TECHNICAL ANALYSIS & RESILIENT SCHEMATIC DESIGN DEVELOPMENT OPTIONS FOR DORCHESTER'S WATERFRONT

EXECUTIVE SUMMARY

JUNE 2023

boston planning & development agency

PREPARED BY:

SCAPE
TETRA TECH
WOODS HOLE GROUP
DAWOOD

ADDITIONAL ACKNOWLEDGEMENTS

Boston Water & Sewer Commission (BWSC)

John Sullivan

Charlie Jewell

Addison Minott

City of Boston

Arthur Jemison, Chief of Planning and BPDA Director

Rev. Mariama White-Hammond, Chief of Environment Energy and Open Spaces

Chris Osgood, Senior Advisor to the Mayor

Ross Cochran, Office of Neighborhood Services Dorchester Representative

Massachusetts Bay Transportation Authority (MBTA)

Hannah Lyons-Galante

Massachusetts Department of Transportation (MassDOT)

Benjamin Muller

Hung Pham

Michael Trepanier

Massachusetts Office of Coastal Zone Management (CZM)

Patricia Bowie

Joanna Yelen

The City of Boston would like to thank the Commonwealth of Massachusetts Office of Coastal Zone Management for their generous support.

boston planning & development agency

PROJECT TEAM

Boston Planning & Development Agency

Richard McGuinness, Deputy Director for Climate Change and Environmental Planning

Delaney Morris, Planner II: Resilience and Waterfront Planning (Project Manager)

Mark McGonagle, Deputy Director of Community Engagement

Naoise McDonnell, Community Engagement Manager

Jill Zick, Senior Landscape Architect

City of Boston

Dr. Alison Brizius, Commissioner, Environment Department

Catherine McCandless, Climate Resilience Project Manager

Massachusetts Department of Conservation and Recreation

Sarah White, Director of Climate Resilience

Former Team Members

Chris Busch, Assistant Deputy Director for Climate Change and Environmental Planning, BPDA

Grace Ng, Landscape Architect, BPDA

Consultant Team

SCAPE Landscape Architecture

Pippa Brashear, RLA, Resilience Principal, Principal-in-Charge

John Donnelly, RLA, Technical Principal

Laura Marett, RLA, Director of Landscape Planning, Project Director

Linh Kim Pham, RLA, Senior Associate, Project Manager

Despo Thoma, Senior Associate, Resilience Lead

Maria Palomares, Senior Designer

Nathalie Mitchell, Designer

Tetra Tech

Jason Hellendrung, ASLA, PLA Vice President, Planning & Design

Tony Omobono, P.E. Vice President, Municipal Infrastructure

Katie Moniz, P.E., AICP, CFM, Director, Permitting & Planning

Jake Oldenburger, P.E., CFM, ENV SP, Senior Civil Engineer

Tetra Tech *(continued)*

Ken Fields, Senior Environmental Planner

Amanda Retta, P.E. Civil Engineer

Natty King, Environmental Planner

Scott Vose, Project Economist

Josh Chabot, P.E. Cost Estimate & Construction

Pete Nix, Geotechnical Engineer

Woods Hole Group

Kirk Bosma, Senior Coastal Engineer, Innovation Director

Nasser Brahim, Senior Climate Resiliency Specialist

Grace Medley, Coastal Scientist

Zach Stromer, Coastal Scientist

Dawood

Noel Poynton, Lead Surveyor

Michael Cridge, Lead Drafter

PARTNERSHIPS

Partners Involved in the Project Design

The Dorchester Resilient Waterfront Project at Tenean Beach / Conley Street is a catalytic project identified in the 2020 Climate Ready Boston (CRB) Coastal Resilience Solutions for Dorchester report. Given this near-term need to address coastal flooding from sea level rise and storm surge, the Boston Planning & Development Agency (BPDA) took the lead on advancing this project by applying for and receiving a Coastal Resilience Grant from the Massachusetts Office of Coastal Zone Management. The team was ultimately awarded this grant whose aim is to advance the conceptual project in Climate Ready Boston to 30% schematic design. While the Boston Planning & Development Agency took the project management lead, the City of Boston's Environment Department was the project management partner. The Massachusetts Department of Conservation and Recreation (DCR), the landowner of Tenean Beach, has also been a key partner thus far.

This project begins to illustrate the complex nature of resilient design options for the City of Boston. The city's 47-mile coastline falls under ownership by various public and private partners. The City of Boston's objective as laid out in the CRB reports is to develop designs to respond to all areas of the coastline effectively while protecting and enhancing our sacred and valuable waterfront public realm. No design or project is intended to use the public realm as sacrificial zones to flooding. Rather, the intent is to strengthen those areas for the public benefit and use in the long term.

Tenean Beach, owned by DCR, is also abutted by other State entities such as the Massachusetts Bay Transportation Authority (MBTA) and the Massachusetts Department of Transportation (MassDOT) who have also been involved in the development of the schematic design options for this grant funded project. Tenean Beach is also the site of several outfalls which the Boston Water and Sewer Commission (BWSC) control and their technical expertise has been extremely valuable to this project as well.

Besides our governmental partners, the Resilient Dorchester Project at Tenean Beach / Conley Street would not have been possible without the technical expertise of our consultant team led by SCAPE Landscape Architecture.

The community has also played an important part in helping to develop this project. We would like to thank and acknowledge everyone who provided valuable feedback and insight that helped refine the proposed designs including the Port Norfolk, Dorchester, and Boston at-large communities, the people representing various Community Based Organizations and Non-Profits, and the elected officials that represent this area of our city.

The schematic design created as a result of this grant is only the beginning of what is to come on this property. Continued collaboration and cooperation between the City and State is needed to fully deliver the final implementation of this project for the future protection of Dorchester. We are hopeful that this project acts as a lesson for future CRB implementation and we will continue to use this as an example for not only ourselves but for other municipalities across the region and beyond.

boston planning & development agency

IN PARTNERSHIP WITH

City of Boston Environment

dcr MASSACHUSETTS DEPARTMENT OF CONSERVATION AND RECREATION

CONSULTANT TEAM

SCAPE — LANDSCAPE ARCHITECTURE

TETRA TECH — COASTAL ENGINEERING DESIGN

WOODS HOLE GROUP — COASTAL MODELING

DAWOOD EST. 1992 — SITE SURVEY

GRANT FUNDED BY

CZM

FY23 GRANT

CONTENTS

INTRODUCTION

PLANNING FOR CLIMATE CHANGE

Climate Ready Boston

The City of Boston released the Climate Ready Boston report in 2016. This report included a vulnerability assessment of current and potential future risks associated with climate change, updated climate projections, and an implementation roadmap that identified the areas of the City that are projected to be the most vulnerable to extreme heat, stormwater flooding, and coastal flooding from sea-level rise and storms. The report also outlined next steps to help the City prioritize subsequent planning efforts and projects to protect Boston's communities, buildings, infrastructure, and economy from these risks. Since 2016, the Climate Ready Boston report has evolved into the City's ongoing initiative to adapt to the current and projected impacts of climate change. The primary focus of Climate Ready Boston has been to address coastal flooding in the City of Boston, a coastal city with 47 miles of shoreline.

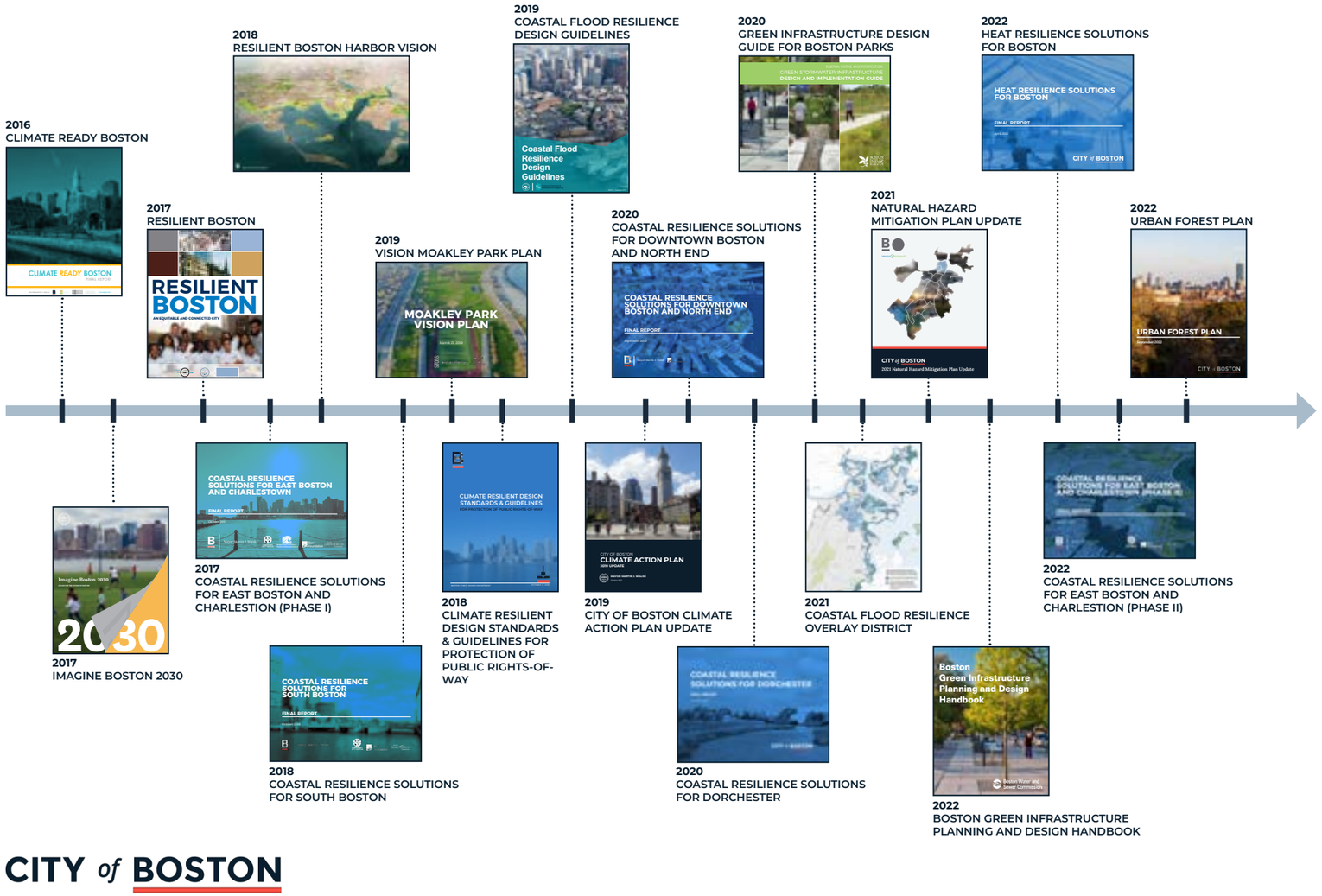


Figure 1: Timeline graphic from Climate Ready Boston report, showing various initiatives

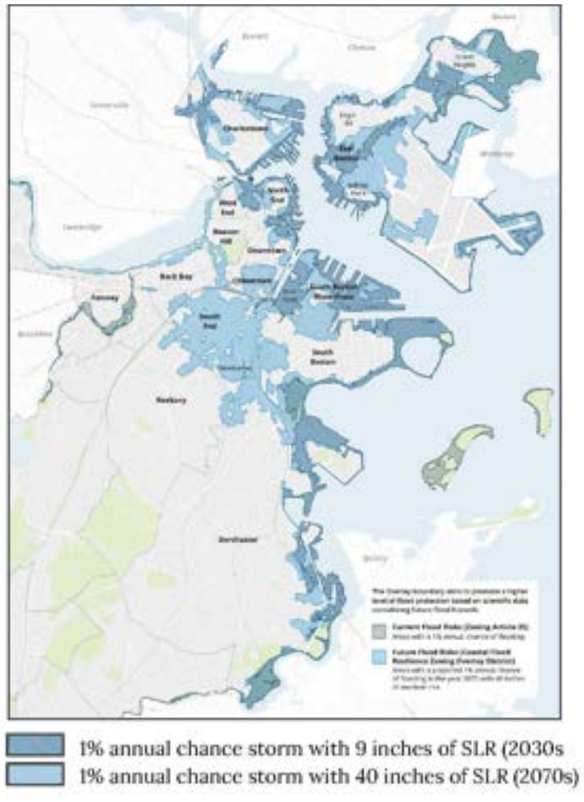
PLANNING FOR CLIMATE CHANGE

Neighborhood-Level Coastal Resilience Planning

Between 2016 and 2022, the City completed neighborhood-level coastal resilience planning studies in each of Boston's five waterfront neighborhoods. Informed by community and stakeholder engagement, each of these plans present conceptual designs that would address coastal flood risk in the near- and long-term. In October of 2020, the City released the Coastal Resilience Solutions for Dorchester plan. The CRS identified Tenean Beach and the Conley Street underpass as high-priority areas given the present-day flood risk at the beach and a flood pathway originating from this area that poses a threat to the broader Dorchester community.

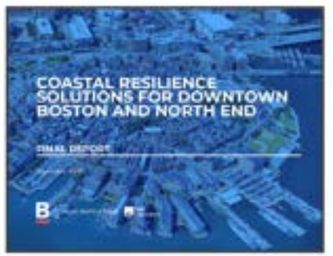
Read more about Coastal Resilience Solutions for Dorchester (2020) report here:

https://www.boston.gov/departments/environment/climate-ready-boston/climate-ready-dorchester



East Boston & Charlestown Phase 1 (2017)

South Boston (2018)



North End & Downtown (2020)

Dorchester (2020)

East Boston & Charlestown Phase 2 (2022)

Figure 2: Graphic showing the five coastal resilience plans for Boston and a map of flood risks

WHY A PROJECT HERE, NOW?

Coastal storm surge and sea-level rise impacts in Dorchester

Coastal flooding in Dorchester has a profound impact on communities, causing physical damage, stress, displacement costs, and business interruption. It also disrupts vital infrastructure systems, such as transportation, stormwater infrastructure, and other essential facilities relied upon by residents.

Through coastal modeling efforts, multiple flood pathways have been identified along the Dorchester waterfront. These flood pathways are low-lying areas that allow water to enter inland, causing damage to critical community and transportation infrastructure. As a result of climate change, there will be an increase in the frequency of severe storms and sea-level rise, further exacerbating flood risk.

The following figures are from the Coastal Resilience Solutions for Dorchester (2020) report. For further information and to access the final report, please use the link provided on page 12.

Fig. A shows the flood pathways created during a 1% annual chance flood in 2030, which includes both fringe and inland flooding.

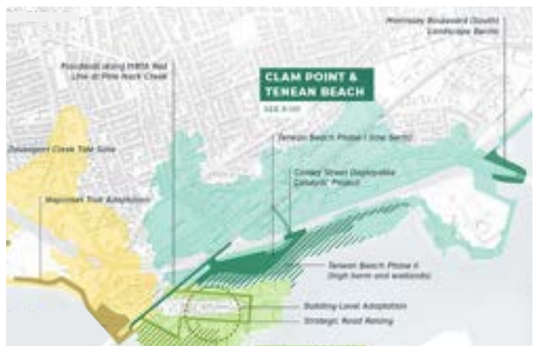
Fig. B. shows this condition in 2070.

At a high-level, these help illustrate the extent of infrastructural and community impact. These will be articulated in finer detail in later pages of the executive summary.

Figure 3: Coastal flooding - 9 inches of SLR (2030s) in the near term

Risk Zones

The 2020 Coastal Resilience Solutions for Dorchester report identified five risk zones with the aim of developing both short-term and long-term solutions to reduce the risks of coastal flooding and sea-level rise. These risk zones are specific to Dorchester's diverse shoreline and population, and each zone is characterized by a series of flood pathways or adjacent areas susceptible to flooding. This particular project is located in the Clam Point and Tenean Beach risk zone, which encompasses three distinct flood pathways, each activated at different flood elevations. The first pathway projected to be activated is at Tenean Beach/ Conley St., specifically at the I-93 underpass. The main objective of this project is to close this flood pathway through the design at Tenean Beach.



Clam Point and Tenean Beach risk zone as identified in Climate Ready Dorchester (CRD)

Figure 4: Coastal flooding - 40 inches of SLR (2070s) in the long term

WHAT IS AT RISK IF WE DO NOTHING?

Without intervention, rising sea levels and storm surges in Dorchester pose a significant risk to buildings, transportation infrastructure, and stormwater systems.

Buildings

In the near future, a significant number of structures are at risk of flooding due to rising sea levels. This flooding could result in substantial damages amounting to millions of dollars ($36 million estimated in the short term, for a 1% Annual Chance Flood). In the long term, various types of buildings, including residential, commercial, governmental, industrial, and educational, may be impacted, along with a small number of mixed-use buildings expected to be minimally affected.

Transportation Infrastructure

The roads and transportation system in Dorchester face frequent and severe floods, posing risks to the community. Immediate concerns include the vulnerability of the MBTA Red Line and Morrissey Boulevard, which could lead to isolations and disruptions in emergency response. By the end of the century, all evacuation routes, including I-93 South, Neponset Avenue, and Gallivan Boulevard, will be susceptible to coastal flooding and sea-level rise. Closure of Morrissey Boulevard due to flooding could result in significant daily delay costs, while delays at Red Line stations could also incur additional expenses.

Stormwater Infrastructure

As sea levels rise and storms become more severe, the existing stormwater system in Dorchester will struggle to cope. Low-lying pipes, outfalls, and facilities located in floodplains will be particularly affected. Additionally, stormwater outlets without tide gates may contribute to flooding in surrounding low-lying areas. With long-term sea level rise, and even near-term coastal storm events, the stormwater system may not be able to discharge due to high water levels at the outlets. Stormwater storage and pumping infrastructure is currently lacking to mitigate these impacts.

LEGEND

- *1% Annual Chance Flood with 40 inches of SLR (2070s)*
- *Planned or Ongoing Project*

POTENTIALLY IMPACTED BUILDINGS BY LAND USE IN A 1% FLOOD WITH 40 INCHES OF SLR

- *Residential*
- *Commercial*
- *Heavy Commercial*
- *Governmental*
- *Industrial*
- *Educational*
- *Other (Tax Exempt)*
- *Mixed Use*

Sources: Boston Open Data, MASSGIS, BH-FRM, MAPC

Figure 5: Potentially impacted buildings in a 1% Annual Chance Flood with 40 inches SLR (2070s)

LEGEND

- *1% Annual Chance Flood with 40 inches of SLR (2070s)*
- *Planned or Ongoing Project*
- *Roadway*
- *Rail Station*
- *Rail Line*
- *Pump Station*
- *Tide Gate*
- *Outfall*
- *Harborwalk*
- *Neponset Greenway Trail*

Sources: Boston Open Data, MASSGIS, BH-FRM

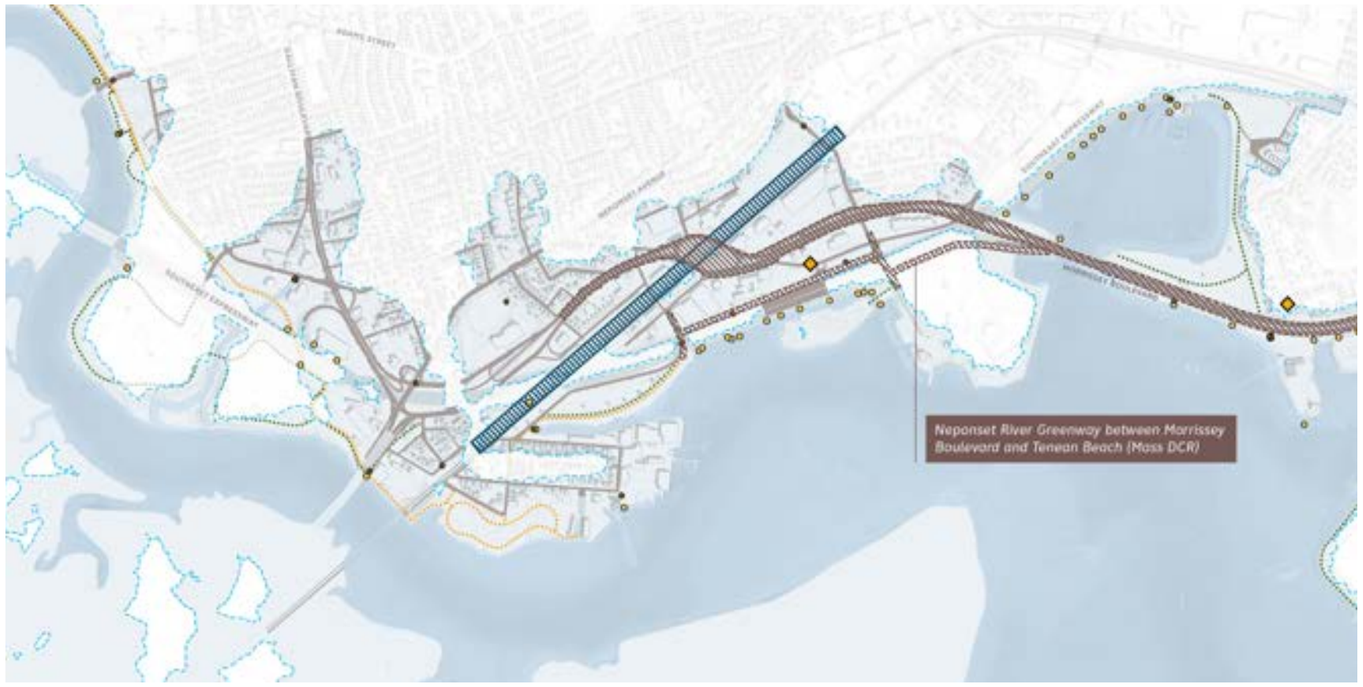


Figure 6: Potentially impacted infrastructure in a 1% Annual Chance Flood with 40 inches SLR (2070s)

WHO IS AT RISK IF WE DO NOTHING?

Community Assets

Dorchester is a thriving neighborhood with a rich multicultural heritage and valuable community and ecological assets.

The neighborhood's community assets, such as libraries, clinics, schools, and associations, play a crucial role in promoting the health and well-being of residents. However, many of these assets are located in the floodplain, putting them at risk of flooding due to projected sea-level rise. Facilities like the Leahy Holloran Community Center and McCormack Middle School are particularly vulnerable. It is important to protect these assets from the impacts of climate change to ensure their continued contribution to the community.

Ecological Assets

Dorchester's ecological assets, including beloved open spaces like Malibu Beach, Tenean Beach, and the Neponset River wetlands, are essential for ecological health and risk reduction. However, anticipated sea-level rise will result in monthly tidal flooding, which will alter the ecosystem's functions and undermine the resilience provided by these natural areas.

Multicultural Heritage

Despite the challenges posed by climate change, Dorchester's multicultural heritage, influenced by Vietnamese, Caribbean, and Irish cultures, remains a source of strength and unity. The blending of these cultures fosters mutual understanding, appreciation, and pride in the neighborhood's diverse traditions. Dorchester exemplifies the power of cultural exchange, where different communities come together, enrich one another, and create a vibrant mosaic of cultural heritage.

By recognizing and preserving its community and ecological assets, while embracing its diverse cultural heritage, Dorchester can pave the way towards a sustainable and inclusive future, where both its physical and cultural landscapes flourish.

VIETNAMESE LUNAR NEW YEAR CELEBRATION

IRISH HERITAGE FESTIVAL CELEBRATION

DORCHESTER DAY PARADE

CARIBBEAN CARNIVAL PARADE

Figure 7: Potentially impacted community assets in a 1% Annual Chance Flood with 40 inches SLR (2070s)

PROJECT GOALS & EVALUATION CRITERIA

Project Goals

The design team worked closely with the City, key stakeholders, and community members to develop project goals to guide the development of the design for Tenean Beach.

The primary project goal is to reduce flood risk to inland neighborhoods and Morrissey Boulevard during both everyday tidal events and larger flood events.

Goals include the preservation, protection, and enhancement of waterfront access, recreation, local ecology and open space. Complimentary goals also include the improvement and increased compatibility with adaptation efforts to protect critical transportation.

1 Provide flood risk reduction to inland neighborhoods as well as DCR's Morrissey Boulevard during:
(a) larger/rare flood events,
(b) tidal flood events.

2 Preserve, protect, and enhance waterfront access and recreation by providing flood risk reduction to DCR's assets at Tenean Beach.

3 Preserve, protect, and enhance local ecology and open space.

4 Improve or be compatible with adaptation efforts of critical transportation infrastructure, such as (1) the Southeast Expressway, (2) MBTA Rail Line, and (3) evacuation routes from Port Norfolk

5 Improve or align with adaptation efforts of stormwater infrastructure.

Evaluation Criteria

The Climate Ready Boston evaluation criteria were used as a tool to weigh design options and ensure that the final design embodies the City's goals for coastal resilience projects. The criteria include:

- Effectiveness: How well does the project meet its resilience goals?
- Feasibility and Maintenance: Is the project feasible and what level of maintenance is required?
- Design Life and Adaptability: What is the design life of the project and can it be adapted to future conditions?
- Environmental and Public Health Benefits: How will the project reduce pollution, improve habitat, or promote healthy activities and human wellbeing?
- Social Equity and Quality of Life: Does the project offer co-benefits that support social equity and quality of life for the surrounding community?

Figure 8: Icons illustrating Climate Ready Boston evaluation criteria

THIS PROJECT AS A FIRST STEP

Near-term Catalytic Project with Long-term Vision

In the near-term, the flood pathway at Conley St./I-93 underpass is activated and causes localized flooding in the adjacent industrial and residential areas inland, in addition to impacting critical transportation and access infrastructure for the surrounding community.

In the long-term, all three flood pathways (that are part of this defined Risk Zone, see Risk Zone on pg 15) are activated, and extensive inland flooding occurs and monthly tidal flooding at Tenean Beach expands further inland to Conley Street. Critical transportation infrastructure and access, such as the local road network, pathways, and MBTA Red Line, are all vulnerable.

This project seeks to close the near-term pathway, and aims to reduce coastal flood risk to areas that are projected to experience coastal flood risk in the near term (2030s, see Fig. 9). The project is the first step towards a long-term continuous line of protection along the coast that reduces coastal flood risk from all three pathways (see Fig. 11).

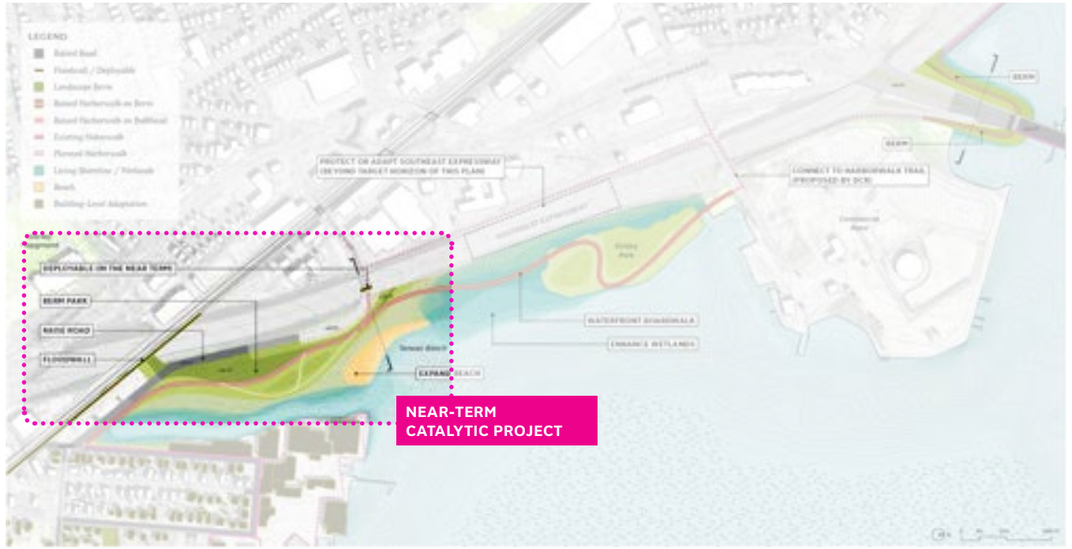


Figure 10: Map illustrating the near-term catalytic project extents

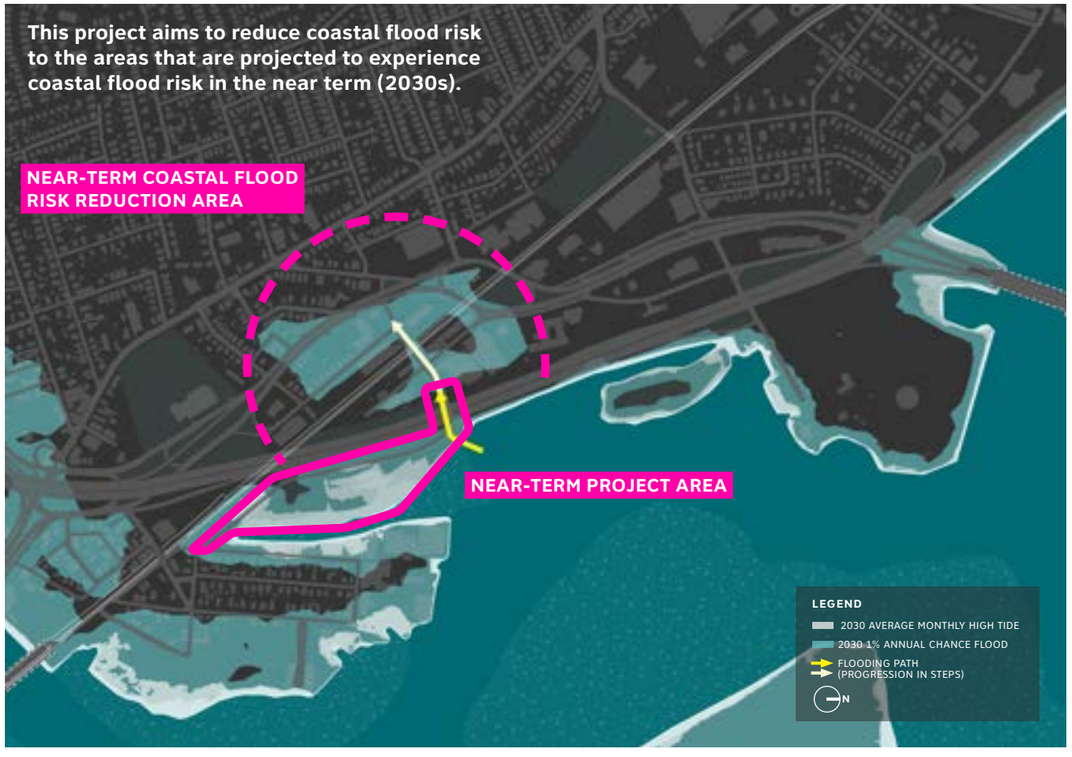


Figure 9: Coastal flooding - 9 inches of SLR (2030s) in the near term

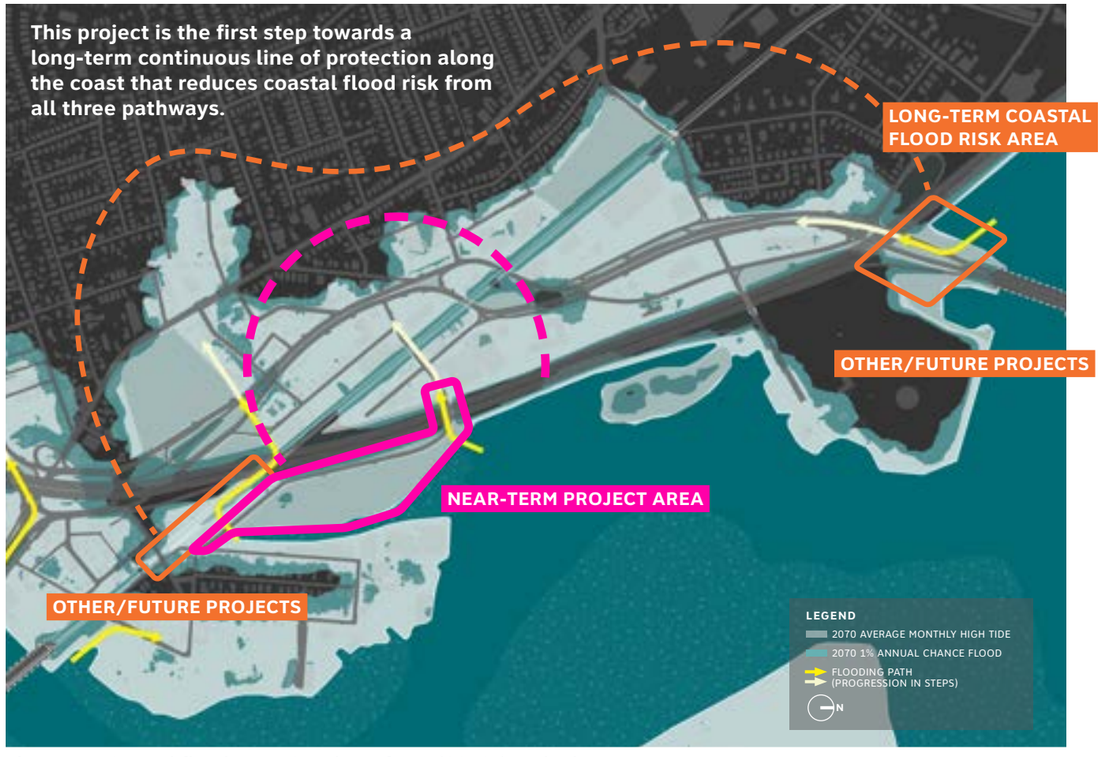


Figure 11: Coastal flooding - 40 inches of SLR (2070s) in the long term

PROJECT DESCRIPTION

SITE CONTEXT

Project Extents and Coordination

The project site – which measures approximately 435,600 square feet (sf) or more than 10 acres – consists of open space owned by the Massachusetts Department of Conservation and Recreation (DCR). The site today includes a public beach, salt marsh, active and passive recreational amenities, a parking lot, and a roadway variously named Conley Street and Tenean Street. Recreational amenities include a harborwalk, playground, basketball court, tennis courts, and picnic shelters. These amenities are distributed across approximately six parcels identified as DCR-owned properties. Parcels and rights-of-way (ROWs) owned by the City of Boston, Massachusetts Bay Transportation Authority (MBTA), and Massachusetts Department of Transportation (MassDOT) also fall within the project site.

The project site is bounded by the Southeast Expressway/Interstate-93 embankment (the "Expressway Embankment") to the west, an MBTA maintenance yard to the south, Pine Neck Creek to the east, and the Neponset River to the north. A stormwater outfall and riprap-stabilized shoreline is located at the upstream end of Pine Neck Creek. Access to the site is provided via Tenean Street from the south and Conley Street from the north. Conley Street passes through an underpass running through the Southeast Expressway Embankment. The surrounding land is used for transportation facilities, residential neighborhoods, and various types of light industrial properties.

As a result of this unique location adjacent to various infrastructures, the project team has worked in direct coordination with respective key agencies – DCR, MASSDOT, MBTA, and BWSC – throughout the design process.

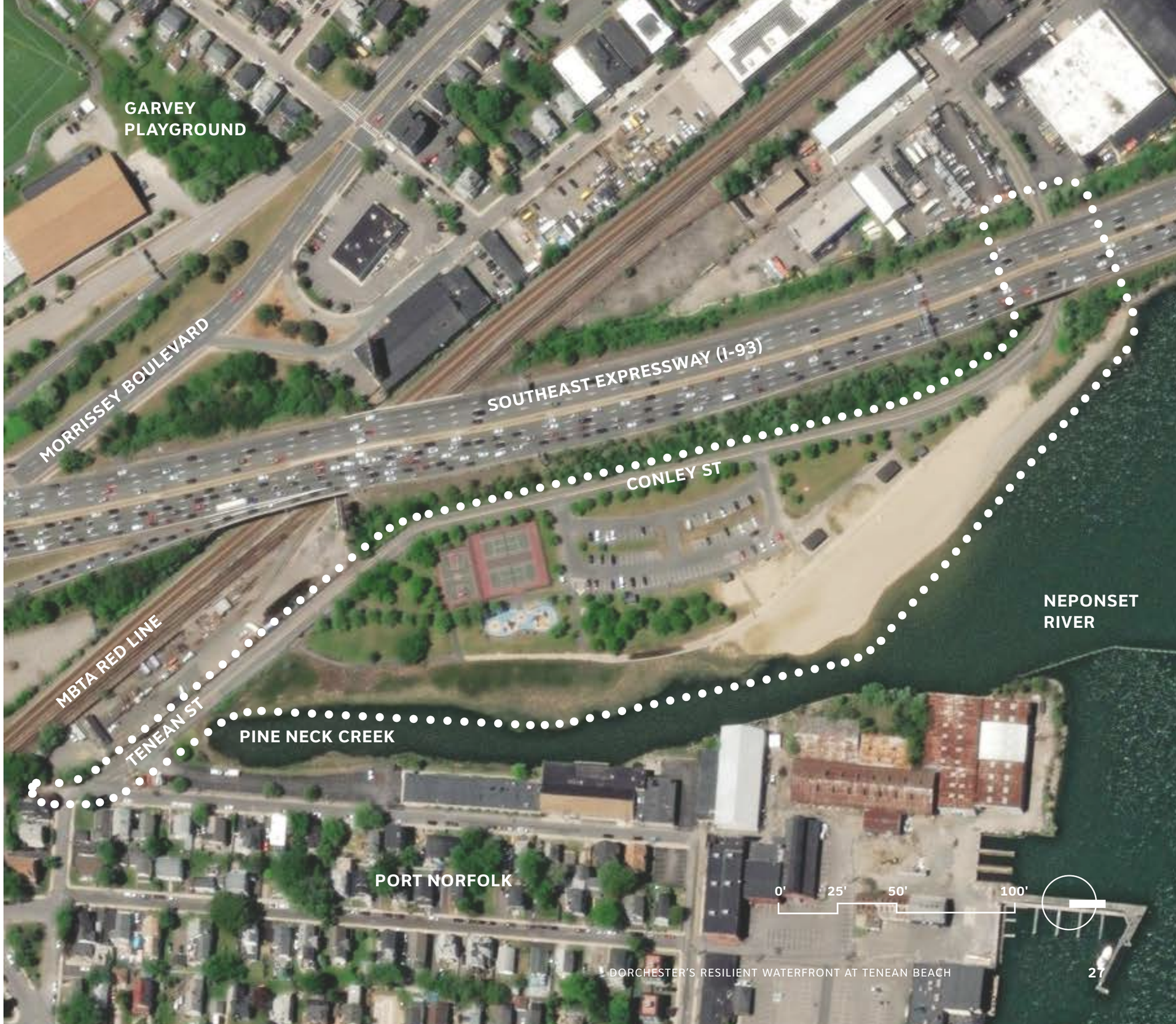


Figure 12: Satellite view of plan and adjacent infrastructure

SITE CONTEXT

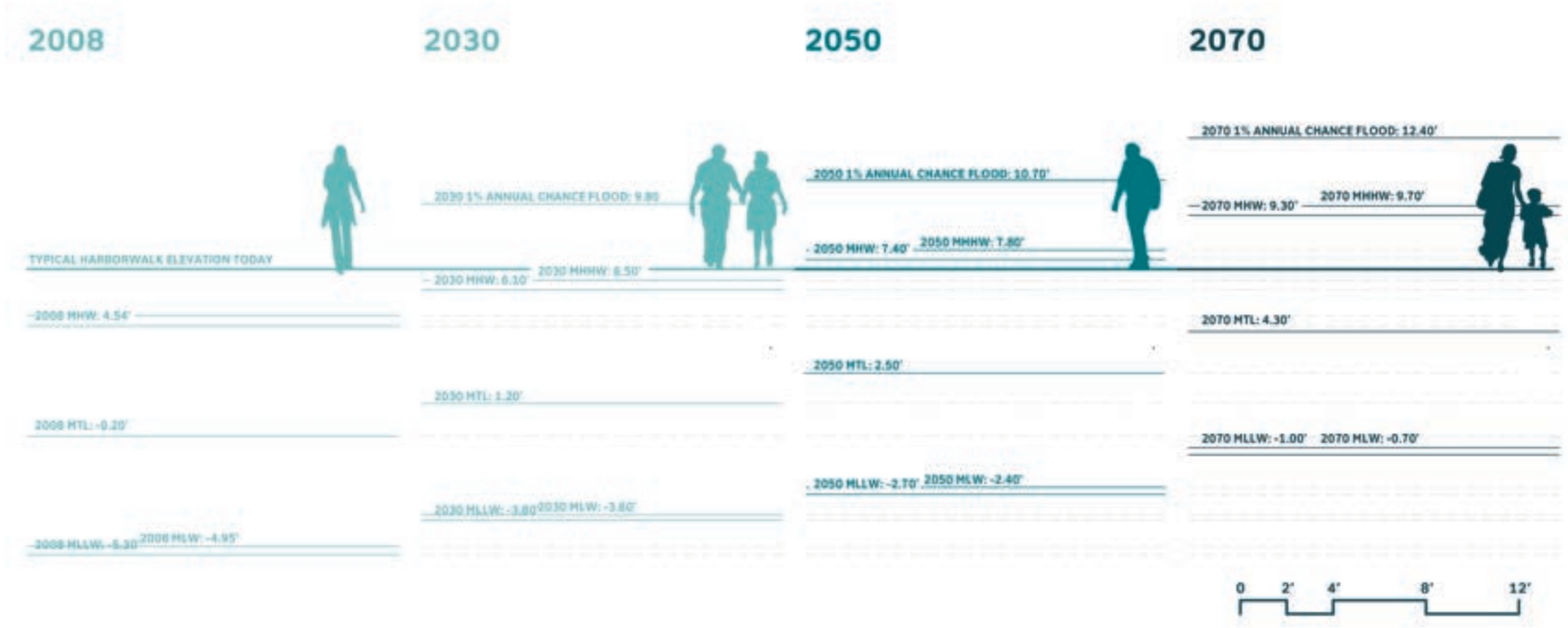
Climate Projections & the Massachusetts Coast Flood Risk Model

The project is guided by the best available science on the future risks of coastal flooding from high tides, storm surge, and waves. The Massachusetts Coast Flood Risk Model (MC-FRM) is a high-resolution, probabilistic, hydrodynamic model that estimates overland coastal flooding risks throughout Massachusetts in Present* (2008), 2030, 2050, and 2070. The MC-FRM accounts for the impacts of sea level rise and climate change influences on tides, waves, storm track, and storm intensity. The Commonwealth of Massachusetts' High sea level rise projections for Boston Harbor of approximately 1.3 ft by 2030, 2.5 ft by 2050, and 4.3 ft by 2070, compared to the 2008 baseline, are integrated in the MC-FRM. If sea level rise follows Intermediate projections, the MC-FRM coastal flood risk projections may occur 20 to 30 years later than indicated.

MC-FRM data was used to establish coastal design parameters for the project. These parameters included future tidal datums, water surface elevations, and wave heights at the project site. Tidal datum projections were used to inform the proposed site design. These projections helped identify areas subject to future daily or monthly high tide inundation and influenced ecological restoration elements and associated plantings. The Design Flood Elevation (DFE) of 14.0 ft NAVD88 was established for proposed coastal flood protection elements based on the 2050 1% annual chance storm including waves. Coastal flood protection elements were also designed to be adapted to meet a higher, long-term DFE of 16.2 ft NAVD88 based on the 2070 1% annual chance storm including waves.

** 2008 represents the mid-point of the 19-year tidal epoch (1999-2017) for which sea level data was available at the time MC-FRM was in development and serves as the baseline for Present day conditions.*

See all data developed for the project, from Design Flood Elevations, to Tidal Datums, and Sea Level Rise in the Appendix: Critical Site Datums.



WHAT'S AT RISK FROM FLOODING?

What are the Coastal Flood Risks in 2030?

Coastal modeling indicates that in the near-term (2030s), the flood pathway that enters at Conley St/I-93 underpass would put the following infrastructures at risk:

1. Commercial and residential buildings
2. Morrissey Boulevard
3. Access to Tenean Beach
4. Conley Street and Port Norfolk access route
5. MBTA Red Line

Figure 13: Coastal Flood Risk in 2030

COASTAL HAZARDS

High Tide Flooding Today

While Tenean Beach is vulnerable to storm events in the future, it is also subject to tidal flooding today, making portions of the site inaccessible.

The image below is during a high tide event where the water is at El. 6.0’ NAVD88.

Given the site elevation and observed water levels at the Boston tide gauge, the extent of flooding viewed here may occur:

- On average of 67 days per year over the past 10 years
- Estimated around 57 days in 2022

This serves to illustrate that certain low-lying portions of the site are already witnessing inaccessibility impacts. With more frequent flood events comes increased maintenance needs such as sweeping sand from paths, cleaning out drains, replacing salt-intolerant and inundation-intolerant planting, and more frequent re-paving, among other concerns.

Figure 14: El 6.0’ NAVD88, 2/19/2023 at 9:00am

Recent Storm Events

In addition to tidal flooding today, the site experiences more frequent storms, including Nor’easters, which raise water elevations even higher.

The image below is during such an event where the water elevation is at El. 7.3’-7.5’ NAVD88. The extent of flooding as viewed here may occur:

- On average of 4 days per year over the past 10 years
- Estimated around 4 days in 2022

While we are planning for future storms, these images show that flooding is already happening frequently at Tenean Beach, rendering it temporarily unusable to the community.

Water Quality Challenges

Another hazard and challenge for Tenean beach is water quality. While many of the beaches in Boston continue to be among the cleanest urban beaches in the country. Eleven area beaches earned scores of over 90% this year, however Tenean scored 89% in 2022 and has a six-year average safety rating of 76%.

Water quality at Tenean Beach is monitored throughout the swimming season in compliance with Massachusetts Department of Public Health (DPH) beach testing guidelines, approximately from Memorial Day to Labor Day of each year. The Massachusetts Department of Conservation and Recreation (DCR) manages the beach posting program at Tenean Beach, displaying blue flags at the beach when bacteria levels meet single sample limits, and red flags when bacteria levels fail to meet the limit. Red flags are also flown following extreme weather events. There are no combined sewer overflows (CSOs) that impact Tenean Beach. Sources of bacteria at Tenean Beach include animal and bird waste and urban stormwater runoff in wet weather. While the tests themselves are extremely accurate, it takes 24 hours for them to be completed and posted. As a result, they are always at least one day late, and do not reflect current conditions on the beach.

Figure 15: EL 7.3’ - 7.5’ NAVD88 (shown), El. 8.47’ Peak, 12/23/2023 at 9:27am

SITE STRATEGY TO MEET DESIGN FLOOD ELEVATION

Design Flood Elevation

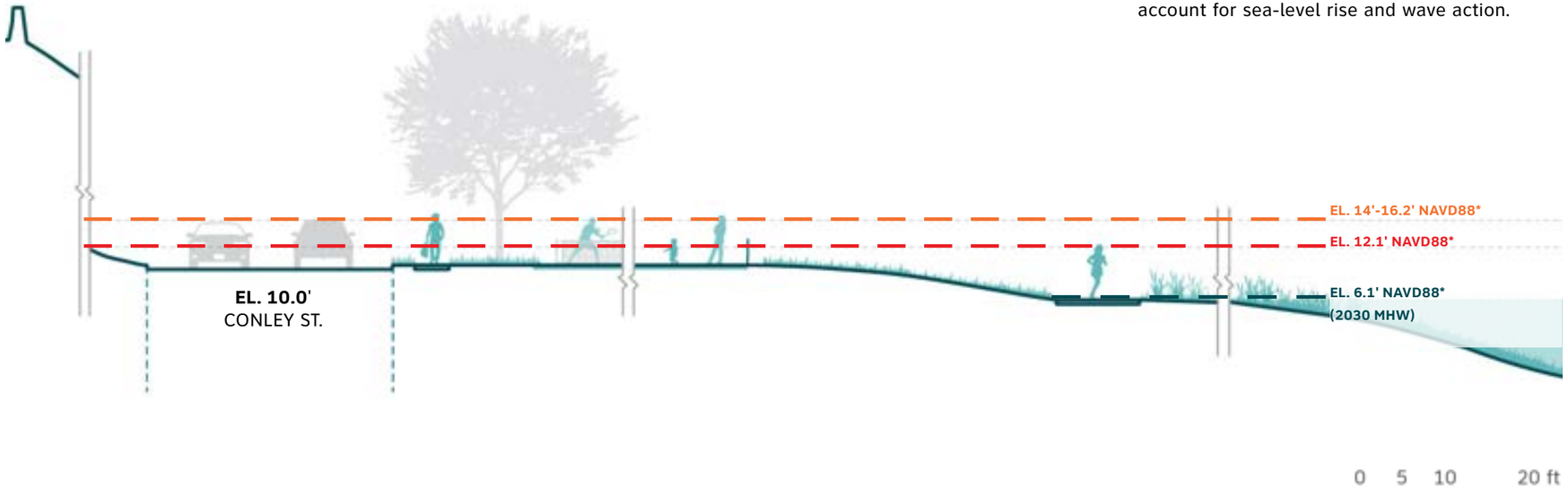
Through coastal modeling efforts using MC-FRM, the team has identified Design Flood Elevations (DFEs) based upon the near-term (2030s) and long-term (2050s-2070s) 1% annual chance flood, accounting for wave action and sea-level rise. Using these target elevations, the team strategized on the best approach to meet the elevation with the technical constraints of the site. These constraints include: minimizing fill, as this is an ACEC resource area (see section on Technical Considerations page 36), working with existing grades, creating a fully passive (non-deployable dependent) system, and reducing hardened infrastructure wherever possible.

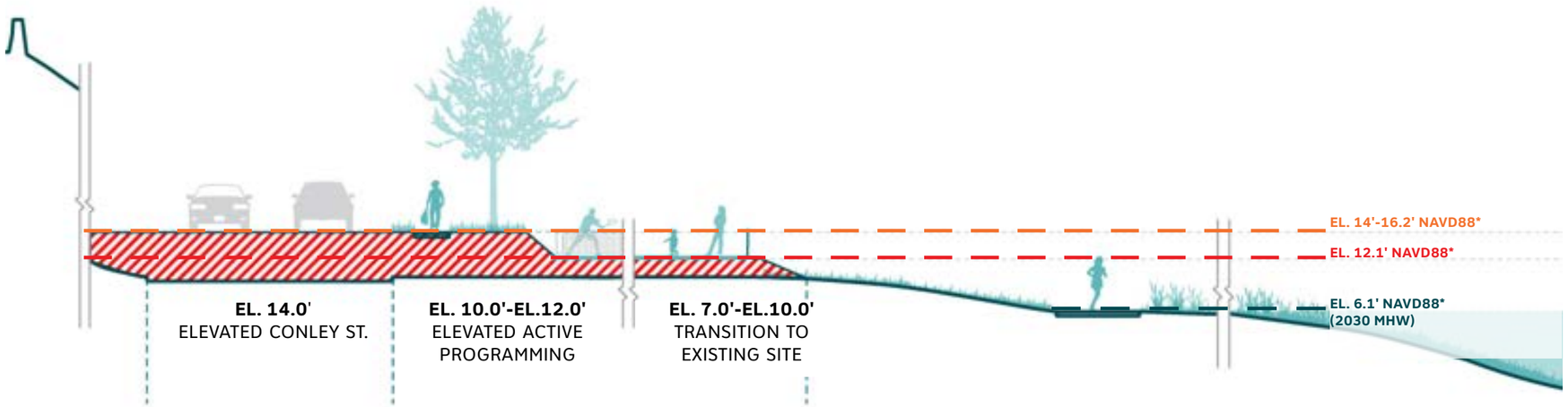
In Figure 16, the proposed DFEs are overlaid on top of an existing site section at Tenean Beach. The red hatch in Figure 17 indicates the full strategy to meet those DFEs. The plan elevates Conley Street to meet El. 14 (about 4ft of grade change), working to address the flood pathway underneath the I-93 underpass as long as is technically possible. To address community feedback encouraging extended use of active recreation, the project also proposes to raise the active recreation between El. 10-12 (about 2-4ft of grade change) to allow this programming to flood less frequently in the future and extend its use. From here, the site steps down to meet existing grade.

The site strategy to meet the DFE creates an independently effective system to close the identified flood pathway in the near-term while elevating other portions of the site for extended programmatic use into the future.

The "Design Flood Elevation" (DFE) is the target elevation for coastal resilience solutions in order to reduce coastal flood risk in the **near term (2030s)** and the **long term (2050s - 2070s)**.

The DFEs are based on 1% annual chance flood and account for sea-level rise and wave action.





**Elevations given in NAVD88 can be converted to Boston City Base (BCB) elevation by adding 6.46 feet.*

Figure 16: Existing Site Section with Design Flood Elevation Datum Overlay

Figure 17: Proposed Site Section with Site Elevation Strategy

DESIGN PARAMETERS & TECHNICAL CONSIDERATIONS

Design Parameters

The parameters used to guide the development of Tenean Beach's design were derived from the community engagement process and conversations with key stakeholders.

- Provide fully passive flood management: After reviewing alternatives, community members and stakeholders expressed a clear preference for a fully passive flood management solution, meaning that no temporary or deployable flood structures would be used. While this approach typically requires more up front investment, it reduces ongoing maintenance costs and labor required to deploy temporary structures. It also offers opportunities to integrate elevated features seamlessly into park amenities.
- Elevate Conley Street and improve it as an access route: Community members emphasized the importance of Conley Street as a key access route serving the Port Norfolk neighborhood and beyond. Low points along Conley Street will be elevated to extend access during flood conditions, and no deployable flood gates will impede access.
- Maintain or expand active recreation opportunities: Community members expressed a desire to maintain or expand the active recreation amenities on site, including basketball and tennis courts and the playground.
- Enhance ecology and opportunities to connect with nature: Many constituents also noted that they value Tenean Beach as a place to connect with the natural environment, indicating that restoration efforts should be balanced with active recreation opportunities.

Figure 18: Existing Plan - Design Parameters

Technical Considerations

A number of technical considerations also guide the design, ensuring that the project performs as expected and complies with relevant regulations.

- Area of Critical Environmental Concern (ACEC): An ACEC is a designated area that protects natural resources, such as the Neponset River Estuary. The entire Tenean Beach site is within the Neponset River Estuary ACEC and has a resource management plan.
- Chapter 91: The Massachusetts Public Waterfront Act - Chapter 91 protects people's access to the waterfront and helps license marine structures and alterations. Portions of the site are within the Chapter 91 delineation.
- The Massachusetts Wetlands Protection Act: The Massachusetts Wetlands Protection Act protects wetlands, floodplains, waterfront areas, and other areas from destruction or alteration. The site is subject to Wetlands Protection Act regulations.
- Project Performance: Coastal modeling of the design has confirmed that the project will perform as expected and will not increase flooding in the Port Norfolk neighborhood or other adjacent areas.

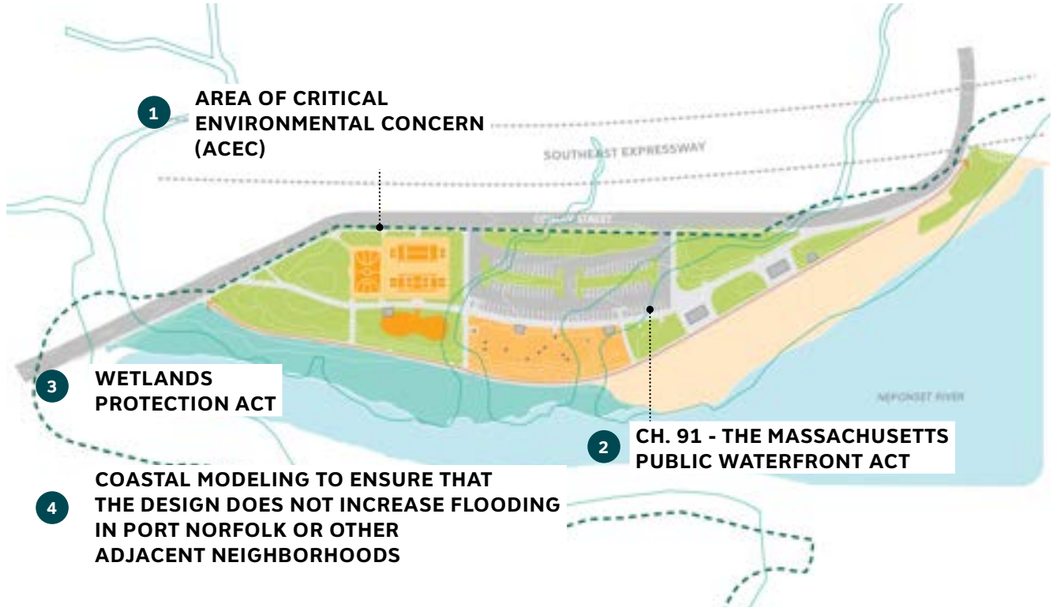


Figure 19: Existing Plan - Technical Considerations

SITE MODIFICATIONS

Maintain and Relocate

The plan maintains all existing recreational amenities or replaces them in-kind.

- The existing playground, recently constructed and well-loved by the community, is maintained and connected to the renovated pathway network.
- The existing picnic area alongside the playground also remains with enhanced seating opportunities. Picnic shelters are replaced.
- Existing sports courts, including basketball and tennis, are elevated and expanded.
- An elevated parking area and drop-off area preserves 70% of the current parking spaces, in accordance with the project parameters.
- The Harborwalk, compromised by frequent flooding today, is elevated and realigned closer to Conley Street to prolong its usability.
- The beach and marsh areas along the Pine Neck Creek are also enhanced.

