



**Massachusetts Bay  
Transportation Authority**

---

# **Resiliency Program Review**

**FMCB Meeting Presentation  
June 10, 2019**

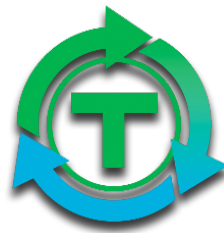


## MBTA Strategic Plan and Resiliency Policy Directive

---

- **2017 MBTA Fiscal and Management Control Board (FMCB) Strategic Plan**
  - › Prioritizes environmental stewardship and climate resiliency
- **Governor Baker's Executive Order 569**
  - › Calls on all state agencies to build on resiliency efforts already in progress





## Developing a Climate Resiliency-Driven Organization

---

- **Expand and codify resiliency programs and policies to formally establish an Authority-wide commitment** to meet the requirements set forth in the FMCB Strategic Plan & EO 569 and build on resiliency efforts already in progress at the MBTA.
  - › Seek to understand vulnerabilities within the MBTA system—and then identify common-sense resiliency measures to reduce such vulnerabilities.
  - › Minimize service disruptions, ensure reliable public transportation to support community needs and the regional economy, and protect taxpayer investments.
- **Key Principles**
  - › Integrate cost-effective climate change adaptation planning, implementation, and reporting into all operations, financial planning, and key agency functions.
  - › Embed resiliency into capital programs by incorporating future projections for extreme weather and climate risk into all project development.
  - › Develop and use climate risk vulnerability assessments to identify critical locations in the transit system.



## Authority-Wide Vulnerability Assessment

---

- Completed the *MBTA Vulnerability Assessment Report* in 2017, a high-level assessment looking at the system and its functions as a whole
- Established an approach for developing future vulnerability assessments with a focus on:
  - **Exposure** -- whether an asset will experience any impact from a climate event, based on location and duration of the event
  - **Sensitivity** -- whether that asset, *if exposed to a stressor*, will be impacted in some significant way
  - **Adaptive Capacity** -- the ability of a sensitive asset to react to or recover from exposure or the criticality of the asset to help the system recover
- Overall Findings highlighted the type of climate stressors we can expect and the overall vulnerability of the Blue Line.



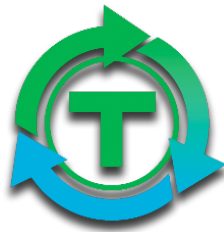


## Transportation Vulnerabilities to Weather and Climate

### Examples of Climate Stressors:

- ***Sea level rise, storm surge, & flooding***
  - Inaccessible facilities
  - Structural damage
  - Long-term impacts from exposure to seawater
- ***Extreme winter storms***
  - Inaccessible facilities and track
  - Ice damage to equipment
  - Vehicle failure, brittle rail, frost heaves in track bed, broken pavement from ice expansion
- ***Extreme heat***
  - Buckled rail
  - Equipment/vehicle overheating
  - Regional brownouts
  - Employee & customer health and safety
- ***Extreme wind***
  - Downed trees
  - Downed catenary
  - Damage to roofs or structures



