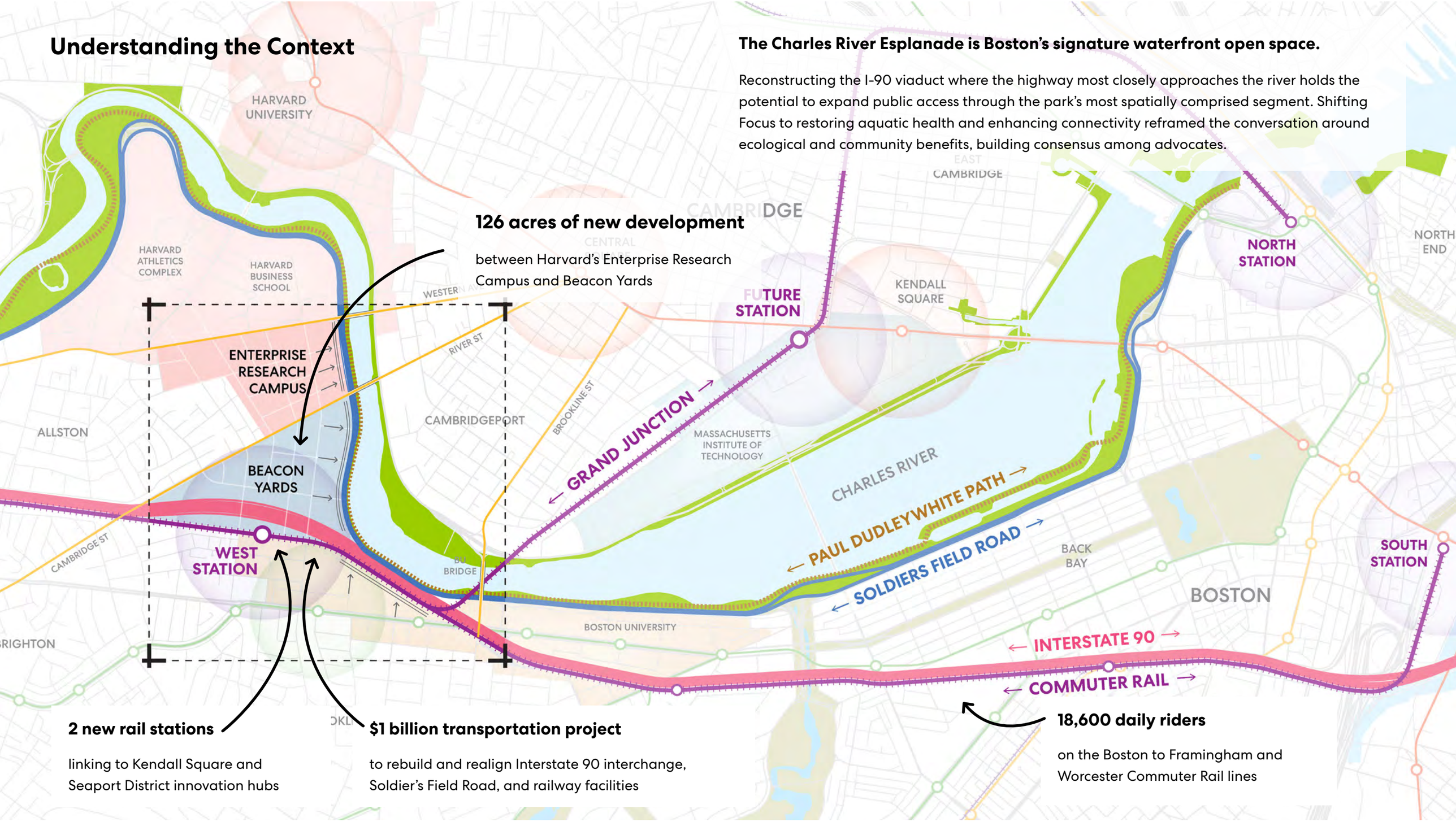

SOCIAL
Cultivate diverse open spaces and network of circulation systems that promote access and a sense of ownership to all.
ENVIRONMENTAL
Re-imagine the Charles River edge as a natural, living shoreline hosting rich and diverse native ecosystems that mitigate impacts of pollution.
ECONOMIC
Replace existing failing infrastructure with resilient and green infrastructure.
10
acres of parks and wetlands
6.6
acres of wetlands absorb water, and filter nitrogen, heavy metals, and phosphorous.
1,750
linear feet of new multi modal promenades and boardwalks
improved
water quality

Understanding the Context

The Charles River Esplanade is Boston's signature waterfront open space.

Reconstructing the I-90 viaduct where the highway most closely approaches the river holds the potential to expand public access through the park's most spatially comprised segment. Shifting Focus to restoring aquatic health and enhancing connectivity reframed the conversation around ecological and community benefits, building consensus among advocates.



126 acres of new development

between Harvard's Enterprise Research Campus and Beacon Yards

2 new rail stations

linking to Kendall Square and Seaport District innovation hubs

$1 billion transportation project

to rebuild and realign Interstate 90 interchange, Soldier's Field Road, and railway facilities

18,600 daily riders

on the Boston to Framingham and Worcester Commuter Rail lines

Charles River: A Vast Hydrological Network

The Charles is part of a large hydrological network, much of which is at risk to flooding and infrastructural decay.

Sea level around Boston has risen 8 inches since 1950, and is now rising by about 1 inch every 8 years

Moody Street Dam
High-Hazard
Waltham, MA

U.S. Army Materials Technology Laboratory
EPA Superfund Site
Watertown, MA

Project Site
Boston, MA

Natick Laboratory Army Research, Development, and Engineering Center
EPA Superfund Site
Natick, MA

Charles River Dam At South Natick
High-Hazard
Natick, MA

Echo Lake Dam
High-Hazard
Hopkinton, MA

Former Rubber and Plastics Industrial Plant
EPA Superfund Site
Franklin, MA

Charles River

- *80 miles long*
- *Intersects 23 municipalities*
- *Fed by 80 streams*

Charles River Drainage Basin

- *Includes 33 lakes and ponds*
- *Intersects 35 municipalities*
- *Contains 3 EPA Superfund sites*
- *Contains 46 Significant or High-Hazard dams*

Legend

Projected Sea Level Rise

6'
5'
4'
3'
2'
1'
0'

Hydrology
Wetland
EPA Superfund Sites
Watershed Boundary

At-Risk Dams

Low Hazard
Significant Hazard
High Hazard
N/A (Private)

