capstan functionality for mooring vessels into the Dry dock
- Wall ties into raised Dry dock abutments

Technical Considerations

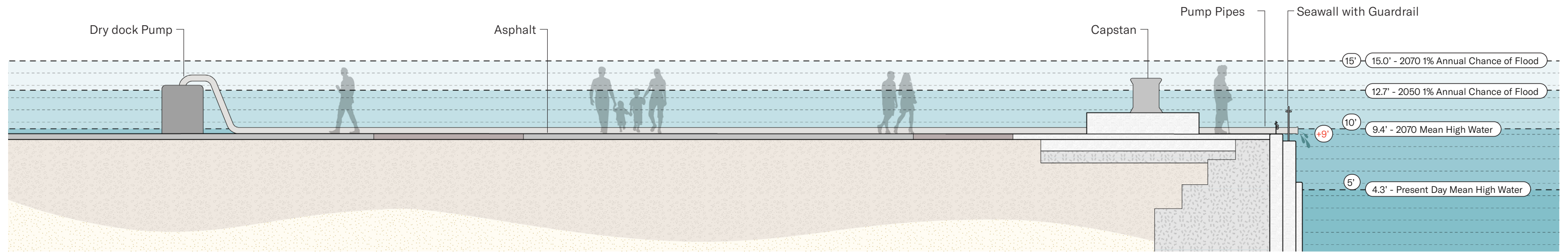
- Dry dock pump infrastructure to be evaluated for necessary retrofits to reduce the risk of backflow during flood events
- Wall penetrations for pump connection to be detailed to maintain watertight performance
- Wall footings to be coordinated with existing sub-grade utilities



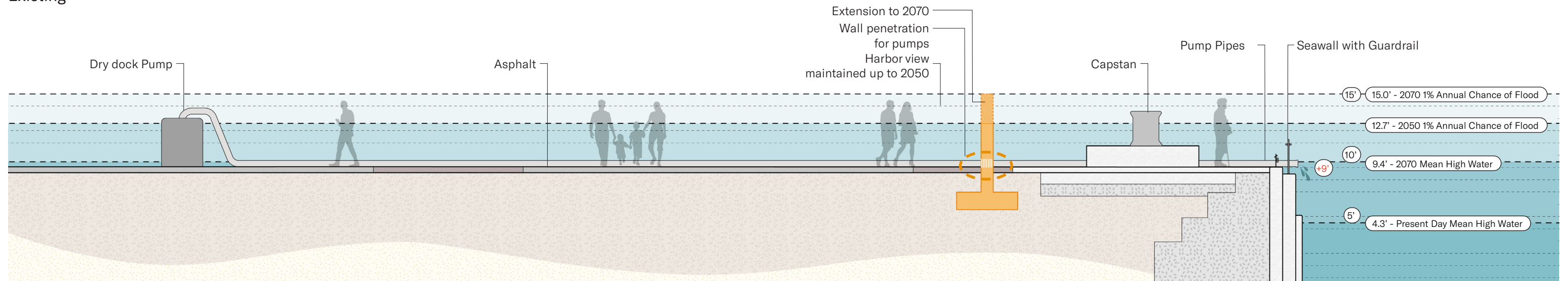
Study Area



Key Plan



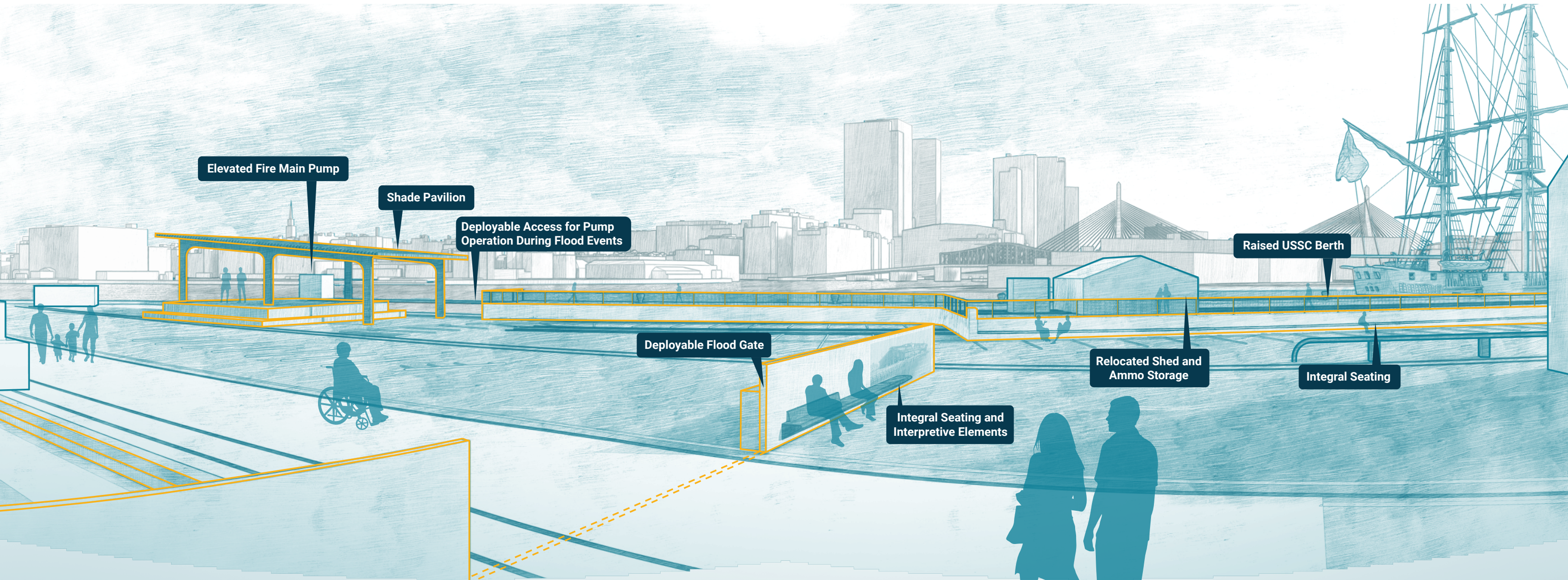
Existing



Proposed



Pier 1



Marine Railway

Key Design Strategies

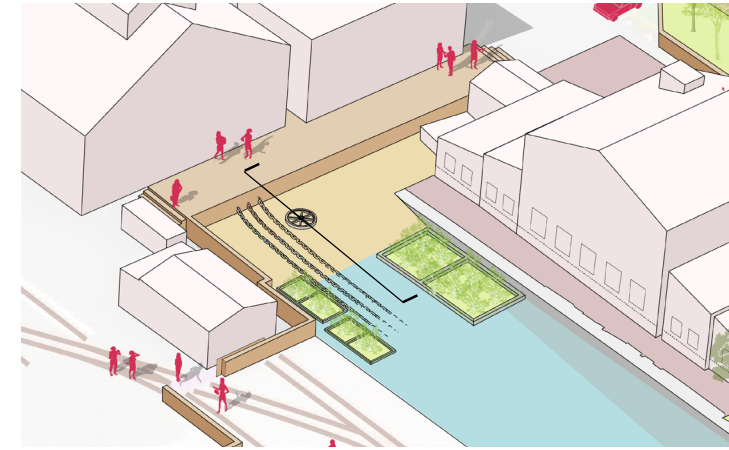
Option 1 is included as a reference study but is not the preferred approach.

Option 2 (Preferred):

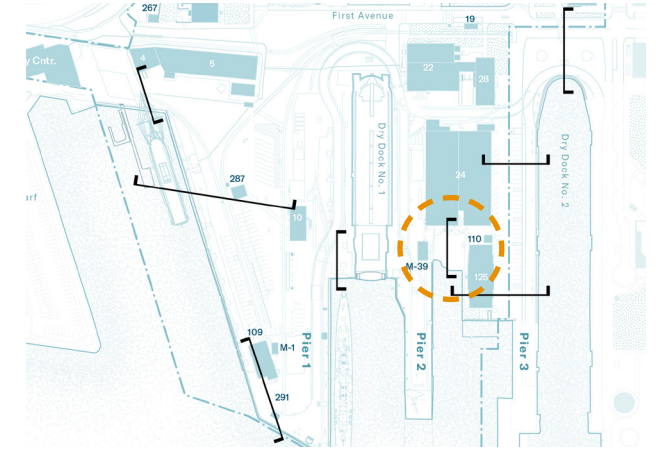
- Raised pad at rear of maintenance facility provides opportunity for seating and visitor interpretation overlooking the artifacts of the former marine railway
- Preserves the Yard's only intertidal zone
- Facilitates public access to Pier 2 from the Harborwalk and western parking in anticipation of future pier redevelopment

Technical Considerations

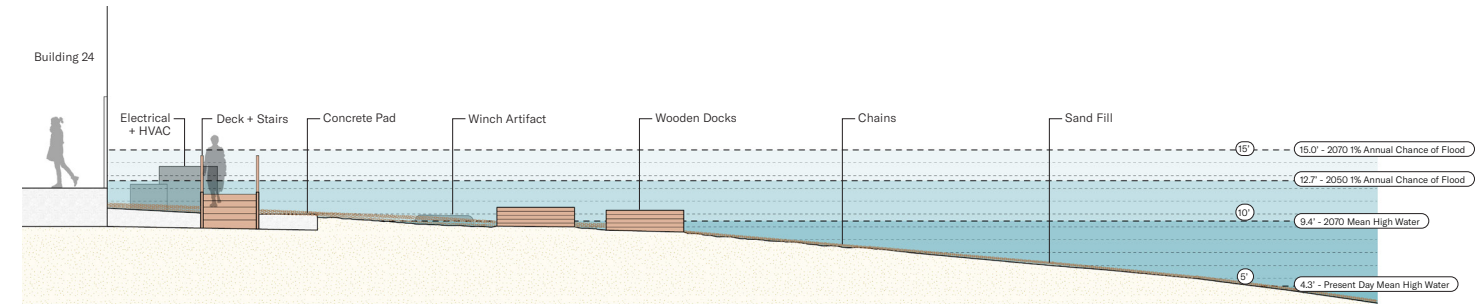
- Feasibility of raising building equipment to be confirmed
- Navy to confirm public access suitability and proximity to maintenance facility
- Geotechnical conditions at the marine railway and along its western wall to be evaluated for compatibility with lightweight fill and flood protection structures