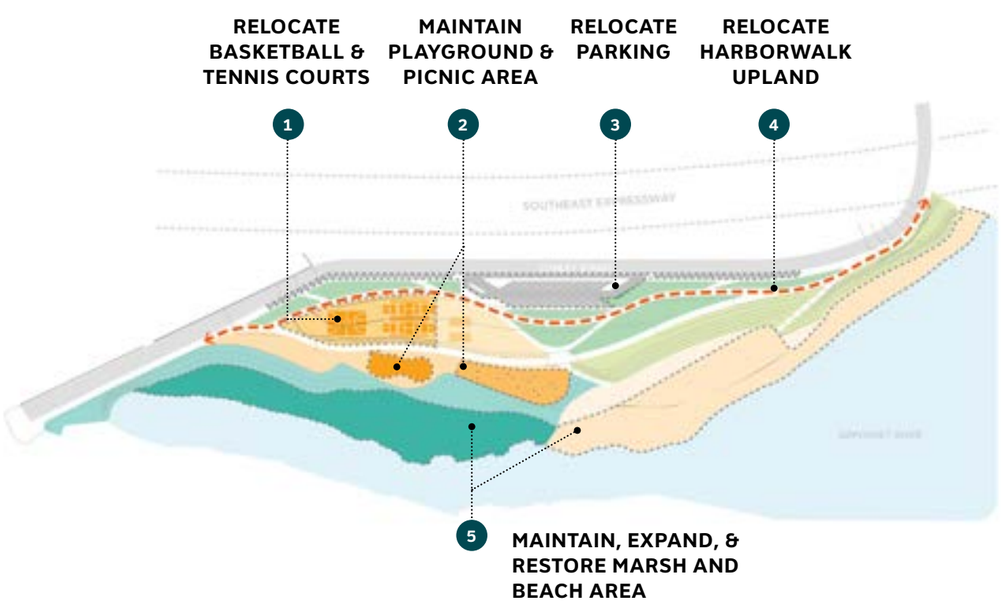


Figure 20: Proposed plan, amenities and assets being maintained

New Passive and Active Programming

The proposal for additional site programming draws from the priorities expressed by community members through the engagement process.

- Overlooking the beach, a recreational lawn provides flexible space for everyday gathering or small events.
- A tree grove at the heart of the site provides opportunities for quiet contemplation and enjoyment of water views.
- Along Conley Street, coastal plantings buffer sound and views of vehicular traffic, while contributing to stormwater management.
- The elevated segment of Harborwalk ties into the Neponset River Greenway Extension to the north and is widened along Conley Street (toward Franklin Street) to the south.

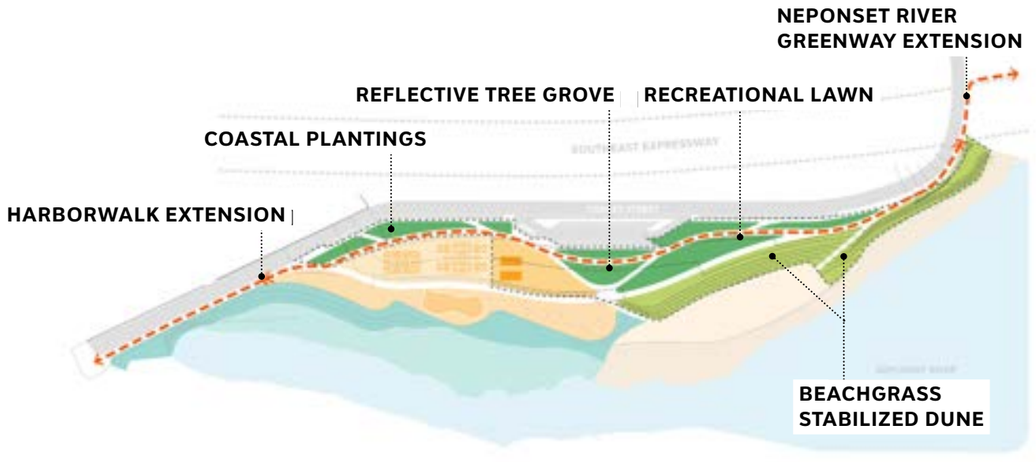


Figure 21: Proposed plan, improved or new programming

ACCESS AND CIRCULATION

The project enhances pedestrian and bicycle connectivity within and beyond the site. The Harborwalk shifts closer to Conley Street and lifts to elevation 14 NAVD88 to prolong its useful life. Secondary pathways link the Harborwalk to the active program areas and the beach. All pathways are designed to support universal access.

A central drop off and parking area provides easy vehicular access to Tenean Beach. On-street parking along Conley Street supplements the parking supply to achieve the project target of 70% of existing parking spaces.

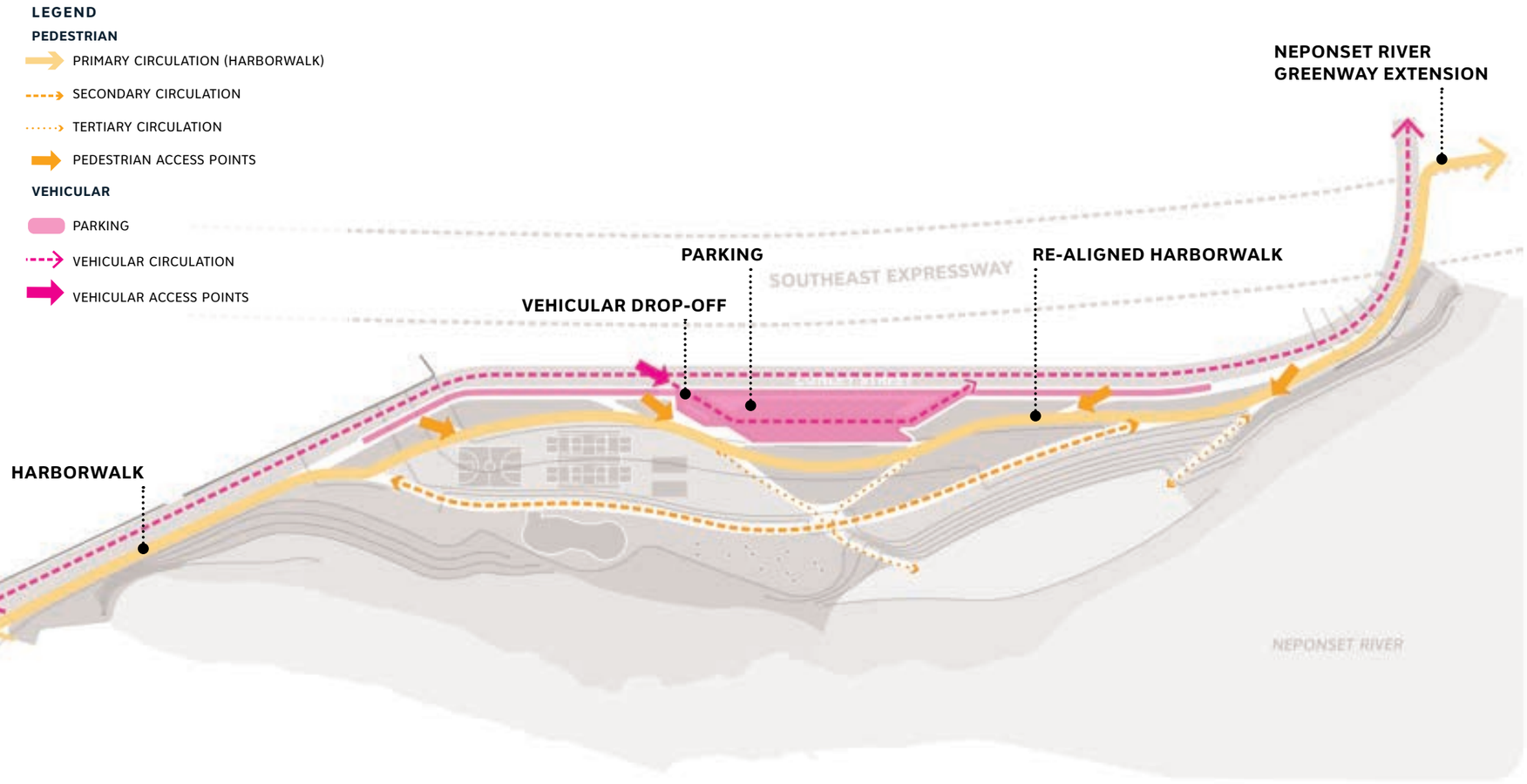


Figure 22: Proposed access and circulation diagram

DESIGN PROPOSAL

This plan envisions Tenean Beach as an even more vibrant recreational destination on the Dorchester Waterfront—a site with the potential to strengthen the physical and social resilience of the surrounding community, enhance safety and access for pedestrians and cyclists, provide active and passive recreation amenities, and revive the coastal ecosystem.

DESIGN PROPOSAL

Figure 23: Design proposal with program callouts

PROJECT BENEFITS

PROJECT EFFECTIVENESS AT RISK REDUCTION

Coastal Flood Risk Reduction in the Near-term

Coastal modeling demonstrates independent effectiveness of the project - reducing flood risk in an area that includes critical transportation infrastructure, industrial and commercial uses, residential buildings, and valued public open space.

The Massachusetts Coast Flood Risk Model (MC-FRM) was used to analyze the reduction in coastal flood risk with the project compared to if no action is taken. The design goal established by the BPDA for the project was to mitigate the Tenean Beach and Conley Street flood pathway, providing protection up to a 2030 1% annual chance flood plus 1 ft of freeboard, at a minimum. MC-FRM simulations performed to evaluate the proposed project's effectiveness confirmed that the project meets this goal.

Figures below demonstrate the near term effectiveness of the design proposal, with the left figure showing extents under existing flood conditions, and the right figure showing flooding extents under the proposed design.

To see wider extents for coastal modeling see Appendix: *Coastal Modeling.*

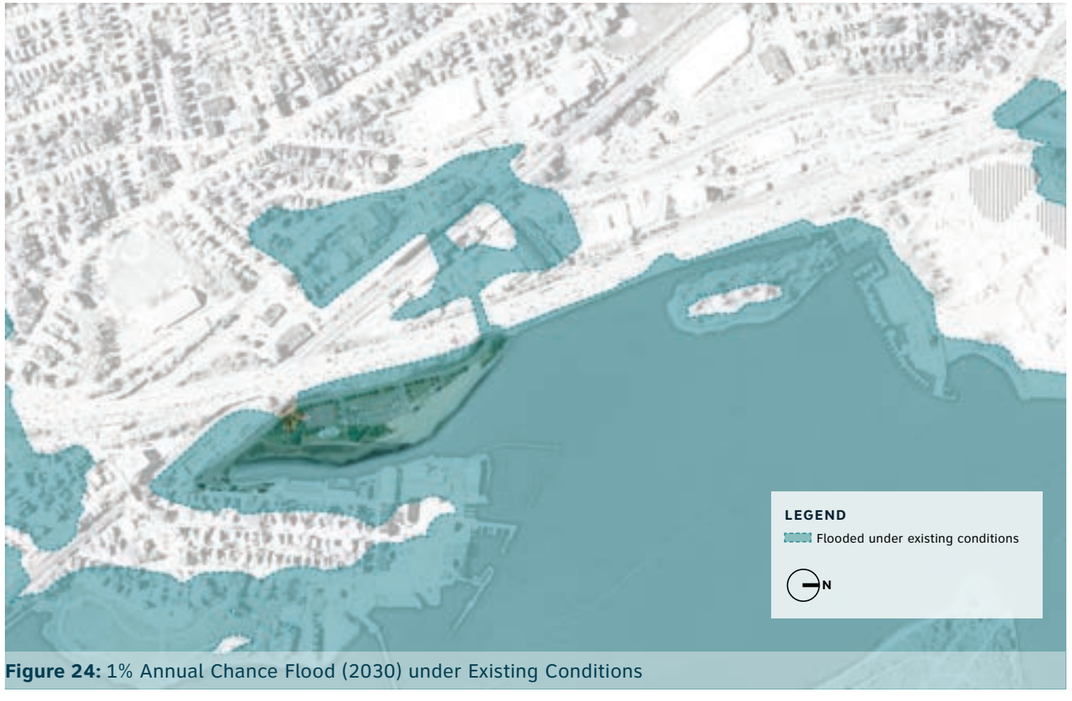


Figure 24: 1% Annual Chance Flood (2030) under Existing Conditions

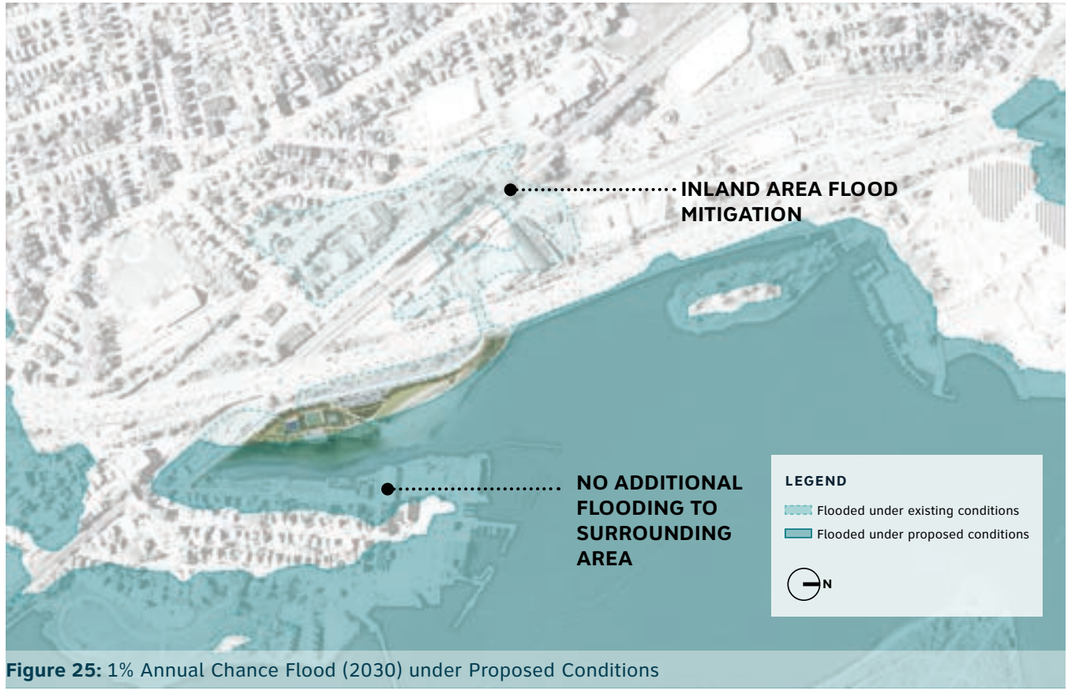


Figure 25: 1% Annual Chance Flood (2030) under Proposed Conditions

PROJECT EFFECTIVENESS AT RISK REDUCTION

Residual Risk in the Long-term

In higher, more extreme floods that become more likely in the long-term, the proposed project is still effective at blocking flooding through Tenean Beach and Conley Street. However, there are other flood pathways through which flooding could impact the area otherwise protected by the project. These flood pathways include the Morrissey Blvd/I-93 underpass located just south of the Dorchester Bay Basin, and the MBTA Red Line maintenance yard located adjacent to the project site. Due to the additional flooding coming from these pathways, there is an area of uncertainty in the flood extents due to the model's resolution, the ability to represent flow hydraulics through the MBTA Red Line underpasses at Morrissey Blvd, and limitations due to LiDAR. This area of uncertainty is represented as the diagonal hatch. Resiliency strategies to address these flood pathways will be necessary for long-term coastal flood protection.

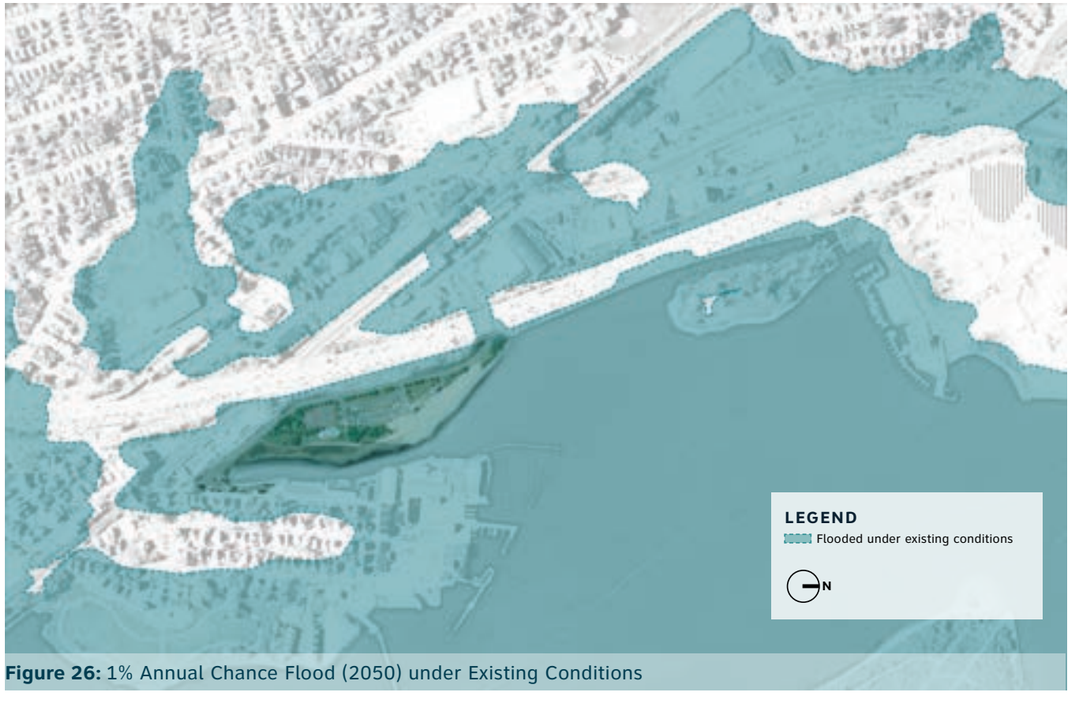


Figure 26: 1% Annual Chance Flood (2050) under Existing Conditions

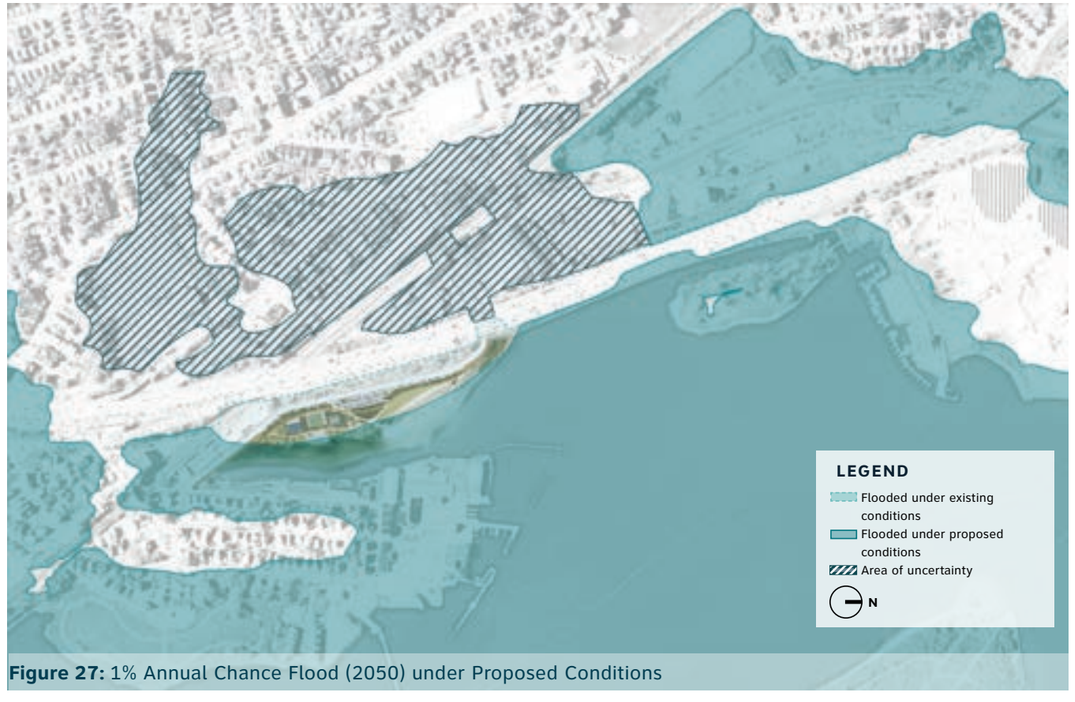


Figure 27: 1% Annual Chance Flood (2050) under Proposed Conditions

1% Annual Chance Flood (2050) under Proposed Conditions

PROJECT EFFECTIVENESS AT RISK REDUCTION

Site Flood Exposure

In addition to reducing risk during extreme flood events, the proposal will also improve the performance of the site flooding and enable extended use of park programs.

The following figures demonstrate:

- Existing Conditions
  - Under existing conditions, Conley St. near Pine Neck Creek, a critical access route to the Port Norfolk community, will be subject to monthly flooding in 2030, an increase of frequency from flooding in moderate floods today.
  - Under existing conditions, the beach will be subject to daily flooding in 2030, an increase of frequency from flooding monthly today - rendering it less usable with more maintenance needs as sand is pushed inland on a regular basis.
  - Under existing conditions, the edges of the sports courts will be subject to flooding in moderate storms in 2030, and to an increase of frequency from flooding in extreme floods today.
- Proposed Conditions
  - With the proposed design in 2030, Conley St. near Pine Neck creek, a critical access route to the Port Norfolk Community, will be subject to flooding only in extreme floods. This is an improvement from potentially flooding monthly under existing conditions.
  - With the proposed design in 2030, the beach will be subject to monthly flooding. This is an improvement from flooding daily under existing conditions. This will enable the sandy beach to be used more often. The coastal dune will also block and trap wind- and water-borne sand, reduce the need to manage sand migration in upland areas
  - With the proposed design in 2030, the sports courts, parking, and parts of Conley street are protected in extreme floods. This is an improvement from potentially flooding in moderate storms under existing conditions.

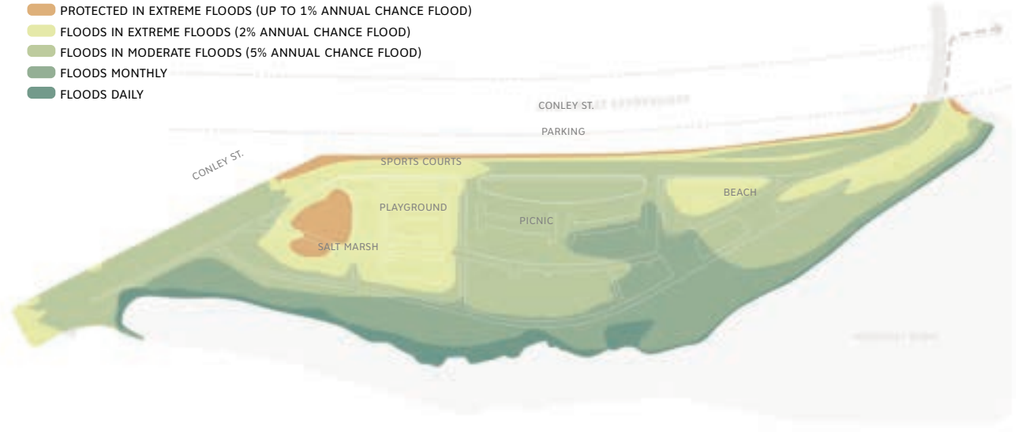


Figure 28: Predicted Flood Frequency Today

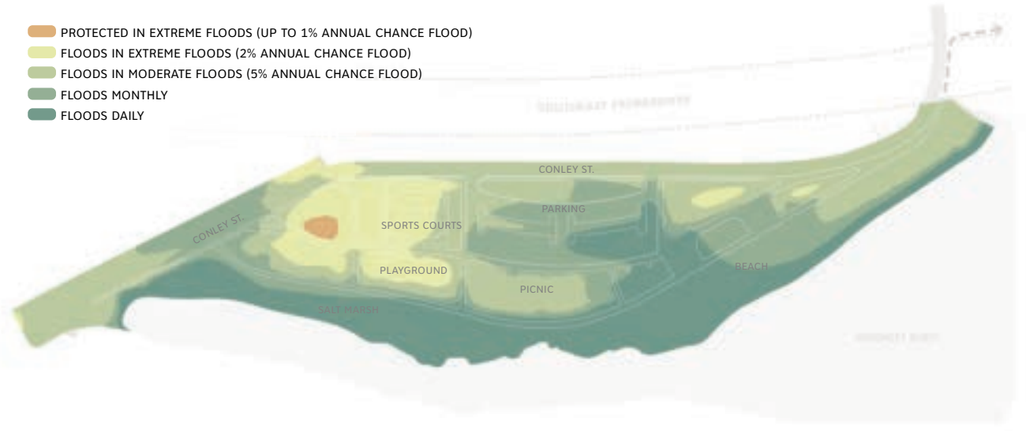


Figure 29: Predicted Flood Frequency in 2030 Without Project

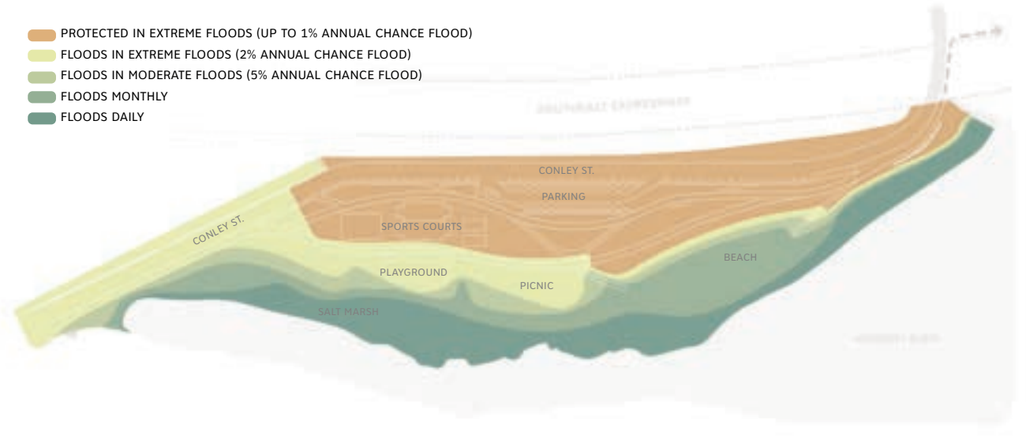


Figure 30: Predicted Flood Frequency in 2030 With Project

COMMUNITY-WIDE BENEFITS

Transportation Access

The project has broad reach outside its focus area at Tenean Beach. Flooding in this location would impact a network of critical transportation infrastructure.

Flooding would impact the (1) MBTA Red Line, which is the subway line with the greatest ridership, (2) the Southeast Expressway, and (3) Morrissey Boulevard. These vital transportation lines move the Dorchester community to their places of work and commerce. As a result, flooding would cause far-reaching impacts to the City's economy such as shutdowns due to failure and maintenance, technical, or structural issues.

The proposal seeks to minimize this risk in the near-term. In the long-term, it will be necessary to adapt and tie into adjacent ongoing efforts to further reduce risk in this area. Minimizing risk in this area would mean sustained mobility for economic growth and housing development to address the affordability crisis. It would also mean critically supporting the social and cultural networks of this diverse community.

Sources: Boston Open Data, MASSGIS, MC-FRM

Figure 31: Map showing impacted buildings and infrastructure from flooding

BENEFITS TO DISADVANTAGED COMMUNITIES

Socially vulnerable community members

Social vulnerability is the extent to which social groups are susceptible to the detrimental impacts of natural hazards, including deaths, injuries, and other losses that are disproportionate to other groups in the same region. The project lies within an area that serves a cross section of low to high socially vulnerable community members. Reducing flood risk would benefit socially vulnerable community members directly.

Designated Geographical Area for Environmental Justice Populations

Areas within one mile of the project site are considered a Designated Geographical Area ("DGA") for Environmental Justice ("EJ") populations in accordance with the Massachusetts Environmental Policy Act ("MEPA") regulations at 301 CMR 11.02. The Project Site is located in Census Block Group 2, Census Tract 1006.03 of Suffolk County, and the EJ criteria of Census Block Groups within the project site's DGA include: Minority; Income; Minority and Income; Minority and English Isolation; and Minority, Income, and English Isolation. The project site has 462 EJ Populations within a five-mile radius and 32 EJ Populations within a one-mile radius. See Figure 7, Environmental Justice Populations (5-Mile Radius) and Figure 8, Environmental Justice Populations (1-Mile Radius).

Figure 32: Environmental Justice populations

Figure 33: Map showing socially vulnerable areas and infrastructure impacted by flooding

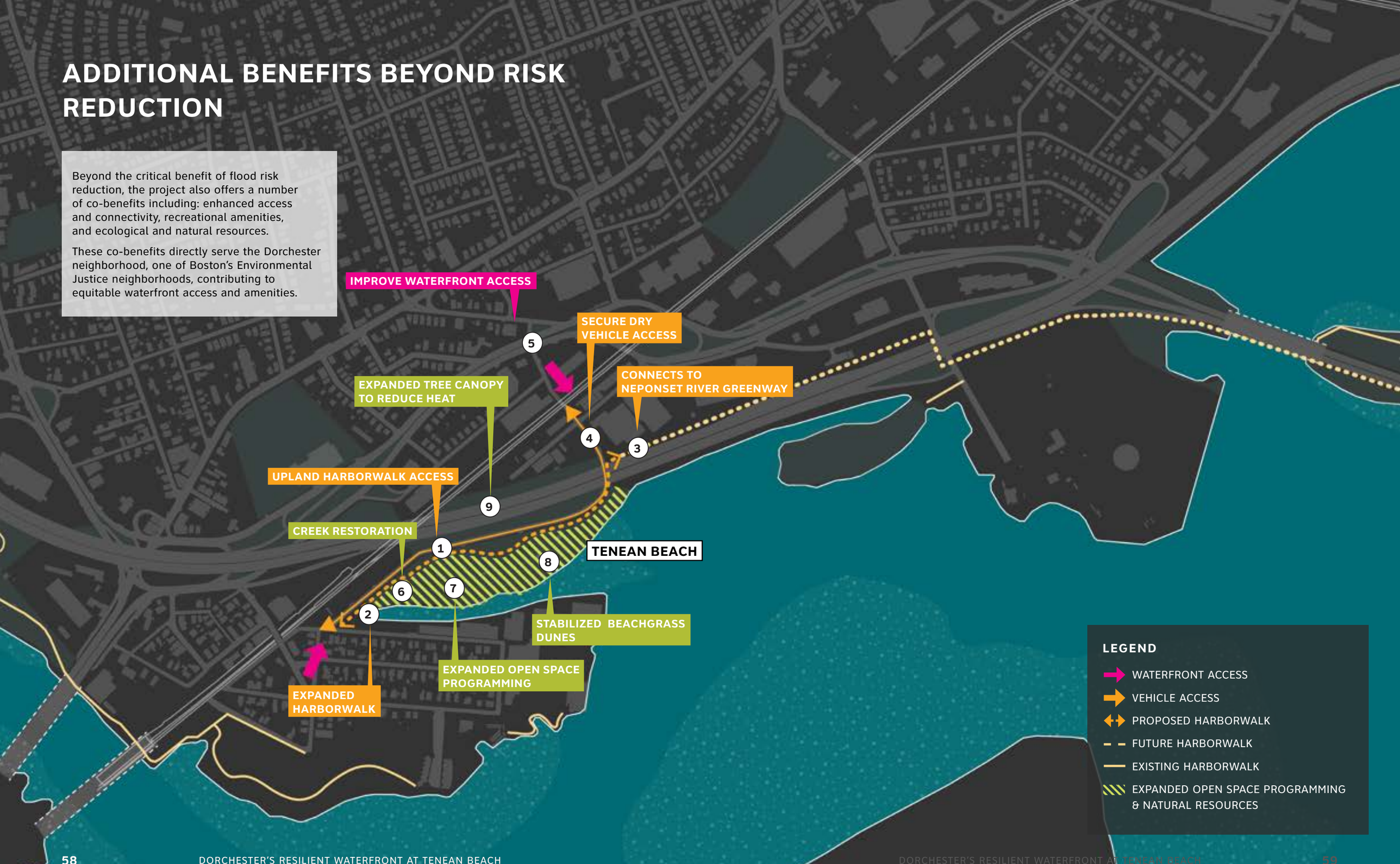
Figure 34: Map illustrating additional benefits beyond risk reduction (following spread)

Sources: Boston Open Data, MASSGIS, MC-FRM

ADDITIONAL BENEFITS BEYOND RISK REDUCTION

Beyond the critical benefit of flood risk reduction, the project also offers a number of co-benefits including: enhanced access and connectivity, recreational amenities, and ecological and natural resources.

These co-benefits directly serve the Dorchester neighborhood, one of Boston's Environmental Justice neighborhoods, contributing to equitable waterfront access and amenities.



ADDITIONAL BENEFITS BEYOND RISK REDUCTION

Access to Open Space and Recreation

The plan envisions Tenean Beach as a critical piece of open space and recreational infrastructure, complementing other parks and amenities nearby.

The existing playground is maintained and is joined by new basketball and tennis courts. A flexible lawn provides a space for everyday gathering and small events. Picnic areas overlook the water's edge, capturing scenic views. A series of new picnic shelters provide comfortable, shady places to gather in the summer months.

All of these amenities connect to the broader open space network via the reconstructed Harborwalk, which ties into the Neponset Greenway Connector.

Ecology and Natural Resources

The plan for Tenean Beach embraces its role as a critical natural resource within the Neponset River Estuary. The design aims to reduce impervious surfaces and enhance stormwater infiltration on the site. In areas near the Pine Neck Creek where segments of the existing Harborwalk are removed, disturbed areas will be restored with native coastal species to promote ecological health.

Heat Benefits

The design recognizes that Dorchester was prioritized as one of Boston's hottest neighborhoods in the 2022 Heat Resilience Solutions for Boston Plan. Taking advantage of coastal breezes, Tenean Beach is already one of the cooler spots in Dorchester, serving as a refuge for community members on the hottest days. Additional canopy trees and picnic shelters proposed in the design will increase climate comfort within the park.

Figure 35: Recreational Amenities (Looking south towards Port Norfolk)

Figure 36: Harborwalk (Looking north towards Harbor)

RE-ALIGNED HARBORWALK

COASTAL PLANTING

RECREATIONAL LAWN

BEACHGRASS STABILIZED DUNES

BEACH

+14.0

+12.0

+10.0

**Elevations given in NAVD88 can be converted to Boston City Base (BCB) elevation by adding 6.46 feet.*

INCORPORATING NATURE-BASED SOLUTIONS

Natural Infrastructure & Other Nature-Based Solutions

The proposed design minimizes hard engineering solutions to the extent feasible given site constraints and the project goals. It relies heavily on natural infrastructure and nature-based solutions to reduce flood risks, erosion, and wave damage. These elements are designed to also generate co-benefits including reducing heat impacts, creating habitat, filtering pollutants, and providing recreational benefits.

Elevated Landscape

The project proposal prioritizes a passive solution to address the flood pathway at Conley St./I-93 underpass, thereby eliminating a need for a deployable flood wall. Through strategically elevating the landscape and meeting existing site conditions, the design is able to develop the open space co-benefits listed above. For further details about the elevated landscape, please see section titled *Site Strategy to Meet Design Flood Elevation* on pg. 34.

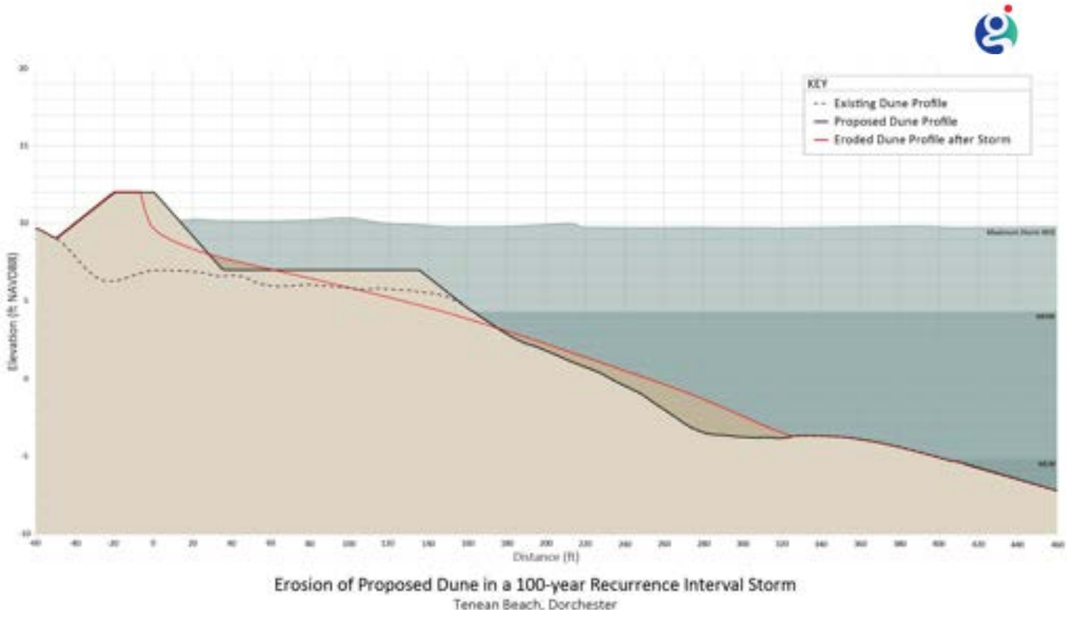


Figure 37: Excerpt from beachgrass stabilized dune modelling process

Beachgrass Stabilized Dune

The project expands and enhances the existing coastal beach and constructs a new beachgrass stabilized coastal dune with beach compatible sand. The footprint of the proposed beach and dune would displace existing hardscapes (paths, sheltered patios, parking), some of which would be relocated further away from the shoreline.

At its widest cross-section, the beach berm will be restored to about 100 ft wide, rising at a 10:1 slope from 7 ft NAVD88 to the toe of the new dune at 8 ft NAVD88. The existing and proposed beach narrows and profile steepens at its northern and southern ends, based on the site topography.

The proposed dune will be approximately 450 feet long, with a foreslope of 7:1 and a 20 ft wide crest at elevation 12 ft NAVD88. The dune will be stabilized with beachgrass and selectively planted with other native dune species, such as downy serviceberry (*Amelanchier arborea*), beach plum (*Prunus maritima*), and black cherry (*Prunus serotina*) to provide a more diverse habitat for a range of species.

The landward edge of the dune will be separated from a parallel access path with dimensioned stone edging. The flood protection berm would be landward of the access path. The edging serves multiple purposes, including providing seating, minimizing sand migration and associated maintenance, and discouraging informal footpaths through the dune. Formal and universally accessible paths to the beach will be provided near the northern and southern ends of the dune.

Coastal modeling has demonstrated that the expanded beach and new dune will provide flood and storm damage protection to upland access paths, recreational areas, and the flood protection berm. Based on cross-shore performance modeling, the beach and dune improvements will withstand a present day 10% annual chance storm with minimal erosion of the beach berm and dune foreslope. In a more extreme 1% annual chance storm, the dune and beach berm would sustain more erosion but not be fully eroded, and a substantial portion of the dune volume and crest would remain intact. After such an event, some maintenance would be required. However, sand eroded in these events would remain in the nearshore above Mean Low Water where they would continue to provide storm damage protection functions. Water levels and wave runup during these storms will not exceed the dune crest, demonstrating the flood protection benefits.

Recreational services provided by the beach will also be made more resilient to sea level rise with the proposed design. If no action is taken, the beach will be fully inundated daily at high tide in 2030. With the proposed improvements, inundation will be limited to a monthly occurrence in 2030 (97% less frequent, not accounting for storms).

Creek Restoration

Coastal wetlands, particularly salt marshes, were once the dominant plant community in the Boston area. However, over the past few centuries, these marshes have experienced significant loss due to land reclamation, pollution, and alterations to the natural water flow.

At the southern end of the Dorchester site, Pine Neck Creek, a small tributary of the Neponset, flows into the surrounding estuary. While there is currently some marsh vegetation along the creek's shores, its quality has been degraded by invasive species and pollutants from upstream sources and nearby roads.

One common issue faced in tidal marshes is the muddling of separation between different salt marsh zones. With rising sea levels and changes in flooding patterns, there is often an increased presence of Saltmeadow cordgrass (Spartina alterniflora), which is typically found in low marsh habitats, in high marsh zones. This alteration can have a significant impact on wildlife, particularly birds that depend on specific breeding areas within the marsh.

To address these challenges, this project aims to restore the important transitional zones from low to high marsh and implement upland plantings. This will help facilitate natural shifts in vegetation without losing the integrity of the high marsh areas. To achieve this, the project will allow for inundation and buffer areas in specific low-lying portions of the site.

Figure 38: Pine Neck Creek outfall and existing marsh

Coastal Planting

This project draws inspiration from various coastal conditions found in Massachusetts, such as Plum Island and Cape Cod National Seashore, to inform the selection of plant species. The chosen plants are naturally salt-tolerant and hardy, making them well-suited for several typological zones within the project area, including the low marsh, high marsh, coastal dune, maritime forest, and planted buffer.

In the low marsh, Saltmeadow Cordgrass (*Spartina alterniflora*) dominates the landscape, forming a nearly monocultural presence in the low-lying areas. Moving to the higher marsh, a diverse mix of grasses, including Saltgrass (*Distichlis spicata*) and Switchgrass (*Panicum virgatum*), coexist with shrubs that can withstand inundation, such as Grounsel Bush (*Baccharis hamifolia*) and Marsh Elder (*Iva frutescens*).

Transitioning to the coastal dune, a range of scrubby and low-lying vegetation thrives in the sandy environment. Examples of these species include American Dunegrass (*Leymus mollis*), Beach Heather (*Hudsonia tormentosa*), and Beach Plum (*Prunus maritima*).

Moving further inland, in the upland portions of the site, the project incorporates elements from the coastal forests of Massachusetts. Here, a higher shade-producing overstory of maples and oaks contributes to the maritime forest. The shrub layer includes species such as Viburnums (*Viburnum dentatum*) and Summersweet (*Clethra alnifolia*).

Lastly, the planted buffer serves a dual purpose of collecting stormwater runoff from adjacent areas and providing visual protection from Conley Street and Southeast Expressway. This buffer zone includes a mix of species that can thrive in urban environments, providing both noise reduction and pollution mitigation along the road.

Figure 39: Dune and maritime forest ecological communities in Plum Island, Massachusetts

Figure 40: Bird's eye view of northern half of the site

**Elevations given in NAVD88 can be converted to Boston City Base (BCB) elevation by adding 6.46 feet.*

DESIGNING WITH ADAPTABILITY

Project Strategy

During the development phase, the project team considered how the design would adapt to meet flood elevations in the long-term. The current design can accommodate these three adaptation possibilities:

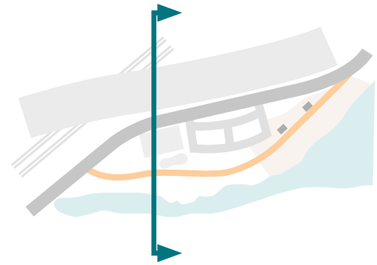
1. **Elevate Site to El. 16.2' NAVD88**
   This option would require more fill, but have less maintenance requirements in the long-term.

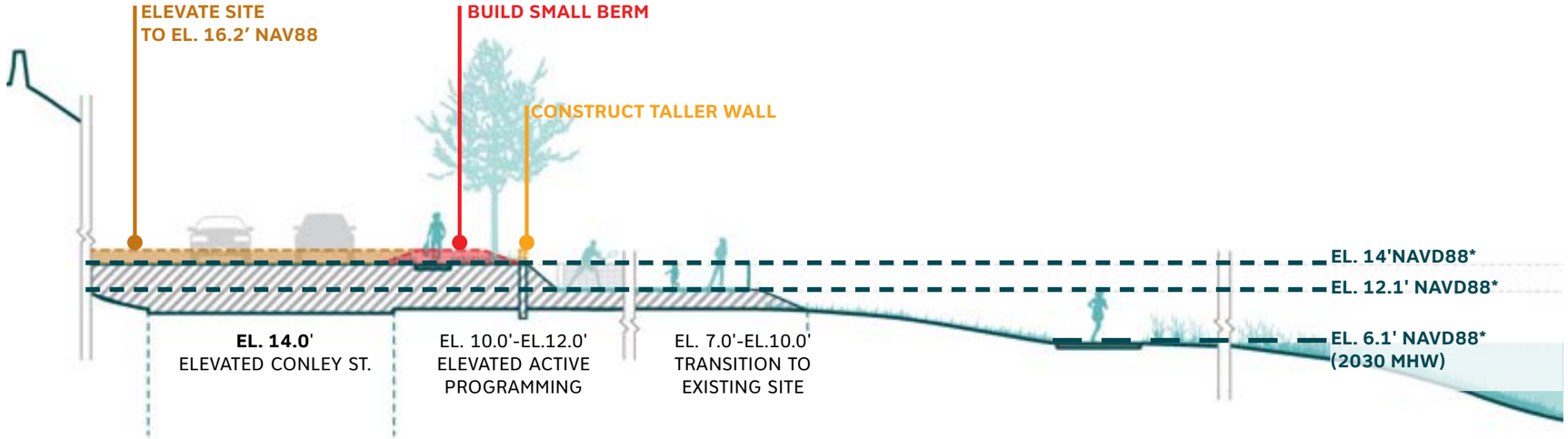
2. **Build a Small Berm**
   This option would limit fill, but leave areas adjacent to Conley Street vulnerable to wave action.

3. **Construct Taller Wall**
   This option would introduce more hardened infrastructure to the site design and require the most maintenance. However, its limited footprint will impact the current design less. Similarly, this would leave areas adjacent to Conley Street vulnerable to wave action.

The direction of adaptation option will depend on design development and continuing conversations on cost, environmental permitting, the site's relationship with adjacent projects, and long-term maintenance roles.

Note: With the implementation of any of these strategies, there is likely to remain some limited risk from intermittent wave splash over during large storm events. This may reduce the usability of the roadway, parking, and sidewalks immediately inland of the flood protection infrastructure. However, it will not be sufficient volume to flood areas inland of the Expressway/I-93.





**Elevations given in NAVD88 can be converted to Boston City Base (BCB) elevation by adding 6.46 feet.*

Figure 41: Diagram showing potential adaptation strategies

COMMUNITY ENGAGEMENT AND PRIORITIES

OUTREACH & ENGAGEMENT

Community Members & Stakeholders

This project continues community and stakeholder outreach and engagement efforts started during Climate Ready Dorchester, with a more definitive focus around the catalytic project site at Tenean Beach.

Engagement with the community was centered on two public workshops, with robust outreach detailed below. Community members were able to contribute feedback to help directly advance the design. For greater detail on these workshops, see the next section on *Engagement Process*.

Stakeholder engagement included recurring meetings throughout the project timeline with key agencies that have direct adjacencies to the project site, these include: DCR, MBTA, MASSDOT, and BWSC. Their contributing feedback and guidance throughout the process enabled a coordinated design and a grounded point of departure for future design development. For further detail, see section on *Partners Involved in the Project Design* at the beginning of this Executive Summary document.

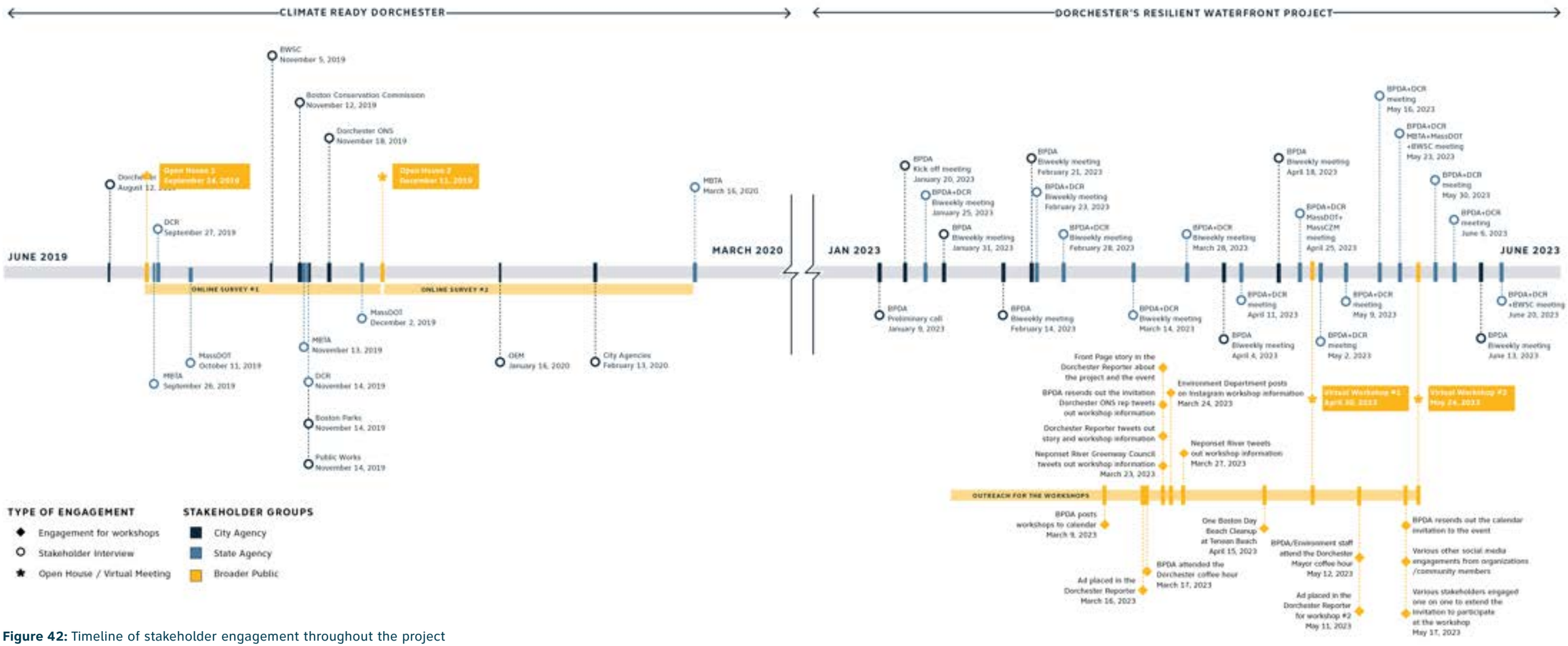


Figure 42: Timeline of stakeholder engagement throughout the project

ENGAGEMENT PROCESS

Community Engagement

Two workshops were held to engage the public in the Dorchester Waterfront project. The workshops were designed to ensure accessibility to a wide audience and were translated into Spanish, Vietnamese, and Haitian Creole. A diverse set of participants attended, including local residents, nonprofits, governing agencies, construction administrators, and researchers. The first workshop was a listening session that aimed to gather feedback on existing conditions and offer two alternatives to understand priorities. The second workshop focused on hearing feedback on a hybrid scheme that incorporated the preferred elements from those two alternatives. Throughout the workshops, participants were given the opportunity to share comments or concerns using the meeting chat and an online interactive feedback tool.

To make the research and design options more accessible to the public, the content was distilled into clear, digestible slides. Technical information was communicated through diagrams and simple statements. During the first workshop, the content was broken down into several topics, including Climate Ready history, ongoing project coordination, existing conditions and key takeaways, project goals and criteria, climate adaptation, and a question session. The second workshop included a recap of the first workshop, a discussion of design refinements, and a question session.

I biked downtown from Milton for 30 years past Tenean beach. It was a beautiful, relaxing respite from the harrowing ride on Morrissey past UMass.

Figure 43: Site photographs paired with feedback quotes from Workshop 1

Port Norfolk was isolated during the 2018 storms. The parking lot floods more than 4 times a year. I have run clean ups of debris.

Deployable walls trap Port Norfolk residents in, and emergency vehicles out.

COMMUNITY PRIORITIES

Key Takeaways

At Workshop 1, participants provided feedback on two schemes: one that was primarily nature-based and another that was primarily recreation-based. The nature-based scheme raised concerns about long-term usability, lack of active space, and floodwater management. While participants appreciated the idea, they felt it did not provide sufficient protection for public transit and lacked parking. On the other hand, the recreation-based scheme received more enthusiasm due to its ability to provide equitable access, passive flood management, and maintain usable space for longer. Some participants suggested incorporating more nature-based measures from the first scheme, and some expressed concerns about floodwater management were also expressed.

The key takeaways from Workshop 1 were that most participants preferred a passive flood management solution. The feedback encouraged maintaining Conley as an evacuation route, evaluating interior stormwater management, and protecting Port Norfolk. Additionally, participants expressed interest in a hybrid solution with both passive and active aspects.

Workshop 2 received less feedback, with participants indicating preference towards the combined scheme's enhanced natural environment, beach and active recreation, passive flood infrastructure, continuity of the Neponset Greenway, and enhanced public transit protection. Some participants expressed their desire for more parking, while others preferred less parking. Additionally, a few participants requested reconsideration of including restrooms and water retention areas.

These key takeaways have been folded into the design parameters, as seen on page 36, and set the guidelines for the design proposal.

Figure 44: Several priorities distilled from Workshop 1

Continued Community Involvement

Community engagement is an integral part of every project that will be advanced from Climate Ready Boston, regardless of who the lead agency. The Resilient Dorchester Waterfront Project at Tenean Beach/Conley Street is no exception. The community was heavily engaged during the grant-funded process. With two public workshops, several public appearances at meetings, coffee hours, and press coverage, the project team strives to give the community a voice to ensure that they influence design outcomes. As the project advances to future phases of design and permitting, public outreach will continue, welcoming all voices to be heard.

To learn more about the two community workshops for this project, please visit:

https://www.bostonplans.org/planning/planning-initiatives/dorchester-resilient-waterfront-project

Figure 45: A Climate Ready Dorchester community meeting

NEXT STEPS

COORDINATING WITH KEY EFFORTS

Hazard Mitigation Plan

The Resilient Dorchester Waterfront project at Tenean Beach / Conley Street is in direct alignment with the goals laid out in the 2021 Natural Hazard Mitigation Plan (NHMP) adopted by the City of Boston through the Office of Emergency Management.

The five goals of the plan are:

1. Equitably protect the health and safety of the public through awareness, preparedness, and connectedness.
2. Increase resilience by protecting and enhancing natural resources.
3. Implement hazard mitigation and climate adaptation projects that meet strategic priorities.
4. Invest in protecting properties and structures.
5. Ensure that essential services and infrastructure will function during and after a hazard event and prepare essential services for projected climate change impacts.

This project works towards goals 2,3, and 4 as well as Climate Adaptation Action #8 (A8): "Implement Climate Ready Boston and Continue to Develop Strategies that Integrate Various Natural Hazards." In the NHMP, Climate Adaptation Action 8 (A8) was deemed as a High Priority project. The Resilient Dorchester Waterfront Project at Tenean Beach / Conley Street was also identified as a catalytic near-term project in the Coastal Resilience Solutions for Dorchester report.

The Federal Emergency Management Agency (FEMA) approved 2021 NHMP update makes the City of Boston eligible for FEMA grants. We can use those grants to put in place the strategies identified in the final report, including projects such as the Tenean Beach / Conley Street project.

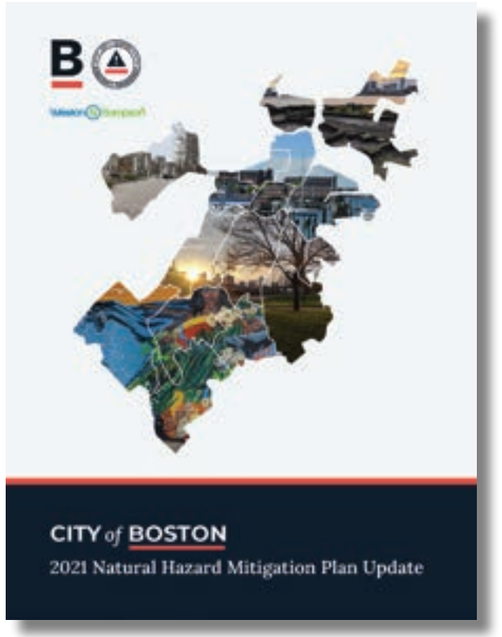


Figure 46: City of Boston 2021 Hazard Mitigation Plan

Read more about 2021 Natural Hazard Mitigation Plan here:

https://www.boston.gov/departments/emergency-management/natural-hazard-mitigation-plan

Morrissey Boulevard

The Massachusetts Department of Transportation, Massachusetts Department of Conservation and Recreation, City of Boston, and Boston Planning and Development Agency are currently collaborating on a planning study for the future redesign of Morrissey Blvd. Morrissey Blvd, a critical transportation infrastructure and designated evacuation route, is vulnerable to coastal flooding from the Tenean Beach and Conley Street flood pathway, as well as other flood pathways emanating from the Dorchester waterfront. Improving the resiliency of Morrissey Blvd to coastal flooding is a key planning goal of the project, thus there is a shared interest with the proposed project at Tenean Beach and Conley Street. The collaborating partners have agreed to plan Morrissey Blvd resiliency improvements to provide protection from the 2070

1% annual chance storm based on the MC-FRM.

Joseph Finnegan Stormwater Park

The Joseph Finnegan Park storage basin envisions a hybrid natural storage system and pump station to be constructed in the park, adjacent to the Neponset River. The basin can serve as a walkable recreation area during dry weather or low tide rain events. However, during heavy rainfalls, it can store excessive water and pump it into the river if necessary. Potentially, some of the stormwater storage tanks could also be located in the Tenean Beach project. This decentralization of tanks from Joseph Finnegan Park would benefit both parks in a mutually advantageous manner.

Neponset River Greenway Extension

The Massachusetts Department of Conservation and Recreation (DCR), with the assistance of the BSC Group, Inc. (BSC) and Massachusetts Department of Transportation (MassDOT), are currently working on an extension to the Neponset River Greenway between Tenean Beach and Morrissey Boulevard in Dorchester. The project features a 3,620-foot long multi-use pathway, with a 10 foot boardwalk portion.

