

A satellite image of Hurricane Sandy, showing a large, swirling cloud system over the ocean. The hurricane's eye is visible as a dark, circular center. The surrounding clouds are dense and white, contrasting with the darker blue of the ocean.

# Hurricane Sandy



Overview of Subway and Bus preparations,  
impact and recovery  
NYCT Committee Meeting  
November 26, 2012

# Agenda

## Storm preparations

Storm event and immediate recovery

Longer term recovery and preparing for future



# Storm preparations were guided by extensive table top exercises and established plans

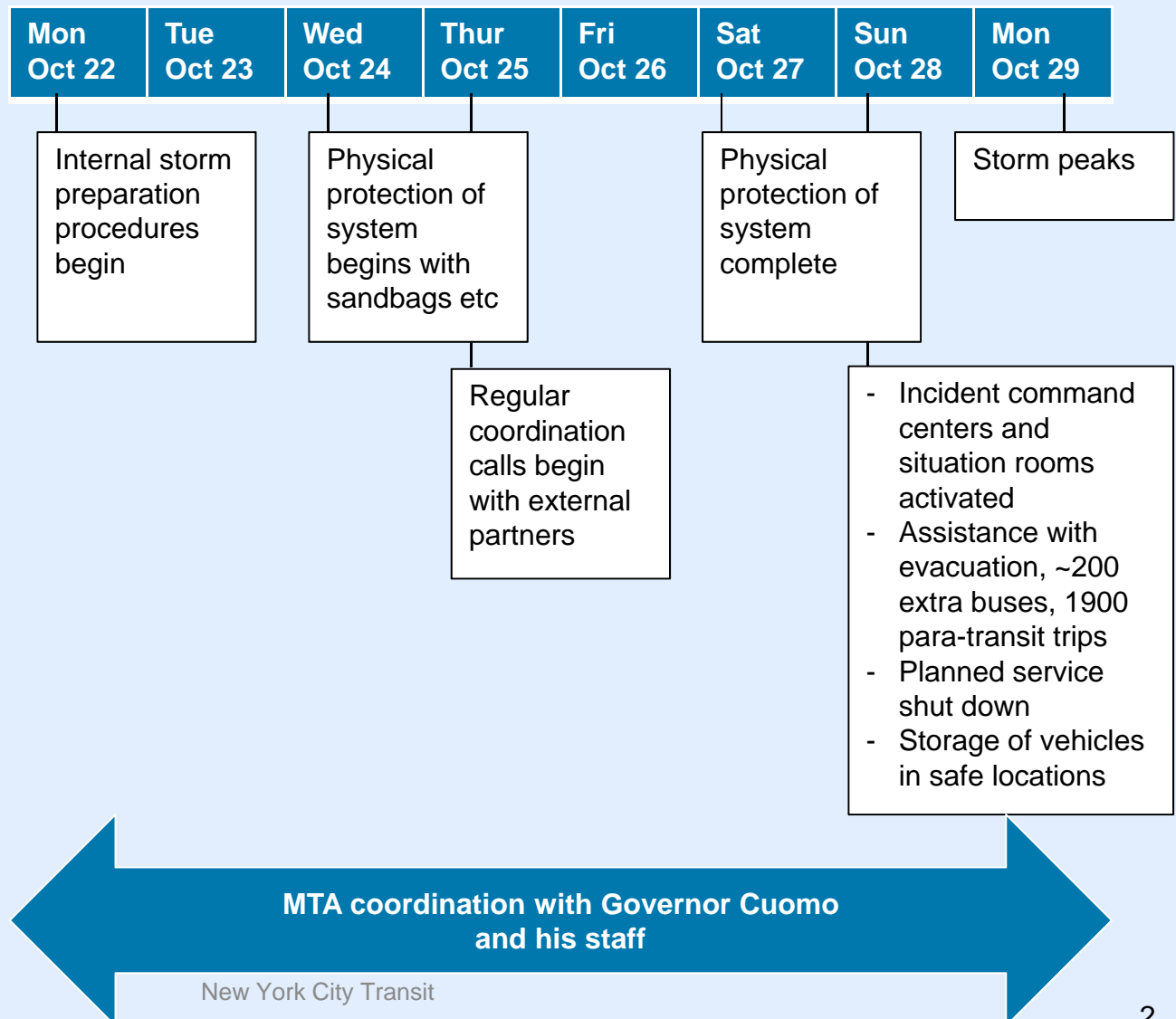
## Pre Sandy event (business as usual)

- Extensive table top exercises internally and with state and city



- Review and updating of comprehensive hurricane plans (along with cold weather plans etc)