Project Site

0 1.5 3 6 miles

Lower Middle Watershed

Newton
Wellesley
Weston
Waltham
Watertown

2019 EPA Grade: *A*

Lower Basin

Watertown
Newton
Brookline
Boston
Cambridge

2019 EPA Grade: B

Upper Watershed

Hopkinton
Milford
Hopedale
Bellingham
Franklin
Medway
Norfolk
Millis
Medfield

2019 EPA Grade: A-

Upper Middle Watershed

Medfield
Sherborn
Dover
Natick
Needham
Wellesley
Westwood
Dedham
Boston
Newton

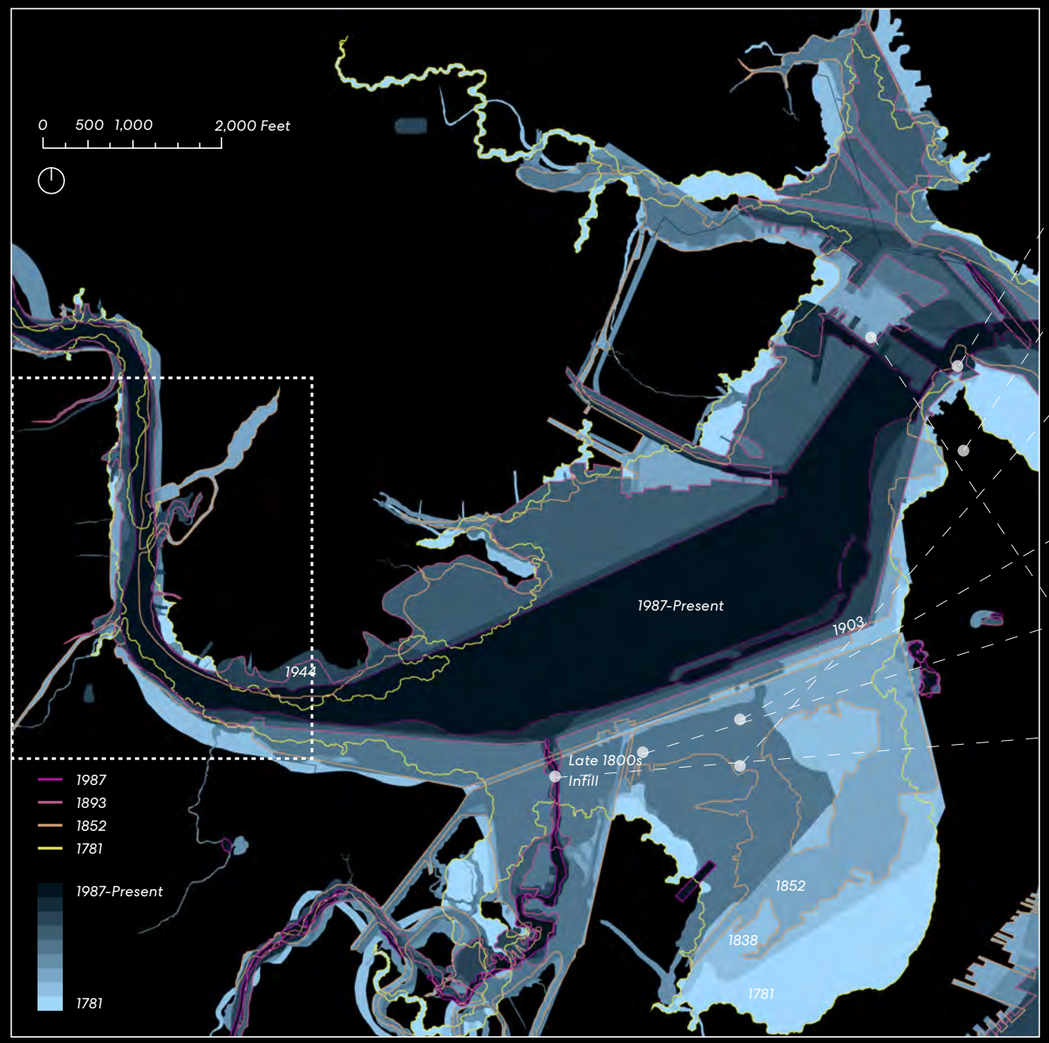
2019 EPA Grade: A

Sources: *MassGIS, NOAA, USGS, EPA, Charles River Watershed Association*

Sources: EPA, Boston Public Library, MassGIS

Evolving Edge of the Charles River

The Charles has a long history of geoengineering and infill. Sea level rise projections demonstrate water will likely return to those filled areas.



43 industrial mills are constructed along the Charles, including at Causeway Street. Damming changes the river's flow, capturing sedimentation. Ponds become repositories for industrial waste.

Boston streets are paved with cobblestones, while an underground drainage system for gray water is created. Paving reduces groundwater recharge while increasing contamination.

Charles Street is created by cutting the top off Trimountain (now Tremont St.) as marshes are filled.

A public water supply is introduced, spurring development of a sewer system carrying waste directly to the Charles. Bacteria proliferate as waste accumulates.

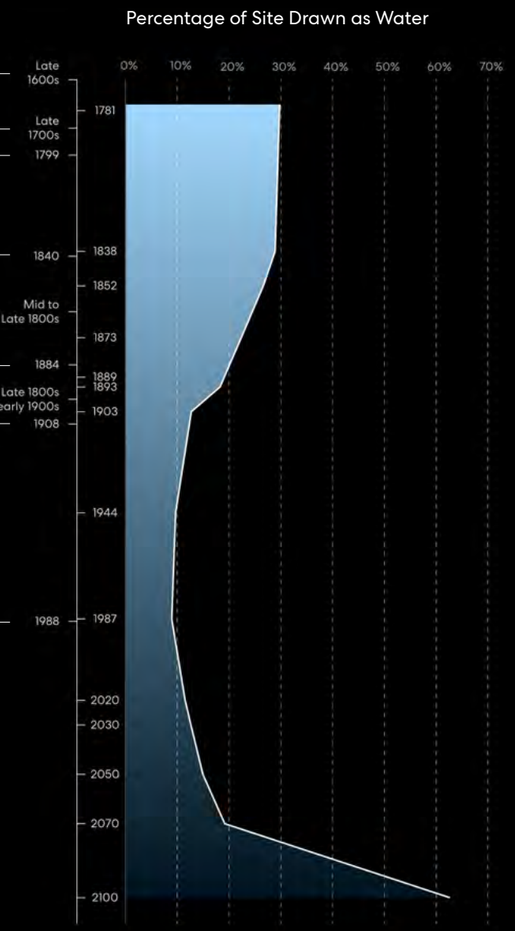
738 acres of tidal marsh in Back Bay is filled with material from Boston drumlins and Needham quarries, substantially reducing the estuarine environment.

Other than a portion at entrance of Stony Brook and Muddy River, all of Back Bay is filled. The entire riverine habitat is lost, and combined sewer overflows discharging sewage become more frequent.

Stony Brook, the largest tributary to the Charles is culverted. Other major tributaries follow suit.

A dam is constructed between Boston and East Cambridge, eliminating the estuarine environment and creating a heavily polluted anoxic zone.

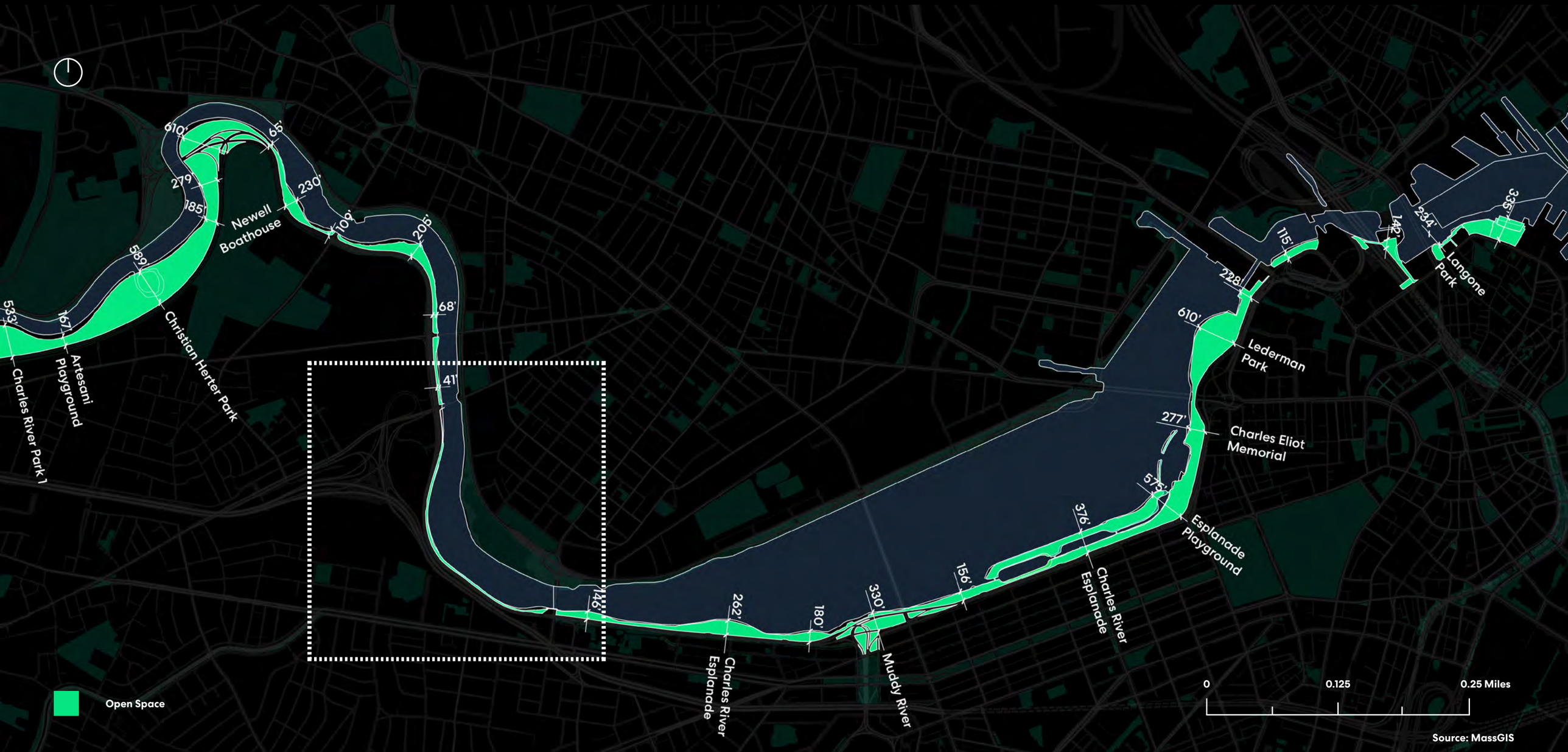
In response to the U.S. Environmental Protection Agency/Conservation Law Foundation) Boston Harbor Cleanup Lawsuit, the Massachusetts Water Resources Authority (MWRA) creates its CSO program, reducing untreated sewage discharge.



