

# State of Good Repair in an Era of Climate Change: The MTA Perspective

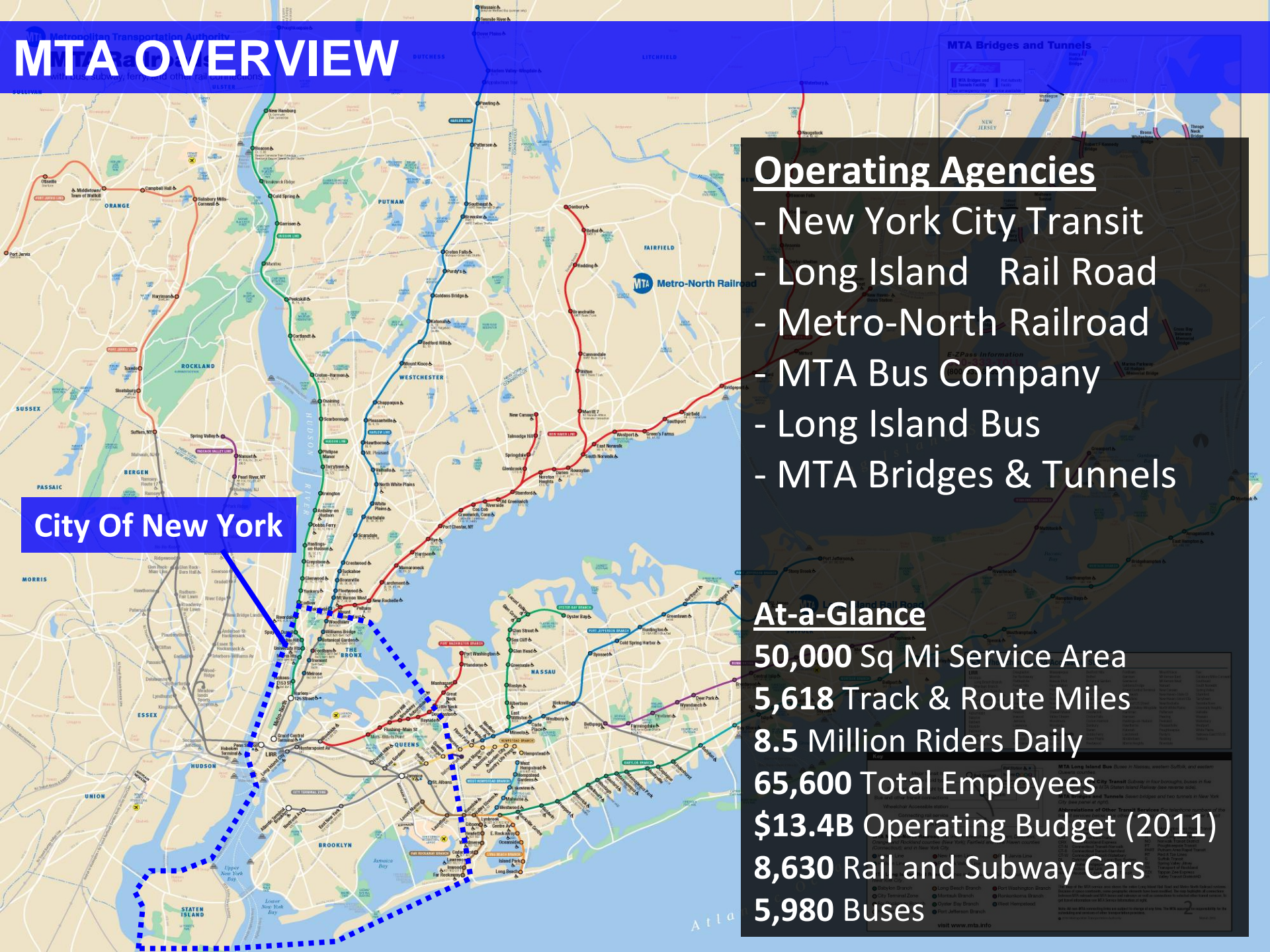
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New York Metropolitan Transportation Authority

APTA Annual Meeting

October 5<sup>th</sup>, 2011



# MTA OVERVIEW

City Of New York

## Operating Agencies

- New York City Transit
- Long Island Rail Road
- Metro-North Railroad
- MTA Bus Company
- Long Island Bus
- MTA Bridges & Tunnels

## At-a-Glance

- 50,000 Sq Mi Service Area
- 5,618 Track & Route Miles
- 8.5 Million Riders Daily
- 65,600 Total Employees
- \$13.4B Operating Budget (2011)
- 8,630 Rail and Subway Cars
- 5,980 Buses