The first section of the project will go from Victory Road to the William T. Morrissey Boulevard, while the second stretches from Victory Road to Tenean Beach off Conley Street, which links in to the Dorchester Waterfront project site.

The project aims to connect the Lower Neponset River Trail Greenway at Tenean Beach to the Harbor Walk. Along the way, the project will resurface some sections of street, add sidewalks, increase stormwater infiltration, and allow for new wetland habitat establishment.

More information available at:

https://www.boston.gov/sites/default/files/file/2021/07/Neponset%20River%20Greenway%20NOI_Combined.pdf

Figure 47: Neponset Greenway Extension, BSC Group

ROADMAP TO IMPLEMENTATION

The Tenean Beach proposal embodies a design solution that effectively mitigates flood risk while providing additional benefits of expanded recreation and improved access to the extended Dorchester community. To achieve successful implementation, further development is required in the following areas.

Coordinate a Comprehensive Flood Resilience Strategy

This is an initial step towards establishing a continuous coastal flood resilience strategy. Efforts must be coordinated and planned in conjunction with adjacent resilience projects to ensure long-term risk reduction.

Explore Funding Opportunities for Design and Construction

There are numerous opportunities for grant funding, including Federal Emergency Management Agency (FEMA), Massachusetts Municipal Vulnerability Preparedness (MVP), Massachusetts Office of Coastal Zone Management (CZM), and National Fish and Wildlife Foundation (NFWF). Continued discussions are necessary to determine which grants would best serve the project, which grants are most competitive for selection, and what design modifications may be required.

Conduct Detailed Site Investigations

Delineation of Wetland Resource Areas

A professional wetlands scientist is required to accurately delineate wetland areas, including salt marshes and bordering wetland vegetation. Identifying these areas is crucial for determining the impacts of the proposed design on wetland resources.

Bathymetric Surveys

Surveyed bathymetric data of the project area will provide more accurate details of site elevations both above and below water. This information is essential for the development of the design and will serve as the foundation for site grading, which is necessary to achieve the proposed project goals.

Geotechnical Investigations

A geotechnical investigation is critical for understanding the subgrade conditions necessary for designing foundations that support flood resilience infrastructure, such as berms and walls.

Figure 48: Next steps include further site investigations, such as wetland delineation and more detailed surveys

Facilitate Discussions with Regulatory Agencies for Permitting

Collaborating with regulatory agencies from the outset allows for smoother design development, integrating permitting requirements with the design process. Continued innovative collaborations between the City, DCR, and other agencies are essential to establish a replicable process that enables coastal risk reduction transformation along the waterfront.

Continual Hydrodynamic Modeling

As the design progresses into more detailed phases of documentation, it is important to model refined designs to confirm that the project is achieving the desired ecological and hydrological goals. Modeling will also be able to demonstrate that there are no adverse impacts on adjacent property owners as a result of the design implementation.

Develop an Inclusive Community Engagement Plan

To engage a broader cross-section of the diverse demographic that resides in the area, outreach and engagement efforts need to be accessible and targeted. Defining an equitable engagement plan, one that is tactical and accessible, will allow diverse voices to be heard and help shape the design proposal towards a more beloved community amenity.

Figure 49: Further hydrodynamic modelling is needed to understand desired goals for the site

APPENDIX

FUNDING OPPORTUNITIES FOR PROJECT IMPLEMENTATION

FUNDING OPPORTUNITIES FOR PROJECT IMPLEMENTATION

Grant Program	Leading Agency	Program Purpose & Eligibility	Opportunities	Challenges	Sample Dates (Renew Annually)
The Building Resilient Infrastructure and Communities (BRIC)	Federal Emergency Management Agency (FEMA)	The BRIC program seeks to move away from responsive disaster spending and towards proactive resiliency investments. The program supports innovative projects that involve partnerships and provide multiple benefits to communities. Eligible projects include those that focus on infrastructure, benefit disadvantaged communities, use nature-based solutions, enhance climate resilience, and adopt hazard resistant building codes.	BRIC is the FEMA grant that most closely aligns with the Dorchester Waterfront project and its timeline. Large scale funding sufficient for construction and there is a 75% federal cost share. There is more time to spend the funds than many other grants.	Would require a Benefit-Cost Analysis (BCA), Wetland Delineation, CLOMR, environmental and historical resources due diligence, and potentially additional studies. Extensive documentation requirements, long-lead times, and cost to pursue and obtain the funding in hand. Will likely require demonstration that FEMA flood zones will be reduced by the project, which will be complex due to transportation infrastructure serving as flood barrier.	Opens: Sept. 30, 2022 Closes: Jan. 27, 2023, at 3 p.m. ET
Municipal Vulnerability Preparedness (MVP) Action Grant (FY 25)	Massachusetts Executive Office of Energy and Environmental Affairs (EEA)	The MVP Action Grant is a financial aid for Massachusetts communities that aim to mitigate the effects of climate change. To qualify for the grant, potential recipients should first be certified as an MVP community. The funding can be utilized to conduct vulnerability assessments and establish resiliency plans.	Project aligns with the state goals related to providing community benefits and climate change adaptation investments in EJ communities. Less cumbersome application process, due diligence requirements, and procurement restrictions (than FEMA). Weighted towards projects that benefit EJ communities. Opportunity for two fiscal year grants, providing continuity in the design and permitting process.	Funding limits may be a bit on the lower side to cover all construction. Money must be spent in a shorter timeframe (1 or 2 fiscal years, with procurement approximately 18 months). May not be able to fund elements that are in regulatory gray areas. Would require wetlands delineation and pre-application with MassDEP, CZM, and DCR regulators to identify areas of consensus around what elements are permittable.	FY25 Grant Round anticipated in Spring 2024.
Coastal Resilience Grant Program (FY 24)	Massachusetts Office of Coastal Zone Management (CZM)	The grant for Coastal Resilience provides financial aid for projects that strive to improve public knowledge regarding coastal storms and climate change. It also covers activities that involve vulnerability assessment, planning adaptations, redesigning facilities and infrastructure that are at risk, and restoring shorelines. The program evaluates proposals that fall into five categories, which consist of comprehensive vulnerability assessments and outreach to the public.	The 2 million dollars in funding could develop the design to address the DCR and permitting concerns. Less cumbersome application process, due diligence requirements, and procurement restrictions (than FEMA). Weighted towards projects that benefit EJ communities. Opportunity for two fiscal year grants, providing continuity in the design and permitting process.	The grant offers 2 million dollars, which would be sufficient to cover design phases and permitting, but not construction. Favors projects with clear environmental permitting pathways. May not be able to fund elements that are in regulatory gray areas, and money may also need to be spent in a shorter timeframe. Would require wetlands delineation and pre-application with MassDEP, CZM, and DCR regulators to identify areas of consensus around what elements are permittable.	FY24 Grant Applications due on July 11, 2023.
National Coastal Resilience Fund (NCRF)	National Fish and Wildlife Foundation (NFWF)	The National Coastal Resilience Fund (NCRF) is a program that aims to protect coastal communities and enhance habitats for fish and wildlife by restoring and strengthening natural infrastructure. The program supports projects that demonstrate dual benefits to both communities and habitats, and prioritize nature-based solutions, community resilience, and fish and wildlife benefits. Additionally, priority is given to projects that have a positive impact on underserved communities, engage community members in project design and implementation, and promote sustainability and long-term maintenance.	Since the project is partly within the bounds of the Area of Critical Environmental Concern (ACEC) it would have a competitive advantage. The reduction of risk for human communities is also part of the grant criteria. DCR and the City of Boston are eligible to receive these grants, providing flexibility for different implementation scenarios.	There is some concern whether the ecological restoration aspects of the project are compelling enough for NFWF. NFWF might fund the ecological portion of the site from EL. 14 down, but there may be need to look into additional funding for upland areas. The ecological benefits may be more compelling as part of a broader suite of actions to improve resilience in the Neponset River Estuary.	Pre-Proposal: Mar. 2, 2023 Closes: Jun. 28, 2023
Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program (PROTECT)	U.S. Department of Transportation (USDOT)	The PROTECT Grant program offers financial support to ensure the resiliency of transportation systems against climate change, flooding, and extreme weather events. It covers eligible activities, such as resilience planning, strengthening evacuation routes, and enhancing the resilience of transportation infrastructure, specifically for highway, transit, and certain port projects.	The project protects the Southeast Expressway, Morrissey Boulevard, and MBTA assets, so would likely qualify.	More rigorous study needed in the design to address transportation vulnerabilities. Would require a Benefit-Cost Analysis (BCA)	Opens: Apr. 21, 2023 Closes: Aug. 18, 2023

Table 1: Funding program descriptions, challenges and opportunities

COST ESTIMATE

COST ESTIMATE

Cost estimation for this project is based on similar projects completed in the greater Boston, Massachusetts area, unit costs provided in the Boston BMP Manual, and MassDOT weighted bid prices adjusted to fit the scope and location of this project.

Dorchester Resiliency Project					6/28/2023
Base Assumptions					
Utilities and Appurtenances					
Existing water main to be relaid to follow grade of new main					
Existing Drainage and sewer manhole structures to be adjusted to new grade					
	Unit	**Quantity/LF**	**Unit Price**	**Cost/LF**	**Notes**
Stabilization and Demolition					$ 523,220.30
Erosion Controls	LF	2020	$ 30.00	$ 60,600.00	
Clearing and Grubbing	Acre	1	$ 45,000.00	$ 46,373.97	
Stump Removed	EA	75	$ 350.00	$ 26,250.00	
Temporary Construction Entrance	EA	2	$ 5,000.00	$ 10,000.00	
Tree Protection	EA	51	$ 200.00	$ 10,200.00	
Remove and Dispose - Steel Guardrail	LF	600	$ 10.00	$ 6,000.00	
Remove and Dispose - Wooden Guardrail	LF	260	$ 10.00	$ 2,600.00	
Remove and Dispose - Stone Block	LF	744	$ 15.00	$ 11,160.00	
Remove and Dispose - Concrete Walkways	SY	1224	$ 12.00	$ 14,693.33	
Remove and Dispose - Asphalt Walkways	SY	3962	$ 10.00	$ 39,616.67	
Remove and Dispose - Existing Asphalt Sportscourts	SY	2206	$ 12.00	$ 26,466.67	
Remove and Stack - Vertical Granite Curbing	LF	4021	$ 8.00	$ 32,168.00	
Reclaimed pavement for base course and/or Sub Base	SY	10473	$ 15.00	$ 157,091.67	Roadway and Parking lot area
Misc Park Demolition	LS	1	$ 80,000.00	$ 80,000.00	Pavillion structures, fencing, utilities
Public Utilities					$ 1,897,289
Drainage Piping	Linear Foot	2000	$ 170.00	$ 340,000.00	12"-24" RCP
Catch Basin	Each	14	$ 5,000.00	$ 70,000.00	includes frame/grate, adjustments, hood, etc
Standard Manhole	Each	15	$ 7,500.00	$ 112,500.00	includes frame/cover, invert, etc
Tide Gate (Backflow Preventer)	Each	2	$ 7,500.00	$ 15,000.00	
BioRetention Pond	SF	17762	$ 34.50	$ 612,789.00	includes plantings and warranty
Water main	Linear Foot	2000	$ 250.00	$ 500,000.00	includes valves connections, flushing and testing
Fire Hydraints	Each	3	$ 9,000.00	$ 27,000.00	includes hydrant, gate valve, and appurtenances
Adjusting existing structures to grade	LS	1	$ 20,000.00	$ 20,000.00	
Utility Relocation (Elect/CATV/Comm)	LS	1	$ 200,000.00	$ 200,000.00	
Site Utilities					$ 500,000
Site Electrical and lighting	AL	1	$ 250,000.00	$ 250,000.00	
Site appurtenances	AL	1	$ 250,000.00	$ 250,000.00	Picnic Benches, seating, trash cans, etc
EarthWork					$ 2,656,523
Strip and Stockpile topsoil (6" Depth)	SY	14915	$ 5.00	$ 74,573.33	
Imported Clean fill	CY	35000	$ 50.00	$ 1,750,000.00	Includes material, trucking and placing
Clay embankment core	CY	50	$ 700.00	$ 35,000.00	For length of Flood wall
Topsoil under Planting Areas (6")	CY	2701	$ 65.00	$ 175,544.54	
Beach Sand for beach and Dunes	CY	7300	$ 65.00	$ 474,500.00	
Flood Wall	CY	93	$ 700.00	$ 65,268.00	2'wide wall, 6' tall on 2'x4' footing = 0.74CY
Seepage Cutoff Wall - driven sheets	Lbs	40819	$ 2.00	$ 81,637.50	For length of flood wall
Roadway Building					$ 976,919
Fine Grading and compaction - Roadway	SY	7196	$ 5.00	$ 35,979.44	
12" Gravel Base - Roadway	CY	2399	$ 60.00	$ 143,917.78	
4" Asphalt Binder Course	TON	1583	$ 150.00	$ 237,464.33	7167sy x 4" x 0.055 = Tonnage
2" Asphalt Top course	TON	792	$ 150.00	$ 118,732.17	7167sy x 2" x 0.055 = Tonnage
Vertical Granite Curb - resetting existing	LF	3810	$ 35.00	$ 133,350.00	
Retaining Wall	CY	362	$ 800.00	$ 289,600.00	
Guard Rail on top of wall	LF	275	$ 65.00	$ 17,875.00	
Site surfacing					$ 2,155,183
Fine Grading and compaction - Parking	SY	1463	$ 5.00	$ 7,314.44	
8" Gravel Base - Parking	CY	327	$ 60.00	$ 19,602.71	
3" Asphalt Binder Course	TON	241	$ 150.00	$ 36,206.50	
1.5" Asphalt Top course	TON	121	$ 150.00	$ 18,103.25	
Vertical Granite Curb - new	LF	883	$ 75.00	$ 66,225.00	
Fine Grading and compaction - sidewalk	SY	5304	$ 7.00	$ 37,130.33	Harborwalk & Exposed Agg Ped Conc
8" Gravel Base - walkways	CY	327	$ 40.00	$ 13,068.47	
Boardwalk on Grade	SY	177	$ 180.00	$ 31,900.00	
Concrete Sidewalks - Harborwalk	SY	2778	$ 145.00	$ 402,761.67	120$/SY is MassDOT median - cement conc sidewalk
Concrete Sidewalks - Exposed Aggregate	SY	2970	$ 135.00	$ 400,920.00	
Concrete - CIP Pedestrian Concrete	SY	4082	$ 85.00	$ 346,951.11	
Basketball Court	EA	1	$ 165,000.00	$ 165,000.00	concrete base sportscourt, including appurtenances
Tennis Courts	EA	2	$ 185,000.00	$ 370,000.00	concrete base sportscourt, including appurtenances
Pickleball Courts	EA	2	$ 120,000.00	$ 240,000.00	concrete base sportscourt, including appurtenances
Landscaping and plantings					$ 1,751,136
Trees	AL	1	$ 185,000.00	$ 185,000.00	
Shrubs	AL	1	$ 485,000.00	$ 485,000.00	
Coastal Dune cover	SF	23515	$ 10.00	$ 235,150.00	
Maritime Forest cover	SF	7181	$ 16.00	$ 114,896.00	
High Marsh Mix	SF	38668	$ 12.00	$ 464,016.00	
Low Marsh Mix	SF	16050	$ 12.00	$ 192,600.00	
Lawn Area	SF	37237	$ 2.00	$ 74,474.00	
				Sub-Total	$ 10,460,271
				15% Contingency -	$ 1,569,041
				Total	**$ 12,029,312**

Table 2: Initial cost estimate

CONSTRUCTION SCHEDULE

CONSTRUCTION SCHEDULE

TASK	TIMELINE
DESIGN AND COORDINATION	
100% DESIGN DEVELOPMENT	4 MONTHS
PERMITTING PROCESS	
SURVEY AND GEOTECHNICAL INVESTIGATION	1 MONTH
PERMITTING DRAWINGS (50% CD-LEVEL)	2 MONTHS
PERMITTING DRAWINGS (75% CD-LEVEL)	1 MONTH
MEPA ENF - APPLICATION PREPARATION TO APPROVAL	5 MONTHS
MEPA SINGLE ENVIRONMENTAL IMPACT REPORT - PREPARATION TO APPROVAL	6 MONTHS
BOSTON CONSERVATION COMMISSION - NOI	3 MONTHS
BWSC SITE PLAN REVIEW	12 MONTHS
MASSDEP CH 91 - APPLICATION PREPARATION TO APPROVAL	7 MONTHS
ACOE - PRECONSTRUCTION NOTIFICATION	7 MONTHS
CONSTRUCTION DRAWINGS	
100% CONSTRUCTION DOCUMENTS REVIEW	1 MONTH
BID PROCESS	
BID DOCUMENTS REVIEW	3 WEEKS
BIDDING PERIOD	2 MONTHS
CONSTRUCTION PROCESS	
CONSTRUCTION SCHEDULE	18 MONTHS

BENEFIT COST ANALYSIS

TETRA TECH

Memo

To:	Linh Pham, Scape
Cc:	Laura Marett, Scape
From:	Scott Vose (Tetra Tech), Jason Hellendrung (Tetra Tech)
Date:	6/29/2023
Subject:	Tenean Beach Preliminary BCA Results

1.0 INTRODUCTION

This memorandum (memo) has been developed to calculate a benefit-cost ratio for the Dorchester Waterfront project located at Tenean Beach. This current analysis builds upon the previous benefit-cost analysis work that was completed for a wider array of projects as documented in the *Climate Ready Dorchester Preliminary BCA Memo*, dated 4 April 2020.

2.0 METHODOLOGY

This benefit-cost analysis uses previous data and information compiled for the *Climate Ready Dorchester Preliminary BCA Memo* and updates key data inputs to develop a benefit-cost ratio consistent with current data and reports for the Tenean Beach improvements. This benefit-cost analysis is also consistent with the general procedures described in the *Climate Ready Boston – Approach and Methodology for Asset Data Collection and Exposure Analysis and Consequence Analysis, Version 1.0*, dated 17 October 2016.

The primary steps in this analysis include:

1. Updating of previously developed structure inventory database to
    a. extract only structures impacted/protected by the proposed Tenean Beach improvements and
    b. update structure and content values for the selected structures to 2023 price levels.
2. Incorporate current hydraulic modeling results for the without- (existing) and with-project (proposed) conditions.
3. Model economic damages for the with- and without-project conditions, which includes estimating damages for the following categories:
    a. Direct physical damages to buildings and their contents
    b. Displacement costs
    c. Mental stress and anxiety costs
    d. Lost productivity costs
    e. Roadway transportation detour costs
4. Calculate annualized benefits and costs for generating a resulting benefit-cost ratio.

Tetra Tech
17885 Von Karman Ave #500, Irvine, CA 92614
Tel: 949.809.5000 | tetratech.com

3.0 BENEFIT-COST ANALYSIS

3.1 PROJECT BENEFITS

Project benefits are estimated as expected annual damages (EAD), which is the annualized difference in damages between the without- and with-project conditions. A summary of the assumptions for each damage category included in this analysis is provided below, including a summary of the final project benefits.

3.1.1 Structures and Contents

Structure and content damages covers the building-related losses associated with direct contact with flood waters. Structure damage relates to the structural components of building such as foundations, walls, and utilities. The content damages reflect damage to the non-structural components of building such as furniture, fixtures, cabinetry and other personal property and equipment.

For this analysis, a detailed structure inventory was already prepared and used in the 2020 BCA analysis referenced previously. This inventory covered a much larger area beyond the Tenean Beach project location. Therefore, the previous structure inventory was compared with the latest hydraulic modeling[1] for the Tenean Beach project area, and the specific structures impacted by this proposed project were extracted. Then these remaining 151 structures in the inventory were updated with current structure and content values using an average escalation factor from several sources including the US Army Corps of Engineers and US Census Bureau data[2].

Damages for each building were then calculated based on depths at each structure point after accounting for changes in ground elevation and estimated first floor elevations. Depth-to-damage functions were taken from several sources[3] to ensure each structure occupancy type was accounted for. The total damages for the with- and without-project conditions are provided below.

Annual Exceed. Probability (AEP)	Without-Project Damages		With-Project Damages		Structure and Content Benefits
	Structures	Contents	Structures	Contents	
5%	$1,252,412	$5,760,450	$0	$0	$7,012,862
2%	$2,426,191	$10,266,436	$44,727	$39,411	$12,608,490
1%	$5,299,015	$30,975,446	$45,751	$42,278	$36,186,431
0.5%	$9,087,832	$43,456,805	$47,117	$46,101	$52,451,418
0.2%	$12,174,795	$53,364,095	$58,758	$63,306	$65,416,825

3.1.2 Disruption Costs

Displacement costs to building owners is generally calculated as a one-time disruption cost, along with a recurring monthly rental cost. For this analysis, only the disruption portion of overall displacement costs has been estimated. This is because the monthly rental cost is significantly driven by the assumptions used to estimate overall duration until

[1] Hydraulic modeling completed by Woods Hole Group, which provided water surface elevations for (a) existing and proposed conditions, (b) the 20-, 50-, 100-, 200- and 500-yr flood events, and (c) the 2030 time horizon hydraulic conditions.
[2] https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll9/id/2596 and https://www.census.gov/construction/cpi/current.html
[3] Depth damage functions taken primarily from *North Atlantic Coast Comprehensive Study* (January 2015) and others taken from USACE's HEC-LifeSim model.

structure owners can reoccupy. These reoccupation durations are often arbitrary and difficult to reasonably estimate, and as such have not been estimated at this time. However, the disruption costs are a one-time cost applied to inundated structures with a well-documented cost per square foot already developed by FEMA[4]. The following table provides a summary of the without- and with-project disruption costs.

AEP	Disruption Costs (without-project)	Disruption Costs (with-project)	Disruption Benefits
5%	$164,211	$0	$164,211
2%	$233,552	$1,301	$232,251
1%	$242,111	$1,301	$240,810
0.5%	$397,110	$1,301	$395,809
0.2%	$583,730	$1,535	$582,195

3.1.3 Stress and Anxiety

This damage category is intended to characterize human health impacts following a flood that may result in decreased quality of life through adverse mental health. Based on FEMA's BCA Toolkit[5] the current value per inundated resident is $2,443. This value was applied to all inundated residential structures, with adjustments for multi-unit residential structures, as well as assumed number of persons per unit taken from US Census data[6]. The following table provides a summary of the without- and with-project mental stress and anxiety costs.

AEP	Stress Costs (without-project)	Stress Costs (with-project)	Stress Benefits
5%	$0	$0	$0
2%	$89,902	$0	$89,902
1%	$123,616	$0	$123,616
0.5%	$219,137	$0	$219,137
0.2%	$309,040	$0	$309,040

3.1.4 Lost Productivity

Lost productivity is intended to estimate worker productivity impacts that arise due to adverse human health impacts following a flood event. Based on FEMA's BCA Toolkit methodology, a value of $8,736 was used for each worker whose residence is inundated. The assumed number of workers per residential unit was calculated from US Census data for the city of Boston[7]. The following table provides a summary of the without- and with-project lost productivity costs.

AEP	Lost Productivity (without-project)	Lost Productivity (with-project)	Lost Productivity Benefits
5%	$0	$0	$0
2%	$223,642	$0	$223,642
1%	$307,507	$0	$307,507
0.5%	$545,126	$0	$545,126
0.2%	$768,768	$0	$768,768

[4] See *Benefit-Cost Analysis Sustainment and Enhancements, Standard Economic Value Methodology Report, Version 9.0*, dated 30 June 2020.
[5] https://www.fema.gov/grants/tools/benefit-cost-analysis
[6] https://www.census.gov/quickfacts/fact/table/bostoncitymassachusetts/PST120222
[7] https://www.census.gov/quickfacts/fact/table/bostoncitymassachusetts/PST120222

3.1.5 Transportation Detours

This damage category addresses impacts to roadway traffic that would incur detours, and thus added travel times, during a flood event. A review of local traffic count data from MassDOT was completed to determine estimates of daily vehicle traffic, and the nearest surface road with traffic counts is on Morrisey Boulevard[8]. MassDOT estimates that 35,875 vehicles travel along Morrisey Blvd just north of Conley Street. Using this daily traffic value with assumed closure durations for each flood magnitude, an estimated added detour time (currently 5-minutes), and an estimated employee compensation rate of $48.23 per hour for the City of Boston[9], total detour costs were estimated.

AEP	Traffic Detour Costs (without-project)	Traffic Detour Costs (with-project)	Traffic Detour Benefits
5%	$24,036	$0	$24,036
2%	$36,054	$0	$36,054
1%	$72,109	$0	$72,109
0.5%	$144,218	$0	$144,218
0.2%	$288,435	$0	$288,435

3.1.6 Expected Annual Damages

Expected annual damages (EAD) are estimated in the following table.

AEP	Total Damages (without-project)	Total Damages (with-project)	Total Benefits	Contribution to EAD
5%	$7,201,109	$0	$7,201,109	$292,381
2%	$13,275,779	$85,439	$13,190,339	$220,709
1%	$37,019,803	$89,331	$36,930,472	$222,779
0.5%	$53,850,228	$94,520	$53,755,708	$180,531
0.2%	$67,488,863	$123,600	$67,365,263	$134,057
			Expected Annual Damages	**$1,050,457**

3.2 PROJECT COSTS

A detailed line-item construction cost estimate has been developed for this project. The total cost includes all proposed elements of the project and is summarized in the table below.

Summary Category	Construction Cost
Stabilization and Demolition	$523,220
Public Utilities	$1,897,289
Site Utilities	$500,000
Earthwork	$2,665,523
Roadway Building	$976,919

[8] https://mhd.public.ms2soft.com/tcds/tsearch.asp?loc=Mhd&mod=
[9] https://www.bls.gov/news.release/pdf/ecec.pdf

Site Surfacing	$2,155,183
Landscaping and Plantings	$1,751,136
Sub-Total	$10,460,271
Contingency (15%)	$1,569,041
Total Cost	**$12,029,312**

In addition to construction, an annual operations and maintenance (O&M) cost has been estimated as 1% of the total construction cost above. This annual O&M is assumed to be incurred every year after construction and for the length of the project life.

4.0 RESULTS

4.1 BENEFIT-COST RATIO

The benefits (EAD) and costs for this project have been annualized based on two different discount rates (3% and 7%) and assumes a 50-year project life. The subsequent table provides the annualized benefits, annualized costs, benefit-cost ratio, and total net benefits for the Tenean Beach project.

Item	Benefit-Cost Ratio (3% Disc. Rate)	Benefit-Cost Ratio (7% Disc. Rate)
Annualized Benefits	$879,741	$699,964
Annualized Costs	$498,162	$681,297
Benefit-Cost Ratio	**1.77**	**1.03**
Net Annualized Benefits	$381,580	$18,667

4.2 LOWER BOUND ANALYSIS

The analysis presented above likely reflects a lower bound analysis. Many of the assumptions used were conservative in their impact, and other benefit categories have been omitted due to limited information available at this time. The following is a list of potential benefit assumptions that could lead to higher benefits with further analysis.

- Many other potential damage categories were not modeled for the benefits estimation. These other damage categories include but are not limited to:
  - Transportation losses for subway/rail lines – The Red Line subway runs directly through the study area, and there is potential that the tracks are inundated or jeopardized during large magnitude flood events.
  - Utility loss of service impacts (electrical, potable water, wastewater) – There are metrics available to estimate these losses over assumed outage duration periods. Due to limited information currently on flood durations, and potential outage periods, these were not estimated.
  - Environmental or ecosystem services benefits – There is insufficient information at this time to make a determination on potential environmental or ecosystem services benefits.
  - Recreation benefits – Flood events often inundate, and thus limit, recreational use areas and opportunities. Recreational facilities in the area have not been analyzed at this time.
  - Emergency response costs – Flooding often causes increased emergency response costs for fire and police departments, and it is likely that some additional emergency services would be expected for flooding in this area.
- The provided hydraulic models used in this analysis account for the existing and proposed hydraulic conditions that are expected in the year 2030. It should be noted that no additional time horizons were used in this benefit-cost analysis. But previous analysis[10] used additional time horizon hydraulic information to estimate EAD in the years 2050 and 2070 and incorporated those time horizons into the previous benefit-cost analysis efforts. Results from the inclusion of 2050 and 2070 hydraulics led to significant increases in EAD as time progresses and climate change impacts are incurred to this study area. Thus, a higher benefit-cost ratio could be expected if further climate change impacts are included in this analysis. Using the current benefit-cost analysis presented above and adjusting EAD at a similar rate as the previous reporting, benefit-cost ratios could more than double if accounting for future hydraulic changes.

[10] *Climate Ready Dorchester Preliminary BCA Memo*, dated 4 April 2020, prepared by Tetra Tech.

CRITICAL DATUMS

CRITICAL SITE DATUMS

DESIGN FLOOD ELEVATION: WATERFRONT

NOW-TERM (BASED ON 2030 1% AEP)

PARAMETER	**VALUE** (NAVD88)
2030 1% AEP WATER SURFACE ELEVATION	10.7 FT
2030 1% HMAX (WAVE HEIGHT)	3.0 FT
2030 1% HSIG (WAVE HEIGHT)	1.8 FT
DESIGN FLOOD ELEVATION (WSE+ HSIG WAVE CREST)	12.1 FT

NEAR-TERM (BASED ON 2050 1% AEP)

PARAMETER	**VALUE** (NAVD88)
2050 1% AEP WATER SURFACE ELEVATION	12.4 FT
2050 1% HMAX (WAVE HEIGHT)	3.5 FT
2050 1% HSIG (WAVE HEIGHT)	2.1 FT
DESIGN FLOOD ELEVATION (WSE+ HSIG WAVE CREST)	14.0 FT

LONG-TERM (BASED ON 2070 1% AEP)

PARAMETER	**VALUE** (NAVD88)
2070 1% AEP WATER SURFACE ELEVATION	14.1 FT
2070 1% HMAX (WAVE HEIGHT)	4.5 FT
2070 1% HSIG (WAVE HEIGHT)	2.6 FT
DESIGN FLOOD ELEVATION (WSE+ HSIG WAVE CREST)	16.2 FT

DESIGN FLOOD ELEVATION: CONLEY ST. I-93 UNDERPASS

NOW-TERM (BASED ON 2030 1% AEP)

PARAMETER	**VALUE** (NAVD88)
2030 1% AEP WATER SURFACE ELEVATION	10.7 FT
2030 1% HMAX (WAVE HEIGHT)	0 FT
2030 1% HSIG (WAVE HEIGHT)	0 FT
DESIGN FLOOD ELEVATION (WSE+ HSIG WAVE CREST)	10.7 FT

NEAR-TERM (BASED ON 2050 1% AEP)

PARAMETER	**VALUE** (NAVD88)
2050 1% AEP WATER SURFACE ELEVATION	12.4 FT
2050 1% HMAX (WAVE HEIGHT)	0 FT
2050 1% HSIG (WAVE HEIGHT)	0 FT
DESIGN FLOOD ELEVATION (WSE+ HSIG WAVE CREST)	12.4 FT

LONG-TERM (BASED ON 2070 1% AEP)

PARAMETER	**VALUE** (NAVD88)
2070 1% AEP WATER SURFACE ELEVATION	14.1 FT
2070 1% HMAX (WAVE HEIGHT)	1.5 FT
2070 1% HSIG (WAVE HEIGHT)	0.9 FT
DESIGN FLOOD ELEVATION (WSE+ HSIG WAVE CREST)	14.8 FT

NOTES:

- All elevation values in NAVD88
- All data utilizing MC-FRM data as described on pg. 102

CRITICAL SITE DATUMS

PRESENT-DAY TIDAL

DATUM	**VALUE** (NAVD88)
MLW	-5.16 FT
MTL	-0.42 FT
MHW	4.33 FT
HTL	6.80 FT

SEA LEVEL RISE ASSUMPTIONS

TIMEFRAME	**VALUE** (FT NAVD88)	**VALUE** (IN NAVD88)
2030	1.3 FT	15.6 IN
2050	2.5 FT	30 IN
2070	4.3 FT	51.6 IN

AVERAGE MONTHLY HIGH TIDE

TIMEFRAME	**VALUE** (NAVD88)
PRESENT	6.5 FT
2030	8.0 FT
2050	9.3 FT
2070	11.2 FT

NOTES:

- All elevation values in NAVD88
- Present-day MLW, MTL, MHW elevation values gathered from NOAA Station 8443970, Boston MA.
- Present-day HTL elevation value gathered from Neponset River Greenway Notice of Intent Plan Set.

2008 TIDAL

DATUM	**VALUE** (NAVD88)
MLLW	-5.30 FT
MLW	-4.95 FT
MTL	-0.20 FT
MHW	4.54 FT
MHHW	5.00 FT

2030 TIDAL

DATUM	**VALUE** (NAVD88)
MLLW	-3.80 FT
MLW	-3.90 FT
MTL	1.20 FT
MHW	6.10 FT
MHHW	6.50 FT

2050 TIDAL

DATUM	**VALUE** (NAVD88)
MLLW	-2.70 FT
MLW	-2.40 FT
MTL	2.50 FT
MHW	7.40 FT
MHHW	7.80 FT

2070 TIDAL

DATUM	**VALUE** (NAVD88)
MLLW	-1.00 FT
MLW	-0.70 FT
MTL	4.30 FT
MHW	9.30 FT
MHHW	9.70 FT

NOTES:

- All elevation values in NAVD88.

COASTAL MODELING

WOODS HOLE GROUP FOR EARTH, FROM SPACE
A CLS COMPANY

WOODSHOLEGROUP.COM

TECHNICAL MEMORANDUM

Sent by Electronic Mail
DATE June 30, 2023 **JOB NO.** 2022-00242

TO Linh Pham, RLA
Senior Associate
Scape Landscape Architecture
linh@scapestudio.com

CC Laura Marett (Scape), Kirk Bosma (WHG), Grace Medley (WHG)

RE: Tenean Beach Flood Resiliency Design – Performance Modeling

Introduction

Woods Hole Group utilized the Massachusetts Coast Flood Risk (MC-FRM) to verify the performance and assess potential impacts associated with the proposed (schematic) coastal flood resiliency improvements at Tenean Beach in the Dorchester neighborhood of Boston, Massachusetts. The intent of the proposed design is to mitigate the Conley St flood pathway into the Dorchester neighborhood, providing protection up to a 2030 1% annual chance flood plus 1 foot of freeboard, at a minimum. This evaluation included influences of the proposed schematic design on flood pathways, flood extents, water surface elevations, and redirected flood waters to neighboring properties in a series of storms representative of coastal flood annual exceedance probabilities (AEPs) in the 2030 time horizon. The following technical memorandum serves to summarize the results of the performance modeling.

Proposed Coastal Flood Resiliency Improvements

Performance modeling involves virtual construction of the proposed design into the MC-FRM domain and additional sub-modeling grids, simulating select AEP storm scenarios within the model(s), and assessing hydrodynamic changes (water levels, extents, etc.) between existing and proposed conditions. For this project, the proposed schematic design combines an elevated waterfront park, elevated roadway, and flood wall, with a maximum continuous crest elevation of 14 feet NAVD88. Figure 1 presents the approximate alignment that was applied to the hydrodynamic modeling grid.

107 Waterhouse Road, Bourne, MA 02532 USA
T: +1 508.540.8080 **F**: +1 508.540.1001

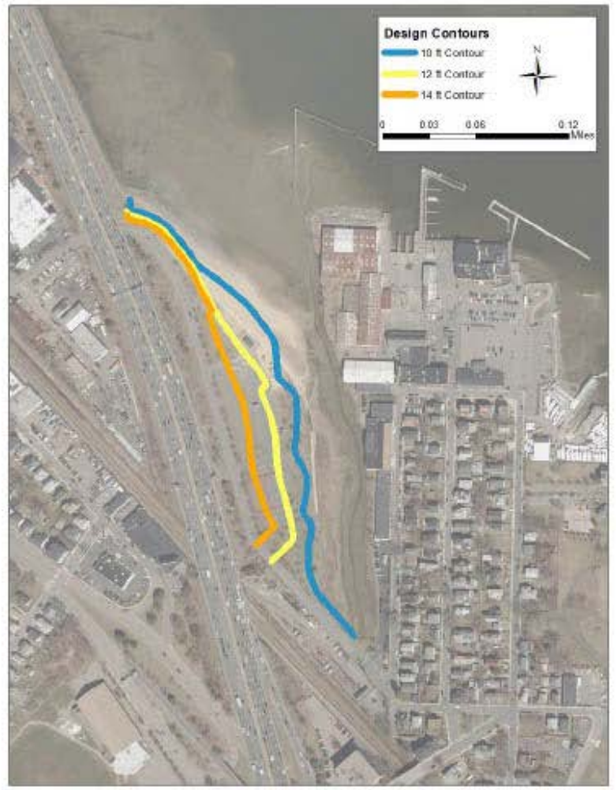


Figure 1: Approximate design alignment contours applied to the modeling domain. The design was applied to the MC-FRM modeling mesh as a series of contours representing the 10ft NAVD88 contour line, the 12 ft NAVD88 contour line, and the 14 ft NAVD88 contour line as proposed by the design drawing.

MC-FRM Performance Modeling

The MC-FRM is a high-resolution, probabilistic flood risk model created specifically to assess physics-based, coastal forced, flooding conditions under present and future climate conditions for the entire coast of Massachusetts. The MC-FRM only considers overland coastal flooding – drainage infrastructure is not included. The model uses a two-way coupled version of the Advanced Circulation (ADCIRC) and Unstructured Simulating Waves Nearshore (UnSWAN) models to fully simulated a variety of storm conditions (e.g., tropical and extra-tropical cyclones, etc.). The MC-FRM incorporates the state standard sea level rise conditions over time as presented by Massachusetts Coastal Zone Management and Resilient MA (https://resilientma.mass.gov/changes/sea-level-rise). Storm intensification due to climate change is also incorporated within the MC-FRM in the 2050 and 2070 time horizons. The model has, and is currently, being used for numerous coastal planning and design projects throughout Massachusetts and is recommended by the Commonwealth of Massachusetts *Climate Resilience Design Standards* as the basis for resilient coastal design.

The MC-FRM provides a probabilistic distribution of water levels for locations throughout Massachusetts based on thousands of storms. From these thousands of storm events, individual storms corresponding closely to

specific annual exceedance probability (AEP) water surface elevations can be selected to evaluate the performance of coastal flood resiliency projects. For this modeling effort, six representative storms, under two different climate horizons were simulated for existing conditions (existing elevations) and proposed conditions (with the proposed development constructed) within the MC-FRM framework.

The six specific storm AEP cases simulated and their respective peak stillwater levels at the project location are provided in Table 1.

Table 1. Peak water levels utilized for the performance modeling

Storm Event Case (Annual Exceedance Probability)	Return Period	Climate Horizon	Still Water Level at Tenean Beach (ft, NAVD88)
5%	20-year	2030	9.8
2%	50-year	2030	10.3
1%	100-year	2030	10.7
0.5%	200-year	2030	11.0-11.1
0.2%	500-year	2030	11.6
1%	100-year	2050	12.4

Flood Pathways Analysis

The proposed design's maximum crest alignment is at 14 feet NAVD88, and none of the storms considered produce high enough water surface elevations to exceed this elevation. As a result, the Conley St flood pathway is fully mitigated as a source of overland coastal flooding by the proposed design in these scenarios.

In the area west of I-93, between Dorchester Bay Basin and Neponset Circle, there are multiple 2030 AEPs in which the Conley St flood pathway is the only source of overland coastal flooding (Figure 2). These include the 2030 5%, 2%, and 1% AEPs (shown in shades of green). Based on the MC-FRM results, the proposed design will fully mitigate overland coastal flooding in this area at these AEPs. The risk of floodwater flanking the proposed design through underground drainage infrastructure in these events was not assessed.

There are additional coastal flood pathways into this area at lower AEPs in 2030 (and higher AEPs in 2050 and 2070). The MC-FRM resolves a significant flood pathway at the Morrissey Blvd/I-93 underpass just south of Dorchester Bay Basin (Figure 2). This pathway contributes to flooding in the area at 2030 0.5% (yellow) and lower AEPs (and 2050 2% and lower AEPs). However, the sub-area that floods from the Morrissey/I-93 pathway is separate from the sub-area that floods from the Conley St flood pathway at the 2030 0.5% (yellow) and 0.2% (orange) AEPs. At the 2030 0.1% AEP (pink), the two sub-areas join to a single larger floodplain. The proposed project will mitigate overland coastal flooding in the sub-area that floods from the Conley St flood pathway at the 2030 0.5% and 0.2% AEPs. The sub-area separately flooded by the Morrissey Blvd/I-93 pathway will remain at risk in these events. The risk of floodwater flanking the proposed design through underground drainage infrastructure in these events was not assessed.

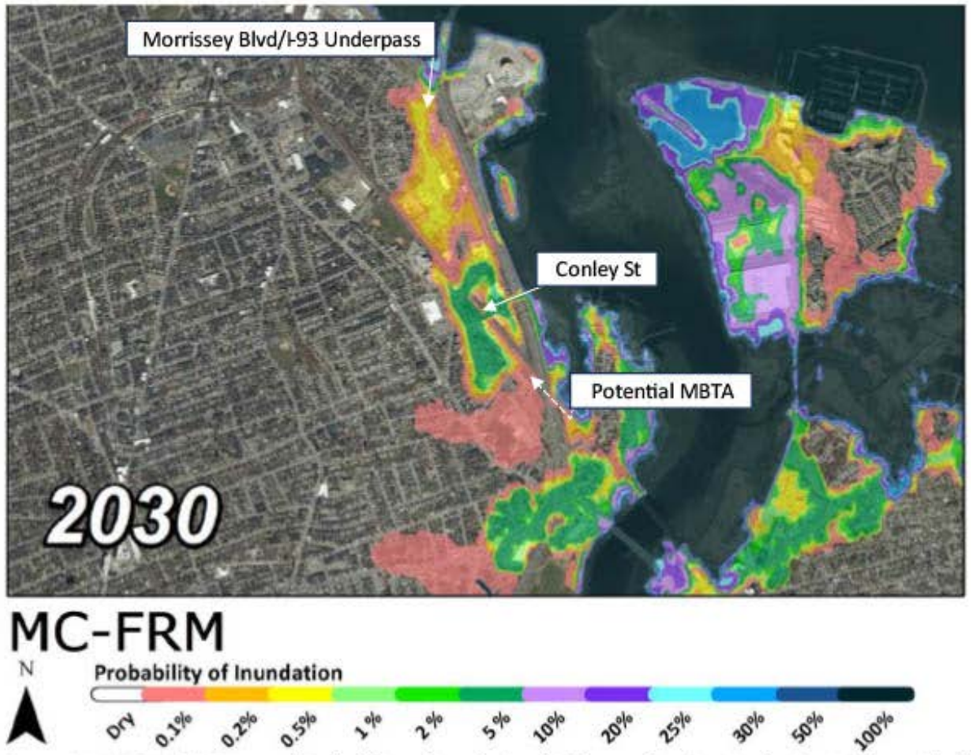


Figure 2: MC-FRM 2030 Annual Probability of Inundation (AEP) map showing Conley St, Morrissey Blvd/I-93 underpass, and potential MBTA flood pathways.

The MC-FRM does not resolve a narrow (approximately 5-10 feet wide) potential flood pathway at the MBTA Red Line maintenance yard on Conley Street (located on the far northern end of the existing concrete noise wall). At high enough water levels, flooding could potentially flank the noise wall on the east side of the rail right-of-way and flow over the rail line, into a narrow drainage ditch on the west side of the rail right-of-way, and north under the I-93 overpass into the sub-area fed by the Conley St flood pathway (Figure 2). Based on survey and LiDAR topographic data, the existing noise wall will block this flood pathway for events with a water surface elevation of up to about 11 feet NAVD88 (2030 0.5% AEP). For less frequent storms that begin to exceed that level, water may flank this noise wall. For example, at the 2030 0.2% water surface elevation (11.6 feet NAVD88) the potential flanking entry point would only be about 5 feet wide with maximum 0.1 feet to 0.6 feet of flood depth at the peak of the storm, limiting the volume of flooding that could potentially flank the proposed project through this pathway. Based on professional engineering judgement, the potential flooding through the MBTA pathway is unlikely to be sufficient to inundate the full sub-area protected by the proposed project up to the 0.2% AEP. With a water surface elevatoin around 13.0 feet NAVD88 (2050 0.5% AEP), this pathway is likely to be fully activated.

Results of Performance Modeling: Extent of Flooding

In a 1% AEP storm event in 2030, the Tenean Beach design meets the design intent of eliminating overland coastal flooding in the sub-area directly affected by the Conley St flood pathway (Figure 3).

Figure 3: Flood extents for the 1% AEP storm event under the 2030 climate horizon. The light blue indicates areas that are flooded in both existing and proposed conditions, whereas the dark blue regions indicate areas of avoided flooding due to the design alternative.

Flooding that occurs during the 2050 1% AEP storm event exceeds the threshold at which the Morrissey Blvd/I-93 flood pathway is activated. Due to the additional flooding coming from this pathway, there is an area of uncertainty in the flood extents due to the model's resolution, the ability to represent flow hydraulics through the MBTA Red Line underpasses at Morrissey Blvd, and limitations due LiDAR. This area of uncertainty is represented in Figure 4 as a hatched shading overlain on the flood extent.

Figure 4: Flood extents for the 1% AEP storm event under the 2050 climate horizon. The light blue indicates areas that are flooded in both existing and proposed conditions, whereas the dark blue regions indicate areas of avoided flooding due to the design alternative. The hatched area represents uncertainty in the extent of flooding.

Results of Performance Modeling: Water Surface Elevations

Part of this analysis involved using the MC-FRM results for water surface elevations (WSE) to provide WSE rasters before and after project implementation to inform a Benefit Cost Analysis conducted by TetraTech. The storms considered for this analysis were the five storms in 2030, where there is an independent project benefit in eliminating the flooding in the sub-area affected by the Conley St flood pathway. The results maps are shown in Figure 5 through Figure 9.

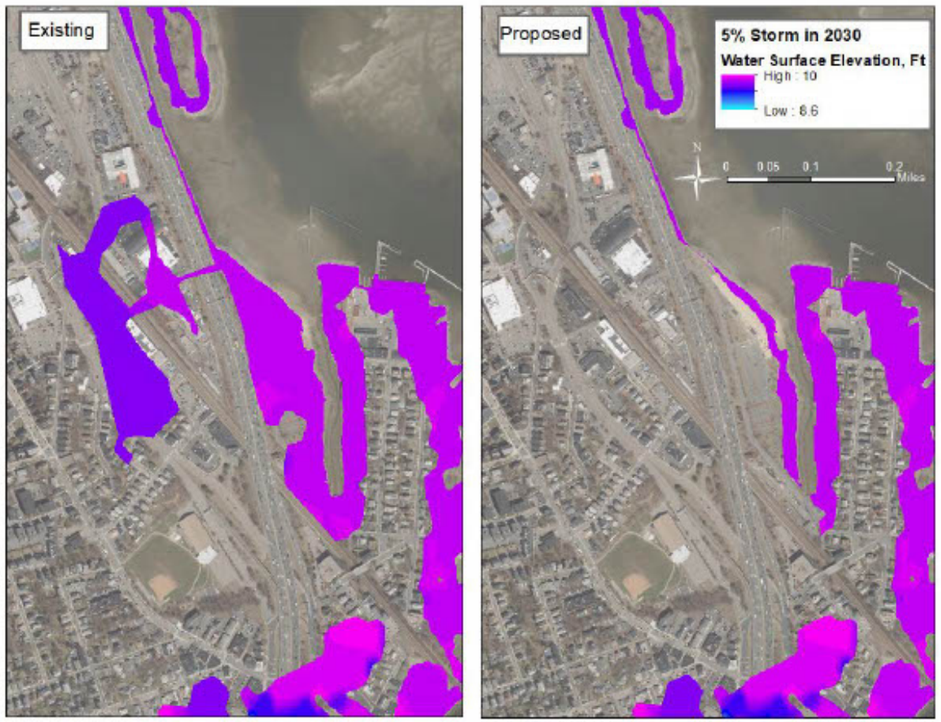


Figure 5: Water surface elevations for the 2030 5% AEP. The left panel represents existing conditions, without the project implemented, and the and the right panel represents proposed conditions, with the project implemented. Water surface elevations above Mean High Water (MHW) are shown in this figure, considering overland flooding only.

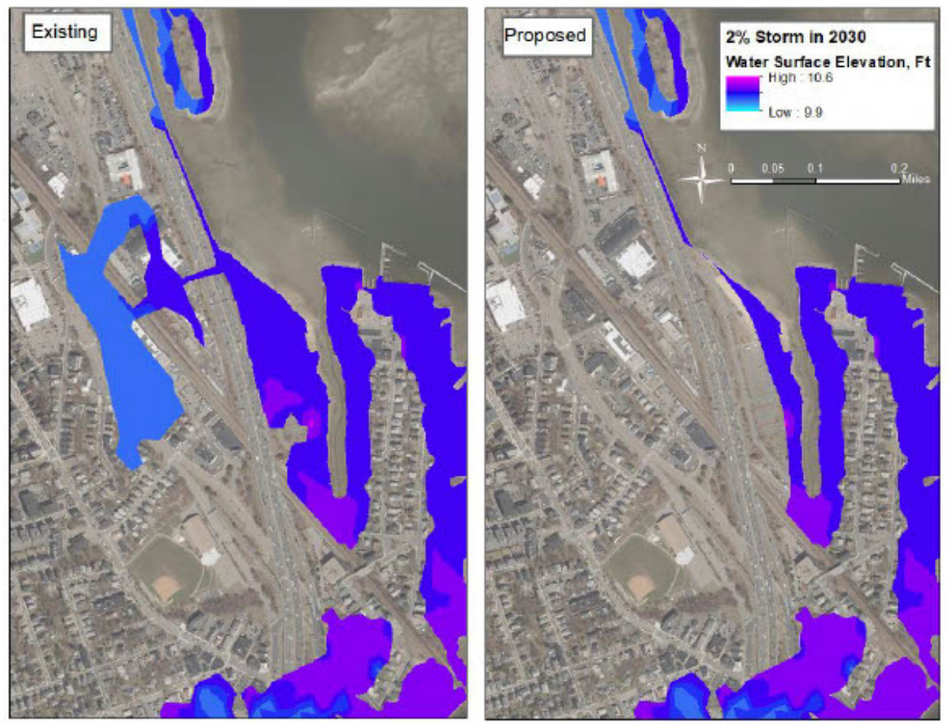


Figure 6: Water surface elevations for the 2030 2% AEP. The left panel represents existing conditions, without the project implemented, and the and the right panel represents proposed conditions, with the project implemented. Water surface elevations above Mean High Water (MHW) are shown in this figure, considering overland flooding only.

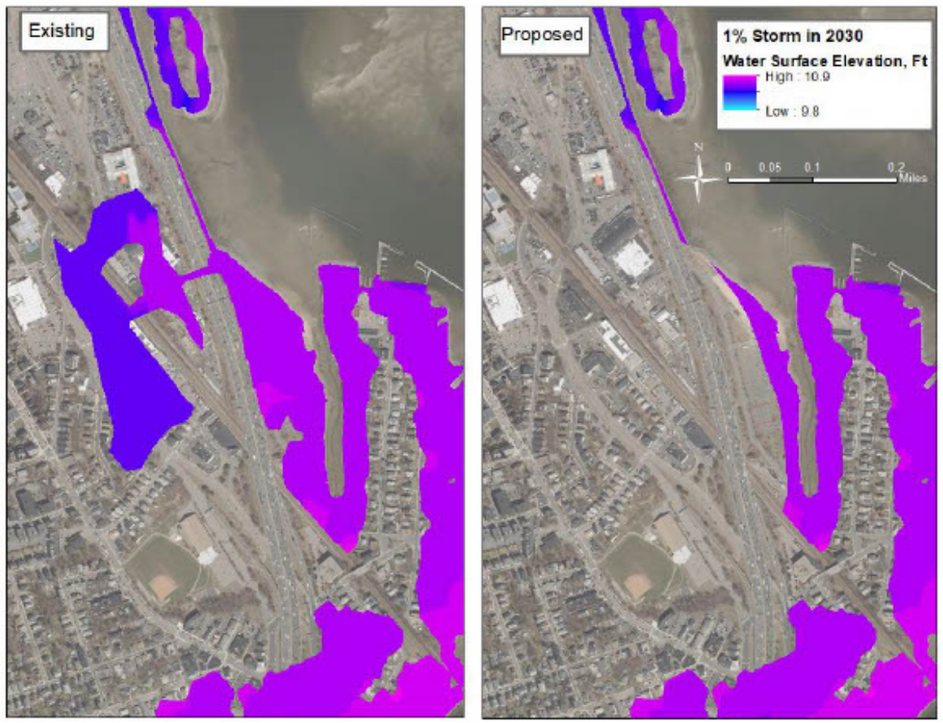


Figure 7: Water surface elevations for the 2030 1% AEP. The left panel represents existing conditions, without the project implemented, and the and the right panel represents proposed conditions, with the project implemented. Water surface elevations above Mean High Water (MHW) are shown in this figure, considering overland flooding only.

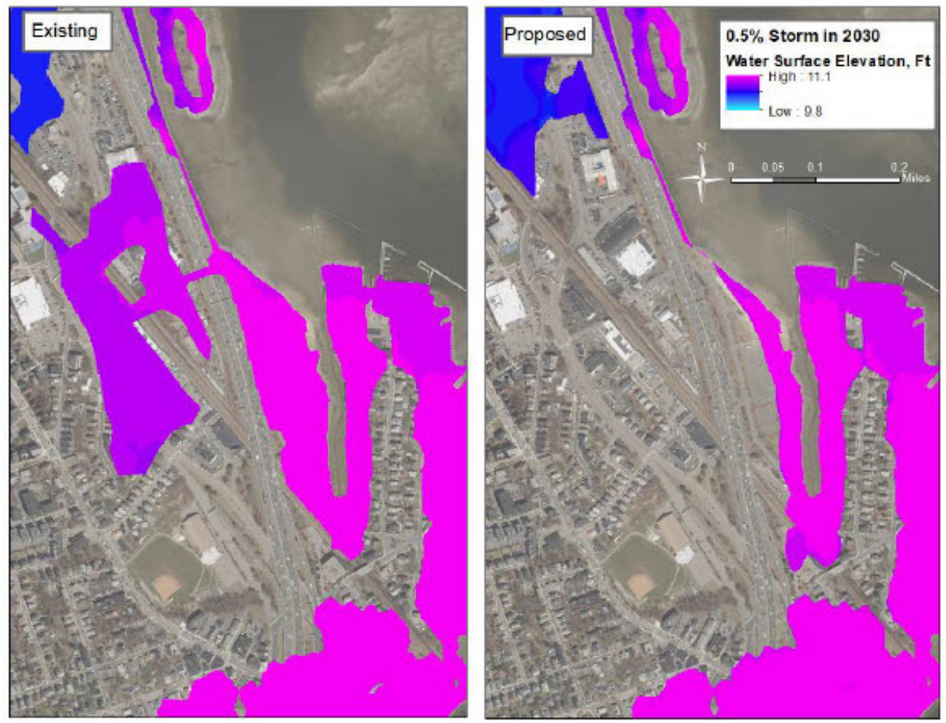


Figure 8: Water surface elevations for the 2030 0.5% AEP. The left panel represents existing conditions, without the project implemented, and the and the right panel represents proposed conditions, with the project implemented. Water surface elevations above Mean High Water (MHW) are shown in this figure, considering overland flooding only.

Figure 9: Water surface elevations for the 2030 0.2% AEP. The left panel represents existing conditions, without the project implemented, and the and the right panel represents proposed conditions, with the project implemented. Water surface elevations above MHW are shown in this figure, considering overland flooding only.

Results of Performance Modeling: Redirected Flood Waters

As flood waters flow inland and interact with infrastructure (both existing and proposed), various patterns and potential redirection of flow magnitudes, directions, and volumes can occur. Proposed infrastructure can function as a barrier to flow, which can potentially alter the flow patterns and modify flow velocities and flow volumes in the vicinity of these changes. Redirected flood waters that cause additional flooding to adjacent neighborhoods will be shown through modeled results as a localized increase in the water surface elevation in areas adjacent to the project implementation site. Impacts to neighboring properties in the form of redirected flood waters due to the placement of the design alignments was investigated for two storms, consisting of the 1% AEP event in 2030, and the 1% AEP event in 2050.

Modeled results indicate that during the most extreme of the storm scenarios simulated, there are no localized increases in water surface elevations, and therefore no redirected flood waters to the Port Norfolk neighborhoods. The assumption is made that results of flow redirection are the most extreme during the largest events, and if no difference is calculated in the largest of the events between existing and proposed water surface elevations, no differences will be observed in events of lesser magnitude.

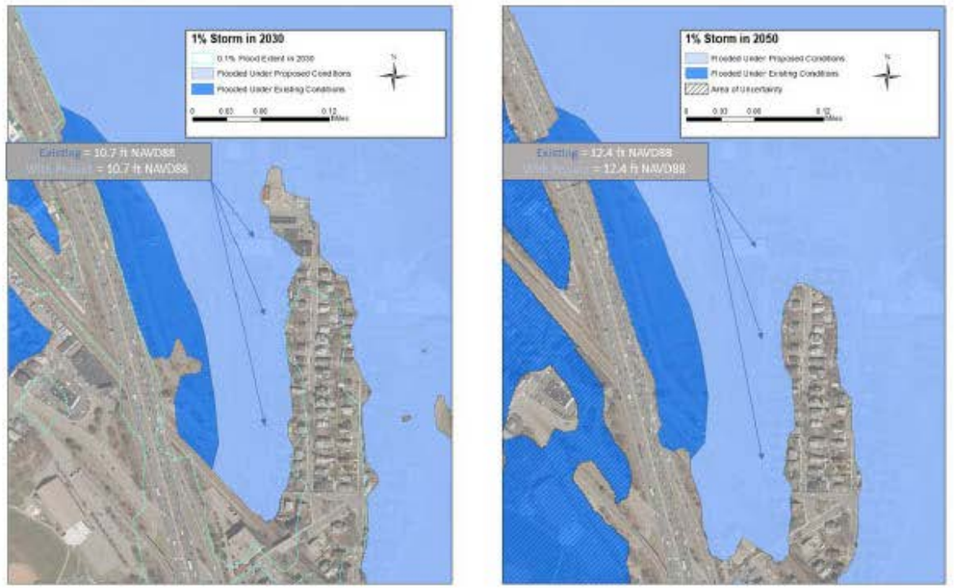


Figure 6: Flood extents, and water surface elevations, for the 1% AEP storm event under the 2030 (Left panel) and 2050 (Right panel) climate horizons, under existing and proposed conditions. The light blue indicates areas that are flooded with the project in place, whereas the dark blue regions indicate areas of the extent of flooding without the project in place. The hatched area in the right panel represents uncertainty in the extent of flooding that occurs when other flood pathways become dominant.