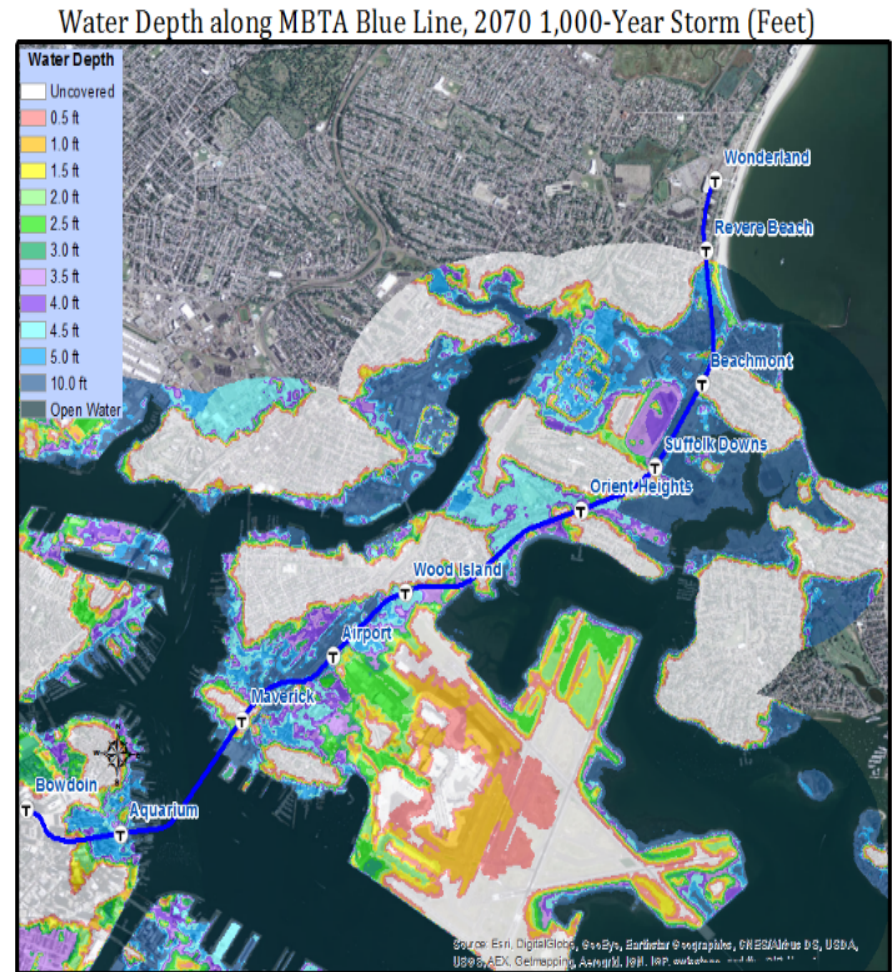


## Next Level Down Vulnerability Assessment -- Blue Line

Most stations on Blue Line could be exposed to flooding by 2070; precipitation-driven or storm surge flooding is plausible at some locations even now.

## Most Consequential Vulnerability:

- Flooding at Aquarium Station
- Flooding at Orient Heights Maintenance Facility from Belle Isle Marsh
- Salt water corrosion to rail, switches, signals, cables







## Further Assessment of Aquarium Station

### **Extensive assessment of all of the above- and below-ground points of entrance for water:**

- Headhouse on Atlantic Avenue
- Portal at Maverick
- Ventilation Shafts, Emergency Egress Structures
- Conduits, manholes, utilities, gravel and ballast below headhouse, *etc.*

### **Developed a series of possible mitigation approaches:**

- Policy and administrative approaches
- Relocate vulnerable infrastructure from impact zone
- Protect the infrastructure via engineering or operational improvements
- Accommodate the infrastructure while reducing the flooding consequences





## Further Assessment of Orient Heights Maintenance Facility

Facility is vulnerable to flooding by 2030 and worsening as we approach 2070. Some flooding is possible in the near term.

### **Critical assets at the facility most likely impacted by storm events:**

- Electrical Equipment (substation, generator, power feeds and disconnects, *etc.*)
- Blue Line Fleet in the facility and in the yard
- Signal bungalow and control systems
- Other associated components for security, fire control, maintenance equipment, *etc.*

### **Recovery of the facility can be fairly short if we protect the critical components considered most at risk:**

- Elevate equipment by an additional 36" to 48"
- Establish operational protocols for moving vehicles as part of emergency preparedness





## Further Assessments to Be Completed

---

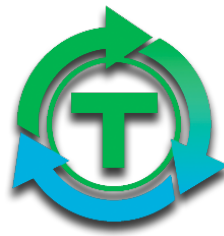
### **Additional Vulnerabilities Underway**

- Systemwide inventory and assessment of all pumping systems
  - » Identify capacity and condition/reliability
  - » Overlay with regional predictive flood mapping to see where pumps need to be upgraded, increased, or replaced

### **Additional Vulnerability Assessments to Be Performed**

- Red, Orange, and Green Lines
- Bus maintenance facilities
- System-wide power, signals, and communications
- Commuter Rail system with focus on maintenance facilities and layovers

Keolis is currently performing assessments of rights of way to look at culvert and stream crossings to assess impacts to rights of way and bridges.



## Major Stakeholders

---

- **Neighborhood of Affordable Housing (NOAH)**

- ClimateCARE program—Kresge Foundation-funded project in East Boston
- MBTA actively participating in working group assessing East Boston Vulnerabilities



- **MassDOT**

- Central Artery Tunnel
- Expanded coastal study
- Statewide, interior impacts from heavy precipitation and extreme heat



- **Climate Ready Boston**

- Ongoing MBTA participation
- Explore district-scale solutions



- **Metro Boston Climate Preparedness Taskforce**

- **Other Municipalities and NGOs working on Resiliency Issues**



Coordination with these stakeholders allows the MBTA to have access to best available climate data as well as information on other resiliency projects or plans occurring nearby.