# NEW YORK CITY TRANSIT (NYCT)



Annual Ridership	2.2 billion
Employees	45,500
Railcars	6,300
Buses	4,400
Stations	468
Subway Lines	24
Track Miles	659
Bus Routes	217
Route Miles	1,796
Rail Yards	23
Switches	2,630
Fan Plants	191
Pumps Facilities	289
Power Substations	215

# CLIMATE CHANGE FORECAST: NEW YORK CITY

## Base Line Climate and Mean Annual Changes<sup>1</sup>

Source: Columbia Center for Climate Systems Research (*Climate Risk Information*, February 2009)

	Baseline 1971-2000	2020s	2050s	2080s
Air temperature	55 °F	+1.5 to 3 °F	+ 3 to °F	+ 4 to 7.5 °F
Precipitation	46.5	+ 0 to 5 %	+ 0 to 10 %	+ 5 to 10 %
Sea level rise <sup>2</sup>	NA	+ 2 to 5 in	+ 7 to 12 in	+ 12 to 23 in

<sup>1</sup> Based on 16 GCMs (7 GCMs for Sea Level Rise) and 3 emissions scenarios. Baseline is 1971-2000 for temperature and precipitation and 2000-2004 for sea level rise. Data is from National Weather Service (NWS) and National Oceanic and Atmospheric Administration (NOAA). Temperature data are from Central Park; precipitation data are the mean of the Central Park and La Guardia Airport values; and sea level data is from the Battery at the southern tip of Manhattan (the only location in NYC for which comprehensive historic sea level rise data are available). All ranges represent the central range (middle 67% of values from model-based probabilities). Temperatures ranges are rounded to the nearest half-degree, precipitation to the nearest 5%, and sea level rise to the nearest inch.

<sup>2</sup> The model-based sea level rise projections may represent the range of possible outcomes less completely than the temperature and precipitation projections.

# THREATS TO TRANSPORTATION INFRASTRUCTURE

## EXTREME TEMPERATURES, HEAT WAVES & COLD EVENTS

- Increased peak electricity load resulting in more frequent power outages
- Fluctuation in voltage which can damage equipment and interrupt service
- Increased heating and cooling requirements for people and equipment
- Damage to temperature sensitive equipment
- Deteriorated road and rail infrastructure from buckling and expansion

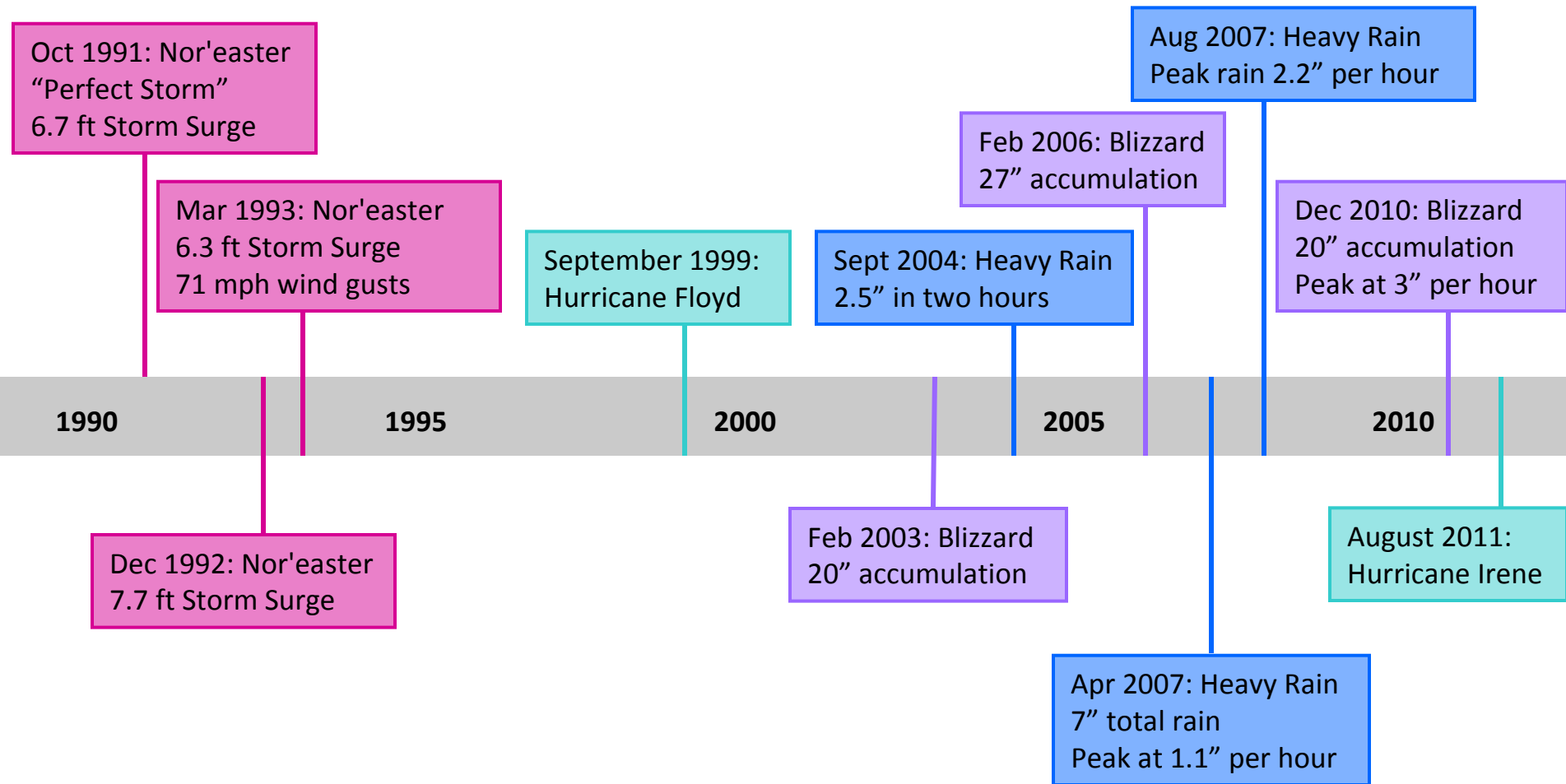
## MORE FREQUENT & INTENSE PRECIPITATION EVENTS

