Ophelia After-Action Report

Service Response & Resilience Planning

October 2023

Storm Response – Lessons from Ida

Record-setting flash flooding event (as opposed to a coastal storm like Sandy)

Through internal efforts and Board Working Group, MTA acted on **key lessons learned, including**:

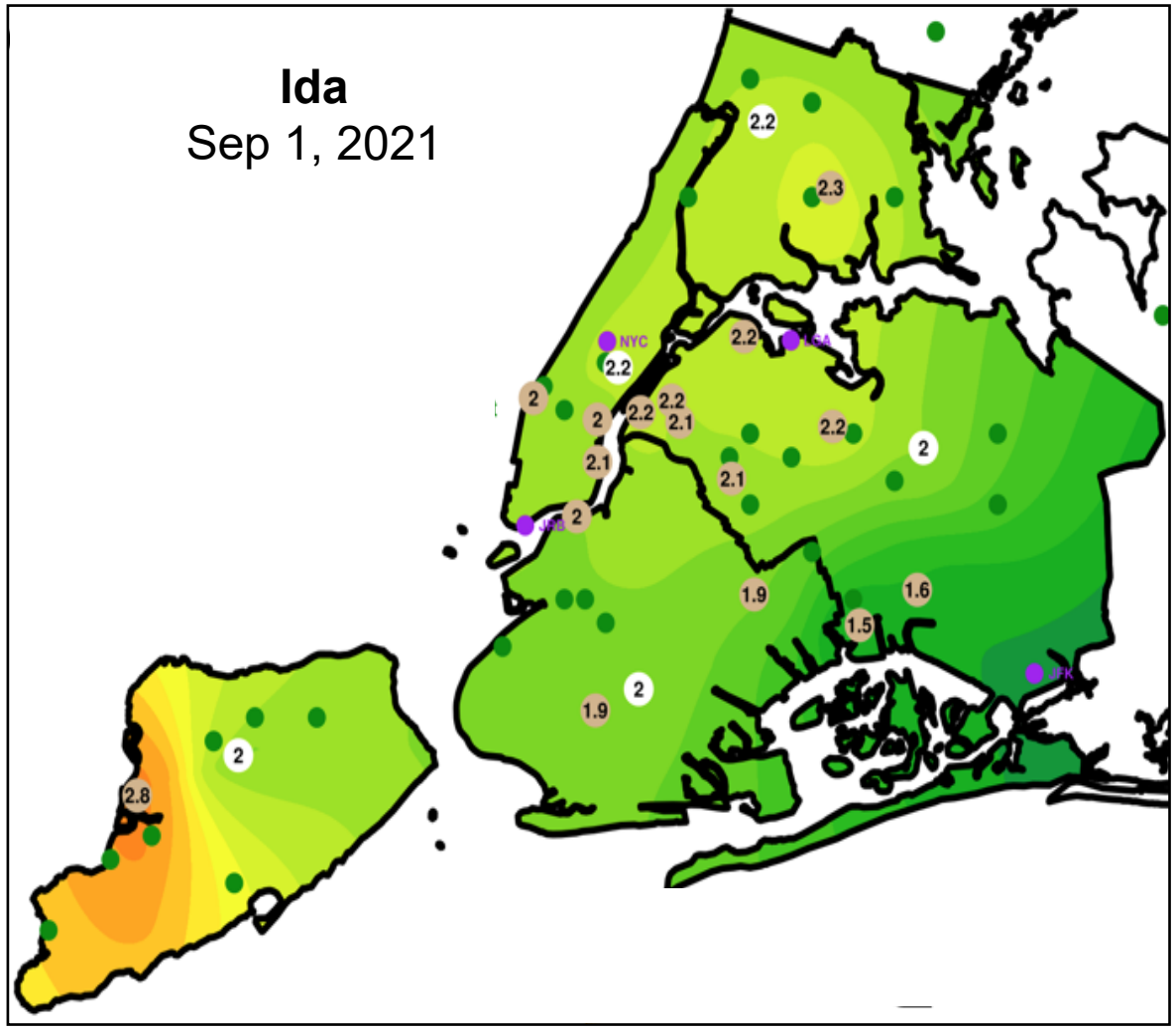
- Surveyed and identified key locations to harden with raised curbs and air vent covers
- Increased coordination with NYC to improve drainage
- Identified problem stations for positioning of pumps

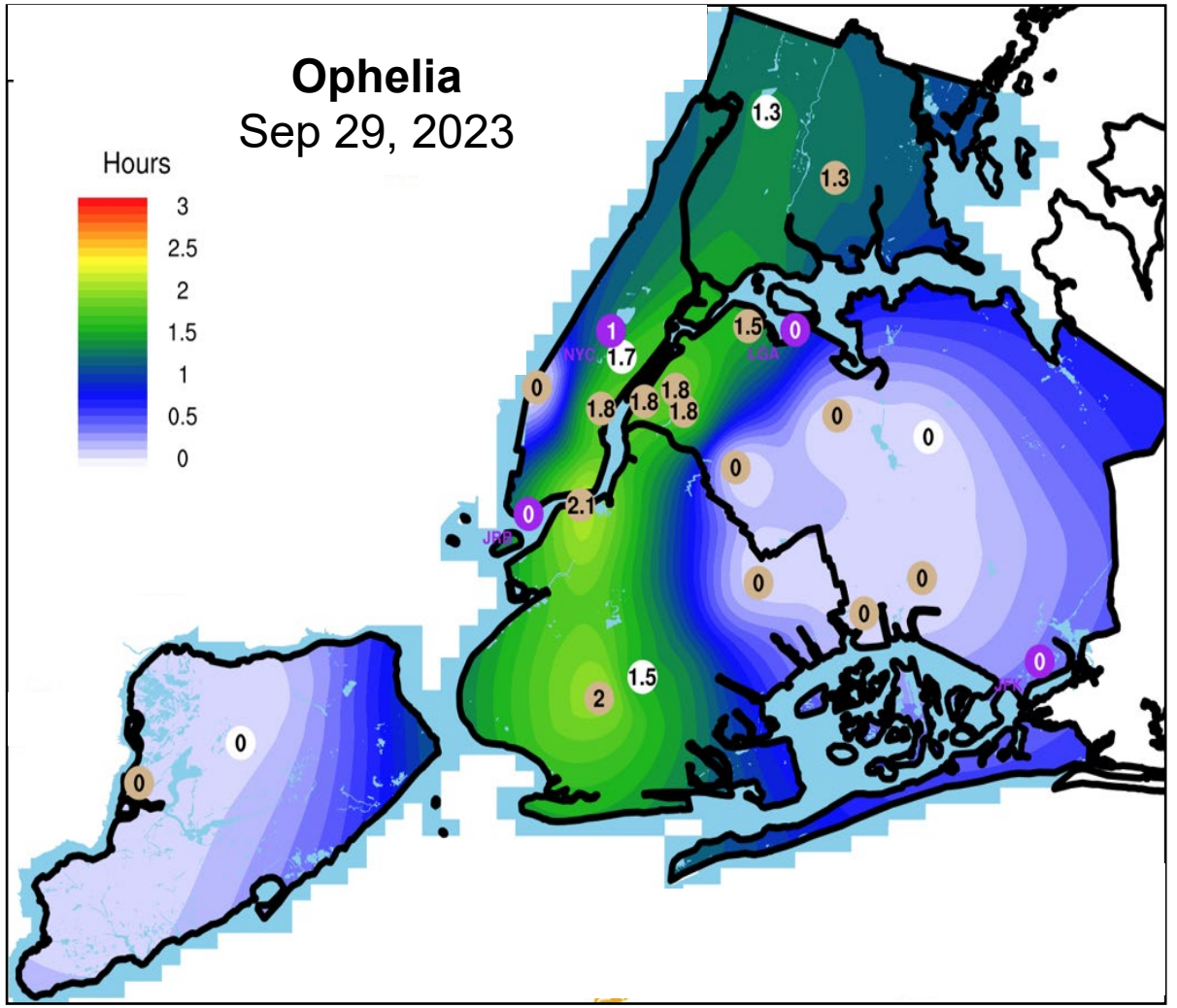
Improvements following Ida reduced damages and return MTA system to full operation increasingly faster.

