Hurricane Sandy Impacts to the Northeastern United States:

2012 and Beyond

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NAD Coastal RTS

26 September 2013

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DRAFT, PRE-DECISIONAL, AND CONFIDENTIAL

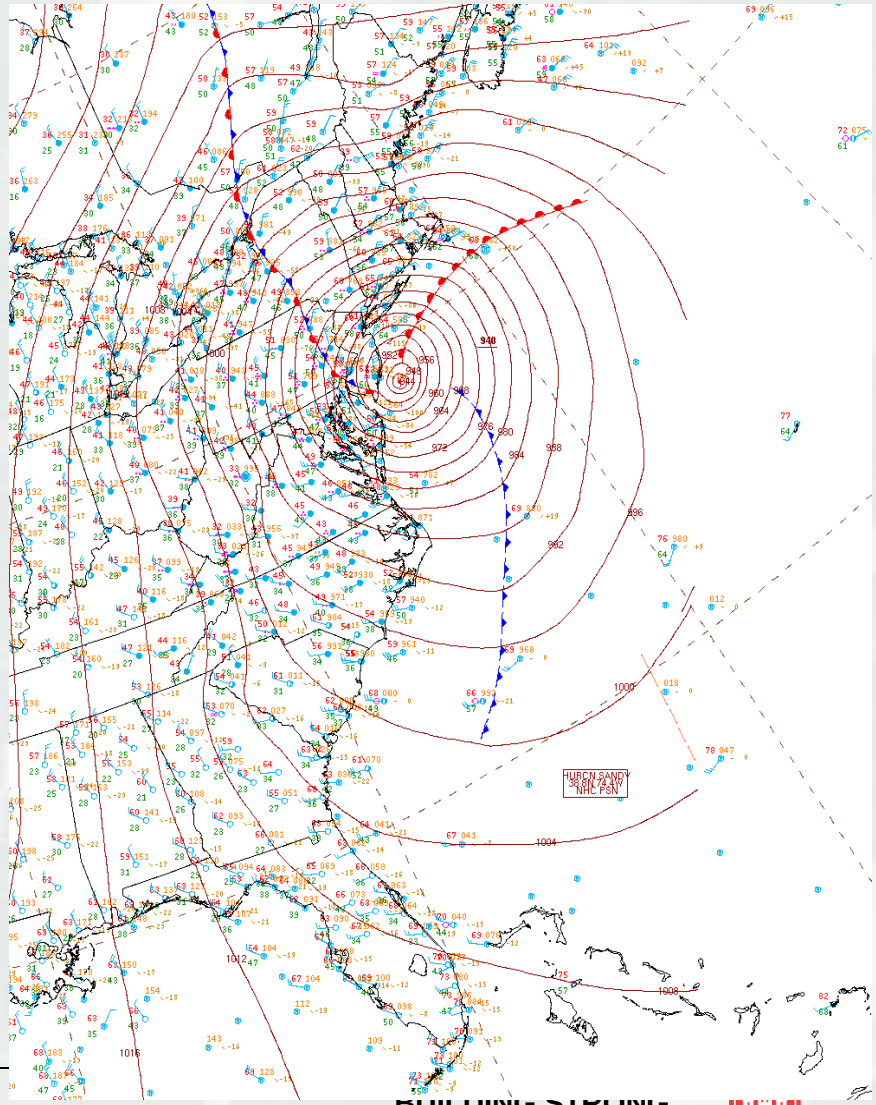
US Army Corps of Engineers
BUILDING STRONG®

Outline

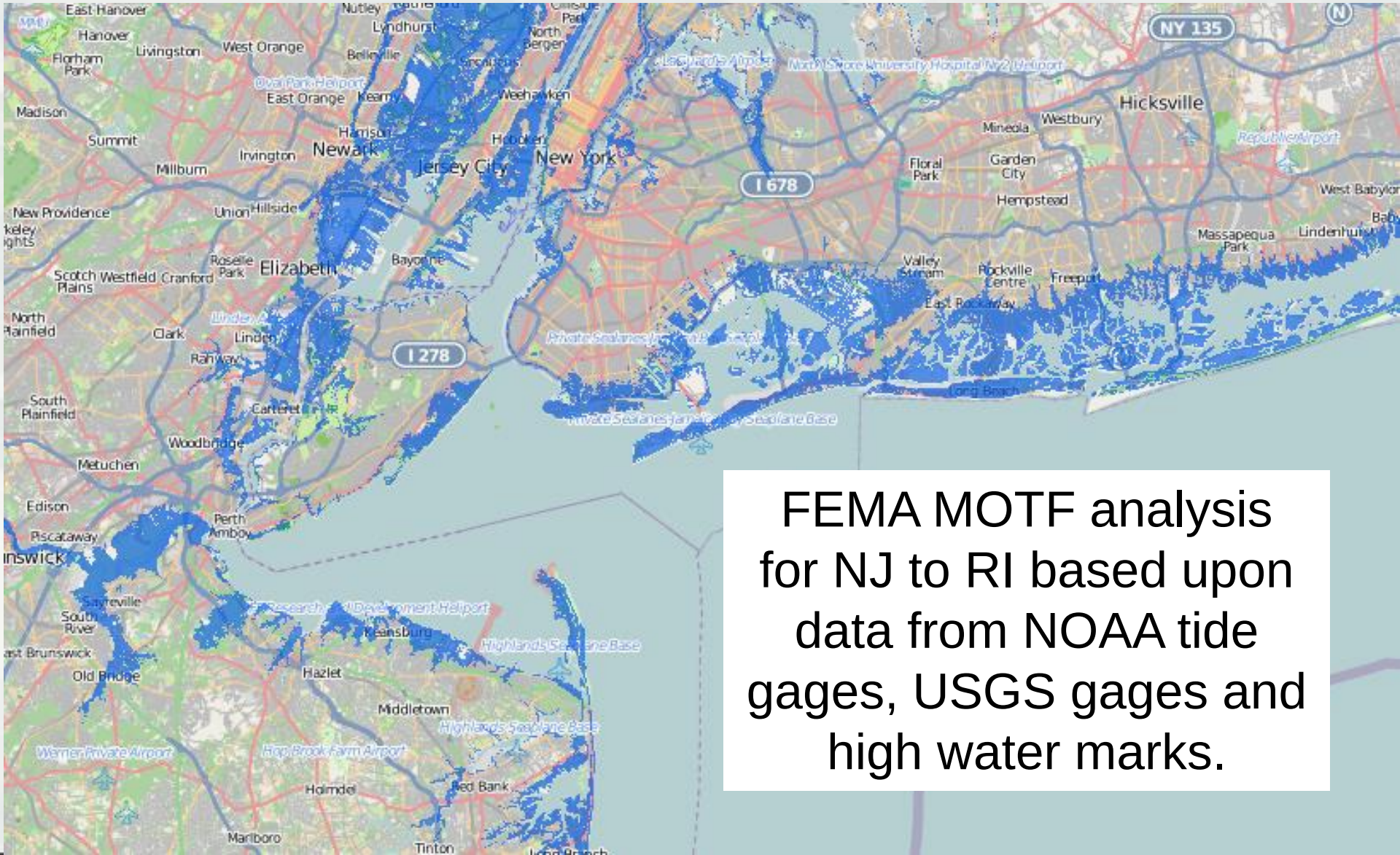
- Hurricane Sandy: Storm Characteristics and Impacts
- Event Preparation
- National Response Framework - Response and Recovery
- Hurricane Sandy Disaster Relief Appropriations Act of 2013
  - FCCE
  - O&M
  - Authorized but Unconstructed
  - Investigations
  - Continuing Authorities Program
- Hurricane Sandy Coastal Projects Performance Evaluation Study
- North Atlantic Coast Comprehensive Study

HURRICANE SANDY

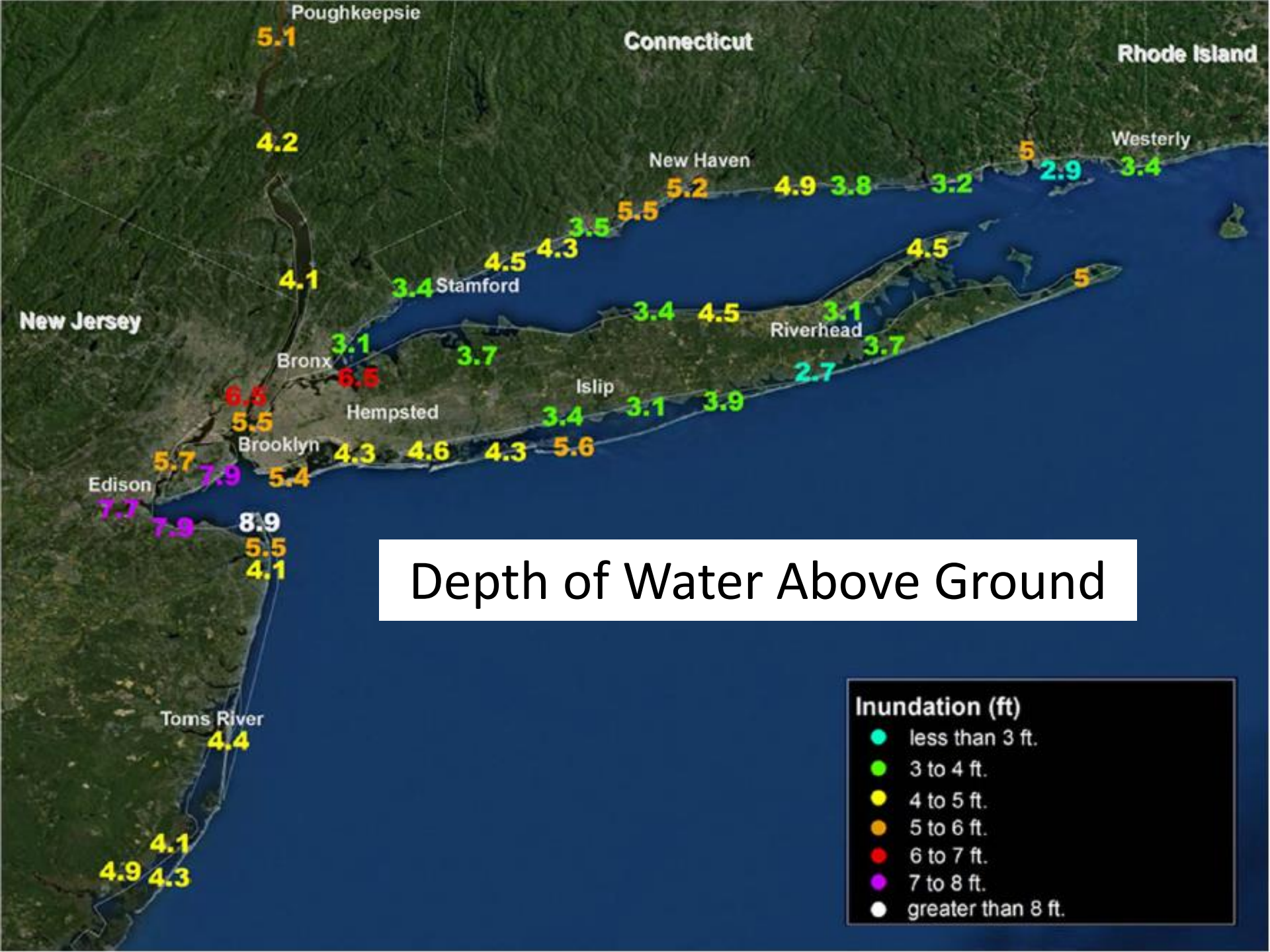
- Approximate size → 800 to 1,000 miles across
- Radius of maximum winds → greater than 100 mi
- Minimum Pressure:
  - ► Lowest ever recorded in north Atlantic Ocean → 940 mb
  - ► Pressure at landfall → 948 mb
- Maximum Storm Surge → 8 to 9 ft
- Maximum Waves → 32.5 ft @ NY Harbor Entrance
- Rain → MD – 15.3 in
- Snow → MD – 29 in, PA – 13 in