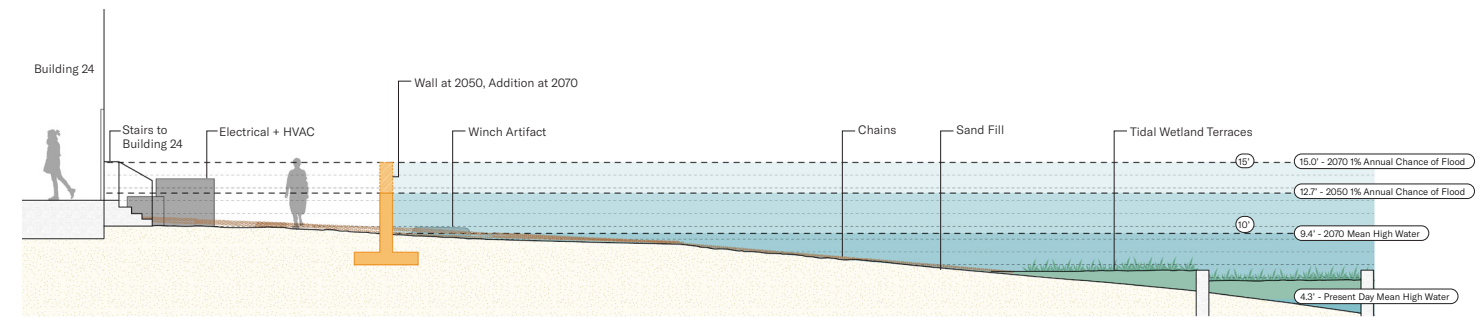
Study Area



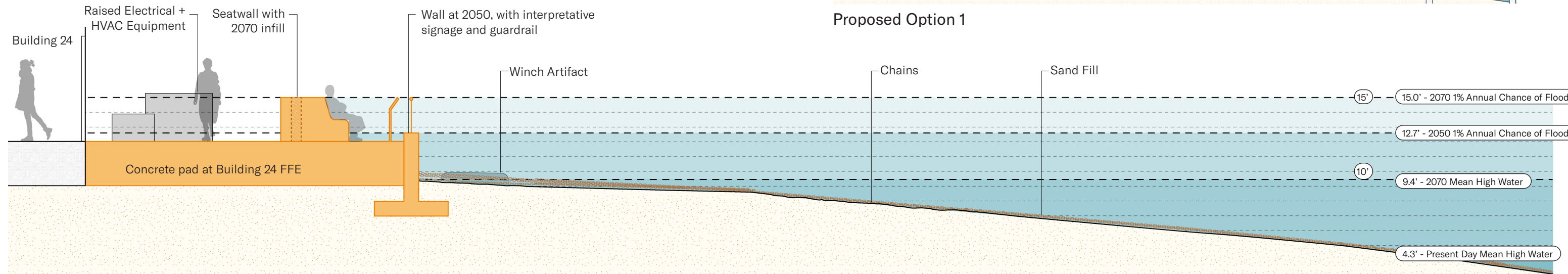
Key Plan



Existing



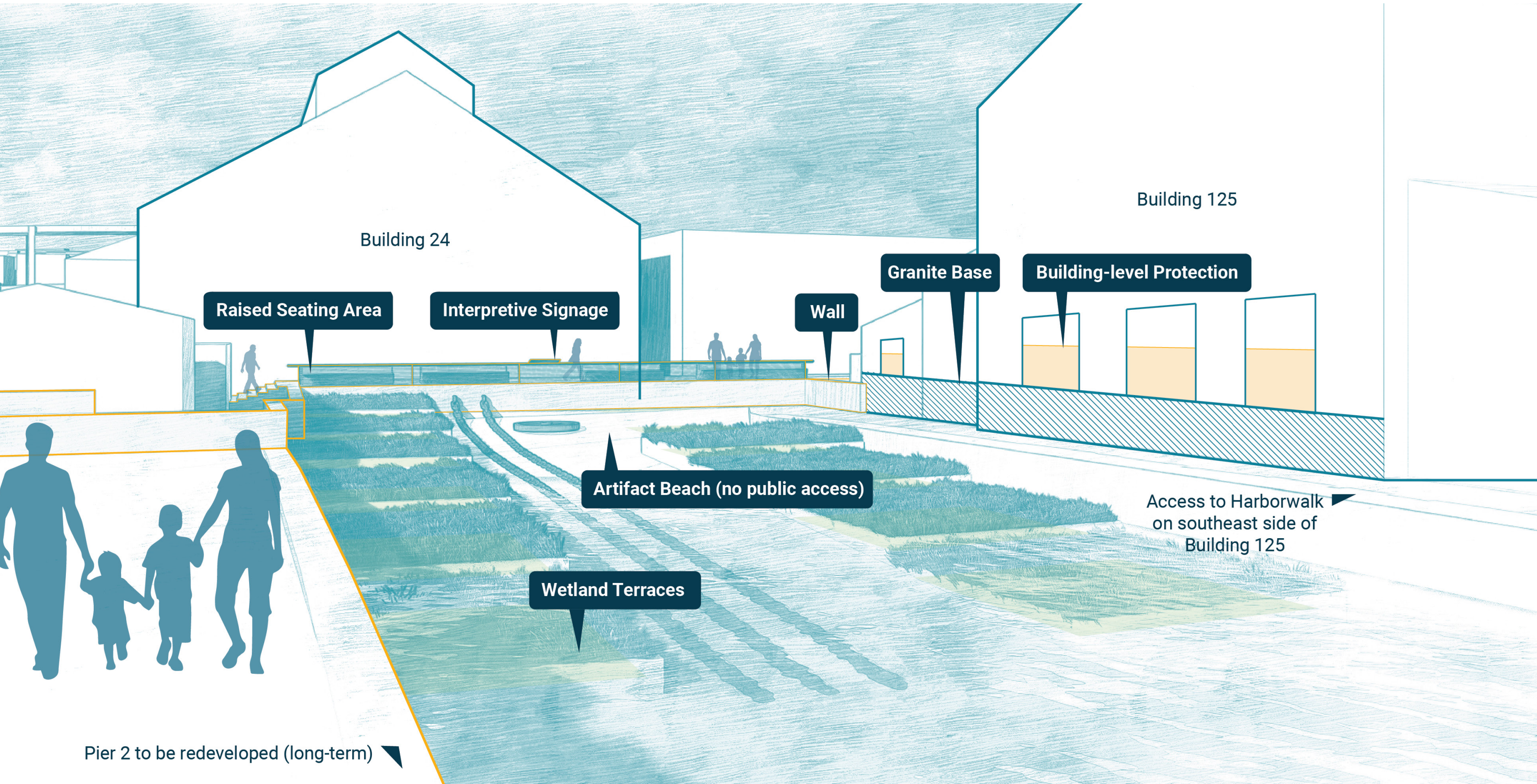
Proposed Option 1



Proposed Option 2 (Preferred)



Marine Railway



Building 125

Key Design Strategies

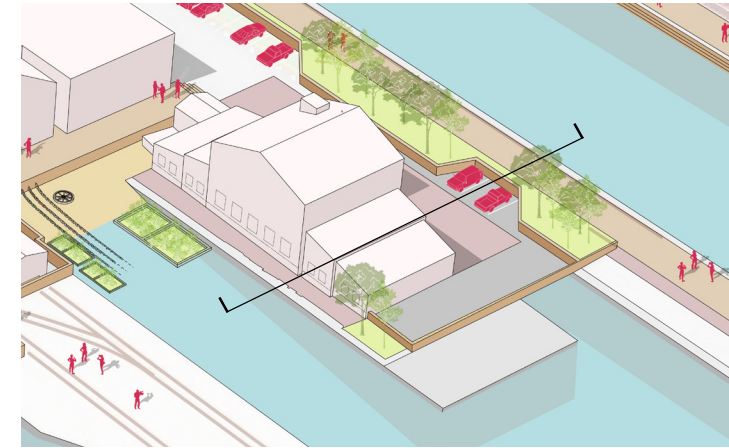
Option 1 is included as a reference study but is not the preferred approach.

Option 2 (Preferred):

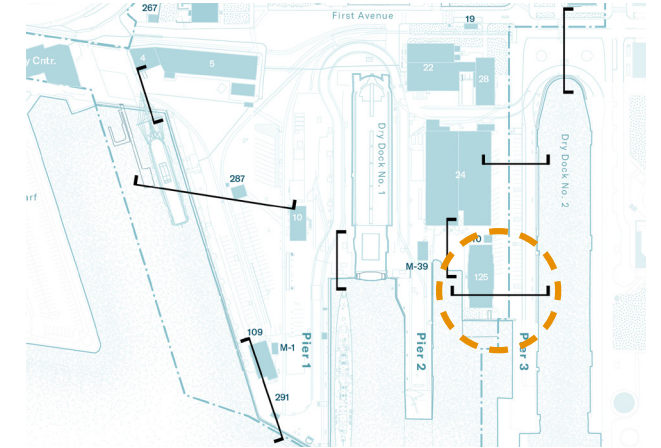
- West side of Building 125 is too constrained for flood protection structures and footings; deployable window barricades are recommended for building-level adaptation
- Seatwall bordering Dry dock 2 preserves open pedestrian circulation on the boardwalk and protected parking adjacent to Building 125
- Walled courtyard preserves waterfront open space for Building 125 tenants

Technical Considerations

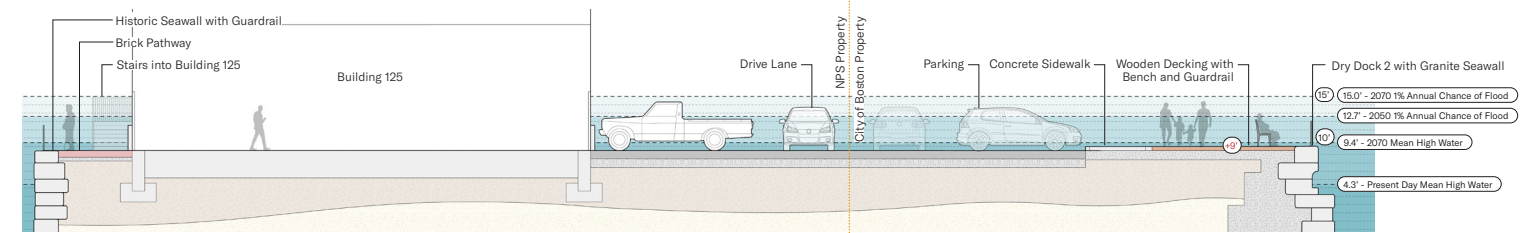
- Seatwall and raised planter are supported on pile foundations to avoid loading within Dry dock 2 seawall zone of influence
- Dedicated storage and operations plans are required for deployable window barricades
- Additional structural investigation is needed to confirm Building 125's granite base wall is able to withstand loads and wave forces from flood waters
- Flood protection is located on City of Boston property across Baxter Road



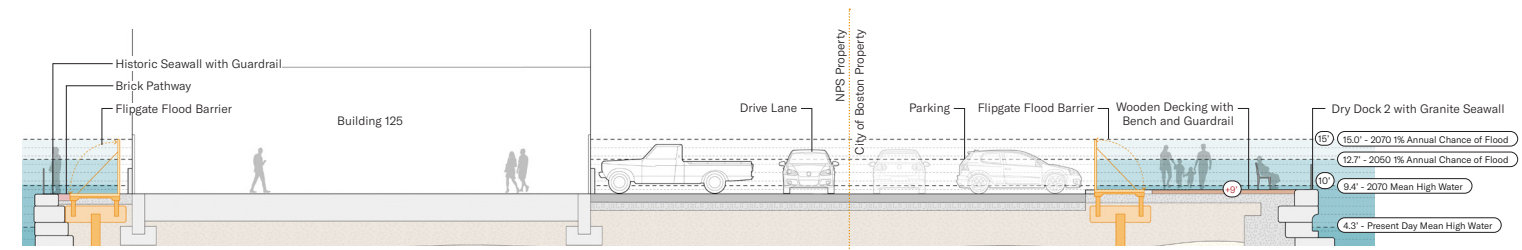
Study Area



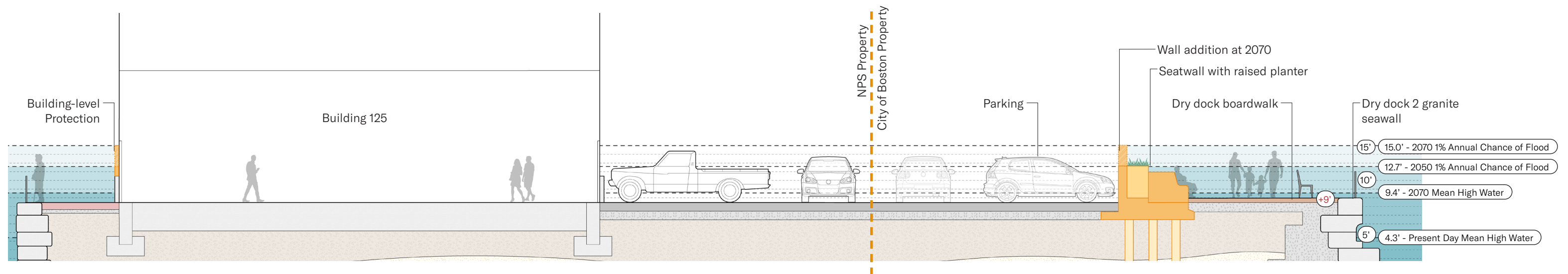
Key Plan



Existing



Proposed Option 1



Proposed Option 2 (Preferred)