Ida had massive impacts at street level…

And within our system

Ida versus Ophelia





Hours in exceedance of sewer capacity of 1.75”/hour
Source: NYS Mesonet, University at Albany

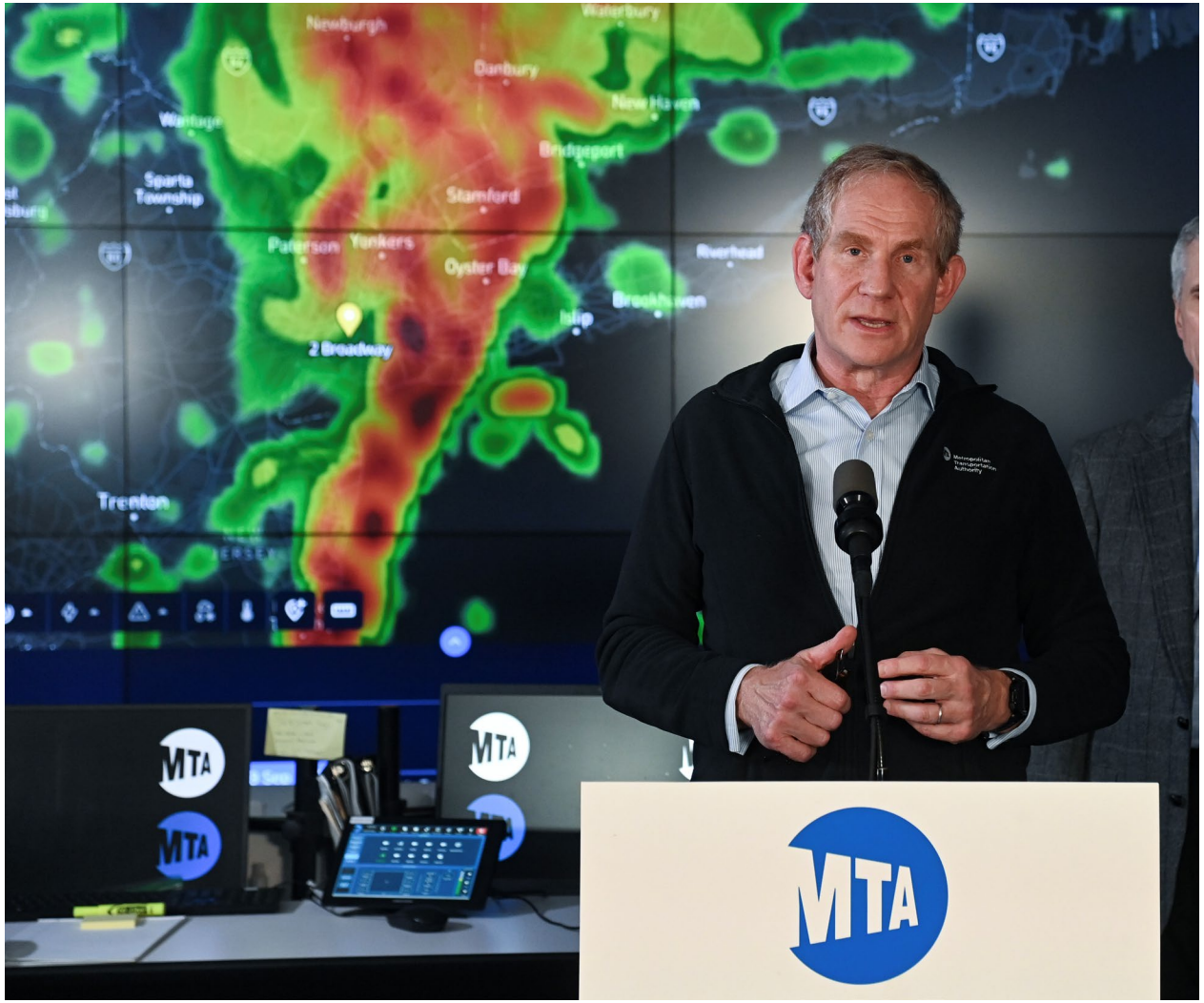
Systemwide Operational Preparation

Thursday: Meteorologists identify fast developing storm that will significantly affect NYC.

- **MTA Emergency Management activates Incident Management System**
  - Establishes communications with City and State

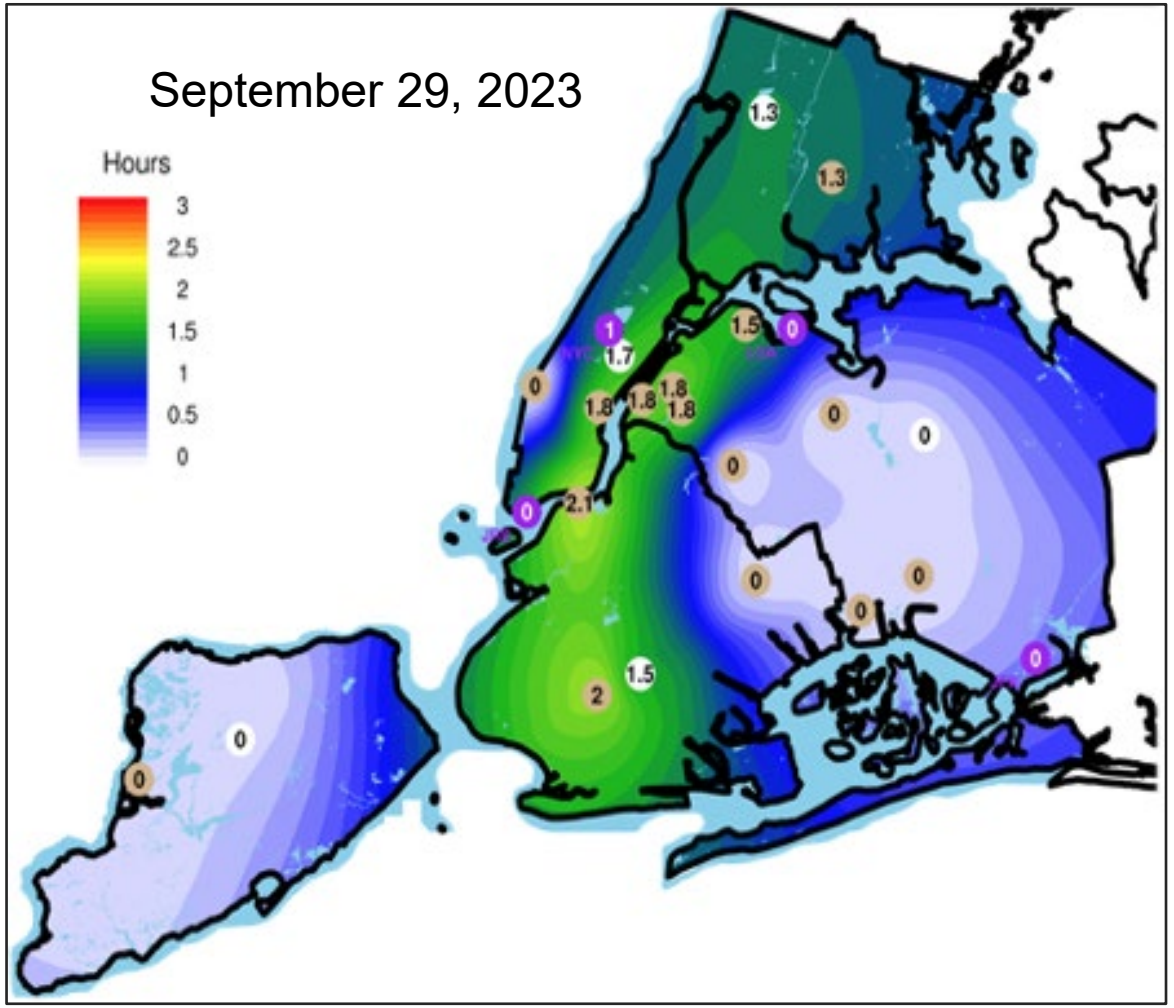
- **Operating Agencies initiate storm prep**
  - Position crews, pumps, equipment.
  - Check/clear drains
  - Covered key vents

- **MTA briefed the public**



Chair Lieber briefs the media in advance of Ophelia

Ophelia



Hours in exceedance of sewer capacity of 1.75”/hour
Source: NYS Mesonet, University at Albany

2:00AM: Intermittent light rain

8:00AM: Heavy rain begins with peak rates of 2”/hour near Coney Island, coinciding with a rising full moon high tide, likely inducing compound flooding, combined sewer overflows and backflows.