## Sandy event



## Storm preparations - subways

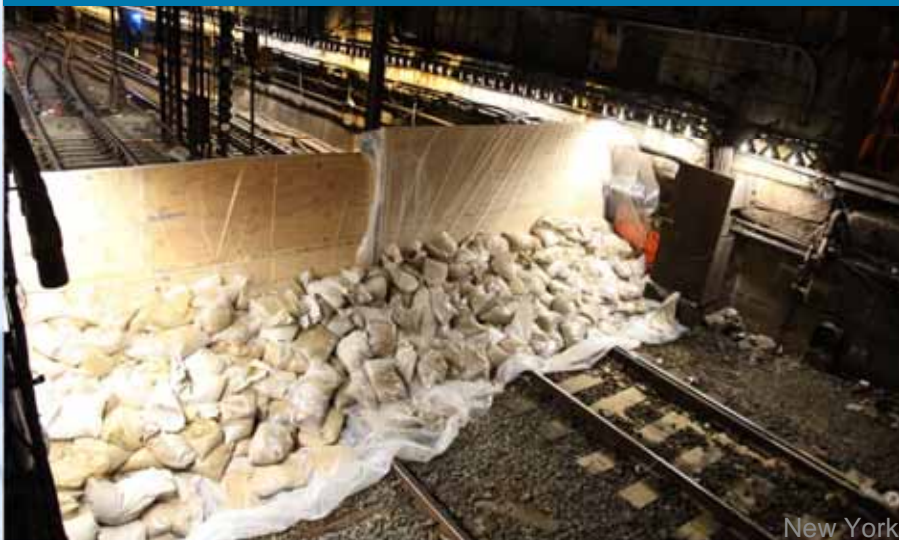
Coney Island Yard



Stillwell Yard



Lenox Terminal



Bowling Green



New York City Transit



## Storm preparations - buses

Buses staged for evacuation (City Island)



Castleton depot



Buses relocated to higher ground (Gun Hill depot)