Conclusions

Based on the performance modeling results and analysis, key findings include:

- The proposed project effectively mitigates overland coastal flooding through the Conley St underpass.
- The proposed project meets the intended design goal of providing protection from overland coastal flooding up to a 2030 1% AEP.
- The proposed project does not redirect coastal floodwaters to the Port Norfolk neighborhood. Water surface elevations in the Port Norfolk area are the same with the project as in existing conditions.
- The proposed project eliminates flooding in the area inland of Conley St up to the 2030 0.5% AEP.
- At the 2030 0.2% AEP the proposed project may begin to be flanked by the MBTA flood pathway, but the flood volume is unlikely to be sufficient to inundate the full sub-area otherwise protected by the proposed project. Other resiliency improvements are required to mitigate this flood pathway.
- Other resiliency improvements are required to mitigate overland coastal flooding through the Morrissey Blvd/I-93 underpass. This flood pathway will activate at the 2030 0.5% AEP. In events with water surface elevations at or above the 2030 0.1% AEP, the degree to which this pathway will contribute flooding to the area otherwise protected by the proposed project is uncertain.

TECHNICAL MEMORANDUM

Sent by Electronic Mail
DATE June 30, 2023 **JOB NO.** 2022-00242

TO Linh Pham, RLA
Senior Associate
Scape Landscape Architecture
linh@scapestudio.com

CC Laura Marett (Scape), Kirk Bosma (WHG), Zach Stromer (WHG)

RE: Tenean Beach Flood Resiliency Design – Beach and Dune Cross-shore Modeling

Introduction

Tenean Beach, located in the Dorchester neighborhood of Boston, MA is a sandy beach situated at the confluence of the mouth of the Neponset River and Dorchester Bay. Tenean Beach has been identified by the Climate Ready Dorchester process as part of an area particularly at risk from climate change. Areas behind and adjacent to the beach were identified as being at risk of flood inundation during extreme coastal flood events with increasing risk due to expected future sea level rise. To provide resiliency benefits to the surrounding neighborhood and for the beach itself, a beach nourishment and dune enhancement element of the overall project has been designed.

The goal of raising the beach and dune with nourishment projects is to maintain a viable beach for recreational use under future sea level rise conditions, while also working in concert with the overall project's flood mitigation elements to reduce flooding under present and future storm conditions. As such, this project raises the elevation of the dune crest and beach berm and increases width of these beach elements to provide a more resilient beach setting and creates a usable beach even under future sea level rise conditions. Cross-shore wave and sediment transport modeling was conducted to understand the expected performance of the proposed project with respect to erosion during coastal storm events. Therefore, providing a measure of potential maintenance requirements with the beach nourishment portion of the overall resiliency mitigation approach.

While Tenean Beach was identified as being at risk due to flooding due to elevated water levels, wave-action is expected to be minimal, which means erosion and maintenance of the beach system may also be reduced. Located in a relatively narrow estuarine channel, and thus exposed to a short wave fetch length, Tenean Beach is fairly protected from wave action. Additionally, Tenean Beach is situated south-east of both Squantum Point and a wave fence at the Port Norfolk Yacht Club that shield Tenean Beach from larger waves during the predominantly nor'easter-driven coastal storm events. As wave-action is a critical component in driving beach erosion, Tenean Beach is expected to be relatively stable, experiencing only moderate erosion under regular conditions. For this reason, it can be expected that the proposed beach nourishment project will remain relatively stable and require infrequent replenishment.

Proposed Beach and Dune Improvements

The project proposes to expand and enhance the existing beach and construct a new beachgrass stabilized primary frontal dune with beach compatible sand. At its widest cross-section (Figure 1), the beach profile will rise from existing grade just above Mean High Water at a 10:1 slope to a 100 ft wide beach berm with a crest elevation of 7 ft NAVD88.

The toe of the dune would be set at elevation 7 ft NAVD88, with a foreslope of 7:1, 20 ft wide crest at elevation 12 ft NAVD88, and backslope of 10:1. The dune will be stabilized with beachgrass.

Cross-shore Performance Modeling

In order to evaluate the conceptual design configurations of beach and dune nourishment at Tenean Beach, estimate service life, and to determine the protective level of the proposed design during high-energy storm events, a cross-shore sediment transport model (XBeach) was utilized. XBeach is an open-source numerical model developed to simulate wave, hydrodynamic and morphodynamic processes. It has been developed with support of various agencies including the US Army Corps of Engineers, Rijkswaterstaat and the EU, together with a consortium of UNESCO-IHE, Deltares (formerly WL|Delft Hydraulics), Delft University of Technology, and the University of Miami. The newest version of the model (XbeachX) was utilized for the purposes of this study. XBeach was originally designed to assess hurricane impacts on sandy beaches. However, with funding from the Dutch Public Works Department the model has been extended, applied, and validated for storm impacts on dune and urbanized coasts, and, with further support from the European Commission XBeach has been validated on a number of dissipative and reflective beaches throughout the EU.

To assess the proposed nourishment design at Tenean Beach a 1-Dimensional representation of the design was created based upon the most recently available survey and lidar data for the site. The proposed design was superimposed on the existing topography data to create a representative transect for the modeling. Figure 1 shows a plan view map of the 1D transect location simulated for this project.

Figure 1. Xbeach 1-D cross sectional transect assessed for Tenean Beach in Boston, MA

Boundary conditions including water levels and wave conditions were created to be applied at the offshore boundary of the Xbeach grid. Four different storm condition cases were utilized for this study. This included coastal storm events corresponding to 10yr, 20yr, 50yr, and 100yr return period storms under present day conditions (2008 centered tidal epoch). Wave and water level conditions were obtained from the Massachusetts Coast Flood Risk Model (MC-FRM) for representative storms. MC-FRM is a high-resolution flood risk dataset based upon the results of a probabilistic hydrodynamic modeling effort. From the MC-FRM ensemble discrete storm simulations were selected which corresponded to water levels representing the return period events.

The model output from each of the simulations conducted consists of wave height, water surface elevation, and velocity along the profile for each model output timestep, along with changes in the bottom profile showing areas of erosion and deposition. The final profile for each case was extracted from the model simulations for comparisons with the initial profile to determine possible impacts to the beach from storm conditions.

Results of Performance Modeling

Figures 2 and 3 show the results of the 10yr and 100yr storm condition cases simulated using the proposed design, respectively. The figures show the existing cross-shore profile (dotted black line), as well as the proposed design (solid black line). The red line in the figure shows the final eroded profile after the storm simulation. The figures also show the maximum water surface elevation that occurred during the storm, including the processes of wave-driven setup and wave run-up. Finally, the figure also shows the levels of mean high water (MHW) and mean low water (MLW) datums demonstrating the levels on the beach where water levels would fall during the different tidal phases.

The results show relatively limited erosion during both storm cases shown, corresponding to the relatively small waves in the project area. The 10yr event simulation resulted in slight erosion (lowering and retreating) of the beach berm with very minor erosion of the dune face. The 100yr event shows slightly deeper erosion of the beach berm with retreat of the dune crest of approximately 10 ft. Both figures show water levels during the storms not exceeding the dune crest, demonstrating the protection offered by the proposed design for near to mid-term climate change conditions. Under longer-term climate change conditions, other elements of the proposed mitigative design would provide flood protection capacity.

Wave run-up also does not exceed the dune crest in the evaluated cases showing that the proposed design protects from overtopping related flooding even during 100yr extreme events. The sand eroded during both evaluated cases is transported seaward from the nourishment but remains between the MHW and MLW datum lines (the intertidal zone). This sediment that is transported into the intertidal zone will remain part of the littoral cell (the coastal area where sediment transport occurs, as opposed to offshore areas where sediment transport is more isolated) being available both for possible shoreward transport during more quiescent summer conditions, as well as continuing to offer protective benefits in the form of enhanced wave breaking further offshore.

Therefore, even under large storm events (e.g., 100-year return period level), all of the added sediment remains in the intertidal zone lending to a wider useable beach that provides energy dissipation for the shoreline. This normal re-adjustment of material remains in an area that still provides recreational ability and a longer overall service life, even after large storm events. Maintenance of the beach is therefore expected to be minimal and no significant renourishment requirements are expected to occur even after storm events over the near to mid-term.

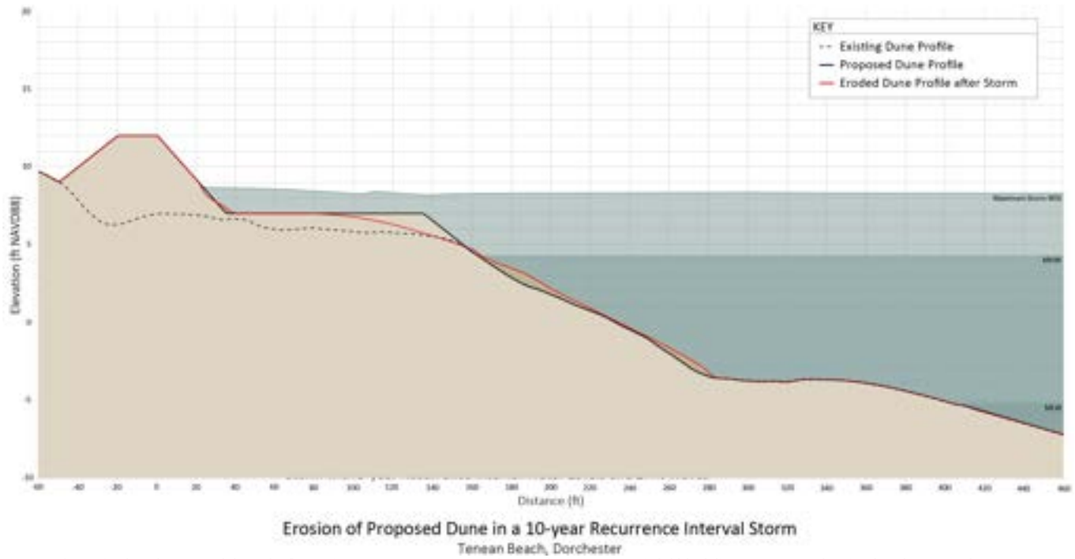


Figure 2. Xbeach 1-D model results for a 10-year recurrence interval coastal storm event. Solid black line represents the simulated proposed design. Dotted black line represents the existing conditions. Red line represents the eroded profile of the proposed design after the event.

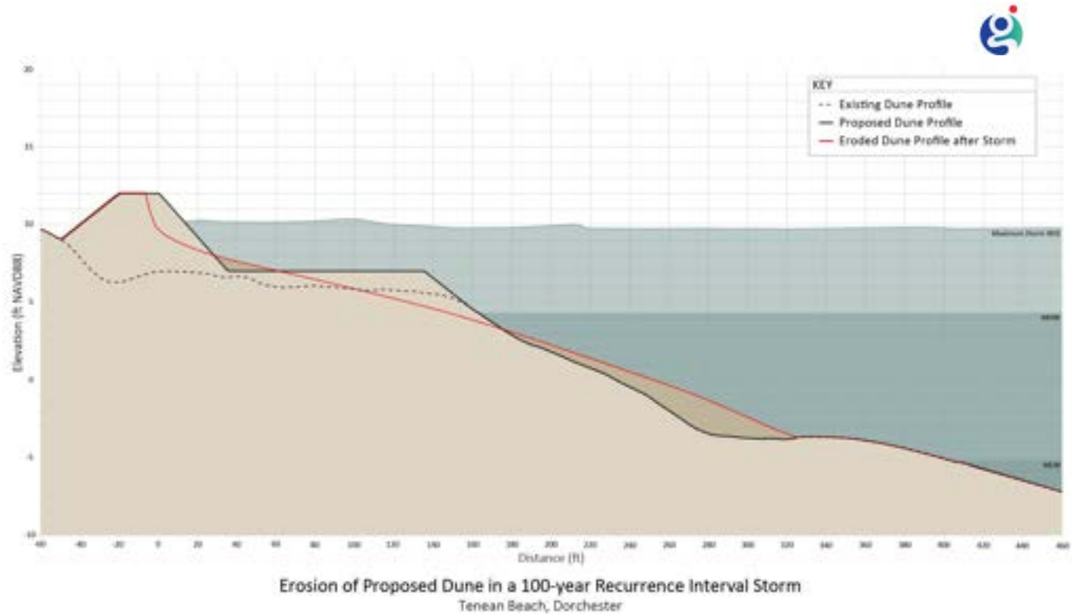


Figure 3. Xbeach 1-D model results for a 100-year recurrence interval coastal storm event. Solid black line represents the simulated proposed design. Dotted black line represents the existing conditions. Red line represents the eroded profile of the proposed design after the event.

PERMITTING EVALUATION

PERMITTING EVALUATION

The project team prepared a technical memorandum summarizing anticipated permitting requirements for the Boston Planning and Development Agency's ("BPDA's") Dorchester Resilient Waterfront Project and Tenean Beach / Conley Street (the "Project") in the Tenean Beach area of Boston's Dorchester Neighborhood. The background and assumptions in this technical memorandum form the basis for the anticipated permitting requirements summarized below.

Based on the scope of work outlined in these schematic plans, the following jurisdictional and protected resource areas as expected to be impacted by the Project:

- Coastal Beach/Tidal Flat and 100' Buffer Zone
- Coastal Bank and 100' Buffer Zone
- Salt Marsh and 100' Buffer Zone
- Bordering Vegetated Wetlands and 100' Buffer Zone
- 25' Riverfront Area
- Land Subject to Coastal Storm Flowage (and potential Bordering Land Subject to Flooding)
- Coastal Flood Resilience Zone
- Land Subject to Flooding or Inundation
- Waterfront Area
- Neponset River Estuary Area of Critical Environmental Concern
- Filled tidelands
- Waters of the United States

Impacts to these resources areas will require submission of the following regulatory submittals to the applicable municipal, state, and federal agencies:

- Notice of Intent – Boston Conservation Commission
- Site Plan Review – Boston Water and Sewer Commission
- Specific Repairs – Boston Public Improvement Commission
- Environmental Notification Form/ Environmental Impact Report – Executive Office of Energy and Environmental Affairs
- Chapter 91 License Application – Massachusetts Department of Environmental Protection Waterways Program
- 401 Water Quality Certification – Massachusetts Department of Environmental Protection
- Construction Access Permit – Massachusetts Department of Conservation and Recreation
- Pre-Construction Notification Form – United States Army Corps of Engineers
- Federal Consistency Review – Massachusetts Office of Coastal Zone Management
- National Pollutant Discharge Elimination System Stormwater Pollution Prevention Plan – United States Environmental Protection Agency

For a detailed description of the permitting evaluation, see Appendix: Permitting Evaluation

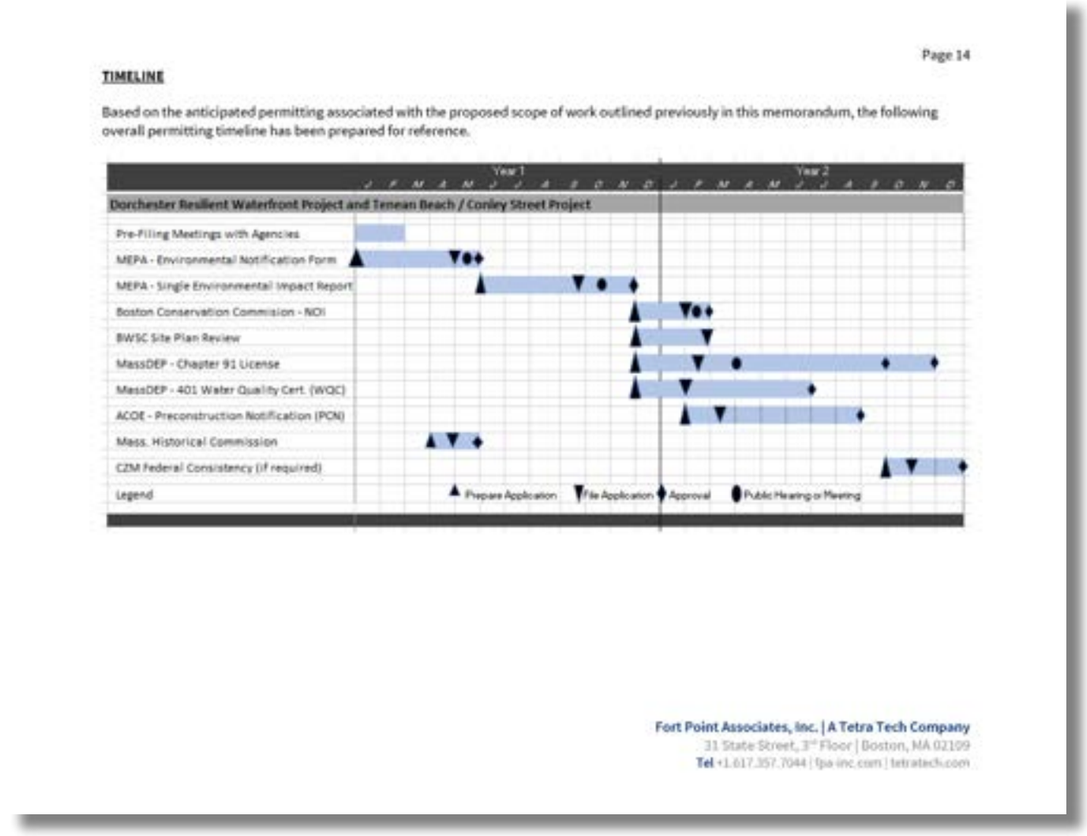


Figure 50: Timeline for permitting , see Appendix: Permitting Evaluation for larger diagram

TETRA TECH

Fort Point Associates, Inc. |
A Tetra Tech Company

Memo

To:	Delaney Morris – Boston Planning & Development Agency Project Manager
Cc:	Linh Pham – Scape Project Manager, Jason Hellendrung – Tetra Tech Project Manager
From:	Katie Moniz – Director of Fort Point Associates, A Tetra Tech Company, Permitting Team
Date:	June 23, 2023
Subject:	Permitting Evaluation for Dorchester Resilient Waterfront Project at Tenean Beach / Conley Street

BACKGROUND & ASSUMPTIONS

The purpose of this memorandum is to summarize anticipated permitting requirements for the Boston Planning and Development Agency's ("BPDA's") Dorchester Resilient Waterfront Project and Tenean Beach / Conley Street (the "Project") in the Tenean Beach area of Boston's Dorchester Neighborhood (the "Project Site"). See Figure 1, Project Locus. The background and assumptions below form the basis for the anticipated permitting requirements summarized in the following sections.

Project Site

The Project Site, which includes approximately 435,600 square feet ("sf") or more than 10 acres in total, consists of open space owned by the Massachusetts Department of Conservation and Recreation ("DCR") and includes a public beach, salt marsh, athletic and passive recreational amenities, a parking lot, and a roadway variously named Conley Street and Tenean Street. Specific amenities include a Harborwalk, playground, basketball court, tennis courts, and picnic shelters. These amenities are distributed across approximately six parcels identified as DCR-owned properties. Parcels and rights-of-way ("ROWs") owned by the City of Boston, Massachusetts Bay Transportation Authority ("MBTA"), and Massachusetts Department of Transportation ("MassDOT") also fall within the Project Site.

The Project Site is bounded by the Southeast Expressway/Interstate-93 embankment (the "Expressway Embankment") to the west, an MBTA maintenance yard to the south, Pine Neck Creek to the east, and the Neponset River to the north. A stormwater outfall and riprap-stabilized shoreline is located at the upstream end of Pine Neck Creek. Access to the Project Site is provided via Tenean Street from the south and Conley Street from the north. The latter accessway passes through an underpass running through the Expressway Embankment. Surrounding land uses include transportation facilities, residential neighborhoods, and light industrial properties of varying types. See Figure 2, Project Site Aerial and Existing Conditions Photographs Key; and Figures 3 through 6, Existing Conditions Photographs.

Areas within one mile of the Project Site are considered a Designated Geographical Area ("DGA") for Environmental Justice ("EJ") Populations in accordance with the Massachusetts Environmental Policy Act ("MEPA") regulations at 301 CMR 11.02. The Project Site is located in Census Block Group 2, Census Tract 1006.03 of Suffolk County, and the EJ criteria of Census Block Groups within the Project Site's DGA include Minority; Income; Minority and Income; Minority and English Isolation; and Minority, Income, and English Isolation. The Project Site has 462 EJ Populations within a five-mile radius and 32 EJ Populations within a one-mile radius. See Figure 7, Environmental Justice Populations (5-Mile Radius) and Figure 8, Environmental Justice Populations (1-Mile Radius).

Initial development of the Project Site predates construction of the Southeast Expressway, which was built between 1954 and 1959. Salt marsh and several tidal creeks comprised the Project site in its natural, predeveloped state. Circa 1914-1918, the City of Boston purchased portions of the Project Site and began filling activities to create a public swimming beach. A bathhouse was constructed around this same time period. Filling and expansion of the site for recreational purposes continued through the early 1930s. Construction of the Southeast Expressway in the 1950s resulted in a large portion of the beach being repurposed for transportation facilities. What remained comprises the present-day Tenean beach, which has been internally reconfigured in the years since the Southeast Expressway project but has seen its overall footprint remain largely unchanged. [1]

Mean high water ("MHW"), high tide line ("HTL"), and base flood elevation ("BFE") at the Project Site are assumed to be approximately El. 4.33, 6.8, and 10-12 NAVD88, respectively. Elevations at the Project Site max out at approximately El 9.0 NAVD88 in inland areas of the park and along Conley Street/Tenean Street, before sloping to higher elevations at the Expressway Embankment. These elevations should be confirmed through field surveys prior to undertaking future Project permitting efforts. See Figure 9, High Tide Line.

The Project Site is prone to tidal and storm surge flooding, with areas between MHW and the inland edge of the parking lot inundated on a reoccurring basis. The majority, or approximately 9.2 acres/401,000 sf, of the Project Site is located within Zone AE (El. 11.0-12.0 NAVD88) as designated by the Federal Emergency Management Agency ("FEMA") in Flood Rate Insurance Map ("FIRM") 25025C0091J, effective March 16, 2016. See Figure 10, Flood Rate Insurance Map 25025C0091J. A flood pathway exists along the section of Conley Street that travels through the Expressway underpass, which increasingly threatens to inundate inland areas west of the Expressway Embankment as the impacts of sea level rise ("SLR") grow in upcoming years.

The Massachusetts Public Waterfront Act Chapter 91 public trust lands include filled and flowed tidelands totaling approximately 53,000 sf, as reflected by the *Tidelands Jurisdiction Data Chapter 91* layers publicly available from Massachusetts Bureau of Geographic Information ("MassGIS") and reviewed in June 2023. This data is intended to be used for planning purposes only, and should be confirmed through review of the historic

[1] This history of development of the Project Site is sourced from review of the book *Gaining Ground: a History of Landmaking in Boston* by local historian Nancy Seasholes and georeferenced historic maps available through the BPDA's *Boston Atlas* and Mapjunction.com.

maps depicting the Project Site in its natural, pre-filling and predevelopment state. All jurisdictional areas within the Project Site on state-owned land (i.e., DCR, MBTA, MassDOT) are considered Commonwealth Tidelands. Three filled tidal creeks and the beach and salt marsh areas below current MHW comprise this area. Structures within jurisdiction may include Conley Street/Tenean Street roadway, the parking lot, a picnic shelter, a small portion of the playground, and portions of the Harborwalk. See Figure 11, Chapter 91 Jurisdiction. There are no known historic Chapter 91 licenses for fill or structures within the Project Site. The Project Site is not located in a Designated Port Area and thus is not subject to requirements for accommodating water-dependent industrial uses under the Chapter 91 Waterways Regulations.

Protected Resource Areas

The extent of resource areas within the Project Site outlined below is sourced from existing, public data available from MassGIS and has not been validated through field delineation. These data sources form the basis for the anticipated permitting requirements summarized in later sections of this memorandum, but should only be relied on for preliminary planning purposes. Field delineation is required to support future permitting efforts.

Wetland Resources

Based on site visits, review of *DEP Wetlands Detailed* GIS layers from MassGIS in June 2023, and review of other publicly available documentation, wetland resource areas protected under the Massachusetts Wetlands Protection Act, M.G.L. Ch. 131 § 40 ("WPA") and the Wetland Protection regulations at 310 CMR 10.00 that may be present at the Project Site include:

- Coastal Beach/Tidal Flat and 100-foot Buffer Zone;
- Coastal Bank and 100-foot Buffer Zone;
- Salt Marsh and 100-foot Buffer zone;
- Bordering Vegetated Wetlands ("BVW")* and 100-foot Buffer Zone;
- Land Under Ocean;
- Land Containing Shellfish;
- Rocky Intertidal Zone;
- 25-foot Riverfront Area**; and
- Land Subject to Coastal Storm Flowage ("LSCSF"); OR
- Bordering Land Subject to Flooding ("BLSF")***

*Though typically only found in Inland Wetlands, the Massachusetts Department of Environmental Protection ("MassDEP") may consider BVW to be present in the higher elevation vegetated areas adjacent to the salt marsh in the southern portion of the Project Site. Field delineation by a professional Wetland Scientist is strongly recommended in advance of conversations with MassDEP to gain a greater understanding of the potential presence of BVW on the Project Site.

**The Project Site includes the Riverfront Area resource area because it is located upriver from the Mouth of Coastal River for the Neponset River, which, as designated by MassDEP and depicted in the MassGIS *Mouth of the River (MOR) Lines* GIS layer, runs between Commercial Point in Dorchester and Squantum Point in Quincy. See Figure 12, Neponset River Mouth of Coastal River. The Riverfront Area may be extended from 25 feet inland from the mean annual high-water line of the river to up to 200 feet in width from that point at the discretion of the Boston Conservation Commission ("BCC") under the local wetlands ordinance.

***Though the Project Site is predominantly part of a coastal floodplain, MassDEP may consider BLSF to be present at the Project Site due to potential flood risk due to upstream flows from the Pine Neck Creek outfall into this riverine channel. Note that FEMA's Flood Insurance Study ("FIS") issued in 2016 did not study potential riverine flood risk in this portion of the Neponset River Estuary and limited its riverine flood studies to riverine system upstream of the Dam at Lower Mills. Conversations with MassDEP are strongly recommended to gain a greater understanding of the potential presence of BLSF on the Project Site.

The City of Boston Wetlands Ordinance, Chapter VII-I-IV, is not enforceable for projects on land owned by state agencies. This memorandum discusses the additional jurisdictional areas established by the Ordinance that also may be present:

- Coastal Flood Resilience Zone,
- Land Subject to Flooding or Inundation, and
- Waterfront Area

See Figure 13, Wetland Resource Areas. As noted above, the data depicted in Figure 13 is sourced from ArcGIS Online web services that were initially accessed from MassGIS in June 2023. Figure 13 only includes data available in the *DEP Wetlands Detailed* data layer and does not include additional wetland resource areas mentioned above.

Areas of Critical Environmental Concern

The Neponset River Estuary Area of Critical Environmental Concern ("ACEC") overlaps approximately 7.8 acres (or 340,000 sf) of the Project Site. See Figure 14, Neponset River Estuary Area of Critical Environmental Concern. As represented in the *Areas of Critical Environmental Concern ACECs* layer from MassGIS as reviewed in June 2023, the ACEC's landward boundary within the Project Site primarily falls along the seaward edge of Conley Street/Tenean Street. Proximate to the upstream end of Pine Neck Creek in the southern portion of the Project Site, the ACEC's boundary extends across the ROW and into the adjacent MBTA maintenance yard. Similarly, the ACEC boundary crosses Conley Street in the northern portion of the Project Site and partially overlaps the Expressway Embankment. A Resource Management Plan ("RMP") for this ACEC was approved in 1996 and references that improvement dredging may not be authorized under the Chapter 91 Waterways regulations at 310 CMR 9.00, within the ACEC. However, the RMP provides for exemptions to this waterway's restriction for improvement

dredging associated with maintenance of the stormwater outfall discharging to Pine Neck Creek as well as sediment removal and re-sanding at Tenean Beach.

Waters of the United States

Both the Neponset River and Pine Neck Creek are navigable waters under Section 10 of the federal Rivers and Harbors Act and are protected as Waters of the United States ("WOTUS") pursuant to the definitions and jurisdictional scope of federal Clean Water Act ("CWA"). The extent of jurisdiction over WOTUS extends to the HTL, which, as described above and depicted in Figure 9, is assumed to be approximately El. 6.8 NAVD88 at the Project Site shoreline. Jurisdiction also extends to adjacent wetlands above that HTL that have a surface water connection with navigable waters at least once during a given year. Contour GIS data sourced from MassGIS in June 2023 indicates that most of the beach, portions of the Harborwalk, the salt marsh and other vegetated areas along Pine Neck Creek, at least one shade structure, and portions of the parking lot all fall within areas that the meet the definition of WOTUS.

Project Description

The Project will provide advanced design solutions to address a near-term (2030) critical flood entry point at Tenean Beach in Dorchester, and is intended to protect adjacent inland areas from current and future coastal flooding associated with SLR by raising the elevation of the Project Site and cutting off the Conley Street flood pathway. It was initially identified in the City of Boston's *Coastal Resilience Solutions for Dorchester* report, released in 2020. The Project is presently in the conceptual design phase and may change during subsequent design refinements.

The Project calls for elevating and relandscaping the Project Site. Portions of the Project Site will be elevated by up to 5 ft to El. 14.0 NAVD88. Beach nourishment will be used to expand the beach inland from its current limit, and a beachgrass-stabilized dune will be introduced at the top of the beach. Construction of a new retaining wall in areas on both sides of the roadway will be required to enable elevation of Conley Street/Tenean Street as it passes along the upstream edge of Pine Neck Creek and the MBTA maintenance yard. The sidewalk along Conley Street/Tenean Street in this area will be expanded to a width of approximately 10 ft, an increase of 5 ft in width as compared to existing conditions. A small length of retaining wall will also be constructed on the seaward side of Conley Street immediately south of the Expressway Embankment underpass. Existing public amenities will be maintained and/or expanded, but some of these features will be reconstructed and their locations reconfigured to enable raising of the Project Site. The Harborwalk and parking lot will be relocated inland from their current locations. The Project also calls for incorporating living shoreline elements immediately inland from the existing salt marsh along the western shore of Pine Neck Creek through regrading and introduction of new salt marsh plantings. The living shoreline is assumed to have an extent of under 1,000 linear feet ("lf"). Replacing water and drain lines running under Conley Street/Tenean Street are anticipated to be included in the Project. See Attachment A, Conceptual Project Plans.

PERMIT SUBMISSIONS

Based on the assumptions described above, the following permit filings are anticipated for the Project.

Local

Notice of Intent – Boston Conservation Commission

A Notice of Intent ("NOI) will be required to be submitted to the BCC for work in coastal resource areas protected under the WPA and Boston Wetlands Ordinance. Field delineation is required to confirm the nature and extent of impacts to wetland resource areas impacted by the different Project components. The proposed elevating and regrading of the Project Site, beach nourishment, installation of retaining walls, living shoreline enhancements and reconfiguration/reconstruction of the overall site layout will all have impacts to resource areas. The Project will be required to comply with the general purposes of the Wetlands Protection regulations outlined at 310 CMR 10.01(2), as well applicable resource area performance standards throughout 310 CMR 10.00. Based on review of conceptual project plans available as of June 2023, the following wetland resource areas protected under the WPA are likely to be impacted by the proposed work:

- Coastal Beach/Tidal Flat and 100' Buffer Zone (beach nourishment and adjacent parkland modifications);
- Coastal Bank and 100' Buffer Zone (majority of Project components);
- 100' Buffer Zone to Salt Marsh (living shoreline, retaining wall along Pine Neck Creek near outfall);
- BVW and 100' Buffer Zone (living shoreline, retaining wall along Pine Neck Creek near outfall);
- 25' Riverfront Area (majority of Project components); and
- LSCSF/BSLF (all Project components)

Additional wetland resource areas established by the Boston Wetlands ordinance that are likely to be impacted by the project include:

- Coastal Flood Resilience Zone (all Project components);
- Land Subject to Flooding or Inundation (likely to overlap LSCF/BLSF jurisdiction under WPA for all Project components); and
- Waterfront Area (beach nourishment; living shoreline; retaining wall along Pine Neck Creek near outfall)

As noted previously, the Boston Wetlands Ordinance is not enforceable for projects on land owned by state agencies.

Projects subject to jurisdiction of the Wetlands Protection Regulations generally cannot decrease the volume or change the form of coastal beaches, 310 CM 10.27(3). However, there is an exemption to this

performance standard for beach nourishment with clean sediment of a grain size compatible with that on the existing beach, 310 CMR 10.27(5).

The beach nourishment and beachgrass-stabilized dune components of the Project will have the biggest impacts to wetland resource areas. This work will expand the extent of the beach as compared to existing conditions and move its current inland limit further inland. The living shoreline component may also result in conversion of BVW to salt marsh as defined under the Wetlands Protection regulations. Both of these Project components may be most suitable for the Ecological Restoration Limited Project permitting pathway.

To qualify for permitting as an Ecological Restoration Limited Project, the proposed work must be determined by BCC to be an Ecological Restoration Project, which is a project whose primary purpose is to restore or otherwise improve the natural capacity of a Resource Area(s) to protect and sustain the interests identified in M.G.L. c. 131, s. 40, when such interests have been degraded or destroyed by anthropogenic influences, 310 CMR 10.04. Ecological Restoration Limited Projects enable permitting of conversion of one resource area protected under the WPA to another, as will likely be necessary for the beach expansion and living shoreline. This proposed work could qualify as Other Ecological Restoration Projects, as they will involve the thinning or planting of vegetation to improve habitat value and fill removal and regrading, 310 CMR 10.24(8)(e)3.

It is noted that MassDEP has recently taken the position that Ecological Restoration Limited Projects cannot involve recreational amenities such as Harborwalks and other public access facilities. Under this circumstance the Harborwalk and other hardscape components of the Project would have to be permitted separately through a traditional NOI. Consultation with MassDEP is strongly recommended prior to Project permitting efforts to gain a greater understanding of whether the Ecological Restoration Limited Project permitting pathway is best approach for the Project.

Notwithstanding strong evidence that flooding on the Project Site is from coastal waters and that the resource area in the flood zone is LSCSF, MassDEP may seek to protect a temporary storage area for flood waters which overtop the bank of the creek by viewing the flood zone as BLSF. As such, the Wetland Protection performance standards would require compensatory storage for fill placed in the flood zone.

Should elements of the Project be viewed as not meeting regulatory performance standards and not qualify as an Ecological Restoration Project or as an Ecological Restoration Limited Project, the Project may need to seek a Superseding Order of Conditions from MassDEP.

Site Plan Review – Boston Water and Sewer Commission

The Boston Water and Sewer Commission ("BWSC") owns and operates the majority of water, wastewater, and storm drain systems in the City of Boston. The Project is subject to site plan review by BWSC for the initial design of proposed utility infrastructure and connections and will then require approval of a General Service Application ("GSA") for modification or connection to BWSC utility

infrastructure by the contractor. Plans and associated design calculations will need to be submitted to BWSC for infrastructure impacted by the proposed work. Additional contractor information and monetary deposit will need to be supplied to initiate a BWSC account and inspection schedule.

Specific Repairs – Boston Public Improvement Commission

The Boston Public Improvement Commission ("PIC") owns and manages ROWs in the City of Boston. The Project is subject to review by the PIC and will require approval from the body for Specific Repairs related to the reconstruction of Tenean Street and a small portion of Conley Street. Tenean Street is owned by the City of Boston, and runs approximately from the intersection with Lawley Street to the south and the northern limit of the MBTA maintenance yard to the north. A small portion of Conley Street underneath and immediately east of the Expressway Overpass is also owned by the City, while majority of the segment running through the Project Site is owned by DCR. Approval for Specific Repairs to the City-owned ROWs will be required from the following City agencies and offices:

- Boston Public Works;
- Boston Transportation Department;
- Inspectional Services Department;
- BWSC;
- Commission for Persons with Disabilities;
- BDPA; and
- Mayor's Office of Neighborhood Services

Plans will need to be submitted to the above-listed entities as well as utility companies that own infrastructure impacted by the proposed work, after which the Project will need to be presented at a new business meeting and public hearing to be approved by the PIC.

State

Massachusetts Environmental Policy Act – Executive Office on Energy and Environmental Affairs

It is anticipated that the Project will trigger full scope Massachusetts Environmental Policy Act ("MEPA") jurisdiction based upon interest in state-owned land (i.e., DCR, MBTA, MassDOT) and potential state funding and/or state agency involvement, 301 CMR 11.01(2)(a)2. Under this scenario an Environmental Notification Form ("ENF") will be required, as well as an Environmental Impact Report ("EIR") because the Project is located in a DGA for EJ Populations, 301 CMR 11.06(7)(b). The Project's location in a DGA requires advance notification of the ENF filing to MEPA-designated Community Based Organizations ("CBOs") and opportunities for the CBOs to have a prefiling meeting regarding the Project. The MEPA Analyst will expect documentation of outreach to the identified EJ Communities beyond the advance notice required by the regulations.

Regardless of the state actions noted above, the Project will at a minimum trigger subject matter jurisdiction and require an ENF and EIR due to triggering the following review thresholds:

Wetlands Waterways and Tidelands: Alteration of coastal dune, barrier beach or coastal bank, 301 CMR 11.03(3)(b)1.a.; alteration of ½ or more acres of any other wetlands, 301 CMR 11.03(3)(b)1.f. These thresholds will be triggered because of the state action of requiring a Chapter 91 License and/or a Water Quality Certificate. Coastal bank is thought to be present at the Project Site, though its location and extent has not been confirmed through field delineation. Expanding the beach inland through beach nourishment will alter coastal bank by moving its location inland and/or replacing it with coastal dune. Additionally, the overall scope of the project will result in alteration of more than ½ acre of any other wetland, at a minimum including LSCSF. The Project may also result in alteration of 5,000 or more sf of bordering or isolated vegetated wetlands, 301 CMR 11.03(3)(b)1.d., if BVW is determined to be present along the edge of the salt marsh adjacent to Pine Neck Creek.

Areas of Critical Environmental Concern: Any Project of ½ or more acres within a designated ACEC, unless the Project consists solely of one single family dwelling, 301 CMR 11.03(11)(b). Most of the Project Site is located within the Neponset River Estuary ACEC, and the scope of the proposed work will exceed the ½ acre review threshold by a large margin.

Massachusetts Historic Commission ("MHC") review will run concurrent to the MEPA review process. MHC is tasked with reviewing projects under the lens of potential impact to state-registered historic properties and places within proximity to the Project. As the Project will not impact a state-registered historic asset, it would be anticipated to receive a letter of "no adverse effect" during this review.

Chapter 91 License Application – Massachusetts Department of Environmental Protection Waterways Program

A Chapter 91 License for the Project may be required for construction, placement, excavation, addition, improvement, maintenance, repair, replacement, reconstruction, demolition or removal of any fill or structures, not previously authorized, or for which a previous grant or license is not presently valid, 310 CMR 9.05(1)(a). Such activities proposed within the scope of the Project include elevating portions of the Project Site, reconfiguring the Harborwalk and parking lot, reconstructing recreational amenities, and reconstructing Conley Street/Tenean Street near Pine Neck Creek and the MBTA maintenance yard by including elevating the ROW, widening the Neponset Trail sidewalk connection adjacent to Pine Neck Creek outfall area, and installing retaining walls. These activities will be within Chapter 91 jurisdiction as they will be undertaken on historically filled Commonwealth Tidelands (classified as such because they are held by the Commonwealth, or by its political subdivisions or a quasi-public agency or authority, in trust for the benefit of the public) but will be above MHW and will not require new fill in flowed tidelands. The proposed retaining wall along the edge of Pine Neck Creek near the existing outfall structure does not appear to have impacts below MHW based on current Project plans, but is within approximately 5 feet of MHW. Beach nourishment below MHW is not proposed in the current conceptual plans for the Project, but, along with introduction of the vegetated berms, may occur over the historically filled tidal creeks running through the Project Site and also be subject to Chapter 91 jurisdiction.

As the intent of the Project is to provide public access to the water's edge, the Project components will be considered water-dependent uses or uses accessory thereto as the Chapter 91 licensing pathway. Water-dependent uses include but are not limited to facilities for water-based recreational activities (310 CMR 9.12(2)(a)3.), pedestrian facilities that promote the use and enjoyment of the water by the general public (310 CMR 9.12(2)(a)4.), beach nourishment (310 CMR 9.12(2)(a)7.), and shore protection structures and associated fill necessary to protect, construct, or expand a water-dependent use (310 CMR 9.12(2)(a)11.). Uses accessory to a water-dependent use include but are not limited to access and interior roadways and parking facilities associated with and necessary to accommodate a principle water-dependent use, 310 CMR 9.12(3)(a).

All of the activities proposed as part of the Project are eligible for licensing according to the categorical restrictions under the Chapter 91 Waterways Regulations. Within ACECs, fill or structures for any use on previously filled tidelands are allowed, 310 CMR 9.32(1)(e)1. Such areas comprise the majority of the Project Site and proposed work. Areas of Conley Street/Tenean Street outside of the ACEC that will be elevated are also permitted as fill or structures for any use of previously filled tidelands, 310 CMR 9.32(1)(a)1. Furthermore, the ACEC RMP provides that improvement dredging associated with the stormwater outfalls at Tenean and Lawley Streets and Pine Neck Creek, and sediment removal and re-sanding at Tenean Beach, have been granted exemptions from the Chapter 91 prohibitions regarding improvement dredging.

The Project is potentially eligible for approval as a Minor Project Modification ("MPM") because it may be exempt from licensing as a continuation of an existing, unauthorized public service project, provided that no unauthorized structural alteration or change in use has occurred subsequent to January , 1984, 310 CMR 9.03(c). MPMs receive streamlined review and approval from MassDEP and avoid licensing requirements. In the context of the Project, the work must be limited to structural alterations which are confined to the existing footprint of the fill or structures being altered and which represent an insignificant deviation from the original specifications in terms of size, configuration, materials, or other relevant design or fabrication parameters, 310 CMR 9.22(3)(1).

The MPM pathway may be applicable to most or all elements of the Project, as the proposed work will occur in areas that have already been filled, introduce no new fill or structures below MHW, and result in no change in uses as compared to existing conditions. The proposed retaining wall near the Pine Neck Creek is the Project component that poses the greater risk making the project ineligible for an MPM depending on how MassDEP Waterways reviews the structural footprint relative to existing conditions. Design of the Project should continue to be refined avoid new structures expanding beyond existing structures over the historically filled tidal creeks.

Consultation with MassDEP and MassDEP review of the Project Plans is recommended to determine whether the Project can be approved as an MPM. If any Project component is deemed ineligible for approval as an MPM for failing to meet the requirements at 310 CMR 9.03(c), a Chapter 91 License Application should be filed for the entire Project.

401 Water Quality Certification – Massachusetts Department of Environmental Protection

Administration of Section 401 of the Clean Water Act, under 33 U.S.C. 1251, has been delegated to MassDEP for state Water Quality Certification ("WQC"). A Section 401 WQC would be required for the discharge of dredged or fill material, dredging, and dredged material disposal activities in waters of the United States within the Commonwealth. The Massachusetts WQC regulations define "dredging" as the removal or repositioning of sediment or other material from below the mean HTL for coastal waters. The 2023 Department of the Army General Permits and Code of Federal Regulations define the term "dredged material" means material that is excavated or dredged from WOTUS, 33 CFR 323.2(c). Section 404 of the Clean Water Act defines the landward limit of jurisdiction as the HTL in tidal waters. Notwithstanding the state regulatory definition of jurisdiction, the WQC regulations indicate that the federal agency issuing a permit initially determines the scope of geographic and activity jurisdiction, 314 CMR 9.02. The HTL (estimated as El. 6.8 NAVD88) at the Project Site reaches across the beach, covering a significant area of the parking lot and along Conley Street at the Pine Neck Creek outfall. Therefore, it is expected that a 401 WQC will be required for Project work . The area of impacts as well as volumes of material to be dredged, moved, or placed should be distinguished and analyzed by the origin or fate of material in relation to HTL, MHW and MLW. The following thresholds determine whether the project may require a WQC application:

- Dredging 100 cubic yards ("cy") or More. Any dredging or dredged material re-use or disposal of 100 cy or greater.
- More than 5,000 sf. Any activity in an area subject to 310 CMR 10.00.
- Any activity resulting in the discharge of dredged or fill material in any salt marsh.
- Individual 404 Permit. Any activity subject to an individual Section 404 permit by the United States Army Corps of Engineers

These thresholds apply except for an Ecological Restoration Project that does not require a WQC application pursuant to 314 CMR 9.03(8).

Placement of fill material for the purposes of beach nourishment does not require an application, provided beach nourishment activities are covered by a Final Order of Conditions issued under M.G.L. c. 131, § 40. Beach nourishment with clean sediment of a grain size compatible with that on the existing beach may be permitted.

Construction Access Permit – Massachusetts Department of Conservation and Recreation

A Construction Access Permit will be required for approval to conduct construction on property owned by DCR. Assuming continued Project coordination between the BPDA and DCR, applying for the Construction Access Permit is expected to be relatively straightforward. Documents that will need to be submitted to DCR include but are not limited to construction and engineering plans, a locus map, existing conditions photographs, a construction schedule, and a traffic management plan.

Federal

Pre-Construction Notification Form – United States Army Corps of Engineers

The United states Army Corps of Engineers (the "Corps") is the permitting authority for structures and activities in navigable waters under Section 10 of the Rivers and Harbors Act of 1899 and the discharge of dredge or fill materials in WOTUS under Section 404 of the Clean Water Act. The Corps jurisdiction extends up to the HTL, estimated at El. 6.8 NAVD88 at the Project Site. On June 2, 2023 the Corps issued 25 General Permits ("GP") for Massachusetts, which are based on the type of activity within jurisdiction and provide categories for streamlined review processes through either a Self-Verification ("SV") or a Preconstruction Notification ("PCN") based on the area or linear footage of impacts. If a project does not qualify for SV or PCN procedures then Corps authorization would proceed through an individual permitting process. Based on the proposed work, the following GPs may apply to the Project:

- *GP-6. UTILITY LINES, OIL OR NATURAL GAS PIPELINES, OUTFALL OR INTAKE STRUCTURES, AND APPURTENANT FEATURES (Authorities: §10 & §404)*
- *GP-7. DREDGING (Authority: §10), DISPOSAL OF DREDGED MATERIAL (Authorities: §10, §404), BEACH NOURISHMENT (Authorities: §10 & §404), ROCK REMOVAL (Authority: §10) AND ROCK RELOCATION (Authorities: §10 & §404);*
- *GP-9. BANK AND SHORELINE STABILIZATION (Authorities: §10 & §404);*
- *GP-10. AQUATIC HABITAT RESTORATION, ENHANCEMENT, AND ESTABLISHMENT ACTIVITIES;*
- *GP-20. LIVING SHORELINES1 (Authorities: §10 and §404); and possibly*
- *GP-22. RESHAPING EXISTING DRAINAGE DITCHES, CONSTRUCTION OF NEW DITCHES, AND MOSQUITO MANAGEMENT (Authorities: §10 and §404)*
- *GP 24. TEMPORARY CONSTRUCTION, ACCESS, AND DEWATERING*

Each of the GPs include a requirement to comply with 46 General Conditions ("GCs"). GC #4 states that the use of more than one GP for a single and complete project is prohibited, except when the acreage loss of WOTUS authorized by the GPs does not exceed the acreage limit of the GPs with the highest specified acreage limit. Below are GP excerpts including relevant coverage and limits of the above referenced GPs.

GP-6 PCN

- *Permanent impacts for any single and complete project that are <½ acre in tidal waters; <1000 SF in saltmarsh, mud flats, riffle and pool complexes, or non-tidal vegetated shallows; or <100 SF in tidal vegetated shallows;*
- *Temporary impacts in tidal waters that are <1 acre; <5,000 SF in saltmarsh, mud flats, or riffle and*
- *pool complexes; or <1,000 SF in vegetated shallows.*

GP-7 PCN

- *New dredging and associated disposal ≤½ acre or <10,000 cy*
- *<1,000 SF permanent impacts to intertidal areas, saltmarsh, mud flats, riffle and pool complexes, or non-tidal vegetated shallows; or <100 SF permanent impacts to tidal vegetated shallows*

- *Beach nourishment in waters of the U.S. not associated with dredging*

GP- 9 PCN

- *Activities in tidal and non-tidal waters that are: a. ≥200 feet to ≤500 feet in total length. Activities >500 feet in total length must have a written waiver from USACE. ≥400 feet to ≤1,000 feet in total length when necessary to protect transportation infrastructure. Activities >1,000 feet in total length must have a written waiver from USACE. >1 cubic yard of fill per linear foot average along the bank waterward of the plane of OHW or HTL. Located in non-tidal wetlands, saltmarsh, vegetated shallows.*
- *Activities with permanent loss of tidal or non-tidal waters that is (a) ≥5,000 SF or (b) ≥1,000 SF in mudflats and natural rocky habitat.*

GP-10 PCN

- *In tidal and non-tidal waters excluding tidal vegetated shallows, the combined permanent and temporary impacts are >5,000 SF*
- *Runneling projects with the purpose of restoring saltmarsh by removing excess water that ponds on the saltmarsh surface.*
- *The conversion of: a stream or natural wetlands to another aquatic habitat type (e.g., stream to wetland or vice versa, wetland to pond, etc.) or uplands, or one wetland type to another (e.g., forested wetland to an emergent wetland).*

GP-20 PCN

- *Tidal and non-tidal living shorelines >100 LF to 200 LF to <1,000 LF, unless waived by the District Engineer*
- *Permanent and temporary impacts in existing salt marsh, tidal vegetated shallows, or mudflats.*

GP-22 PCN

- *Reshape drainage ditch, excavated material is deposited in a water of the U.S., or the reshaping of the ditch increases the drainage capacity beyond the original as-built capacity or expands the area drained by the ditch as originally constructed (i.e., the capacity of the ditch is not the same as originally constructed or drains additional wetlands or other waters of the U.S.).*
- *Stream channelization, relocation, impoundments, or loss of streambed.*

GP-24 PCN

- *In tidal waters, temporary impacts are >5,000 SF; >1,000 SF in mudflats and/or natural rocky habitat, or located in saltmarsh and tidal vegetated shallows.*

To be eligible for a permit, proponents must demonstrate that the Project will avoid, minimize or mitigate impacts. Mitigation is required when there are unavoidable adverse effects to the environment that are considered more than minimal or are contrary to the public interest. The Massachusetts In-Lieu Fee Program ("MA ILFP") is the preferred method of compensatory mitigation in Massachusetts.

Activities that result in net increases in aquatic resource functions in WOTUS associated with the restoration, enhancement, and establishment of tidal and non-tidal aquatic resources are not considered loss and are not subject to the mitigation thresholds. The thresholds for impact mitigation

are as follows: Stream (200 lf), Bank Stabilization (500 lf), Open Water (project dependent), Wetlands - Salt Marsh or BVW (500 sf), Mudflat or Inter-tidal (1,000 sf).

Construction of Solid Fill Structures and Fills Along the Coastline or Baseline from Which the Territorial Sea is Measured are further subject to review by the Solicitor of the Department of the Interior for comments concerning the effects of the proposed work on the outer continental rights of the United States.

Should Project elements exceed the eligibility limitations of the GPs and any waivers, the Corps may authorize the Project through an Individual Permit. The process entails a longer review time and includes a public notice and an Environmental Assessment or Environmental Impact Statement under the National Environmental Policy Act.

Federal Consistency Review – Coastal Zone Management

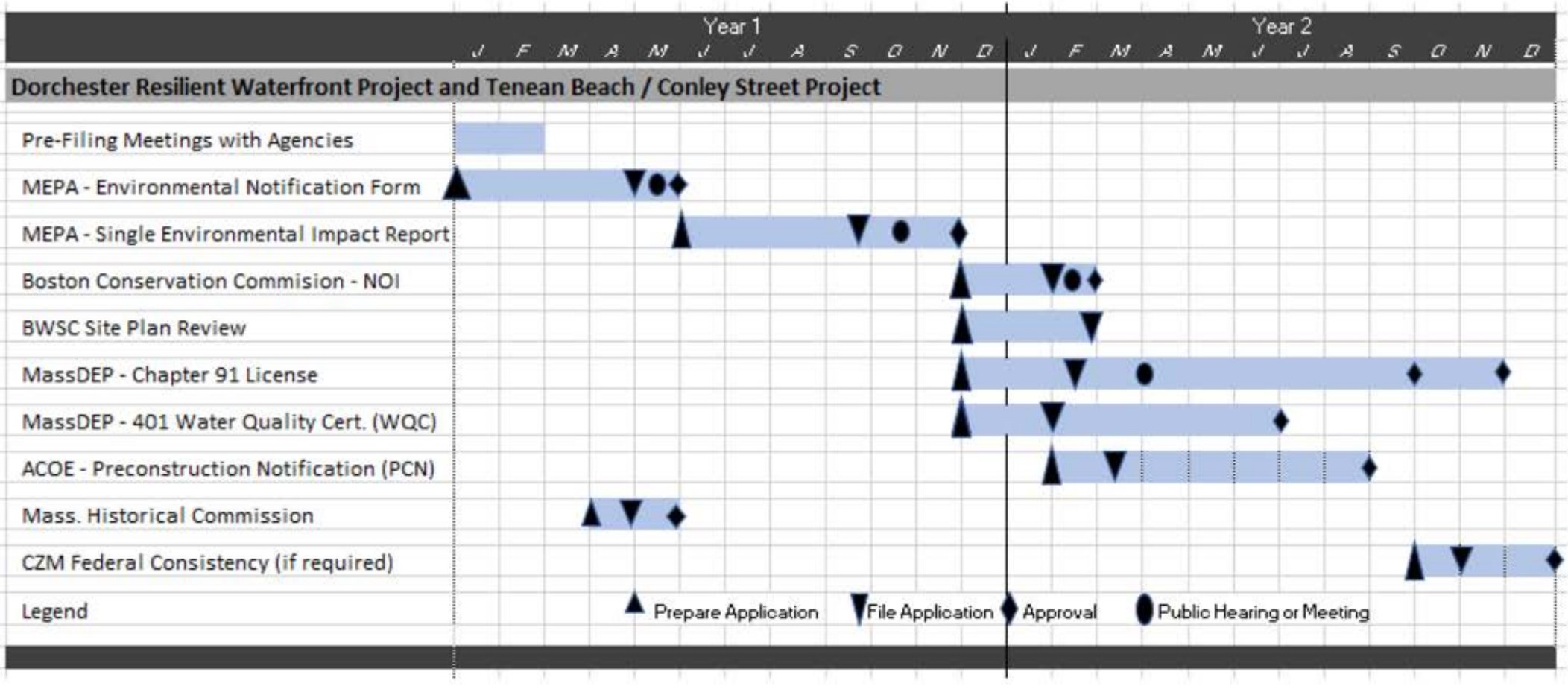
The federal consistency review process is implemented in Massachusetts by the Massachusetts Office of Coastal Zone Management ("CZM"). Projects that are *"in or can reasonably be expected to affect a use or resource of the Massachusetts coastal zone, and/or require federal licenses or permits, receive certain federal funds…"* may be subject to Federal Consistency Review. A pre-application meeting will be required with CZM to review the scope and nature of the Project pursuant to its Corps permits, as well as consideration of the use of federal funds to support the construction of the Project.

National Pollutant Discharge Elimination System Stormwater Pollution Prevention Plan – United States Environmental Protection Agency

Pursuant to Section 402 of the Clean Water Act a National Pollutant Discharge Elimination System ("NPDES") Construction General Permit ("CGP") is required for all construction and dewatering activities that disturb one acre or greater of land and result in a discharge to a WOTUS. The Project is subject to this requirement due to expected disturbance of up to 10 acres as part of the proposed work and its location along Pine Neck Creek and the Neponset River. To receive a CGP under the NPDES program, a Stormwater Pollution Prevention Plan ("SWPPP") must be prepared for the Project and a Notice of Intent must be submitted to the United States Environmental Protection Agency ("EPA"). The intent of a SWPPP is to outline best practices for preventing erosion, sedimentation, and pollution during the construction period. A copy of the SWPPP must be kept on site during construction and all protocols outlined within must be followed during Project construction.

TIMELINE

Based on the anticipated permitting associated with the proposed scope of work outlined previously in this memorandum, the following overall permitting timeline has been prepared for reference.