9:00AM: Peak rainfall rates in central/northern Brooklyn recorded just over 3”/hr. – *Exceeds NYC’s drainage capacity of 1.75”/hr*

10:00AM: Heavy rains impact nearly all of Manhattan, the Bronx, eastern Queens and Nassau with peak rates exceeding 1.5”/hour. Heavy rain continues through 11AM.

Historically, a storm of this magnitude is 1% (100-year) annual chance

New York City Transit Impacts

Heavy rain caused flooding at 45 stations and 8 yards, concentrated in Brooklyn, Manhattan, and the Bronx

11 subway lines were either suspended or saw severe service disruptions

Flooding in the tunnels disrupted service

New York City Transit Impacts

Throughout the day, NYCT **pumped an additional 4 million gallons of water out of the subway system**; at the peak, NYCT pumped 228,000 gallons of water per hour out of the subway system

All divisions staged personnel at key locations to **monitor and respond to flooding conditions**, taking actions including:

- Inspecting and clearing drains in flood prone locations
- Staging emergency trucks and emergency response equipment at key locations
- Resetting 117 switches and 120 signals affected

Crews respond to flooded tunnels on the Crosstown G line

New York City Transit Service Restoration

By the evening rush hour, most service had been restored. Despite the disruptions, preliminary numbers show that 45% of trips ran on time on Friday

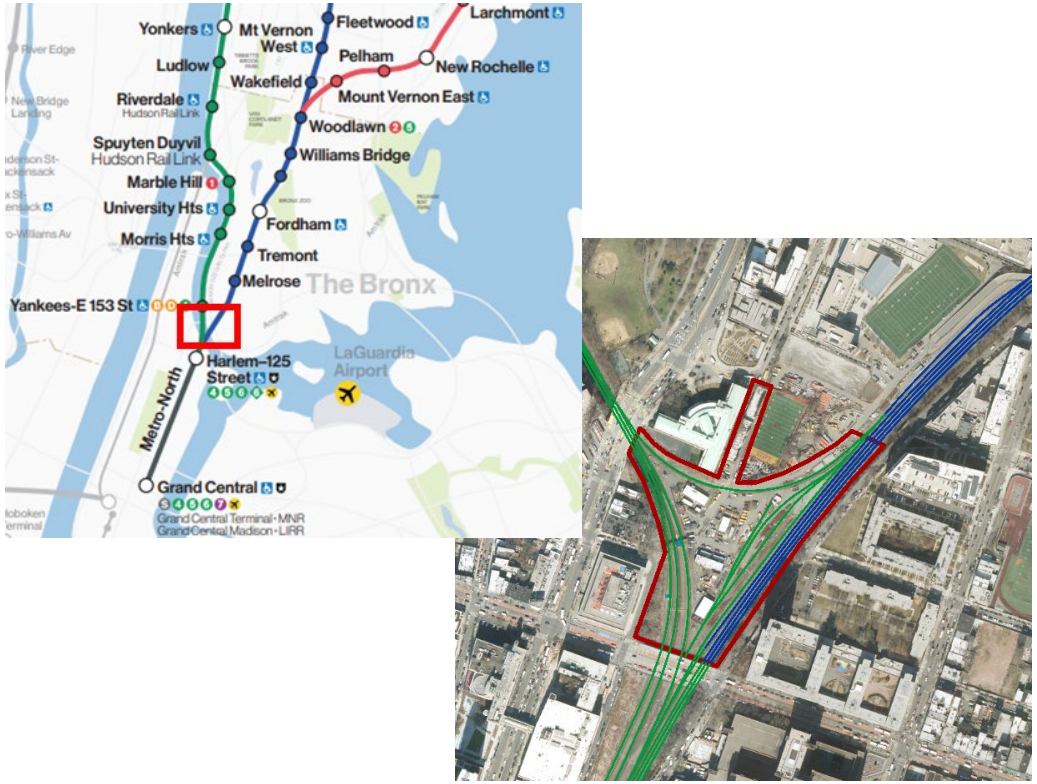
By Saturday morning, all service had been restored.

Bus service helped fill in gaps to get New Yorkers home.

Service on the F as the system recovered

Metro-North Impacts

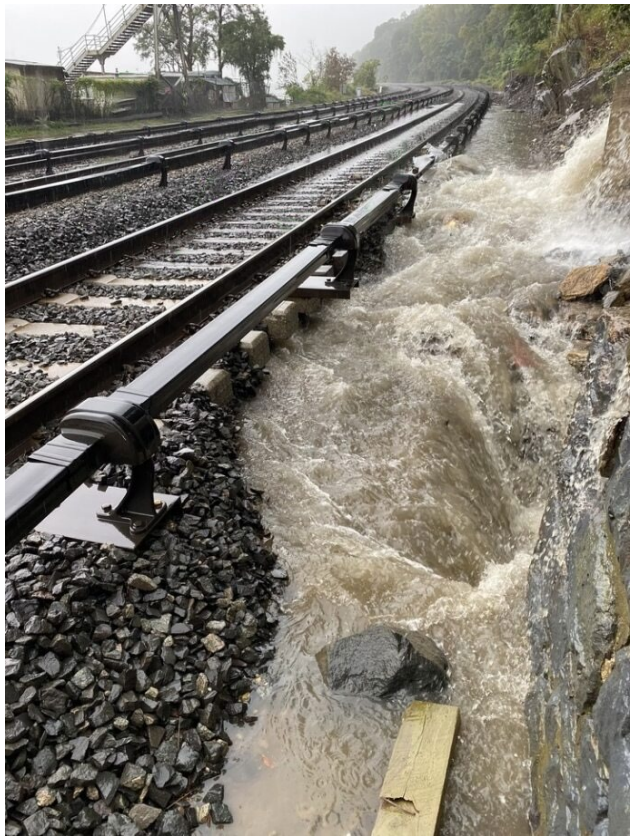
Heavy rain in the south Bronx inundated the Mott Haven Yard, **impacting all east of Hudson service**



All tracks through Mott Haven Yard were submerged

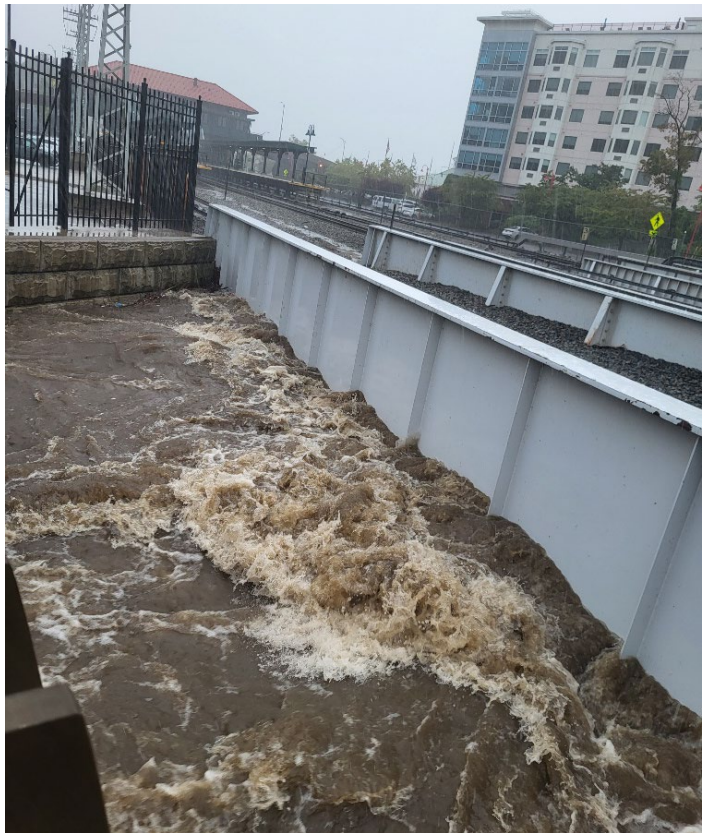
Metro-North Impacts

On the Harlem and Hudson lines north of New York City, **high water conditions also impacted service**



Between Glenwood & Greystone

Crews repairing destroyed signal box



Ossining Station on the Hudson Line

Metro-North Impacts

Lakeview Ave

Near Valhalla Station

Metro-North Service Restoration

Throughout the day and through the night, Metro-North Maintenance of Way teams worked to address all of the trouble areas throughout the system.

Around 9 AM, service was shutdown on all three lines to Grand Central Terminal

By 4:30PM, hourly service had been restored from Grand Central Terminal on the Hudson and New Haven Lines

By 6:00PM, hourly service had been restored from Grand Central Terminal to North White Plains. A bus bridge was provided between North White Plains and Mount Kisco.