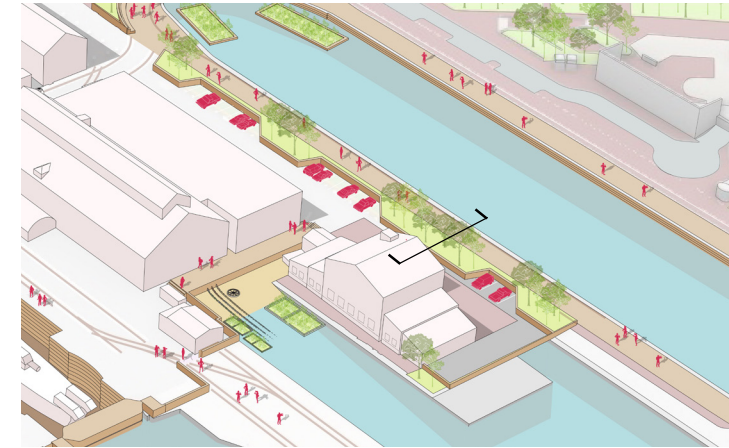
Dry Dock 2 Green Gateway

Key Design Strategies

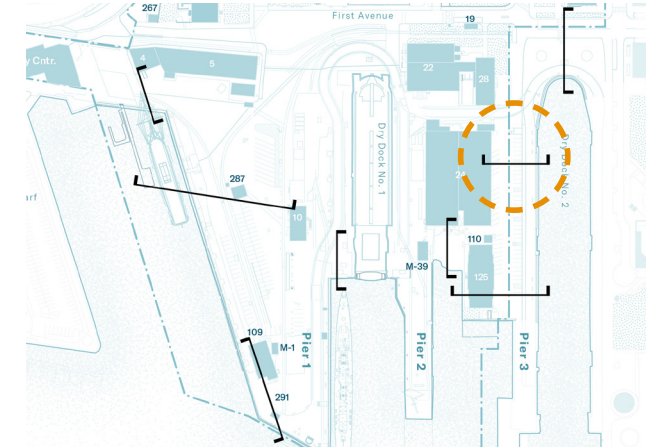
- Series of seatwalls and raised planters provide larger soil volumes for robust tree and shrub plantings
- Varied green edge creates a welcoming, comfortable, and shady threshold to the Yard for visitors arriving via the Harborwalk and Shipyard Park
- Preserves two-way Baxter Road, fire access, and parking adjacent to building 125 while screening views of vehicles from the Park
- Planting offers opportunity to conceal full wall built out to 2070 DFE

Technical Considerations

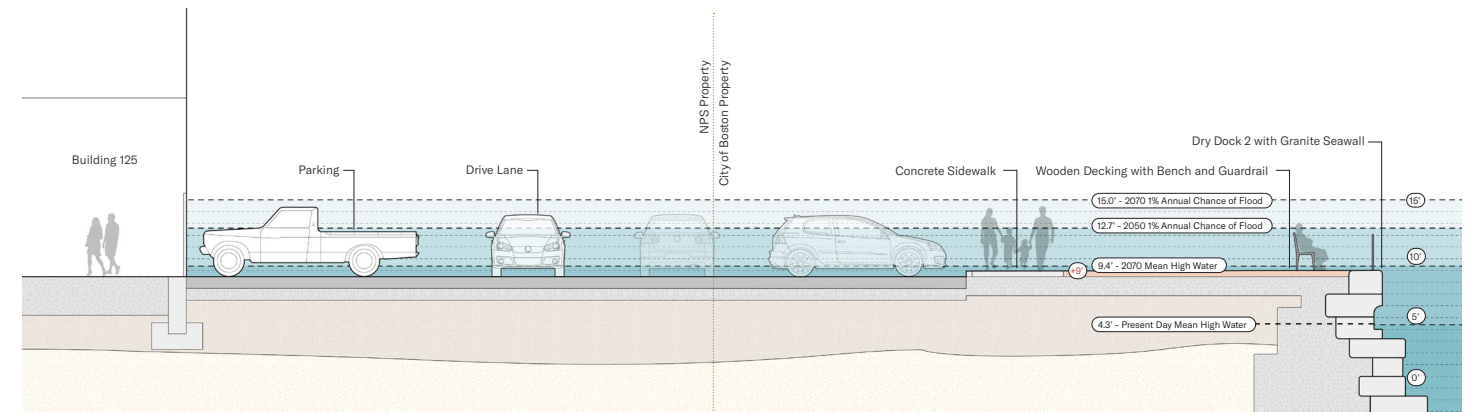
- Structures are supported on pile foundations to avoid loading within Dry dock 2 seawall zone of influence
- Lightweight fill, horticultural soils, irrigation, and adequate drainage needed to support vegetation in raised planters
- Flood protection is located on City of Boston property across Baxter Road



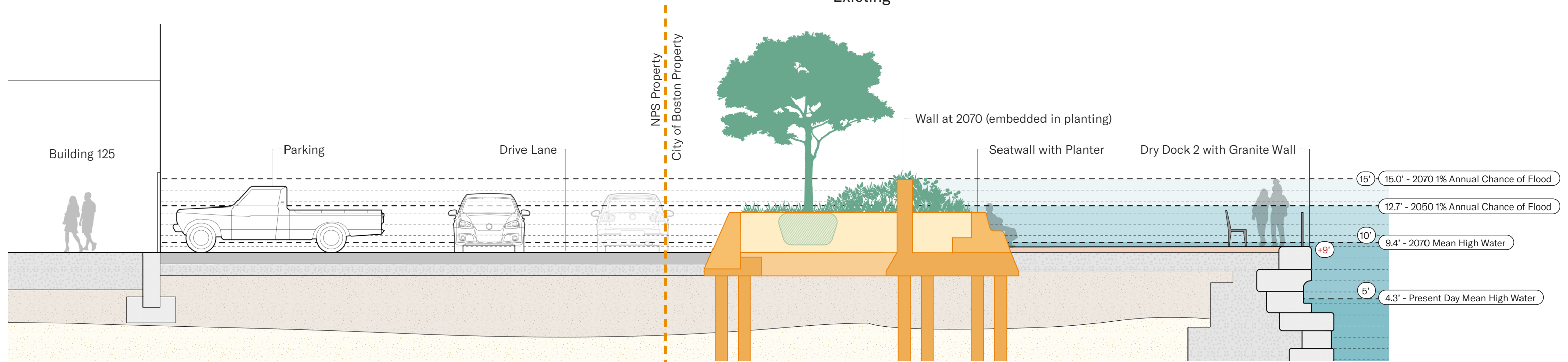
Study Area



Key Plan



Existing



Proposed Option



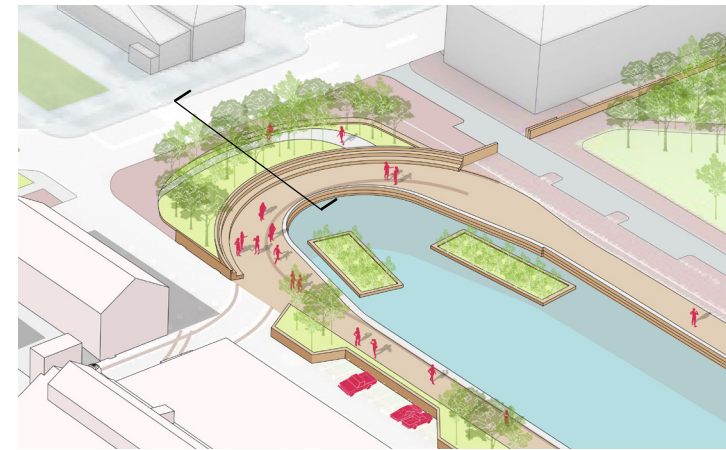
Dry Dock 2 Overlook

Key Design Strategies

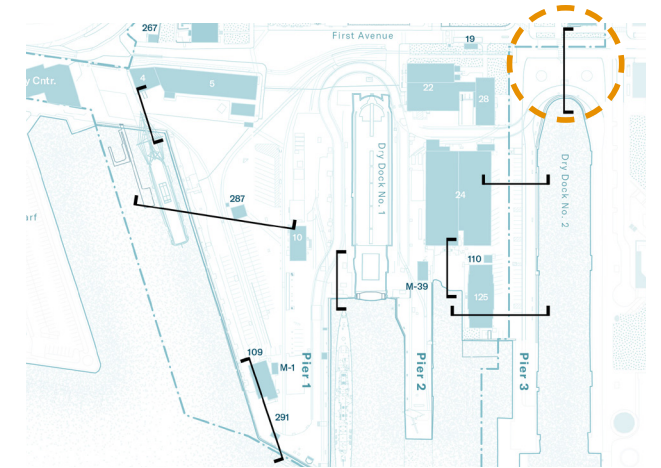
- Accessible raised lawn and planted area provides elevated views and integral seating at the head of the Dry dock, while maintaining views of the water from First Avenue
- Green edge wraps the Dry dock to create a continuous park experience and welcoming threshold to the Yard
- Generous plaza space on First Avenue frontage incorporates existing anchor artifacts while maintaining comfortable and accessible space for pedestrians

Technical Considerations

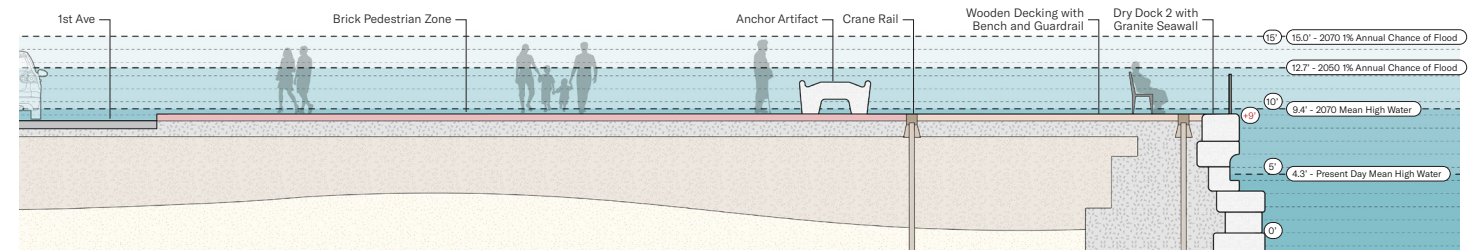
- Structures are supported on pile foundations to avoid loading within Dry dock 2 seawall zone of influence
- Lightweight fill, horticultural soils, irrigation, and adequate drainage needed to support raised plantings
- Flood protection is located on City of Boston property