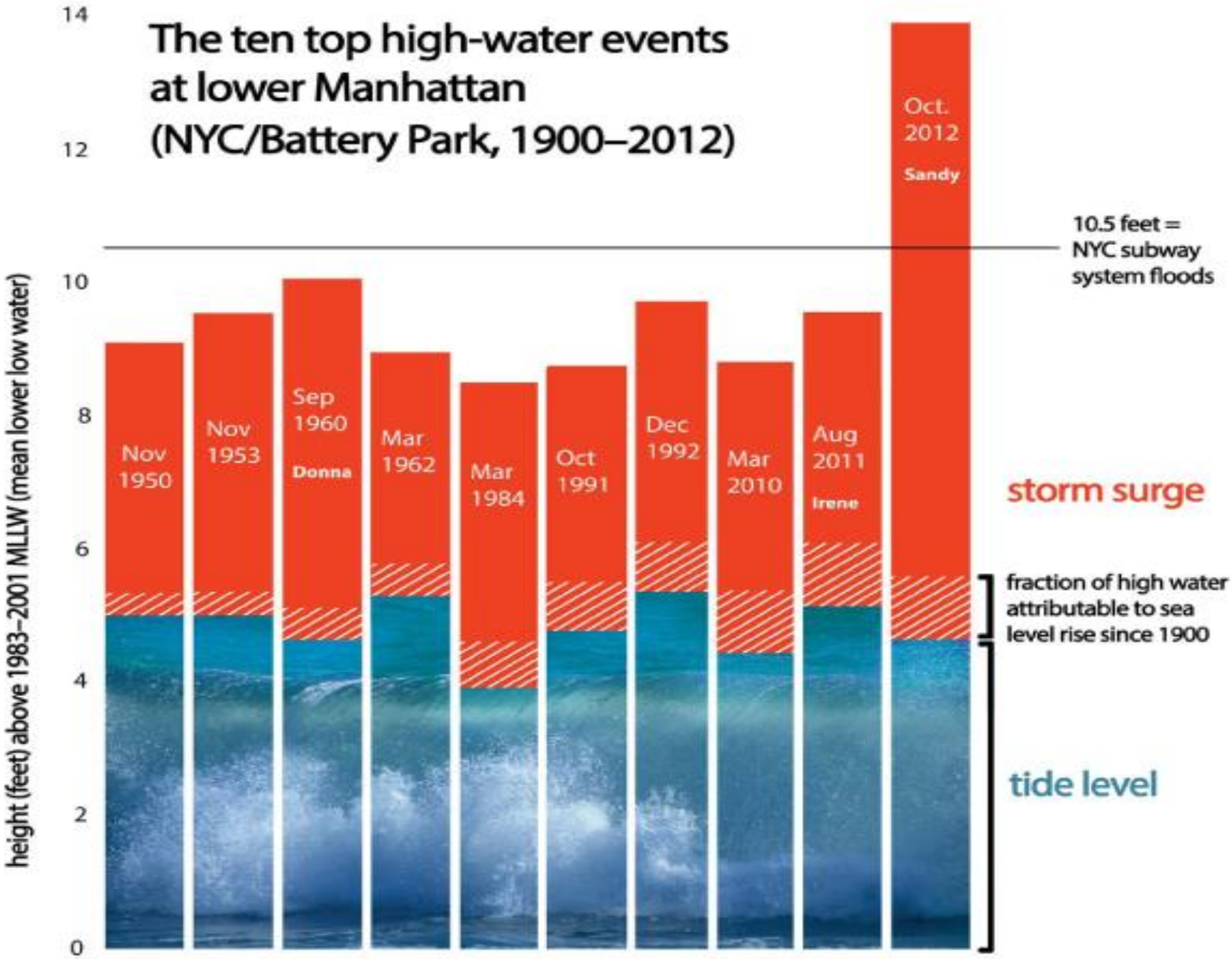


Actual Extent of Storm Surge

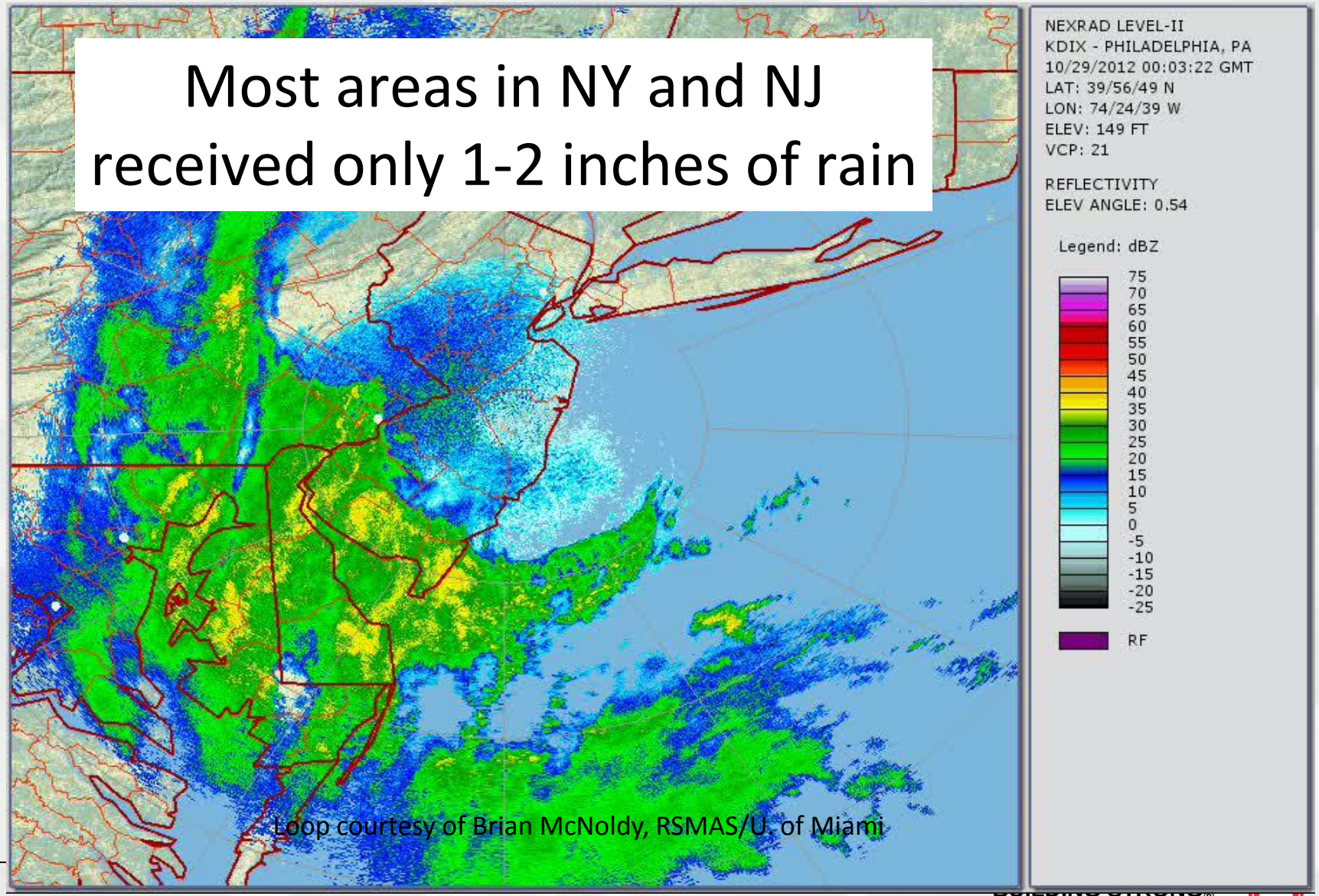


FEMA MOTF analysis for NJ to RI based upon data from NOAA tide gages, USGS gages and high water marks.


Poughkeepsie
5.1
Connecticut
Rhode Island
4.2
Westerly
New Haven
5.2
4.9
3.8
3.2
5
2.9
3.4
5.5
3.5
4.3
4.5
4.5
4.1
3.4
Stamford
5
New Jersey
3.4
4.5
3.1
Riverhead
3.1
3.7
3.7
Bronx
6.5
2.7
Islip
6.5
5.5
Hempsted
3.4
3.1
3.9
Brooklyn
4.3
4.6
4.3
5.6
5.7
7.9
5.4
Edison
7.7
7.9
8.9
5.5
4.1
Toms River
4.4
4.1
4.9
4.3
Depth of Water Above Ground
Inundation (ft)
less than 3 ft.
3 to 4 ft.
4 to 5 ft.
5 to 6 ft.
6 to 7 ft.
7 to 8 ft.
greater than 8 ft.


The ten top high-water events at lower Manhattan (NYC/Battery Park, 1900–2012)
height (feet) above 1983–2001 MLLW (mean lower low water)
14
12
10
8
6
4
2
0
Nov 1950
Nov 1953
Sep 1960
Donna
Mar 1962
Mar 1984
Oct 1991
Dec 1992
Mar 2010
Aug 2011
Irene
Oct. 2012
Sandy
10.5 feet = NYC subway system floods
storm surge
fraction of high water attributable to sea level rise since 1900
tide level

Radar Imagery of Sandy's U.S. Landfall

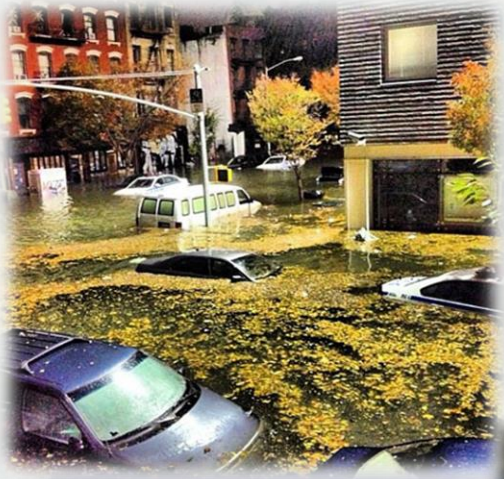


Consequences and Impacts

- 72 direct fatalities in United States (147 total direct fatalities)
  - Deadliest northeastern U.S. cyclone since Agnes (1972)
  - NY 48, NJ 12, CT 5, PA 2, VA 2, 1 each in NH, WV, MD
  - Storm surge responsible for most - 41 (57%) due to drowning
  - 20 due to falling trees
- At least 87 indirect fatalities due to storm cleanup efforts, falls, hypothermia, carbon monoxide, car accidents
- At least 650,000 houses damaged or destroyed in NY and NJ
- 5 million customers lost power in NY and NJ
- At least $50 Billion damage in United States
- Environmental impacts to NY and NJ waterways
  - > 1 Billion gallons of raw sewage
  - > 5 Billion gallons of partially treated sewage
  - Petrochemicals, diesel, and gasoline

Effects of Hurricane Sandy

Effects of Hurricane Sandy



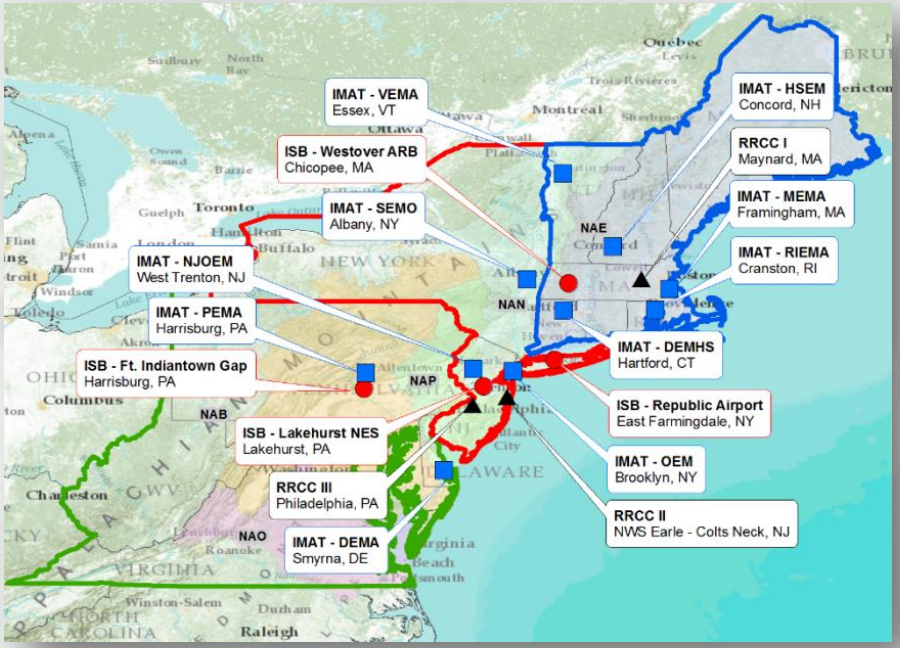
Event Preparation - Positioned & Postured

Pre-Hurricane Season Activities:

- *Coordination:*
  - Interagency Planning & Coordination
  - Regional Catastrophic Planning Team
  - FEMA Regional Interagency Steering Committee (RISC)
  - Regional Response Team (RRT) meeting led by USCG & EPA & ESF

- *Training*: ESF #3 Team Leader (TL) & Assistant Team Leader (ATL), Local Government Liaison, Planning Response Team and Emergency Management Team Members Credentialing

- *Exercises:*
  - Hurricane Table Top Exercise
  - Performed 2,700 power assessment in NYC Area
  - Project-specific Exercises & Drills



Pre-Sandy Activities

- Lowered pool elevations behind Corps dams to prevent flooding
- Closed hurricane barriers along New England Coast
- Moved Corps vessels from MD, VA, NY/NJ harbors to safe havens
- Issued 218,000 Sandbags in NJ & PA
- Secured Corps Construction Projects and Facilities
- Executed pre-storm inspections of Corps projects in NAD
- Updated surveying plans
- Coordinated with legislators and governors on USACE capabilities
- Conducted coordination calls with Districts and HQ UOC
- Staffed and Activated District and Division EOCs
- Activated Alternate EOC for each of the impacted Districts
- Deployed FCCE liaisons to state EOCs in New England, NY, NJ, PA
- Deployed ESF #3 TLs and ATLs to 10 state EOCs
- Deployed supplemental Logistics & IT Teams to NAP, NAN, & NAD to support the responders.
- Deployed liaisons to NYC and Washington DC OEMs
- Deployed 3 Mobile Command vehicles to ISBs in NJ, PA, MA
- Pre-positioned 374 power generators to ISBs
- Provided expertise to jurisdictions for evacuation decisions

NAD Support to the NRF - Response

- **Regional Activation**
  - Activated and deployed 113 ESF #3 teammates to NY and NJ within 48 hours after FEMA direction, including RRCC, IOF, JFO, IMATs, ESF#5, and others.
  - Used Local Government Liaisons to provide information to Division EOC and advise local government officials on what missions FEMA and USACE could provide the State

- **Power Mission**
  - Provided local and state officials with temporary emergency power needs at critical facilities to reinstitute local command and control and post-event recovery.
  - Performed 596 assessments
  - Installed 210 generators
  - Generated 55MW of power, enough power for 50,000 families

- **Unwatering Mission**
  - Unwatered strategic infrastructure immediately after the event to restore subway, commuter rail, and automotive lines.
  - Tunnels were unwatered in New York & New Jersey in 11 days (Oct 31- Nov 10)
  - Removed 474.5 million gallons

- **Pump Mission** (Unwatering sub-tasking)
  - Removed 400 tons of trash/debris
  - Pumped 10 million gallons
  - Enabled Prime Power to conduct assessments

- **Response Debris Mission**
  - Clearance of emergency routes in coordination with power companies.