Nearly 400 trains were impacted by this incident.

Grand Central Terminal on Saturday morning after the storm

Metro-North – Less than a month later…

On **Saturday, October 21st**, heavy rains compounded already saturated ground conditions, resulting in the collapse of a private property owner's embankment and wall, covering the entire 4-track segment of the Hudson Line near Scarborough

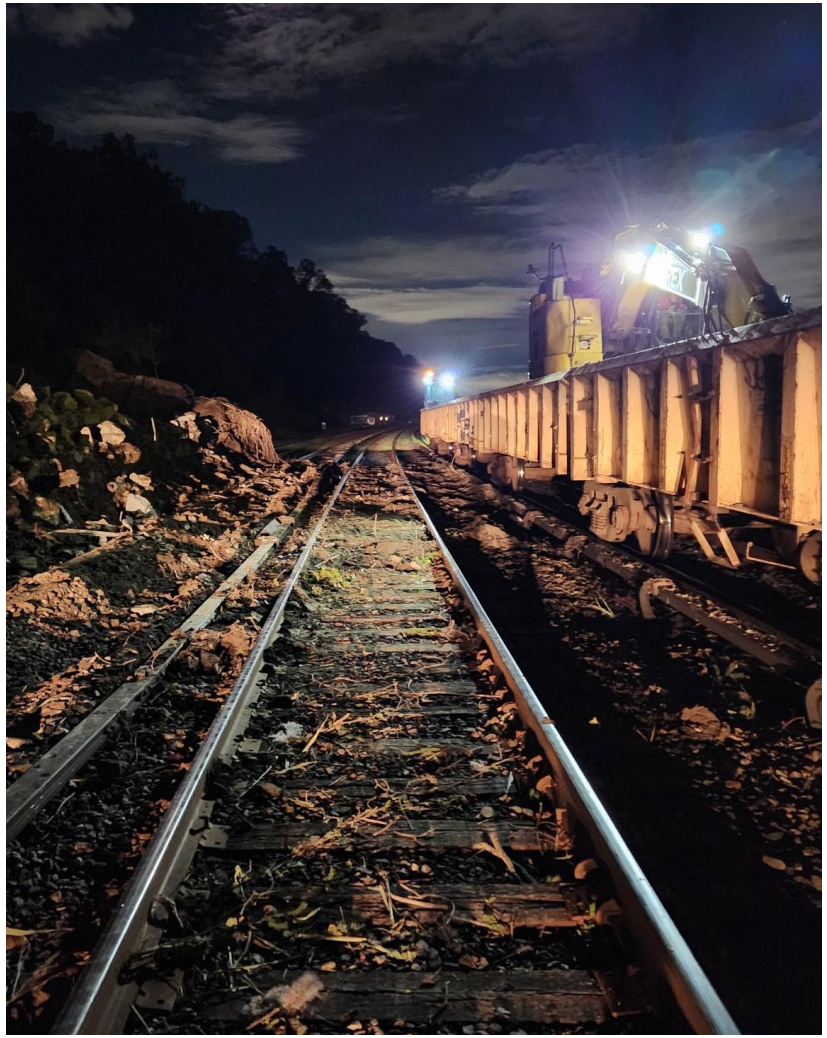
First reported at 9:45AM, crews worked around the clock to safely clear the tracks and rebuild infrastructure

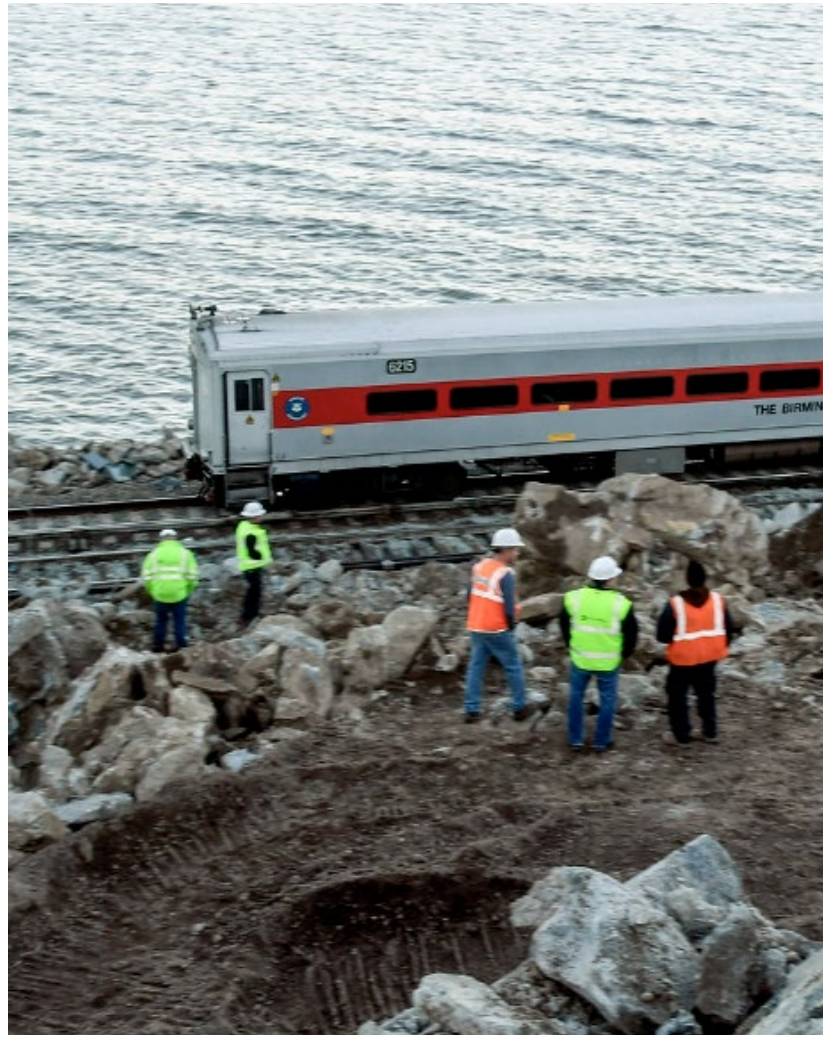
By 4:30AM on Monday, two tracks were returned to service restoring near normal service

Recovery efforts remain on-going to restore to service the remaining two most damaged tracks

The immediate aftermath of the retaining wall failure

Metro-North – Hudson Line, Scarborough





Crews worked around the clock to clear debris, repair damage, and restore service

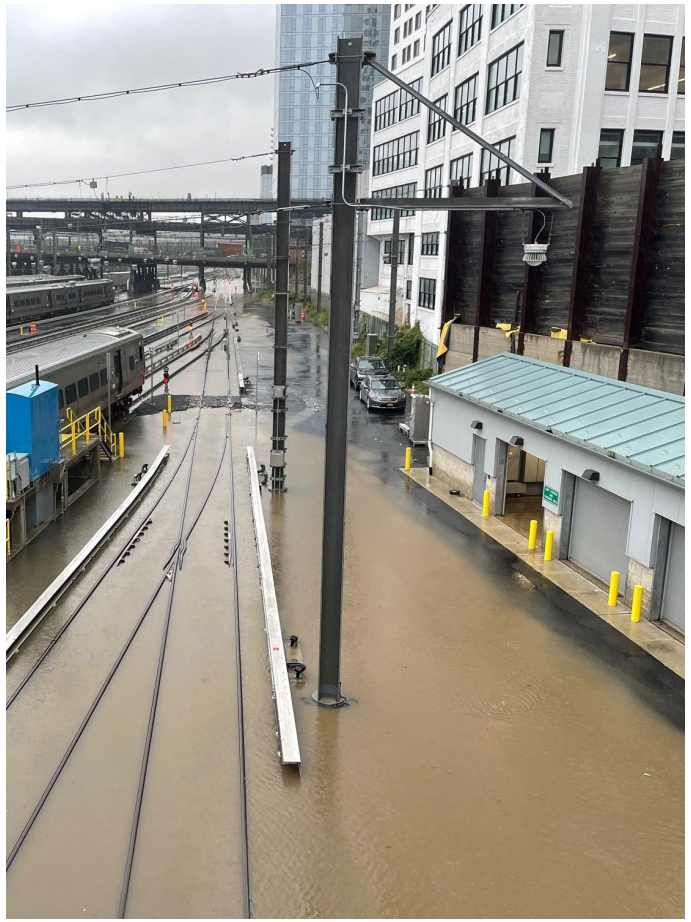
Long Island Rail Road Impacts

Heavy rain caused flooding at key revenue and non-revenue LIRR facilities

Flooding at the entrance of Line 2 **resulted in the tunnel being shut down to train service**