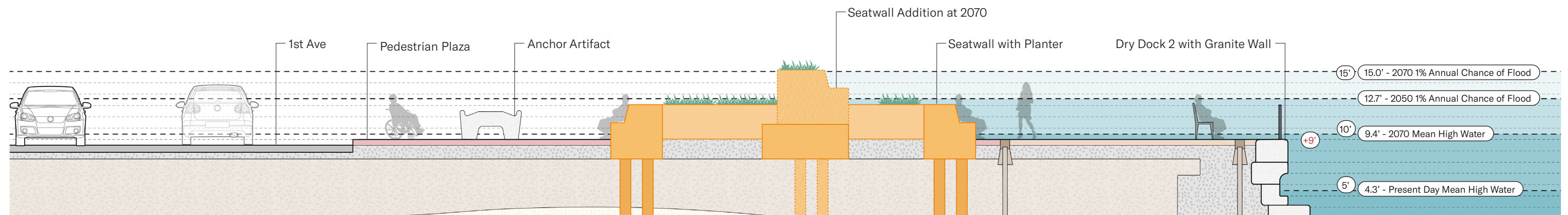
Study Area



Key Plan



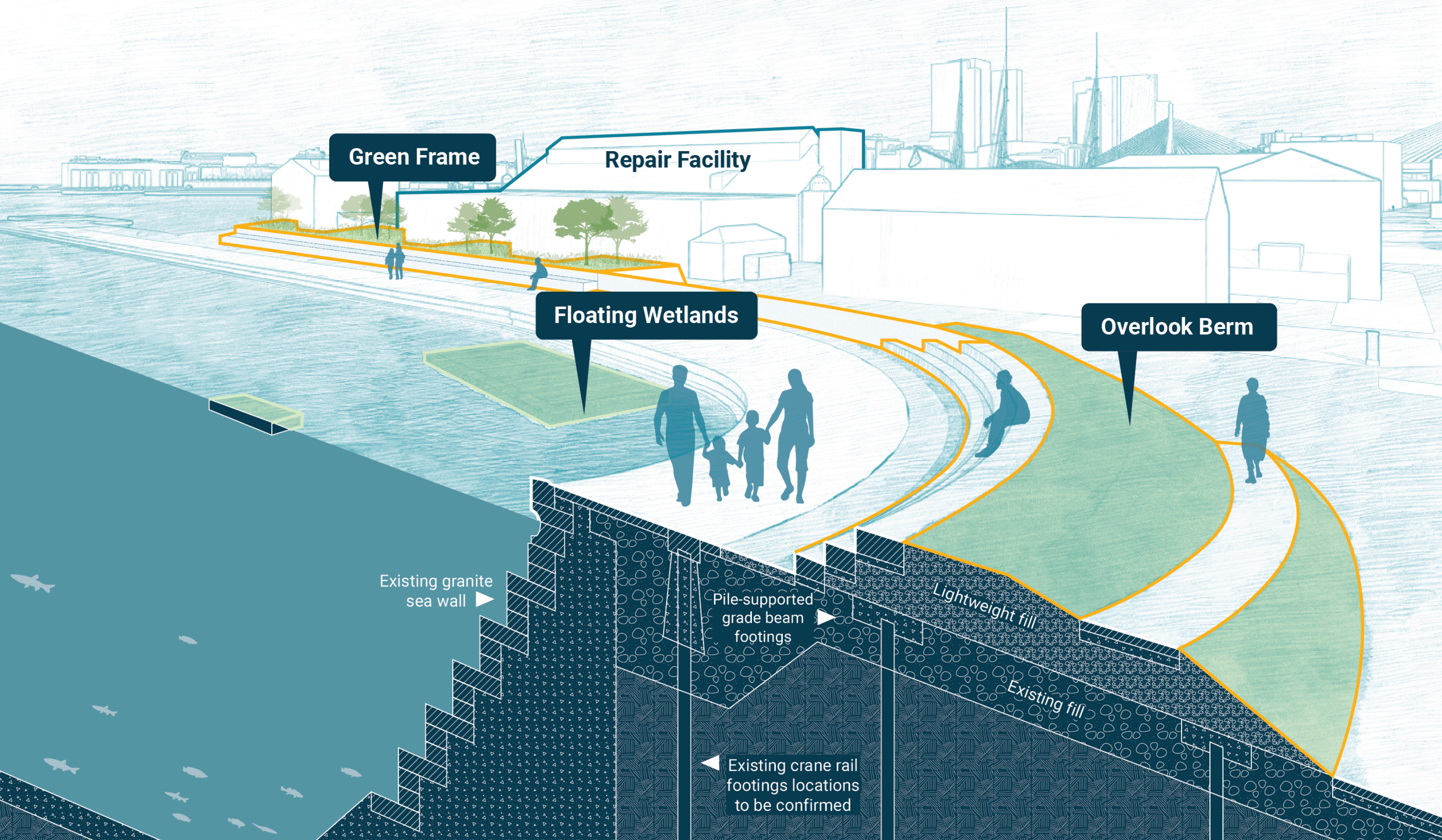
Existing



Proposed Option



Dry Dock 2 Overlook



Green Frame

Floating Wetlands

Overlook Berm

Repair Facility

Existing granite sea wall

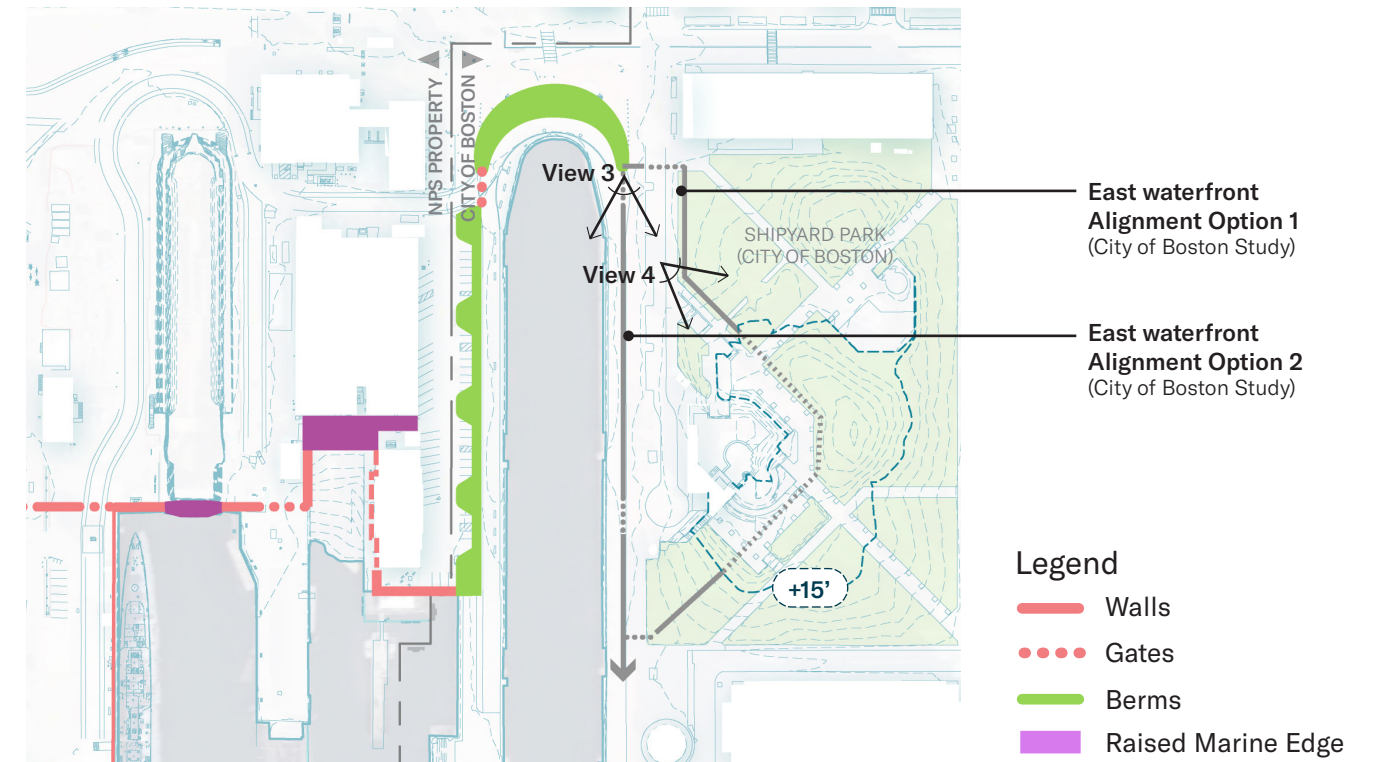
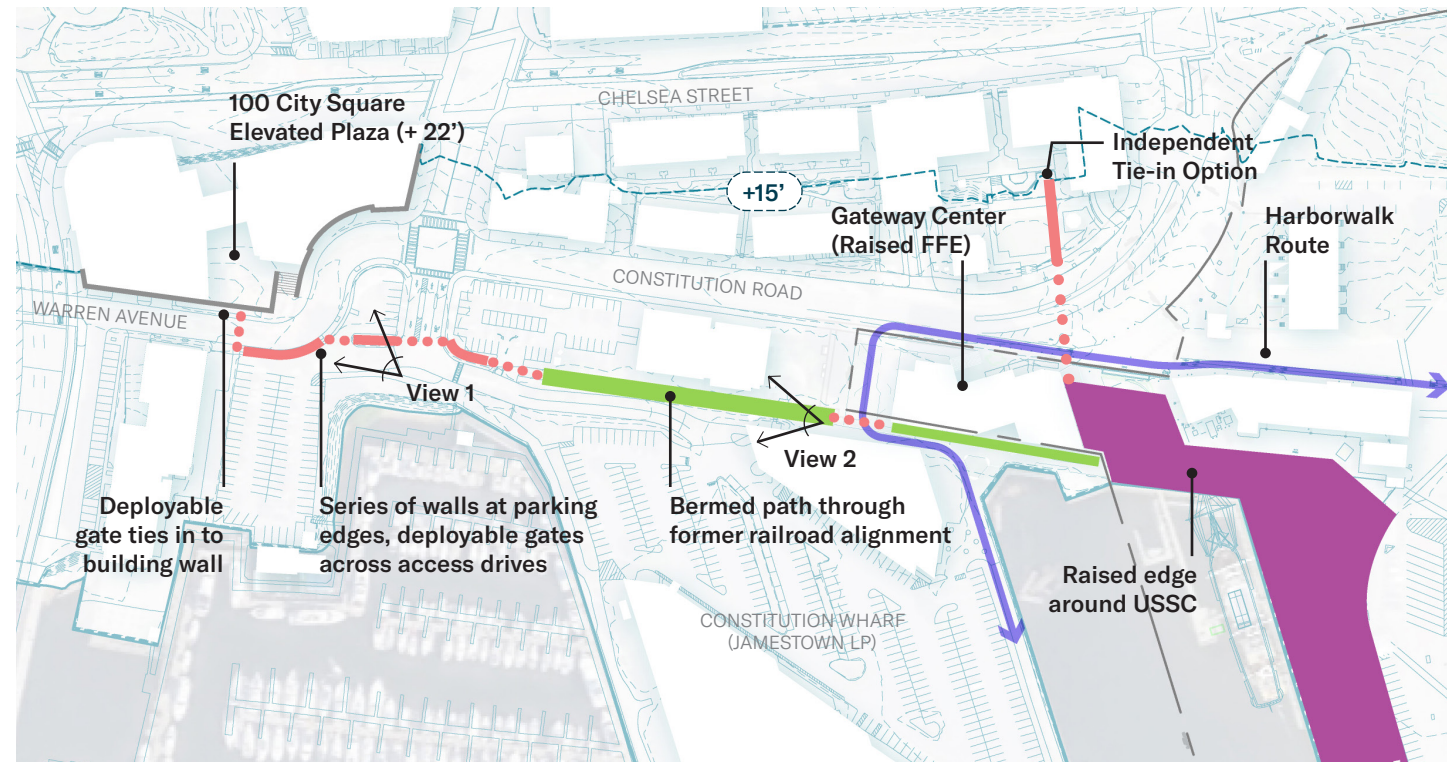
Pile-supported grade beam footings

Lightweight fill

Existing fill

Existing crane rail footings locations to be confirmed

West and East Waterfront Tie-Ins



Continuous Protection

Achieving continuous protection for the site requires blocking key flood pathways beyond NPS-managed land. Coordination with adjacent property owners is essential to ensure that barriers within the site connect seamlessly to those at the edges. The options shown above reflect preliminary tie-off locations informed by the 2023 interagency Resilience Charettes, ongoing coordination with the City of Boston's study of the eastern waterfront, and updated

existing conditions and DFE analysis.

West Waterfront

To the west, land ownership is mixed, including Massport, private parcels, and public rights-of-way. The proposed alignment uses public corridors and interstitial spaces between parking lots wherever possible, tying into the existing elevated wall and plaza at 100 City Square along Warren Avenue. Further coordination is needed with Massport and

Jamestown LP to confirm the raised berm approach along the edge of Constitution wharf. Further coordination is also needed with the City and owners of 100 City Square to complete the alignment.

East Waterfront

To the east, nearby high ground is within the City-owned Charlestown Naval Shipyard Park. The City is currently evaluating resilience options for a broader stretch of the East

Charlestown waterfront from Shipyard Park to the Little Mystic Channel. The illustration reflects the City team's latest alignments, with the understanding that one preferred option will be selected. The approach around Dry Dock 2 in this report is compatible with either City option, but additional coordination will be needed to confirm a shared vision, cost sharing, maintenance responsibilities, and implementation pathways for the portions of flood protection proposed on City Property.

NEXT STEPS



Photo Credit: Xiquinho Silva on Flickr.com
(includes edits)



Process Considerations

Engagement and Next Steps

This study brings together a broad community of partners to understand the challenges and opportunities of protecting the Charlestown Navy Yard's critical cultural, historic, and operational assets from future coastal flooding. Led by the National Park Service and Boston Harbor Now, the team collaborated closely with agency partners, technical advisors, and local stakeholders to evaluate flood risk, develop concept-level design strategies, and outline a path toward long-term resilience. The preceding chapters summarize the technical analyses, design criteria, and concept designs prepared to reduce vulnerability across the Navy Yard, including assets managed by both NPS and the U.S. Navy. This work reflects a shared-stewardship approach, grounded in data, coordinated risk mitigation, and a commitment to sustaining the Yard's essential functions, historic character, and visitor experience as coastal conditions continue to evolve.

Throughout the study, the team advanced areas of consensus while also identifying locations where additional collaboration will be required before moving into technical design. This is especially true at Pier 1, where protecting USS *Constitution* and surrounding historic resources requires close alignment between the Navy Command responsible for daily operations and the Naval Facilities Engineering Systems Command (NAVFAC), who draw on experience

from other Navy facilities. The study documents two viable options that capture stakeholder input to date and can be advanced through further coordination between the Navy, NAVFAC, and NPS. Similar coordination will also be needed as the Navy Yard's resilience planning interfaces with the broader Charlestown waterfront resilience initiatives led by the City of Boston.