Sources: EPA, Boston Public Library, MassGIS

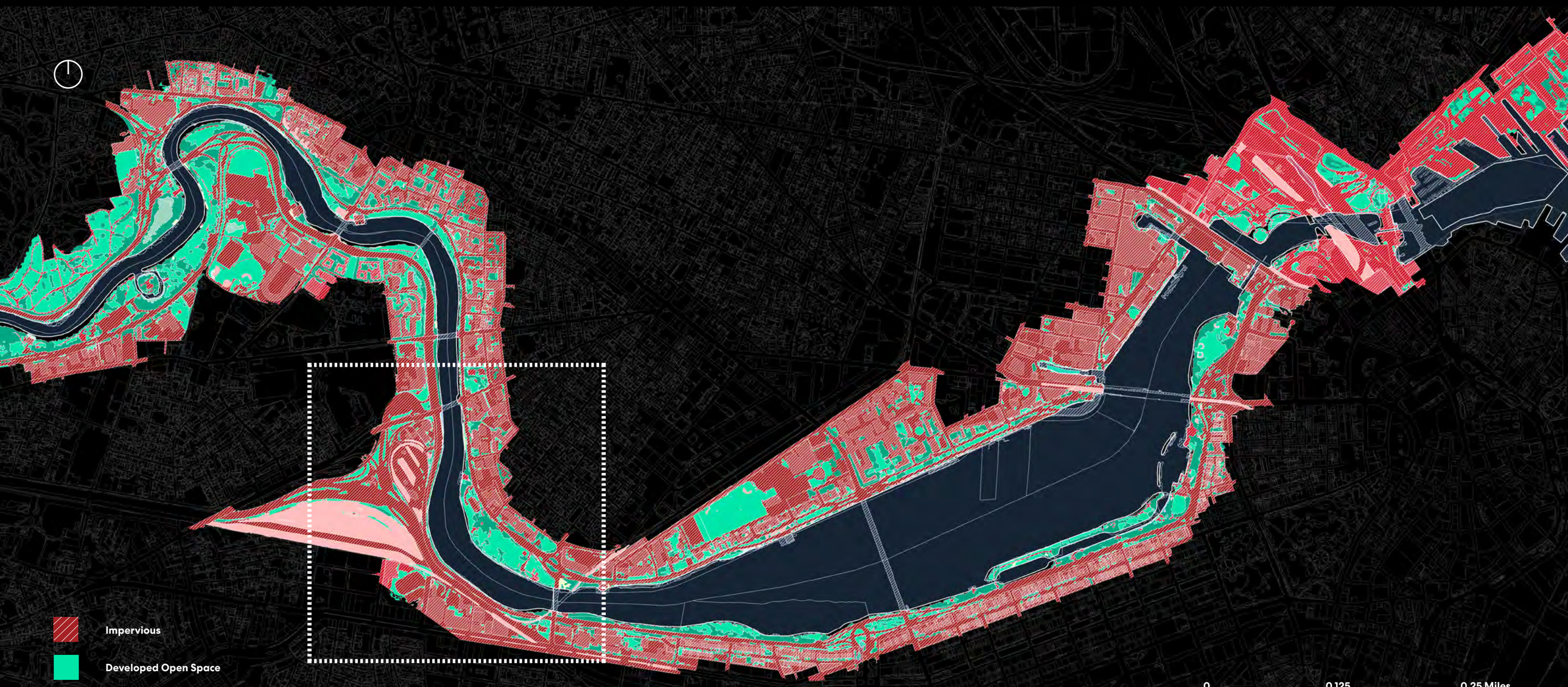
Riverbank Conditions: Riverbank Widths

Open space along the Allston riverbank is narrower than 40 feet wide, providing little area for riparian vegetation and biodiversity.



Riverbank Conditions: Impervious Surfaces

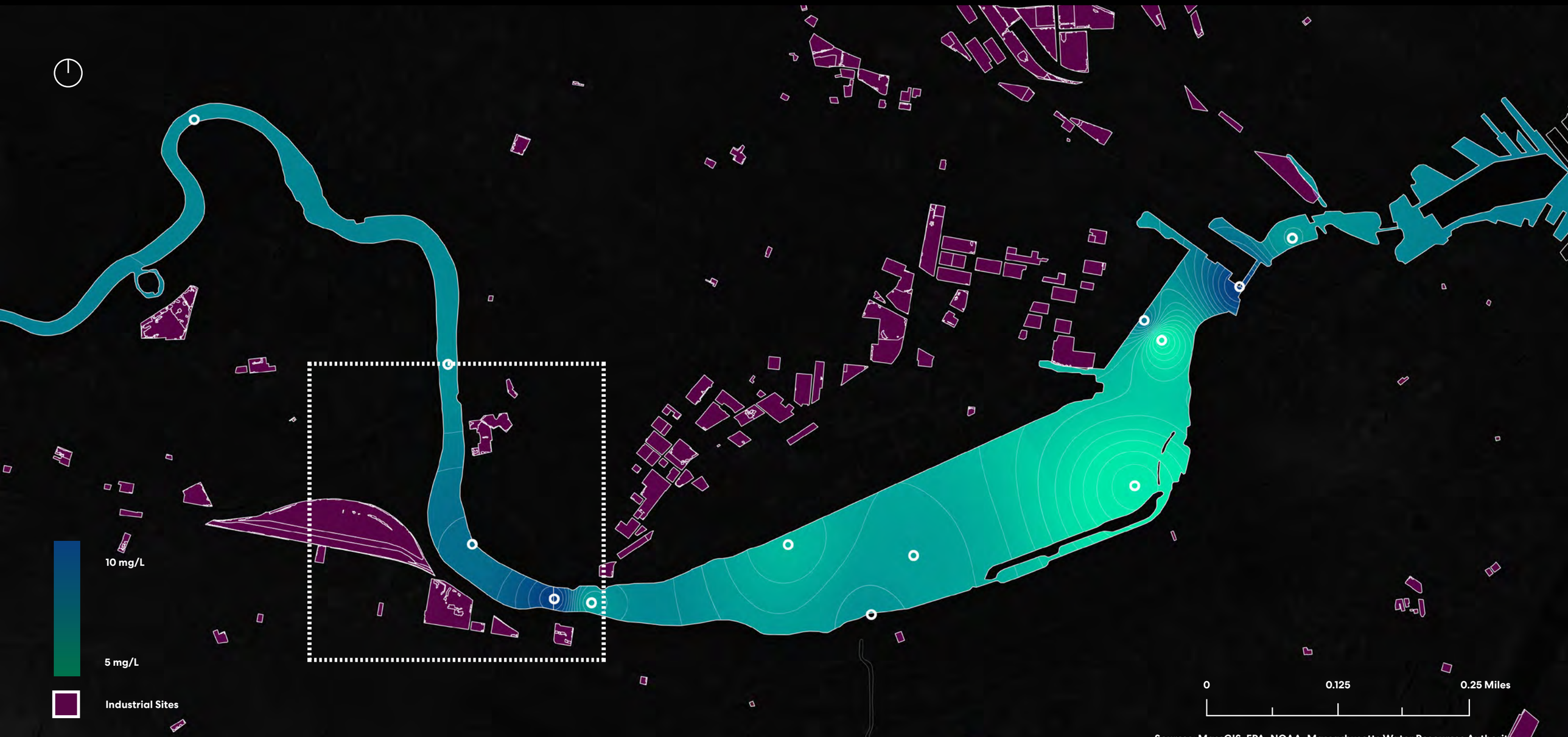
69% of the land within 1,000 feet of the Charles' Lower Basin is impervious, contributing directly to stormwater runoff entering and polluting the Charles.