Parts of the Far Rockaway and Long Beach branches were suspended

Multiple tracks in Midday Storage Yard experienced flooding, limiting operational capacity and requiring trains to be re-located



Flooding at the Midday Storage Yard

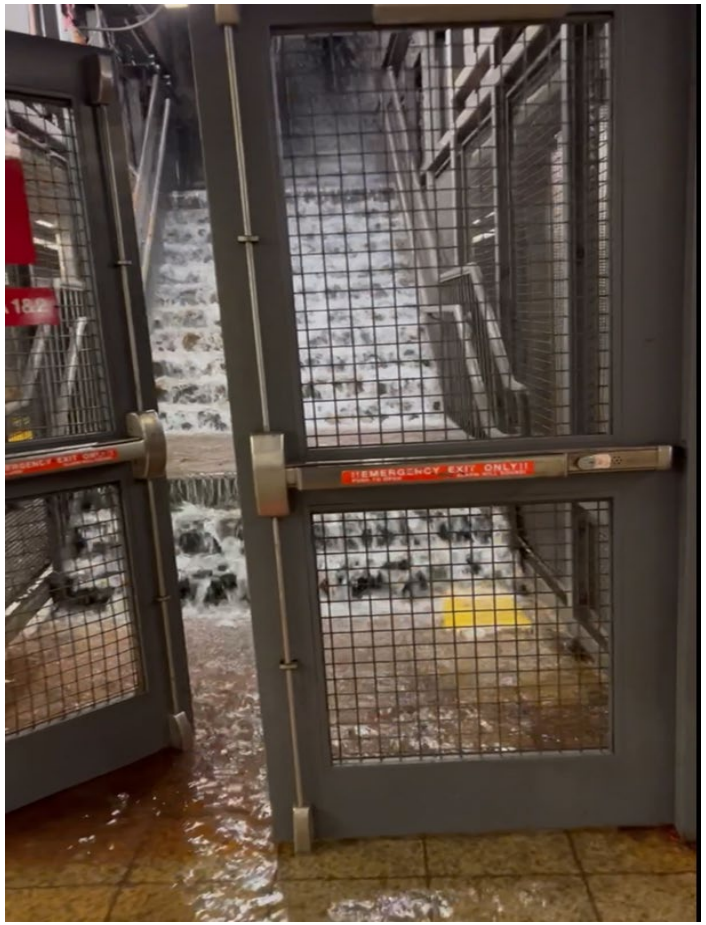
Inundated tracks on the Long Beach Branch at Oceanside

Long Island Rail Road Impacts

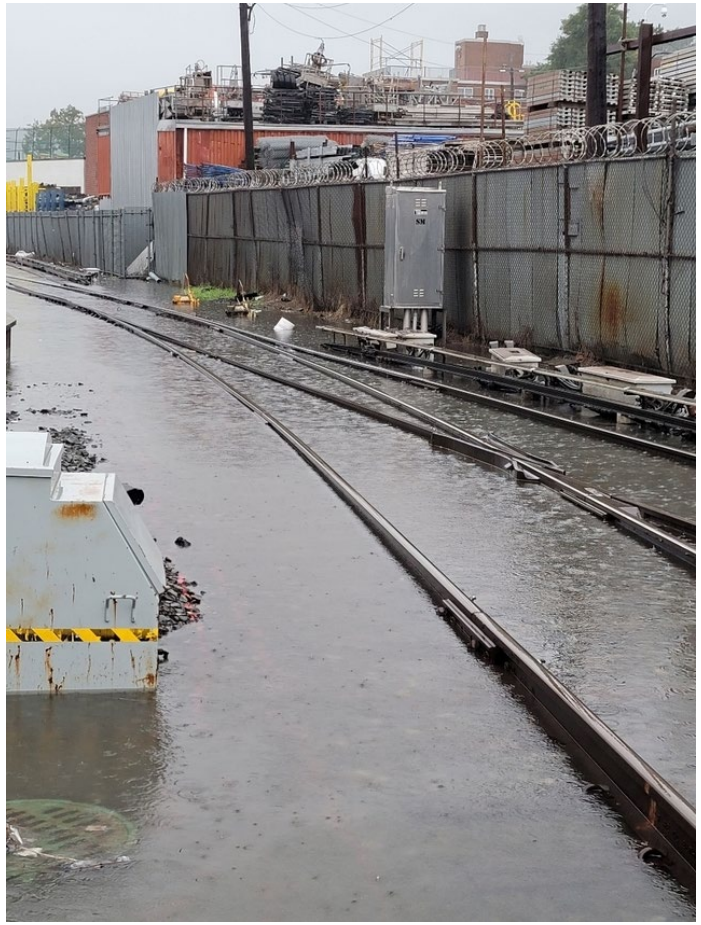
Throughout the day, LIRR operated a virtual Incident Command Center to **monitor flooding and direct the response**

As water receded, **equipment like substations, switches, signals, and track circuits were tested and returned to service**

Additional lessons learned are being evaluated



Water streams down emergency egress stairs at Atlantic Terminal



Flooding at Far Rockaway impacting access to Station and Yard

Long Island Rail Road – Service Restoration

By 10:00PM, service on the Far Rockaway & Long Beach Branches was restored

By 4:00PM Saturday, the Mid-Day Storage Yard was back to full capacity

On-time Performance was still 86.5%, with 43% of delays associated with the Long Beach and Far Rockaway branches

Penn Station Saturday after the storm

Bridges & Tunnels Impact & Restoration

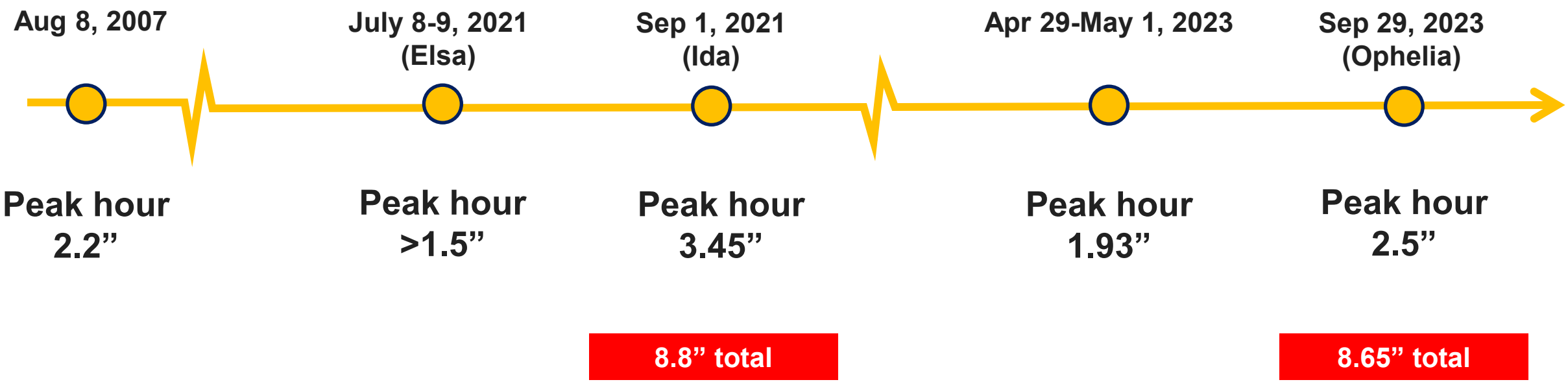
At B&T facilities, off-property flooding impacted traffic, especially on highways and ramps connected to the Verrazzano Narrows, RFK, and Throgs Neck Bridges and Hugh L. Carey Tunnel

Having been placed on alert in advance of the storm, emergency response was deployed, responding to stranded MTA Buses on Randall's Island, helping ConEd restore power to the Throgs Neck Bridge, and clearing debris and stranded vehicles from off-property locations