CONCLUSION

Based on the scope of work outlined previously in this memorandum, the following jurisdictional and protected resource areas as expected to be impacted by the Project:

- Coastal Beach/Tidal Flat and 100' Buffer Zone
- Coastal Bank and 100' Buffer Zone
- Salt Marsh and 100' Buffer Zone
- Bordering Vegetated Wetlands and 100' Buffer Zone
- 25' Riverfront Area
- Land Subject to Coastal Storm Flowage (and potential Bordering Land Subject to Flooding)
- Coastal Flood Resilience Zone
- Land Subject to Flooding or Inundation
- Waterfront Area
- Neponset River Estuary Area of Critical Environmental Concern
- Filled tidelands
- Waters of the United States

Impacts to these resources areas will require submission of the following regulatory submittals to the applicable municipal, state, and federal agencies:

- Notice of Intent – Boston Conservation Commission
- Site Plan Review – Boston Water and Sewer Commission
- Specific Repairs – Boston Public Improvement Commission
- Environmental Notification Form/Environmental Impact Report – Executive Office of Energy and Environmental Affairs
- Chapter 91 License Application – Massachusetts Department of Environmental Protection Waterways Program
- 401 Water Quality Certification – Massachusetts Department of Environmental Protection
- Construction Access Permit – Massachusetts Department of Conservation and Recreation
- Pre-Construction Notification Form – United States Army Corps of Engineers
- Federal Consistency Review – Massachusetts Office of Coastal Zone Management
- National Pollutant Discharge Elimination System Stormwater Pollution Prevention Plan – United States Environmental Protection Agency

Tetra Tech is prepared to support on permitting efforts for the Dorchester Resilient Waterfront Project at Tenean Beach / Conley Street as the BPDA continues to advance this important initiative. Please contact Katie Moniz at kmoniz@fpa-inc.com or (617) 279-4388 with any questions.

FIGURES & ATTACHMENTS

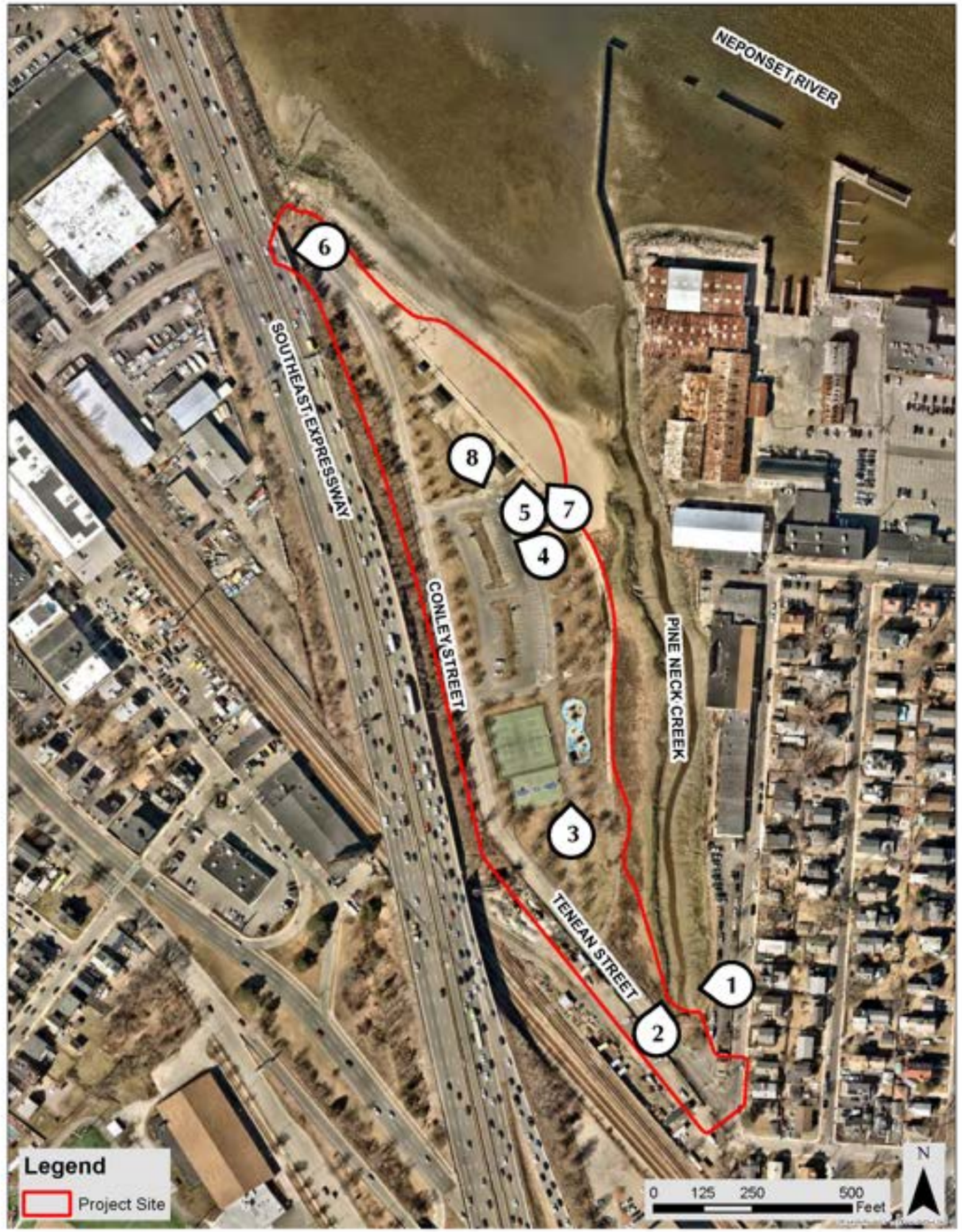
Figures

Attachments

Fort Point Associates, Inc. | A Tetra Tech Company
31 State Street, 3rd Floor | Boston, MA 02109
Tel +1.617.357.7044 | fpa-inc.com | tetratech.com

Boston, MA

Figure 1
Locus Map
Source: USGS, 2021



Boston, MA

Figure 2
Project Site Aerial and Existing Conditions Photographs Key
Source: Fort Point Associates, Inc., 2023

Photo 1: View of the Pine Neck Creek outfall, riprap shoreline, and salt marsh with Tenean Street and the MBTA maintenance yard in the background.

Photo 2: View of Pine Neck Creek, and existing retaining wall, and the salt marsh along the edge of Tenean Street.

Photo 3: View of the basketball court, tennis courts, and playground in inland areas of Tenean Beach.

Photo 4: View of the Tenean Beach parking lot with Conley Street in the background.

Photo 5: View of the Harborwalk, a shade structure, and the beach with the Neponset River in the background.

Photo 6: Inland-facing view of Conley Street as it passes through the Expressway underpass/location of the Conley Street flood pathway.

Boston, MA

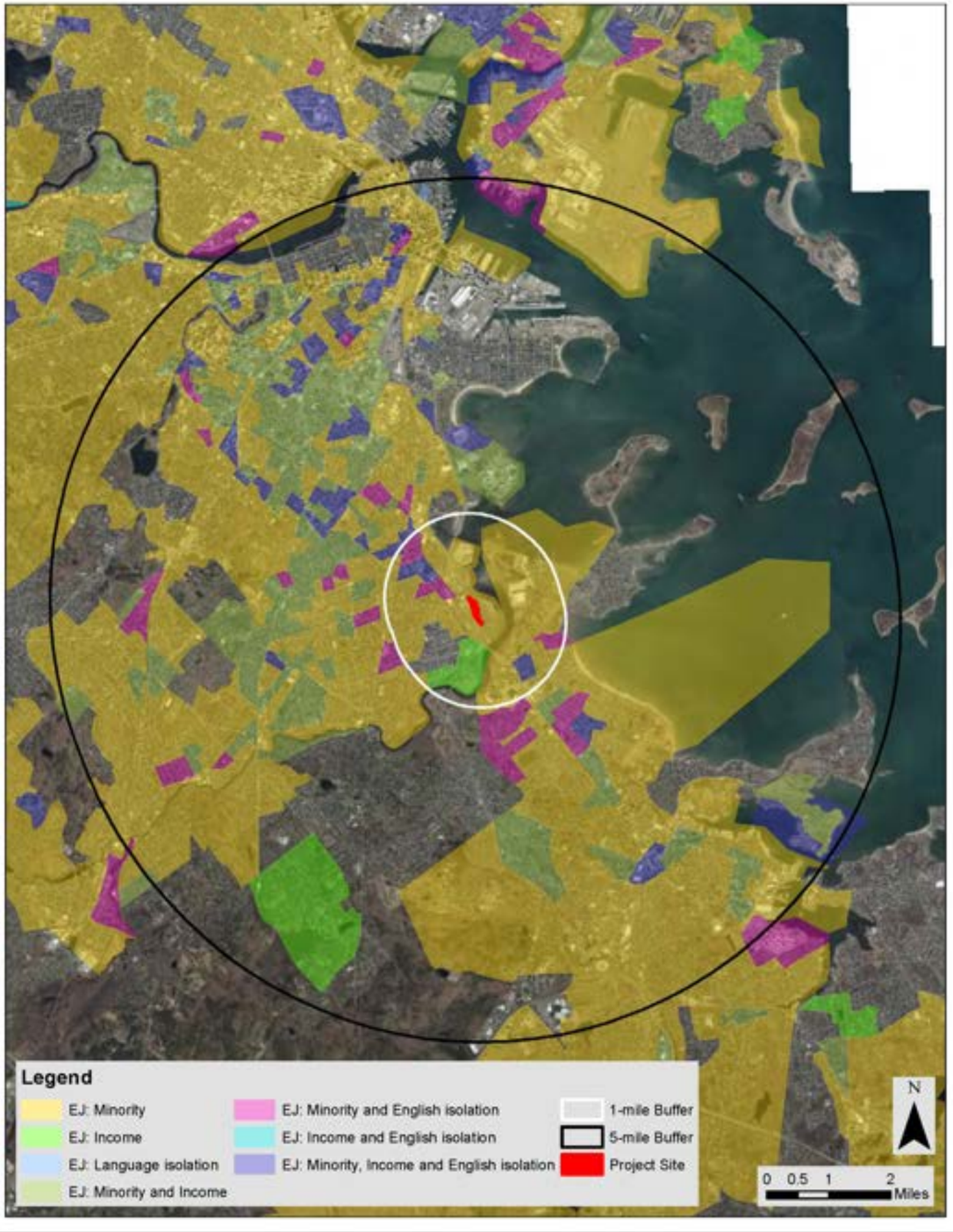
Figure 5
Existing Conditions Photographs
Source: Fort Point Associates, Inc., 2023

Photo 7: View of the flooded beach and Harborwalk at Tenean Beach during a king tide in February, 2023.

Photo 8: View of the flooded parking lot at Tenean Beach during a king tide in February, 2023.

Boston, MA

Figure 6
Existing Conditions Photographs
Source: Fort Point Associates, Inc., 2023

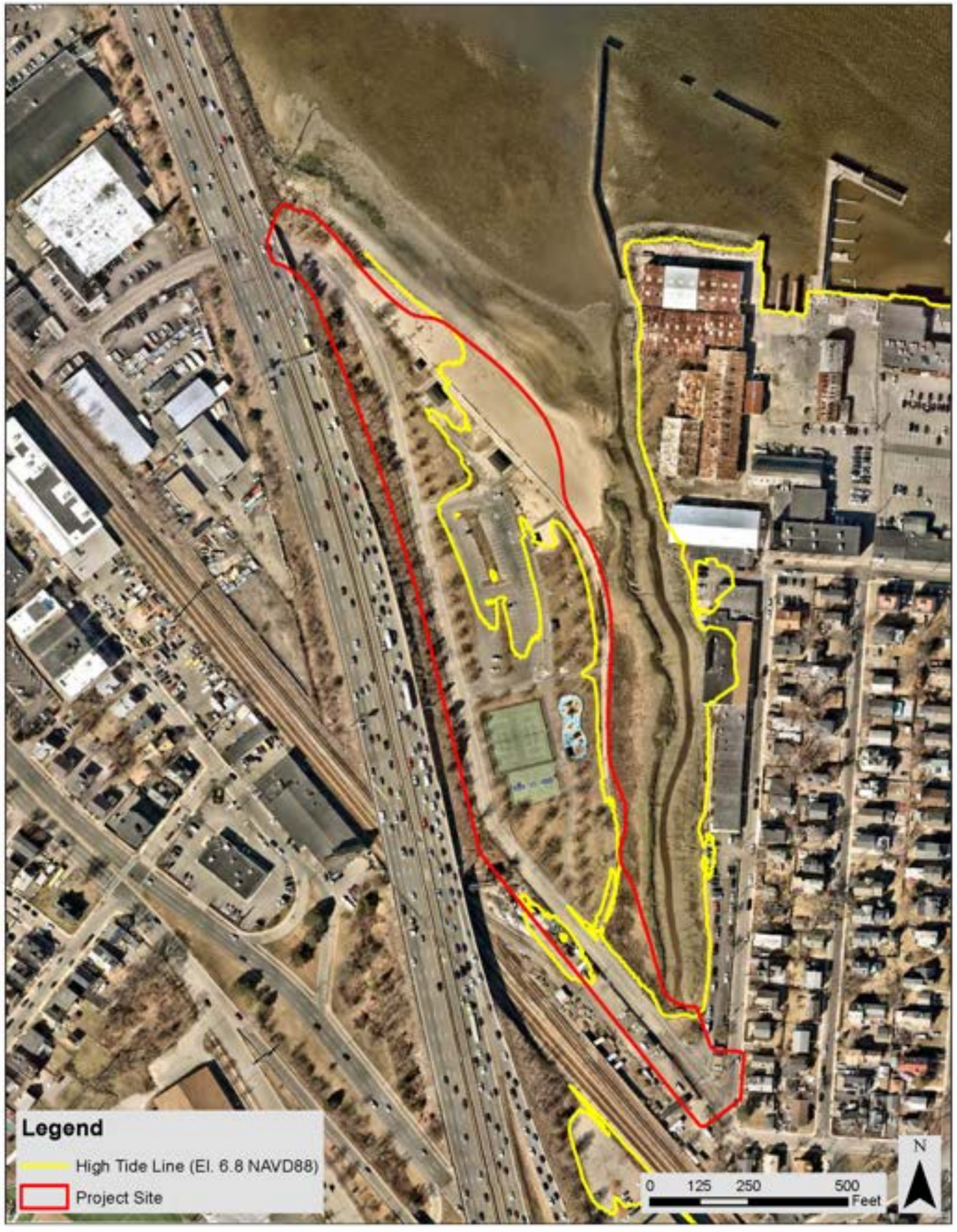


Boston, MA

Figure 7
Environmental Justice Populations (5-Mile Radius)
Source: EEA, 2022; US Census Bureau, 2021

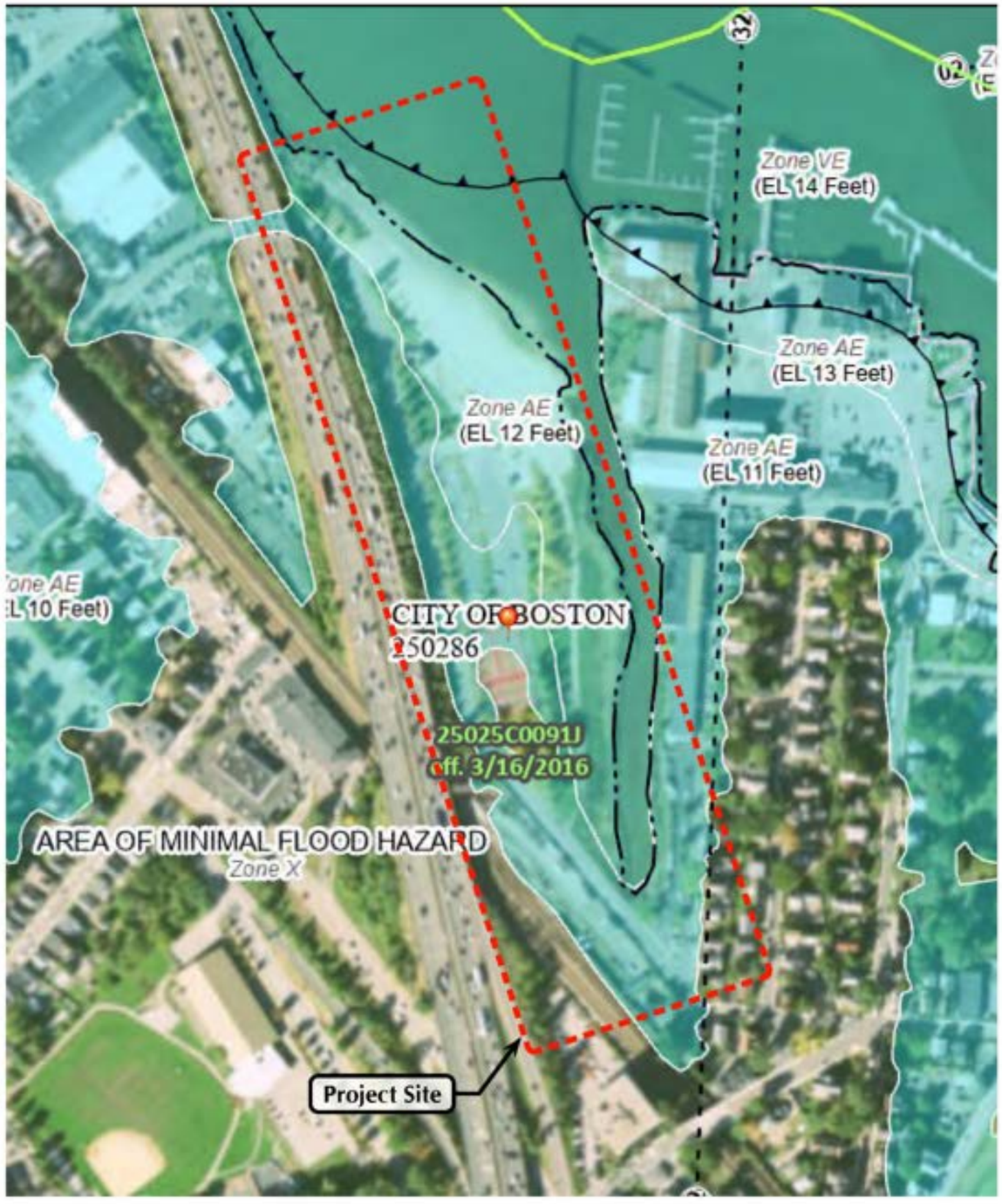
Boston, MA

Figure 8
Environmental Justice Populations (1-Mile Radius)
Source: EEA, 2022; US Census Bureau, 2021



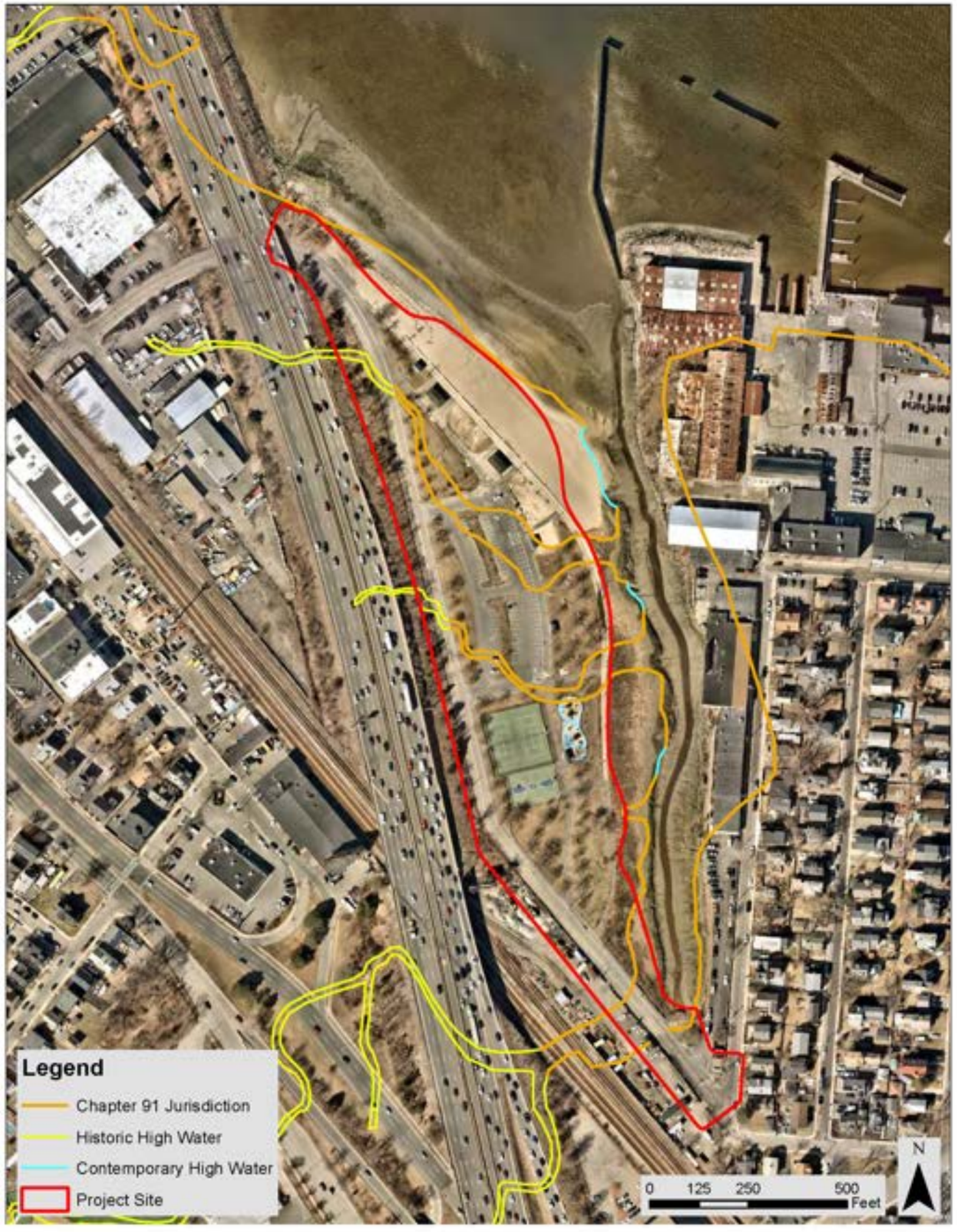
Boston, MA

Figure 9
High Tide Line
Source: MassGIS, 2021



Boston, MA

Figure 10
Flood Rate Insurance Map 25025C0091J
Source: FEMA, 2016

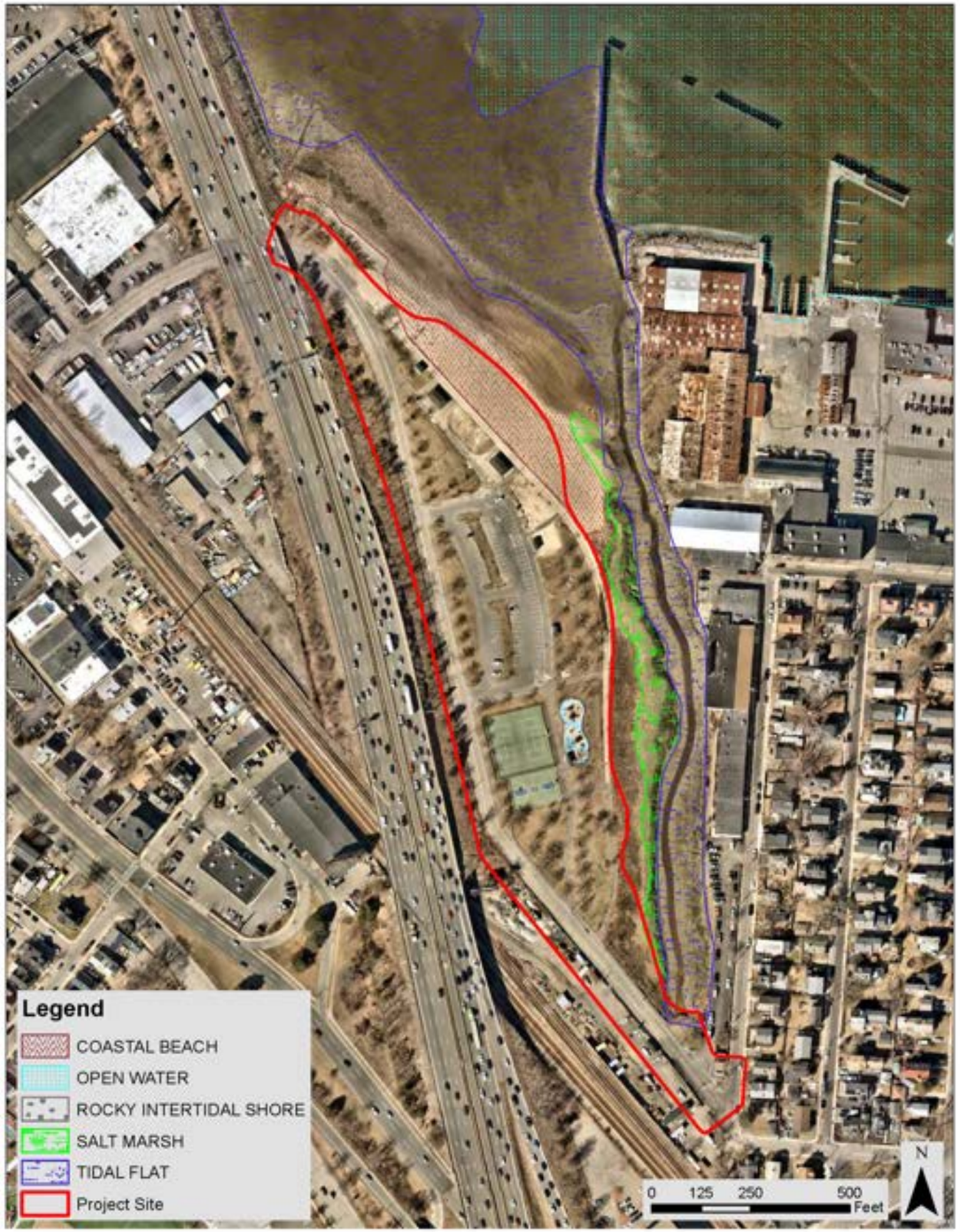


Boston, MA

Figure 11
Chapter 91 Jurisdiction
Source: CZM, 2011

Boston, MA

Figure 12
Neponset River Mouth of Coastal River
Source: MassDEP, 2005



Boston, MA

Figure 13
Wetland Resource Areas
Source: MassDEP, 2017

Boston, MA

Figure 14
Neponset River Estuary Area of Critical Environmental Concern
Source: EEA and DCR, 2009

TECHNICAL SET

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

TABLE OF CONTENTS	
Sheet Number	Sheet Title
L-000	COVER SHEET
L-001	EXISTING CONDITIONS AND REGULATIONS PLAN
L-002	EXISTING CONDITIONS AND REGULATIONS PLAN
L-003	DEMO PLAN
L-004	DEMO PLAN
L-100	LANDSCAPE PLAN
L-101	LANDSCAPE PLAN
L-200	UTILITIES AND INFRASTRUCTURE PLAN
L-201	UTILITIES AND INFRASTRUCTURE PLAN
L-300	PLANTING ZONES PLAN
L-301	PLANTING ZONES PLAN
L-302	PLANTING SCHEDULE
L-400	SITE SECTIONS
L-401	SITE SECTIONS
L-402	SITE SECTIONS
L-403	SITE SECTIONS
L-404	SITE SECTIONS
L-500	DETAILS - PAVING
L-501	DETAILS - CURBS, WALLS, EDGES
L-502	DETAILS - PLANTING
L-503	DETAILS - PLANTING

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

100% PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT — SCAPE LANDSCAPE ARCHITECTURE DPC

COASTAL ENGINEERING — TETRA TECH

RESILIENCY MODELING — WOODS HOLE GROUP

SURVEY — DAWOOD

NUMBER	DATE	ISSUE

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

SHEET NAME

COVER SHEET

PROJECT NO. — SHEET NO.

DRAWN BY

SCALE

PLOTTED

CHECKED BY

DATE

L-000

© SCAPE LANDSCAPE ARCHITECTURE DPC 2020

LEGEND

- LIMIT OF WORK
- PROPERTY LINE
- ACEC EXTENTS
- CH. 91 JURISDICTION
- APPROX. EDGE OF WATER 2/2/23 - 10:55 AM - EL. 4.50
- WETLAND - COASTAL BEACH
- WETLAND - SALT MARSH
- WETLAND - TIDAL FLATS
- WETLAND - ROCKY INTERTIDAL ZONE
- HIGH TIDE LEVEL EL. 5.80 NAVD88
- MEAN HIGH WATER EL. 4.33 NAVD88

NOTES

1. ALL ELEVATIONS IN NAVD88
2. MLW = EL. -5.16. ELEVATION VALUE OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA THIS DATA IS OMITTED IN PLANS SINCE FIELD SURVEY WAS NOT CONDUCTED BELOW EL. 4.30
3. MHW ELEVATION VALUES OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA
4. HTL ELEVATION VALUE PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)
5. COASTAL BANK DELINEATION PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)

MATCHLINE L-001

MATCHLINE L-002

SOUTHEAST EXPRESSWAY

LIMIT OF WORK

CONLEY STREET

EXISTING SPORTS COURTS

EXISTING PARKING (90 SPACES)

EXISTING PLAYGROUND

EXISTING PICNIC AREA

MBTA RAILYARD

AREA OF CRITICAL ENVIRONMENTAL CONCERN (ACEC)

HIGH TIDE LEVEL EL. 5.80 NAVD88

APPROX EDGE OF WATER FEBRUARY 2, 2023 10:55AM EL. 4.50 NAVD88

MEAN HIGH WATER EL. 4.33 NAVD88

WETLANDS - SALT MARSH

WETLANDS - TIDAL FLATS

NEPONSET TRAIL

LAWLEY STREET

0 20' 40' 80' 120'

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

KEY PLAN

CLIENT

BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

SHEET NAME

EXISTING CONDITIONS AND REGULATIONS PLAN

PROJECT NO. | SHEET NO.

DRAWN BY

CHECKED BY

DATE

L-001

© SCAPE LANDSCAPE ARCHITECTURE DPC 2023

MATCHLINE L-001

MATCHLINE L-002

SOUTHBOUND

INTERSTATE 93

NORTHBOUND

CONLEY STREET

LIMIT OF WORK

EXISTING PARKING (80 SPACES)

EXISTING PARKING (56 SPACES)

EXISTING PICNIC AREA

NEPONSET TRAIL

COASTAL BANK DELINEATION

AREA OF CRITICAL ENVIRONMENTAL CONCERN (ACEC)

APPROX EDGE OF WATER FEBRUARY 2, 2023 10:55AM EL. 4.50 NAVD88
2008 MHW EL. 4.54 NAVD88
2030 MHW EL. 5.13 NAVD88

HIGH TIDE LEVEL EL. 6.80 NAVD88

WETLANDS - COASTAL BEACH

WETLANDS - TIDAL FLATS (WATERWARD), COASTAL BEACH (LANDWARD)

WETLANDS - COASTAL BEACH

APPROX EDGE OF WATER FEBRUARY 2, 2023 10:55AM EL. 4.50 NAVD88

MEAN HIGH WATER EL. 4.33 NAVD88

NEPONSET RIVER

WETLANDS - SALT MARSH (WATERWARD), COASTAL BEACH (LANDWARD)

WETLANDS - TIDAL FLATS (WATERWARD), COASTAL BEACH (LANDWARD)

0 20' 40' 80' 120'

LEGEND

- LIMIT OF WORK
- PROPERTY LINE
- ACEC EXTENTS
- CH. 91 JURISDICTION
- APPROX. EDGE OF WATER 2/2/23 - 10:55 AM - EL. 4.50
- WETLAND - COASTAL BEACH
- WETLAND - SALT MARSH
- WETLAND - TIDAL FLATS
- WETLAND - ROCKY INTERTIDAL ZONE
- HIGH TIDE LEVEL EL. 6.80 NAVD88
- MEAN HIGH WATER EL. 4.33 NAVD88

NOTES

1. ALL ELEVATIONS IN NAVD88
2. MLW = EL. -5.15. ELEVATION VALUE OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA. THIS DATA IS OMITTED IN PLANS SINCE FIELD SURVEY WAS NOT CONDUCTED BELOW EL. 4.30.
3. MHW ELEVATION VALUES OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA
4. HTL ELEVATION VALUE PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)
5. COASTAL BANK DELINEATION PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

NOI PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

EXISTING CONDITIONS AND REGULATIONS PLAN

L-002

© SCAPE LANDSCAPE ARCHITECTURE DPC 2023

LEGEND

- LIMITS OF DISTURBANCE
- PROPERTY LINE
- ACEC EXTENTS
- CH. 91 JURISDICTION
- FULL DEPTH ASPHALT REMOVAL
- EXISTING BLOCKS TO BE REPURPOSED
- EXISTING TEXTURED CONCRETE WALK TO REMOVE
- EXISTING PATH TO REMOVE
- EXISTING PATH TO REMAIN
- EXISTING TREE TO REMAIN
- EXISTING TREE TO BE REMOVED
- SAWCUT
- COASTAL BANK DELINEATION

NOTES

1. MAINTAIN AND PROTECT EXISTING UTILITIES DURING CONSTRUCTION.

MATCHLINE L-003

MATCHLINE L-004

PROPERTY LINE

EXISTING ASPHALT PARKING LOT TO BE REMOVED

EXISTING CATCH BASIN TO BE REMOVED , TYP.

EXISTING BAR GATE POSTS TO BE REMOVED

EXISTING ASPHALT TRAIL TO BE REMOVED

INTERSTATE 93 NORTHBOUND

EXISTING CURB TO BE REMOVED AND MAINTAINED FOR REINSTALLMENT, TYP.

LIMIT OF DISTURBANCE

EXISTING MANHOLE TO BE REMOVED , TYP.

EXISTING GAS LINE TO REMAIN

EXISTING BASKETBALL COURT TO BE REMOVED

EXISTING CHAIN LINK FENCE TO BE REMOVED

EXISTING TENNIS COURT TO BE REMOVED

EXISTING TREE TO BE REMOVED , TYP.

EXISTING WATERLINE TO BE ABANDONED AND REPLACED, TYP., APPROX. LOCATION

EXISTING CURB TO BE REMOVED AND MAINTAINED FOR REINSTALLMENT, TYP.

EXISTING UTILITY POLE TO BE REMOVED , TYP.

REMOVE EXISTING WOOD BENCH , TYP.

PROPERTY LINE

EXISTING STEEL GUARDRAIL TO BE REMOVED

EXISTING ELECTRIC MANHOLE TO BE REMOVED , TYP.

EXISTING GATE TO BE REMOVED TO FACILITATE CONSTRUCTION

EXISTING ASPHALT TRAIL TO BE REMOVED

EXISTING UTILITY POLE TO BE REMOVED , TYP.

EXISTING TREE TO REMAIN , TYP.

EXISTING WOOD GUARDRAIL TO BE REMOVED , TYP.

EXISTING ASPHALT TRAIL TO BE REMOVED

EXISTING STEEL BAR GATE TO BE REMOVED , TYP.

EXISTING ASPHALT TRAIL TO BE REMOVED

EXISTING PATH TO REMAIN

PROTECT EXISTING HEADWALLS

PROPERTY LINE

NEPONSET RIVER

EXISTING ASPHALT TRAIL TO BE REMOVED

WOOD TEXTURED CONCRETE WALK TO BE REMOVED, TYP.

EXISTING PLAYGROUND AND EQUIPMENT TO REMAIN

EXISTING ASPHALT TRAIL TO BE REMOVED

PICNIC TABLE TO BE REMOVED , TYP.

STONE BLOCKS TO BE REPURPOSED

EXISTING LAMP POST TO BE REMOVED , TYP.

APPROXIMATE EDGE OF WATER

LIMITS OF EXCAVATION, TYP.

LAWLEY STREET

0 20' 40' 80' 120'

MATCHLINE L-003

MATCHLINE L-004

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

100 PLAN

CLIENT

BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

NUMBER	DATE	ISSUE

SEAL

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

SHEET NAME

DEMO PLAN

PROJECT NO.	SHEET NO.
SCALE	
AS NOTED	
DRAWN BY	
CHKD	
CHECKED BY	
ISSUED	
DATE	
June 12, 2020	

L-003

© SCAPE LANDSCAPE ARCHITECTURE DPC 2020

MATCHLINE L-003

MATCHLINE L-004

EXISTING CHAIN LINK FENCE TO BE REMOVED

EXISTING CURB TO BE REMOVED AND MAINTAINED FOR REINSTALLMENT, TYP.

EXISTING GATE POSTS TO BE REMOVED , TYP.

EXISTING TRAFFIC SIGN TO BE REMOVED , TYP.

EXISTING ASPHALT PARKING LOT TO BE REMOVED

PROPERTY LINE

EXISTING WATER GAUGE TO BE REMOVED , TYP., EXISTING WATER LINE AND LEADS TO BE REMOVED, TYP.

AREA OF CRITICAL ENVIRONMENTAL CONCERN

EXISTING WATERLINE TO BE ABANDONED AND REPLACED, TYP., APPROX. LOCATION

FLAG POLE ON CONCRETE PAD TO BE REMOVED

EXISTING CONCRETE PADS TO BE REMOVED

EXISTING BIKE RACKS TO BE REMOVED

REMOVE EXISTING BENCHES , TYP.

EXISTING BENCHES TO BE REMOVED, TYP.

WOOD TEXTURED CONCRETE WALK TO BE REMOVED, TYP.

EXISTING TREE TO BE REMOVED , TYP.

EXISTING SUN SHELTER ON CONCRETE PAD TO BE REMOVED , TYP.

EXISTING ASPHALT TRAIL TO BE REMOVED

WOOD TEXTURED CONCRETE WALK TO BE REMOVED , TYP.

PICNIC TABLE TO BE REMOVED , TYP.

STONE BLOCKS TO BE REMOVED , TYP.

EXISTING TREE TO REMAIN , TYP.

REMOVE FULL DEPTH ASPHALT WITHIN SAWCUT LIMITS

LIMIT OF DISTURBANCE

EXISTING CATCH BASIN TO BE REMOVED , TYP.

EXISTING HANDHOLE TO BE REMOVED , TYP.

EXISTING TREE TO BE REMOVED , TYP.

COASTAL BANK DELINEATION

EXISTING POLE TO BE REMOVED, TYP.

EXISTING LAMP POST TO BE REMOVED, TYP.

EXISTING PARK BENCH TO BE REMOVED , TYP.

EXISTING SAFETY BOLLARD TO BE REMOVED, TYP.

EXISTING ELECTRIC HANDHOLE TO BE REMOVED , TYP.

EXISTING WATER METER TO BE REMOVED , TYP.

RELOCATION OF SANITARY SEWER MH TO BE CONFIRMED BY DCR

APPROXIMATE EDGE OF WATER

0 20' 40' 80' 100'

LEGEND

- LIMITS OF DISTURBANCE
- PROPERTY LINE
- ACEC EXTENTS
- CH. 91 JURISDICTION
- FULL DEPTH ASPHALT REMOVAL
- EXISTING BLOCKS TO BE REPURPOSED
- EXISTING TEXTURED CONCRETE WALK TO REMOVE
- EXISTING PATH TO REMOVE
- EXISTING PATH TO REMAIN
- EXISTING TREE TO REMAIN
- EXISTING TREE TO BE REMOVED
- SAWCUT
- COASTAL BANK DELINEATION

NOTES

1. MAINTAIN AND PROTECT EXISTING UTILITIES DURING CONSTRUCTION

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

401 PLAN

CLIENT

BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

DEMO PLAN

L-004

LEGEND

- LIMIT OF WORK
- PROPERTY LINE
- ACEC EXTENTS
- CH. 91 JURISDICTION
- APPROX. EDGE OF WATER 2/2/23 - 10:55 AM - EL. 4.50
- EXISTING HIGH TIDE LEVEL EL. 9.80 NAVD88
- PROPOSED HIGH TIDE LEVEL EL. 9.80 NAVD88
- MEAN HIGH WATER EL. 4.33 NAVD88
- COASTAL BANK DELINEATION
- PROPOSED CONTOURS
- CIP EXPOSED AGGREGATE VEHICULAR CONCRETE
- CIP EXPOSED AGGREGATE PEDESTRIAN CONCRETE
- CIP PEDESTRIAN CONCRETE
- ASPHALT
- COURT SURFACING
- PLANTING, TYP.
- SAND
- LAWN
- HARBORWALK
- EXISTING PATH TO REMAIN
- XX PROPOSED CONTOURS
- XX EXISTING CONTOURS
- X:X PROPOSED SLOPE
- WALLS, SEE PLAN FOR WALL TYPE
- GUARDRAIL
- DIMENSIONED STONE EDGING (REPURPOSED)

NOTES

1. ALL ELEVATIONS IN NAVD88
2. MLW = EL. -5.16. ELEVATION VALUE OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA. THIS DATA IS OMITTED IN PLANS SINCE FIELD SURVEY WAS NOT CONDUCTED BELOW EL. 4.30.
3. MHW ELEVATION VALUES OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA
4. HTL ELEVATION VALUE PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)
5. COASTAL BANK DELINEATION PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)

MATCHLINE L-100

MATCHLINE L-101

SOUTHEAST EXPRESSWAY

CIP EXPOSED AGGREGATE CONCRETE (PEDESTRIAN) 1 / L-500

1 / L-403

BOARDWALK ON GRADE 6 / L-500

DIMENSIONED STONE EDGING 4 / L-501

PLANTER EDGING 5 / L-501

COURT SURFACE 5 / L-500

CIP PEDESTRIAN CONCRETE 3 / L-500

CIP CURB 1 / L-501

LIMIT OF WORK

[14.00]

TW 14.00
BW 11.00

EL. 14.00

CIP EXPOSED AGGREGATE CONCRETE (VEHICULAR) 2 / L-500

ASPHALT 4 / L-500

[13.00]

AREA OF ENVIRONMENTAL CONCERN

RAMP DESIGN TO BE COORDINATED WITH MBTA

TW 10.00
BW 7.77

TC 11.50
BC 11.00

TC 11.25
BC 10.75

TW 11.25
BW 10.00

TW 11.25
BW 9.50

COMLEY STREET

EXPANDED 12'W HARBORWALK PATH

TW 10.00
BW 7.77

1 / L-404

RETAINING WALL - WITH NO GUARDRAIL 2 / L-501

TC 11.00
BC 10.50

TW 10.00
BW 9.70

[9.70]

TW 10.75
BW 9.25

BASKETBALL COURT

TENNIS COURTS

PICKLEBALL COURTS

PARKING

SHADED PICNIC PAVILION

EXISTING PLAYGROUND TO REMAIN

EXISTING HIGH TIDE LEVEL EL. 9.80 NAVD88

LIMIT OF WORK

PROPOSED HIGH TIDE LEVEL EL. 9.80 NAVD88

APPROX EDGE OF WATER FEBRUARY 2, 2023 10:55AM EL. 4.50 NAVD88

MEAN HIGH WATER EL. 4.33 NAVD88

LONG-TERM PIER EXTENTS

RETAINING WALL - WITH GUARDRAIL 2 / L-501

PLANTING, TYP

EXISTING PATH TO REMAIN

LIMIT OF WORK

LAWLEY STREET

0 20' 40' 80' 120'

MATCHLINE L-100

MATCHLINE L-101

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

KEY PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

SHEET NAME

LANDSCAPE PLAN

PROJECT NO.	SHEET NO.
TITLE	
SCALE	
AS NOTED	
DRAWN BY	
ICHKD	
CHECKED BY	
ICHKD	
DATE	
MAR 17, 2023	

L-100

© SCAPE LANDSCAPE ARCHITECTURE DPC 2023

MATCHLINE L-100

MATCHLINE L-101

1A & 1B / L-401

1 / L-402

1 / L-400

4 / L-500 ASPHALT

4 / L-501 DIMENSIONED STONE EDGING

5 / L-501 PLANTER EDGING

1 / L-501 CIP CURB

6 / L-500 BOARDWALK ON GRADE

LIMIT OF WORK

AREA OF CRITICAL ENVIRONMENTAL CONCERN

CONLEY STREET

PARKING

PICKLEBALL COURTS

SHADE PONIC PAVILION

SHADE STRUCTURES

TW 14.00

3 / L-501 FLOODWALL AT CONLEY ST. UNDERPASS

2'-6" H FLOODWALL

COASTAL BANK DELINEATION

EXISTING HIGH TIDE LEVEL EL 6.80 NAVD88

APPROX EDGE OF WATER FEBRUARY 2, 2023 10:55AM EL. 4.50 NAVD88

MEAN HIGH WATER EL. 4.33 NAVD88

PROPOSED HIGH TIDE LEVEL EL 6.80 NAVD88

2 / L-500 CIP EXPOSED AGGREGATE CONCRETE (VEHICULAR)

1 / L-500 CIP EXPOSED AGGREGATE CONCRETE (PEDESTRIAN)

4 / L-501 DIMENSIONED STONE EDGING

3 / L-500 CIP PEDESTRIAN CONCRETE

NEPONSET RIVER

0 20' 40' 80' 120'

LEGEND

- LIMIT OF WORK
- PROPERTY LINE
- ACEC EXTENTS
- CH. 91 JURISDICTION
- APPROX. EDGE OF WATER 2/2/23 - 10:55 AM - EL 4.50
- EXISTING HIGH TIDE LEVEL EL 6.80 NAVD88
- PROPOSED HIGH TIDE LEVEL EL 6.80 NAVD88
- MEAN HIGH WATER EL 4.33 NAVD88
- COASTAL BANK DELINEATION
- PROPOSED CONTOURS
- CIP EXPOSED AGGREGATE VEHICULAR CONCRETE
- CIP EXPOSED AGGREGATE PEDESTRIAN CONCRETE
- CIP PEDESTRIAN CONCRETE
- ASPHALT
- COURT SURFACING
- PLANTING, TYP.
- SAND
- LAWN
- HARBORWALK
- EXISTING PATH TO REMAIN
- XX PROPOSED CONTOURS
- XX EXISTING CONTOURS
- XX PROPOSED SLOPE
- WALLS, SEE PLAN FOR WALL TYPE
- GUARDRAIL
- DIMENSIONED STONE EDGING (REPURPOSED)

NOTES

1. ALL ELEVATIONS IN NAVD88
2. MLW = EL -5.16. ELEVATION VALUE OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA.THIS DATA IS OMITTED IN PLANS SINCE FIELD SURVEY WAS NOT CONDUCTED BELOW EL 4.30.
3. MHW ELEVATION VALUES OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA
4. HTL ELEVATION VALUE PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)
5. COASTAL BANK DELINEATION PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

401 PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

SHEET NAME

LANDSCAPE PLAN

SHEET NO.

L-101

© SCAPE LANDSCAPE ARCHITECTURE DPC 2023

LEGEND

- LIMITS OF DISTURBANCE
- PROPERTY LINE
- PROPOSED WATER MAIN
- PROPOSED STORM MAIN
- ACEC EXTENTS
- CH. 91 JURISDICTION
- APPROX. EDGE OF WATER 2/2/23 - 10:55 AM - EL. 4.50
- COASTAL BANK DELINEATION
- GREEN INFRASTRUCTURE - BIORETENTION POND
- DRAINAGE ARROW
- PROPOSED CATCH BASIN
- PROPOSED STORM MANHOLE
- PROPOSED HYDRANT

MATCHLINE L-300

MATCHLINE L-301

INTERSTATE 93 NORTHBOUND

PROPOSED STORM SEWER MANHOLE, TYP.

BIORETENTION POND, TYP.

REPLACE UTILITY POLE AND METER

PROPOSED CATCH BASIN, TYP.

PROPOSED BACK FLOW PREVENTER

TIE INTO EXISTING STORM SEWER

AREA OF CRITICAL ENVIROMENTAL CONCERN

PROPOSED GATE VALVE

LIMITS OF DISTURBANCE

PROPOSED HYDRANT, TYP.

APPROX. EDGE OF WATER

TENEAN STREET

NEPONSET RIVER

PROPERTY LINE

LAWLEY STREET

TIE INTO EXISTING WATER MAIN (APPROXIMATE LOCATION)

MATCHLINE L-300

MATCHLINE L-301

0 20' 40' 80' 120'

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

KEY PLAN

CLIENT

BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

NUMBER	DATE	ISSUE

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

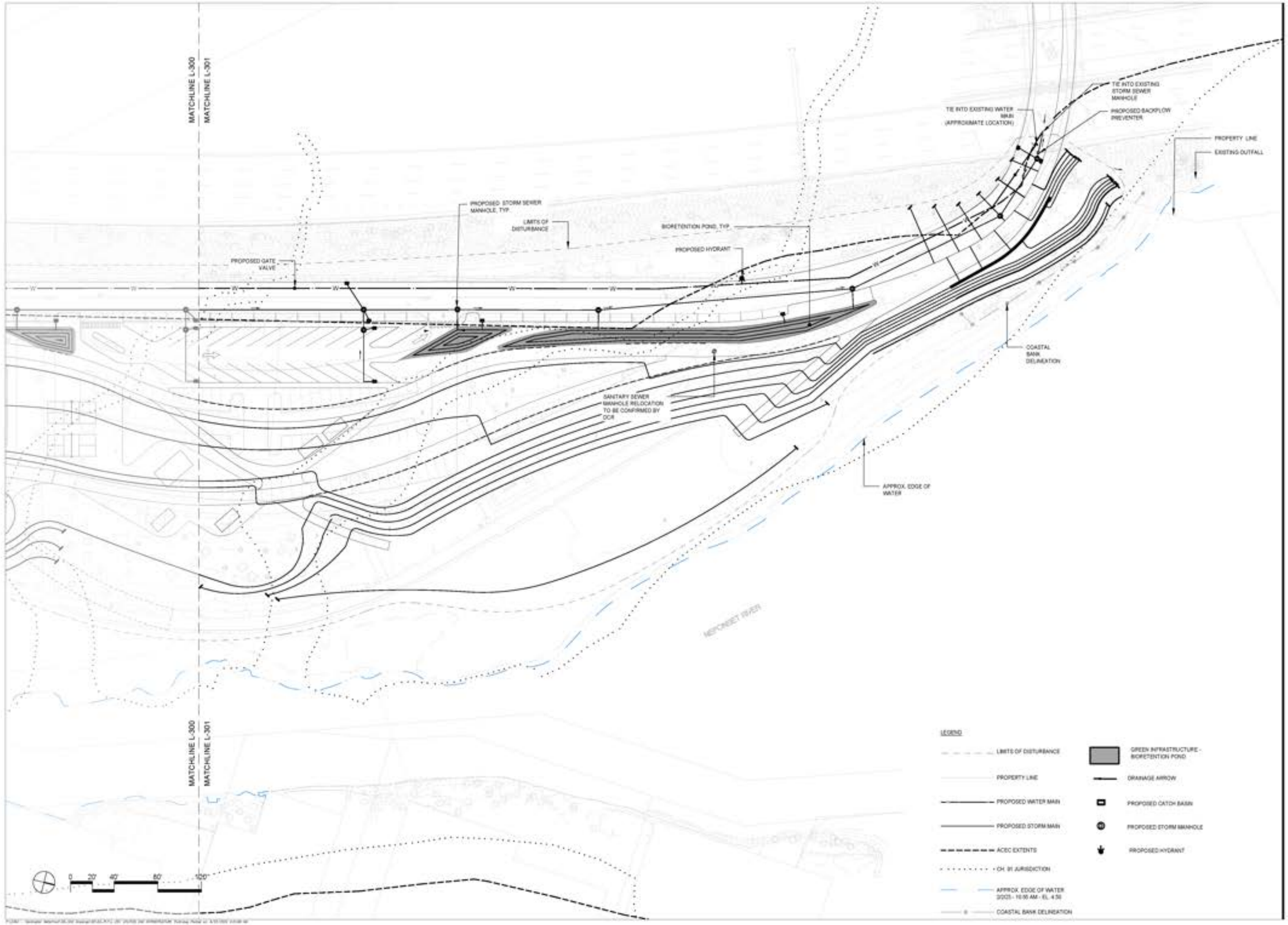
SCHEMATIC DESIGN

SHEET NAME

UTILITIES AND INFRASTRUCTURE PLAN

PROJECT NO.	SHEET NO.
TITLE	
SCALE	
AS NOTED	
DRAWN BY	
ICHKD	
CHECKED BY	L-200
SCAPE	
DATE	
JUNE 13, 2023	

© SCAPE LANDSCAPE ARCHITECTURE DPC 2023



SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

KEY PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

NUMBER DATE ISSUE

SEAL

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

SHEET NAME

UTILITIES AND INFRASTRUCTURE PLAN

PROJECT NO. SHEET NO.
DRN
SCALE
AS NOTED
DRAWN BY
SCAPE
CHECKED BY
SCAPE
DATE
MAR 17, 2023

L-201

© SCAPE LANDSCAPE ARCHITECTURE DPC 2023

LEGEND

- LIMIT OF WORK
- ACEC EXTENTS
- CH. 91 JURISDICTION
- COASTAL BANK DELINEATION
- APPROX. EDGE OF WATER 3/2023 - 10:55 AM - EL. 4.50
- EXISTING HIGH TIDE LEVEL EL. 6.80 NAVD88
- PROPOSED HIGH TIDE LEVEL EL. 6.80 NAVD88
- MEAN HIGH WATER EL. 4.33 NAVD88

- COASTAL DUNE
- PLANTED BUFFER
- HIGH MARSH MIX
- LOW MARSH MIX
- MARITIME FOREST
- LAWN

- XX PROPOSED TREE
- EXISTING TREE

NOTES

1. ALL ELEVATIONS IN NAVD88
2. MLW = EL. -5.16. ELEVATION VALUE OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA. THIS DATA IS OMITTED IN PLANS SINCE FIELD SURVEY WAS NOT CONDUCTED BELOW EL 4.30
3. MHW ELEVATION VALUES OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA
4. HTL ELEVATION VALUE PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)
5. COASTAL BANK DELINEATION PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)

SHRUB PLANTING 1/L-503 · PERENNIAL PLANTING 2/L-503 · TREE PLANTING TYP 1/L-502 · TURF LAWN 3/L-503 · TREE PLANTING IN PAVING 3/L-502 · STREET TREE PLANTING 4/L-502 · PLANTED BUFFER MIX

MATCHLINE L-300 / MATCHLINE L-301

LAWN

HIGH MARSH MIX

LOW MARSH MIX

4/L-502 TIDAL WETLAND PLANTING

4/L-301 TIDAL WETLA

MATCHLINE L-300 / MATCHLINE L-301

0 20' 40' 80' 120'

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

401 PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

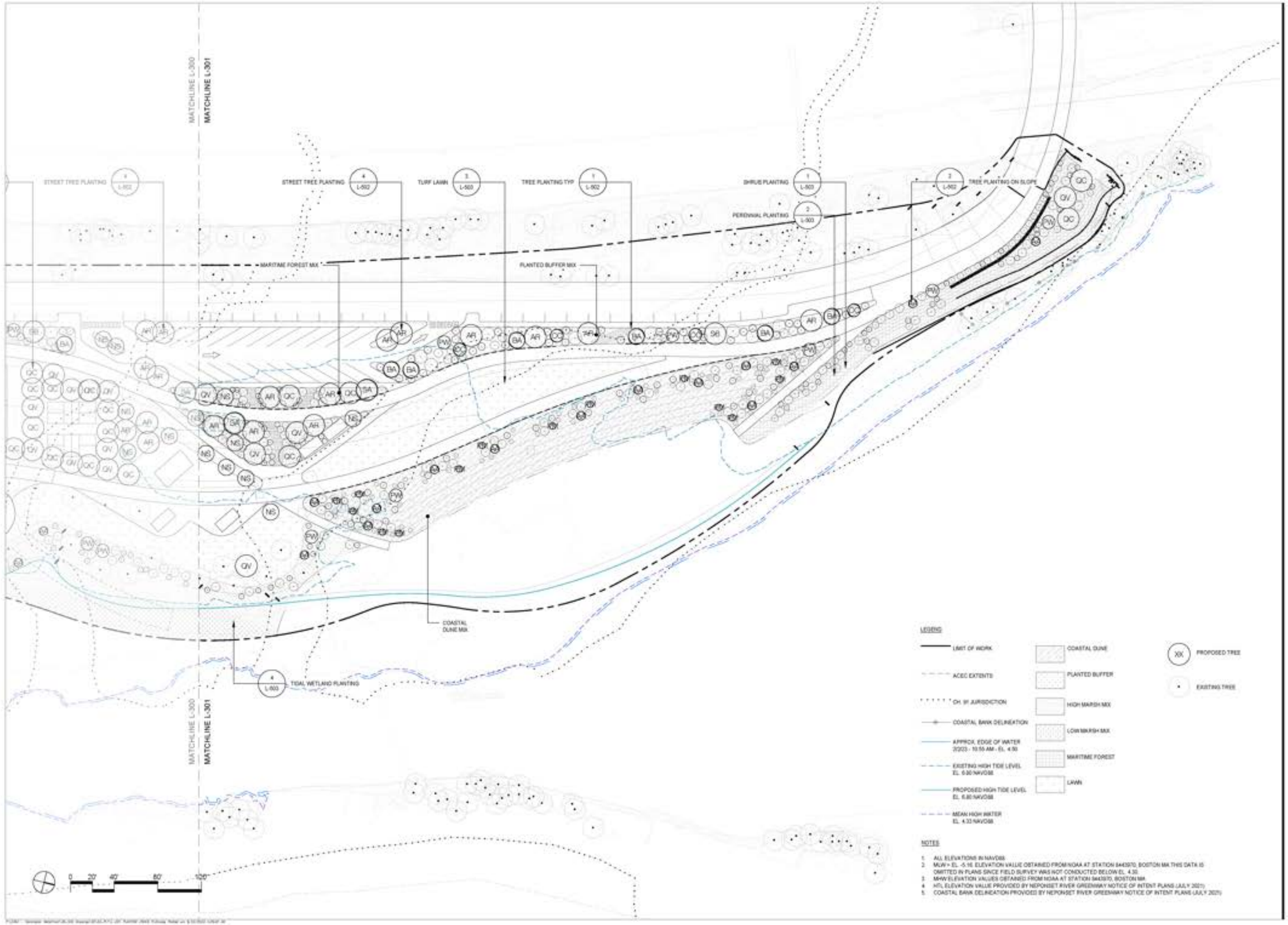
THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

PLANTING ZONES PLAN

L-300

© SCAPE LANDSCAPE ARCHITECTURE DPC 2022



SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

KEY PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

SHEET NAME
PLANTING ZONES PLAN

SHEET NO.
L-301

© SCAPE LANDSCAPE ARCHITECTURE DPC 2023

TREES

Code	Quantity	Botanical	Common	Size	Condition	Spacing
AR	22	ACER RUBRUM	RED MAPLE	10-12' HT.	B&B	AS SHOWN
AA	19	AMELANCHIER ARBOREA	DOWNY SERVICEBERRY	8-10' HT.	B&B	AS SHOWN
BA	31	BETULA ALLEGHANIENSIS	YELLOW BIRCH	10' - 12' HT.	B&B	AS SHOWN
CC	6	CERCIS CANADENSIS	EASTERN REDBUD	8-10' HT.	B&B	AS SHOWN
NS	13	NYSSA SYLVATICA	TUPELO	10-12' HT.	B&B	AS SHOWN
PM	14	PRUNUS MARITIMA	BEACH PLUM	6-8' HT.	B&B	AS SHOWN
PW	20	PRUNUS SEROTINA	BLACK CHERRY	10-12' HT.	B&B	AS SHOWN
QC	33	QUERCUS COCCINEA	SCARLET OAK	10-12' HT.	B&B	AS SHOWN
QV	30	QUERCUS VELUTINA	BLACK OAK	10-12' HT.	B&B	AS SHOWN
SB	4	SALIX NIGRA	BLACK WILLOW	10-12' HT.	B&B	AS SHOWN
SA	3	SASSAFRAS ALBIDUM	SASSAFRAS	10-12' HT.	B&B	AS SHOWN

SHRUBS

COASTAL DUNE

Code	Quantity	Botanical	Common	Size	Condition	Spacing
Af	28	ARONIA ARBUTIFOLIA	RED CHOKEBERRY	7 GAL.	CONT.	AS SHOWN
Et	65	EURYBIA SPECTABILIS	EASTERN SHOWY ASTER	3 GAL.	CONT.	AS SHOWN
Mp	40	MYRICA PENSYLVANICA	NORTHERN BAYBERRY	7 GAL.	CONT.	AS SHOWN

PLANTED BUFFER

Code	Quantity	Botanical	Common	Size	Condition	Spacing
Hv	19	HAMAMELIS VIRGINIANA	COMMON WITCH HAZEL	7 GAL.	CONT.	AS SHOWN
Lb	61	LINDERA BENZOIN	SPICEBUSH	7 GAL.	CONT.	AS SHOWN
Sg	27	SAMBUCUS NIGRA	BLACK ELDERBERRY	7 GAL.	CONT.	AS SHOWN

MARITIME FOREST

Code	Quantity	Botanical	Common	Size	Condition	Spacing
Ca	52	CLETHRA ALNIFOLIA	SUMMERSWEET	5 GAL.	CONT.	AS SHOWN
Rw	43	RHUS COPALLINA	WINGED SUMAC	7 GAL.	CONT.	AS SHOWN
Va	50	VIBURNUM DENTATUM	VIBURNUM	7 GAL.	CONT.	AS SHOWN

HIGH MARSH MIX

Code	Quantity	Botanical	Common	Size	Condition	Spacing
Bh	62	BACCHARIS HALIMIFOLIA	GROUNDSEL BUSH	7 GAL.	CONT.	AS SHOWN
If	61	IVA FRUTESCENS	MARSH ELDER	5 GAL.	CONT.	AS SHOWN

NOTE: NO SHRUBS SELECTED FOR LAWN OR LOW MARSH

GROUND COVERS

COASTAL DUNE

Code	Quantity	Botanical	Common	Size	Condition	Spacing
Ab	1358	AMMOPHILA BREVILIGULATA	AMERICAN BEACHGRASS	1 GAL.	CONT.	24", O.C.
Au	679	ARCTOSTAPHYLOS UVA-URSI	KINNIKINNICK	1 GAL.	CONT.	24", O.C.
Cr	679	COMPTONIA PEREGRINA	SWEET FERN	1 GAL.	CONT.	24", O.C.
Hu	679	HUDSONIA TOMENTOSA	SAND GOLDENHEATHER	1 GAL.	CONT.	24", O.C.
Lm	1358	LEYMUS MOLLIS	AMERICAN DUNEGRASS	1 GAL.	CONT.	24", O.C.
Pv	1358	PANICUM VIRGATUM	SWITCH GRASS	1 GAL.	CONT.	24", O.C.
Sv	679	SOLIDAGO SEMPERVIRENS	SEASIDE GOLDENROD	1 GAL.	CONT.	24", O.C.