To ensure momentum and support a smooth transition into schematic design and beyond, this chapter outlines the key process considerations and decision points that will guide future phases. Topics include design flood elevations, structural and stormwater requirements, maintenance and operational needs, access considerations, cost implications, and permitting and review pathways. Together, these considerations provide a clear roadmap for collaborative decision-making and build on the progress achieved to date, preparing the National Park Service, the U.S. Navy, Boston Harbor Now, and their partners to move the Navy Yard's coastal resilience strategy toward implementation.

Design Flood Elevation Considerations

Key Strategies

The Commonwealth of Massachusetts has developed, and the City of Boston has adopted, the Massachusetts Coast Flood Risk Model (MC-FRM), a state-of-the-art, high-resolution modeling tool that captures the complex dynamics of coastal flooding including critical processes driven by storm events, such as wind, storm surge, and wave action to support planning and design for coastal flood resilience.

The MC-FRM dataset delivers detailed inundation maps illustrating a spectrum of annual flood exceedance probability events, with simulations provided for present-day conditions and future projections for 2030, 2050, and 2070. These datasets account for a wide array of coastal flood drivers, including wind, storm surge, waves, wave setup, wave runup, and overtopping, all mapped over existing topographic conditions to provide a nuanced understanding of potential flood impacts.

For this project, MC-FRM datasets formed the basis for evaluating flood risks within the project area. Design Flood Elevation (DFE) datasets corresponding to the 1% Annual Exceedance Probability (AEP) were extracted for the years 2030, 2050, and 2070. Each year's projections were assessed along the entire proposed structure alignment, with DFEs selected for three distinct segments. Analysis revealed that structure segments directly exposed to coastal waters between Piers 1 and 3 require DFEs that are one foot higher than those for the set-back sections due to higher wave height at the pier edges. For conceptual planning purposes, the varying DFE values were averaged across the site and used for consistency across all technical studies in the previous chapters. For a more detailed breakdown of varying DFEs across the site, see Appendix F.

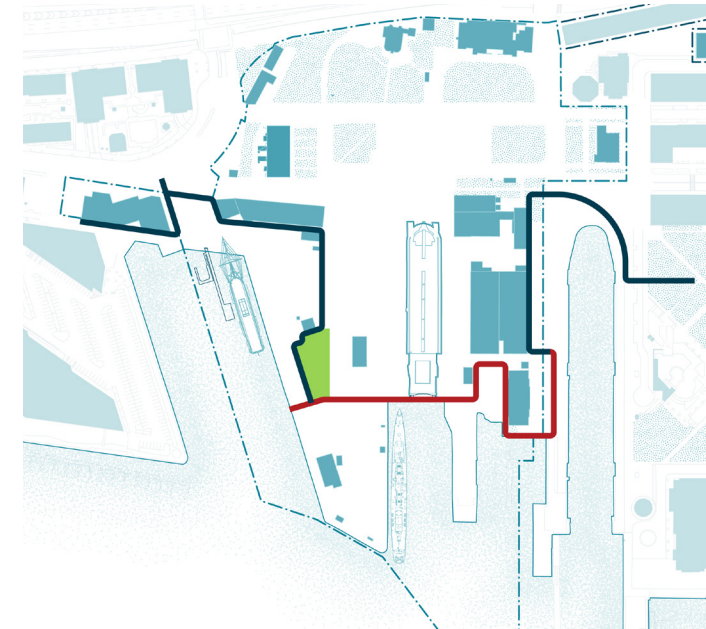
Given the timelines required for design, permitting, and construction of coastal flood risk reduction systems, the project team determined that using 2030 flooding conditions would be outdated by the time construction is complete. Therefore, design elevations targeting 2050 conditions were selected (12.7'), with a recommendation to develop designs that can be adapted for 2070 conditions (15') in the future. This phased approach reduces the initial construction investment and provides flexibility to address increasingly severe flood risks, allowing more time to plan and secure funding for future enhancements to the flood risk reduction system.

Future Considerations

The design flood elevations were extracted from the MC-FRM model and reflect flooding components based on existing topographic conditions. This conceptual design phase did not assess how proposed project features may alter flood dynamics. In subsequent project stages, it is important to evaluate potential changes, particularly in runup and overtopping processes, to ensure comprehensive and effective resilience planning.

Future design phases should also incorporate appropriate factors of safety and consider structural enhancements, such as curving floodwalls, adding bullnoses to direct floodwaters back toward the harbor, and adjusting crest elevations to provide additional freeboard. These measures will help manage residual flood risk and account for uncertainties.

Finally, ongoing coordination with the project end-user is essential to integrate the Navy's operational requirements and adhere to their best practices throughout design and construction.



Legend (All NAVD)

- Shorter DFE at 13' (2050) and 15' (2070)
- Taller DFE at 14' (2050) and 16' (2070)

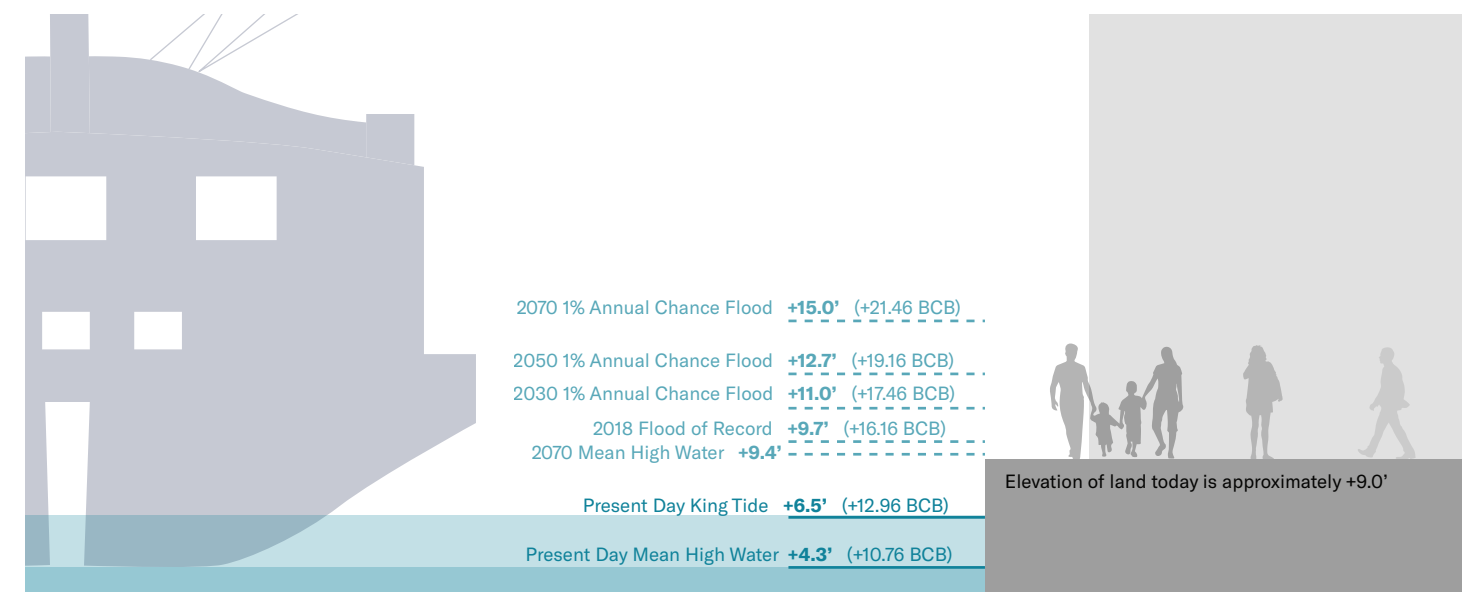
Design Flood Elevation Baseline - 2050 1% AEP and Design Flood Elevation Future Target - 2070 1% AEP

For the baseline design flood elevation, protection targets 2050 projections.

For the design flood elevation at 2070, flood protection across the site is designed for adaptation to higher levels in the future. This takes the form of wall extensions and multipurpose seawalls where possible. If resources align, deployable gates should be installed to the 2070 level from the outset, as they will be more difficult to modify.

(below) Design Flood Elevations and Future Tides

In addition to flooding from severe storms, the plan provides continuous protection around Pier 1 for projected mean high water levels in 2070.

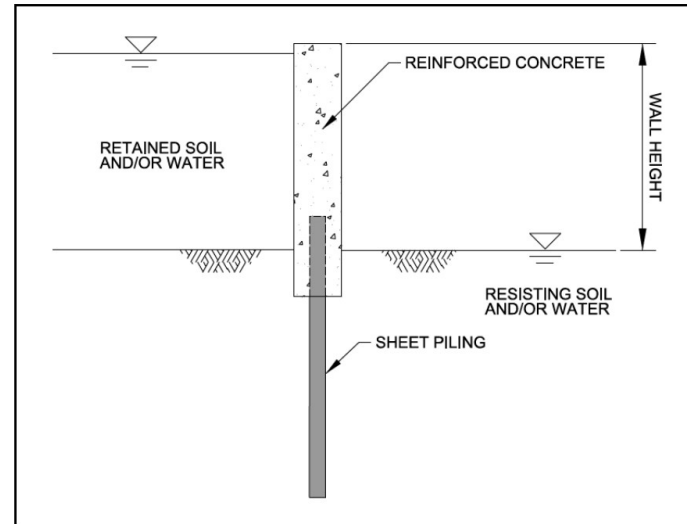


Structural Considerations

Key Strategies

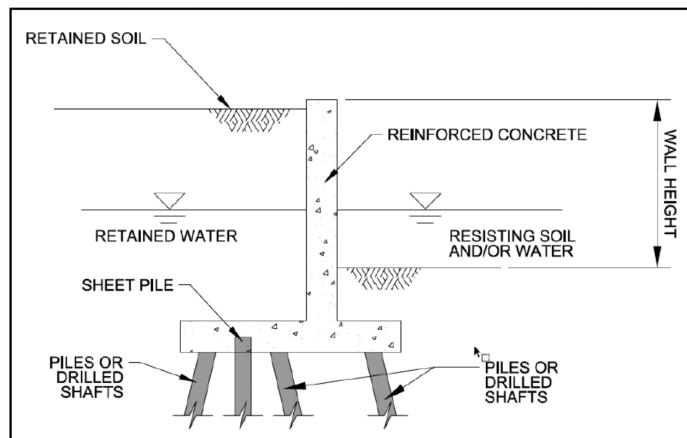
Where flood walls are implemented, the first consideration is the design flood elevation (DFE). Retaining walls must resist hydrostatic, hydrodynamic, and wave loads. Although designs can be evaluated for both 2050 and 2070 DFEs, it is impractical to build a near-term wall that cannot be adapted for future conditions. Therefore, below-grade foundations should be designed for the 2070 DFE for long-term resilience, while above-grade wall components, which can be more easily replaced or modified, may be designed for shorter-term flood conditions.

A second key consideration is whether flood walls must resist vessel impact loading. This requires assessing vessel types in the area and their velocities if they break loose during a storm. Barges present the greatest risk due to their shallow draft and ability to overtop piers or seawalls and strike flood walls. According to guidance from the U.S. Army Corps of Engineers, T-walls are recommended where barge impacts are possible. T-walls consist of a concrete retaining wall and footing supported by battered H-piles, with sheet piles for seepage control. If T-walls are not feasible, studies should evaluate water infiltration rates in the event of a breach and identify alternative mitigation measures to minimize potential damage.