Source: MassGIS

Riverbank Conditions: Pollution (Dissolved Oxygen)

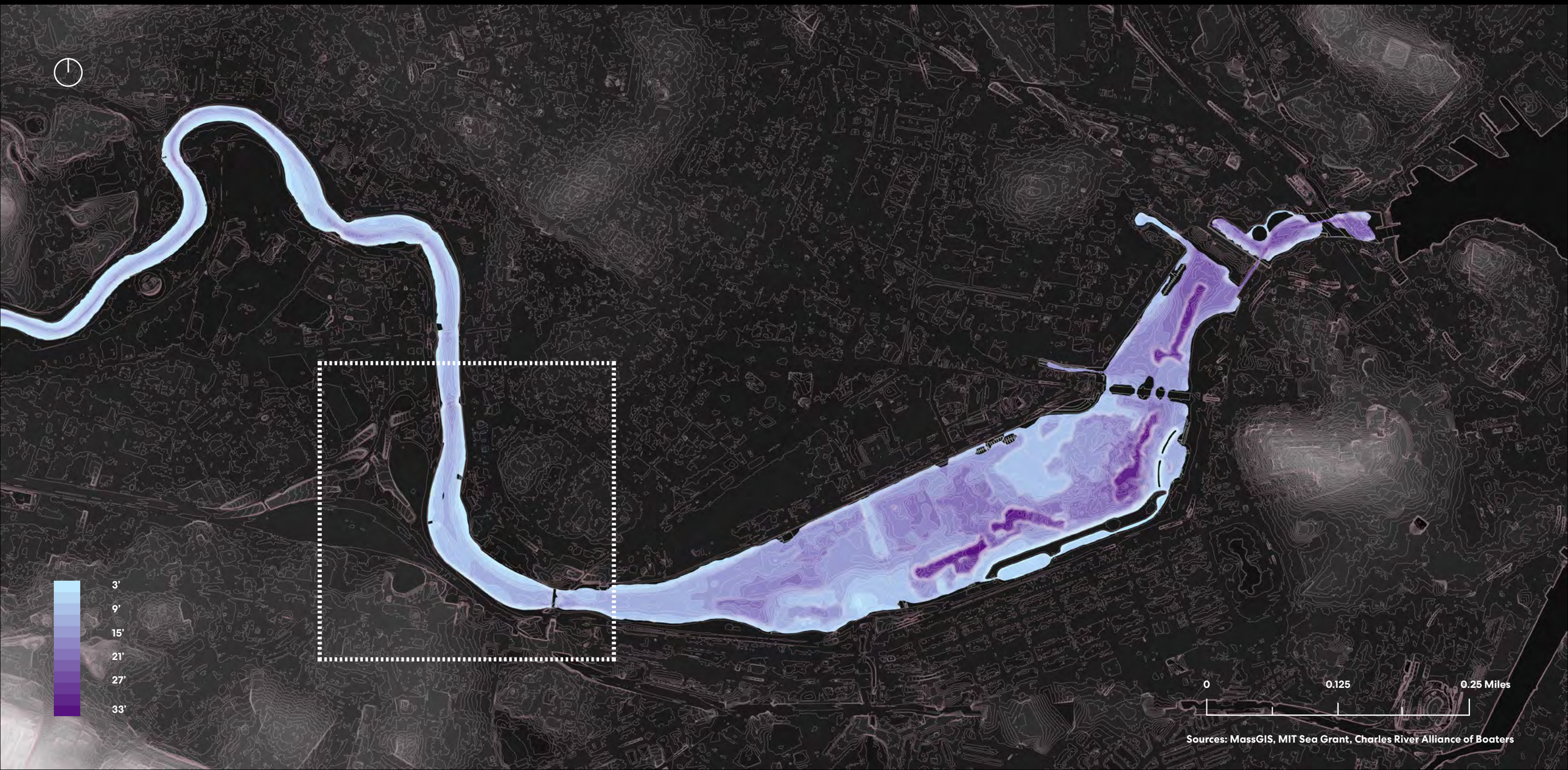
The EPA rates water quality in the Charles' Lower Basin as degraded, with low levels of dissolved oxygen, cyanobacteria blooms, and E. Coli threatening aquatic life.



Sources: MassGIS, EPA, NOAA, Massachusetts Water Resources Authority

Riverbank Conditions: Bathymetry

The Lower Basin of the Charles River is very shallow, leading to sediment deposit build-up that reduces the hydrological flow.

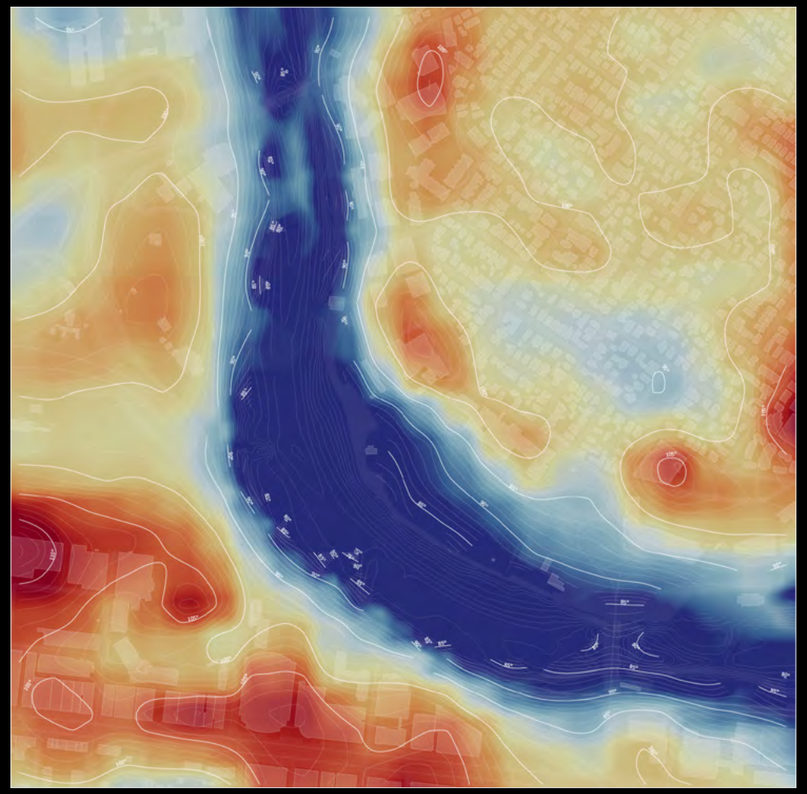


Localized Climate Change

Impervious

Impervious Surfaces

Roadways, parking lots, and buildings adjacent to the Charles River prevent natural filtration of contaminants, resulting in higher pollutant levels and reduced water quality.



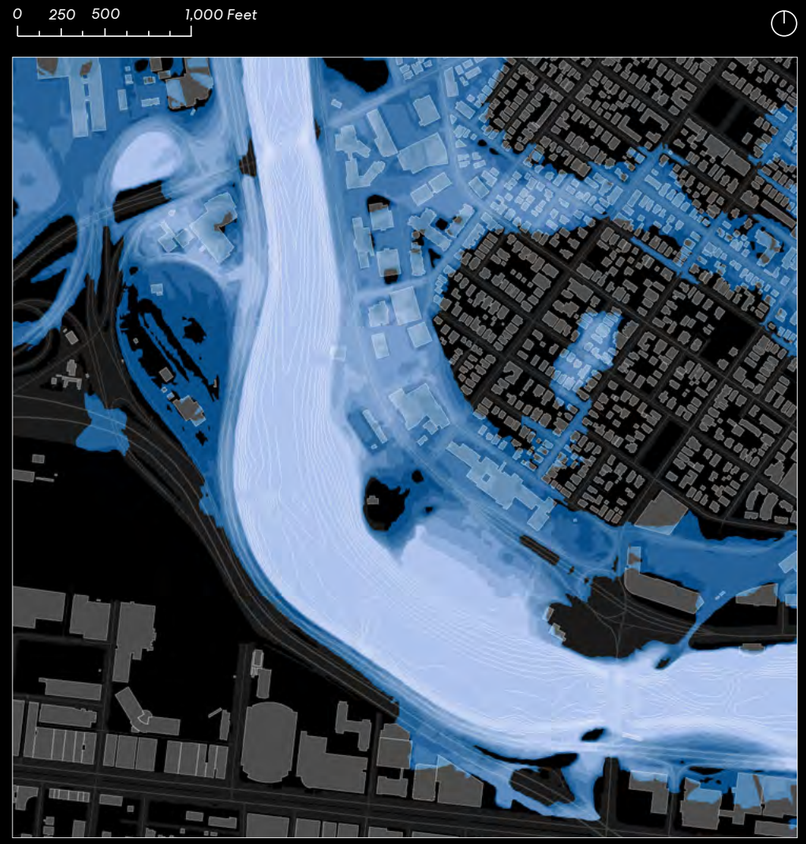
Mean Summer Land Surface Temperature

115°

92 °

Urban Heat Island Effect

Impervious surfaces drive higher land surface temperatures, adversely impacting human comfort and stressing the adjacent riparian ecology.