- **National Water Mission**
  - Provided 512 truckloads of water (9.2 million liters)

NAD Support to the NRF - Recovery

- **Recovery Debris Mission**
  - Coordinated with state and local government officials for debris removal
  - 894,300 cy (298,100 tons) removed by ACI Contractor in New York.

- **Temporary Housing**
  - Refitted one building to provide 45 (3- bedroom) apartments and re-activating one building and 21 duplexes at Fort Monmouth, NJ, for citizens made homeless by Hurricane Sandy.
  - Apartments will be ADA-compliant.
  - FEMA to handle operations and maintenance after project turnover.

- **Infrastructure Assessment**
  - Augmented local public works to provide rapid structural assessment capabilities (primarily residential).
  - Provided a management cell for the full range of ad hoc technical assistance missions that are not covered by other PRTs.
    - Assessed tidal flooding issues
    - Recommended repairs at a wastewater treatment plant
    - Operations at Passaic Valley Wastewater Treatment Plant
    - Structural assessments of ferry facilities

- **Technical Assistance**
  - Provided expertise when state/local jurisdictions lack the ability to perform Civil Works and Engineering efforts.
    - Hoboken
    - Passaic Valley Sewage Commission
    - NY Coast
    - Coastal Repair

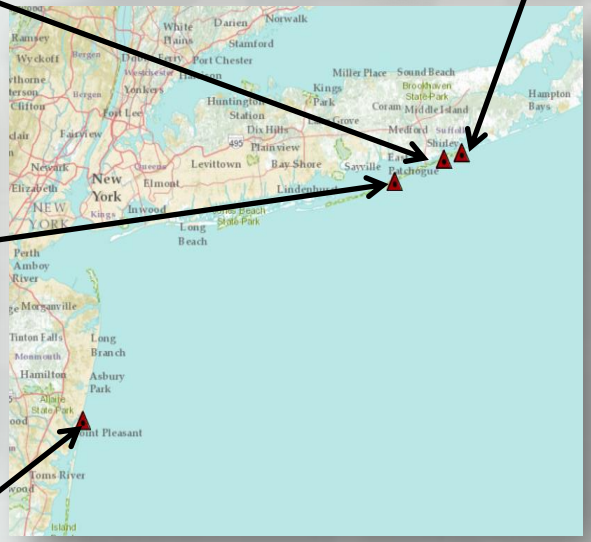
NAD received over 62 FEMA Mission Assignments for approximately $350M

Comprehensive Coastal Recovery Short-Term

Immediately following Hurricane Sandy NAD inspected all impacted projects. Four barrier island breaches were identified.

- 3 breaches eligible for repair within FEMA and USACE Authorities and as requested by the respective states.
  - Mantoloking, NJ - FEMA
  - Cupsogue County Park, NY – USACE Construction Funds
  - Smith Point County Park, NY – USACE Construction Funds
- 4th breach was located in an uninhabited wild life area (Fire Island, NY), managed by the National Park Service, has not been requested by the state.

Coastal Recovery – Short-term



Mission: Expedite emergency breach repair and transition to long-term shore recovery

Method of Delivery: Expedited contracts modifications to relocate two dredges from maintenance dredging work to accomplish breach closure at Cupsogue and Smith County State Park.

Results:

Cupsogue County Park, NY
- Started: November 18, 2012
- Competed: November 27, 2012
- Sand Placed: 200,000 cy

Smith Point County Park, NY
- Started: November 19, 2012
- Completed: 8 December 2012
- Sand Placed: 55,000 cy

Fire Island Wilderness Area, NY
- Restoration plan ongoing

Mantoloking, NJ
- Started: November 4, 2012
- Completed: December 6, 2012
- Sand Placed: 80,000 cy
- Rip Rap Placed: 1,550 tons

Hurricane Sandy Disaster Relief Appropriations Act of 2013 (PL 113 – 2)

- Allocated $5.35B ($5.1B after sequestration) to the USACE to address areas impacted by Hurricane Sandy
- North Atlantic Division (NAD) received $4.56B ($4.33B after sequestration) of this funding
- NAD execution of the Sandy Work Program:
  - Near-Term Coastal Restoration (FCCE)
  - Operations and Maintenance
  - Authorized But Not Yet Constructed
  - Coastal Storm Damage Risk Reduction Studies
  - Continuing Authorities Program
- Website for further information:

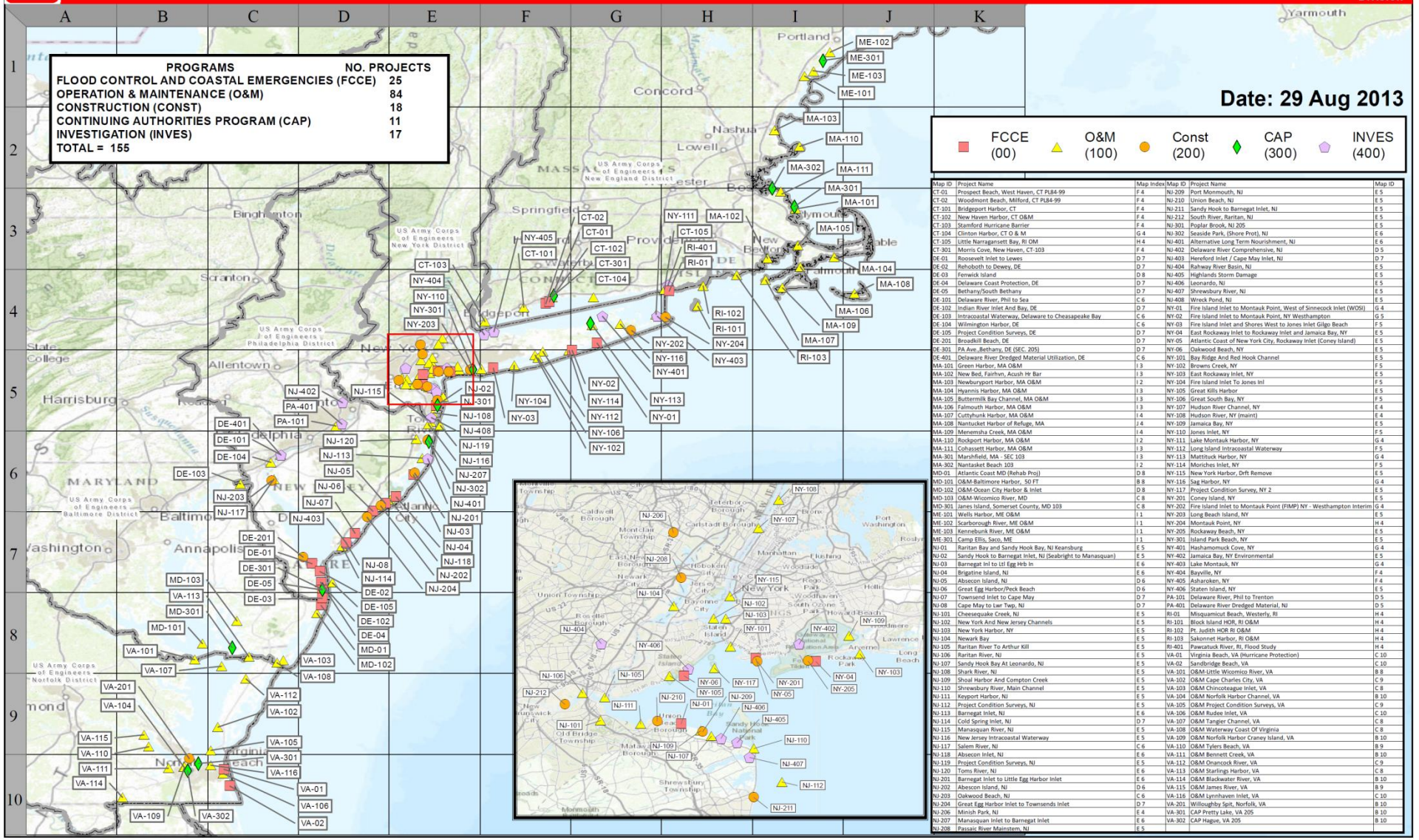
http://www.nad.usace.army.mil/Sandy

NAD Sandy Supplemental Projects

CENAD COMPREHENSIVE SANDY SUPPLEMENTAL PROGRAM - OVERVIEW

North Atlantic Division

PROGRAMS	NO. PROJECTS
FLOOD CONTROL AND COASTAL EMERGENCIES (FCCE)	25
OPERATION & MAINTENANCE (O&M)	84
CONSTRUCTION (CONST)	18
CONTINUING AUTHORITIES PROGRAM (CAP)	11
INVESTIGATION (INVES)	17
TOTAL =	155