- More frequent flooding causing delays in service and loss of revenue
- Water damage to facilities and electrical equipment
- Strain on pumps and other water equipment
- Increase in maintenance and reduction of useful life of equipment

## SEA LEVEL RISE, COASTAL FLOODING & TROPICAL STORMS

- Increased salt water encroachment damaging to infrastructure and equipment
- Increased rates of coastal erosion and/or permanent inundation in low lying area
- Damage to track and yards in areas prone to flooding

# STORM HISTORY IN NEW YORK REGION

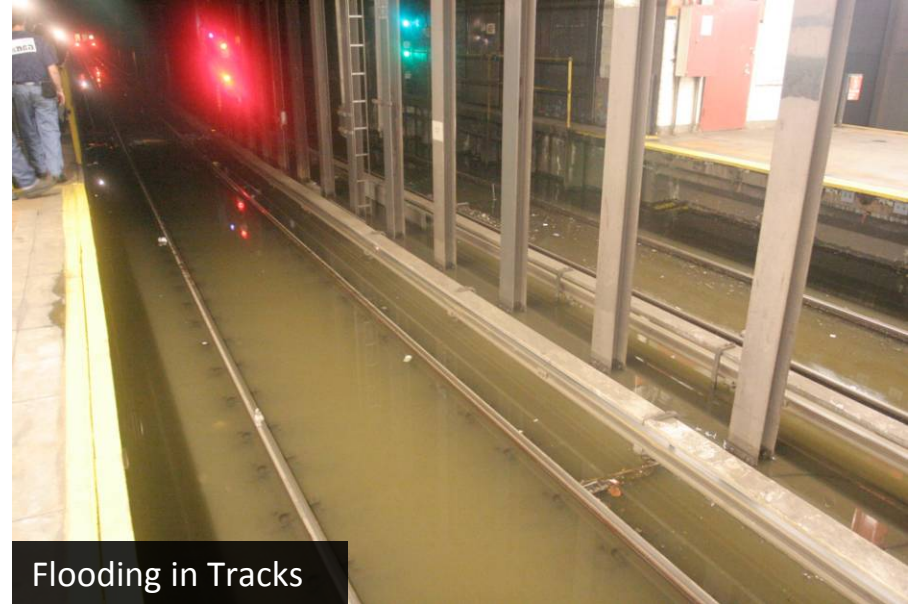




# HEAVY RAIN EVENTS: 2006 & 2007

Even short rain events of high intensity can have significant impacts on our system.

On August 8<sup>th</sup> 2007, 19 subway line segments were disrupted even though total rainfall was only 3.5".