Projected Sea Level Rise

6’
5’
4’
3’
2’
1’
0’

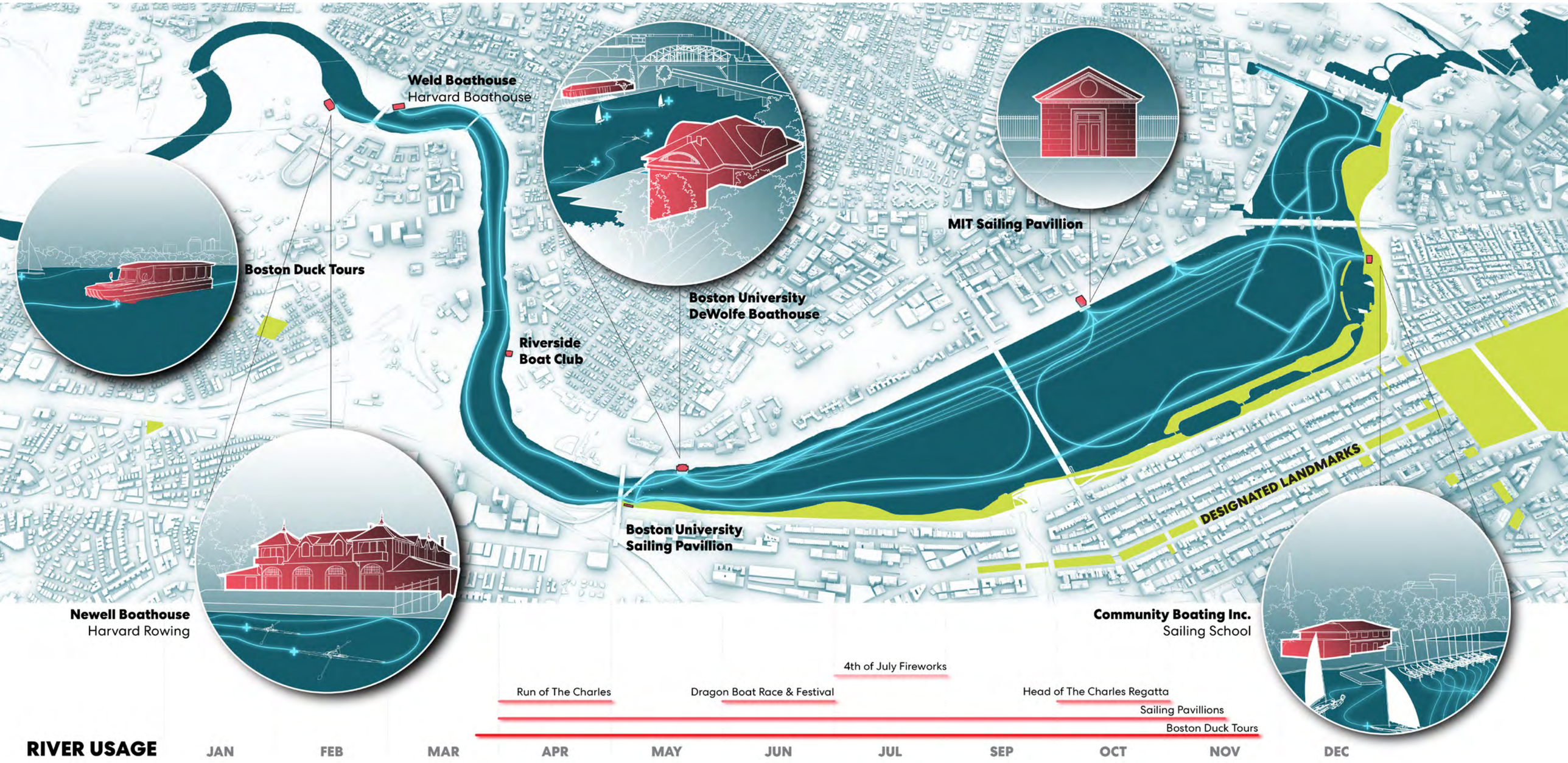
Sea Level Rise Predictions

The site plays a vital role in protecting critical infrastructure, existing community fabric, and future development from flooding.

Sources: MassGIS, NASA, NOAA, Wang, JA (2017)

Cultural Resource Mapping

Cultural resources along the Charles River inform its civic identity. We explore how design can reconnect communities with an underutilized portion of the riverbank.



Understanding the Challenges

Analysis of the Charles through historical, cultural, and ecological lenses clarifies the environmental and infrastructural challenges that must be addressed to restore the river's health.

Engagement Framework

Social

Identify stakeholders + champions, create an inclusive framework. Analyze data to determine alignment with social equity outcomes.

Raise awareness, develop strategies, and track success indicators for health, environment and economic.

Environmental

Analyze disaster + hazards to understand vulnerabilities and risks. Map environmental degradation to natural resources and establish climate projections.

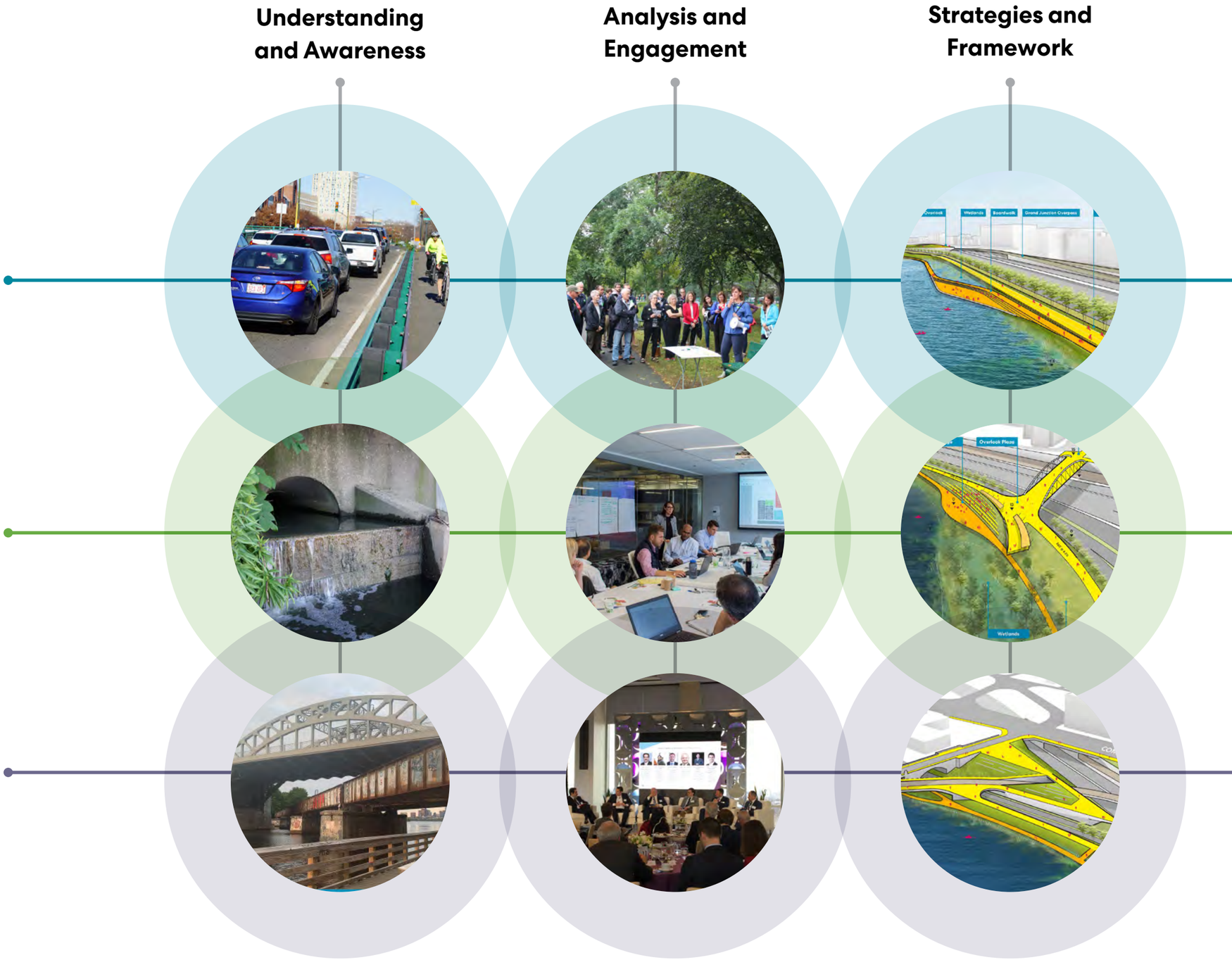
Engage community to develop a design with nature strategies. Create awareness on benefits of environmental stewardship, enhance regional economy. Focus on pilot projects to demonstrate successes and opportunities.

Economic

Understand existing and proposed land uses and future drivers.

Find opportunities to foster alliances between public and private sector.

Develop an Advocacy Action Plan that promotes diversity, equity, and inclusivity.



Engagement Process

Discover

- Conduct Research
- Collect Data
- Evaluate Existing Conditions

How can we ground our understanding in rigorous research and investigation?

Envision

How do we build concensus among diverse advocates and stakeholders?