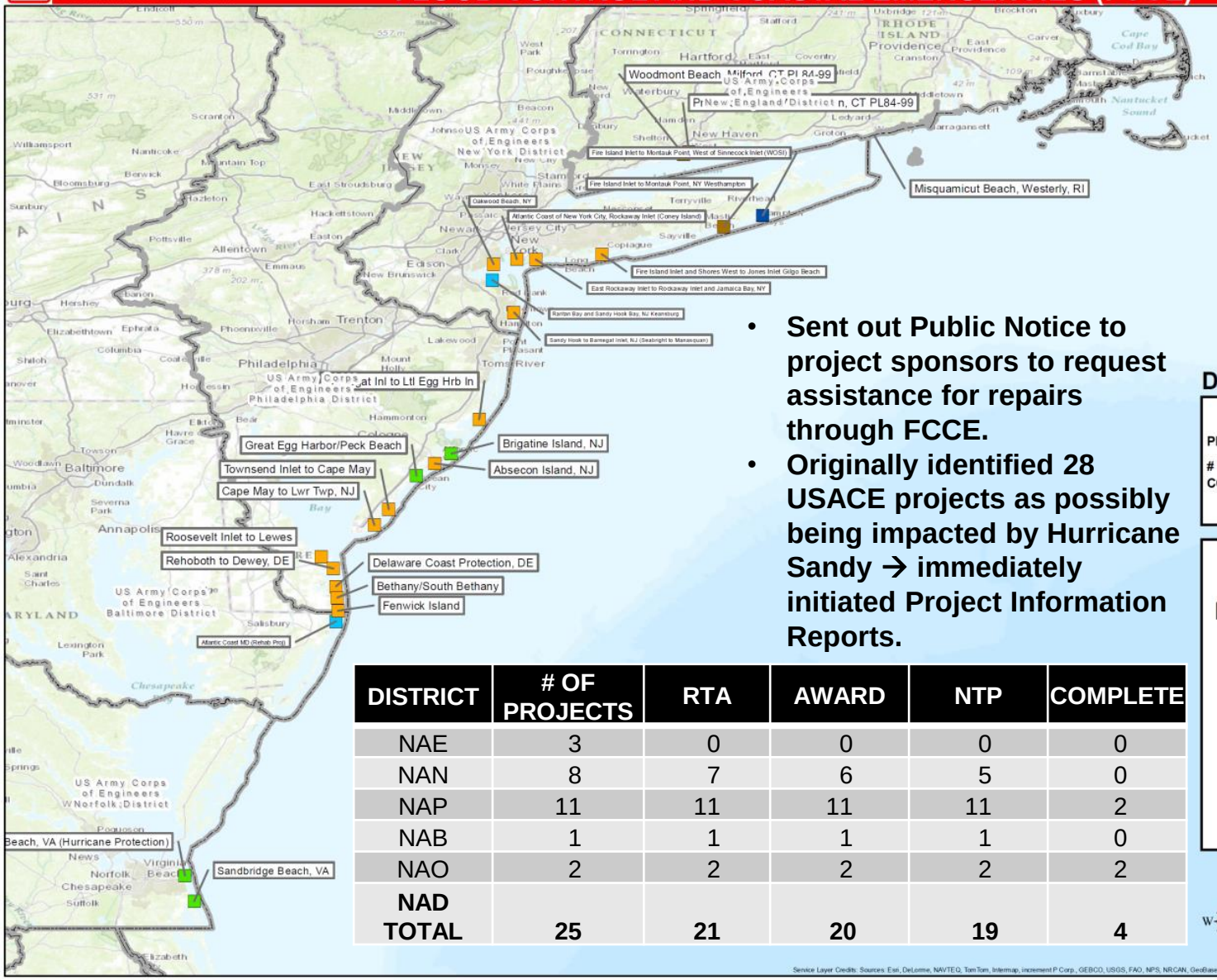
Map ID	Project Name	Map Index	Map ID	Project Name	Map ID
CT-01	Prospect Beach, West Haven, CT PL84-99	F 4	NJ-209	Port Monmouth, NJ	E 5
CT-02	Woodmont Beach, Milford, CT PL84-99	F 4	NJ-210	Union Beach, NJ	E 5
CT-101	Bridgeport Harbor, CT	F 4	NJ-211	Sandy Hook to Barnegat Inlet, NJ	E 5
CT-102	New Haven Harbor, CT O&M	F 4	NJ-212	South River, Raritan, NJ	E 5
CT-103	Stamford Hurricane Barrier	F 4	NJ-301	Poplar Brook, NJ 205	E 5
CT-104	Clinton Harbor, CT O & M	G 4	NJ-302	Seaside Park, (Shore Prot), NJ	E 6
CT-105	Little Narragansett Bay, RI OM	H 4	NJ-401	Alternative Long Term Nourishment, NJ	E 6
CT-301	Morris Cove, New Haven, CT-103	F 4	NJ-402	Delaware River Comprehensive, NJ	D 5
DE-01	Roosevelt Inlet to Lewes	D 7	NJ-403	Hereford Inlet / Cape May Inlet, NJ	D 7
DE-02	Rehoboth to Dewey, DE	D 7	NJ-404	Rahway River Basin, NJ	E 5
DE-03	Fenwick Island	D 8	NJ-405	Highlands Storm Damage	E 5
DE-04	Delaware Coast Protection, DE	D 7	NJ-406	Leonardo, NJ	E 5
DE-05	Bethany/South Bethany	D 7	NJ-407	Shrewsbury River, NJ	E 5
DE-101	Delaware River, Phil to Sea	C 6	NJ-408	Wreck Pond, NJ	E 5
DE-102	Indian River Inlet And Bay, DE	D 7	NY-01	Fire Island Inlet to Montauk Point, West of Sinnecock Inlet (WOSI)	G 4
DE-103	Intracoastal Waterway, Delaware to Cheasapeake Bay	C 6	NY-02	Fire Island Inlet to Montauk Point, NY Westhampton	G 5
DE-104	Wilmington Harbor, DE	C 6	NY-03	Fire Island Inlet and Shores West to Jones Inlet Gilgo Beach	F 5
DE-105	Project Condition Surveys, DE	D 7	NY-04	East Rockaway Inlet to Rockaway Inlet and Jamaica Bay, NY	E 5
DE-201	Broadkill Beach, DE	D 7	NY-05	Atlantic Coast of New York City, Rockaway Inlet (Coney Island)	E 5
DE-301	PA Ave.,Bethany, DE (SEC. 205)	D 7	NY-06	Oakwood Beach, NY	E 5
DE-401	Delaware River Dredged Material Utilization, DE	C 6	NY-101	Bay Ridge And Red Hook Channel	E 5
MA-101	Green Harbor, MA O&M	I 3	NY-102	Browns Creek, NY	F 5
MA-102	New Bed, Fairhvn, Acush Hr Bar	I 3	NY-103	East Rockaway Inlet, NY	E 5
MA-103	Newburyport Harbor, MA O&M	I 2	NY-104	Fire Island Inlet To Jones Inl	F 5
MA-104	Hyannis Harbor, MA O&M	I 3	NY-105	Great Kills Harbor	E 5
MA-105	Buttermilk Bay Channel, MA O&M	I 3	NY-106	Great South Bay, NY	F 5
MA-106	Falmouth Harbor, MA O&M	I 3	NY-107	Hudson River Channel, NY	E 4
MA-107	Cuttyhunk Harbor, MA O&M	I 4	NY-108	Hudson River, NY (maint)	E 4
MA-108	Nantucket Harbor of Refuge, MA	J 4	NY-109	Jamaica Bay, NY	E 5
MA-109	Menemsha Creek, MA O&M	I 4	NY-110	Jones Inlet, NY	F 5
MA-110	Rockport Harbor, MA O&M	I 2	NY-111	Lake Montauk Harbor, NY	G 4
MA-111	Cohassett Harbor, MA O&M	I 3	NY-112	Long Island Intracoastal Waterway	F 5
MA-301	Marshfield, MA - SEC 103	I 3	NY-113	Mattituck Harbor, NY	G 4
MA-302	Nantasket Beach 103	I 2	NY-114	Moriches Inlet, NY	F 5
MD-01	Atlantic Coast MD (Rehab Proj)	D 8	NY-115	New York Harbor, Drft Remove	E 5
MD-103	O&M-Baltimore Harbor, 50 FT	B 8	NY-116	Sag Harbor, NY	G 4
MD-102	O&M-Ocean City Harbor & Inlet	D 8	NY-117	Project Condition Survey, NY 2	E 5
MD-103	O&M-Wicomico River, MD	C 8	NY-201	Coney Island, NY	E 5
MD-301	Janes Island, Somerset County, MD 103	C 8	NY-202	Fire Island Inlet to Montauk Point (FIMP) NY - Westhampton Interim	G 4
ME-101	Wells Harbor, ME O&M	I 1	NY-203	Long Beach Island, NY	E 5
ME-102	Scarborough River, ME O&M	I 1	NY-204	Montauk Point, NY	H 4
ME-103	Kennebunk River, ME O&M	I 1	NY-205	Rockaway Beach, NY	E 5
ME-301	Camp Ellis, Saco, ME	I 1	NY-301	Island Park Beach, NY	E 5
NJ-01	Raritan Bay and Sandy Hook Bay, NJ Keansburg	E 5	NY-401	Hashamomuck Cove, NY	G 4
NJ-02	Sandy Hook to Barnegat Inlet, NJ (Seabright to Manasquan)	E 5	NY-402	Jamaica Bay, NY Environmental	E 5
NJ-03	Barnegat Inl to Lt Egg Hrb In	E 6	NY-403	Lake Montauk, NY	G 4
NJ-04	Brigatine Island, NJ	E 6	NY-404	Bayville, NY	F 4
NJ-05	Absecon Island, NJ	D 6	NY-405	Asharoken, NY	F 4
NJ-06	Great Egg Harbor/Peck Beach	D 6	NY-406	Staten Island, NY	E 5
NJ-07	Townsend Inlet to Cape May	D 7	PA-101	Delaware River, Phil to Trenton	D 5
NJ-08	Cape May to Lwr Twp, NJ	D 7	PA-401	Delaware River Dredged Material, NJ	D 5
NJ-101	Cheesequake Creek, NJ	E 5	RI-01	Misquamicut Beach, Westerly, RI	H 4
NJ-102	New York And New Jersey Channels	E 5	RI-101	Block Island HOR, RI O&M	H 4
NJ-103	New York Harbor, NY	E 5	RI-102	Pt. Judith HOR RI O&M	H 4
NJ-104	Newark Bay	E 5	RI-103	Sakonnet Harbor, RI O&M	H 4
NJ-105	Raritan River To Arthur Kill	E 5	RI-401	Pawcatuck River, RI, Flood Study	H 4
NJ-106	Raritan River, NJ	E 5	VA-01	Virginia Beach, VA (Hurricane Protection)	C 10
NJ-107	Sandy Hook Bay At Leonardo, NJ	E 5	VA-02	Sandbridge Beach, VA	C 10
NJ-108	Shark River, NJ	E 5	VA-101	O&M-Little Wicomico River, VA	B 8
NJ-109	Shoal Harbor And Compton Creek	E 5	VA-102	O&M Cape Charles City, VA	C 9
NJ-110	Shrewsbury River, Main Channel	E 5	VA-103	O&M Chincoteague Inlet, VA	C 8
NJ-111	Keyport Harbor, NJ	E 5	VA-104	O&M Norfolk Harbor Channel, VA	B 10
NJ-112	Project Condition Surveys, NJ	E 5	VA-105	O&M Project Condition Surveys, VA	C 9
NJ-113	Barnegat Inlet, NJ	E 6	VA-106	O&M Rudee Inlet, VA	C 10
NJ-114	Cold Spring Inlet, NJ	D 7	VA-107	O&M Tangier Channel, VA	C 8
NJ-115	Manasquan River, NJ	E 5	VA-108	O&M Waterway Coast Of Virginia	C 8
NJ-116	New Jersey Intracoastal Waterway	E 5	VA-109	O&M Norfolk Harbor Craney Island, VA	B 10
NJ-117	Salem River, NJ	C 6	VA-110	O&M Tylers Beach, VA	B 9
NJ-118	Absecon Inlet, NJ	E 6	VA-111	O&M Bennett Creek, VA	B 10
NJ-119	Project Condition Surveys, NJ	E 5	VA-112	O&M Onancock River, VA	C 9
NJ-120	Toms River, NJ	E 6	VA-113	O&M Starlings Harbor, VA	C 8
NJ-201	Barnegat Inlet to Little Egg Harbor Inlet	E 6	VA-114	O&M Blackwater River, VA	B 10
NJ-202	Absecon Island, NJ	D 6	VA-115	O&M James River, VA	B 9
NJ-203	Oakwood Beach, NJ	C 6	VA-116	O&M Lynnhaven Inlet, VA	C 10
NJ-204	Great Egg Harbor Inlet to Townsends Inlet	D 7	VA-201	Willoughby Spit, Norfolk, VA	B 10
NJ-206	Minish Park, NJ	E 4	VA-301	CAP Pretty Lake, VA 205	B 10
NJ-207	Manasquan Inlet to Barnegat Inlet	E 6	VA-302	CAP Hague, VA 205	B 10
NJ-208	Passaic River Mainstem, NJ	E 5			

Sandy FCCE Projects

COMPREHENSIVE SANDY SUPPLEMENTAL PROGRAM

FLOOD CONTROL AND COASTAL EMERGENCIES (FCCE)

NORTH ATLANTIC DIVISION



- **Sent out Public Notice to project sponsors to request assistance for repairs through FCCE.**
- **Originally identified 28 USACE projects as possibly being impacted by Hurricane Sandy → immediately initiated Project Information Reports.**

DISTRICT	# OF PROJECTS	RTA	AWARD	NTP	COMPLETE
NAE	3	0	0	0	0
NAN	8	7	6	5	0
NAP	11	11	11	11	2
NAB	1	1	1	1	0
NAO	2	2	2	2	2
NAD TOTAL	**25**	**21**	**20**	**19**	**4**

Date: 29 August 2013

PROGRAM:	FLOOD CONTROL AND COASTAL EMERGENCIES (FCCE)	
# OF PROJECTS:		25
COST:	$	607,638,611

Legend

Project Construction Status

- Funds Received
- RTA
- Contract Awarded
- NTP/Construction
- Complete
- District Boundary

N W E S

0 12.5 25 50 75 100

Miles

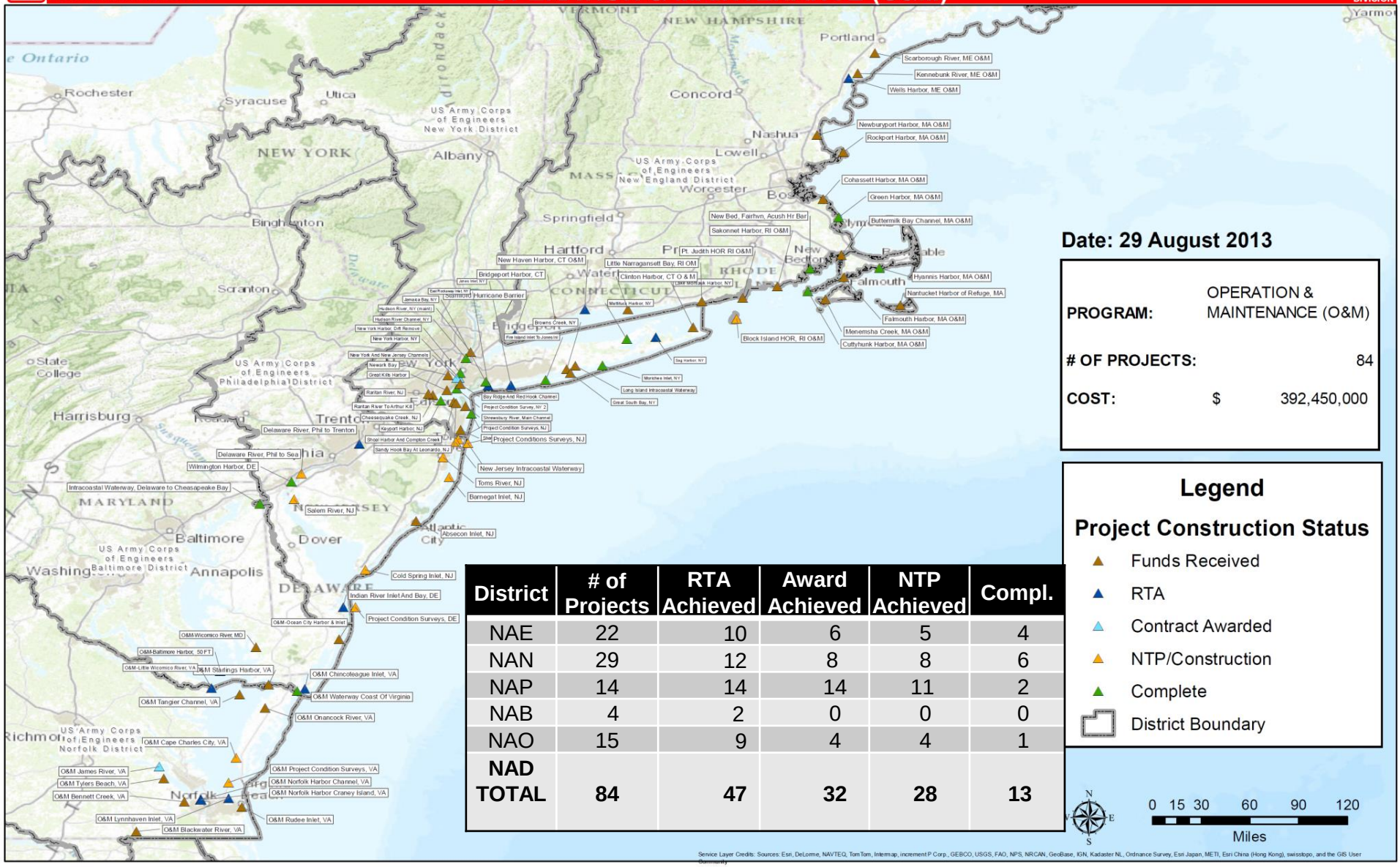
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Sandy O&M Projects