## **Integrate Resiliency into Project Development and Asset Management**

---

Develop risk assessments for infrastructure projects in development in order to build resiliency into “non-resiliency” projects.

- Consider weather and future climate resiliency in all Capital Delivery projects. Required elements for design projects at 30% stage. Account for the lifespan of the project and how climate stressors are expected to change/increase over the lifetime.
- Identify resiliency measures to minimize vulnerability.
  - › Elevated footprint, flood barriers, materials that can withstand increased exposure to high temperatures and flooding, *etc.*

Incorporate weather and climate vulnerabilities into Transit Asset Management system.



## Integrate Resiliency in the Capital Plan

---

Identify high-need and/or cost-effective resiliency efforts so that they can be prioritized into the CIP.

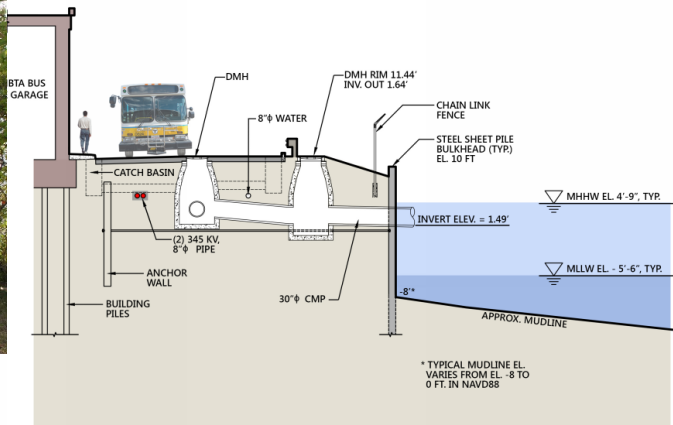
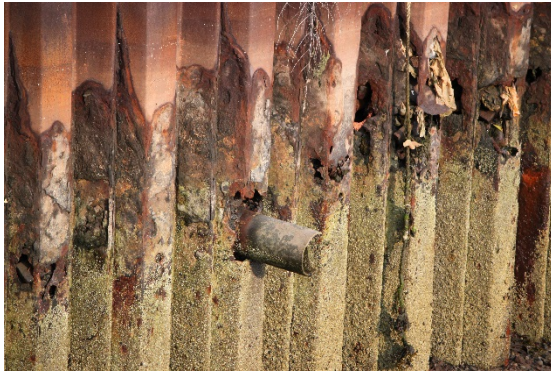
- Resiliency is currently one of the criteria for new capital projects.
- Work to build a more comprehensive, transparent, and data-driven approach to measuring the climate efficacy of a possible project.
- Recent planning effort through Harvard Kennedy School program:
  - › Developed the foundation of a “calculator” that would allow us to measure the economic, social, and environmental costs and benefits of a resiliency project.
  - › When fully developed, this can be used to compare one type of resiliency project to another.





## FTA Resiliency Grant: Charlestown Bus Garage and Somerville Engineering Rail Yard

### Current Site Conditions



EXISTING CONDITIONS SECTION @ BUS STORAGE GARAGE (TYP)

ALFORD STREET MBTA BUS STORAGE GARAGE

SCALE: NTS





## FTA Resiliency Grant: Charlestown Bus Garage and Somerville Engineering Rail Yard





## FTA Resiliency Grant: Fenway Portal

- Fenway Portal on the D Line flooded in Oct 1996 via Muddy River storm with ~7" of rain over 48 hours.
  - › Resulted in Green Line flooding from Kenmore Station to Arlington Station
- **Existing protection:**
  - › Timber logs and Sandbags
  - › Manual reading of changes in river elevation







## FTA Resiliency Grant: Fenway Portal

MBTA received a \$21 Million FTA competitive grant to improve flood protection.

### Solutions:

- Hinged gate at the top of the slope leading to portal
- Improve pumping and drainage capacity
- Improve communications system

Coordinating with separate DCR/USACE project to restore surface Muddy River flow and help prevent future flooding