- Conduct Webinars
- Document Site
- Research Precedents

Ideate

- Articulate Guiding Principles
- Craft Strategy Toolkit
- Test Multiple Solutions

What are the overarching pricipals that inform our framework plan?

Synthesize

How do we balance competing social, ecological, and infrastructural goals?

- Craft Framework Plan
- Conduct Site Studies
- Define Quantifiable Metrics

Advocate

- Outline Actionable Goals
- Build Strategic Partnerships
- Raise Public Awareness

How can we articulate the vision to build understanding and broad public support?

Research & Analysis

- 400+ years of human intervention
- 4,500 linear feet of shoreline
- 5 competing modalities
- 4 outfall structures
- 15 stakeholder & advocacy groups
- 5 virtual webinars
- 3 visioning sessions

Toolkit & Framework

- 11 precedent studies
- 9 riparian transects
- 3 design lenses
  - social
  - environmental
  - economic
- +10 acres of parkland
- +7 acres of wetlands
- 3 site-specific designs
- 3 newly created biomes

Implementation

- public presentations
- newspaper op-ed
- advocacy round-tables
- webinars

Site Plan

01 —— Themes

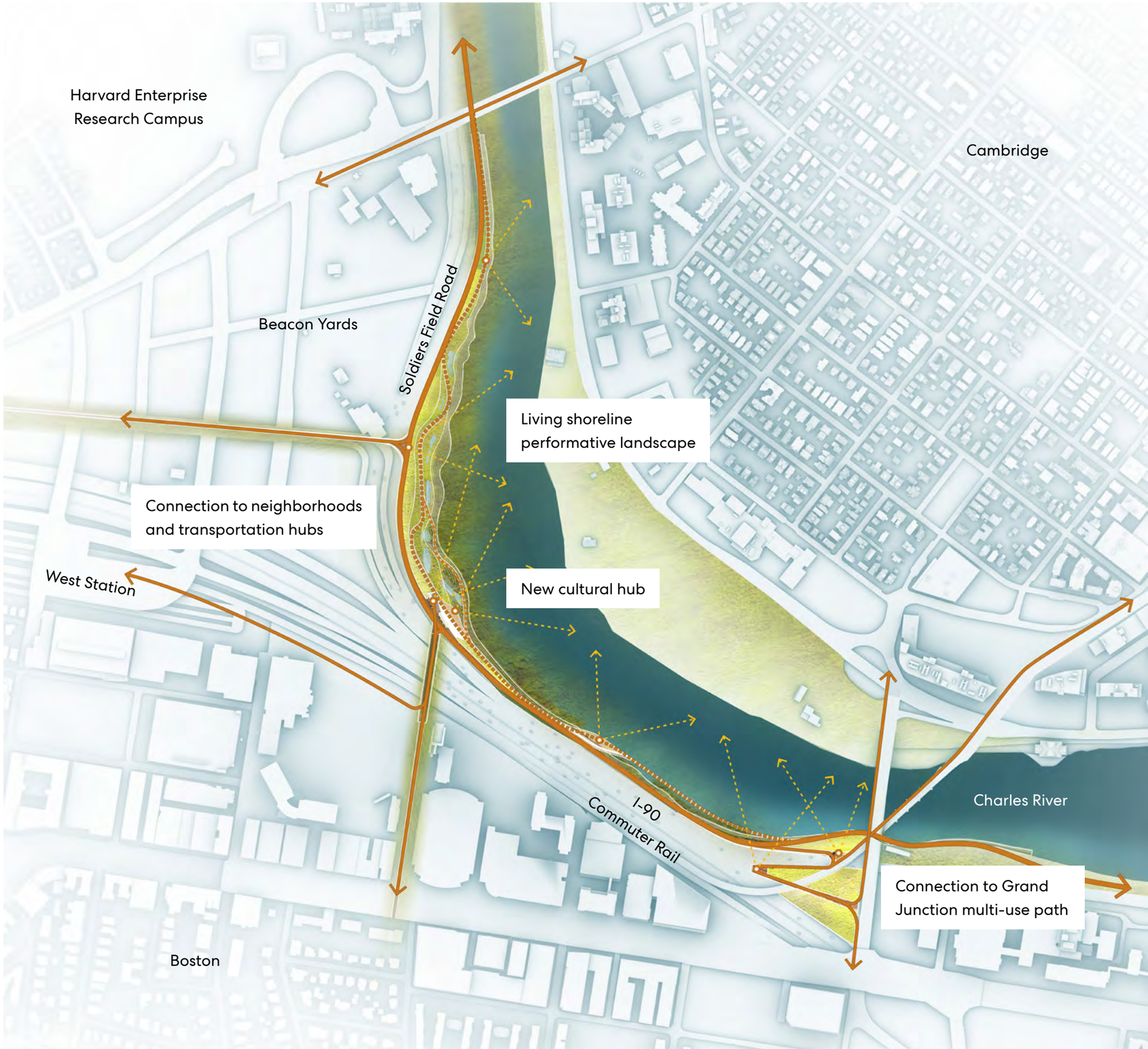
- **Celebrate** the rich history and culture of the Charles River
- **Bio-diverse** ecological shoreline that stabilizes the edge condition
- **Resilient** infrastructure systems that benefit generations to come
- **Social equity** and equal access and a sense of ownership for all

02 —— Principles

- Propose a series of landscape systems that **mitigate the impacts of pollution** discharge and improve environmental conditions.
- Address the impacts of climate change to **create a resilient riverfront.**
- Re-imagine the river's edge as a **natural living shoreline** of rich and diverse ecosystems.
- Introduce robust circulation systems & open spaces **connecting surrounding communities to riverfront.**

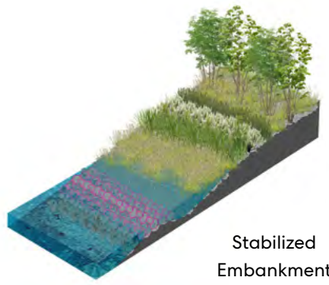
03 —— Strategies

- Create a **toolkit of landscape strategies** that respond to the varying conditions along the river's edge.
- Draw upon knowledge gained from precedent examples and **best management practices.**
- Weave individual solutions into comprehensive framework plan that **restores the river's ecology.**

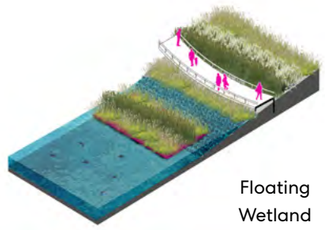


Elements of Influence

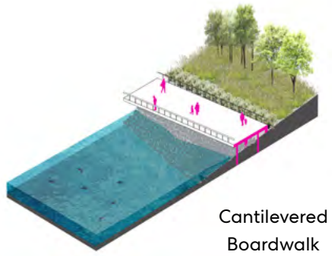
01: Resilient embankments with elevated pedestrian walkways that protect during storm surge and flood events —— **02:** Accessible walkways that connect neighborhoods to the riverfornt —— **03:** Natural and planted shoreline to stabilize edge conditions —— **04:** Raised boardwalks through floating wetlands bring the public into contact with the restored river's edge —— **05:** Emergent wetlands that purify water and absorb storm surge to create a resilient park —— **06:** Overlook and pavilions provide grand views to wetlands park and river —— **07:** Amphitheater and gathering spaces to view performances and events on the charles river