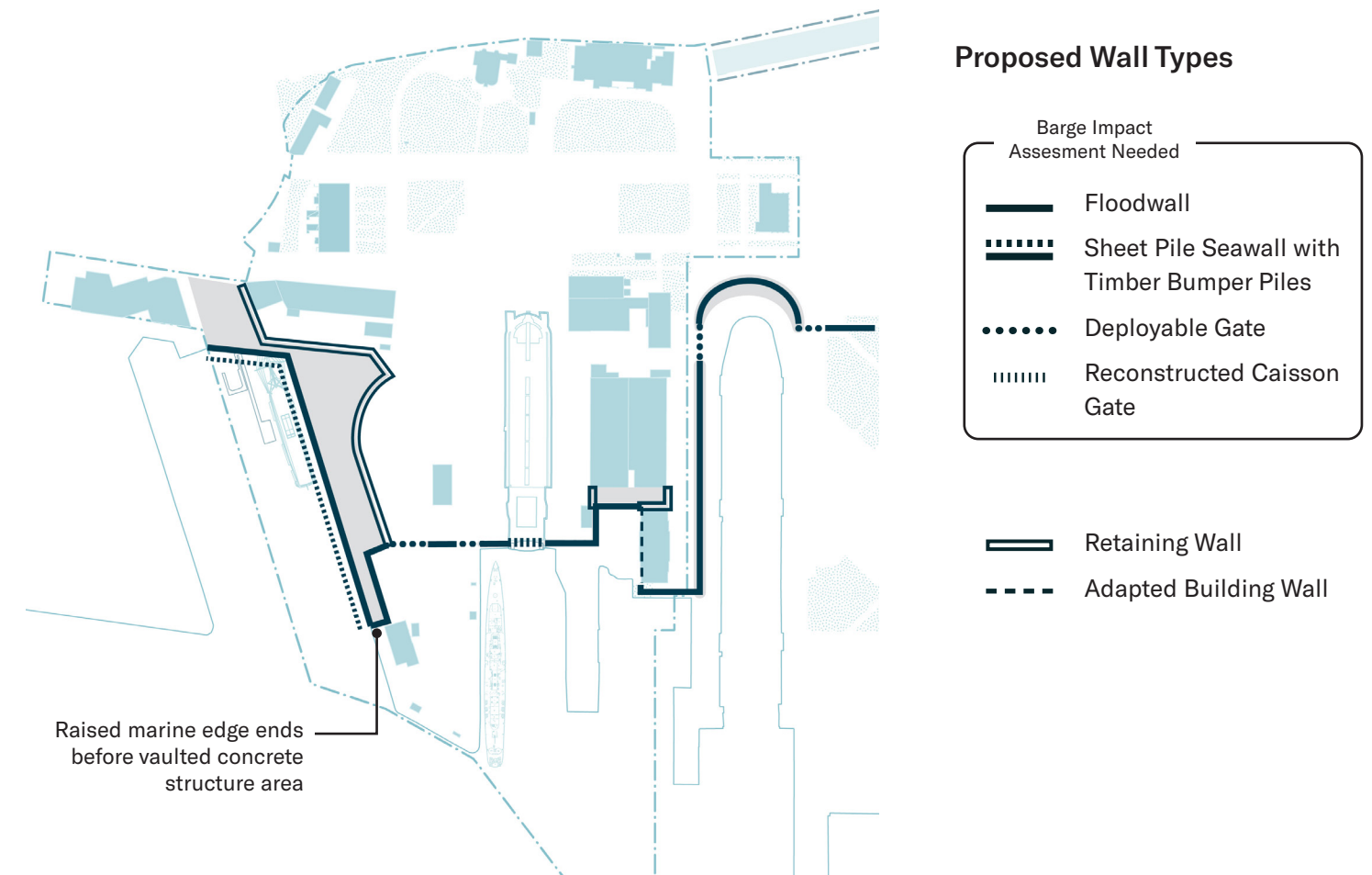
I-Wall - Sheet Pile Wall with Concrete Cap

Not Suitable for Barge Impacts



T-Wall Supported by deep foundation

USACE Standard for Barge Impacts



Future Considerations

There are many unknowns regarding the capacity of the existing structures to support new flood mitigation systems. A Geotechnical investigation is needed to assess soil properties, determine whether deep foundations are required, evaluate settlement potential, and confirm the feasibility of raising the grade.

At Pier 1's harbor edge, concrete vaulted edges are known to have a 250 lb/sf loading capacity, which is insufficient to support a raised marine edge. The remaining edge should be assessed for its capacity to support additional surcharge loads and a vertical extension for a raised marine edge; if insufficient, a new outshore sheet pile bulkhead may be required. Due to uncertain soil conditions, extensive ground improvements may be needed to remove voids

and ensure the deck can support live loads and added fill. Because the pier was originally constructed with timber cribbing and foundation structures for buildings, obstructions may be encountered during the installation of flood walls with sheet piles or battered H-piles. Ground Penetrating Radar (GPR) may help locate these buried elements. The outshore deck also includes vaulted concrete sections undergoing structural rehabilitation, requiring careful coordination to minimize disturbance.

At Dry dock #2, a berm would impose significant dead loads, requiring a setback outside the dock's zone of influence. Although the area was originally designed to support a 40-ton portal crane rail, long-term settlement and varying subsurface conditions may require deep foundations, depending on soil types, vibration risks, and nearby utilities.

Stormwater Considerations

Key Strategies

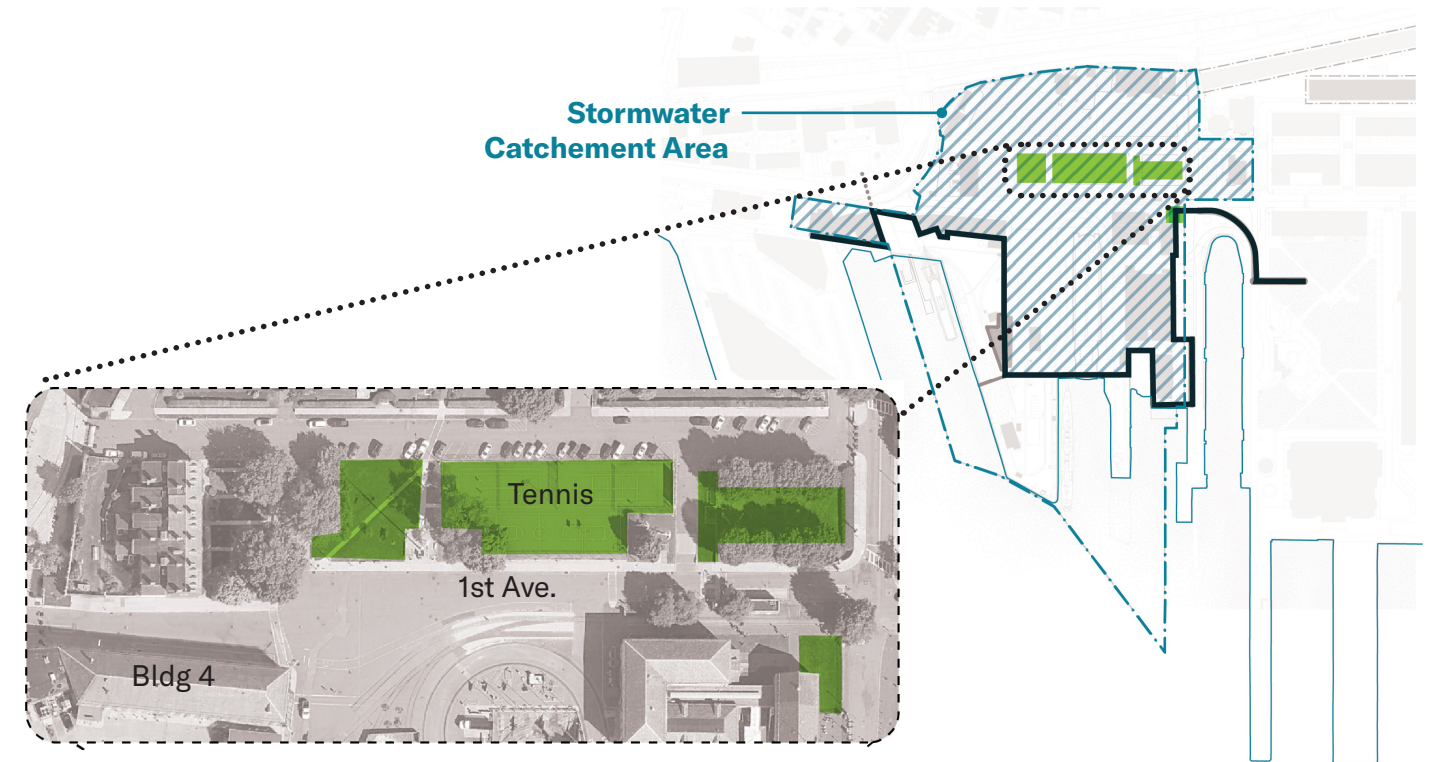
A conceptual-level stormwater analysis was performed to understand the potential stormwater runoff volume generated on site during rain storms. The analysis was performed using SewerCAD, and NOAA Atlas 14 precipitation estimates for Charlestown, MA. We evaluated the 24-hour duration storm event because the 24-hour hydrograph aligns with the design condition of a co-incident storm surge and precipitation event. The watershed area for this analysis was assumed to be the 15 acres of the NPS parcel area behind the proposed coastal flood protection infrastructure, as runoff will flow from the northern portion of the parcel to the harbor, and there appears to be fully built out collection system infrastructure outside of the boundaries of the NPS parcel to capture runoff from other nearby areas. Preliminary analysis indicates peak runoff volumes (hours 10-16 of the 24-hour storm) are on the order of 90,000-300,000 CF depending on the design storm.

Options for addressing stormwater runoff include **storing, pumping, or conveying runoff** (or some combination). During design of any coastal flood protection infrastructure, careful consideration may be given to opportunities to convey stormwater through the protective barrier, though some pumping may still be required. Storing stormwater and pumping it out or releasing it later by gravity may also be an option. As such, at least one potential storage area was identified on site. There may be space for some storage under the existing tennis courts and lawns along 1st Ave. However, their location poses a challenge in that not all stormwater runoff from the site could be easily routed there. Another option is pumping the stormwater out. The working drydock on site has pumps that are

meant to move a significant volume of water out quickly to keep ships and equipment dry while work is being performed. NPS and Navy can perform an evaluation of the dry dock pumps to understand if the existing pumps could handle both dry dock pumping and stormwater pumping during storms. New larger capacity pumps could be considered if they would be needed to maintain drydock operations while also being utilized for stormwater. If the dry dock pumps are not an option, there may be opportunities on site to reuse buildings as a stormwater pump station. **In all cases, stormwater outfalls should have backflow prevention (tide gates, etc.) installed to prevent water from the harbor flowing back into the stormwater system on site.**

Future Considerations

In February 2024, Nitsch Engineering completed a stormwater infrastructure report for the site, which documents existing infrastructure, assesses its condition, and provides recommendations for both repairs and water quality improvements. Recommendations for repairs include full or partial pipe replacement, slip lining, and cut and cap. Recommendations for water quality improvements include installation of check valves to existing outfalls to Boston Harbor, installation of water quality structures, retrofit of existing catch basins, and/or repair of existing gate valves at the harborside. The report by Nitsch Engineering did not include assessment of the existing outfalls at the site or a capacity assessment for the existing stormwater infrastructure on site to determine if the conveyance system is adequately sized to mitigate peak flows during heavy rain events. It is recommended that a capacity assessment of the existing stormwater conveyance system occurs prior to completing



any rehabilitation recommendations outlined by Nitsch to determine if any portions of the existing system should be upsized or relocated due to work proposed as part of this project. In addition, an outfalls assessment should occur to identify conditions of existing outfalls, existence of any tide gate structures or mechanisms, and evaluate their condition and effectiveness if applicable.

During further design phases, coordination with adjacent properties and Boston Water and Sewer Commission (BWSC) should occur to align strategies for stormwater management. For example, Hazen & Sawyer completed an analysis of vulnerable BWSC outfalls and outlined conceptual solutions for each outfall in a report. For the Charlestown Naval Shipyard Park, a subsurface storage area and pump station were recommended. At this time, the status of this project and planned implementation timeline is unknown. In next phases of work, coordination with BWSC and adjacent properties may result in an opportunity to collaborate on stormwater management techniques, such as routing stormwater flows to designated storage areas or pump stations.

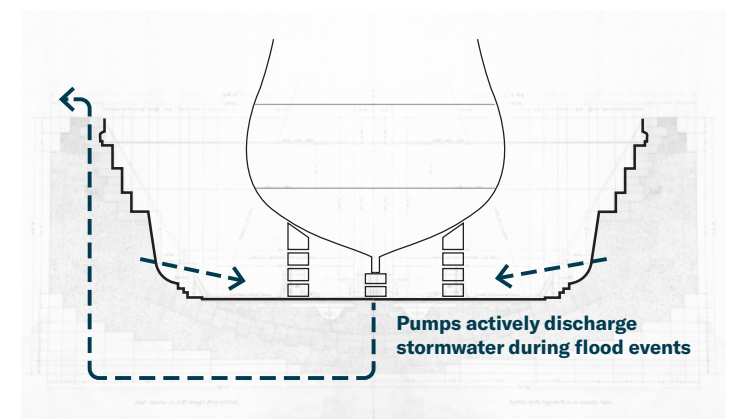
Potential Stormwater Storage - Tennis Court Subgrade

There is limited room in the Yard for installing additional stormwater storage and “wet feet” or surface storage during flood events is understood to not be viable for Naval operations during a flood event. The area highlighted in green could accommodate:

~50% of the needed **underground storage** during the peak of a 100-year storm.