COMPREHENSIVE SANDY SUPPLEMENTAL PROGRAM

OPERATION & MAINTENANCE (O&M)

NORTH ATLANTIC DIVISION



Date: 29 August 2013

PROGRAM:	OPERATION & MAINTENANCE (O&M)	
# OF PROJECTS:		84
COST:	$	392,450,000

District	# of Projects	RTA Achieved	Award Achieved	NTP Achieved	Compl.
NAE	22	10	6	5	4
NAN	29	12	8	8	6
NAP	14	14	14	11	2
NAB	4	2	0	0	0
NAO	15	9	4	4	1
NAD TOTAL	**84**	**47**	**32**	**28**	**13**

Legend

Project Construction Status

- Funds Received
- RTA
- Contract Awarded
- NTP/Construction
- Complete
- District Boundary

0 15 30 60 90 120

Miles

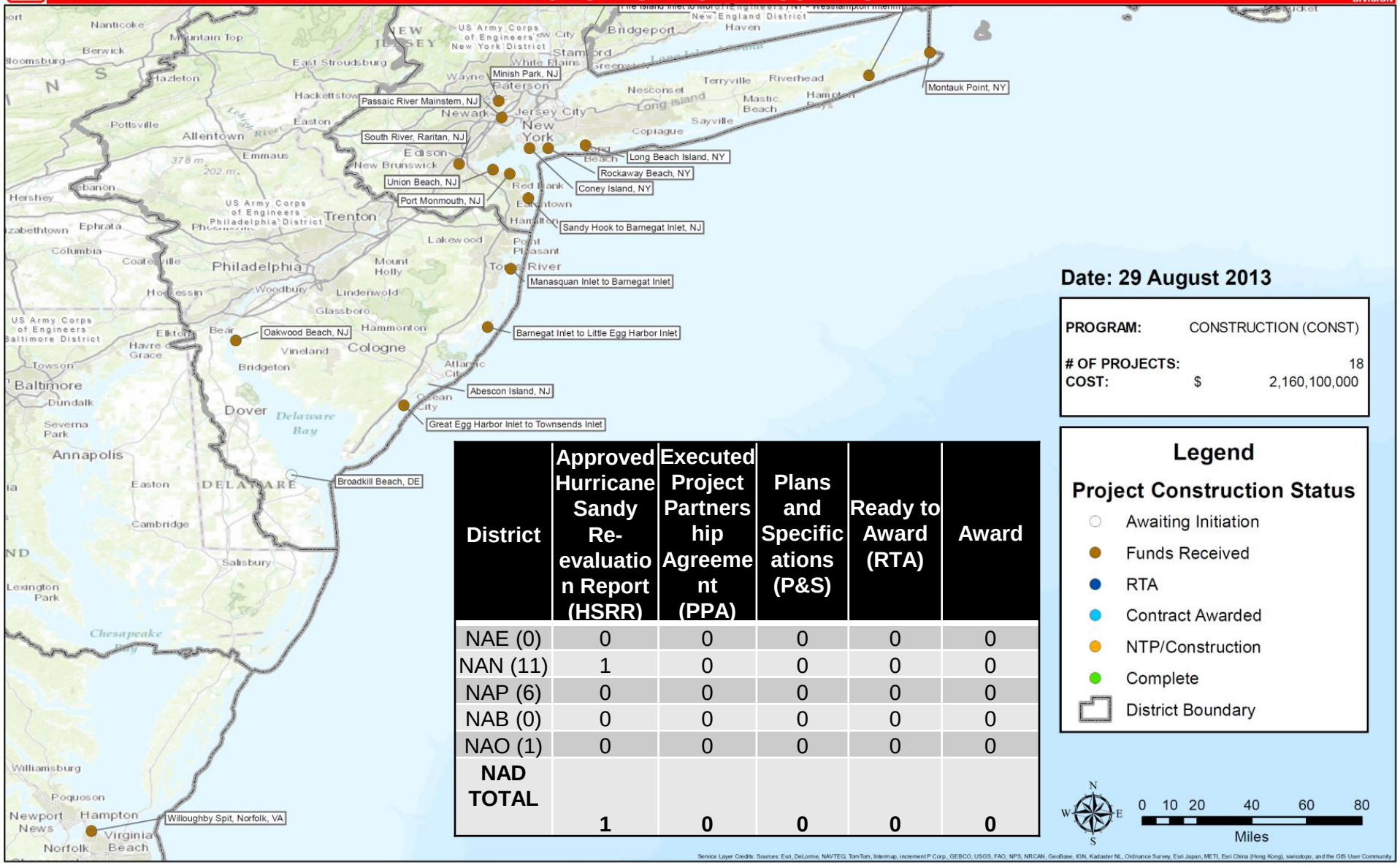
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Sandy Authorized but Unconstructed Construction Projects

COMPREHENSIVE SANDY SUPPLEMENTAL PROGRAM

CONSTRUCTION PROJECTS

NORTH ATLANTIC DIVISION



Date: 29 August 2013

PROGRAM:	CONSTRUCTION (CONST)	
# OF PROJECTS:		18
COST:	$	2,160,100,000

District	Approved Hurricane Sandy Re-evaluation Report (HSRR)	Executed Project Partnership Agreement (PPA)	Plans and Specifications (P&S)	Ready to Award (RTA)	Award
NAE (0)	0	0	0	0	0
NAN (11)	1	0	0	0	0
NAP (6)	0	0	0	0	0
NAB (0)	0	0	0	0	0
NAO (1)	0	0	0	0	0
NAD TOTAL	**1**	**0**	**0**	**0**	**0**

Legend

Project Construction Status

- Awaiting Initiation
- Funds Received
- RTA
- Contract Awarded
- NTP/Construction
- Complete
- District Boundary

N W E S

0 10 20 40 60 80

Miles

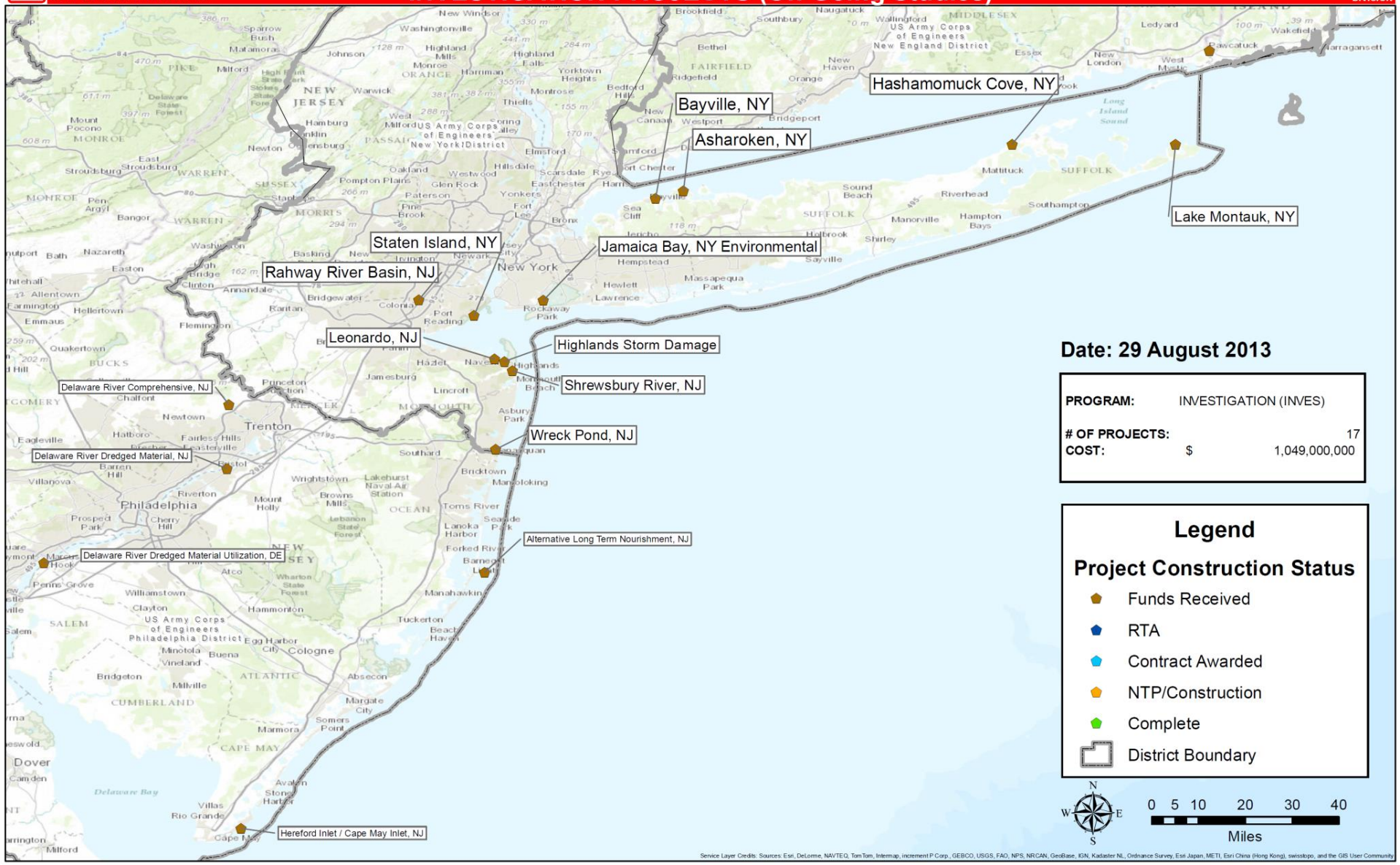
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Sandy Investigations