Quill depot



New York City Transit

# Agenda

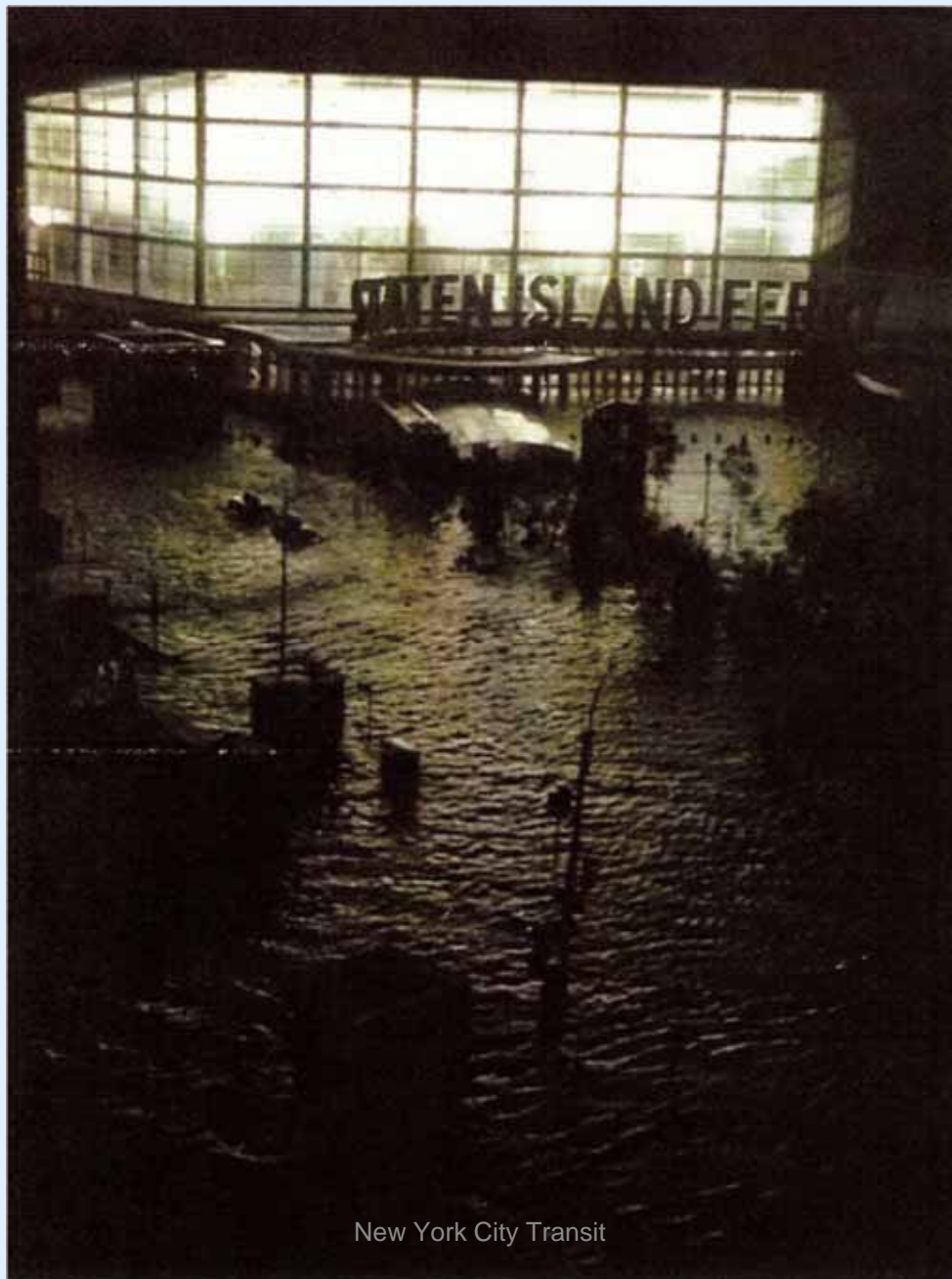
Storm preparations

**Storm event and immediate recovery**

Longer term recovery and preparing for future



**A record storm surge hit New York City on the evening of Mon Oct 29**



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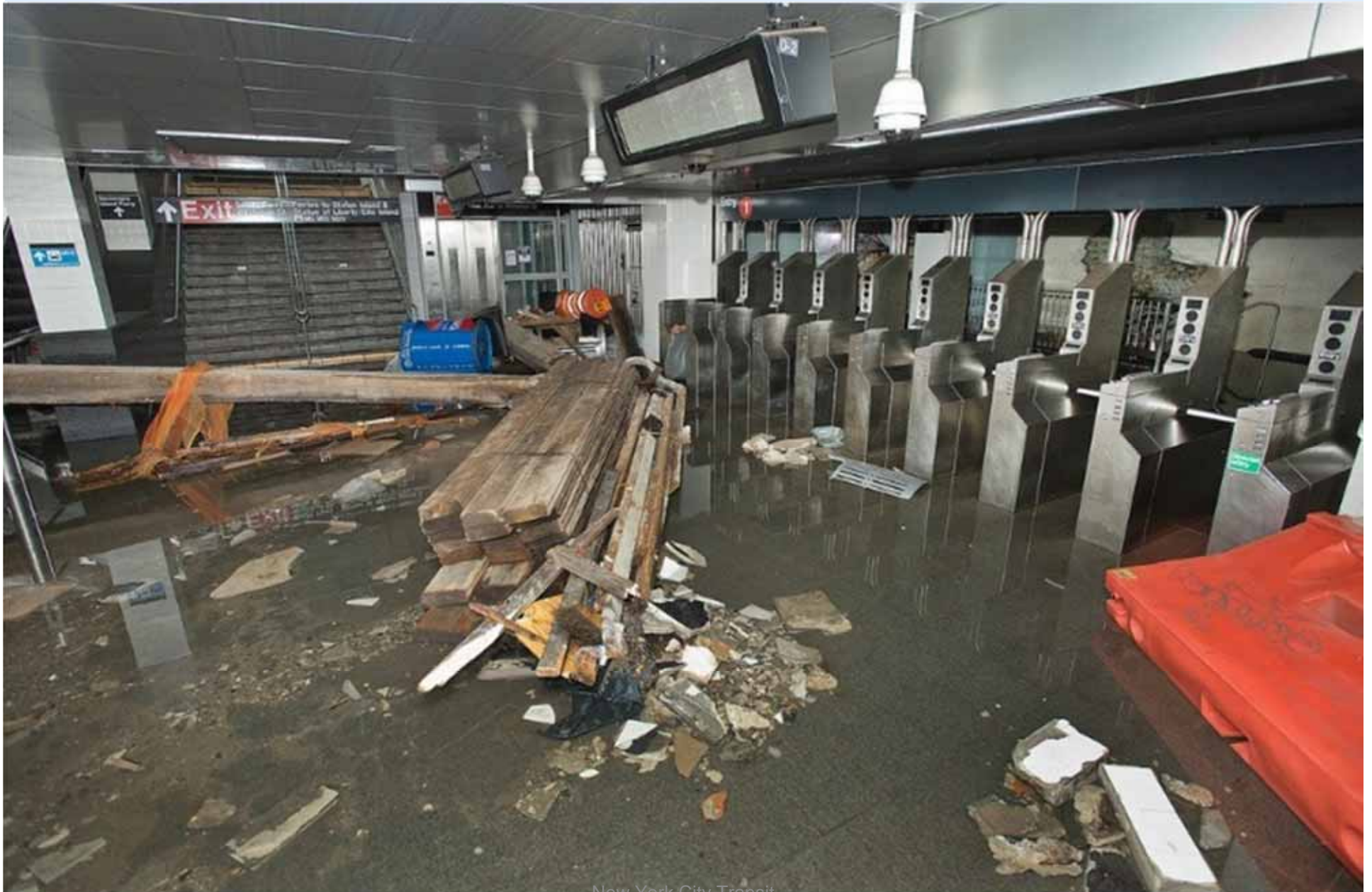
# Sandy caused major flood damage across the system