Or ~ 65% of a 25-year storm.

This assumes 6' deep storage cisterns or reservoirs.



Potential Dry Dock Stormwater Pumping Option

Daily Operations, Maintenance, and Security Considerations

Key Strategies

Daily operations and security needs were central to the development of the concept design. The Yard continues to function as an active installation that supports Navy personnel living in Building 4 and key areas of the site must maintain restricted/secure access. The design preserves required security perimeters, avoids conflicts with Navy circulation and mission-critical functions, and retains operations for staff, sailors, and partners working across the yard.

The concept re-shapes one area currently designated as Naval laydown space near the Marine Railway. This space serves back-of-house functions today including some space for HVAC equipment, but mostly it is unutilized. Future public access to Pier 2 will require a reconfiguration of this zone. The concept anticipates this transition by introducing public access along the west side of Dry Dock 2 and through the Marine Railway while maintaining a secure area on the west side of the Naval Historical Center Detachment's Maintenance & Repair Facility.

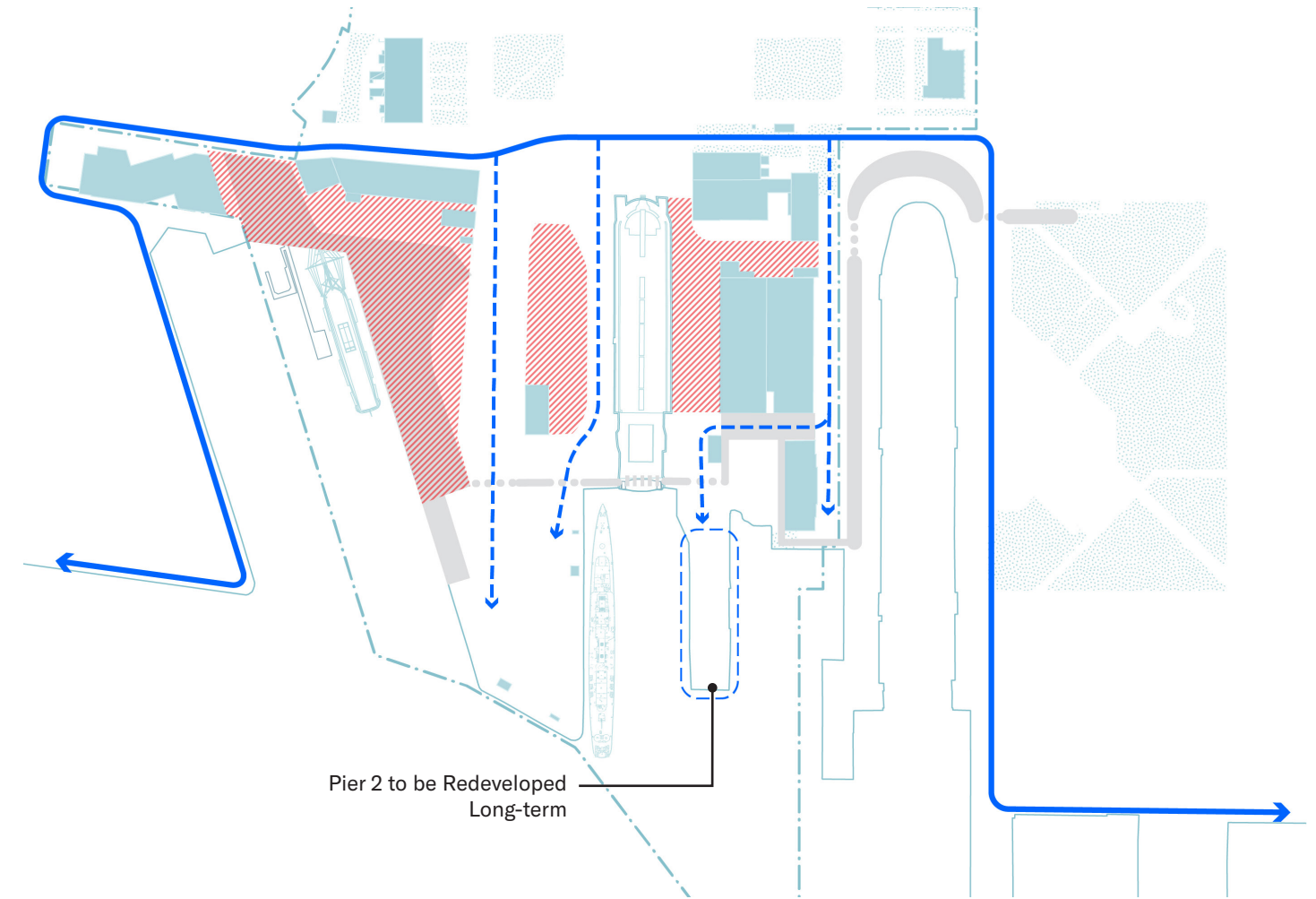
Across all areas, the design seeks to limit new maintenance responsibilities, avoid additional operational burdens, and support reliable day-to-day functioning for both NPS and the Navy. The intent is to position long-term flood resilience in a way that reinforces existing workflows rather than complicating them, ensuring that the site remains both secure and accessible.

Future Considerations

As design advances, several operational and security issues will require coordinated study among NPS, the Navy, and Naval Facilities Engineering Systems Command. At Pier 1, the partners will need to determine which arrangement best balances flood protection, secure access to Building 4, and ongoing Navy operational needs. The selected approach will influence the configuration of security fencing, checkpoints, circulation routes, and access control between public areas and Navy-managed facilities.

The anticipated future public connection to Pier 2 will also require detailed planning. While the concept identifies a feasible alignment, further coordination is needed to reconcile public circulation with existing Navy laydown and back-of-house areas. This includes defining the level of separation between public and Navy zones, evaluating sightlines and secure pathways, and assessing how visitor access can be introduced without compromising security.

Operational planning will also need to confirm how maintenance responsibilities are shared, particularly in locations where new resilience features intersect with Navy facilities. These discussions will help clarify long-term stewardship and ensure that both partners have the capacity to support the improvements. Collectively, these future decisions will help refine a design that maintains secure operations while opening new opportunities for public access and interpretation of the historic yard.



Operations and Public Access

- Harborwalk
- - - Harborwalk Spurs/
Public Access Routes
- ▨ Navy Laydown and
Secure Areas

Ongoing Flood Protection Maintenance and Operations Considerations

Key Strategies

The long-term performance of the flood protection system will depend on consistent maintenance, clear operational procedures, and reliable storage and access for staff responsible for deploying and inspecting resilience elements. The concept design incorporates a mix of permanent and deployable features intended to minimize maintenance demands while providing effective protection during coastal flood events.

Deployable systems require particular attention. The study team evaluated multiple options and each was assessed for durability, lifecycle cost, ease of deployment, storage requirements, and compatibility with sensitive historic structures. The matrix accompanying this section summarizes these findings and supports the recommended approaches - window barricades at Building 125 and rolling gates at openings between flood walls and raised areas.

Future Considerations

As the design progresses, additional study will be needed to determine detailed operations and maintenance procedures for each resilience feature. This includes identifying who is responsible for deployment, how long activation takes, how equipment is stored and inspected, and what training or staffing needs may arise. Locations with deployable elements will require clear staging plans and predictable access routes so that barriers can be mobilized quickly and safely.

Further engineering analysis will be needed to

refine the reconstruction or adaptation approach for the Dry Dock 1 caisson. The team will need to confirm structural requirements, sealing mechanisms, and operational protocols that account for higher design flood elevations. The Navy will also need to determine whether its operations can support keeping the caisson in place under most conditions or deploying it in the case of an emergency or impending coastal flood event.

As the system matures, both NPS and the Navy will need to develop long-term maintenance schedules, documentation, and training protocols. These steps will help ensure that the flood protection system remains durable, functional, and aligned with the historic and operational context of the Charlestown Navy Yard.

Deployable Type	Durability	Lifecycle Cost	Ease of Deployment	Storage Requirements	Structural Compatibility
AquaFence	High (Salt-resistant, 10-15 yrs)	Moderate-High	Moderate (requires training, 2-3 people per section; may need surface protection for historic pavements)	Moderate (stackable, but needs dry, sheltered storage)	Good (protects facades, minimal anchoring, but heavy units)
Modular Flood Barrier	Moderate (prone to salt, 7-12 yrs)	Moderate	Easy (light, tool-free, quick assembly; low impact on surroundings)	Low-Moderate (stackable, fits in small spaces)	Good (minimal ground disturbance, flexible around buildings)
Water Filled Flood Tubes	Moderate (can degrade, 5-8 yrs)	Low-Moderate	Easy (fast, but water source needed and heavy when filled)	Moderate-High (bulky; may be hard to store on-site)	Fair (needs flat, non-porous surfaces; potential for water leakage or pressure on fragile structures)
Flood Barricade	Moderate (plastic/metal, 7-10 yrs)	Moderate	Easy (quick set-up, lightweight, minimal ground impact)	Low (compact, good for urban sites)	Good (flexible layout, minimal risk to buildings)
Deployable Flood Wall System	High (engineered, 15-25 yrs)	High	Moderate (requires crew, mechanical aids; may need permits for historic buildings)	High (large/stored off-site or in dedicated space)	Excellent (custom fit, can be designed for historic compatibility)
Passive Flood Barriers (Aqua Trigger)	High (auto, 15-25 yrs)	High	Very Easy (self-activating, no deployment labor; must be pre-installed)	Low-Moderate (integrated, little visible storage)	Excellent (embedded, minimal visual/physical impact, suitable for preservation)
Rolling Gate	Very High (engineered, 20+ yrs)	Very High	Moderate (manual/mechanical operation; permanent installation may conflict with historic character)	High (requires dedicated fixed space)	Excellent structurally, but may have adverse visual/heritage impact; requires careful architectural integration



Deployable Barriers for the Yard

(Left) Rolling Flood Gate

(Right) Stackable window barriers for Building 125

Rough Order of Magnitude Costs

Construction Cost Ranges by Area

1A - Pier 1 at USSC Option 1	\$18.6 - 23.2 Million
1B - Pier 1 at USSC Option 2	\$10.7 - 13.4 Million +\$6.1 M for barge impact resistance
2 - Pier 1 Public Access	\$3.1 - 3.9 Million +\$1.7 M for barge impact resistance
3 - Drydock Caisson	\$38 - 47.5 Million
4 - Pier 2 and Marine Railway	\$4.1 - 5.1 Million +4.25 M for barge impact resistance
5 - Building 125	\$1.9 - 2.4 Million +\$2 M for barge impact resistance
6 - Drydock 2 Green Gateway	\$7.6 - 9.5 Million + \$7.4 M for barge impact resistance
7 - Drydock 2 Overlook	\$4.6 - 5.8 Million + \$3.7 M for barge impact resistance