Stabilized Embankment

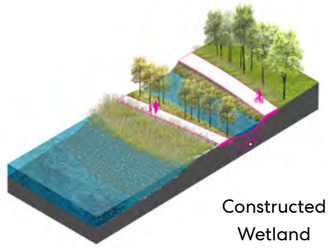


Floating Wetland

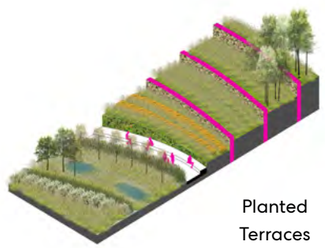


Cantilevered Boardwalk

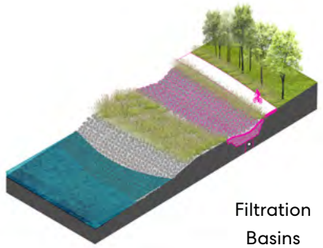
Naturalize the Shoreline



Constructed Wetland

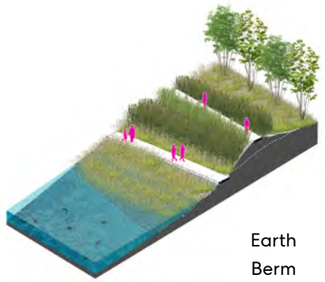


Planted Terraces

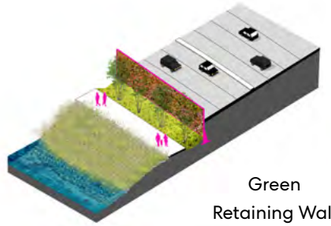


Filtration Basins

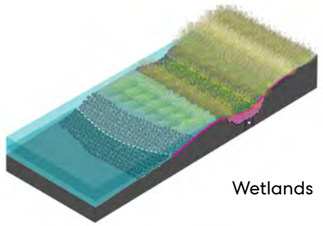
Enhance Biodiversity



Earth Berm

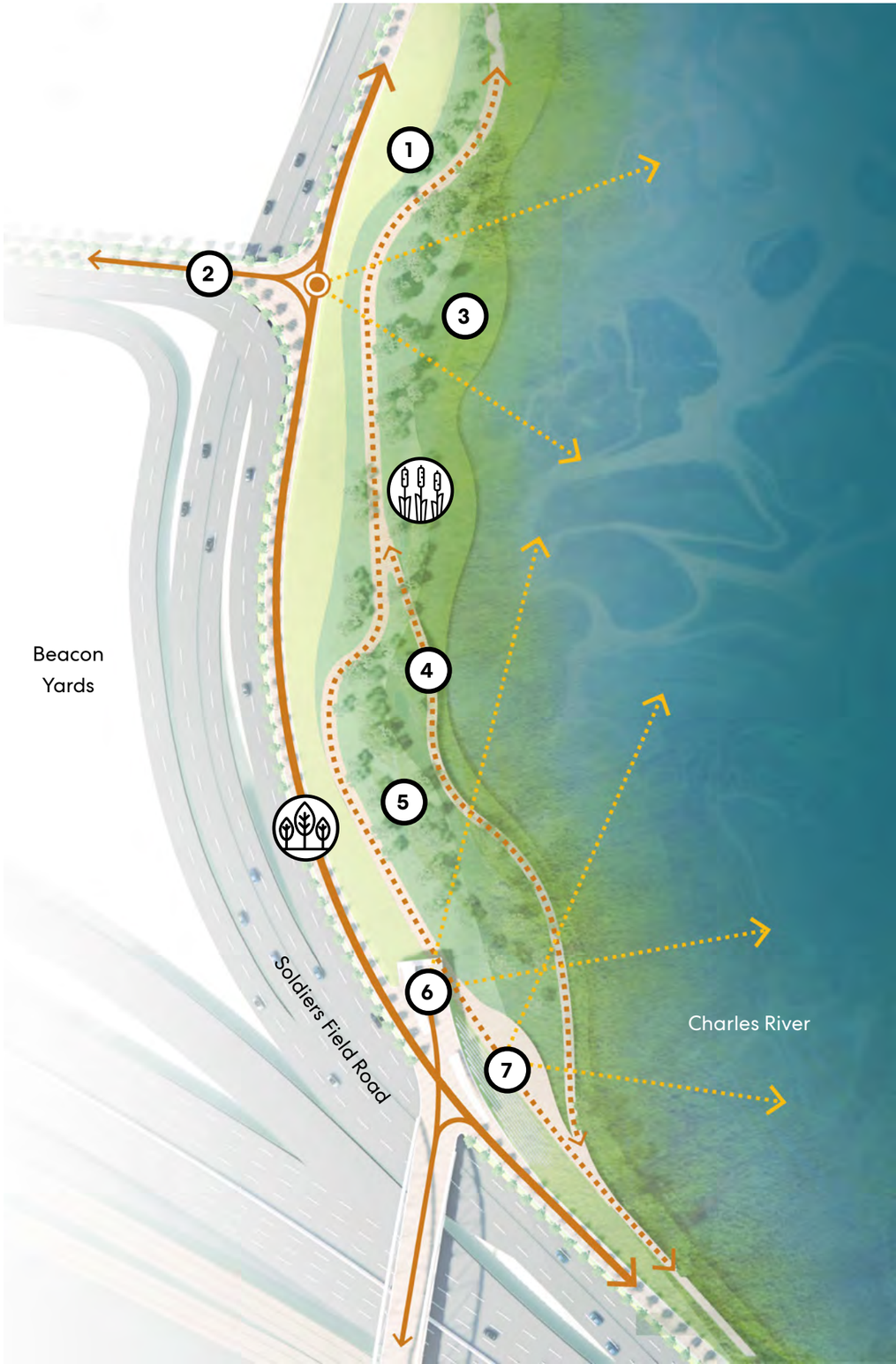


Green Retaining Wall

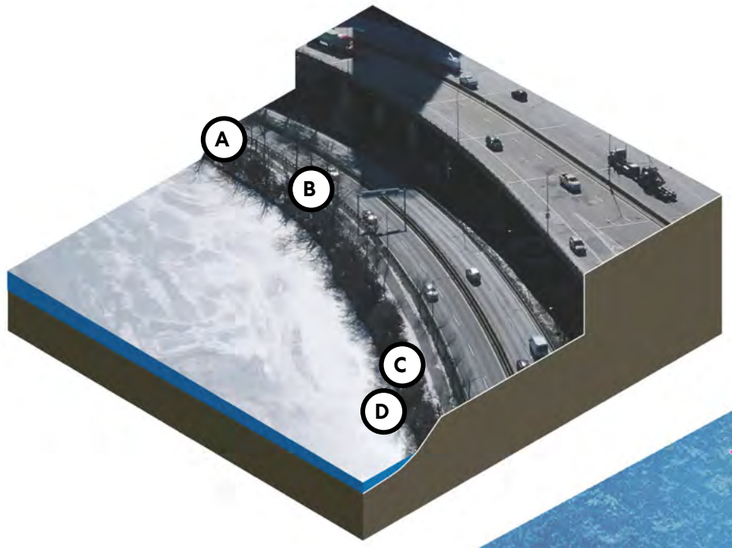


Wetlands

Resilient Embankments



Shifting Ecology and Resilient Infrastructure



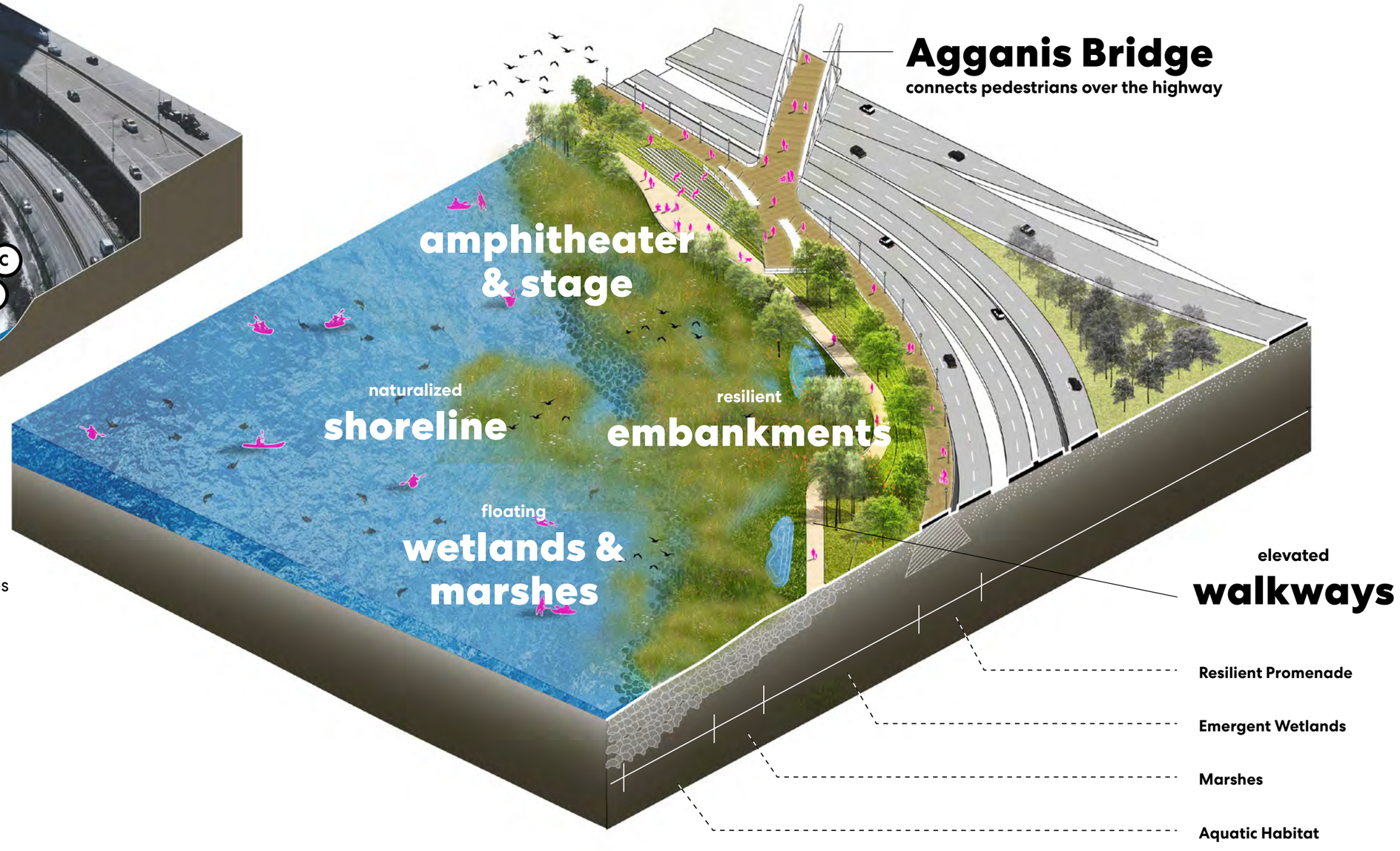
Existing

a. Steep slopes with overgrown and invasive planting

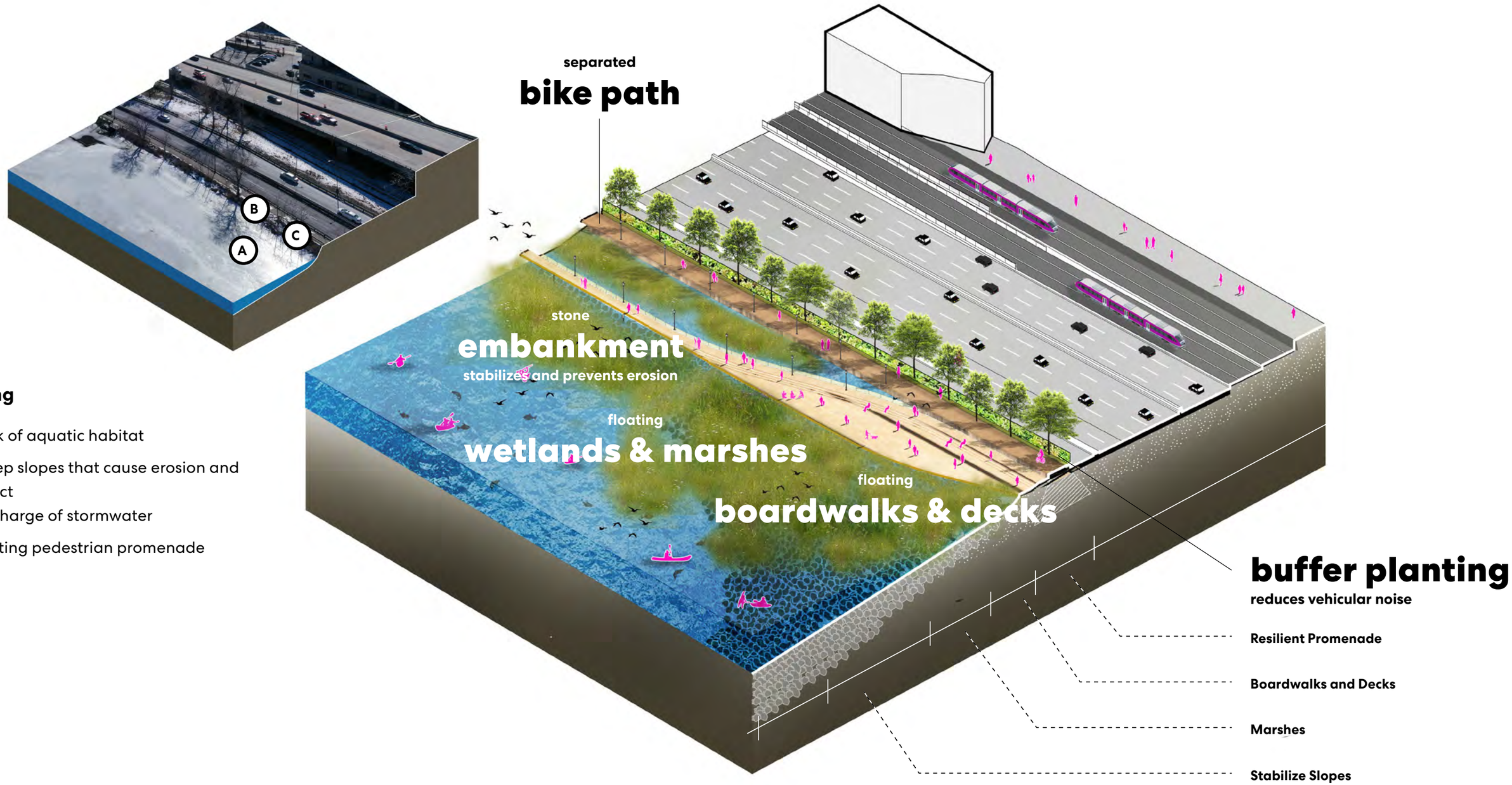
b. Existing narrow pedestrian path

c. Aging infrastructure an outfall structures

d. Majority of the watershed does not have any pre treatment of pollutants before being discharged in to the river



Experience the Charles



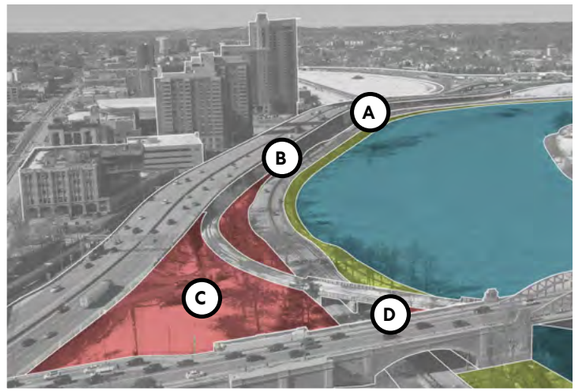
Existing

a. Lack of aquatic habitat

b. Steep slopes that cause erosion and direct
discharge of stormwater

c. Existing pedestrian promenade

An Accessible Riverfront for All



Existing

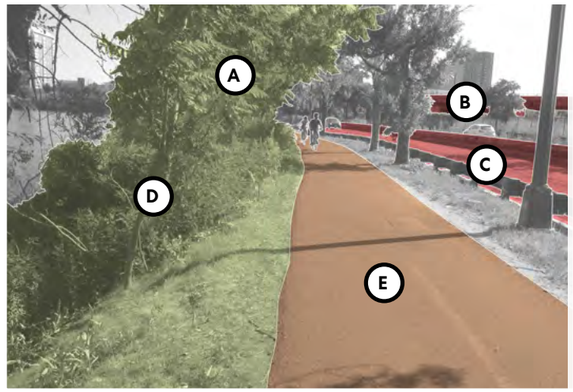