COMPREHENSIVE SANDY SUPPLEMENTAL PROGRAM

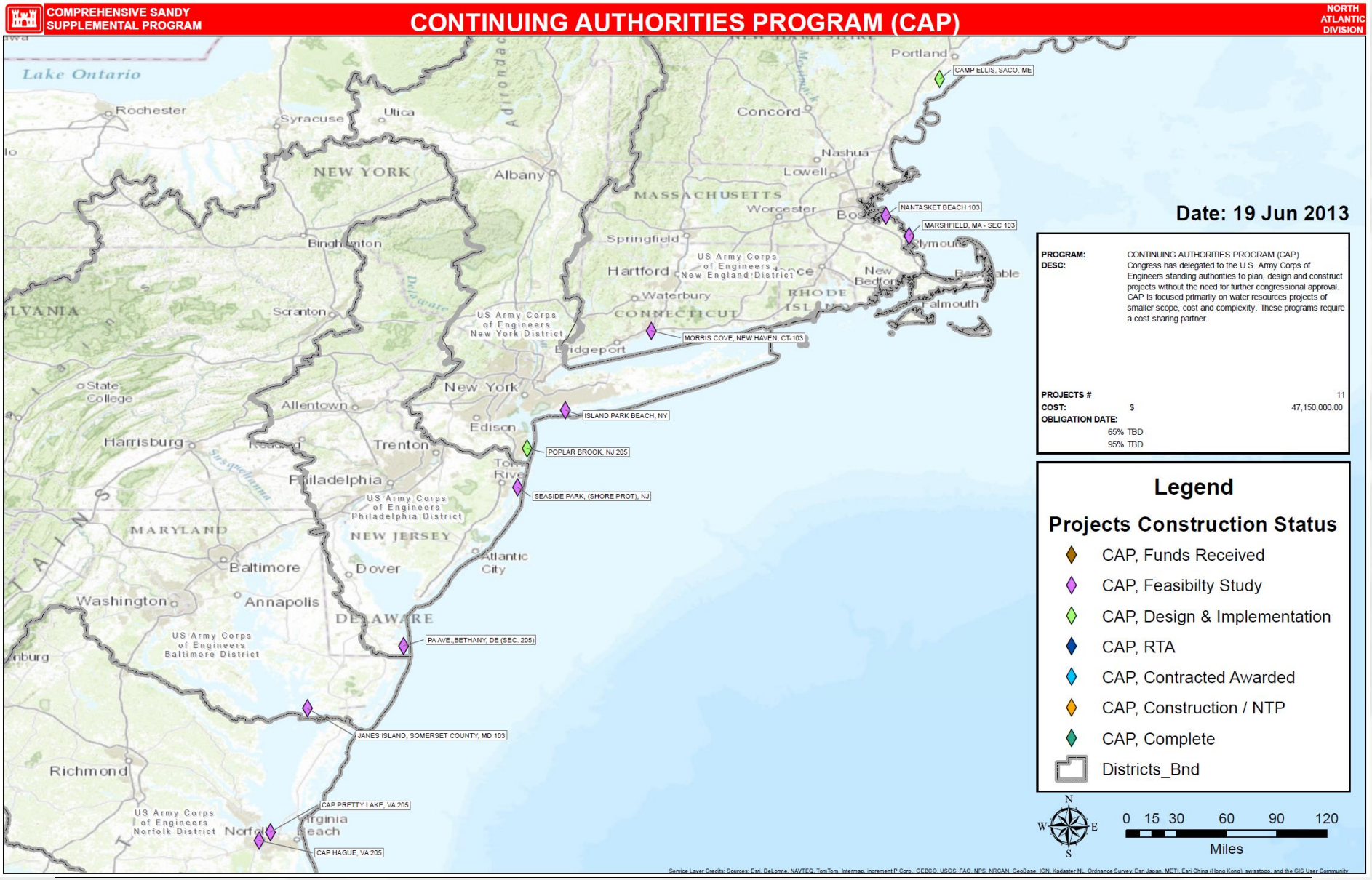
INVESTIGATION PROJECTS (On-Going Studies)

NORTH ATLANTIC DIVISION



BUILDING STRONG®

Sandy Continuing Authorities Program (CAP) Projects



Hurricane Sandy Coastal Projects Performance Evaluation Study

Per Disaster Relief Appropriations Act of 2013 (PL 113-2) the USACE was tasked to:

- Evaluate the performance of existing (constructed) Corps coastal projects affected by Hurricane Sandy throughout North Atlantic Division
- Determine effectiveness of the projects
- Recommend improvements to individual projects and to design standards and practices
- Assess institutional and other barriers preventing comprehensive protection to coastal areas
- Identify and discuss benefit categories not considered in project justification, such as:
  - Safety
  - Avoidance of Loss of Life
  - Infrastructure Impacts
  - Ecosystem Services
  - Other Social Effects
  - Long lasting Consequences of Impacts
  - Disruptions

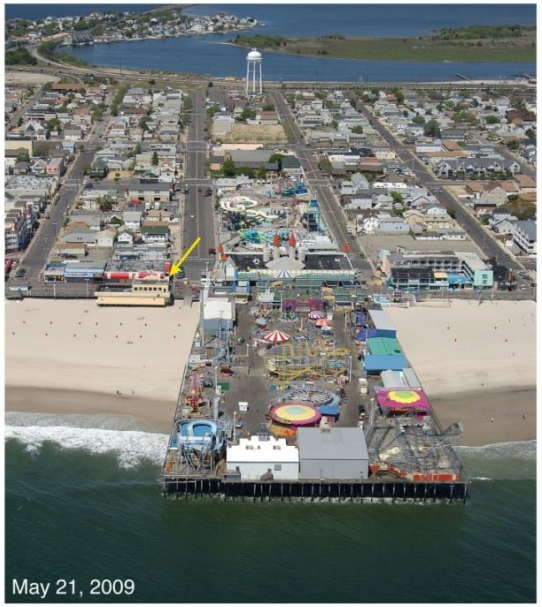
- Projects were evaluated primarily on engineering metrics with a secondary evaluation based upon economics and damages prevented
- Funding - $475K

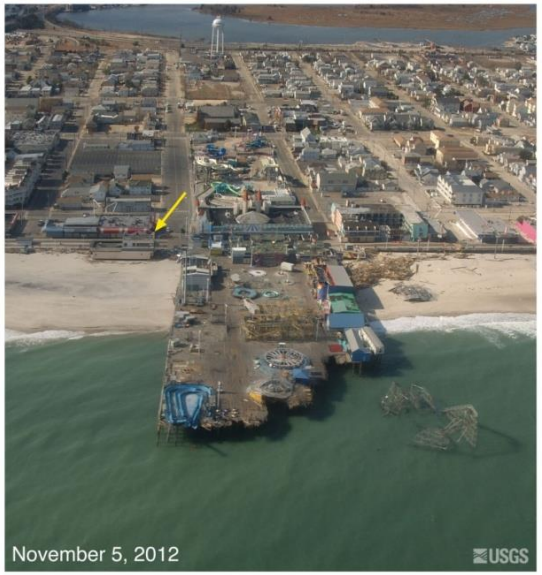
Projects Evaluated

- Constructed coastal flood risk management and ecosystem restoration projects within North Atlantic Division (75 projects):
  - NH – 2, MA – 15, RI – 4, CT – 13, NY – 11, NJ – 11, DE – 7, MD – 2, VA - 10
- CAP Section 103, 14 and 204 projects were included
- General performance evaluations were performed for projects within SAD and LRD as a whole.

Performance Evaluation Methodology

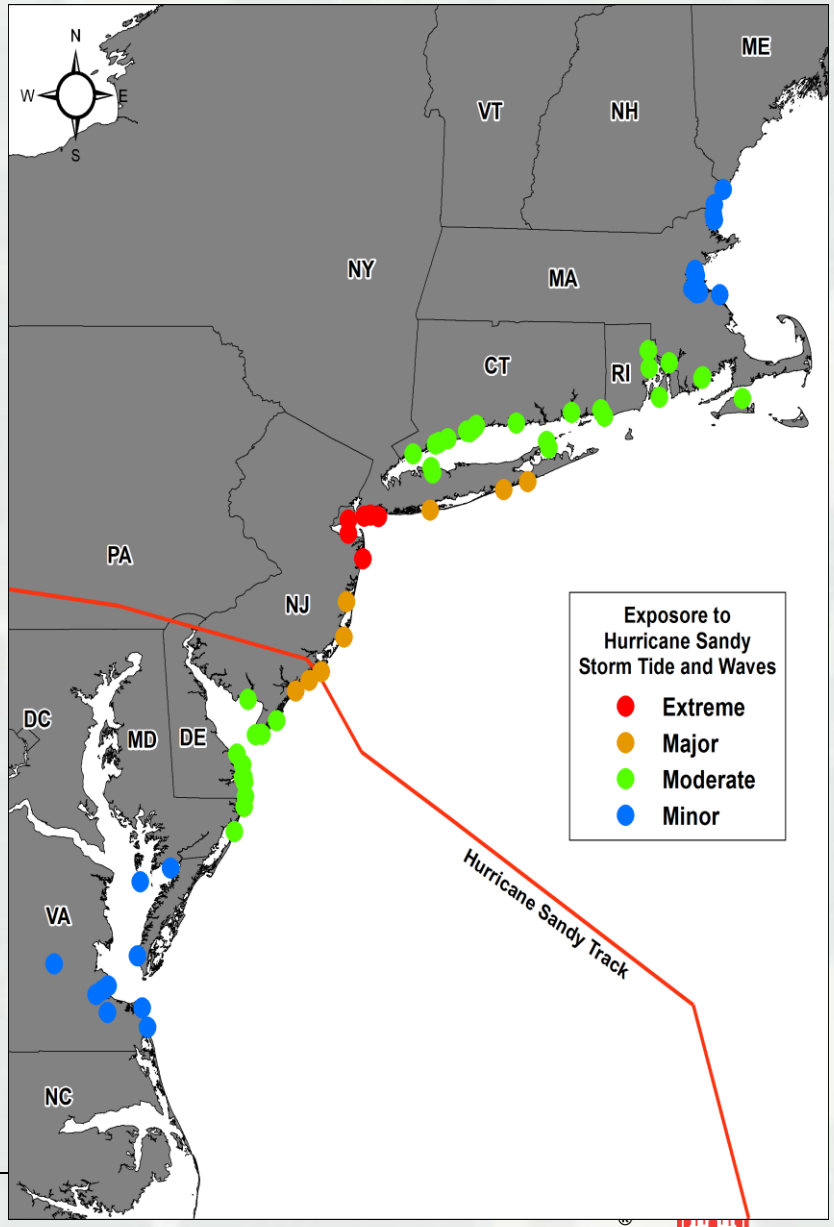
- **Physical performance –** Evaluated the performance of the project itself as an engineered feature to limit inundation, wave attack and storm induced erosion.
- **Economic performance –** Evaluated the manner in and the extent to which the project achieved the intended reduction in risk of coastal storm damages.
- Performance of each project was documented in standardized data call templates and impacts to project features were documented.





Project Performance

- Summarized according to four classifications used to organize the evaluation study.
- **Extreme:** Storm tide greater than +9 ft MHHW, offshore significant wave heights greater than 30 ft. Greater than a 200-year event.
- **Major:** Storm tide between +6 and +9 ft MHHW, offshore significant wave heights greater than 30 ft. Between a 30 and a 200- year event.
- **Moderate:** Storm tide between +4 and +6 ft MHHW, offshore significant wave heights 20 to 30 ft. Between a 10 and a 30-year event.
- **Minor:** Storm tide less than +4 ft MHHW, offshore significant waves heights less than 20 ft. Less than a 10-year event.



Physical Performance Evaluation Considerations

- The performance evaluation considered three key factors:
  - The type, extent and magnitude of storm damages experienced and benefits provided by the project.
    - This is the measure of whether a project met its intended purpose. Comparisons of Hurricane Sandy's impact to immediately adjacent communities and the neighboring areas are a gage of a project's effectiveness.
  - The pre-storm condition of the projects and whether advanced or delayed nourishment or deferred maintenance affected the reliability of the project.
    - This could influence recommendations regarding funding and maintenance and re-nourishment practices.
  - How the physical features of the projects performed relative to design expectations and other nearby projects.
    - This evaluation could affect recommendations regarding design standards or best practices.

Economic Performance for Extreme Exposure Projects

- Significant economic benefits even though design level significantly exceeded.
- Structures on the beach generally destroyed or severely damaged.
- Buildings set back from shoreline were subject to less significant wave and erosion damages, but subject to inundation.
- Projects provided reduction in storm damage, protected some critical infrastructure and reduced post storm recovery efforts

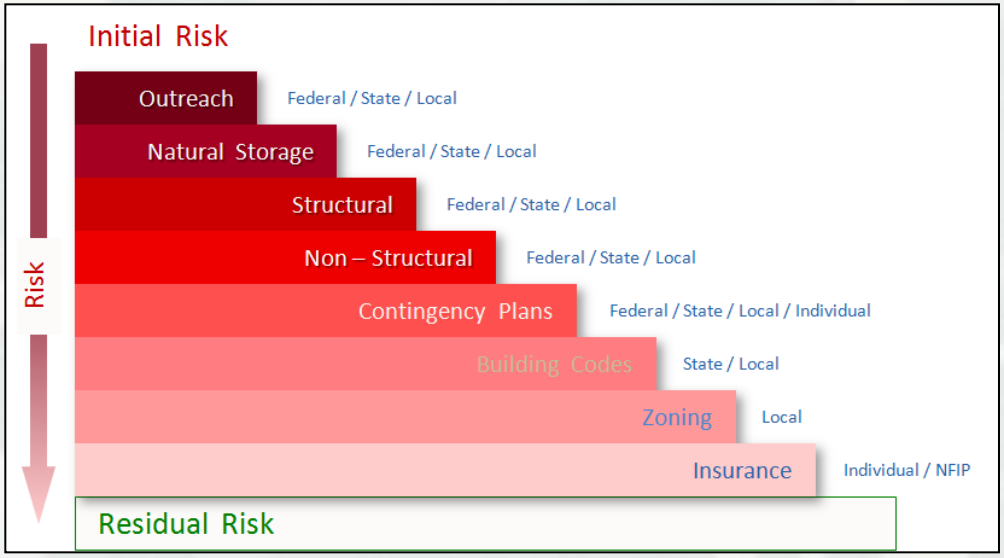
Project Performance in SAD and LRD

- South Atlantic Division
  - Projects performed as intended
  - Significant erosion occurred to beach berms
    - Erosion potential based on Storm Erosion Index > than Hurricane Frances and Jeanne (2004) → 30-yr erosion event
  - Damage to shorefront structures and infrastructure was minimal → damage limited to beach berm and dune system
- Great Lakes and Ohio River Division
  - Higher vulnerability to storm damage due to lack of maintenance and age of projects
  - 15 to 20 ft waves recorded across the Great Lakes caused damage to thirty one projects

Preliminary Findings

- Records set throughout NAD for storm tides and waves
- Projects performed better than expected
- Experienced widespread back-bay flooding
- Protective dunes and high storm berms performed well
- Increased damages at project ends
- Damages less than without project
- Specifying a specific level of risk reduction is not common throughout NAD
- Findings support a strategy to implement a systems approach to comprehensive coastal protection; the development and maintenance of the Coastal Systems Portfolio Initiative; and the development of coastal depth-damage curves to more accurately identify storm damages prevented.