Flooding in Tracks



Flooding in Streets



Flooding on Platforms



# 'SNOWMAGEDDON': DECEMBER 2010

A blizzard on December 26<sup>th</sup> of 2010, affecting all MTA operating agencies, was exacerbated by poor forecasting and low employee availability

- 20" of snowfall, 3<sup>rd</sup> highest on record
- 3 inches per hour at peak intensity
- 40 mph wind gusts and snow drifts



Stuck Buses



Open-cut Subway Station



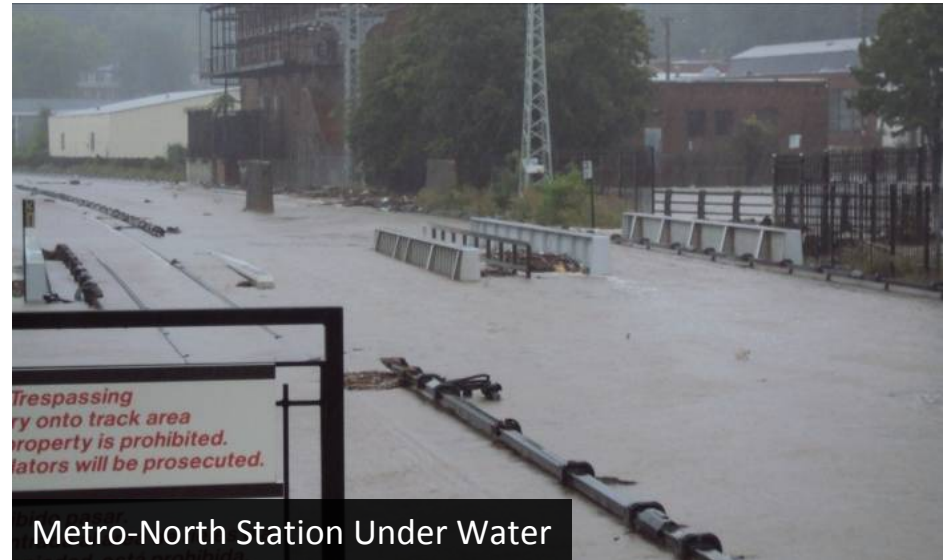
Paratransit vehicles



# HURRICANE IRENE: AUGUST 2011

A category 1 hurricane was predicted to pass the New York area on August 28<sup>th</sup>.

Implemented the first pre-emptive shutdown of MTA service in history.



Metro-North Station Under Water



Track Damage on the Railroads



Coastal Flooding



# HURRICANE IRENE: AUGUST 2011



# RESPONSES TO CLIMATE CHANGE

**ADAPTATION:** Modify assets and operations to better protect against the expected impacts of climate change

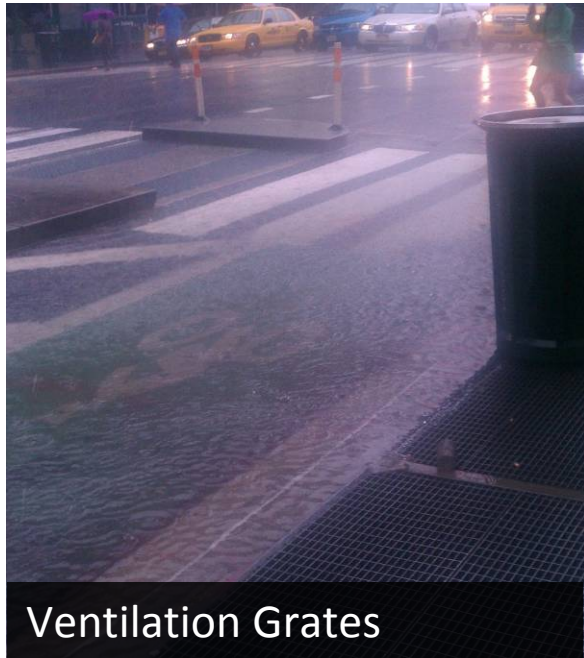
- Assess risks and retrofit equipment and facilities
- Build new infrastructure to higher standards (100 year flood plain)
- Improve storm prediction
- Improve storm plans: protect, respond, and recover
- Develop internal and external communication strategies
- Partner with other city agencies and research centers