PLANTED BUFFER

Code	Quantity	Botanical	Common	Size	Condition	Spacing
Ad	982	ANDROPOGON GERARDII 'DANCING '	DANCING WIND BIG BLUESTEM	1 GAL.	CONT.	24", O.C.
Aq	246	AQUILEGIA CANADENSIS	EASTERN COLUMBINE	1 GAL.	CONT.	24", O.C.
Cp	982	CAREX PENSYLVANICA	PENNSYLVANIA SEDGE	1 GAL.	CONT.	24", O.C.
Ep	491	ERAGROSTIS PECTINACEA	TUFTED LOVEGRASS	1 GAL.	CONT.	24", O.C.
Sn	982	SORGHASTRUM NUTANS	INDIAN GRASS	1 GAL.	CONT.	24", O.C.
Ve	246	VERBENA HASTATA	BLUE VERVAIN	1 GAL.	CONT.	24", O.C.
Vv	491	VERNONIA NOVEBORACENSIS	COMMON IRONWEED	1 GAL.	CONT.	24", O.C.
Zi	491	ZIZIA AUREA	GOLDEN ALEXANDER	1 GAL.	CONT.	24", O.C.

MARITIME FOREST

Code	Quantity	Botanical	Common	Size	Condition	Spacing
Cp	1662	CAREX PENSYLVANICA	PENNSYLVANIA SEDGE	1 GAL.	CONT.	24", O.C.
Mc	554	MAIANTHEMUM CANADENSE	CANADA MAYFLOWER	1 GAL.	CONT.	24", O.C.
Mr	1108	MITCHELLA REPENS	PARTRIDGE BERRY	1 GAL.	CONT.	24", O.C.
Pv	1108	PANICUM VIRGATUM	SWITCH GRASS	1 GAL.	CONT.	24", O.C.
Pa	1108	PTERIDIUM AQUILINUM	WESTERN BRACKEN FERN	1 GAL.	CONT.	24", O.C.

HIGH MARSH MIX

Code	Quantity	Botanical	Common	Size	Condition	Spacing
Ds	2252	DISTICHLIS SPICATA	SALTGRASS	PLUG	PLUG	24", O.C.
Jg	1126	JUNCUS GERARDII	SALTMARSH RUSH	PLUG	PLUG	24", O.C.
Lc	1126	LIMONIUM CAROLINIANUM	CAROLINA SEA LAVENDER	1 GAL.	CONT.	24", O.C.
Pv	1126	PANICUM VIRGATUM	SWITCH GRASS	1 GAL.	CONT.	24", O.C.
Sv	1126	SOLIDAGO SEMPERVIRENS	SEASIDE GOLDENROD	1 GAL.	CONT.	24", O.C.
Sp	4503	SPARTINA PATENS	SALTMEADOW CORDGRASS	PLUG	PLUG	24", O.C.

LOW MARSH MIX

Code	Quantity	Botanical	Common	Size	Condition	Spacing
Sf	4988	SPARTINA ALTERNIFLORA	SALT MARSH GRASS	PLUG	PLUG	24", O.C.

LAWN

Code	Quantity	Botanical	Common	Size	Condition	Spacing
Pp	37907 sq ft	POA PRATENSIS	KENTUCKY BLUEGRASS	SOD		

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

100% PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT — SCAPE LANDSCAPE ARCHITECTURE DPC

COASTAL ENGINEERING — TETRA TECH

RESILIENCY MODELING — WOODS HOLE GROUP

SURVEY — DAWOOD

NUMBER | DATE | ISSUE

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

SHEET NAME

PLANTING SCHEDULE

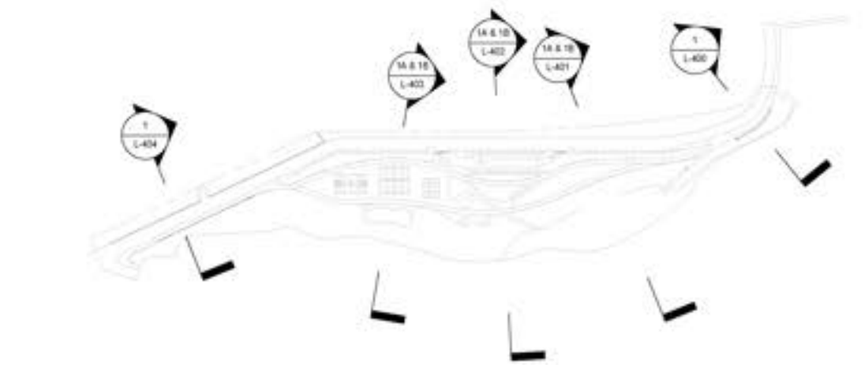
PROJECT NO. | SHEET NO.
DRAWN BY
SCALE
CHECKED BY
DATE

L-302

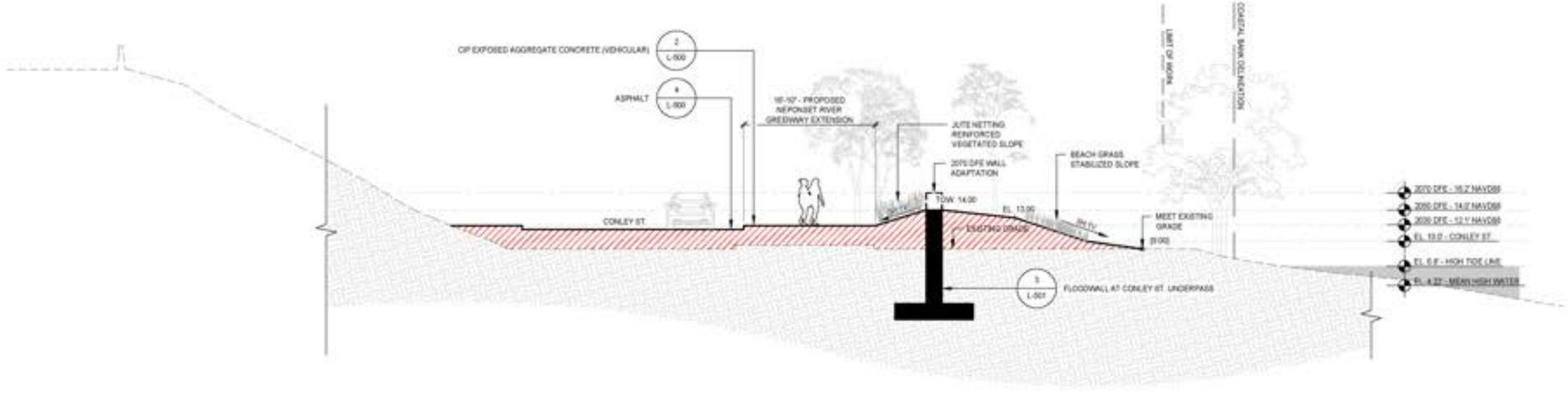
© SCAPE LANDSCAPE ARCHITECTURE DPC 2020

NOTES:

1. ALL ELEVATIONS IN NAVD88
2. MLW = EL -5.16. ELEVATION VALUE OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA.THIS DATA IS OMITTED IN SECTIONS SINCE FIELD SURVEY WAS NOT CONDUCTED BELOW EL. 4.30.
3. MHW ELEVATION VALUES OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA
4. HTL ELEVATION VALUE PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)



KEY PLAN
SCALE: 1"= 200'-0"



1 CONLEY ST. UNDERPASS AT FLOOD WALL LOOKING NORTH
SCALE: 1/8" = 1'-0"

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

REV PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT — SCAPE LANDSCAPE ARCHITECTURE DPC

COASTAL ENGINEERING — TETRA TECH

RESILIENCY MODELING — WOODS HOLE GROUP

SURVEY — DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

SHEET NAME

SITE SECTIONS

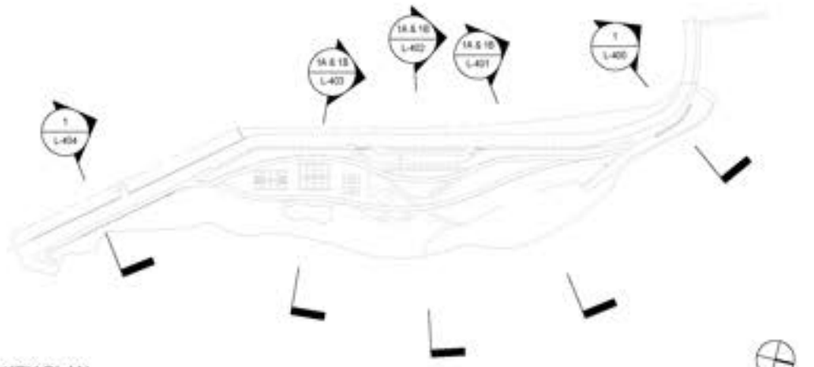
PROJECT NO. — SHEET NO.
DATE
SCALE
AS NOTED
DRAWN BY
CHKD
CHECKED BY
SCAPE
DATE
rev 01 2021

L-400

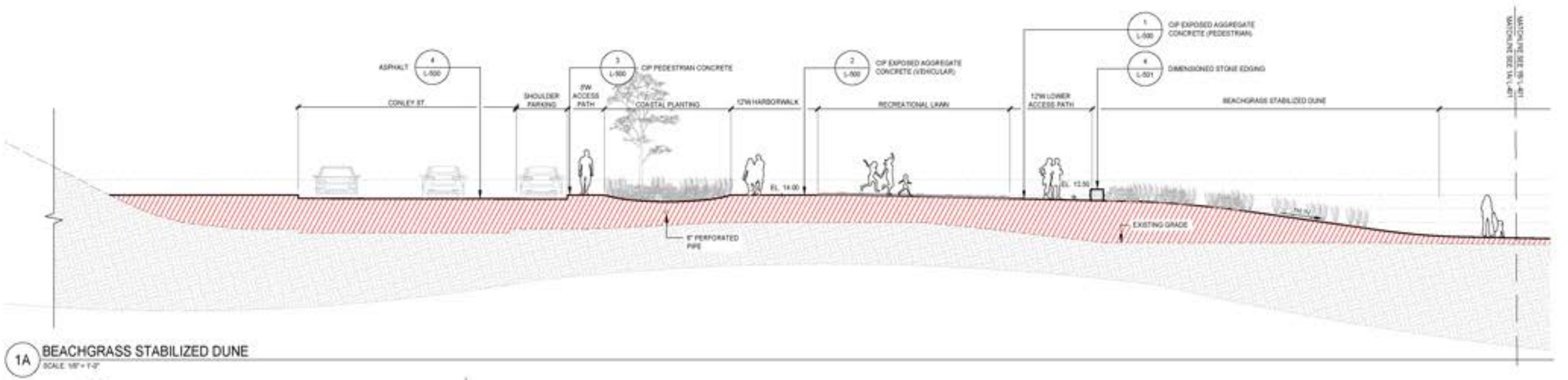
© SCAPE LANDSCAPE ARCHITECTURE DPC 2021

NOTES:

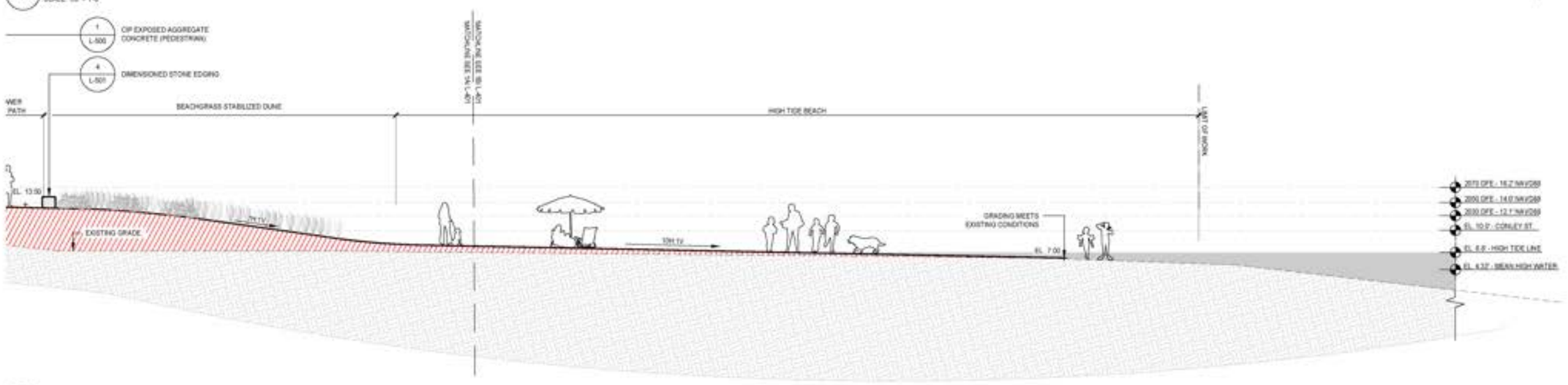
1. ALL ELEVATIONS IN NAVD88
2. MLW = EL. -5.16. ELEVATION VALUE OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA.THIS DATA IS OMITTED IN SECTIONS SINCE FIELD SURVEY WAS NOT CONDUCTED BELOW EL. 4.30
3. MHW ELEVATION VALUES OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA
4. HTL ELEVATION VALUE PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)



KEY PLAN
SCALE: 1"= 200'-0"



1A BEACHGRASS STABILIZED DUNE
SCALE: 1/8" = 1'-0"



1B BEACHGRASS STABILIZED DUNE
SCALE: 1/8" = 1'-0"

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

KEY PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

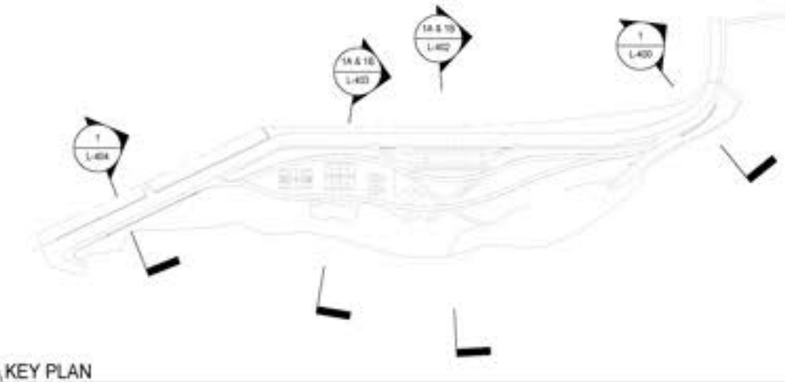
SCHEMATIC DESIGN

SITE SECTIONS

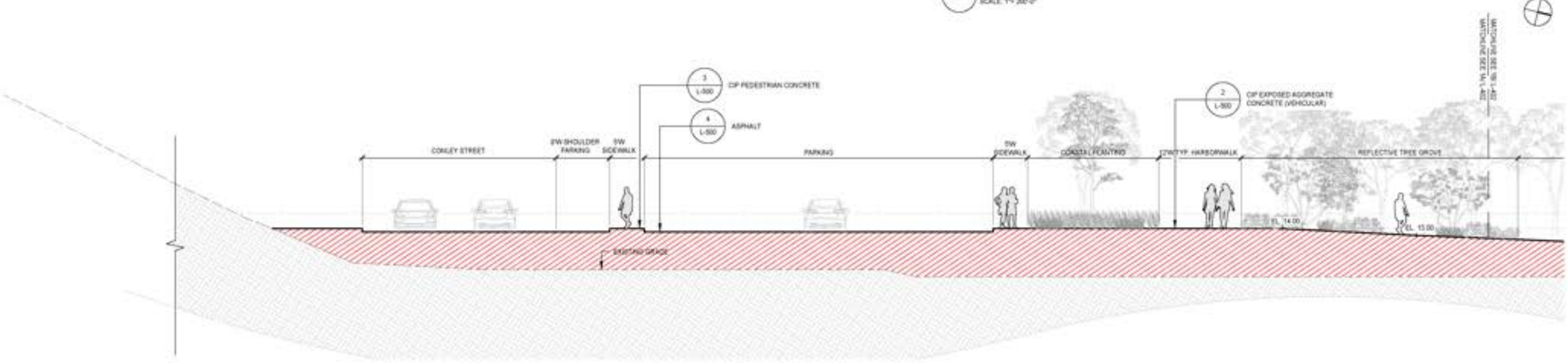
L-401

NOTES

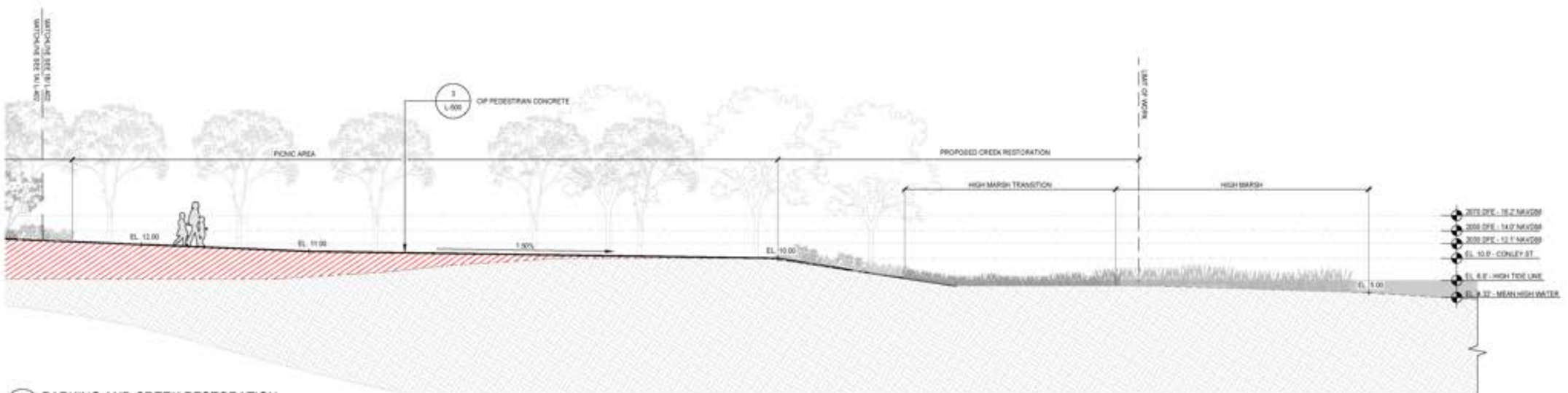
1. ALL ELEVATIONS IN NAVD88
2. MLW = EL -3.16. ELEVATION VALUE OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA.THIS DATA IS OMITTED IN SECTIONS SINCE FIELD SURVEY WAS NOT CONDUCTED BELOW EL 4.30
3. MHW ELEVATION VALUES OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA
4. HTL ELEVATION VALUE PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)



KEY PLAN
SCALE: 1"= 200'-0"



1A PARKING AND CREEK RESTORATION
SCALE: 1/8" = 1'-0"



1B PARKING AND CREEK RESTORATION
SCALE: 1/8" = 1'-0" (Bridge)_XREF

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

KEY PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

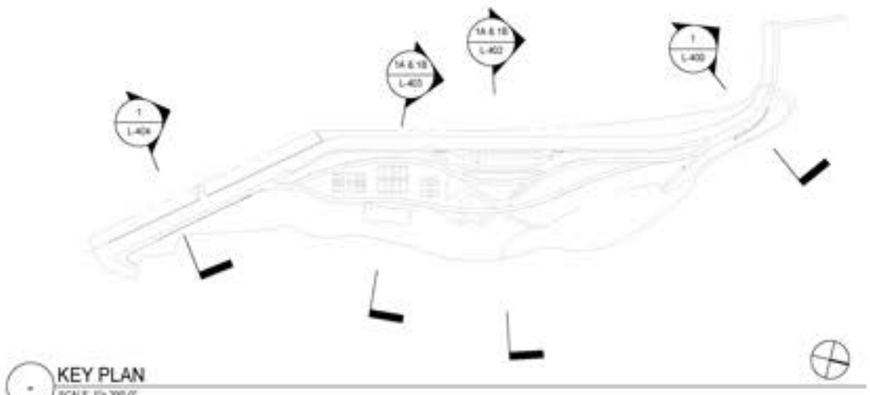
SHEET NAME

SITE SECTIONS

PROJECT NO.
DRN.
SCALE
AS NOTED
DRAWN BY
SCAPE
CHECKED BY
SCAPE
DATE
June 17, 2022

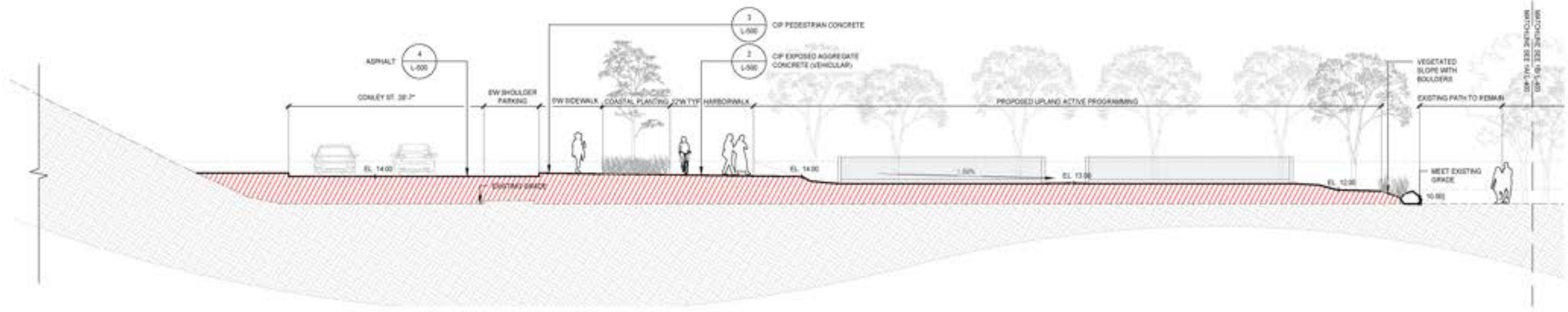
SHEET NO.
L-402

© SCAPE LANDSCAPE ARCHITECTURE DPC 2022

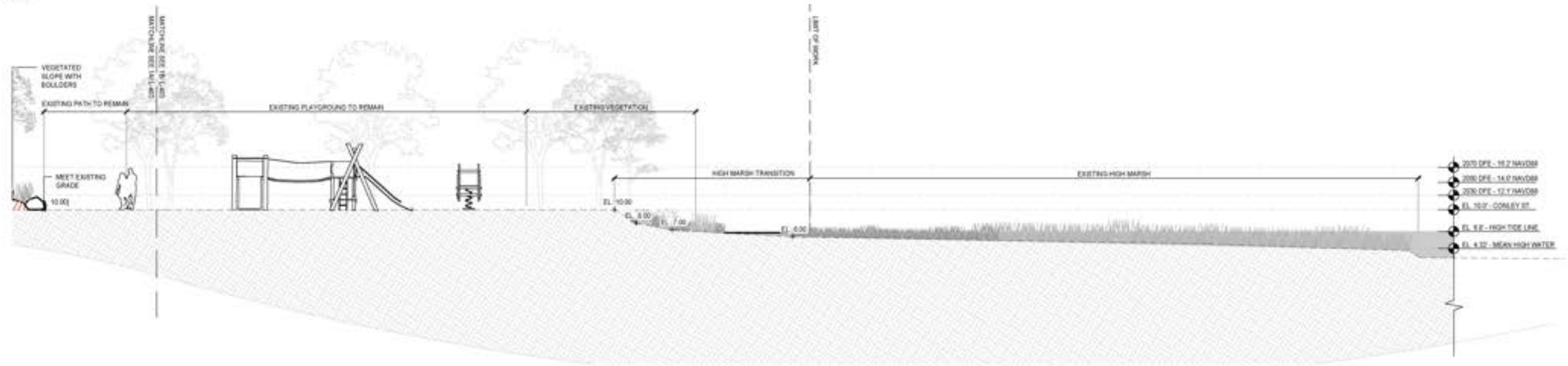


KEY PLAN
SCALE: 1"= 200'-0"

NOTES:
1. ALL ELEVATIONS IN NAVD88
2. MLW = EL. -5.16. ELEVATION VALUE OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA. THIS DATA IS OMITTED IN SECTIONS SINCE FIELD SURVEY WAS NOT CONDUCTED BELOW EL. 4.30
3. MHW ELEVATION VALUES OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA
4. HTL ELEVATION VALUE PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)



1A ACTIVE PROGRAMMING AND EXISTING PLAYGROUND LOOKING NORTH
SCALE: 1/8" = 1'-0"



1B ACTIVE PROGRAMMING AND EXISTING PLAYGROUND LOOKING NORTH
SCALE: 1/8" = 1'-0"

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

401 PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

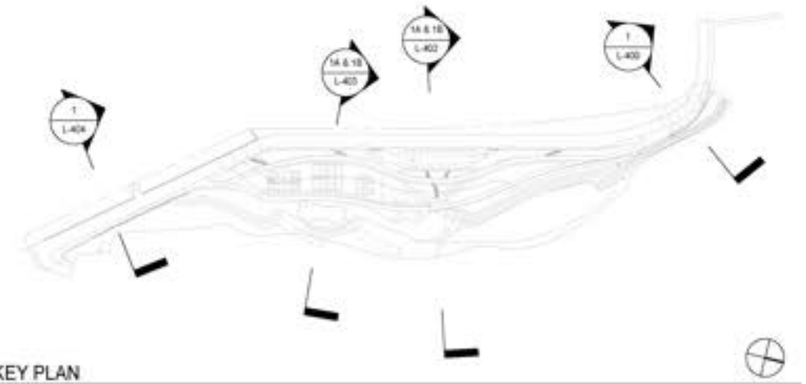
THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

SITE SECTIONS

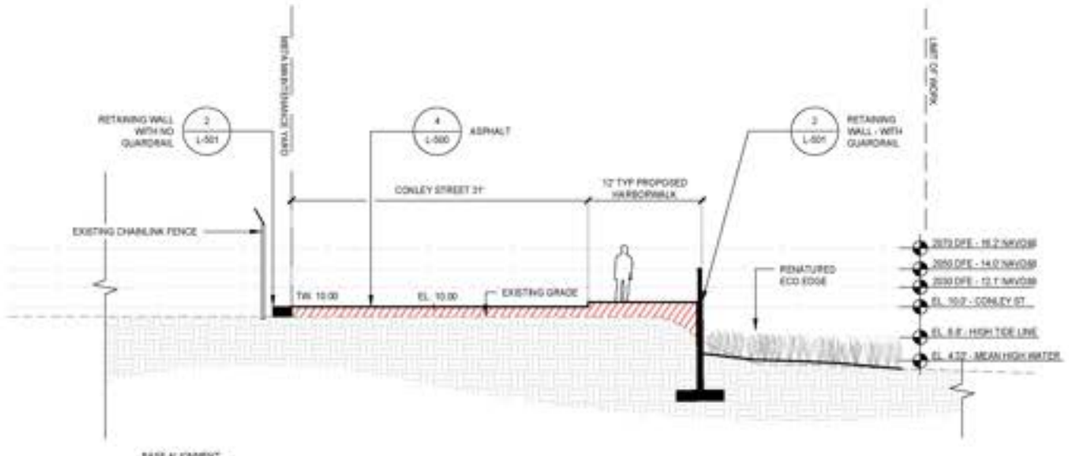
L-403

© SCAPE LANDSCAPE ARCHITECTURE DPC 2021

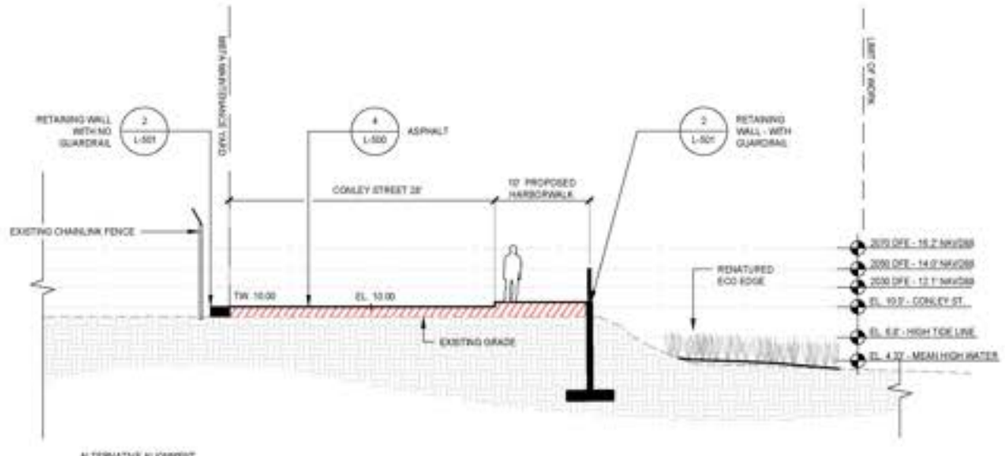


KEY PLAN
SCALE: 1"= 200'-0"

NOTES:
1. ALL ELEVATIONS IN NAVD88
2. MLW = EL. -5.16. ELEVATION VALUE OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA. THIS DATA IS OMITTED IN SECTIONS SINCE FIELD SURVEY WAS NOT CONDUCTED BELOW EL. 4.30
3. MHW ELEVATION VALUES OBTAINED FROM NOAA AT STATION 8443970, BOSTON MA
4. HTL ELEVATION VALUE PROVIDED BY NEPONSET RIVER GREENWAY NOTICE OF INTENT PLANS (JULY 2021)



BASE ALIGNMENT
- CONLEY ST. REMAINS AT EXISTING 31'W
- HARBORWALK AT 12'W TYP.
- INTENSIVE RETAINING WALL DESIGN AT WATER'S EDGE (ACCOUNTS FOR WAVE ACTION AND DAILY WATER INUNDATION)



ALTERNATIVE ALIGNMENT
- ROAD DIET AT CONLEY ST. (7' REDUCTION)
- REDUCED HARBORWALK WIDTH TO 10'
- LESS INTENSIVE RETAINING WALL DESIGN DUE TO SETBACK FROM WATER

1 PINE NECK CREEK OUTFALL LOOKING NORTH
SCALE: 1/8" = 1'-0" (Bridges_XREF)

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

KEY PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

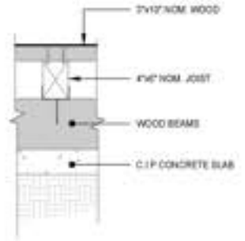
THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

SCHEMATIC DESIGN

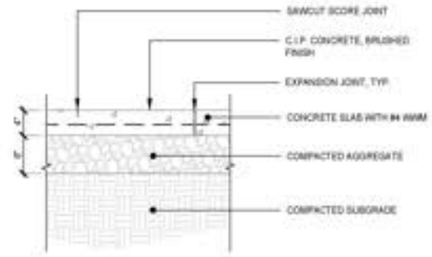
SITE SECTIONS

L-404

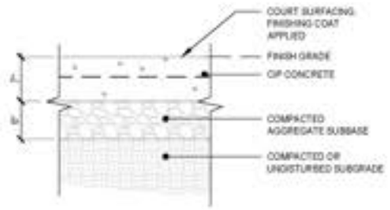
© SCAPE LANDSCAPE ARCHITECTURE DPC 2021



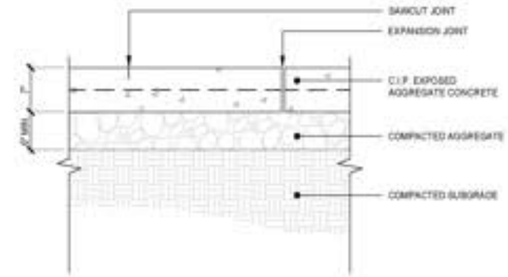
6 BOARDWALK ON GRADE
SCALE: 1" = 1'-0"



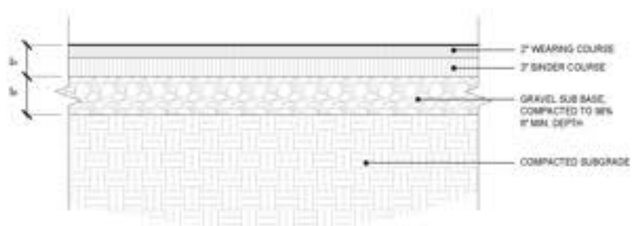
3 CIP PEDESTRIAN CONCRETE
SCALE: 1" = 1'-0"



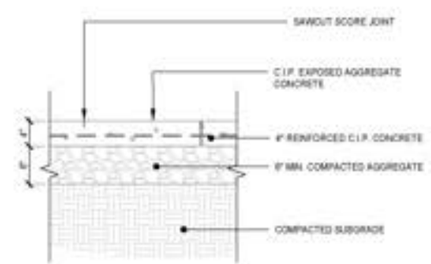
5 COURT SURFACE
SCALE: 1" = 1'-0"



2 CIP EXPOSED AGGREGATE CONCRETE (VEHICULAR)
SCALE: 1" = 1'-0"



4 ASPHALT
SCALE: 1" = 1'-0"



1 CIP EXPOSED AGGREGATE CONCRETE (PEDESTRIAN)
SCALE: 1" = 1'-0"

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

REV PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT: SCAPE LANDSCAPE ARCHITECTURE DPC

CIVIL ENGINEERING: TETRA TECH

RESILIENCY MODELING: WOODS HOLE GROUP

SURVEY: DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

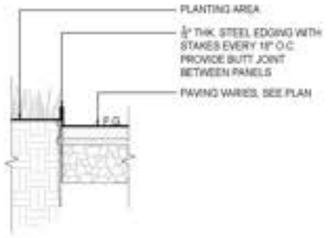
SCHEMATIC DESIGN

SHEET NAME
DETAILS - PAVING

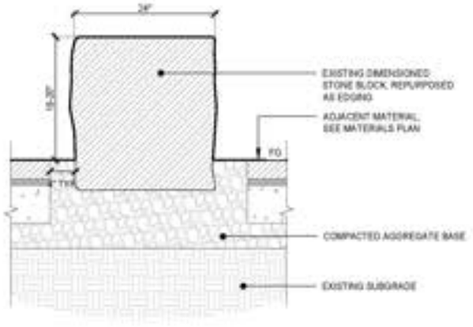
PROJECT NO.
DRA
SCALE
AS NOTED
DRAWN BY
SCAPE
CHECKED BY
SCAPE
DATE
June 12, 2020

SHEET NO.
L-500

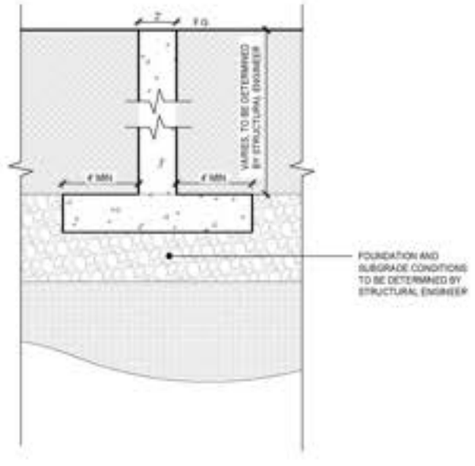
© SCAPE LANDSCAPE ARCHITECTURE DPC 2020



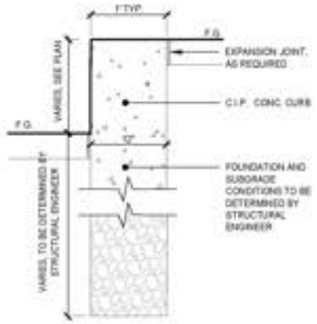
5 PLANTER EDGING
SCALE: 1" = 1'-0"

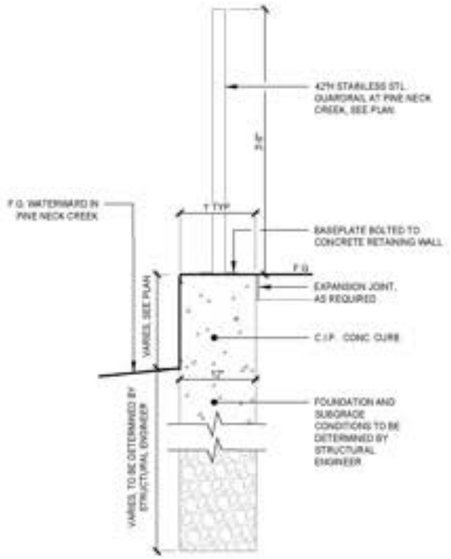


4 DIMENSIONED STONE EDGING
SCALE: 1" = 1'-0"

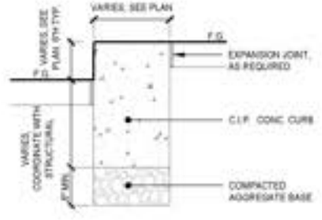


3 FLOODWALL AT CONLEY ST. UNDERPASS
SCALE: 1/4" = 1'-0"





2 RETAINING WALL
SCALE: 1" = 1'-0"



1 CIP CURB
SCALE: 1" = 1'-0"

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

REV PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
CIVIL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

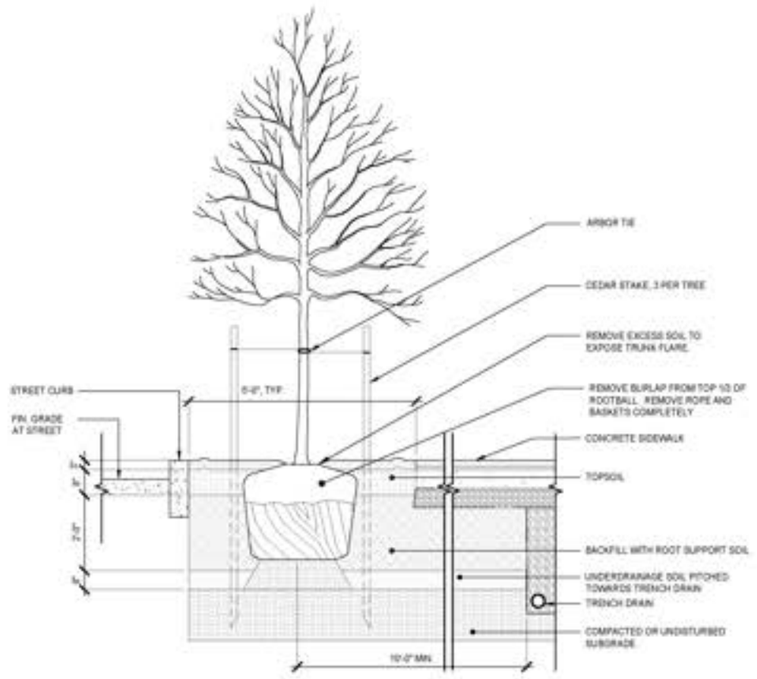
SCHEMATIC DESIGN

SHEET NAME
DETAILS - CURBS, WALLS, EDGES

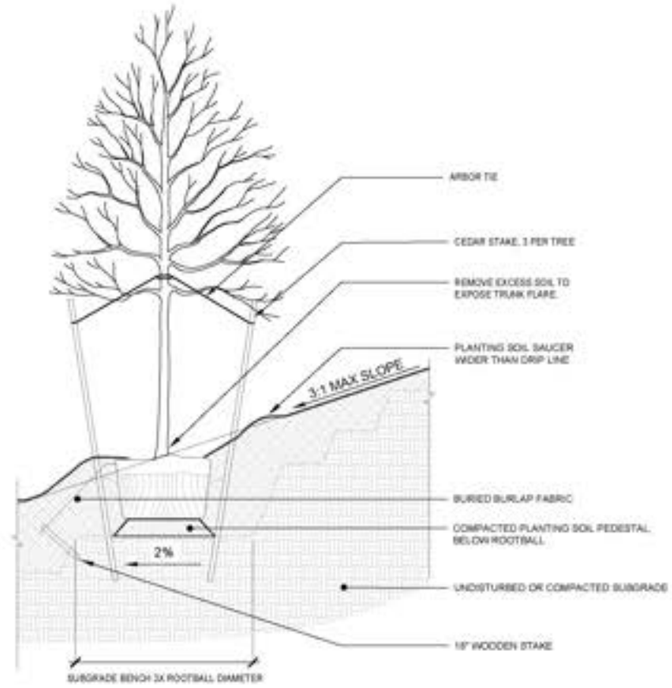
PROJECT NO. | SHEET NO.
DRAWN
SCALE
REVIEWED
CHECKED BY
DATE
JUNE 12, 2020

L-501

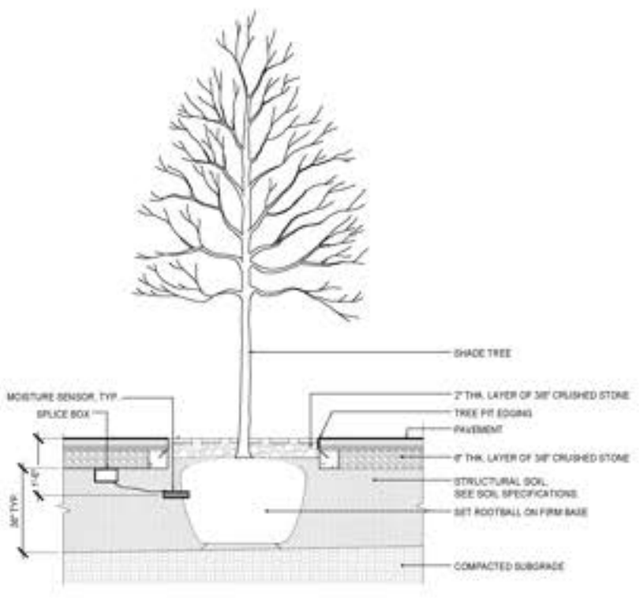
© SCAPE LANDSCAPE ARCHITECTURE DPC 2020



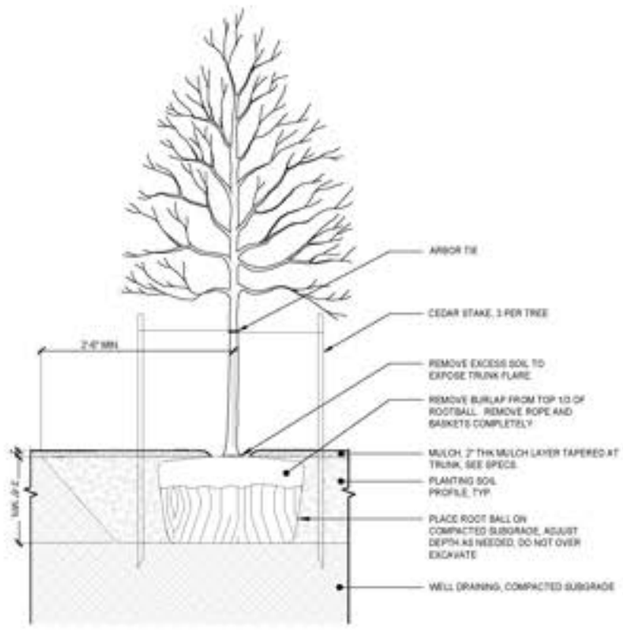
4 STREET TREE PLANTING
SCALE: 1/2" = 1'-0"



2 TREE PLANTING ON SLOPE
SCALE: 1/2" = 1'-0"



3 TREE PLANTING IN PAVING
SCALE: 1/2" = 1'-0"



1 TREE PLANTING TYP
SCALE: 1/2" = 1'-0"

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

100% PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

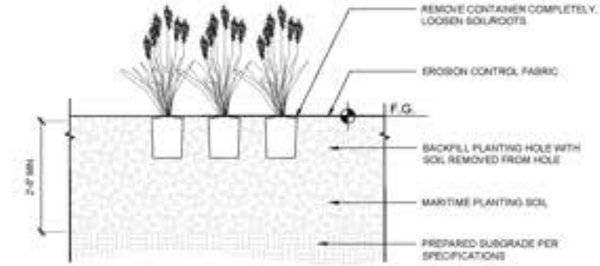
PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

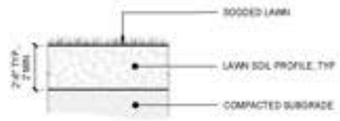
SCHEMATIC DESIGN

DETAILS - PLANTING

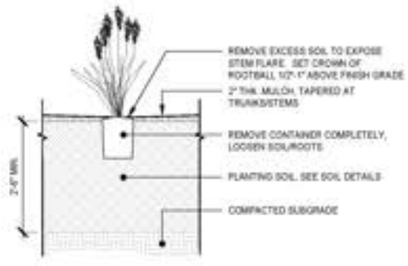
L-502



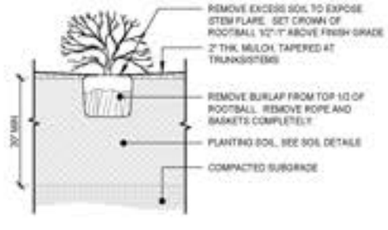
4 TIDAL WETLAND PLANTING
SCALE: 1/2" = 1'-0"



3 TURF LAWN
SCALE: 1/2" = 1'-0"



2 PERENNIAL PLANTING
SCALE: 1/2" = 1'-0"



1 SHRUB PLANTING
SCALE: 1/2" = 1'-0"

SCAPE

RESILIENT DESIGN FOR DORCHESTER'S WATERFRONT

DORCHESTER, BOSTON, MASSACHUSETTS

100% PLAN

CLIENT
BOSTON PLANNING & DEVELOPMENT AGENCY

boston planning & development agency

LANDSCAPE ARCHITECT	SCAPE LANDSCAPE ARCHITECTURE DPC
COASTAL ENGINEERING	TETRA TECH
RESILIENCY MODELING	WOODS HOLE GROUP
SURVEY	DAWOOD

PROGRESS DRAWINGS NOT FOR CONSTRUCTION

THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

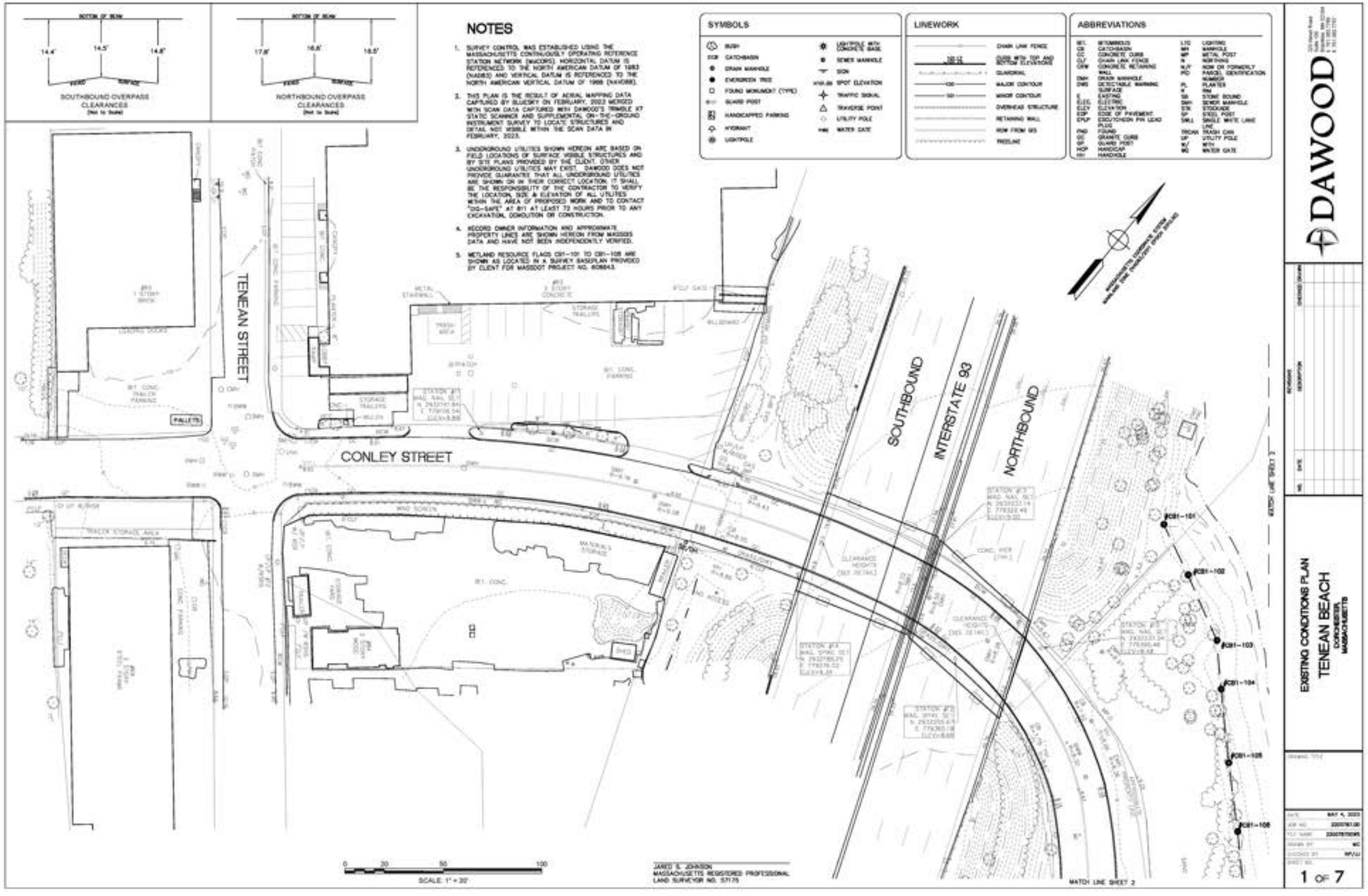
SCHEMATIC DESIGN

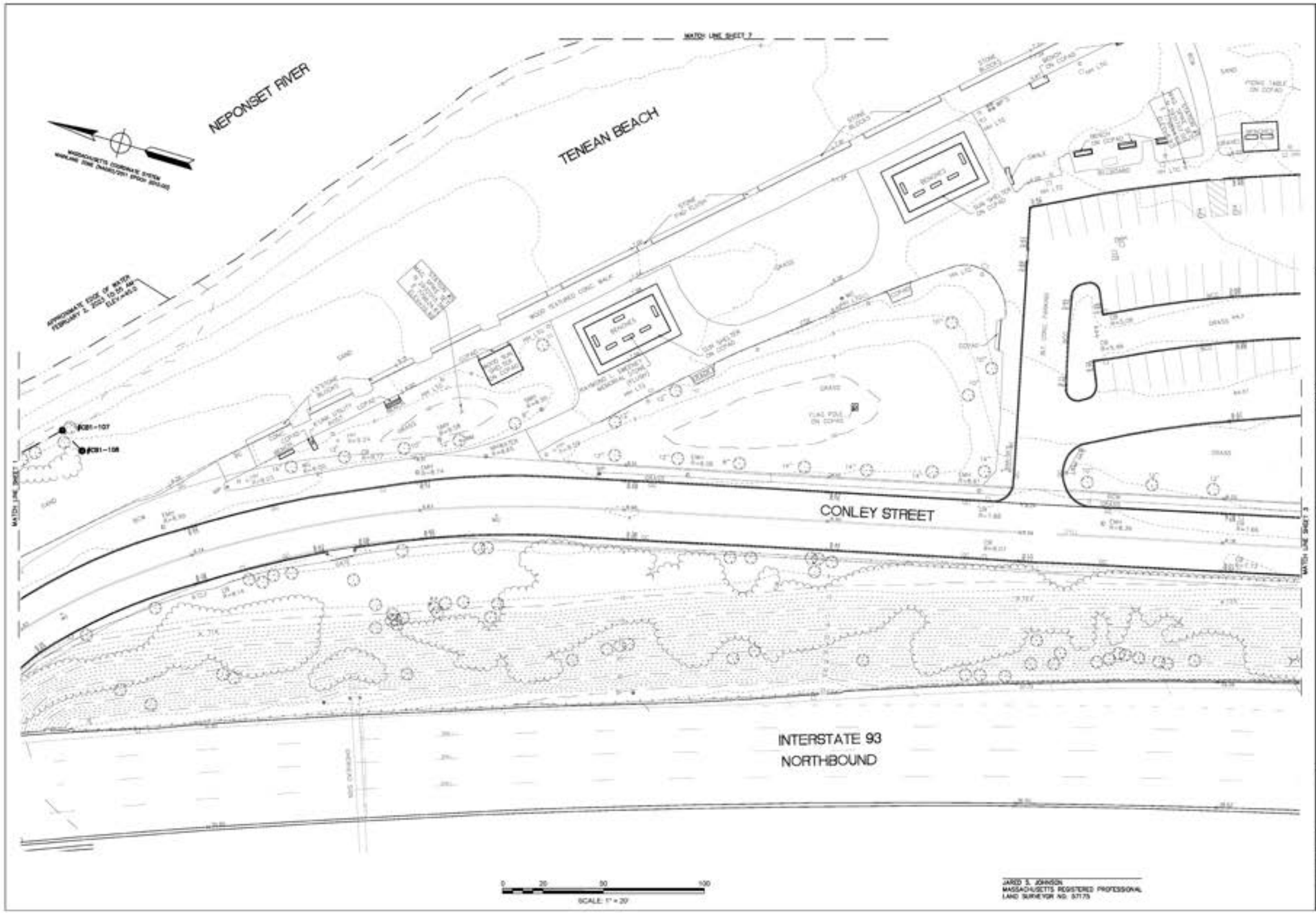
DETAILS - PLANTING

PROJECT NO.	SHEET NO.
Date	
SCALE	
AS NOTED	
DRAWN BY	L-503
ICHRO	
CHECKED BY	
SCAPE	
DATE	
June 13, 2022	

© SCAPE LANDSCAPE ARCHITECTURE DPC 2022

SITE SURVEY


BOTTOM OF BEAM
14.4'
14.5'
14.8'
FIXED
SURFACE
SOUTHBOUND OVERPASS CLEARANCES
(Not to Scale)
BOTTOM OF BEAM
17.8'
16.8'
16.5'
FIXED
SURFACE
NORTHBOUND OVERPASS CLEARANCES
(Not to Scale)
NOTES
1. SURVEY CONTROL WAS ESTABLISHED USING THE MASSACHUSETTS CONTINUOUSLY OPERATING REFERENCE STATION NETWORK (MaCORS). HORIZONTAL DATUM IS REFERENCED TO THE NORTH AMERICAN DATUM OF 1983 (NAD83) AND VERTICAL DATUM IS REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
2. THIS PLAN IS THE RESULT OF AERIAL MAPPING DATA CAPTURED BY BLUESKY ON FEBRUARY, 2023 MERGED WITH SCAN DATA CAPTURED WITH DAWOOD'S TRIMBLE X7 STATIC SCANNER AND SUPPLEMENTAL ON-THE-GROUND INSTRUMENT SURVEY TO LOCATE STRUCTURES AND DETAIL NOT VISIBLE WITHIN THE SCAN DATA IN FEBRUARY, 2023.
3. UNDERGROUND UTILITIES SHOWN HEREON ARE BASED ON FIELD LOCATIONS OF SURFACE VISIBLE STRUCTURES AND BY SITE PLANS PROVIDED BY THE CLIENT. OTHER UNDERGROUND UTILITIES MAY EXIST. DAWOOD DOES NOT PROVIDE GUARANTEE THAT ALL UNDERGROUND UTILITIES ARE SHOWN ON IN THEIR CORRECT LOCATION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION, SIZE & ELEVATION OF ALL UTILITIES WITHIN THE AREA OF PROPOSED WORK AND TO CONTACT "DIG-SAFE" AT 811 AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION, DEMOLITION OR CONSTRUCTION.
4. RECORD OWNER INFORMATION AND APPROXIMATE PROPERTY LINES ARE SHOWN HEREON FROM MASSGIS DATA AND HAVE NOT BEEN INDEPENDENTLY VERIFIED.
5. WETLAND RESOURCE FLAGS CB1-101 TO CB1-108 ARE SHOWN AS LOCATED IN A SURVEY BASEPLAN PROVIDED BY CLIENT FOR MASSDOT PROJECT NO. 608643.
SYMBOLS
BUSH
CB CATCHBASIN
DRAIN MANHOLE
EVERGREEN TREE
FOUND MONUMENT (TYPE)
GUARD POST
HANDICAPPED PARKING
HYDRANT
LIGHTPOLE
LIGHTPOLE WITH CONCRETE BASE
SEWER MANHOLE
SIGN
SPOT ELEVATION
TRAFFIC SIGNAL
TRAVERSE POINT
UTILITY POLE
WATER GATE
LINEWORK
CHAIN LINK FENCE
CURB WITH TOP AND BOTTOM ELEVATIONS
GUARDRAIL
MAJOR CONTOUR
MINOR CONTOUR
OVERHEAD STRUCTURE
RETAINING WALL
ROW FROM GIS
TREELINE
ABBREVIATIONS
BIT. BITUMINOUS
CB CATCHBASIN
CC CONCRETE CURB
CLF CHAIN LINK FENCE
CRW CONCRETE RETAINING WALL
DMH DRAIN MANHOLE
DWS DETECTABLE WARNING SURFACE
E EASTING
ELEC ELECTRIC
ELEV ELEVATION
EOP EDGE OF PAVEMENT
EXP EXPLOSION PIN LEAD PLUG
FND FOUND
GC GRANITE CURB
GP GUARD POST
HCP HANDICAP
HH HANDHOLE
LTG LIGHTING
MH MANHOLE
MP METAL POST
N NORTHING
N/F NOW OR FORMERLY
PID PARCEL IDENTIFICATION NUMBER
PL PLANTER
R RIM
SB STONE BOUND
SMH SEWER MANHOLE
STK STOCKADE
SP STEEL POST
SWLL SINGLE WHITE LINE LINE
TRCAN TRASH CAN
UP UTILITY POLE
W/ WITH
WG WATER GATE
TENEAN STREET
CONLEY STREET
SOUTHBOUND
INTERSTATE 93
NORTHBOUND
CB1-101
CB1-102
CB1-103
CB1-104
CB1-105
CB1-106
MATCH LINE SHEET 2
0 20 50 100
SCALE: 1" = 20'
JARED S. JOHNSON
MASSACHUSETTS REGISTERED PROFESSIONAL
LAND SURVEYOR NO. 57175
DAWOOD
EXISTING CONDITIONS PLAN
TENEAN BEACH
CONCORD, MASSACHUSETTS
MAY 4, 2023
1 OF 7