NOT EXHAUSTIVE



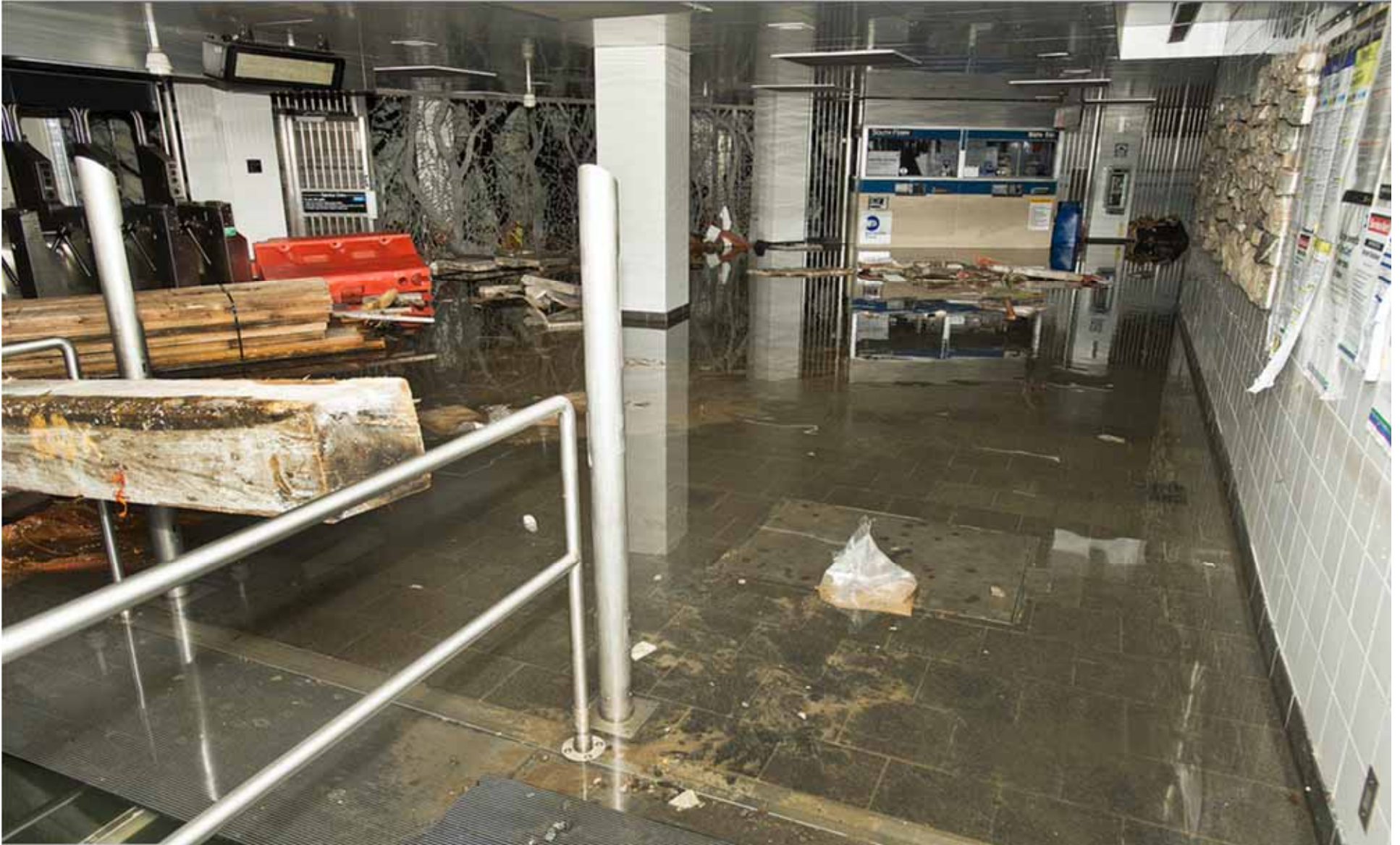


## Flooded stations – South Ferry





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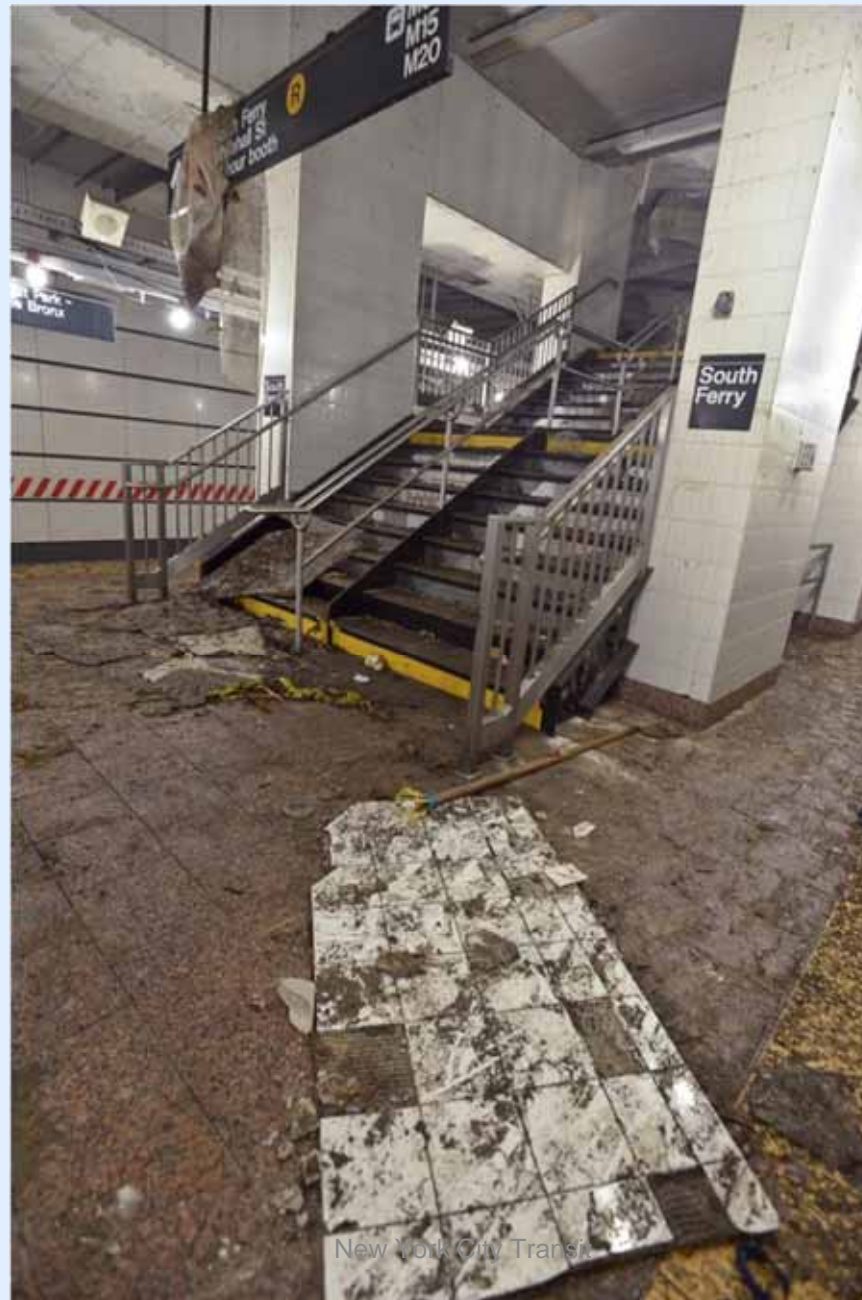