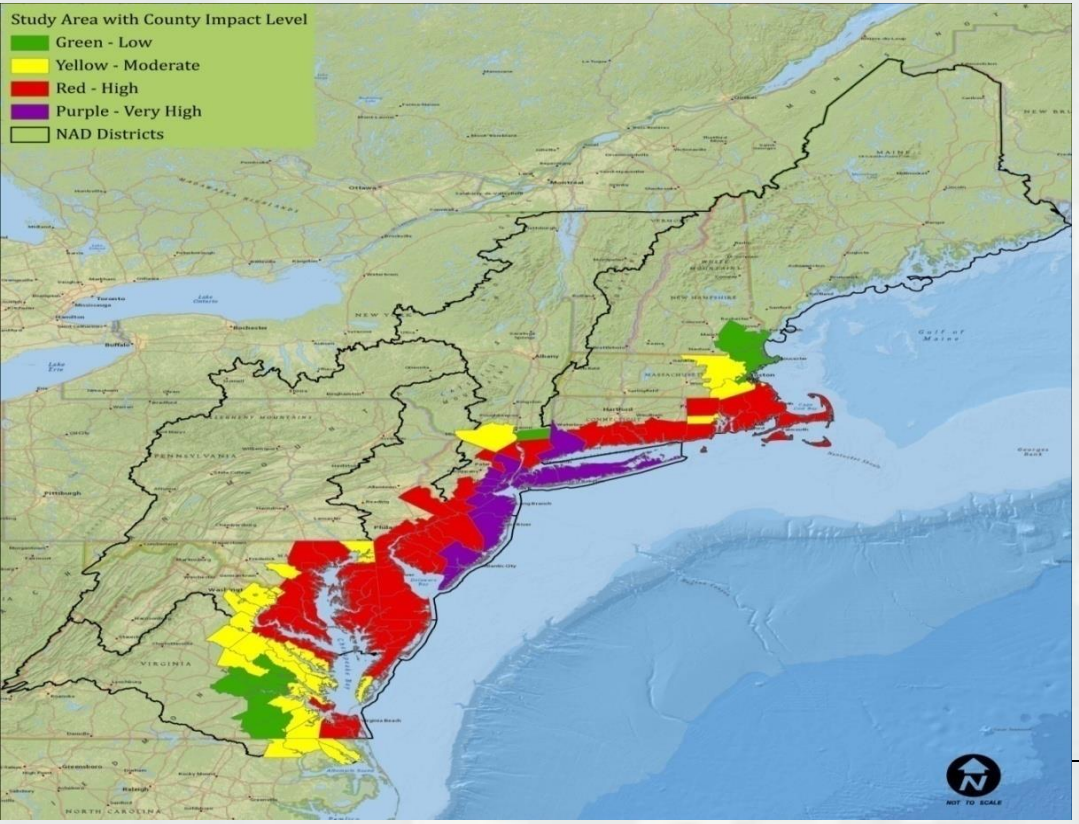
Preliminary Institutional and Other Barriers to Comprehensive Protection



- Lack of authorizations to address back-bay flooding
- Lack of dunes
- Limited availability of data
- Cost and acquisition of real estate easements
- Maintaining the profile of a nourished shoreline
- Permitting constraints and environmental construction windows
- Formulation of coastal flood risk management projects
- Cost sharing requirements and local sponsor's ability to pay
- Implementable and enforceable flood plain management plans
- Opposition from recreational shoreline users

North Atlantic Coast Comprehensive Study Authority, Study Area, and Goals

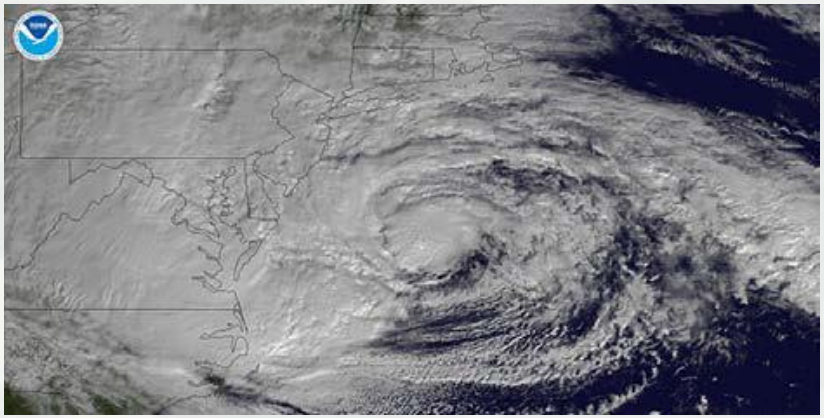
- "… using up to $20,000,000* of the funds provided herein, the Secretary shall conduct a **comprehensive study** to address the flood risks of **vulnerable coastal populations** in areas that were **affected by Hurricane Sandy** within the boundaries of the **North Atlantic Division** of the Corps…" (*$19M - sequestration)
- To be completed by **Jan 2015**



According to the NOAA-USACE Infrastructure Systems Rebuilding Principles the NACCS will:

- Provide a **Risk Reduction Framework**
- Support **resilient coastal communities and sustainable coastal landscape systems,** considering future sea level rise and climate change scenarios, to reduce risk to vulnerable population, property, ecosystems, and infrastructure.

Scoping Process



Infrastructure Systems Rebuilding Principles NOAA-USACE
28 February 2013

Resilience: Ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies

Coastal Risk Reduction Framework

- Collaborative across multiple scales of governance (Local, State, Tribal, and Federal)
- Improve coastal resilience by pursuing a systems approach that incorporates natural, social, and built systems as a whole
- Promote increased recognition and awareness of risks and consequences among decision makers, stakeholders, and the public

Scoping Process

- USACE Coastal Storm Risk Management

National Planning Center of Expertise

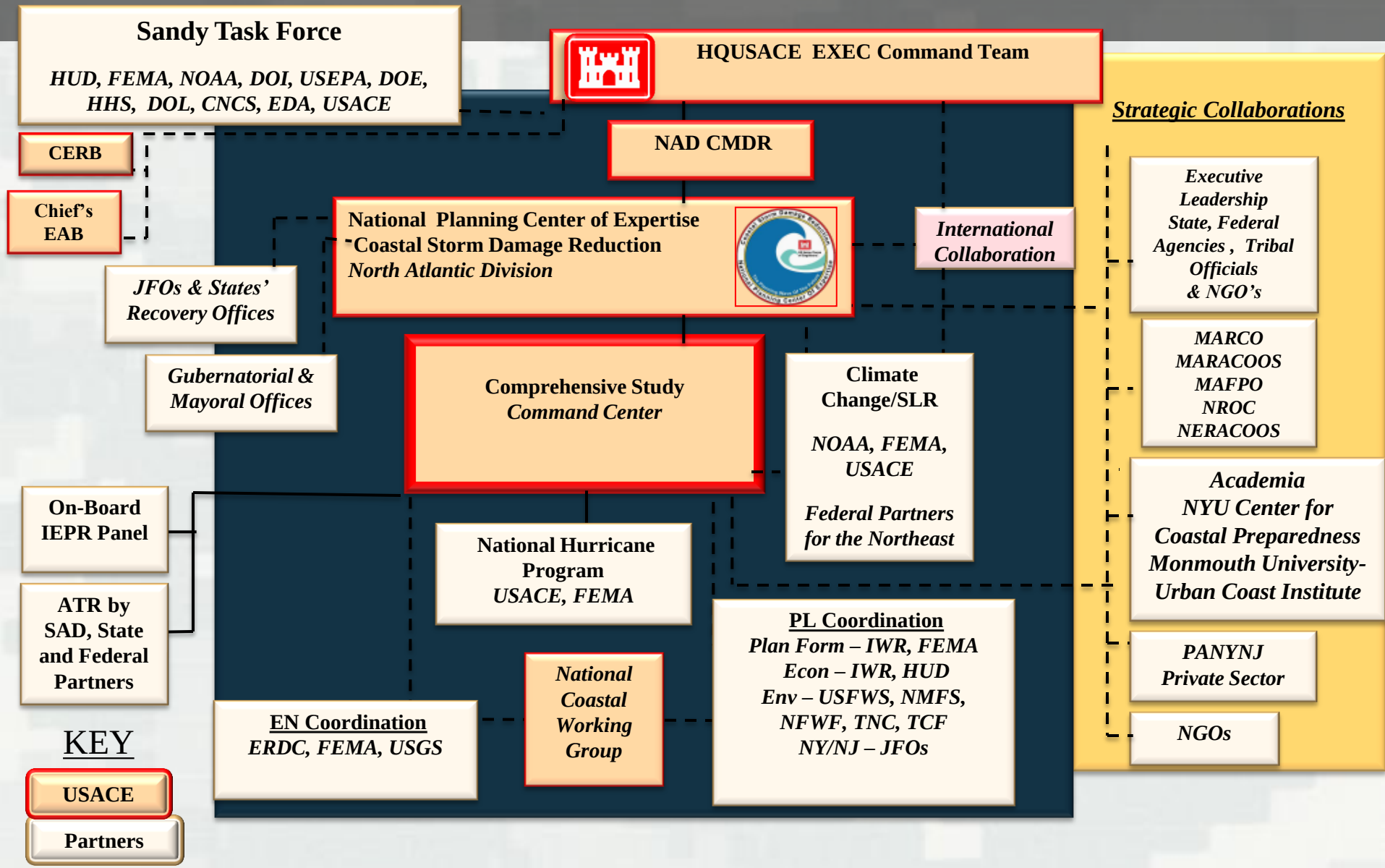
- USACE Vertical Team
  - HQUSACE Governing Body
  - USACE Enterprise Technical Team
- Project Management Plan and Scope of Work
- National and Regional Collaboration: Federal Agencies, States, NYC, DC, Tribes
  - Agency Single Point of Contact and Subject Matter Experts
  - Federal Register Notice (19 June 2013)
  - Response to 267 comments issued (28 June 2013)
- Review Plan (30 June 2013)
- Continuous Smart Planning Decision Log

Scoping Process

- **Coastal Framework**
  - Storm suite modeling and sea level rise analyses
  - Economic depth-damage curves with secondary and tertiary effects
  - Regional Sediment Management
  - Social Vulnerability
  - Nature-Based Features
  - USFWS and NMFS Planning Aid Reports

- **No NEPA Documentation**
- **No Design/Construction Recommendations**
- **Identify activities warranting additional analysis**
- **Identify social and Institutional barriers**