By the evening rush, normal operations had resumed

Cross-Island Parkway ramp to the Throgs Neck Bridge

Recent torrential rainfall events



Stormwater flood causes

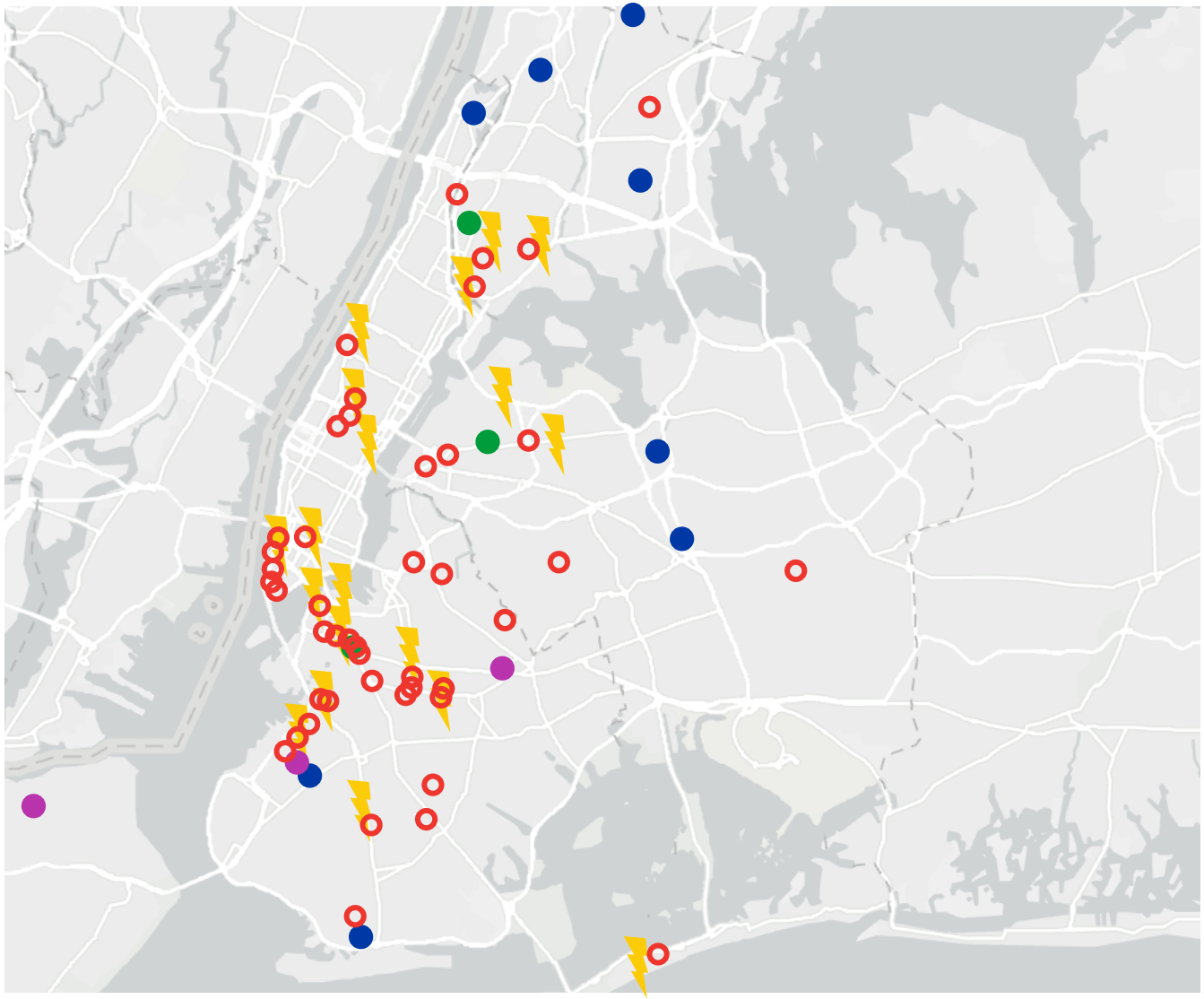
Undersized direct connections

Clogged catch basins & siphons

Insufficient sidewalk curbs

Overloaded drainage and pumping infrastructure

Ophelia stormwater flood impacts in NYC

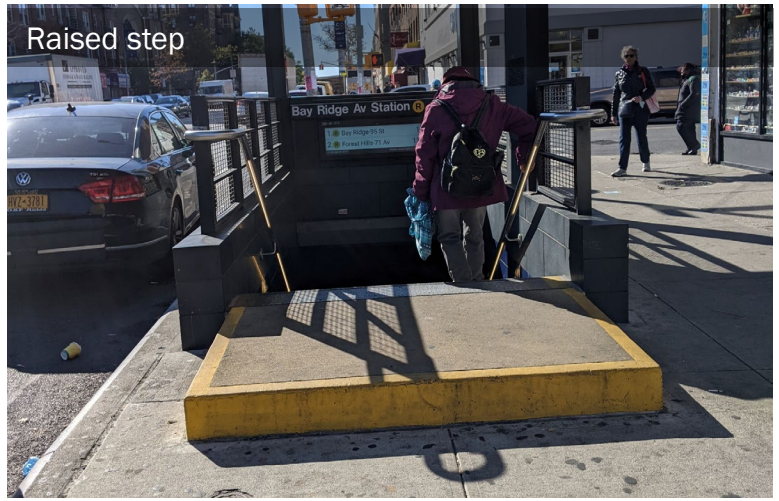


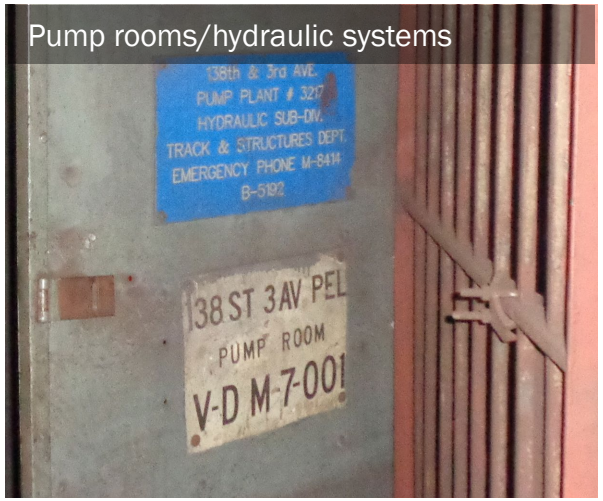
- **45** subway stations with disrupted service*
  - Location of potential subway flooding source
- **8** subway yards
- **3** bus depots
- **2** commuter railroad yards

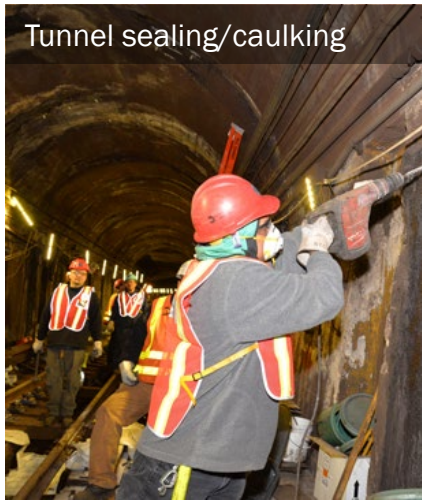
*From DOS Service Delivery reports and Emergency Management data as of 10/19