**MITIGATION:** Reduce our contribution to the causes of climate change

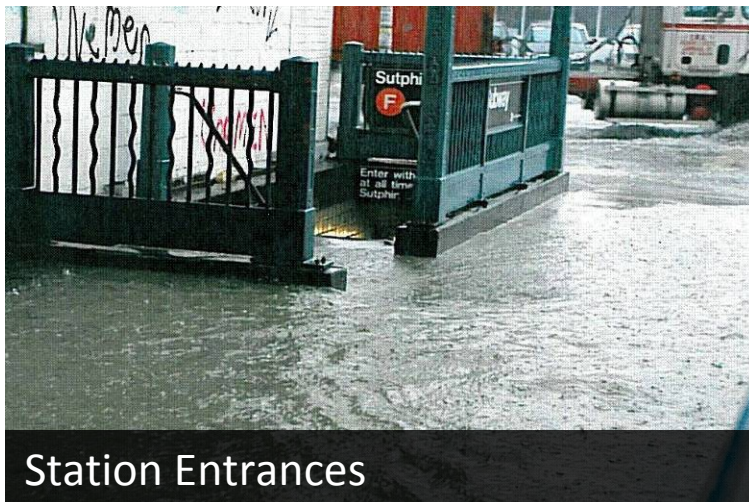
- Introduce green design elements in building and operations
- Reduce our energy demand
- Limit waste water runoff



# ADAPTATION: RISK ASSESSMENT



Ventilation Grates



Station Entrances

NYCT Locations	Occurrences (1997 - 2007)
Parsons - Hillside (F)	38
65th St Stn / Northern Blvd (R,G)	27
79th St / Broadway (1,2,3)	26
36th St & Steinway St Stns (G,R)	20
Queens Plaza (E,G,R,V)	19
Chambers St / 7th Ave (1,2,3)	18
Utica Ave (A)	17
86th St (4,5,6)	16
Lawrence St (R,M)	14
North of Pacific St (D,M,N,R)	14
34th St / 8th Ave (A,C)	12
125th St (4,5,6)	12
23rd St / Park Ave (4,5,6)	7
86th St & Broadway (1,2,3)	7
34th St / Herald Sq (B,D,F)	7
47th - 50th Sts / Rock Center (B,D)	7
Canal St (N,R)	5
Broadway (G)	4
Union St (R,N)	4
Nevins St (2,3,4,5)	4
110th St / Lenox (2,3)	4

# ADAPTATION: RETROFITTING ASSETS

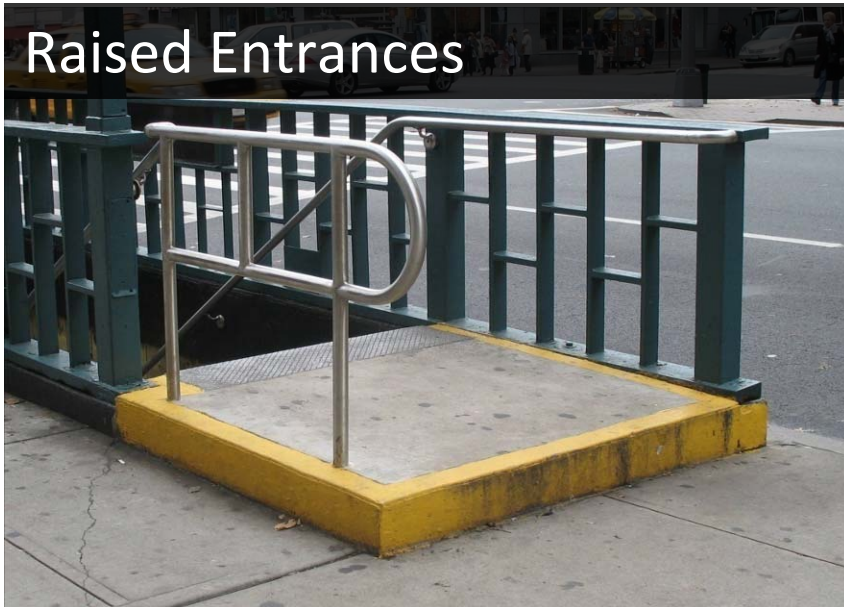
Since the 2007 Flood Report:

- 25 priority locations addressed
- Over 5,300 linear feet of ventilation gratings raised
- 30 stair pads installed at entrances
- \$89.8 million allocated