## Flooded stations – South Ferry



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## Flooded stations – 86<sup>th</sup> St Sea Beach line



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## Flooded stations – 148<sup>th</sup> St Harlem



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## Flooded stations – 148<sup>th</sup> St Harlem



## Flooded under-river tubes - Cranberry



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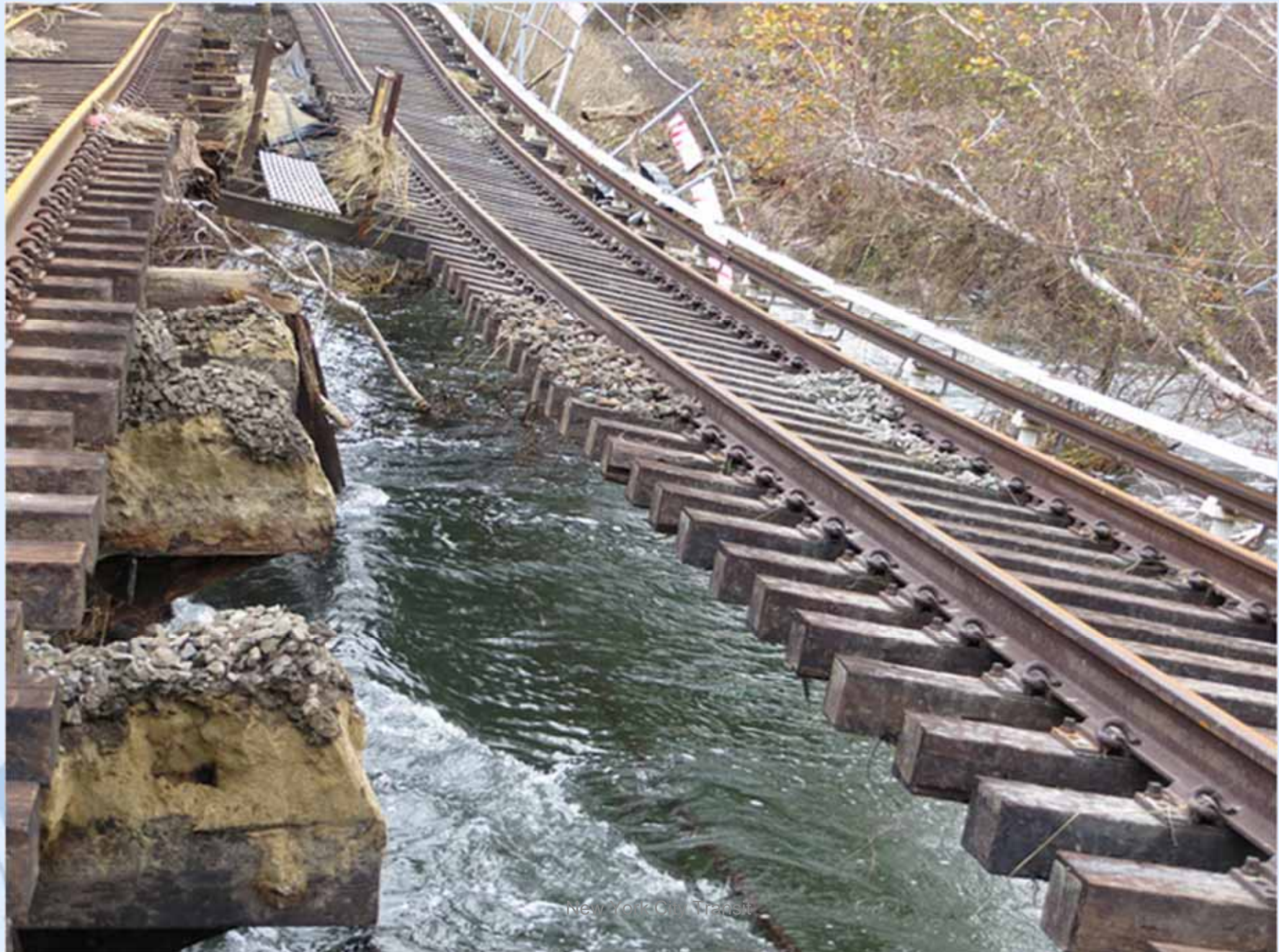
## Rockaways track washout