Stormwater flood protections

Within subway stations and rights-of-way



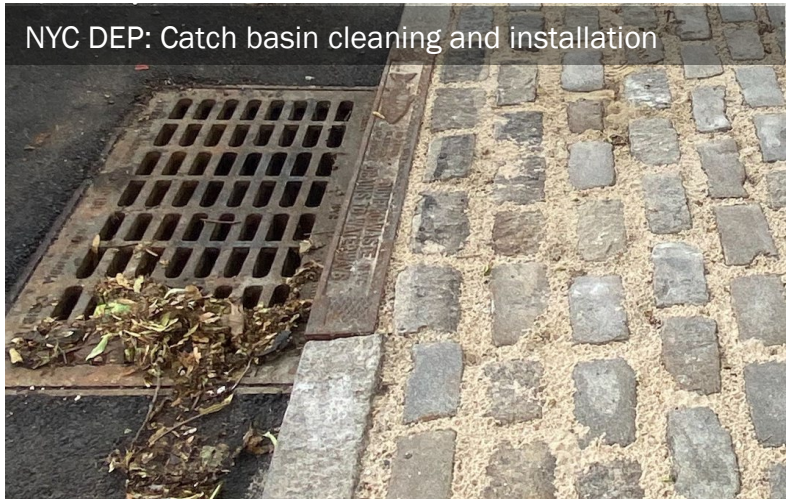




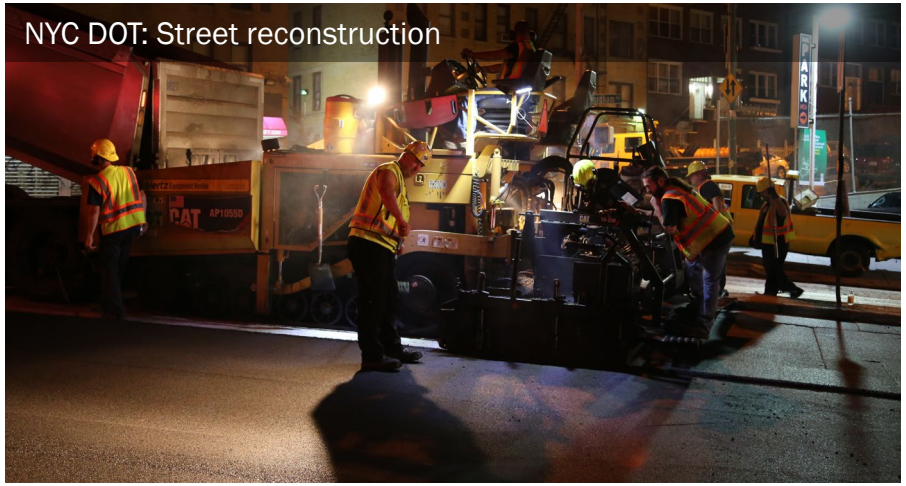
Stormwater flood protections

NYC DOT and NYC DEP interventions


NYC DOT: Selective milling

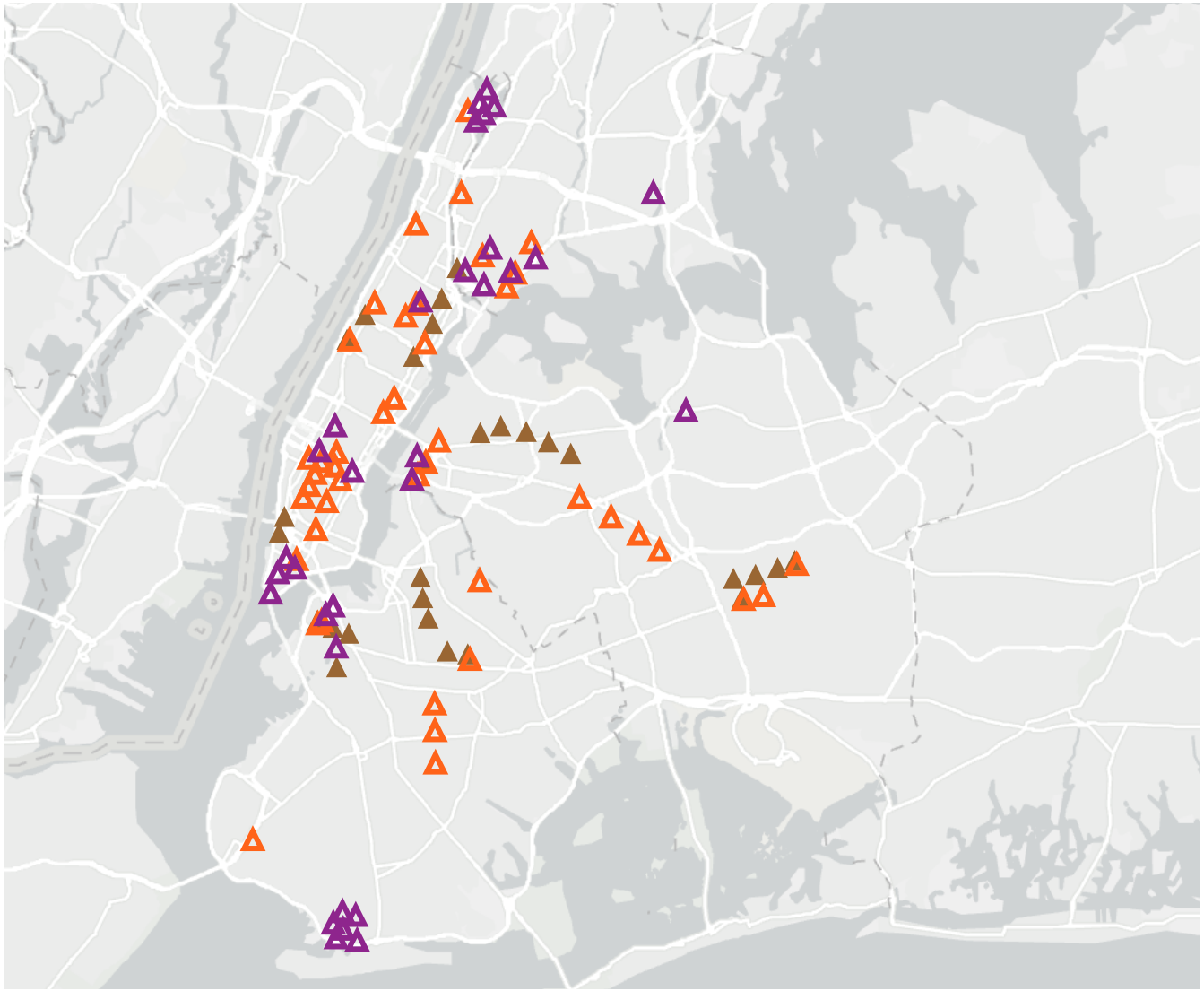

NYC DEP: Catch basin cleaning and installation


NYC DEP: Areawide drainage capacity upgrades


NYC DOT: Street reconstruction


NYC DEP: Sewer and siphon cleaning

Status of stormwater flood protections



▲ Completed

28 station stormwater protections installed
7 reported flooding on Sep 29

Before Sep 29, DEP cleaned **16 catch basins** near stations identified in Post-Ida Task Force
3 reported flooding on Sep 29

△ Underway

44 subway stormwater protections identified by Post-Ida Task Force

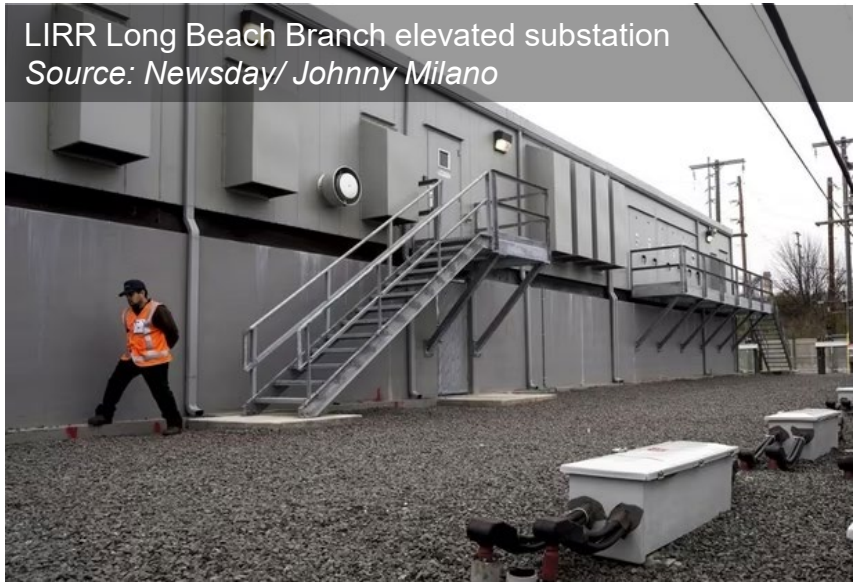
△ Future focus (example)

32 subway pump rooms identified for future capital investment serve **20 locations** impacted by one or more recent rainfall events