## Raised Ventilation Grates



## Raised Entrances

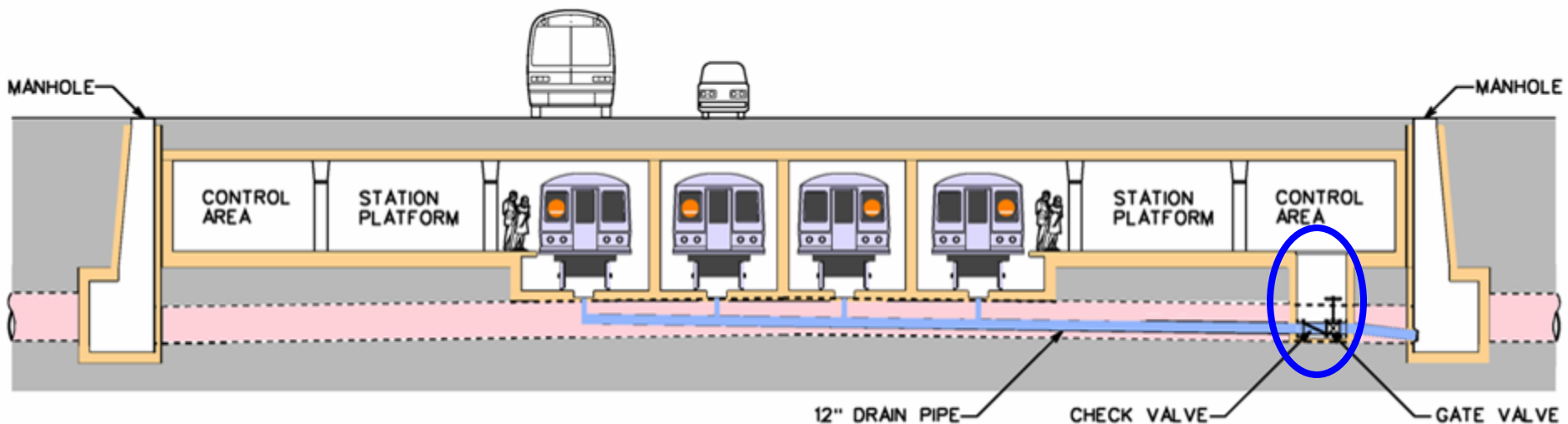




# ADAPTATION: RETROFITTING ASSETS

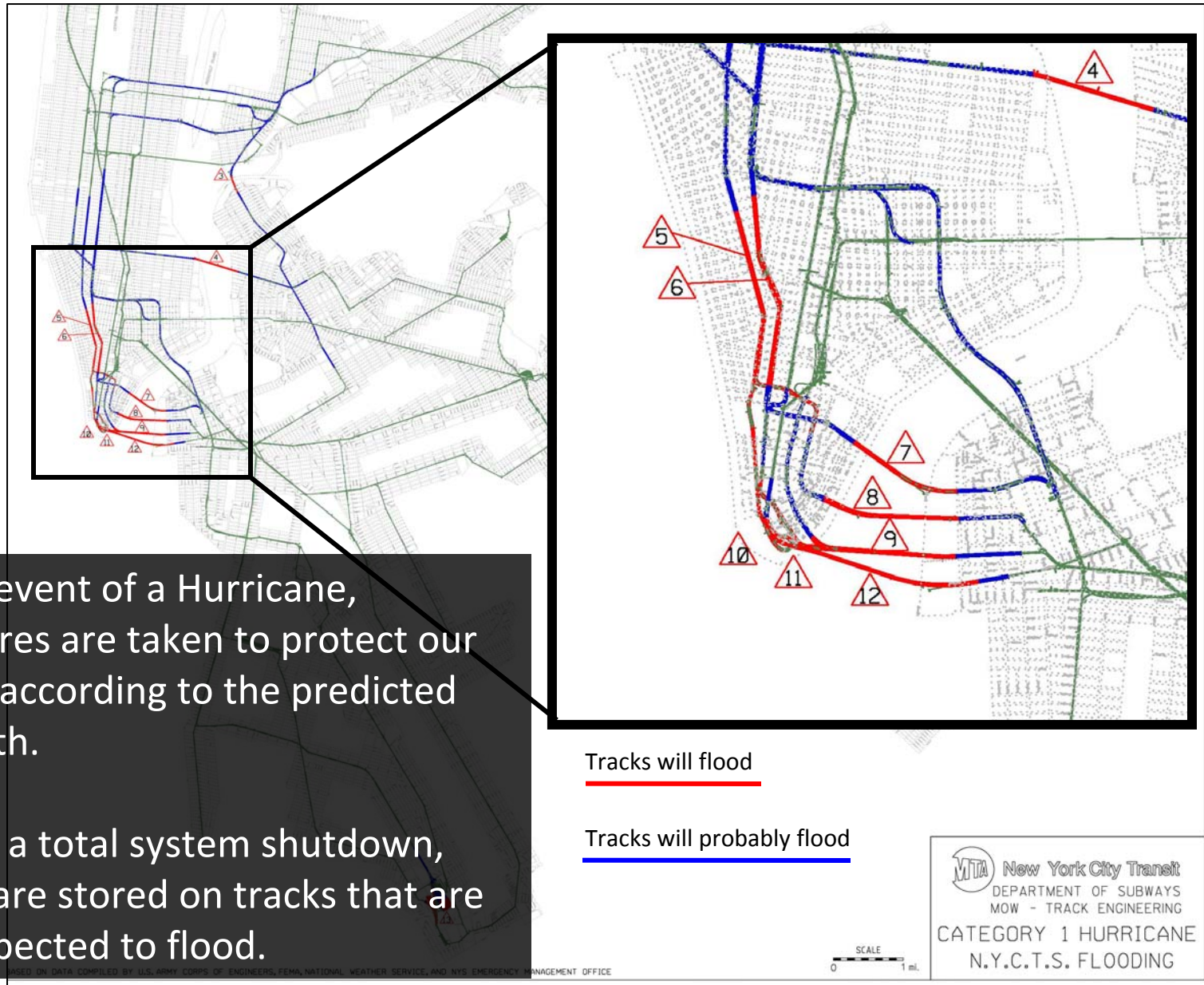
Install check valves to reduce backflow of sewer water into tracks and stations at locations with direct output drain systems