JARED S. JOHNSON
MASSACHUSETTS REGISTERED PROFESSIONAL
LAND SURVEYOR NO. 57175

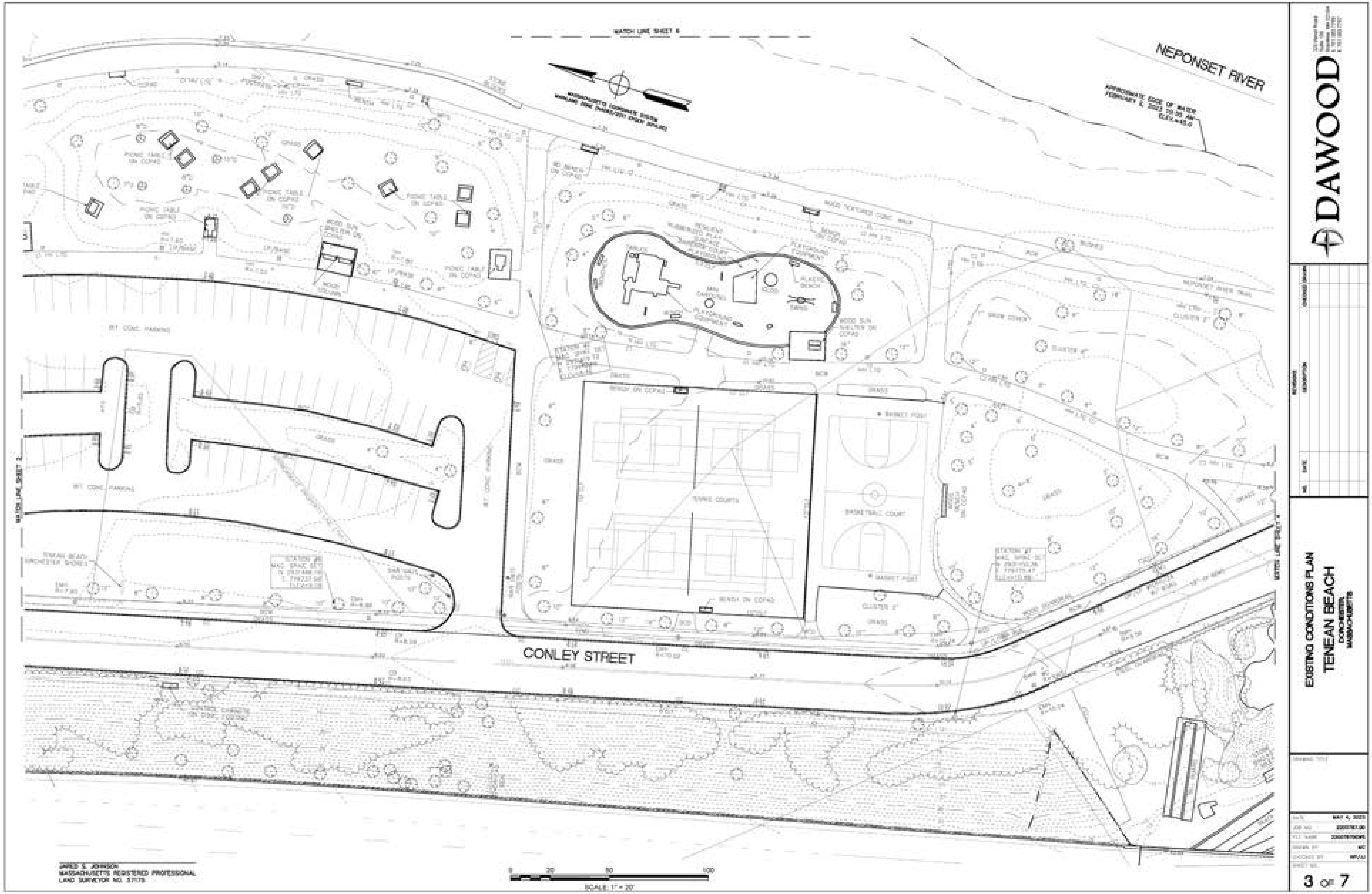
DAWOOD

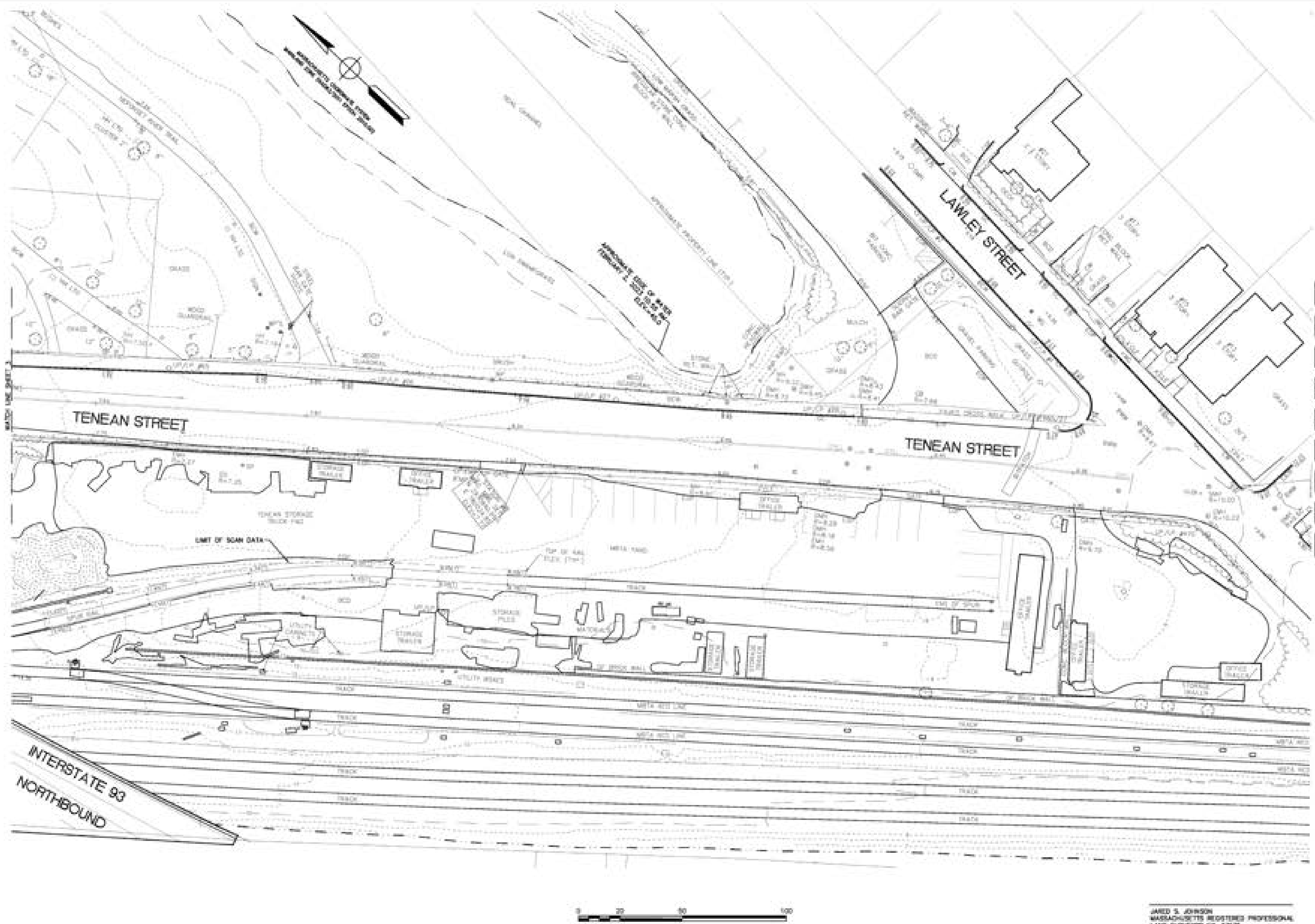
EXISTING CONDITIONS PLAN

TENEAN BEACH
DORCHESTER
MASSACHUSETTS

MAY 4, 2023

2 OF 7


MATCH LINE SHEET 6
NEPONSET RIVER
TENNIS COURTS
BASKETBALL COURT
CONLEY STREET
NEPONSET RIVER TRAIL
EXISTING CONDITIONS PLAN
TENEAN BEACH
DORCHESTER, MASSACHUSETTS
DAWOOD
MAY 4, 2023
3 OF 7
JARED S. JOHNSON
MASSACHUSETTS REGISTERED PROFESSIONAL LAND SURVEYOR NO. 57179
SCALE: 1" = 20'



JARED S. JOHNSON
MASSACHUSETTS REGISTERED PROFESSIONAL
LAND SURVEYOR NO. 57175

DAWOOD

EXISTING CONDITIONS PLAN
TENEAN BEACH
DORCHESTER,
MASSACHUSETTS

DATE: MAY 4, 2023

0 20 50 100
SCALE: 1" = 20'

JAMES S. JOHNSON
MASSACHUSETTS REGISTERED PROFESSIONAL
LAND SURVEYOR NO. 51175

5 of 7

EXISTING CONDITIONS PLAN

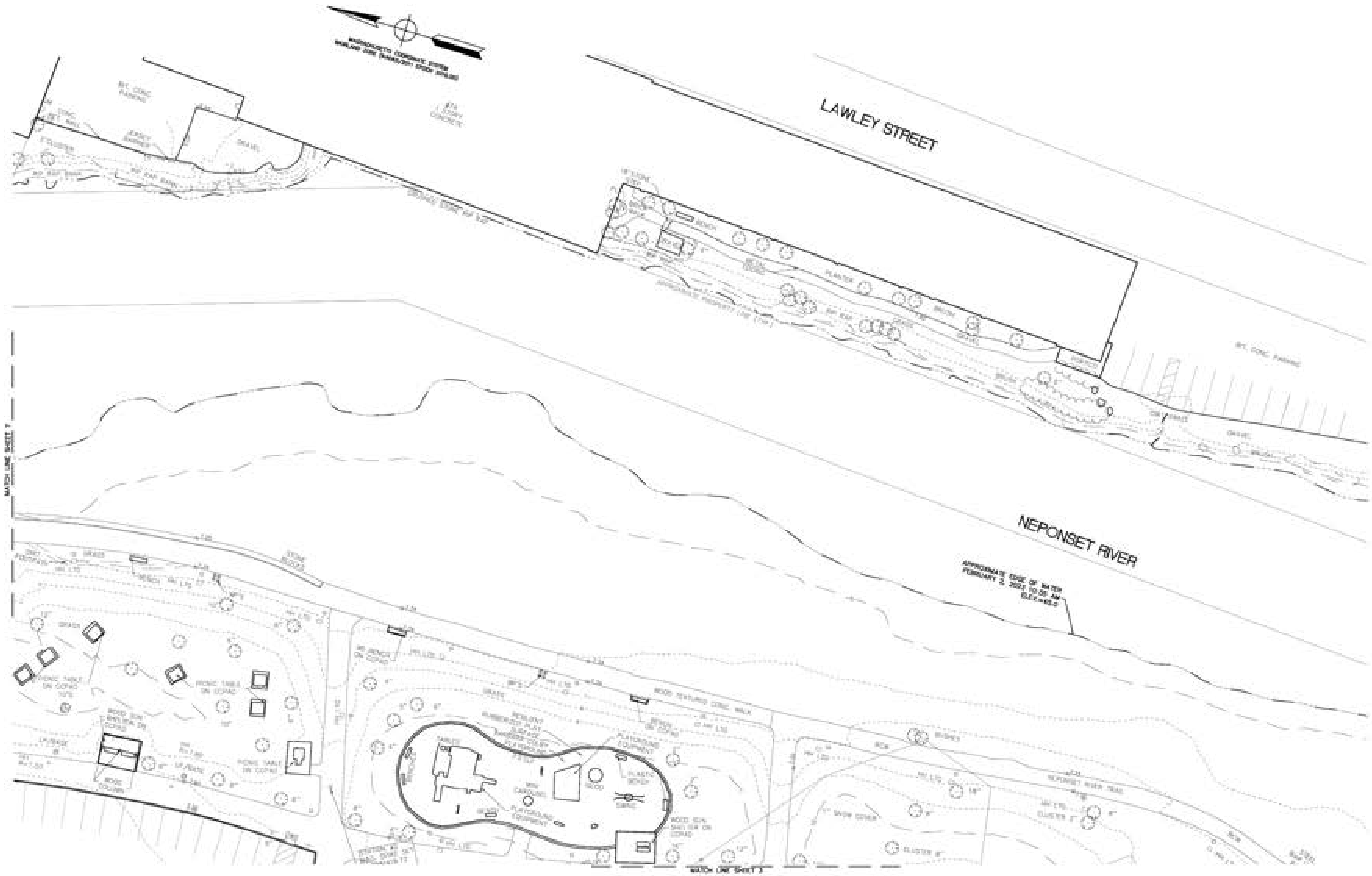
TENEAN BEACH

DORCHESTER,
MASSACHUSETTS

REVISIONS				
NO.	DATE	DESCRIPTION	CHECKED	DRAWN

DAWOOD

320 Harvard Road
Suite 100
Stoughton, MA 02072
t. 781.982.7799
f. 781.982.7797



0 20 50 100

SCALE: 1" = 20'

JARED S. JOHNSON
MASSACHUSETTS REGISTERED PROFESSIONAL
LAND SURVEYOR NO. 57175

DAWOOD

REVISIONS

EXISTING CONDITIONS PLAN

TENEAN BEACH

DORCHESTER, MASSACHUSETTS

DRAWING TITLE

DATE MAY 4, 2023

JOB NO.

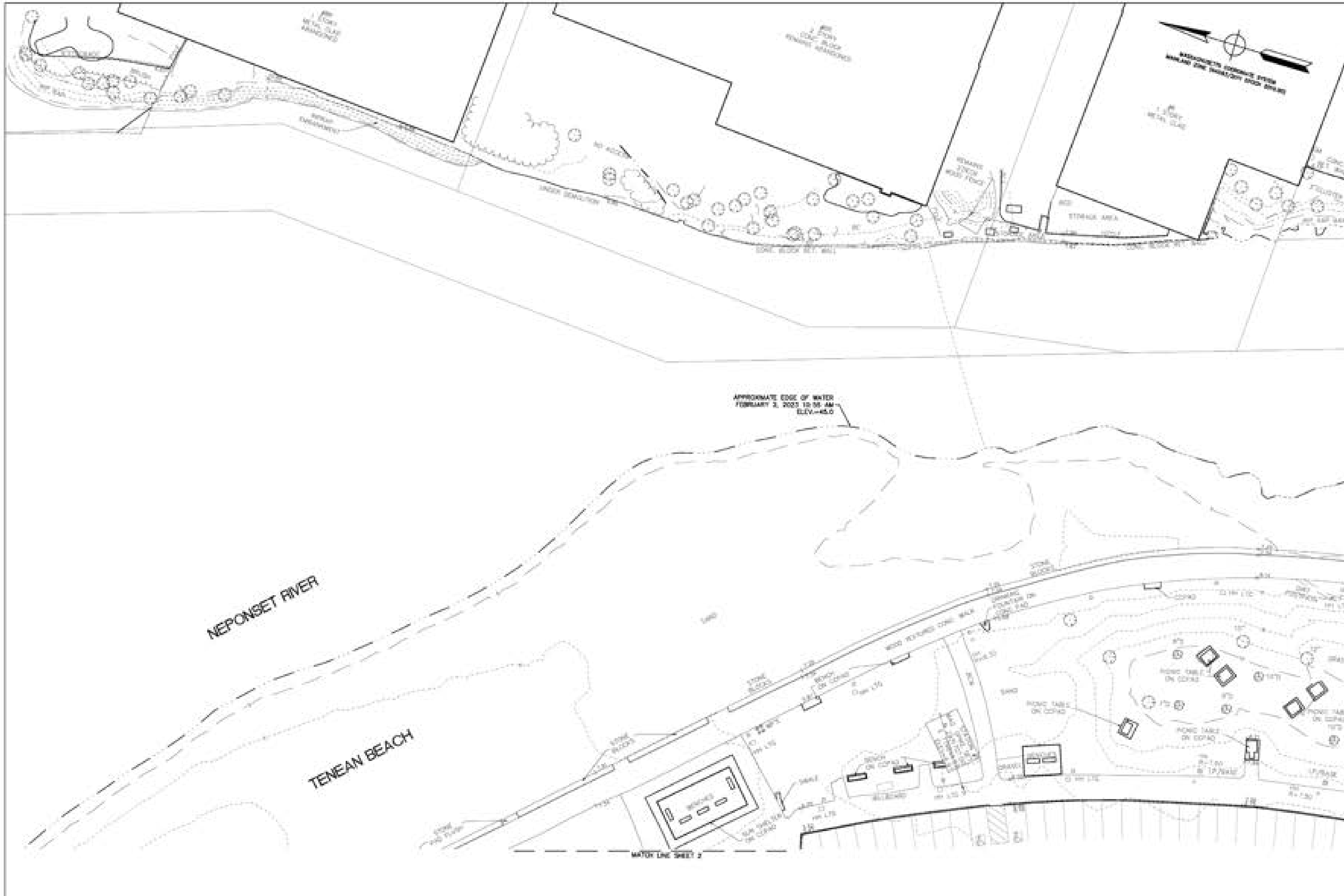
FILE NAME

DRAWN BY

CHECKED BY

SHEET NO.

6 OF 7



JARED S. JOHNSON
MASSACHUSETTS REGISTERED PROFESSIONAL
LAND SURVEYOR NO. 37170

DAWOOD

EXISTING CONDITIONS PLAN
TENEAN BEACH
DORCHESTER, MASSACHUSETTS

DATE	MAY 4, 2023
DRAWN BY	MC
CHECKED BY	RP/JJ
SHEET NO.	7 OF 7

LITERATURE SUMMARIES

NEPONSET RIVER ESTUARY AREA OF CRITICAL ENVIRONMENTAL CONCERN (ACEC) RESOURCE MANAGEMENT PLAN

STATE-APPROVED RESOURCE MANAGEMENT PLAN

ENTITY

The ACEC Program is a Department of Conservation and Recreation (DCR) program. During the designation and Resource Management Plan (RMP) process, it was a Department of Environmental Management (DEM) program. In 2003, DEM merged with the Metropolitan District Commission (MDC) to become DCR.

TIMELINE

Neponset River Estuary ACEC has a designation date of March 1995. Amended on December 1, 1995. This RMP was approved on May 15, 1996.

OVERVIEW

The Neponset River Estuary ACEC is approximately 1,300 acres in size and is located in Boston (435 acres), Milton (355 acres) and Quincy (470 acres). The ACEC boundary is based upon the Wetlands Protection Act Regulations (wetlands resource areas and a 100-foot buffer) plus adjacent public open space and historic districts. The central resource features of the Neponset River Estuary ACEC are the Neponset River and portions of its tributaries, the estuary, salt marshes, , fishery habitat, and diverse wildlife habitat. The predominant ecological and visual features of the ACEC are the Neponset River and the adjacent salt marshes.

The DCR, formerly Metropolitan District Commission) owns over 500 acres within the ACEC, providing a wide variety of public open space and recreational opportunities. Following the ACEC designation in March, 1995, Environmental Affairs Secretary Trudy Coxe directed EOEA agencies to develop a Resource Management Plan for the ACEC to guide the implementation of the ACEC designation. As part of this process, the ACEC was amended on December 1, 1995 to provide for a variety of publicly and environmentally beneficial projects. This final ACEC RMP was approved by the Secretary on May 15, 1996.

AREA OF STUDY

Neponset River Estuary ACEC – approximately 1,300 acres of land in Boston, Quincy, and Milton, Massachusetts.

SUMMARY

The stated purpose of the RMP is "*to guide the implementation of the Neponset River Estuary* ACEC *and coordinate the activities and interests of federal, state, and local agencies and the public and private sectors within the* ACEC. The RMP establishes goals and makes recommendations for managing the ACEC and its resource areas and features including to promote increased coordination and cooperation among the several municipalities, state and federal agencies, nonprofit groups, and citizens in gathering and sharing information, considering future land and water use, reviewing proposed development, and in designing and implementing specific solutions to problems. The RMP clearly identifies historic authorizations for dredging activities and licenses for water-dependent and nonwater-dependent structures and fill within the ACEC and provides guidance for future state agency review of these activities and uses within the ACEC. It

notes that improvement dredging is prohibited except for the sole purpose of fisheries and wildlife enhancement. However, improvement dredging should be limited to specific areas where public projects are undertaken to promote public health, public recreation and environmental quality improvements. Furthermore, some exemptions have been granted from the Chapter 91 prohibitions regarding improvement dredging. It also includes an implementation strategy for proposed projects and initiatives with associated timelines and associated stewardship necessary to maintain the ACEC and revise the RMP going forward. The RMP includes contributions from numerous public and private entities and underwent rigorous public process and community input prior to being approved by the state in 1996.

TOPICS ADDRESSED

Parks and open space, natural resources, coastal structures, dredging, floodplains, stormwater management, etc.

DORCHESTER RELEVANCY

No historic authorizations for dredge activities or record licenses for structures or fill are included in the RMP for the Project study area. Per the RMP, no new or improvement dredging shall be authorized within the ACEC. However, improvement dredging associated with the stormwater outfalls at Tenean and Lawley Streets and Pine Neck Creek, and sediment removal and re-sanding at Tenean Beach have been granted exemptions from the Chapter 91 prohibitions regarding improvement dredging per the RMP.[1]

The RMP also provides only limited exemption for the licensing of new structures or fill below the high tide line in the ACEC as follows:

1) *Shoreline stabilization or rehabilitation of an existing shore protection structure*;
2) *Installation or drainage, ventilation, or utility structures, or placement of minor or incidental fill necessary to accommodate any modification to existing public roadways or railroad track and/or rail bed; or*
3) *Improvement or rehabilitation of existing public roadways or railroad track and/or rail bed, provided that any net encroachment with respect to public roadways is limited to widening by less than a single lane, adding shoulders, and upgrading substandard intersections.*

Per the Chapter 91 Waterways Regulations, the Massachusetts Department of Environmental Protection (MassDEP) may authorize projects that meet the categorical restrictions within an ACEC at 310 CMR 9.32(1)(e):

- *fill or structures for any use on previously filled tidelands*;
- *structures to accommodate public pedestrian access on flowed tidelands, provided that it is not feasible to locate such structures above the high-water mark or within the footprint of existing pile-supported structures or pile fields*;
- *fill or structures to accommodate an Ecological Restoration Project, subject to approval under* 314 CMR 9.00: 401 *Water Quality Certification for Discharge of Dredged or Fill Material, Dredging, and Dredged Material Disposal in Waters of the United States Within the Commonwealth*, 310 CMR 10.00: *Wetlands Protection, and* 310 CMR 40.000: *Massachusetts Contingency Plan if applicable, provided that any fill or dredged material used in an Ecological Restoration Project may not contain a chemical above the RCS-1 concentration, as defined in* 310 CMR 40.000: *Massachusetts Contingency Plan*;
- *publicly owned structures for other water-dependent uses below the high water mark, provided that such structures are designed to minimize encroachment in the water*;
- *and other privately-owned structures for other water-dependent uses.*

Additionally, consideration should be given to general tenets of the RMP, which include, but are not limited to, improving water quality, enhancing public access, restoring salt marshes, and improving of areas of potential habitat in any proposed Project design.

Should proposed uses, activities, and/or other alterations to address growing coastal flood risk due to climate change conflict with state approved RMP, an amendment of the RMP supported by state agencies, local municipalities, and other key stakeholders may be necessary. Per the RMP, the original intention of the RMP process was create a *dynamic plan* that would be revised every 3-5 years under the guidance of the Neponset River Estuary ACEC Stewardship Council and that the plan be *adjusted as new issues arise*.

---

[1] It should be noted that the version of the RMP posted on the ACEC Programs site is an incomplete version as page and 69 is not included in the published electronic document. An unofficial copy of the RMP including the missing Page 69 was generously provided by the Neponset River Watershed Association.

CLIMATE CHANGE IMPACTS AND PROJECTIONS FOR THE GREATER BOSTON AREA: FINDINGS OF THE GREATER BOSTON RESEARCH ADVISORY GROUP REPORT

REPORT

CLIENT

The Barr Foundation provided the funding.

TIMELINE

The report was published in 2022.

OVERVIEW

The report "summarizes the most recent (as of late 2021) scientific understanding of climate risk factors pertinent to Greater Boston."

AREA OF STUDY

Relative sea level rise projections are provided for the Boston tide gauge (NOAA Station 8443970).

CONSULTANT TEAM

The study was led by Ellen Douglas and Paul Kirshen of UMass Boston, with support from a large and diverse academic and technical team, as well as a steering committee of public, non-governmental, and private organizations.

SUMMARY

The most relevant component of the Greater Boston Research Advisory Group (GBRAG) report is its updated relative sea level rise projections for Boston. By examining these projections, the City can ascertain the degree to which projections in the original Climate Ready Boston vulnerability assessment and the Massachusetts Coast Flood Risk Model (MC-FRM) are reflective of conservative (extremely unlikely to be exceeded) scenarios based on the most recent and best available science for the region.

The GBRAG report provides updated probabilistic projections for the Boston tide gauge based on the best available science, summarized in Table 4.1 from the report, shown below. Note that the values are in cm. The second row of the table indicates the probability that the values in cells below will be exceeded in each time horizon (0.99 is 99% probability. The inverse of these probabilities would be the degree to which the values below are unlikely to be exceeded (0.17 is 83% or very unlikely to be exceeded, 0.05 is 95% or extremely unlikely to be exceeded).

Table 4.1

Relative sea level probabilities for Boston Harbor relative to a 2000 baseline for three RCP greenhouse gas emissions scenarios.

				Likely range					
		0.99	0.95	0.83	0.5	0.17	0.05	0.01	0.001
RCP8.5	2020	1	5	8	13	17	21	25	31
	2030	4	9	14	20	27	33	40	54
	2050	12	19	27	39	52	65	83	127
	2070	19	31	44	63	85	109	145	239
	2100	28	49	72	105	146	192	273	476
	2200	118	148	184	257	378	550	904	1,690
RCP4.5	2020	3	6	8	12	15	18	21	25
	2030	6	10	14	19	24	28	33	43
	2050	9	16	23	34	44	54	66	95
	2070	13	23	34	50	68	84	105	161
	2100	16	31	48	73	100	129	173	290
	2200	23	54	89	147	230	335	543	1,050
RCP2.6	2020	3	6	9	13	16	19	22	27
	2030	4	8	13	19	25	30	35	44
	2050	4	12	20	32	43	53	64	85
	2070	6	16	27	43	59	73	90	130
	2100	6	20	35	56	78	101	133	214
	2200	41	54	69	97	143	208	341	680

Values are in cm and columns show percentiles. 0.5 represents the 50th percentile (median) estimate, while 0.83 to 0.17 represent the 17th to 83rd percentile "likely range" of possible outcomes. There is a 66% likelihood that sea level will fall within the likely range (light blue columns), while there is a 5% chance that sea level will exceed the 0.05 (95th percentile) value.

The Climate Ready Boston (CBR) vulnerability assessment report centers the City's coastal resilience planning around relative sea level rise projections of about 1.0 ft[1] by 2030, 2.0 ft[2] by 2050, and 3.6 ft[3] by 2070, relative to a 2000 baseline, based on a high emissions scenario (RCP 8.5). These projections were extremely unlikely to be exceeded in 2030 (99% probability) and 2050 (95-99% probability) and unlikely to extremely unlikely to be exceeded in 2070 (83-95%) based on the Boston Research Advisory Group (BRAG) Climate Projections Consensus report (2016) (see Table 1-1 from BRAG 2016 below).

[1] The report indicates about 3 inches of RSLR occurred between 2000 and 2015, and 9 inches are projected between 2016 and 2030.
[2] The report indicates about 3 inches of RSLR occurred between 2000 and 2015, and 21 inches are projected between 2016 and 2030.
[3] The report indicates about 3 inches of RSLR occurred between 2000 and 2015, and originally indicated that 36 inches are projected between 2016 and 2030, though the City later revised its communications to reflect 40 inches. This revision was to align the City's projections more closely with the Boston Harbor Flood Risk Model projections.

Table 1-1. *RSL projections for Boston, MA (in ft, relative to 2000) categorized by exceedance probabilities.*

			Likely range					Maximum
	0.99	0.95	0.833	0.5	0.167	0.05	0.01	0.001
RCP8.5								
2030	-0.1	0.1	0.3	0.5	0.7	0.9	1.0	1.2
2050	0.1	0.4	0.7	1.1	1.5	1.8	2.1	2.4
2070	0.6	1.0	1.5	2.2	3.1	3.7	4.3	4.8
2100	1.6	2.4	3.2	4.9	7.4	8.6	9.5	10.5
2200	18.9	19.9	21.4	26.1	32.8	34.1	35.3	36.9
RCP4.5								
2030	-0.1	0.1	0.3	0.5	0.7	0.9	1.0	1.2
2050	0.1	0.4	0.7	1.0	1.4	1.7	2.0	2.3
2070	0.4	0.9	1.5	1.9	2.6	3.1	3.6	4.1
2100	0.9	1.7	2.4	3.6	5.1	6.1	7.0	8.0
2200	5.5	6.2	7.2	10.9	16.5	18.0	19.3	20.9
RCP2.6								
2030	-0.1	0.1	0.3	0.5	0.7	0.9	1.0	1.2
2050	0.1	0.4	0.6	1.0	1.4	1.7	2.0	2.3
2070	0.3	0.7	1.1	1.7	2.3	2.7	3.1	3.6
2100	0.4	1.2	1.8	2.8	3.8	4.6	5.3	6.2
2200	3.6	4.4	5.2	6.4	7.7	8.8	9.9	11.8

MC-FRM uses the Commonwealth's High scenario[4] relative sea level rise projections for the Boston tide gauge (DeConto and Kopp, 2017). Relative to a 2000 baseline, these equate to approximately 1.4 ft by 2030, 2.6 ft by 2050, and 4.4 ft by 2070. These projections were estimated to be extremely unlikely to be exceeded (99.5% probability, or 0.005 relative to numbers in the second row of Table 1) under a high emissions scenario (RCP 8.5).

To determine the likelihood that CRB and MC-FRM projections are exceeded based on the updated projections for a high emissions scenario, a modified version of the GBRAG report's Table 4.1 was created and compared with prior projections (see Table 1 below). The results indicate that projections used in CRB's vulnerability assessment (red text in Table 1) are unlikely to extremely unlikely to be exceeded in 2030 and 2050 (83-95% probability) and extremely unlikely to be exceeded in 2070 (95% probability). They also indicate that the MC-FRM projections (yellow cells in Table 1) are extremely unlikely to be exceeded in 2030 (99-99.9%) and 2050 and 2070 (95-99%).

Table 1. Modified excerpt of Table 4.1 - Relative sea level probabilities for Boston Harbor relative to a 2000 baseline for three RCP greenhouse gas emissions scenarios.[5]

				Likely range					
		0.99	0.95	0.83	0.5	0.17	0.05	0.01	0.001
RCP 8.5	2030	0.1	0.3	0.5	0.7	0.9	1.1	1.3	1.8
	2050	0.4	0.6	0.9	1.3	1.7	2.1	2.7	4.2
	2070	0.6	1.0	1.4	2.1	2.8	3.6	4.8	7.8

TOPICS ADDRESSED

[4] https://eea-nescaum-dataservices-assets-prd.s3.us-east-1.amazonaws.com/resources/production/MA%20Statewide%20and%20MajorBasins%20Climate%20Projections_Guidebook%20Supplement_March2018.pdf
[5] Excerpt is limited to RCP 8.5. Modifications are limited to conversion of values from cm to ft and rounding to the tenths decimal place. The red text color indicates the range in which CRB projections fall for each time horizon. The yellow cell color indicate the range in which MC-FRM projections fall for each time horizon.

Climate science, sea level rise, projections, modeling

DORCHESTER RELEVANCY

Based on the findings, the City can confidently expect that relative sea level rise projections included in the MC-FRM are extremely unlikely to be exceeded based on the most recent climate science. There is a higher, but still low probability that CRB projections will be exceeded.

BOSTON PUBLIC WORKS DEPARTMENT CLIMATE RESILIENT DESIGN GUIDELINES & STANDARDS FOR PROTECTING THE PUBLIC RIGHT OF WAY

TYPE

CLIENT

Boston Public Works Department.

TIMELINE

October 17, 2018

OVERVIEW

With the growing number of conceptual solutions to climate resilience and urgency for action, the City has proactively identified that a framework for designing and evaluating climate resilient projects was needed to protect the public right-of-way (ROW).

The City is drafting a new policy to protect the public ROW from acute and chronic flooding due to SLR and storm surge. The Boston Public Works Department (BPWD) has prepared the Climate Resilient Design Standards & Guidelines for engineers and designers as guidance when designing flood barriers to protect the public ROW. The guidelines are intended to provide climate design adjustments and a standardized climate resilient design process for flood barriers. The document is meant to augment existing City and State design standards by considering climate impact and managing segmental shore-based flood protection projects over time.

Four sample barrier types and sample sites within the City were selected to provide example design considerations and real-world context for designing flood protection:

- Vegetated Berm: construct a vegetated earthen berm to serve as a flood barrier, with the goals of creating open space and additional value along Boston's waterfront
- Harborwalk (Seawall barrier: Transform the existing Boston Harborwalk into a flood barrier that maintains pedestrian connectivity to the waterfront
- Raised Roadways: elevate roadways to act as a flood barrier (or as emergency access/evacuation routes)
- Deployable Flood Barriers: Deploy temporary flood barriers as short-term solutions while long-term solutions are designed, permitted and constructed.

AREA OF STUDY

Effective for the City of Boston. There are sample sites for each barrier type, but these simply serve as a limited model of guidelines for city-wide implementation.

CONSULTANT TEAM

Julie Eaton, Project manager and Lead Resiliency Engineer, Weston & Sampson

Dean Groves, Principal-in-Charge, Weston & Sampson

Frank Ricciardi, Technical Review Lead, Weston & Sampson

SUMMARY

The Guidelines and Standards are defined by climate design adjustments for *useful life*. Useful life is defined as generally having longer timeline than design life and represents the extended service life of most infrastructure and should be assessed using professional knowledge, prior useful lifetime frames, and projected future conditions. The useful life estimates will inform the selection of climate adjustments to increase infrastructure resilience.

This is framed through the 2030, 2050, and 2070 time horizons. The 2070 time horizon represents a 50-year useful life and should be the goal for flood barrier design. The 50-year useful life may not be feasible for all projects, so climate design adjustments for 2030 and 2050 time horizons are presented to help designers select an incremental approach.

2030: Through 2040

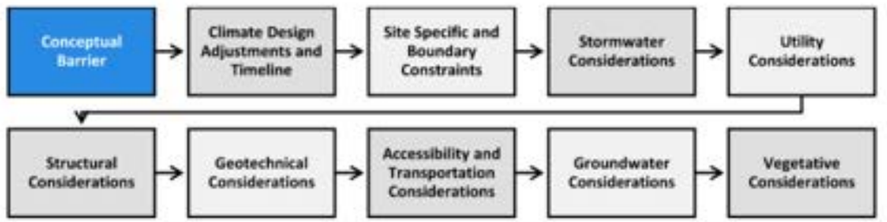
2050: 2041 to 2060

2070: 2061 to 2080

Section 2.0 articulates useful life time horizons for climate design adjustments and associated target projections for Sea Level Rise & Storm Surge, Extreme Precipitation, and Extreme Heat.

- Sea Level Rise & Storm Surge: See Table 1 in Appendix. Note that these were developed through the Boston Harbor Flood Risk Model (BH-FRM). Incremental approach: If 2070 DFE is not feasible to achieve at this point due to available funding and/or site constraints, intermediary DFE presented below should be used to prepare a plan to reach the 2070 DFE elevation incrementally. Temporary, deployable flood barriers may use intermediary DFE (2030 and 2050 time horizons) but are not considered appropriate for long-term flood defense from SLR and storm surge.
- Extreme Precipitation: See Table 2 in Appendix. Note that the Boston Water and Sewer Commission (BWSC) uses NOAA ATLAS 14 POINT PRECIPITTATION FREQUENCY ESTIMATES for design of stormwater collection and management systems. Designers are advised to use available projections and trend from Climate Ready Boston studies. Drainage planning and stormwater management for flood protections structure should assume future precipitation increases behind the barrier as well as on the flood side.
- Extreme Heat: See Table 3 in Appendix.
    - Extreme heat is a concern for protection structures due to several reasons, including but not limited to:
        - Heath and safety impacts
        - Thermal expansion
        - Material degradation from excessive heat
        - Pavement softening
        - Increased failure/reduced efficiency of electrical/mechanical systems (power outages and pumps)
    - Cold temperatures should be accounted and should include, but not limited to:
        - Health and safety impacts
        - Snow and ice ground cover
        - Plowing and snow removal
        - Snow storage on-site or off-site
        - Drainage and infiltration impacts
        - Ice jams

Section 3.0 details design, O&M (operations and maintenance), and cost considerations for the design process:



See appendix for in-depth description of design considerations.

See document for detailed O&M considerations, as well as Cost estimate considerations.

See **Section 4.0** for in-depth description of **Vegetated Barrier** and see Appendix for sample design drawing that implement the standards for protecting the public ROW.

See **Section 5.0** for in-depth description of **Harborwalk** and see Appendix for sample design drawing that implement the standards for protecting the public ROW.

See **Section 6.0** for in-depth description of **Raised Roadway Barrier** and see Appendix for sample design drawing that implement the standards for protecting the public ROW.

See **Section 7.0** for in-depth description of **Deployable Flood Barrier Guidance** and specific products of varying physical attributes and structural attributes.

TOPICS ADDRESSED

Design standards, climate resilience, sea level rise and storm surge, extreme precipitation, extreme heat, climate design adjustments, useful life

DORCHESTER RELEVANCY

These guidelines directly impact the design of the project at Tenean Beach as it articulates standards and considerations for the project flood risk reduction kit of parts:

- Vegetated Berm
- Raised Roadways
- Harborwalk
- Deployables

The guidelines offer a detailed description of considerations engineers and designers should take to develop the resilient strategies to reduce flood risk while also protecting the public ROW. It serves as a helpful tool as the project enters the Schematic Design phase and develops and evaluates the options in further detail.

Table 1. Sea Level Rise Design Adjustments – Reference the BH-FRM for site-specific BFE

End of useful life	Sea Level Rise Adjustment	1% annual flood event elevation (BFE) *BCB	Minimum DFE for non-critical assets *BCB	Minimum DFE for critical assets *BCB
Baseline	N/A	15.7	16.7	17.7
2030	+9 inches	17	18	19
2050	+21 inches	18	19	20
2070	+40 inches	19.5	20.5	21.5

Notes:
2030: Through 2040
2050: 2041 to 2060
2070: 2061 to 2080
1% annual flood event is also known as the 100-year flood event.
Boston City Base (BCB) Datum can be converted to NAVD88 by: NAVD88 = BCB – 6.46 ft.

Table 2. Extreme Precipitation Design Adjustments

Peak Hourly Intensity Rainfall (inch/hour)			
End of useful life	**10% annual design storm (in/hr) (BWSC 2015 (A1FI))**	**2% annual design storm (in/hr)**	**1% annual design storm (in/hr)**
Baseline (NOAA 14)	1.66	2.33	2.62
2035	1.78	*Data not available*	*Data not available*
2060	1.91	*Data not available*	*Data not available*
2100	2.11	*Data not available*	*Data not available*
Total Storm Depth (inches/24 hour)			
End of useful life	**10% annual design storm (in) (BWSC 2015 (A1FI))**	**2% annual design storm (in)**	**1% annual design storm (in) (City of Cambridge 2015)**
Baseline (NOAA 14)	5.25	7.18	8.08
2035	5.60	*Data not available*	10.2
2060	6.03	*Data not available*	*Data not available*
2100	6.65	*Data not available*	11.7

Notes:
10% annual design storm is also known as the 10-year flood event.
2% annual design storm is also known as the 50-year flood event.
1% annual design storm is also known as the 100-year flood event.

Table 3: Extreme Heat Design Adjustments

Extreme Heat Events		
End of useful life	**# days above 90°F (Rossi et all, 2015)**	**Average Summer Temperature (°F) (Houser et al, 2015)**
Baseline	11	69
2030	20-40	69-73
2070	25-90	Up to 84 by 2100

Notes:
Baseline: 1971 through 2000
2030: Through 2040
2070: 2061 to 2080

DESIGN CONSIDERATIONS

Refer to **Appendix B – General Design Considerations** for detailed general design considerations and guidance

Climate Design Adjustments and Timeline	► Refer to Section 2.0 for climate design adjustment for useful life. Evaluate a risk-based approach for identifying design parameters based on exposure, sensitivity, adaptive capacity, and consequence of flooding. ► Sea Level Rise & Storm Surge Climate Adjustments. ▲ Evaluate if the site is within the Boston Planning and Development Agency "SLR-BFE" zone via the zoning viewer. ▲ Identify if the site is within a major flood pathway that will impact the right-of-way. ▲ Identify if the site should be designed for the 1%, 0.2%, or 0.1% annual flood event. ▲ Boston Harbor Flood Risk Model (BH-FRM) Design Details: Probability of flooding, flood depth, duration of flood, flood pathways, wave impacts, wind velocity. ► Extreme Precipitation. ▲ Select design storm events for analysis (10%, 4%, 2%, or 1% annual storm). ▲ Estimate the drainage area contained by new barrier. ► Extreme Temperature. ▲ Evaluate heatwave, annual maximum temperature, and winter storm impacts. ► Incremental Climate Adjustments. ▲ If 50-year useful life climate design adjustment is not feasible, identify approach to reach climate design adjustment over time.
Boundary Constraints and Site Considerations	► Identify the extent of the barrier (current and future, if proposed incremental approach). ► Identify related zoning regulations and requirements. ► Evaluate available open space. ▲ What is needed for construction, operations, and maintenance? ▲ What are the downstream encroachment considerations? ► Identify opportunities to maintain the public right-of-way and access to waterfront. Livability, walkability, connectivity, and social and neighborhood context are essential. ► Coordinate with private properties and abutters. ▲ Existing or new easements must be established. ► Consider existing operational capacity to maintain barrier. ▲ What is the ease of access to site for maintenance vehicles and equipment? ► Conduct a Phase I Environmental Site Assessment to assess if the potential exists for Recognized Environmental Conditions including soil and/or groundwater impacts. ► Identify off-site impacts resulting from barrier – both sites adjacent to barrier and inland. ▲ Will neighboring sites have stormwater redirected or stored on them? ► Consider Climate Ready Boston Evaluation Criteria (social impact, equity, value creation). ► Estimate incremental impacts to boundary and site constraints.
Stormwater Considerations	► Identify Green Infrastructure (GI) opportunities and challenges. ▲ Consider Low Impact Design (LID), Extreme temperatures (drought, frozen ground). Refer to vegetative considerations. ► Assess volume capture and control. ▲ What are opportunities to resist, delay, store, and/or discharge stormwater?

Stormwater Considerations (continued)	► Identify possible off-site flooding impacts. ► Consider water quality. ▲ Polluted stormwater runoff is commonly transported through municipal separate storm sewer systems (MS4 pollutants). ► Evaluate watershed approach for stormwater management. ▲ Assess inland opportunities to delay, divert, store in off-site areas. ► Consider incremental and adaptive management approach, and possible current or future land use changes. ► Establish inspection, debris and sediment removal, and maintenance processes essential to system performance.
Utility Considerations	► Coordinate with local utility providers to identify gas, electric, communications, and other utilities that may be located within the project area. Consider engaging a professional subsurface utility engineering firm to identify utilities. ► Eliminate perpendicular barrier crossing of utilities. If elimination is not feasible, consider placing the conduit within a watertight sleeve to protect the barrier and the utility from movement. ► Estimate additional loads on existing utilities resulting from raised grades and higher groundwater levels. ► Identify existing connections to surrounding infrastructure and buildings. ► Water utilities considerations. ▲ What are impacts to fire hydrants and emergency access? ► Sewer utilities considerations. ▲ Look for opportunities to implement backflow valves and seal manholes. ► Combined Sewer Overflow (CSO) and Outfalls considerations. ▲ Off-site flooding may back up CSOs behind barrier. Study the extent of the stormwater system to the critical nodes and identify preliminary vulnerability of these locations. ▲ Implement tide gates and establish operations and maintenance protocols. ► Stormwater utilities considerations. ▲ Future pump stations may need to be constructed in the vicinity to manage stormwater behind barrier. ▲ Design for pump redundancy, over-design of wet-well capacity (future flow volumes), pump approaches, trash accumulation and removal, on-site generators and power supply (emergency systems also). ► Consider relocation of infrastructure to maintain access to utilities.
Structural Considerations	► Estimate anticipated loads. ▲ American Society of Civil Engineers (ASCE) guidance provided in ASCE 7-16, earth pressures with raised grades, live loads, etc. with climate adjustments. ► Assess condition of nearby existing structures. ▲ Perform field inspection and data review. ► Wall considerations. ▲ Floodwalls should be designed in accordance with United States Army Corps of Engineers (USACOE) guidance provided in EM-1110-2-2502, Retaining and Flood Walls. ► Material considerations.

Structural Considerations (continued)	▲ Consider impact of increased extreme temperatures and sensitive materials. ► Connection considerations. ▲ Analyze shear, tensile, breakout, pullout, blowout, splitting, etc. ► Durability considerations. ▲ Prioritize "Safe-to-Fail" design. ▲ Identify repair considerations. ► Identify possible failure mechanisms and the likelihood of progressive failure. ► Constructability considerations. ► Incremental considerations may include lengthening barrier vertically and/or laterally. Design for final loading conditions. ► Establish annual inspections and maintenance protocols.
Geotechnical Considerations	► Conduct subsurface explorations to evaluate overall subsurface conditions, seepage conditions, bearing capacity, and potential for settlement. ► Identify impact to existing structures. ▲ Raised grades may result in a surcharge on the underlying utilities or adjacent structures located within the "zone-of-influence" of the barrier. ► Perform stability analysis. ▲ Earthen flood barriers should be designed in accordance with USACOE guidance provided in EM 1110-2-1913, Design and Construction of Levees. ▲ Slopes of 3H:1V (Horizontal:Vertical) are recommended for stability and ease of maintenance. ► Perform settlement analysis. ► Assess seepage. ▲ Prevent sediment transport. ▲ Cutoff walls or trenches; if used, consider area groundwater hydrology and its effects on area foundations. ► Erosion and scour protection considerations. ▲ Place riprap in areas with high erosional forces. ▲ Materials and vegetation must be able to withstand wave action and saltwater. ► Foundation considerations. ▲ Overdesign foundation to support future loads. (i.e. if grades or walls are planned to be raised over time). ▲ Incorporate foundations for future floodwalls as needed into the embankment. ► Establish annual monitoring and maintenance program for embankment structures.
Transportation & Accessibility Considerations	► Maintain ADA accessibility and connection to inland area (existing buildings, sidewalks, roadways) and waterfront. ► It is unacceptable to raise a roadway four to six feet and leave existing sidewalks and entries at grade if there is less than 14 feet between the back of the existing sidewalk and a building; clearance greater than 14 feet may be required for public health and safety. ► Accessible routes shall not exceed 5% slope. Changes in slope for connections to side streets, driveways, and parking lots shall not exceed 15%, so vehicles do not bottom out. ► The minimum width of access paths shall be 12 feet so that a maintenance vehicle can bypass a wheelchair without impeding movement. ► Bridges and underpasses within 500 feet of a barrier should be analyzed for clearance.

Transportation & Accessibility Considerations (continued)	► Raising roadways will impact the public and stakeholders beyond the immediate streetscape. Coordinate with property owners and stakeholders, including but not limited to the City, MassDOT, Massachusetts Bay Transportation Authority (MBTA), community organizations, and private property owners. ► Construction materials should consider increases in heat as well as freezing temperatures. ► Evaluate parking needs. ► Create maintenance accessibility (vehicle or tracked equipment). ► Develop snow, ice, and stormwater management tasks that are critical for proper maintenance. ► Incremental considerations include access to surrounding infrastructure and redevelopment of roadways and property over time. ► Streetscapes should consider emergency vehicle access (police, fire, EMS), and meet City Standards for Boston Complete Streets and the BPWD Roadway Design Standards.
Groundwater Considerations	► Higher tides may increase groundwater levels and may result in reduced stormwater infiltration and affect stormwater drainage systems. ► Barriers must be designed to prevent excessive hydraulic gradients, internal erosion and loss of material (piping), and sand boils caused by underseepage. ► Uplift pressure may impact underground structures. ► Freshwater-Saltwater interface may impact: ▲ Coastal ecosystems ▲ Water treatment ▲ Corrosion of buried structures ► Higher groundwater may increase the risk of contaminant transport. ► Groundwater intrusion risks in below grade structures, including steam infrastructure.
Vegetative Considerations	► Current USACOE setbacks and easements do not allow for trees to be within 15 feet of dams or levees. ► Identify native or naturalized salt tolerant vegetation and non-invasive plant materials appropriate to the surrounding microclimate and ecosystem and complement passive recreational activities. ► Evaluate aesthetic considerations to create value. ► Promote open space opportunities. ► Select plants with erosion control qualities for embankments and steep slopes. Woody vegetation and brush can also prevent observation of deficiencies forming that increase the risk of failure. ► Consider plants that are "low maintenance" such as grasses and groundcovers that may also provide habitat that are tolerant of urban pollutants (emissions, oils, etc.). ► Consider plant heights as they relate to view-sheds and corridors towards the water and also the inland side.

Trees are not permitted on flood barriers because of their root systems. If trees are uprooted during a storm event, the barrier may result in a breach. Tree root systems also pose a risk as a flood pathway; roots rot over time and can provide pathways for animals to burrow. If trees are desired, a root barrier system may be designed for the inland side of the barrier (waterfront side is a higher risk of breaching the structure). A structural wall may be designed in the embankment to reduce the impact of a breach. The wall should consider groundwater, geotechnical, and structural considerations.

CLIMATE RESILIENT DESIGN STANDARDS AND GUIDELINES FOR PROTECTION OF PUBLIC RIGHTS-OF-WAY

B.1 VEGETATED BERM BARRIER

Refer to Climate Resilient Design Standards and Guidelines for notes and guidance.

DOWNLOADABLE FILES:

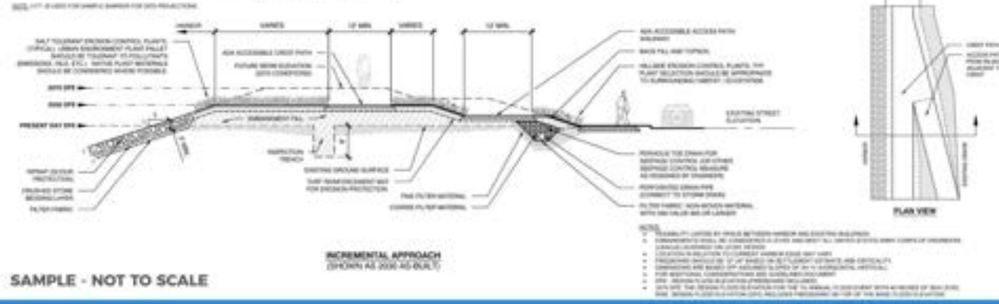
Standard PWD Details for reference and download can be found here

B.1. SAMPLE VEGETATED BERM BARRIER

CAD

PDF

SAMPLE



INCREMENTAL APPROACH (SHOWN AS 2030 AS-BUILT)

SAMPLE - NOT TO SCALE

1 CITY HALL SQUARE
ROOM 714
BOSTON, MA 02201-2024

PUBLIC WORKS DEPARTMENT
(T): 617 635 4900
(E): publicworks@boston.gov

CLIMATE RESILIENT DESIGN STANDARDS AND GUIDELINES FOR PROTECTION OF PUBLIC RIGHTS-OF-WAY

B.2 HARBORWALK AS FLOOD BARRIER (RAISED SEAWALL)

Refer to Climate Resilient Design Standards and Guidelines for notes and guidance.

DOWNLOADABLE FILES:

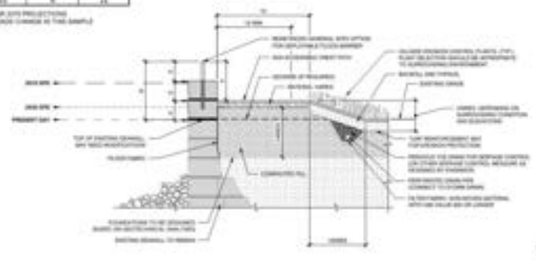
Standard PWD Details for reference and download can be found here

B.2 SAMPLE HARBORWALK AS FLOOD BARRIER (RAISED SEAWALL)

CAD

PDF

SAMPLE



SAMPLE - NOT TO SCALE

1 CITY HALL SQUARE
ROOM 714
BOSTON, MA 02201-2024

PUBLIC WORKS DEPARTMENT
(T): 617 635 4900
(E): publicworks@boston.gov

CLIMATE RESILIENT DESIGN STANDARDS AND GUIDELINES FOR PROTECTION OF PUBLIC RIGHTS-OF-WAY

B.3 RAISED ROADWAY - OPTION 1 NO BUILT PROPERTY WITHIN AT LEAST 14 FEET OF EXISTING RIGHT OF WAY

Refer to Climate Resilient Design Standards and Guidelines for notes and guidance.