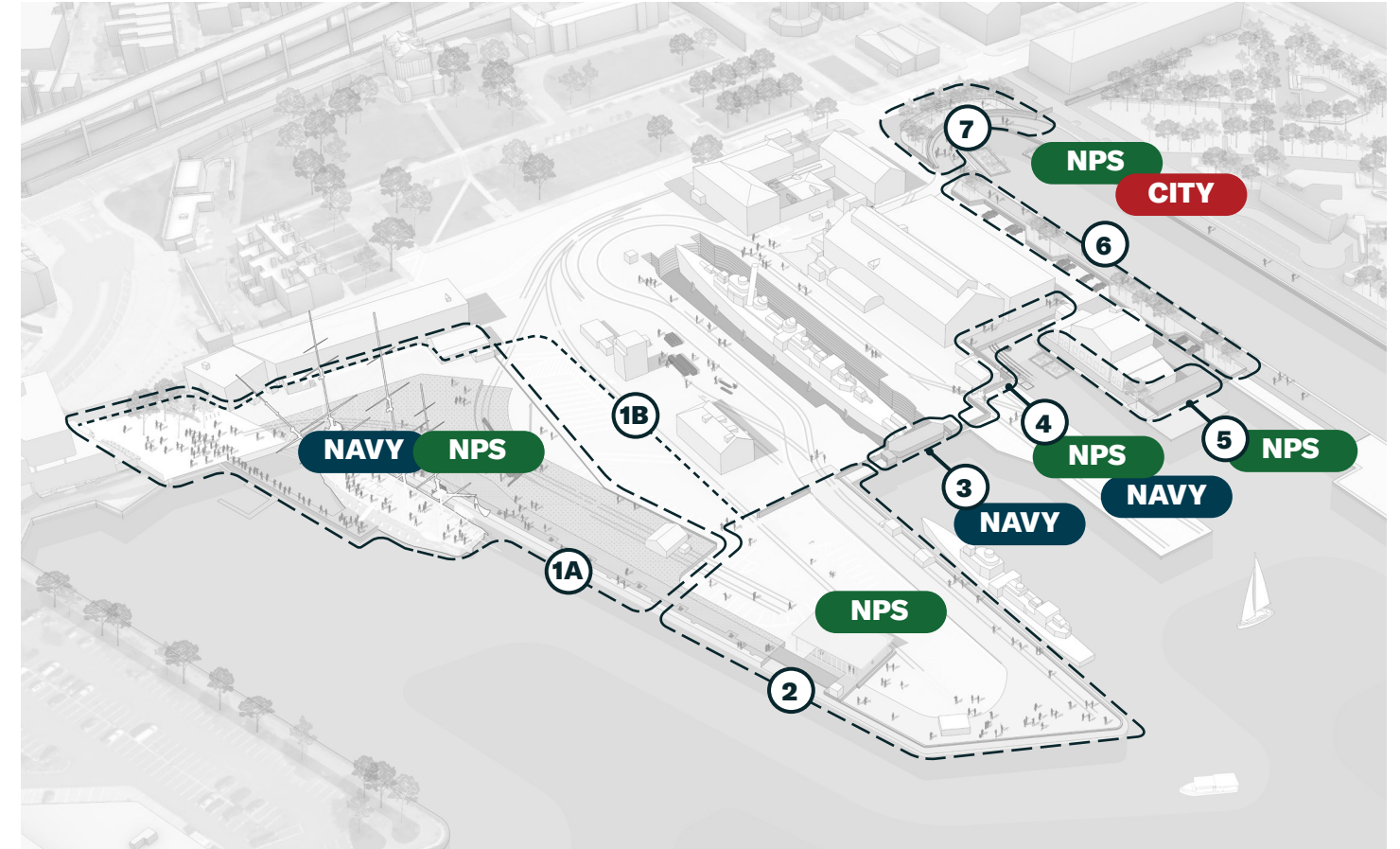
Cost Assumptions

The totals above represent preliminary construction cost estimates, shown as a low-range baseline and a high range that includes a 25 percent design and construction contingency. Soft costs, such as design fees, general conditions, insurance, and bonding, are not included. Design, permitting, and documentation costs are anticipated to add approximately 10 to 12 percent to construction costs.

Estimates reflect current pricing and labor conditions. Future cost and schedule

refinement should account for escalation, typically estimated at approximately 4 percent per year until the anticipated mid-point of construction. Given current market shifts, escalation assumptions will be important for accurate long-term projections.

Costs reflect required resilience measures and exclude optional amenities not essential to flood protection, critical operations, or visitor access. A more detailed breakdown of assumptions and exclusions are documented in Appendix H.



Potential Cost Sharing Opportunities

Funding and Cost-Sharing Opportunities

Boston Harbor Now conducted a review of potential local, state, and federal funding sources available at the time of this study. Many early funding opportunities support greening, open space, and public realm improvements and are accessible primarily to state agencies, municipalities, and nonprofit organizations. As a result, full implementation will likely require interagency partnerships. See Appendix G for a full matrix of potential funding sources.

Given the critical role that flood protection will

play for Navy operations at Pier 1, the Dry dock, and areas around Building 24, coordination with the Navy and Department of Defense will be important to align resilience investments that support the continued use and protection of key operational infrastructure, alongside other public funding sources. Future phases of study and design will also need to coordinate closely with the Navy to ensure that proposed solutions align with applicable Navy design standards and capital planning processes to ensure clear and feasible funding pathways.

Permitting + Reviews

Key Permitting Reviews

Permitting and compliance review processes for flood risk reduction projects are essential to ensure that projects are constructed to appropriate standards, protecting lives and property while safeguarding the environment. These processes also ensure legal compliance, promote transparency and stakeholder engagement, and facilitate coordination across federal, state, and local agencies to prevent duplication and conflict.

The specific permits required for a project depend on factors such as location, scope, potential environmental impacts, regulatory jurisdiction, historical significance, land ownership, and funding sources. Federal funding, in particular, can trigger additional permit requirements such as NEPA (National Environmental Policy Act), Section 106 (National Historic Preservation Act), and Section 7 (Endangered Species Act), which necessitate further coordination with federal agencies.

For this project site, most flood protection features are located landward, outside the jurisdiction of USACE Section 404 and Section 10 permits. However, the inclusion of modified or replaced caisson as part of the flood risk reduction system will require these federal permits due to work within navigable waters. Inclusion of these permits will likely increase time necessary to secure permits prior to construction activities.

The table at right outlines the permits likely required for the project, organized by federal, state, and local levels.

Future Considerations

For large infrastructure projects, a 12–24 month permitting timeline is common, but early coordination can sometimes streamline the process. To facilitate an efficient and successful permitting process for the flood risk reduction project, it is recommended to pursue concurrent permit reviews where possible, such as submitting joint applications to the USACE and MassDEP, to streamline regulatory approvals. Early and proactive engagement with regulatory agencies is essential; initiating coordination meetings before formal application submission can help identify potential issues and reduce the risk of delays. Public engagement should be prioritized, as several permits require public notice and hearings that may affect timelines; planning for these requirements early in the process will help manage expectations and schedules. Additionally, construction activities in waterways should be carefully scheduled to account for seasonal restrictions designed to protect fish, wildlife, and sensitive habitats. The project team should remain responsive to agency feedback, as requests for additional information or significant design revisions can extend review periods. Overall, a collaborative and transparent approach with all stakeholders and permitting authorities will minimize delays and ensure compliance with all regulatory requirements.

Agency	Permit	Trigger
FEDERAL		
U.S. Army Corps of Engineers	Section 404 and Section 10 – Assumed Individual Permit (IP)	Caisson
U.S. Fish and Wildlife Service	Section 7 Endangered Species Act Consultation	Supporting IP
National Oceanic and Atmospheric (NOAA) National Marine Fisheries Service (NMFS)	"Section 7 Endangered Species Act Consultation Essential Fish Habitat Consultation"	Supporting IP
U.S. Environmental Protection Agency	National Pollutant Discharge Elimination System Construction General Permit	Entire Project
U.S. Department of Interior	National Environmental Policy Act - Environmental Assessment	Entire Project. Assumed based upon NPS lead effort. MEPA if State led.
U.S. Coast Guard	Notice to Mariners	If construction requires water access
U.S. National Park Service	Section 106 Consultation with Massachusetts State Historic Preservation Office	Entire Project
STATE		
Massachusetts Environmental Policy Act (MEPA) Office	MEPA Review. Environmental Notification Form, with potential for Environmental Impact Report	Entire Project
Massachusetts Department of Environmental Protection	Water Quality Certification	Caisson
Massachusetts Department of Environmental Protection	Massachusetts Public Waterfront Act - Chapter 91	Caisson. Existing Chapter 91 could be still valid.
Massachusetts Department of Environmental Protection	Massachusetts Endangered Species Act (MESA) Consultation	Entire Project
Massachusetts Office of Coastal Zone Management	Federal Consistency Review	Caisson
LOCAL		
Boston Conservation Commission	Notice of Intent for Massachusetts and Boston Wetland Protection Regulations	Caisson and landward buffers
Boston Street Opening Permit	Public Works	Entire Project

Next Steps

A Roadmap for Collaborative Implementation

The Concept Plan establishes a unified vision for protecting the yard’s essential historic and operational assets from coastal flood risks. The design concept blends a Multi-Purpose Barrier and Elevated Pier approach, targeting a 2050 Design Flood Elevation while ensuring the system is adaptable for the long-term 2070 DFE. The successful implementation of this vision now depends on achieving final interagency consensus, performing critical technical evaluations, and developing a prioritization and phasing strategy.

Key Open Items and Decision Points

The first step ahead is resolving critical decisions that require coordinated consensus among the major stakeholders including NPS, the US Navy, NAVFAC, and the City of Boston.

Final Pier 1 Approach: The most immediate decision is to confirm a single preferred alignment for flood protection at Pier 1, which secures USS *Constitution* and key naval operations. NPS, Navy Command, and NAVFAC must reconvene to finalize this direction, drawing on resilience lessons learned (e.g., from the Portsmouth Navy Yard) and balancing operational needs against flood protection priorities and costs.

Dry dock 1: The resilience approach for Dry Dock 1 should be confirmed by determining whether to adapt or reconstruct the caisson gate, and whether it can act as an integral piece of both the flood protection and stormwater discharge system.

Maintenance and Operations Responsibilities: A formal agreement defining shared maintenance responsibilities is needed, especially where new

resilience features interface with Navy facilities.

Tie-off Locations and Shared Improvements with the City: NPS and the City of Boston should coordinate on key transition points between studies for the East Charlestown waterfront, the NPS property, and the West Charlestown waterfront. The City, NPS, and the Navy should align on maintenance and cost responsibilities for pieces of the alignment that straddle NPS and City property, such as the Dry Dock 2 Green Gateway and Overlook.

Future Enabling and Design Work

To transition from conceptual studies to detailed design and precision cost estimates, several technical assessments must be completed:

Stormwater Infrastructure: As the Stormwater Upgrades project progresses, findings should be integrated into the Yard’s Resilience Planning. This study will inform the design of necessary upsizing, relocation, or dedicated storage/pumping capacity.

Structural Investigations: Future phases must build out more detailed site surveys, and technical assessments of the existing waterfront structures, specifically the impacted bulkheads, piers, and buildings to determine where structural upgrades are feasible or necessary to support the load of elevated piers or extensive flood walls. Geotechnical borings and ground penetrating radar surveys should be carried out to determine the locations and conditions of remnant subgrade structures.

DFE Adaptable Foundations: Rough sizing of necessary flood wall foundations should be determined and overlaid onto the alignment to assess potential impacts with subgrade structures and utilities.

High-Level Lookahead

Implementation will require regulatory coordination and prioritization.

Future implementation must be guided by clear prioritization criteria, balancing major long-term protection with more immediate “early wins”. NPS and partner organizations can work to align on key criteria, which may include Independent Effectiveness (addressing critical flood

pathways that pose near-term risk by the 2030 DFE), Available Funding (allowing piecemeal construction based on secured financing), and maximizing Co-Benefits (enhancing visitor experience, public access, operations, and waterfront improvements).

Altogether, these steps will transition the concept from a shared vision to a coordinated resilience project that will safeguard this cherished landmark site for decades to come.

Phase	Duration	Key Activities and Partners	Regulatory Considerations
Internal Alignment	3-6 Months	Finalize Pier 1 preferred option (NPS, NAVY, NAVFAC). Finalize coordination with City’s parallel resilience studies.	NEPA/SHPO Compliance initiation (TBD).
Schematic Or Design Development (DD)	Ongoing	Advance design to 35%–60% detail. Perform structural/ stormwater capacity studies. Refine cost precision.	Initiate Concurrent Permitting Reviews (USACE Section 404, MA DEP 401/Chapter 91, Federal Consistency). Address Federal Floodplain FSOF review.
Prioritization & Phasing	Ongoing	Define criteria for near-term implementation.	Permitting process typically requires 12–24 months; proactive coordination is crucial.



Photo Credit: National Park Service



Photo Credit: Arlan Foneşca
 Source: Boston National Historic Park
 Online Image Gallery

Appendices and References

- **Appendix A - Technical Analysis Presentation**
- **Appendix B - Technical Analysis Civil Report**
- **Appendix C - Technical Analysis Structural Report**
- **Appendix D - Pier 1 Structural Memo**
- **Appendix E - Dry Dock 2 Structural Memo**
- **Appendix F - Detailed Revised DFEs**
- **Appendix G - Potential Public Funding Sources Matrix**
- **Appendix H - Detailed ROM Cost Breakout**

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Agency
Landscape + Planning

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