## Check Valves



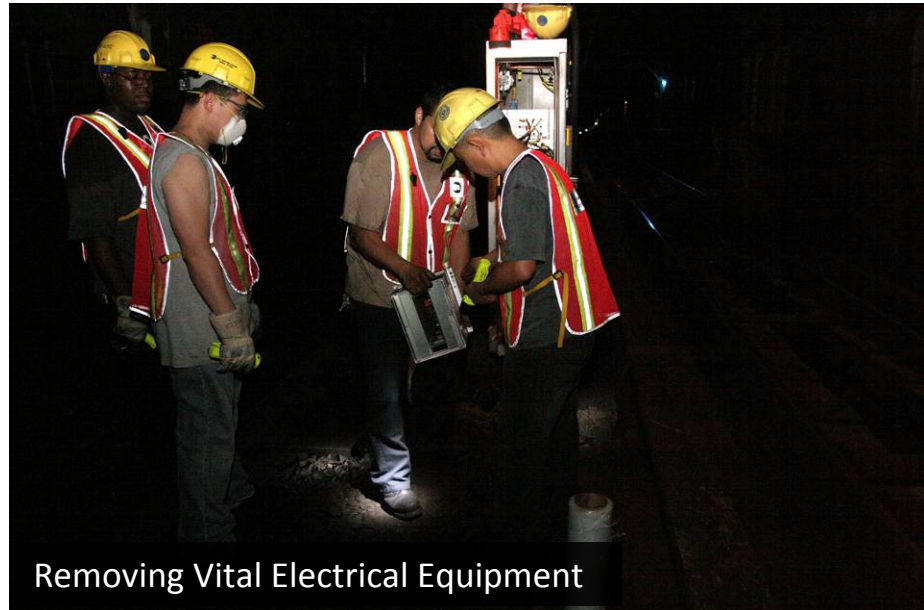
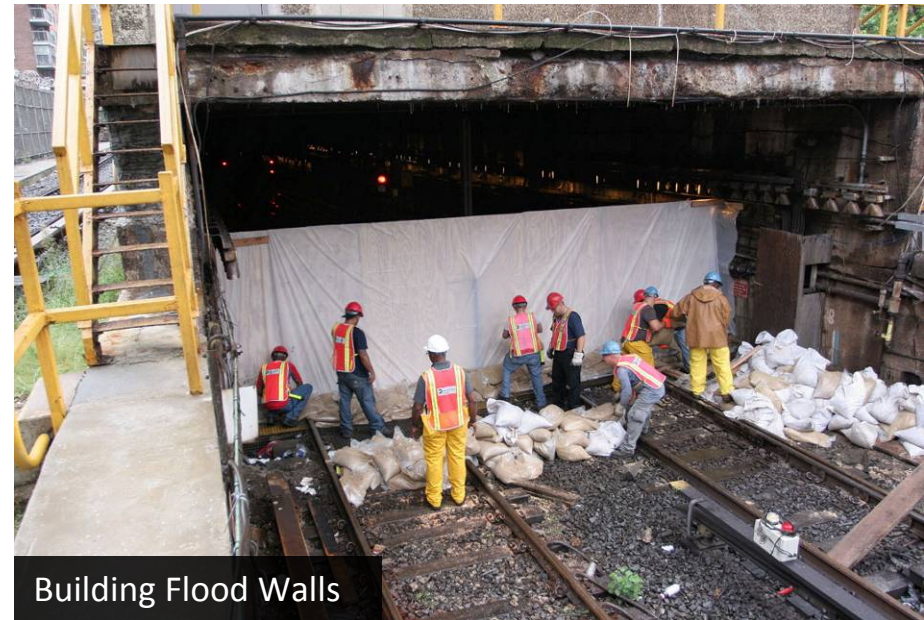