DOWNLOADABLE FILES:

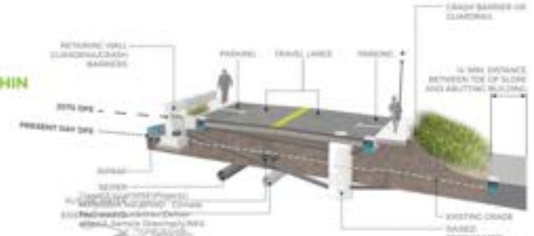
Standard PWD Details for reference and download can be found here

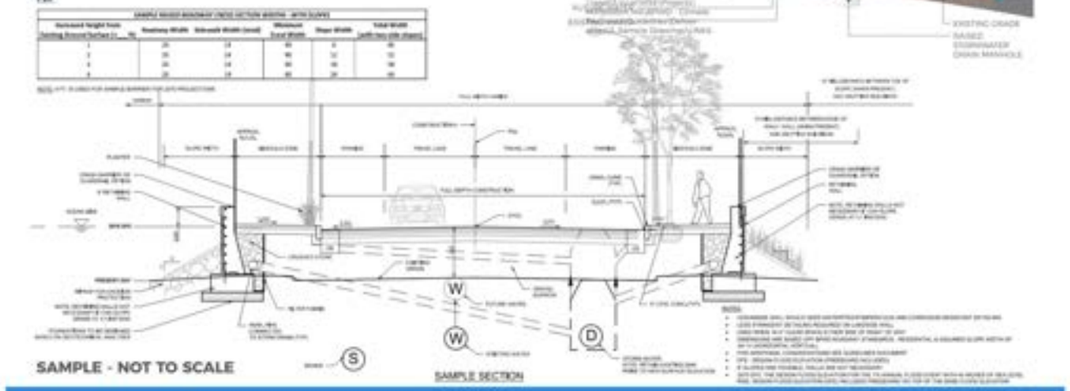
B.3 SAMPLE RAISED ROADWAY - OPTION 1

CAD

PDF

SAMPLE





SAMPLE - NOT TO SCALE

1 CITY HALL SQUARE
ROOM 714
BOSTON, MA 02201-2024

PUBLIC WORKS DEPARTMENT
(T): 617 635 4900
(E): publicworks@boston.gov

CLIMATE RESILIENT DESIGN STANDARDS AND GUIDELINES FOR PROTECTION OF PUBLIC RIGHTS-OF-WAY

B.4 RAISED ROADWAY - OPTION 2 RAISED ROADWAY & SIDEWALKS WITH NEW DEVELOPMENT

Refer to Climate Resilient Design Standards and Guidelines for notes and guidance.

DOWNLOADABLE FILES:

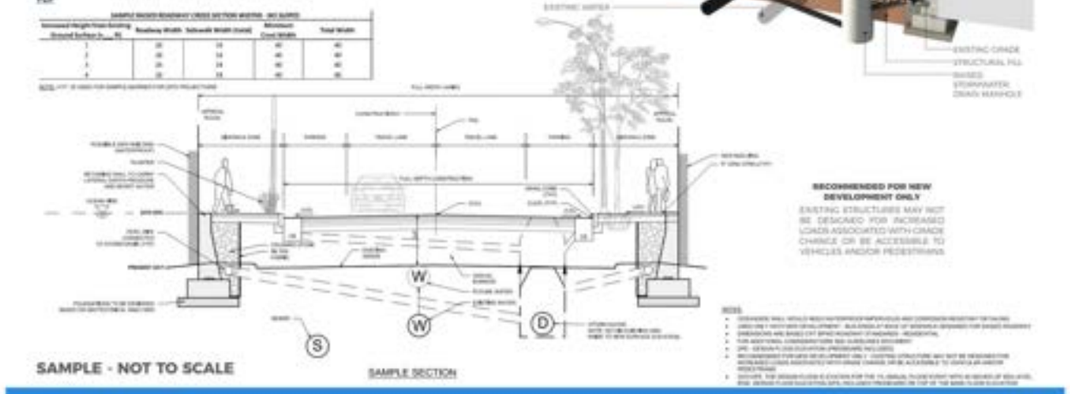
Standard PWD Details for reference and download can be found here

B.4 SAMPLE RAISED ROADWAY - OPTION 2

CAD

PDF

SAMPLE



RECOMMENDED FOR NEW DEVELOPMENT ONLY

EXISTING STRUCTURES MAY NOT BE DESIGNED FOR INCREASED LOADS ASSOCIATED WITH GRADE CHANGE OR BE ACCESSIBLE TO VEHICLES AND/OR PEDESTRIANS

SAMPLE - NOT TO SCALE

1 CITY HALL SQUARE
ROOM 714
BOSTON, MA 02201-2024

PUBLIC WORKS DEPARTMENT
(T): 617 635 4900
(E): publicworks@boston.gov

310 CMR 10.00 MASSACHUSETTS WETLANDS PROTECTION ACT (WPA)

STATE ENVIRONMENTAL REGULATIONS

ENTITY

The Massachusetts Department of Environmental Protection (MassDEP)

TIMELINE

Current WPA regulations became effective as of October 23, 2014.

OVERVIEW

310 CMR 10.00, the Massachusetts Wetlands Protection Act (WPA) regulations for all inland and coastal wetlands, is promulgated by the Commissioner of the Massachusetts Department of Environmental Protection pursuant to the authority granted under The Wetlands Protection Act, M.G.L. c. 131, § 40. The WPA protects wetlands and the public interests they serve, including flood control, prevention of pollution and storm damage, and protection of public and private water supplies, groundwater supply, fisheries, land containing shellfish, and wildlife habitat. The law protects not only wetlands, but other resource areas, such as land subject to flooding (100-year floodplains), the riverfront area (added by the Rivers Protection Act), and land under water bodies, waterways, salt ponds, fish runs, and the ocean.

AREA OF STUDY

Water-related lands such as inland and coastal wetlands, floodplains, riverfront areas, etc. in the Commonwealth of MA.

SUMMARY

The WPA regulations describe how each type of resource area provides one or more of the public interests and address the type and extent of work allowed in resource areas. Proposed work must meet these WPA performance standards for each impacted resource area. The law regulates many types of work in resource areas, including vegetation removal, regrading, and construction of structures, and work within 100 feet of a wetland resource area (the buffer zone).

Proposed work that will alter any coastal or inland resource area requires the filing of a Notice of Intent (NOI) and associated application fee to the local conservation commission and to MassDEP. The NOI requires a plan describing the details of the proposed project, location of wetland resource areas and buffer zones, and measures to be taken to protect these regulated resource areas. Following a public hearing, the local conservation commission will issue an Order of Conditions that either approve the project -- with special conditions that will protect the public interests -- or denies the project if impacts to resource areas cannot be avoided or mitigated. The applicant, landowner, any aggrieved person, abutter, group of 10 citizens, or MassDEP may appeal the local commission's decision to MassDEP.

TOPICS ADDRESSED

Wetlands, floodplains, riverfront areas, natural resources, coastal resilience, and stormwater management.

DORCHESTER RELEVANCY

The Project study area includes multiple wetlands resource areas that are regulated under the WPA, including, but not limited to, Land under the Ocean, Land Containing Shellfish, Coastal Beaches, Coastal Banks, Rocky Intertidal Shores, Salt Marshes, Land Subject to Coastal Storm Flowage, and Riverfront Area. All resource areas should be delineated clearly on project plans and all project design concepts should be reviewed to understand the area and nature of

proposed impacts to resources areas.

BOSTON HEAT RESILIENCE PLAN

STUDY & CITY-WIDE PLAN

CLIENT

City of Boston Department of the Environment

TIMELINE

April 2021 to March 2022. Published: April 2022

OVERVIEW

Heat Resilience Solutions for Boston presents a roadmap for navigating extreme heat. By building on the legacy of previous resilience plans, including 2016's Climate Ready Boston report, it prepares the City to tackle the heat impacts of climate change. The study centers people and recognizes the challenges extreme heat poses to residents' quality of life.

AREA OF STUDY

Citywide strategies; focus on the environmental justice neighborhoods of Chinatown, Dorchester, East Boston, Mattapan, and Roxbury.

CONSULTANT TEAM

Sasaki, Klimaat, All Aces, WSP

SUMMARY

Heat Resilience Solutions for Boston (the Heat Plan) presents the City's action plan to prepare for the near-term and long-term impacts of extreme heat in a changing climate. As a product of the Climate Ready Boston initiative, the City's ongoing program to prepare Boston for the effects of climate change, this plan provides an in-depth analysis of extreme summer temperatures during a recent heat wave and an all-of-government framework for strategies to reduce the risks of extreme heat. The plan helps accelerate Boston's progress toward increased climate resilience, charting our course for protecting residents from the effects of extreme heat.

To build resilience to heat, Boston must address three factors of heat risk: exposure to extreme heat, the adaptive capacity to access cooling, and the sensitivity to changes in temperature due to underlying factors like health or age that may influence vulnerability to heat. This report presents a comprehensive framework of strategies to address these core factors of heat risk–and to prepare Boston for extreme heat, both today and under future climate conditions.

TOPICS ADDRESSED

Keywords for topics addressed by the document (examples include: coastal resilience, stormwater management, parks and open space, education, community strengthening, etc.)

1. **Heat Vulnerability and health:** Extreme heat disproportionally affects some people and communities more than others. There are three main factors that affect heat vulnerability:
    A. Exposure: People with elevated heat exposure include those with jobs, living situations, or hobbies in outdoor or indoor environments without adequate shade to block direct sunlight or ventilation to circulate cool air flow.
    B. Sensitivity: People with elevated heat sensitivity include those with chronic health conditions (especially respiratory conditions), children, and older adults.

C. Adaptive capacity: A person's ability to adapt to extreme heat by taking measures to cool themselves also affects their heat vulnerability. The ability to access cooling resources is a critical factor of adaptive capacity.

2. **Boston's Risk from Extreme Heat**

   A. Extreme heat affects all of Boston today.
   B. Extreme heat impacts cause significant health risks.
   C. Extreme heat is already a daily stressor for many Bostonians during hot weather.
   D. Green infrastructure to reduce stormwater flooding could also reduce temperatures.

3. **Heat Experience Factors**

   A. **Personal Health and Cooling Access:** Chronic health conditions and age can increase vulnerability to heat risk.
   B. **Physical Environment (Built and Natural):** Trees and parks help cool off neighborhoods, while denser neighborhoods and large amounts of pavement make them heat up more and stay hot longer.
   C. **Air Flow:** The dynamic nature of air shapes how individuals and neighborhoods experience heat.
   D. **History And Structural Inequity:** Environmental injustices and systemic racism are drivers of differences in heat experiences for both places and people. A history of discriminatory planning actions, such as redlining, has lasting effects on health and heat vulnerability today.

4. **Infrastructure Vulnerabilities: Transportation and Energy.**

   A. **Transportation Infrastructure**. Thermal expansion causes impacts to roads and the subway/trolley system that affect the ability of residents, workers, and visitors to move around the city.
   B. **Energy Infrastructure**. Extreme heat can lead to increased peak summertime energy consumption, reduced transmission capacity, and decreased efficiency of solar panels.

5. **Extreme Heat Risk in Boston:**

   A. **Heat trends and projections:** In Massachusetts, due to climate change, temperatures have increased by 3.5°F since the beginning of the 20th century. The number of hot days and hot nights is expected to increase in both low and high carbon emissions scenarios through the end of the century.

      i. In a scenario where emissions trends continue at the current rate (RCP 8.5), climate projections estimate that the number of very hot days (over 90°F) will most likely (17th to 83rd percentile) increase from a range of 17 to 26 days by the 2030s, to 25 to 42 days by the 2050s, and 33 to 62 days by the 2070s. In an extreme case, the number of very hot days (over 90°F) could reach up to 87 days by the 2080s.

      ii. If aggressive action is taken to reduce emissions (RCP 4.5), the number of very hot days (over 90°F) by the 2070s will be about half (20 to 38 days) what we might see in the previous high emissions scenario.

   B. **City wide Analysis:** Some places experience disproportionately greater heat risk, with higher temperatures and extended heat wave conditions. Boston is very hot during the day and is also hot at night.
      i. Dark, paved, and impervious surfaces, such as asphalt roads and buildings with black roofs, contribute to the urban heat island effect. These surfaces absorb more heat than vegetated or light colored surfaces, and they release this heat back into the surrounding environment.
      ii. Areas with less trees, grass, and other vegetation tend to feel hotter when there is little shade or evapotranspiration to help reduce high air temperatures.

      iii. Tall buildings and dense development also impact heat within a city. Building form and orientation can change how ventilating wind flows through corridors, how readily radiated heat can disperse, and how much sun or shade hits the surface.

   C. **Extreme heat response:** In Boston, a heat advisory is issued if there is a heat wave—a period of three or more consecutive days above 90°F. A heat emergency is declared if there is a period of two or more consecutive days above 95°F, and the overnight temperature does not fall below 75°F.

      i. When a heat emergency is declared, public facilities like designated Boston Centers for Youth and Families (BCYF) community centers are activated to serve as cooling centers within Boston neighborhoods.

      ii. The City of Boston has also implemented short-term cooling strategies, such as the distribution of cooling appliances to older adult residents and residents with disabilities or chronic illnesses.

   D. **Heat experiences:** Bostonians shared that their highest priorities for heat resilience include increasing shade and trees, reducing dark surfaces and pavements, increasing comfort in densely developed areas, addressing the impacts of pollution on health and wellbeing, and increasing the accessibility and affordability of places to cool off.

   E. **Heat analysis relined neighborhoods:** Redlined areas are 7.5°F hotter in the day, 3.6°F hotter at night, and have 20% less parkland and 40% less tree canopy than areas designated as A: Best.

6. **Focus Neighborhoods:** The planning process and strategy development for the Heat Plan included additional detailed study of solutions within five of the hottest environmental justice neighborhoods in Boston: Chinatown, **Dorchester**, East Boston, Mattapan, and Roxbury.

7. **Citywide Heat Resilience Strategies:**

   A. **Goals:** Reduce heat vulnerability for Bostonians and recognize the challenges that heat can bring to their quality of life, including negative health outcomes and physical or mental stress.

      i. **Reduce Heat Exposure:** Reduce indoor and outdoor urban heat exposure, intensity, and duration by enhancing the capacity of the built environment to recover from daytime heat.

      ii. **Adapt to Heat:** Expand choices for staying cool during heat waves and improve awareness of actions residents can take to stay safe and cool.

      iii. **Reduce Sensitivity and Foster Healthy, Connected Communities:** Create healthier, more connected neighborhoods that help reduce underlying social determinants of health that increase heat risk.

   B. **Heat Resilience Strategies.** The Heat Plan includes a wide range of strategies for the City of Boston to take action and address the risks of extreme heat in a changing climate.

      i. **Relief during heat waves**

         1. OPERATIONS AND COMMUNICATIONS
            a. BOSTON EXTREME TEMPERATURES RESPONSE TASK FORCE
            b. PRE-HEAT WAVE RESOURCES MOBILIZATION
            c. HEAT SENSOR NETWORKS
         2. COOLING DURING HEAT WAVES
            a. POP-UP HEAT RELIEF
            b. ENHANCED AND EXPANDED CITY-RUN COOLING CENTERS
            c. CITYWIDE COOLING NETWORK

3. LOOKING OUT FOR NEIGHBORS
    a. EXPANDED COMMUNITY CLIMATE
    b. EXTREME TEMPERATURE PLANS FOR OUTDOOR WORKERS
4. AWARENESS, EDUCATION, AND TRAINING
    a. HEAT RESILIENCE PUBLIC EDUCATION CAMPAIGN
    b. HEAT SURVEY
    c. EXPANSION OF GREEN WORKFORCE DEVELOPMENT FOR HEAT RESILIENCE

ii. **COOLER COMMUNITIES**

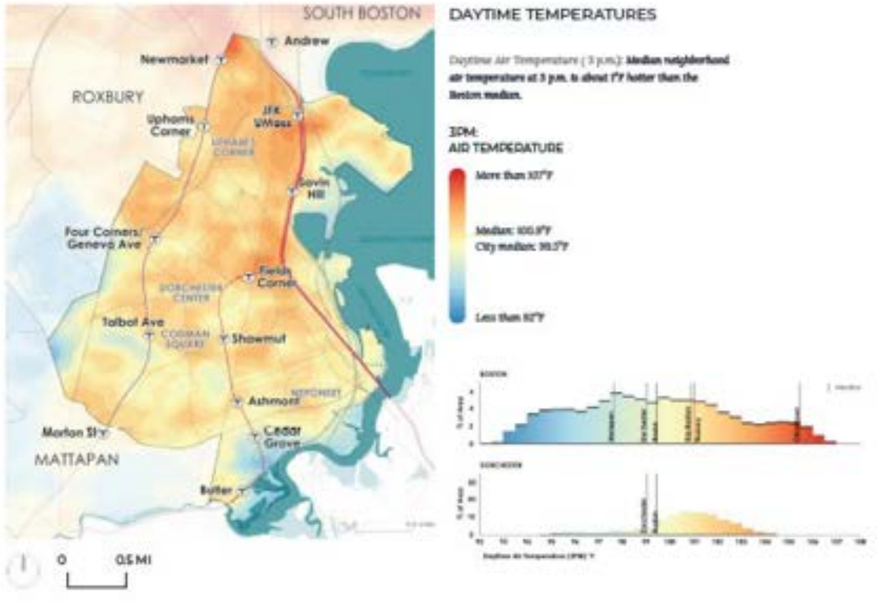
1. BUILDINGS
    a. HOME COOLING RESOURCES DISTRIBUTION
    b. COOL ROOFS PROGRAM
    c. HOME ENERGY RETROFITS
    d. AFFORDABLE HOUSING RESOURCES AND RETROFITS
    e. COOL SCHOOLS
2. PARKS, TREES, AND OUTDOOR SPACES
    a. ENHANCED COOLING IN POCKET GREEN SPACES AND STREET-TO-GREEN CONVERSIONS
    b. INCREASED SHADE ON MUNICIPAL SITES
    c. EXPANDED DRINKING FOUNTAIN NETWORK
    d. PLANNING FOR FUTURE PARKS
3. TRANSPORTATION AND INFRASTRUCTURE
    a. COOL COMMUTES
    b. ENERGY RESILIENCE UPGRADES AND MICROGRIDS
    c. COOL MAIN STREETS
4. PLANNING, ZONING, AND PERMITTING
    a. UPDATED CLIMATE RESILIENCY CHECKLIST
    b. HEAT RESILIENCE BEST PRACTICE GUIDELINES
    c. ZONING REVISIONS TO SUPPORT COOLER NEIGHBORHOODS

DORCHESTER RELEVANCY

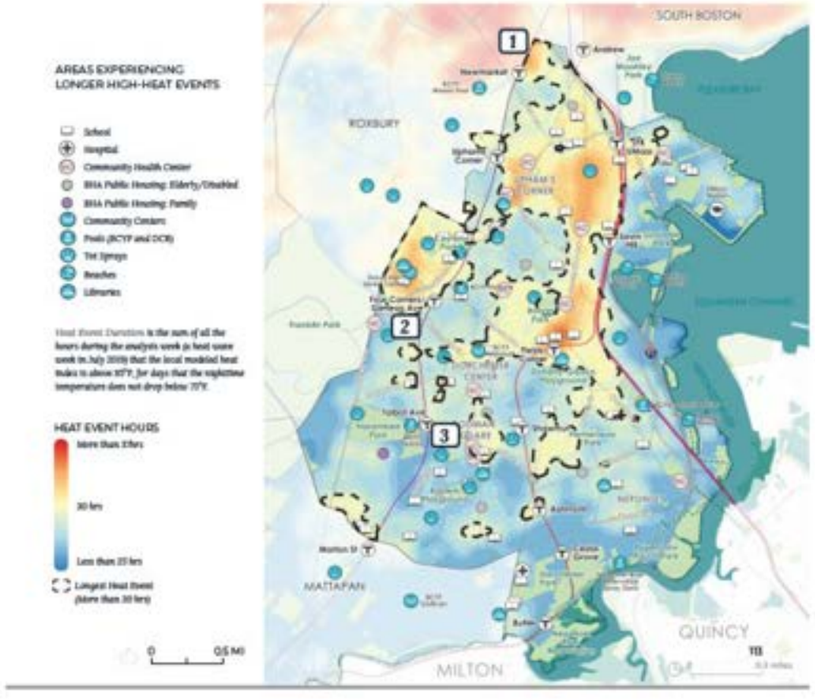
Dorchester was selected for the neighborhood-level analysis. The purpose of the neighborhood-level analysis was to evaluate how current day heat impacts vary across the city, identify temperature hot spots within environmental justice neighborhoods, and assess how racism, inequality, historic urban planning decisions, and other policies have influenced existing heat exposure and vulnerability.

1. **Dorchester's Heat Story:** As a large neighborhood, Dorchester has some areas that are hotter (Fields Corner, JFK/UMass MBTA station, and Newmarket and South Bay areas) and some areas that are cooler (around parks or adjacent to the waterfront).
    A. Contributing factors to hotter areas are unshaded pavement, parking lots, and dark roofs.

B. Areas of Dorchester experience temperatures that exceed Boston's median temperatures.
C. Dorchester's hotter microclimates are a result of several factors, including less green space, building characteristics, and impermeable surfaces.
D. Even as parks and waterfront areas are cooler, the experience along roadways and pathways accessing those areas is very hot.



2. **Dorchester Community Cooling ideas.** Dorchester residents suggested cooling strategies that expand access to cooling at home and in the neighborhood and increase cool outdoor spaces.
    A. **Cool Accessible Parks:** Additional shade elements and hydration stations in parks paired with digital wayfinding tools to help identify nearby open spaces.
    B. **Public Cooling Centers:** Opportunities to integrate public art and community engagement at Cool Spots and cooling centers.
    C. **Affordable Ways to Stay Cool at Home:** Opportunities to expand awareness about energy and utilities assistance programs to overcome challenges of staying cool at home and the cost of using air conditioning.



URBAN FOREST PLAN

PLAN

CLIENT

City of Boston

TIMELINE

September 2022

OVERVIEW

The Urban Forest Plan (UFP) is a long-term citywide strategic plan to create a sustainable and equitable urban forest in Boston. It sets a vision not only for the care, management, and expansion of the urban forest but also for how the Boston community works together to plan for its future.

Goals:

- **Goal #1: Equity First:** Focus investments and improvements in under-canopied, historically excluded and socially vulnerable areas
- **Goal #2: Proactive Care and Preservation:** Ensure trees/tree canopy are proactively cared for
- **Goal #3: Community-Led:** Ensure community priorities drive urban forest decisions and management
- **Goal #4: Prioritize and Value Trees:** Increase awareness and buy-in regarding the importance of trees in Boston, across the public and private sectors

AREA OF STUDY

City-wide

CONSULTANT TEAM

- Stoss Landscape Urbanism
- Urban Canopy Works
- Star-Luna Consulting
- American Forests
- Nitsch Engineering

SUMMARY

The Urban Forest Plan (UFP) is a long-term citywide strategic plan to create a sustainable and equitable urban forest in Boston. It sets a vision not only for the care, management, and expansion of the urban forest but also for how the Boston community works together to plan for its future.

Social equity and environmental justice are key to long-term resilience and therefore at the heart of the Urban Forest Plan. From the start, the planning process has recognized that access to the urban forest and the benefits its canopy provides are not equitably distributed, and that this lack of equity is reflective of historic and ongoing physical, political,

and social barriers. Many important voices and concerns have historically been excluded from formal decision-making processes. Specifically, communities of color, linguistically isolated communities, socio-economically disadvantaged populations, and others are too often left outside formal public input and planning processes.

Together the community and City leadership are working to eliminate these barriers and change practices that perpetuate them. Through these efforts and the recommended actions included in this plan, we can work towards long-term resilience, protect and grow our urban forest, establish management practices that support a diverse, healthy climate-adapted urban forest, and ensure these critical resources are available for the enjoyment and benefit of all of Boston's residents for years to come.

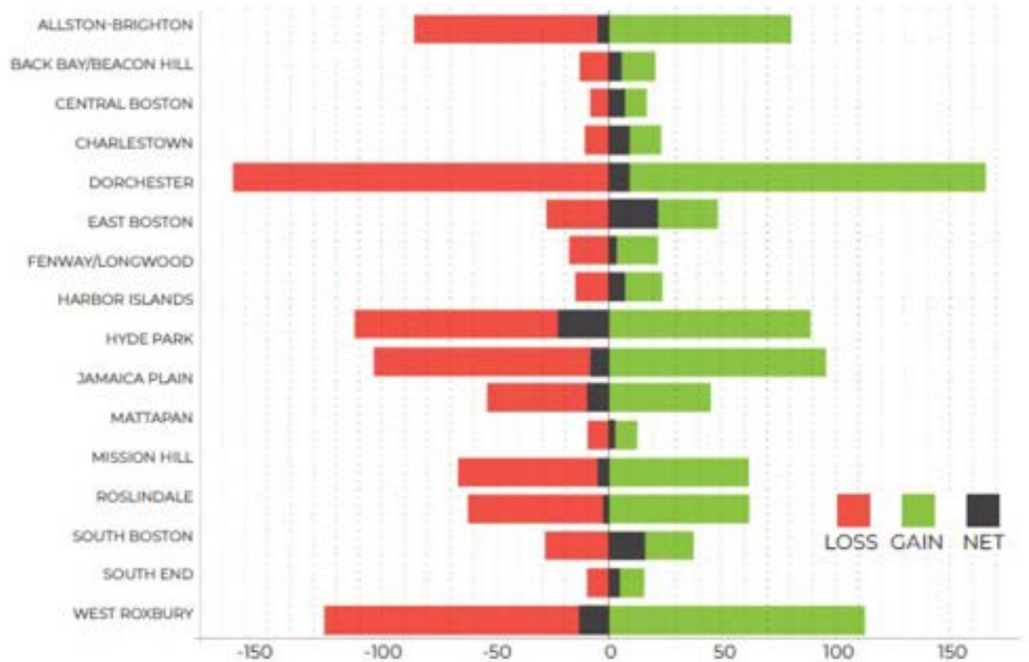
TOPICS ADDRESSED

- A Vision for Boston's Urban Forest
- State of Boston's Urban Forest Today
- Strategies and Recommendations
    - Strategy #1: Expand and Reorganize Urban Forestry Management
        - Recommendation 1.1 - Establish an urban forest leadership position within the City
        - Recommendation 1.2 - Increase and sustain operational staffing resources for Parks Department urban forest management
        - Recommendation 1.3 - Improve collaboration between the City and community partners
        - Recommendation 1.4 - Promote the formation of formal networking and advocacy bodies
    - Strategy #2: Proactively Protect and Care for Existing Trees
        - Recommendation 2.1 - Develop and implement a proactive work plan for trees on public land
        - Recommendation 2.2 - Perform plant health care and integrated pest management
        - Recommendation 2.3 - Prioritize proactive tree care in areas of highest need
        - Recommendation 2.4 - Protect and better manage trees with clear policies
        - Recommendation 2.5 - Increase interdepartmental support of urban forestry efforts
        - Recommendation 2.6 - Consider new programs and changes in code to protect mature trees and enhance the urban forest
    - Strategy #3: Strategically and Equitably Expand Tree Canopy
        - Recommendation 3.1 - Set up a process for neighborhood planting strategy implementation
        - Recommendation 3.2 - Expand canopy with resilience in mind
        - Recommendation 3.3 - Expand canopy through street tree planting
        - Recommendation 3.4 - Expand canopy in open spaces
        - Recommendation 3.5 - Expand canopy on residential land
    - Strategy #4: Make Space and Improve Conditions for Trees
        - Recommendation 4.1 - Recognize trees as critical infrastructure to be prioritized in right-of-way projects, and equivalent to utilities, sidewalks, bikeways and travel lanes

        - Recommendation 4.2 - Balance parking and room for planting
        - Recommendation 4.3 - Explore adding tree canopy to underutilized/vacant lands
        - Recommendation 4.4 - Implement updated planting standards
        - Recommendation 4.5 - Minimize above-grade conflicts
    - Strategy #5: Improve Communications - Both Process and Content
        - Recommendation 5.1 - Improve avenues of City communications
        - Recommendation 5.2 - Promote awareness of the role of trees in Boston
    - Strategy #6: Improve Information Collection and Sharing
        - Recommendation 6.1: Complete and sustain data sets on the entire urban forest
        - Recommendation 6.2: Regularly assess canopy change patterns and causes
        - Recommendation 6.3: Improve access to tree data for all residents
    - Strategy #7: Build and Support a Local Tree Workforce
        - Recommendation 7.1 - Support existing and emerging workforce development opportunities
        - Recommendation 7.2 - Establish an urban forestry career pathway program
        - Recommendation 7.3 - Create and support forest-related entrepreneurial opportunities
- A Roadmap for Implementation
- Appendices
    - Appendix A: Trees and Tree Canopy Benefits
    - Appendix B: Glossary
    - Appendix C: Species Guide
    - Appendix D: UFP Assessment Framework and Extended Findings

DORCHESTER RELEVANCY

1. **Resilience:** The urban forest can help us to live more comfortably with the impacts of climate change. However, these changes not only create more stressful city environments for humans, but also for the urban forest. Trees experiencing hotter temperatures and heat stress are more susceptible to pest and disease infestations, severe weather can cause more damage and loss of trees, and a warming climate inflicts greater pressures from invasive plant species outcompeting natives. Flooding also has negative impacts on trees, especially coastal flooding, as saline inundation can be deadly to trees.
2. A number of neighborhoods with Environmental Justice populations have low canopy cover, including **Dorchester**. Parts of Dorchester with higher canopy are now losing canopy at a rapid rate. Dorchester is also one of the Boston neighborhoods anticipated to be most impacted by increased stormwater. Tree planting and species selection at Tenean Beach should pay careful attention to Recommendation 3.2 - Expand canopy with resilience in mind. Considerations will include contributing to tree diversity in Dorchester specifically; selecting plants that can tolerate saltwater inundation; and ensuring that climate-ready implementation projects contribute to tree canopy expansion.
3. Reference Appendix C: **Species guide** during SD plant selection, which includes the known climate response of trees when known.



Canopy Coverage Change between 2014 - 2019

KOSCIUSKO CIRCLE / WILLIAM T. MORRISSEY BOULEVARD CORRIDOR STUDY

TRANSPORTATION PLANNING STUDY

CLIENT

MassDOT Office of Transportation Planning (OTP) is the client, but the project is managed by an inter-agency group including MassDOT, City of Boston & BPDA, and DCR. There will also be a steering committee established by Governor Baker, but members are not yet identified.

TIMELINE

The study began in 2022 and is ongoing.

OVERVIEW

The goal of the planning study is ultimately "to develop and analyze alternatives for the corridor to improve the public realm, mobility, connectivity, safety, and climate resiliency throughout the area for the City and other communities in the surrounding region." The scope includes existing and future conditions analysis, goal setting, public involvement, alternatives development and analysis, and near-schematic design.

AREA OF STUDY

The study area includes the Morrissey Blvd corridor from Neponset Circle to Kosciusko Circle.

CONSULTANT TEAM

AECOM is the prime consultant, and Woods Hole Group is one of several subconsultants.

SUMMARY

The most relevant element of the project is its coastal resiliency strategy and design criteria and how it interfaces with the Tenean Beach/Conley Street flood pathway mitigation design. Through iterative meetings and communications between the agencies and the consultant team, the agencies agreed to proceed with the following resiliency recommendations for the Morrissey Blvd corridor:

1. That coastal flood risk mitigation to protect Morrissey Blvd should be implemented at the shoreline (advancing strategies identified in Climate Ready Dorchester, including Tenean Beach/Conley St).
2. That coastal flood risk mitigation strategies to protect Morrissey Blvd should be designed to the MC-FRM 2070 1% annual chance coastal flooding hazards, including water surface elevation and maximum or significant wave heights, with no freeboard.

The alternatives development, analysis, and design efforts for coastal resiliency included in the Morrissey Blvd project will therefore focus on the central area of the corridor, from south of Beades Bridge at the I-93 overpass, to north of the UMass Boston entrance at Bianculli Blvd. This is the portion of the corridor where the right-of-way coincides with the shoreline and associated coastal resilience strategies identified in Climate Ready Dorchester. Morrissey Blvd redesign projects will therefore depend on implementation of shoreline/flood pathway mitigation strategies, including Tenean

Beach/Conley St, to achieve the corridor's resilient design objectives.

The Morrissey Blvd project will not develop alternatives or initial designs to improve conditions on intersecting roadways, like Conley St.

TOPICS ADDRESSED

Design criteria, coastal resilience, transportation, connectivity

DORCHESTER RELEVANCY

Interagency/Property Owner Cooperation: As the Morrissey Blvd project agency team members are key property owners at the Tenean Beach/Conley Street site - DCR (Tenean Beach), MassDOT (I-93 overpass), and City of Boston (Conley St) - their agreement to pursue a shoreline/flood pathways focused coastal resiliency strategy for Morrissey Blvd implies that they have a common interest and commitment to a positive outcome for the Tenean Beach/Conley St project. Further engagement is required to elucidate each agencies responsibilities and address concerns through design.

Design Criteria: The Tenean Beach/Conley Street project's near-term design should at a minimum be adaptable to the specific design criteria that the Morrissey Blvd project team has agreed to for long-term coastal flood resiliency measures. At best, it should be designed to meet the long-term design criteria in a single implementation phase.

Independent Effectiveness: The long-term effectiveness of the Tenean Beach/Conley St project for coastal flood mitigation will depend on other efforts to address a secondary/longer-term flood pathway into Dorchester at the I-93 overpass south of Beades Bridge. This secondary flood pathway and its floodplain join with the Tenean Beach/Conley St flood pathway and floodplain in future time horizons. The Morrissey Blvd project will include alternatives and initial design to address the secondary flood pathway.

Conley Street Improvements: Climate Ready Dorchester calls out the need for improvements on Conley St to improve connectivity and waterfront access to the Tenean Beach site from the broader Dorchester community. DCR's plans for the Neponset Greenway connector may include some improvements to Conley St that advance that objective. However, the Morrissey Blvd project will not. If improvements to Conley St (e.g., complete streets improvements) are developed as part of the Tenean Beach/Conley St project, they should be coordinated with the Morrissey Blvd and Neponset Greenway projects.

Implementation Funding: It is possible that future implementation of Morrissey Blvd improvements may be linked, as a design/construction/funding package, with Tenean Beach/Conley Street coastal flood mitigation implementation. This has not been discussed or agreed to by the Morrissey Blvd project agency partners. If that linkage occurs, it is likely that the hypothetical Morrissey Blvd project would seek to implement a long-term coastal flood mitigation strategy at Tenean Beach/Conley Street, rather than a near-term strategy that depends on further incremental adaptation in the future. This may make Tenean Beach/Conley Street design efforts focused on a near-term, incremental implementation strategy obsolete.

A MASTER PLAN FOR THE LOWER NEPONSET RIVER RESERVATION

OPEN SPACE PLAN

ENTITY

Metropolitan District Commission (MDC), which was merged with Department of Environmental Management (DEM) to form the Massachusetts Department of Conservation and Recreation (DCR) in 2003 under Governor Mitt Romney.

TIMELINE

Published in December 1996.

OVERVIEW

This master plan presents a program for improving the Lower Neponset River Reservation, including the development of three new parks totaling 125 acres and a three mile-long multi-use trail. The plan focuses on preserving and enhancing the natural qualities of the river system, while increasing public access in appropriate locations, including between Tenean Beach and Victory Park. Phase 1 of this plan successfully created new parkland along the Neponset River and remediated the sites of former landfills, industrial sites, and other nuisance uses that plagued the riverfront for many years.

AREA OF STUDY

The lower four miles of the Neponset River between the City of Boston's Mattapan and Dorchester neighborhoods.

SUMMARY

The master plan presents an overview of open space planning for additional community parks, enhancement and extension of the Neponset River Trail, and stewardship of the Neponset River Reservation. The master plan includes specific project considerations related to funding, phasing, maintenance, and permitting for proposed amenities, as well as other key features such as increased lighting, visibility, and other public safety enhancements needed to improve community enjoyment of the Lower Neponset River Reservation. The major goals of the master plan are as follows:

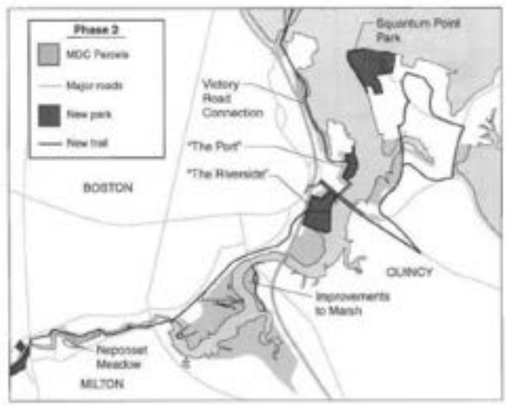
- *Preserve, restore, and enhance the natural qualities of the river system.*
- *Increase views and public access to the river and reservation in appropriate ways and locations.*
- *Create a corridor plan which responds to the variety of recreational needs of the many communities in the area.*
- *Create opportunities along the corridor for people to learn about the river, local history, and culture of the area.*
- *Connect the Lower Neponset River Reservation with the larger Metropolitan Park System.*
- *Ensure that the highest possible emphasis is given to public safety along the corridor.*
- *Incorporate maintenance standards and life-cycle cost effectiveness in the preparation of park and trail designs.*

TOPICS ADDRESSED

Parks and open space, trails and connectivity, natural resources, habitat, and public access and education.

DORCHESTER RELEVANCY

Phase 2 of the master plan includes direct reference to making a physical connection described as the "Victory Road Boardwalk to Tenean Beach" between Tenean Beach and Victory Park along the eastern edge of the Southeast Expressway. Approximate costs for this work were estimated at $1.4M plus 25% design and contingency. The master plan also includes an estimate of 10,500 square feet of wetlands impacts, including Land Under Ocean, Land Containing Shellfish, Land Subject to Coastal Storm Flowage, Coastal Beach, and associated buffer zones, inside the ACEC associated with a physical connection between Victory Road and Tenean Beach.



Phase 2 (Three to five years)

PHASE II

		range	
The Port			
Port Norfolk Site Remediation	$ 400,000		$ 515,000
PJP II Park Development at Port Norfolk	$ 2,350,000		$ 2,350,000
The Riverside			
Drive-In Site Remediation	$ 2,800,000		$ 5,300,000
PJP II Park at Neponset Drive-In	$ 5,150,000		$ 5,150,000
Squantum Point Park	$ 1,700,000		$ 1,700,000
Victory Road Boardwalk to Tenean Beach	$ 1,400,000		$ 1,400,000
Neponset Marsh Reserve Improvements	$ 115,000		$ 115,000
Granite Railway Trail	$ 26,000		$ 26,000
Neponset Meadow	$ 28,000		$ 50,000
Phase II Total	$13,969,000		$16,586,000
25% Design and Contingency	$ 3,485,250		$ 4,146,500
Total	$17,461,250		$20,732,500

MBTA RED LINE CLIMATE CHANGE VULNERABILITY ASSESSMENT

STUDY

CLIENT

MBTA

TIMELINE

August 2021

OVERVIEW

The Massachusetts Bay Transportation Authority (MBTA) conducted a systemwide climate change vulnerability assessment (CCVA) to better understand which of its assets are most vulnerable to climate stressors and to identify adaptation measures that can be implemented to improve the system's resilience to the changing climate. This report focuses on the Red Line rapid transit line, which includes the Mattapan high-speed line. Prior to COVID, 243,000 passengers road the Red Line daily.

AREA OF STUDY

Red Line Corridor in Boston (and Cambridge and Somerville to the North, and Quincy and Braintree to the South)

CONSULTANT TEAM

AECOM

SUMMARY

The Massachusetts Bay Transportation Authority (MBTA) conducted a systemwide climate change vulnerability assessment (CCVA) to better understand which of its assets are most vulnerable to climate stressors and to identify adaptation measures that can be implemented to improve the system's resilience to the changing climate. This report focuses on the Red Line rapid transit line, which includes the Mattapan high-speed line.

The CCVA followed the methodology of the Federal Highway Administration's (FHWA's) Vulnerability Assessment Scoring Tool (VAST), which uses exposure, sensitivity, and adaptive capacity to create a holistic view of vulnerability to future climate change.

The Study was focused on three phases: Information Gathering and Climate Science Review (including inventory of assets); stakeholders with the communities; and site visits (the site visits were more detailed analysis of specific assets in sub-chapters, including a sub-chapter for Tenean Yard, adjacent to Tenean Beach). Vulnerability profiles were developed for the stations, maintenance facilities/yards, and segments of guideway. Tenean Yard has a high degree of vulnerability due to its exposure to SLR and Winter Weather impacts (as an outdoor maintenance yard/facility, subject to snow/ice accumulation). If Tenean Yard is unavailable, that segment of guideway is inaccessible.

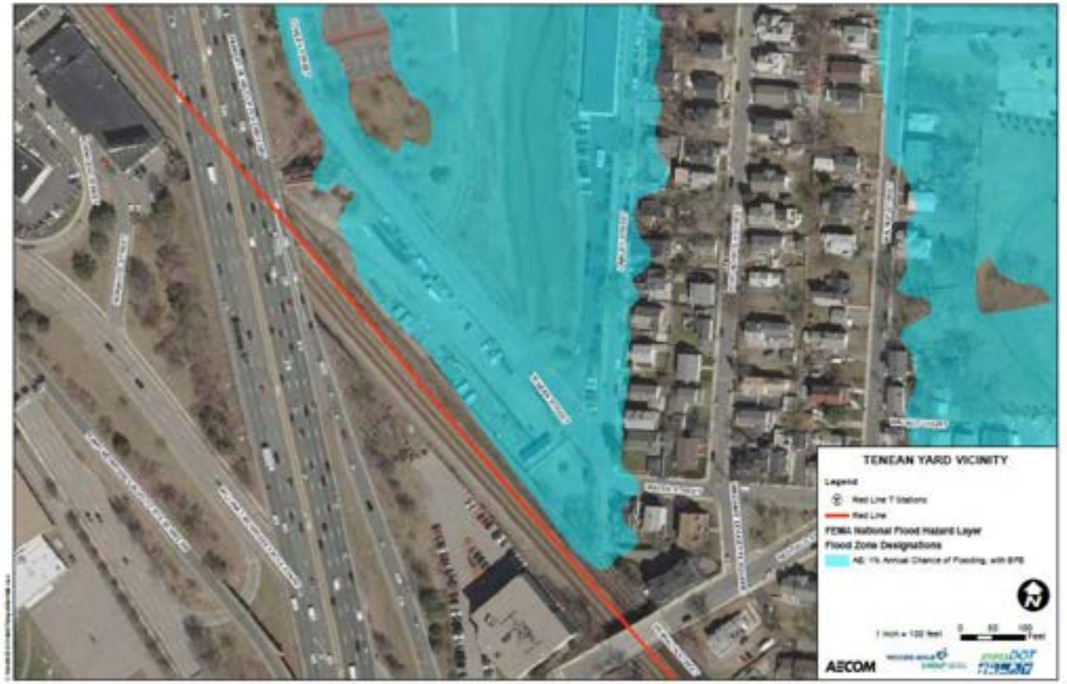
Adapting to Climate Change: To address the vulnerabilities identified in the Red Line CCVA, a menu of 42 adaptation measures was developed to consider both asset-specific and area-wide protection from the five climate stressors being evaluated for the Red Line CCVA. The measures focus on infrastructure, policy, management, and operations.

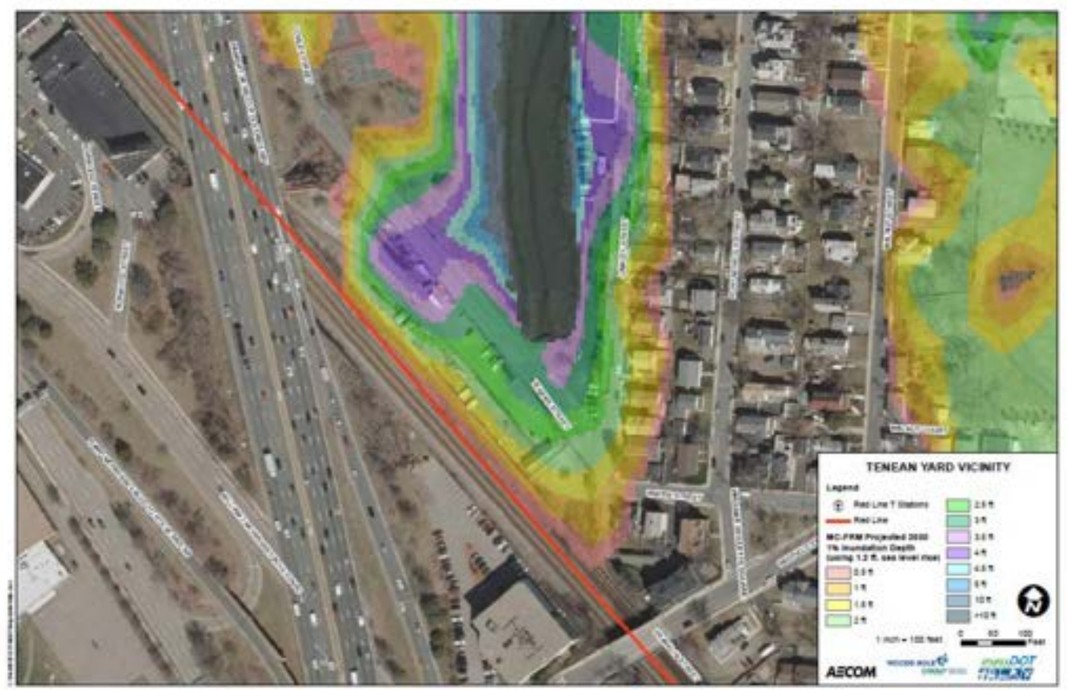
TOPICS ADDRESSED

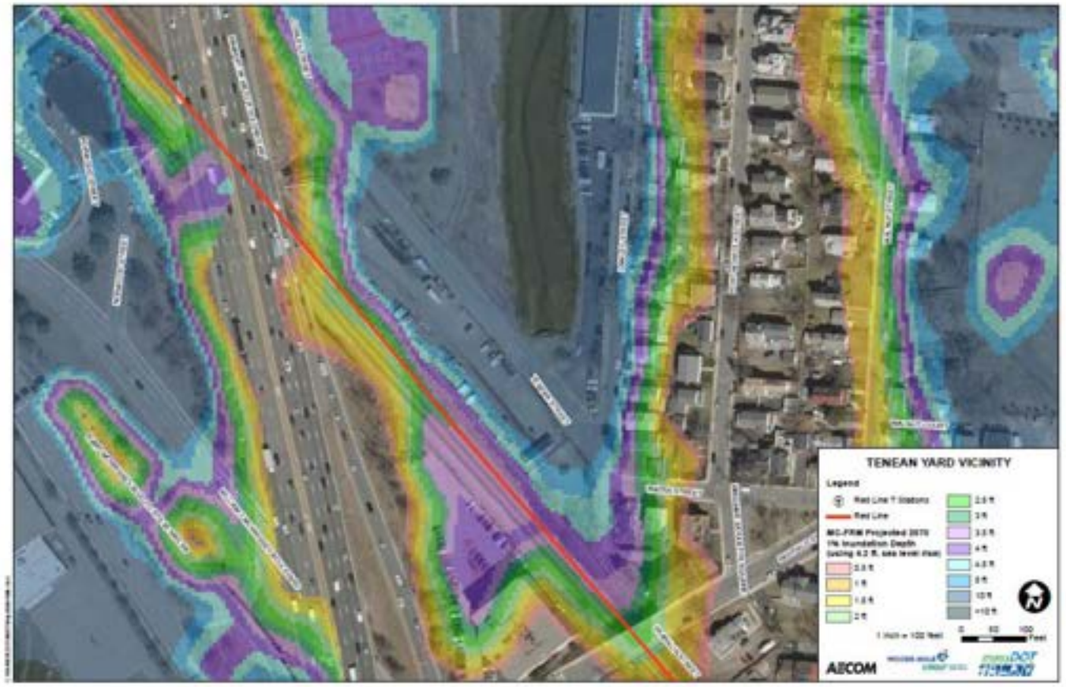
Infrastructure climate vulnerability and adaptation.

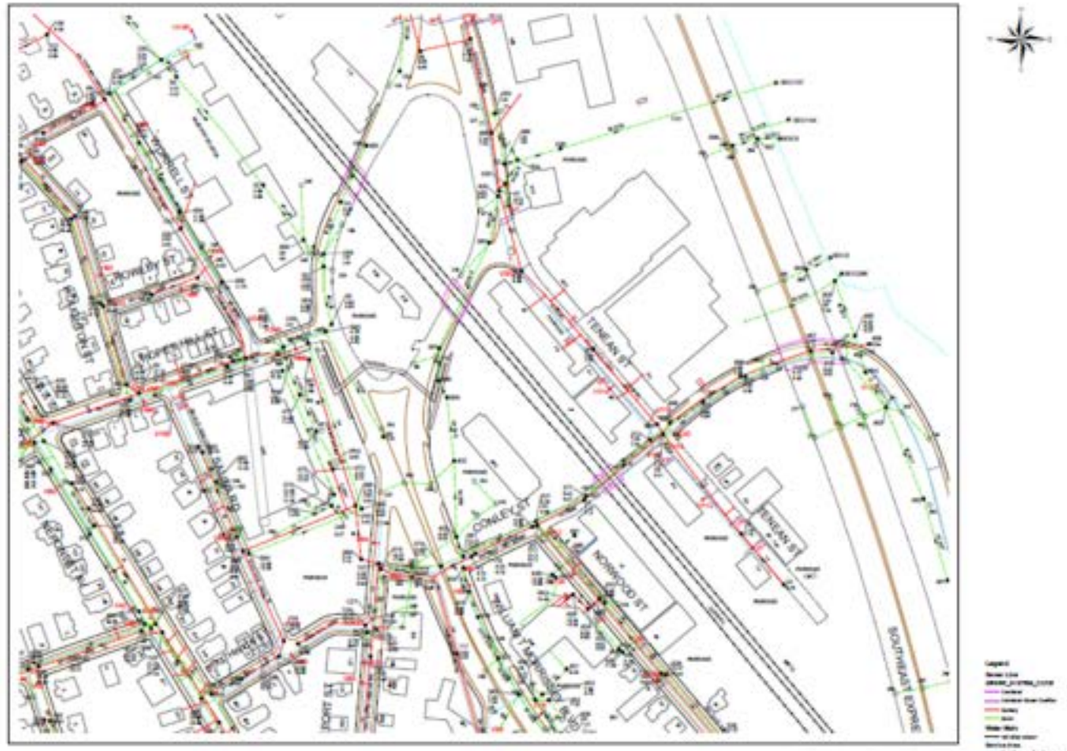
DORCHESTER RELEVANCY

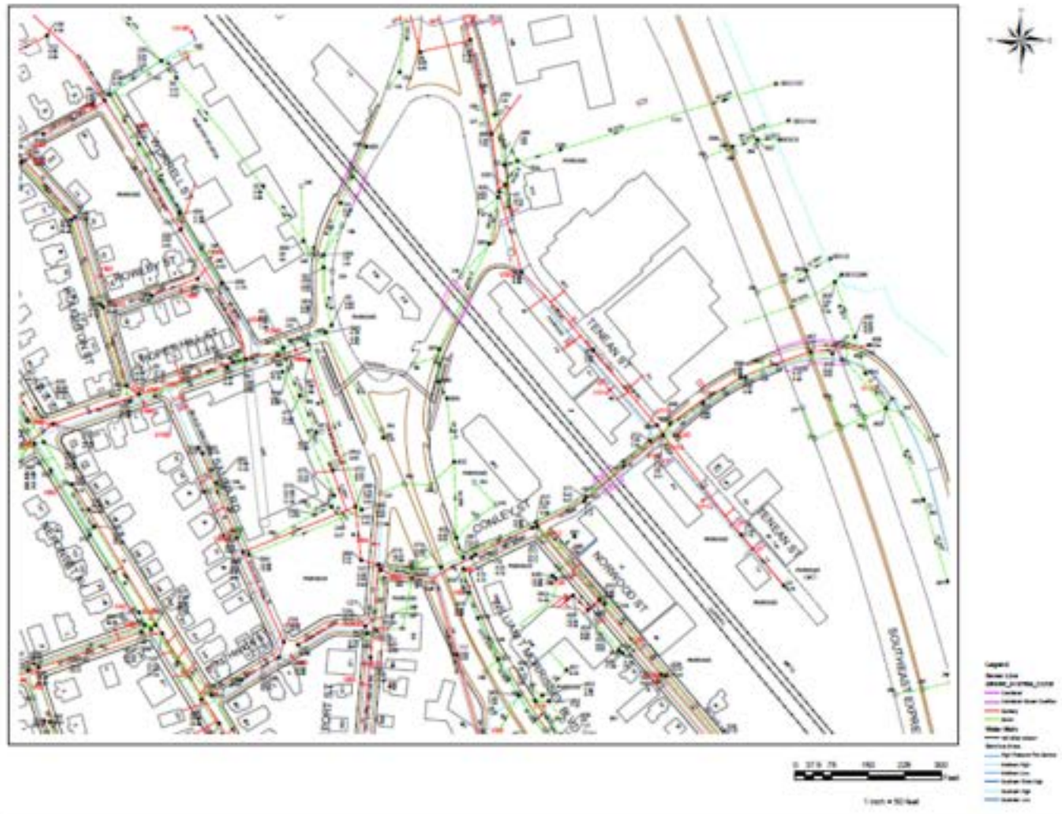
- Tenean Yard has a high degree of vulnerability, the second highest on the Red Line system next to Cabot Yard, due to past incidents at the Yard and its exposure to SLR, Precipitation, and Winter Weather impacts (as an outdoor maintenance yard/facility, subject to snow/ice accumulation). If Tenean Yard is unavailable, that segment of guideway is inaccessible.
- The JFK to Braintree, Tenean Yard Grade segment of guideway similarly has the highest degree of vulnerability, due to its collective exposure to multiple climate stressors: SLR, Precipitation, Wind, and Winter Weather.
- While Tenean Yard has a high degree of exposure and vulnerability in the quantitative assessment, it is not deemed as high an asset because it does not have major infrastructure costs associated with critical assets (such as a below-grade stations, elevators, escalators, tunnels, bridges, or MEP/HVAC systems). Tenean Yard only has the Tracks & Roadbed, Switches & Switch Heaters.
- Additional public health and social equity analysis exists in the report, with data from 2016 through 2018, pulled from the Boston Region Metropolitan Planning Organization's Central Transportation Planning Staff (CTPS) conducted an MBTA Systemwide Passage Survey (Boston Region MPO, 2018), but this data is more broadly for census tracts in all of Dorchester utilizing the Red Line and around specific stations, so not specific to the area directly adjacent to Tenean Beach.
- Tenean Yard is included in Appendix E, with a detailed site visit and mapping, on page 318 (this is consolidated with Mattapan Station, Mattapan Yard, and the Ashmont-Mattapan High-speed Line). From **Section 2.3, Tenean Yard**:
  Tenean Yard is a small maintenance facility located in Dorchester that provides an entry point for specialized equipment to access the Red Line (high rail vehicles, etc.). There is limited infrastructure and fixed assets at the yard. It was noted there is a staging area where ties and ballast were stored. The yard is located across the street from an inlet of the Neponset River, and the site has flooded in the past. As shown in the maps at the end of this Memo, Tenean Yard is located within a currently mapped FEMA flood hazard zone (AE) and is predicted to be inundated by the 1% (100-year) annual exceedance probability coastal flooding event by 2030 according MC-FRM results. The MC-FRM results reflect a projected 1.2 feet of sea level rise for 2030.
- Appendix G includes maps of the BWSC Culverts and utility data, including spot grades of utilities around Tenean Beach, with two plans attached.






TENEAN YARD VICINITY
Legend
AECOM


TENEAN ST
NORWOOD ST
CONLEY ST
SOUTHBAY EXPRESS



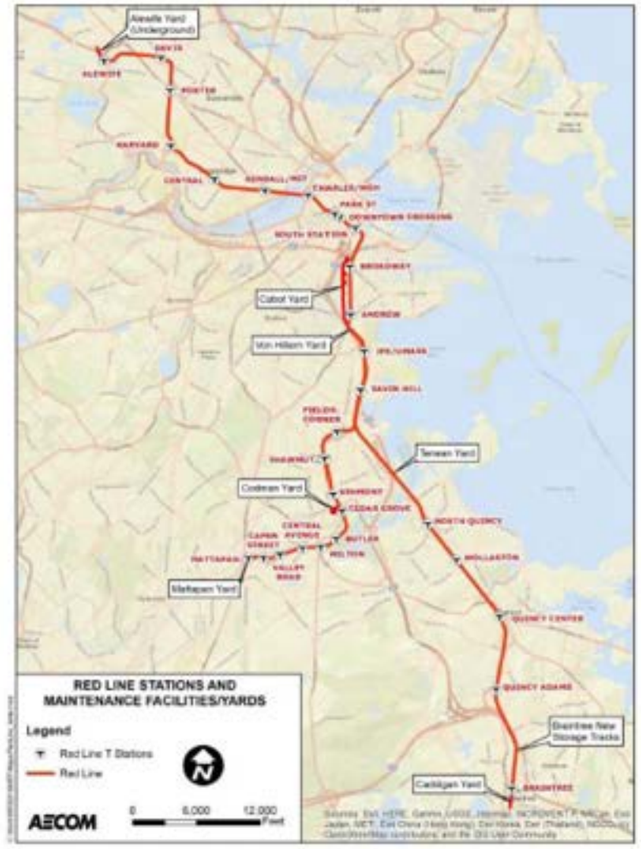


Figure 1-1: Red Line Stations and Maintenance Facilities/Yards