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## Rockaways track washout



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## Rockaways track washout





## Rockaways track washout



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## Bus routes impassable



## Facilities operated on local generator power





## Bus depot flooding – Far Rockaway



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## Bus depot flooding – 126<sup>th</sup> St



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## Bus depot flooding – Quill



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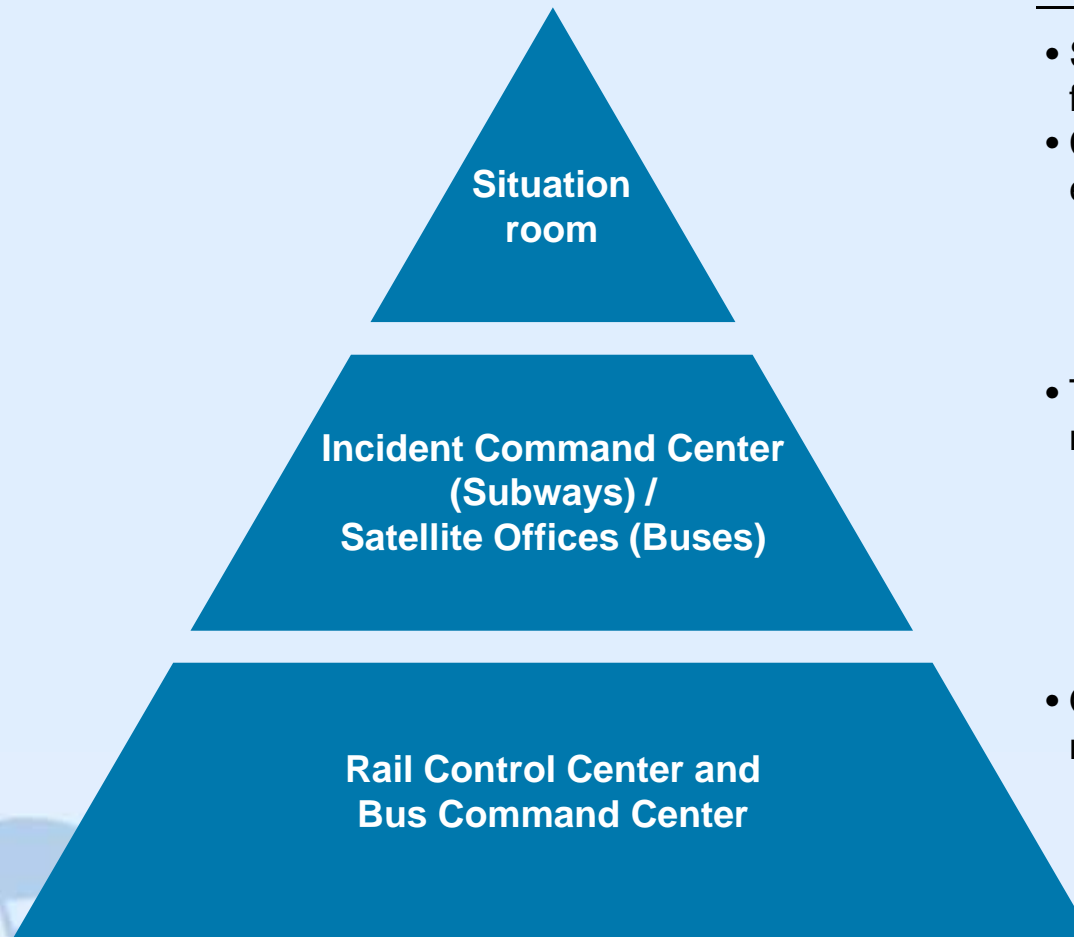


## Flooded Staten Island Railway shop



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## Throughout storm event Subways and Buses deployed an established 3 tiered emergency management structure



### Role

- Strategic direction and oversight from senior leadership
- Coordination with MTA HQ and external partners
- Tactical decision making and monitoring
- Operational decision making and monitoring

## Bus service restoration began ~ 7 hours after storm and supported restored subway service with an unprecedented 'bus bridge'