# ADAPTATION: HURRICANE PLAN



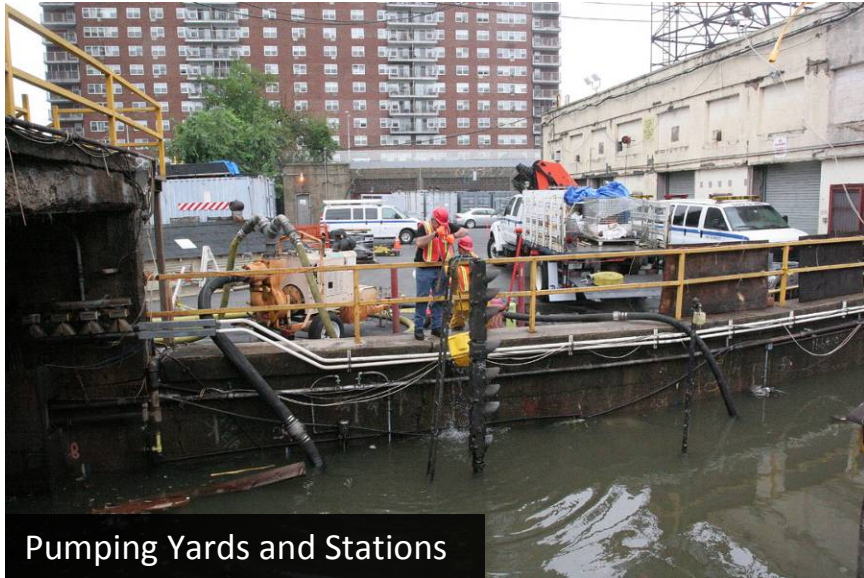


# ADAPTATION: ASSET PROTECTION PLAN





# ADAPTATION: FAST & EFFICIENT RECOVERY





# ADAPTATION: COMMUNICATION STRATEGY

Clear internal and external communication strategies:

- Incident Command Centers
- Coordination among agencies
- Televised press conferences
- Up-to-date MTA website



Incident Command Center in Brooklyn



City-wide Press Conference

mta.info

## Service Status

### Subway

123	Suspended
456	Suspended
7	Suspended
A C E	Suspended
B D F M	Suspended
G	Suspended
J Z	Suspended
L	Suspended
N Q R	Suspended
S	Suspended
SIR	Suspended

### Bus

MTA	Suspended
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MTA Website

## MTA Service Advisory

### Orderly Shutdown of Scheduled Service Concludes

**MTA Turning Focus to Getting All Employees to Safety and Securing Equipment and Facilities**

Subway, bus and railroad services have now completed their final runs. Stations are closed. People should not attempt to travel on the MTA's public transportation network.

The MTA's Bridges and Tunnels remain open, but restrictions or closures are likely. MTA bridges will close if winds reach sustained speeds of 60 mph, but this does not preclude them from closing sooner if high winds are coupled with other weather-related conditions including flooding.

MTA employees are moving trains and buses out of low-lying, flood-prone locations into safety. Crews are securing facilities by deploying sand bags and other flood-mitigating buffers. Workers from the LIRR and Metro-North are securing or removing gates at 370 railroad crossings throughout the region.

These are some of the actions we are undertaking in order to ensure the safety of employees and equipment, and put the MTA in the best position possible for the restoration of service. Even if damage proves to be minimal, restoration of service takes time. Please check back at MTA.info at the conclusion of the storm for information about restoration of service.

# MITIGATION: REDUCING OUR CONTRIBUTION

WATER: reduce runoff

- Green roofs
- Rain water collection
- Wash water recycling systems

ENERGY: reduce consumption

- Solar panel arrays
- Regenerative braking on fleets
- White roofs
- LED tunnel lighting



Green Roof of Crew Facility



Stillwell Ave Solar Panel Canopy



Photo Voltaic Panels on White Roof

# CONCLUSION

## Summary:

Partnerships with research centers and local universities

Identify and address vulnerabilities in the system

Build and procure assets to higher standards

Develop and refine weather plans, including strategies for:

- Predicting events
- Preparing and protecting assets
- Internal and external communications
- Recovering and restoring service

## Contacts for Further Questions:

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