Hurricane Sandy Comprehensive Study: Collaboration



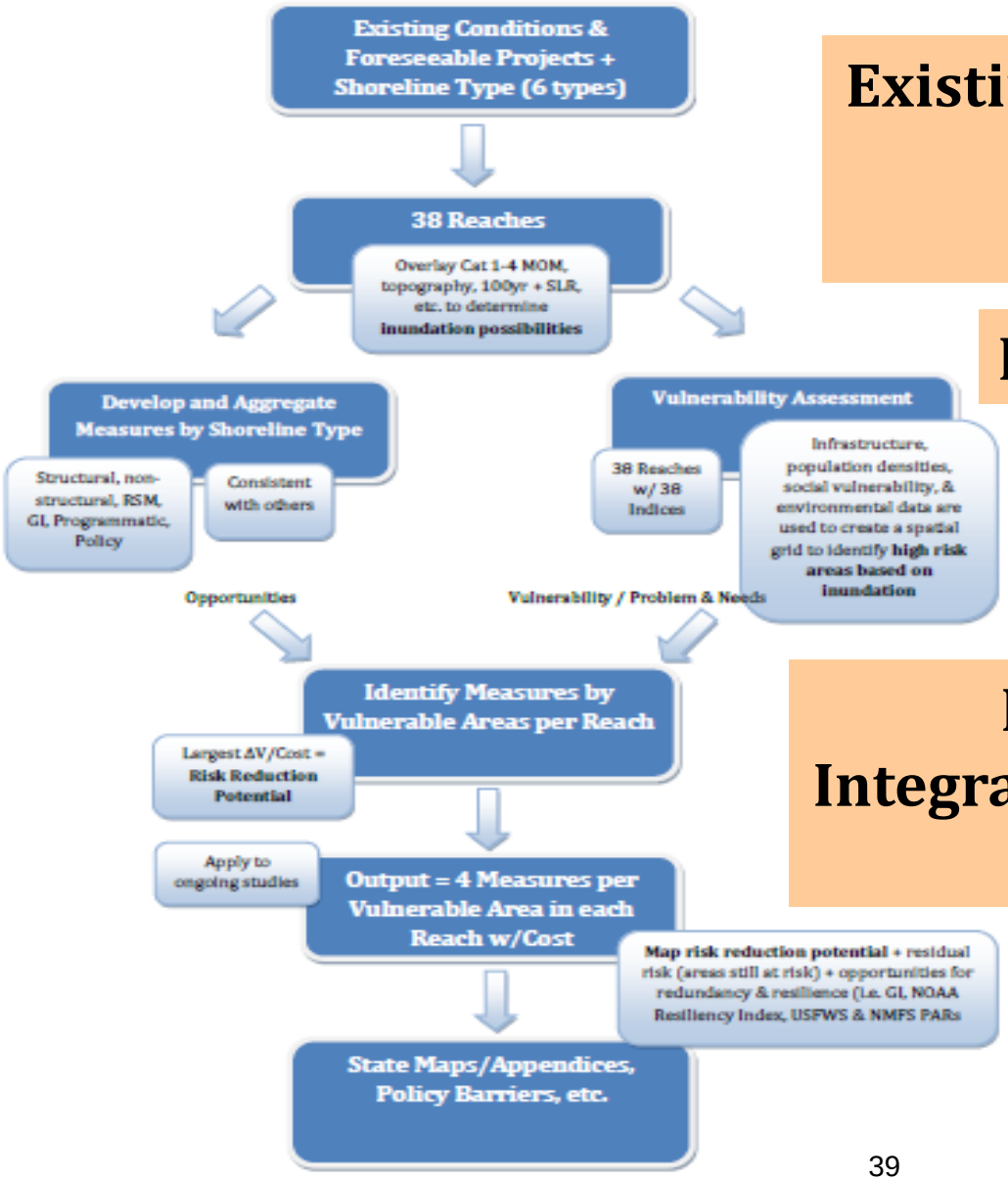
Collaboration and Public Outreach

- **Technical Working Meetings & Webinars (Jul-Sep 2013)**
  - Numerical Modeling
  - Resiliency Measures
  - Nature-Based Features
- **Interagency Collaboration Webinar Series (Jul-Dec 2013)**
  - July – Nature-Based Measures
  - Aug – Ecosystem Goods and Services
  - Sep – Identification of Vulnerable Communities
  - Oct – Adaptive Management
  - Nov – Sea Level Rise & Climate Change
  - Dec – Nature-Based Measures (risk reduction applications) and/or Policy Barriers
- **Partner and Stakeholder Outreach (Fall 2013 – Jun 2014)**
  - NY/NJ Harbor Coordination Meeting (Fall 2013)
  - Federal, State (NYC and DC), NGO, Tribal (Jan-Mar 2014)

Collaboration and Public Outreach

- **Notice in Federal Register**
- **Press Releases and Media Communication**
- **Task Force and Joint Field Offices**
- **Public Engagement Opportunities**
  - Participate in State and Regional Forum
  - Local, academia, agency, public meetings/events
  - Exchange of ideas and input
- **Visioning Sessions**
  - Oct 2013-March 2014
  - Locations throughout the North Atlantic Coast Study Area
- **Public Website**
  http://www.nad.usace.army.mil/Missions/CivilWorks/HurricaneSandyCoastalRecovery/NorthAtlanticComprehensiveStudy.aspx
  - Subscribe for Update Alerts
  - Solicit Coastal Resiliency Input

Risk Reduction Framework



Existing and Future Conditions
31,000 miles
38 Reaches

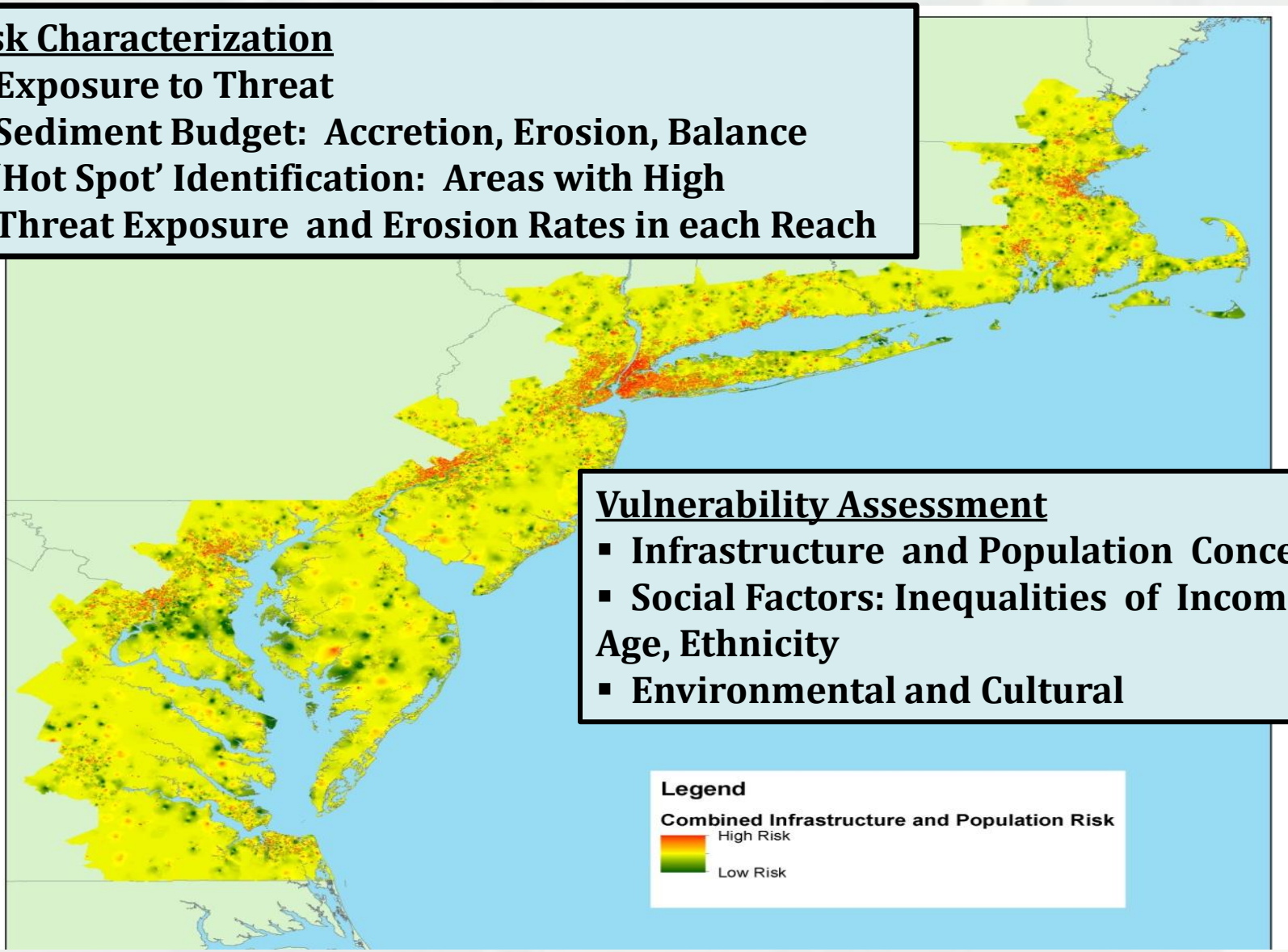
Measures - Vulnerability

Measures by Reach
Integrated Conceptual Plans for Vulnerable Areas

Risk Reduction Framework

Risk Characterization

- Exposure to Threat
- Sediment Budget: Accretion, Erosion, Balance
- 'Hot Spot' Identification: Areas with High
- Threat Exposure and Erosion Rates in each Reach



Vulnerability Assessment

- Infrastructure and Population Concentration
- Social Factors: Inequalities of Income Status, Age, Ethnicity
- Environmental and Cultural

Coastal Risk Reduction and Resilience Measures

Measure	Definition	Effect	Examples
Natural	Created through the action of physical, biological, geologic, and chemical processes operating in nature	Shoreline erosion control, wave and surge attenuation, especially in low-energy environments; additional resilience benefits; dynamic behavior and response affect performance with respect to objectives	Barrier islands, dunes, reefs, wetlands, marsh islands and riparian corridors  
Nature-Based	Products of planning, engineering design, and construction incorporating natural processes that contribute to coastal risk reduction and resilience	Shoreline erosion control, wave and surge attenuation, especially in low-energy environments; dynamic behavior and response affect performance with respect to objectives	
Non-Structural	Products of public policy, management and regulatory practices; may include pricing schemes, planning, engineering design, and construction	Modify or avoid the impacts of the hazard (vs. modifying the hazard); relatively predictable level of performance with respect to objectives	Structure acquisitions or relocations, flood proofing, implementing flood warning systems, flood preparedness planning, use regulations, development restrictions within the greatest flood hazard areas, elevated development, managed retreat, evacuation, buyout and leaseback 
Structural	Products of planning, engineering design, and construction	Shoreline erosion control, wave and surge attenuation, reduced flooding; relatively predictable level of performance with respect to objectives	Levees, storm surge barrier seawalls, groins, revetments, and near-shore breakwaters 

Coastal Risk Reduction and Resilience Measures
Nature-Based Features as Risk Resiliency Measures

- Natural landscapes or engineered, and blended solutions
- Provides multiple, diverse benefits
- Intrinsically dynamic, adaptive, and potentially more environmentally resilient than built systems.

- Interagency Webinars
- Interagency Meetings
- Planning Aid Reports
- Performance Evaluation
  - Identifying features that were especially resilient to storms
  - Advancing tools for evaluation of benefits including coastal storm risk reduction

NACCS - Schedule

29 Jan 13
Enactment of Supplemental Legislation PL 113-2

Develop draft PMP and SOW (NLT 15 Mar; approved 27 Mar √)

Phase 1
Interagency & NGO coordination to assemble existing/future conditions. Assessment & formulation of measures
(PDT Milestone Meetings 1√, 2√, 3√)

Phase 2
Interagency & international validation & collaboration

Phase 3
Finalize comprehensive report & submit to Congress (January 2015)

Jan 2013 — Quarterly IPR 20 May 13 — Public Web Site — Quarterly IPR 19 Jul 13 — Quarterly IPR Oct 13 — Quarterly IPR Jan 14 — Quarterly IPR Apr 14 — Quarterly IPR Jul 14 — Sep 2014 — Quarterly IPR Oct 14 — Jan 28, 2015

PDT Milestone 1 √
8 May 13

PDT Milestone 2 √
19 Jun 13

PDT Milestone 3 √
20 Aug 13

Further Opportunities for Input

Draft Final to HQUSACE

FEMA-NDRF Synchronization w/ missions scoping assessments

PHASE 1 [Months 1-14]
- √ Initiate high level interagency coordination
  - federal, state, local, tribal
- √ Develop communication strategy
- √ Utilize existing data/GIS
  - RSM, CSPI, NHP, PIRs, SPA, etc.
- √ Integrate sea level rise and climate change
- √ Integrate ongoing or planned data & reports
- √ Identify data gaps/needs
- √ Identify existing problems
- √ Assess future conditions
- √ Identify structural and non-structural solutions
- √ Identify programmatic and policy solutions
- √ Identify USACE projects for repair, authorization, construction, etc.
  - Integrate risk reduction measures
  - Identify near-term and long-term risks
  - Identify gaps in current risk reduction

Identify/refine planning-level cost estimates and benefits/risk reduction approaches
Product: Identification of NAD risk and preliminary approaches for system resilience
In-progress review meetings

PHASE 2 [Months 15-18]
Coordinate with federal, state, local and tribal agencies
Define IWRM and alternative approaches for systems analysis (FRM, ENR, NAV, etc)
Develop concept animations and/or info-graphics
Identify areas at risk and implementation options
Identify implementation and fiscal challenges

Product: Receive interagency and international comments
In-progress review meeting
Prepare clearance letters to OASA (CW)

PHASE 3 [Months 19-24]
Additional interagency collaboration, as needed
Conduct quality control reviews
Conduct concurrent reviews (public, policy, ATR, legal, interagency)
Resolve comments
Prepare hardcopy and online materials

Product: Draft comprehensive study to HQUSACE (Sep 2014)
Product: Draft comprehensive study to OASA(CW) (Dec 2014)
Product: Submit final report to Congress

Jan 2015

Identify institutional barriers and develop coastal framework (complete by January 2015)

Way Ahead

- Interagency and Tribal coordination ongoing
- Plan Formulation
  - Intensive assessment, GIS analyses and future scenarios for 36 reaches
  - Existing/future conditions
  - Vulnerable populations & infrastructure
  - Identification of risk and application of appropriate measures
  - Shared-waters analysis
  - Institutional and policy barriers
- Integrate Regional Plans
  - NYC Mayor's Report
  - Joint Field Offices State Recovery Support Strategies
  - Task Force Strategy
- Agency Technical Review of Analytic Products - SAD

Way Ahead

- **Deliverables (Jan 2015)**
  - Compilation of Impacts & Effects from Hurricane Sandy
  - Storm Suite Modeling
  - Coastal GIS Analysis
  - Coastal Risk Reduction Framework and Institutional Barriers
    - Identify activities / areas for further analyses
    - Range of measures and parametric costs
- **Outcomes:**

  Develop framework and identify institutional barriers, and in doing so,

  - Enable crosscut budgeting to "buy down" risk
  - Align agency priorities
  - Strengthen Regional Partnerships
  - Leverage resources
  - Provide "roadmap" and catalyst for Regional Risk Reduction

For More Information, Contact:

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