**Buses operating on modified routes** initially due to routes blocked by trees, cars, boats etc

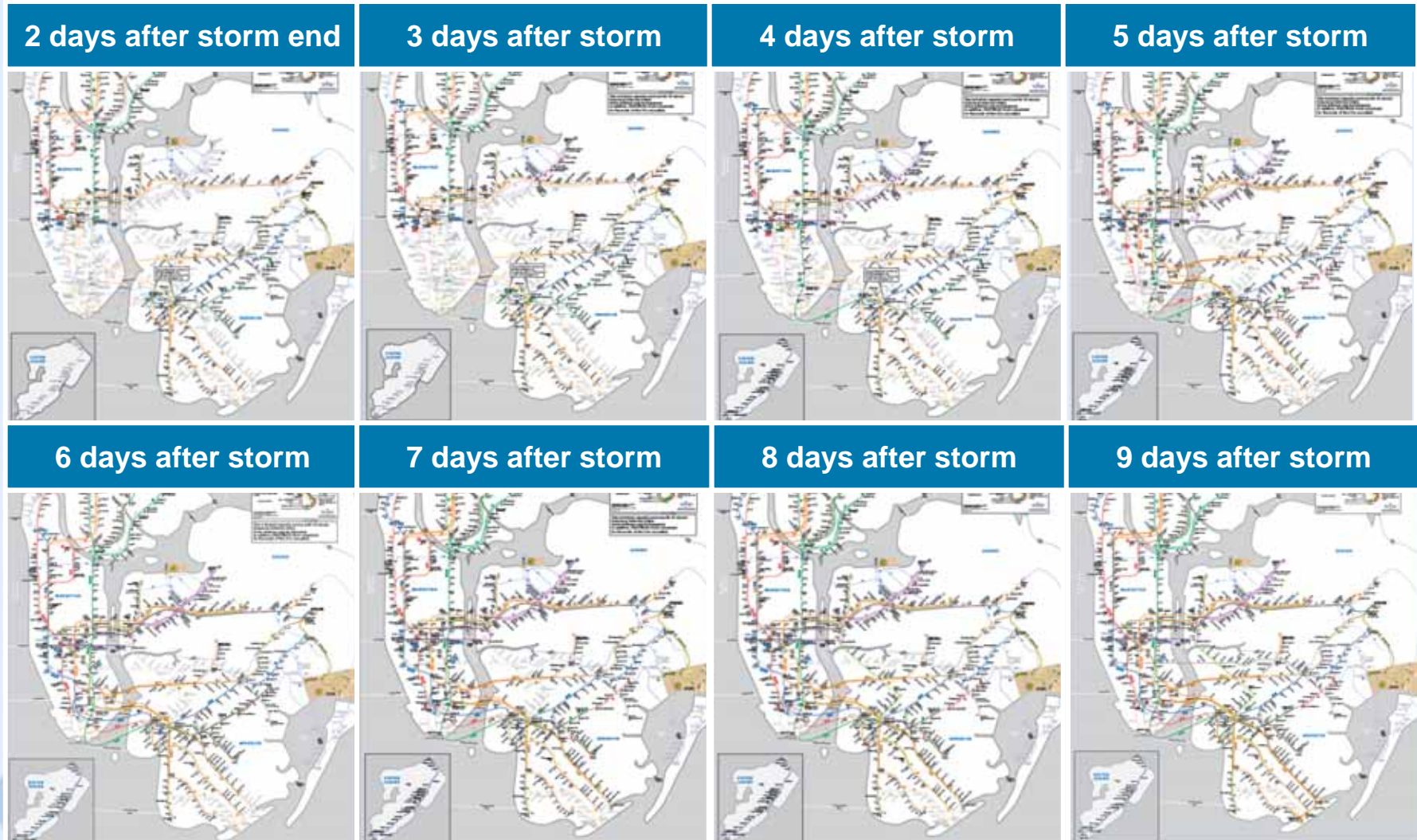
**'Bus bridge' shuttle between Manhattan and Brooklyn** – Buses also added extra service to Lower Manhattan where there was initially no power and subway service



Buses also contributed to broader city recovery efforts through **election day shuttle bus specials** and ongoing **OEM 'Warming Bus'** deployment



## Most subway service was recovered within a week of the storm



# Agenda

Storm preparations

Storm event and immediate recovery

**Longer term recovery and preparing for future**





# Important system elements that remain out of service are being worked on with high priority

NOT EXHAUSTIVE

## Current status

**A S**  
To Far Rockaway and  
Rockaway Park

- Work underway to restore washed out track sections over Jamaica Bay
- Work underway to assess and repair signal system at Rockaway Park
- **H** shuttle operating on peninsula with bus shuttle connection to Howard Beach

**1**  
South Ferry Station

- Extensive flood damage to all systems
- Assessment and restoration work ongoing
- **1** operating to/from Rector St at normal frequencies, using the old South Ferry loop to reverse direction

**R**  
Between Manhattan  
and Brooklyn

- Operating in 2 sections – no service between 34 St – Herald Sq and Jay St Metrotech
- Significant damage to electrical systems in Montague tube – restoration work underway
- Flood damage to Whitehall Station
- Expect to extend service from 34<sup>th</sup> St to Whitehall St as next step in restoration

**J Z**  
Between Chambers St  
and Broad St

- Signal and third rail damage
- Repairs well advanced and entering testing phase

Far Rockaway bus  
depot

- Evaluation and assessment of plans for Far Rockaway Depot
- Buses being run out of JFK depot

## Reconstruction work - Rockaways



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## Beyond known issues, general failure rates are expected to accelerate in system elements that experienced flooding

### Corrosion



- Metallic components that were exposed to salt water will experience accelerated corrosion
- Particularly problematic for electro-mechanical and electronic systems
- Long term deterioration of huge number of small gauge electrical connections

### Trash / sediment ingress and water damage



- Despite extensive clean up efforts, system has absorbed more trash and sediment that can cause track fires, foul drains etc
- Useful life of some system elements reduced due to water submersion, eg cloth cable sheathings

# Operations Planning is helping to manage increased uncertainty in system

## Increased uncertainty in system due to

- Unknown negative impacts of flooding
- Evolving restoration timelines
- Potential for changing external factors due to storm aftermath (eg demand levels in local areas)