Coastal protections can also help during torrential rainfall

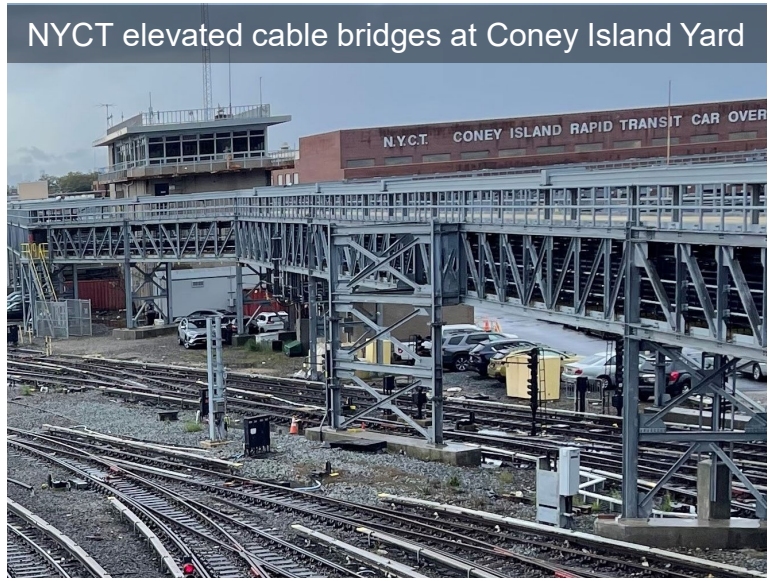
Resilient design

LIRR Long Beach Branch elevated substation
Source: Newsday/ Johnny Milano



MNR Hudson Line signal case on elevated platform

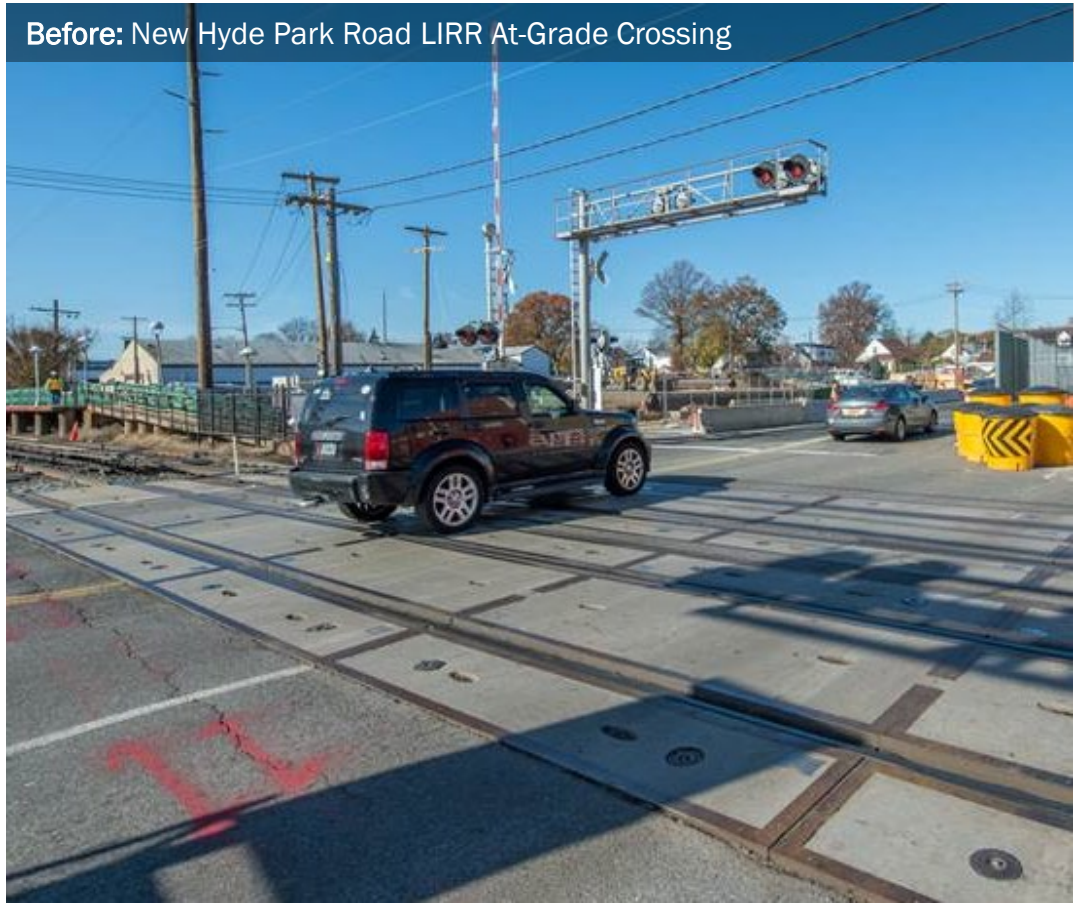
NYCT elevated cable bridges at Coney Island Yard



Stormwater flood protections

Resilient design

Before: New Hyde Park Road LIRR At-Grade Crossing



After: New Hyde Park Road Grade-separated LIRR Underpass

Actions to reduce stormwater flood risks

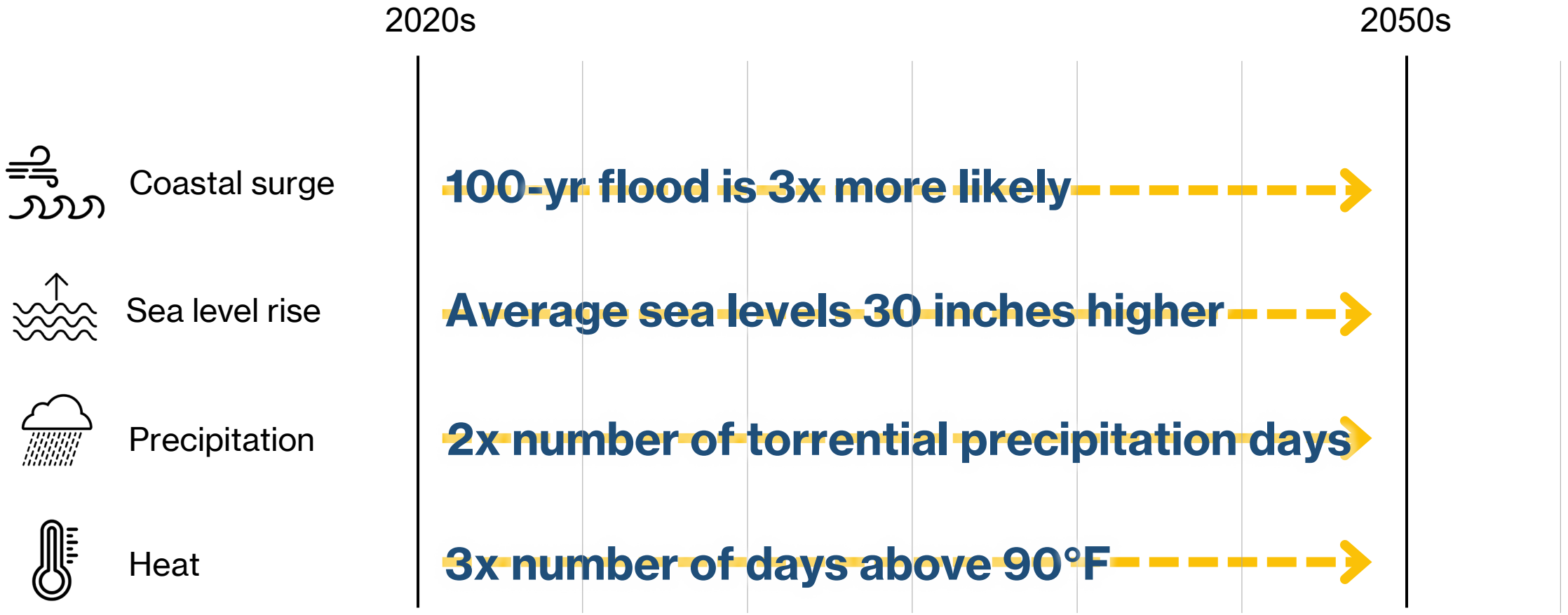
We will prioritize actions that reduce service impacts.

In NYC alone, recent torrential rainfall events indicate **88 subway stations, 8 subway yards, 4 bus depots, and 2 commuter railroad yards** have stormwater vulnerabilities.

Actions include:

1. **Targeted interventions** to address immediate flooding risks
2. **Dedicated resilience projects** at key locations to reduce long-term risks
3. **Resilient design** strategies across entire portfolio
4. **Ongoing engagement with City,** including with the Flash Flood Task Force, to address neighborhood-wide vulnerabilities

New York's climate is changing...



Source: New York City Panel on Climate Change, 2019

2023-24 MTA Climate Action Milestones

1. **Climate Sustainability Framework – Apr 2023**
2. **Twenty Year Needs Assessment - Oct 2023**
   Including Climate Sustainability and Resilience
3. **Clean Construction Program – Oct 2023**
4. **Climate Action Plan - end 2023**
5. **2025-29 Five Year Capital Plan – Oct 2024**