a. Lack of connectivity limits use of riverfront for cultural uses

b. Elevated road disconnects neighborhood

c. Overlapping infrastructure chokes parkland

d. Mutliple levels thwart connectivity between the elevated urban fabric and the river.

Shifting Ecology and Resilient Infrastructure



Existing

a. Invasive species dominate the river's edge.

b. I-90 viaduct severs adjacent neighborhoods from the river

c. Constricted by Soldiers Field Road

d. Overgrowth prohibits waterfront access

e. Narrow 10' bi-directional pathway

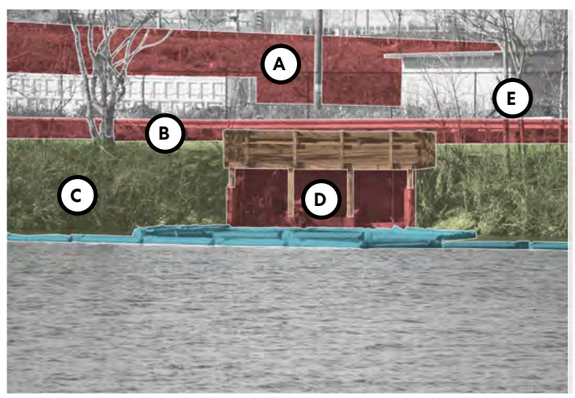
restore the
aquatic habitat

foster an
urban habitat

create social and cultural
connections

eliminate direct discharge of
pollutants and improve
water quality

Resilient Park For All



Existing

a. Elevated highway dominates landscape

b. No buffer between pathways and road

c. Steep, unstable banks exacerbate erosion

d. Outfalls discharge untreated stormwater into the river

e. Invasive species crowd out native flora

raised embankment
to create a resilient park

pedestrian bridge
connecting
park to Allston neighborhood

floodable
open spaces

pre-treatment facilities to
purify stormwater
and remove pollutants

natural and planted shoreline to
stabilize edge