## Operations Planning response

- Optimize service delivery with available assets
- Facilitate service restoration with service plans to accommodate repair work
- Develop and assess potential scenarios ahead of time
- React quickly with updated plans, timetables, work programs and approaches as circumstances change
- Develop and post customer information signs, and deploy staff resources to assist customers at critical locations





## Increasing frequency of extreme weather events means a comprehensive approach to protection is required

### Coordinated multi-party effort to protect vulnerable zones

- Federal
- State
- City
- Real Estate community

### MTA level asset hardening

- Raising ingresses
- Removable water barriers
- More powerful and resilient water evacuation systems



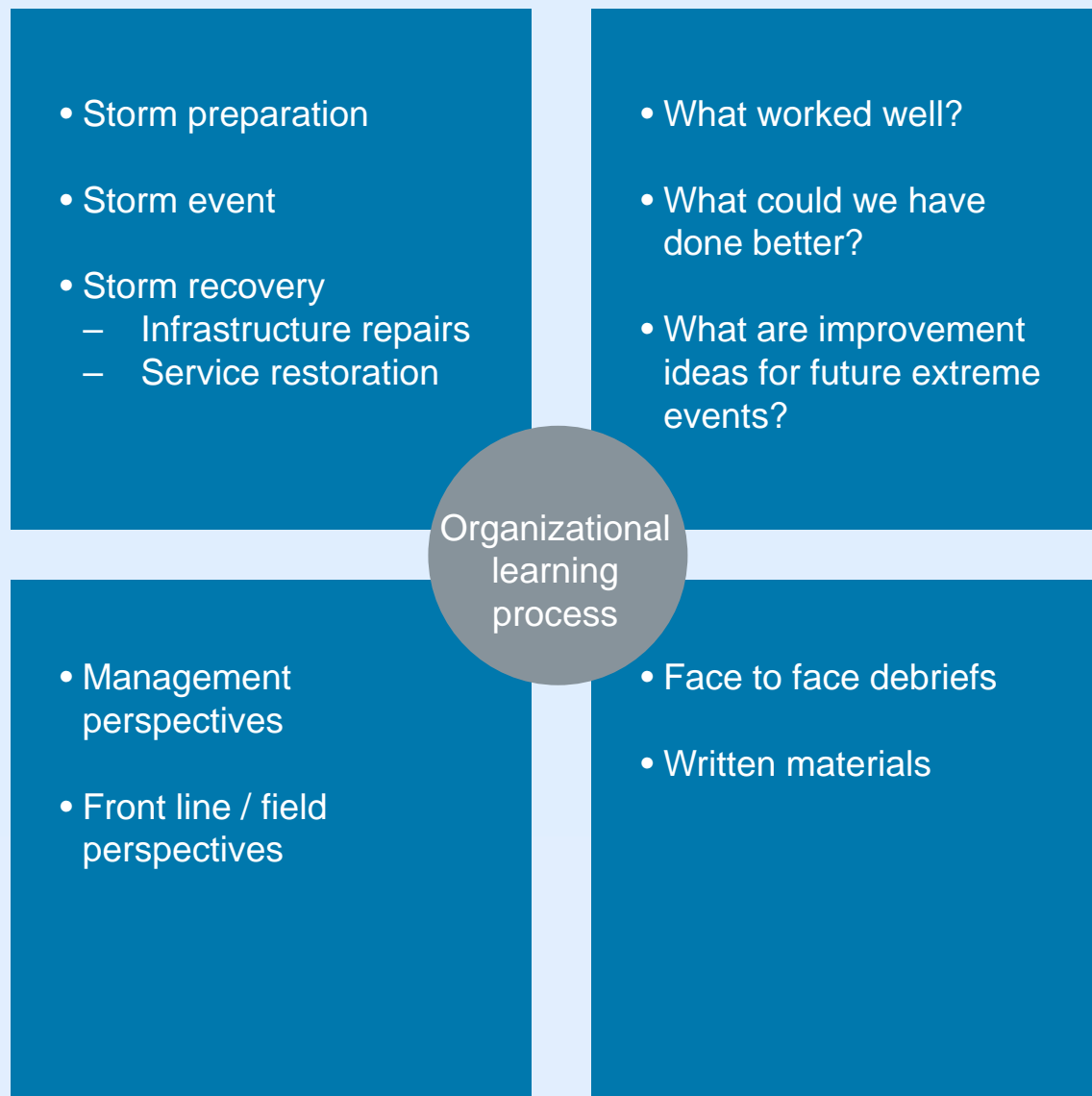
## Specific concepts for MTA level asset hardening are being investigated

NOT EXHAUSTIVE & NOT PRIORITIZED

- Stair closures
- Vent closures
- Elevator hardening
- Bladders and/or floodgates
- Pre-engineering and site mobilization for temporary mitigation structures
- Hardening of line equipment
- Discharge lines
- Upsizing of pumps
- Power redundancy for pumps
- Communications, EDR, & relay room hardening
- Hardening of signal equipment
- Additional deep wells
- Hardening of power supply systems
- Backflow preventers
- Flood mitigation measures at low lying depots
- Additional generators
- Additional pump trains



## Lessons from Sandy are being captured across disciplines and levels of organization



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