WILL NEW YORK CITY EVER BE SAFE FROM FUTURE FLOODING?

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Portland OR
Worst case flooding scenario. Note that the State of NJ does not exist in the eyes of NYC planners. Well it exists, but it does not flood and therefore a regional approach is unneeded!
Planning precautions for Sandy - covering over a subway ventilation shaft.
Bowling Green subway station at The Battery, Manhattan.
Will Sandy visit the Jersey Shore?
Data courtesy of Fuqing Zhang, Penn State U; graphics by Hamish Bowman.
Ground Zero

Entrance to Brooklyn
Battery tunnel under New York Harbor
Mother Nature has not been kind to us.
FIG. 2. Time series of the daily maximum positive surge (water level minus astronomical tide) at the Battery (see Fig. 1 for location) between 1959 and 2007. The two dashed lines represent the minor (0.6 m) and moderate (1.0 m) surge thresholds used in this study. From Colle et al, 2010.
Fig. 6: Frequency histogram of storm surges, starting at 0.5 m at The Battery from 1959 to 2007 (from Colle et al., 2010).

Fig. 7: Number of flooding events per year at The Battery for 1959-2007 after adding a specified sea level rise of 12.5 cm (white bars), 25 cm (gray bars) and 50 cm (black bars). From Colle et al. (2010).

Fig. 8: Surface (10 m) wind-rose plot at JFK/Bennett field airports displaying the frequency of wind direction and speed (shaded; m s$^{-1}$) at the time of maximum surge at The Battery for all surges greater than 1.0 m between 1959-2007. The wind direction producing maximum surges (~ENE) is essentially the same as the orientation of Long Island Sound/south shore of Long Island. From Colle et al. (2010).
New York Harbor endures two surges; one propagating through Long Island Sound and the second entering through the Verrazano Narrows.
Effect of diurnal inequality at The Battery NYC. The Sandy water level peak tide was not the highest of the day.
Battery mean = 2.93 m, sigma = +/- 0.53 m,
In Wake of Sandy, NOAA Alters Hurricane Warning Policy

Government

UPDATE: Christie Predicts FEMA Will Scale Back Flood Maps

Governor provides update on rebuilding, with focus on flood maps and Blue Acres buyout, and plenty of anecdotes

By Catherine Gallofo | Email the author | March 22, 2013

Stamford
Norwalk

Clifton
Union City
Edgewater

Newark
Jersey City
Yonkers
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Opinion Pages

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WORLD

Opinion

A New Manhattan Project

Steve Collanenst

WORLD

Opinion

A New Manhattan Project

By BILL KELLER
Published: November 11, 2012 | 859 Comments

As the monster storm struck, my colleagues at The Times’s Room Debate desk asked an array of experts whether New York should spend more money on sea walls and other protective barriers against the next one. The answers covered, once the expression, the WHAT?!? Do something big! (“Worth Investment”) Do something small! (“Big Projects, Big Problems”) nothing much! (“Low on the List of Life-Saving Ideas”) Think about doing, well, something! (“A Wake-Up Call to Consider the Addams”)
Sea-Level Rise

- More than 8 million people live in areas at risk of coastal flooding. Along the U.S. Atlantic Coast alone, almost 60 percent of the land that is within a meter of sea level is planned for further development, with inadequate information on the potential rates and amount of sea level rise.

- Range of rise varies on low end, 12 inches and high end, 6 feet over a 100-year period.

- USACE contributed to the Sea Level Rise Tool for Sandy Recovery to create a set of map services to help communities, residents, and other stakeholders consider risks from future sea level rise in planning for reconstruction following Hurricane Sandy.
Governor Cuomo states the need for a new paradigm – let’s stop arguing about climate change and let’s move ahead and develop bold new approaches…
Andrew M. Cuomo - Governor

Governor Cuomo Outlines Bold Agenda for 2013: Builds on Progress of Past Two Years by Growing the Economy, Investing in Education, Maintaining Legacy as Progressive Capital of the Nation, and Rising to Meet Challenges in the Wake of Hurricane Sandy

- Toward a More Resilient New York Harbor: To build a more resilient Harbor, a long-term strategy will need to be developed that includes conserving and rebuilding natural systems that were lost to centuries of man-made activity, plus the building of additional barriers where needed. The state will work with other government partners to timely complete a comprehensive engineering evaluation of proposals, including potential barrier systems.

- Harden the Subway System: Flood-proof subways and bus depots with vertical roll-down doors, vent closures, inflatable bladders, and upsized fixed pumps (with back-up power sources) are all options to harden New York's subway system.

- Harden our Fuel Delivery System: Redundancies must be built into the fuel system, and generators and pumping systems must be readily deployable. The Governor proposed that gas stations in strategic locations be required to have on-site back-up power capacity to protect New Yorkers from temporary disruptions in fuel supply.

- Harden our Utilities: The Public Service Commission will require utilities to submit detailed implementation plans to harden their facilities, including raising substation walls and elevating transformer installations.

- Strengthen Wastewater Infrastructure: Flooding and storm surges from Lee, Irene, and Sandy resulted in hundreds of millions of dollars of damage to waste water treatment plants and the release of hundreds of millions of gallons of raw and undertreated sewage. To prevent a repeat of this scenario in the short-term, the existing wastewater treatment plants need to be repaired and mitigated to withstand higher flood levels.
That Bowman guy out at Stony Brook is full of &*##$@ with his crazy ideas about huge storm surge barriers....

Presenting the Final 2014 New York City Hazard Mitigation Plan
The New York City Office of Emergency Management (OEM), in partnership with the Department of City Planning (DCP), is pleased to announce the official adoption of the 2014 New York City Hazard Mitigation Plan (HMP). The preparation of the HMP demonstrates New York City’s continued commitment to understanding our risk from a range of hazards, and identifying strategies to reduce the effects of these hazards on New York City’s environment. The 2014 HMP serves as an update to the 2009 New York City Natural Hazard Mitigation Plan.

The HMP was approved by New York State Division of Homeland Security and Emergency Services (NYS DHSES) and FEMA on March 21, 2014, and officially adopted by the City of New York on April 15, 2014.

Science fiction…….
http://www.pbs.org/wgbh/nova/tech/storm-surges-cities.html

Bring back the oysters beds of the 1800’s!
Poaching proliferates! Would you eat those oysters from such polluted waters? Not me!
How to Think Like the Dutch in a Post-Sandy World

In December 2012, Shaun Donovan, the secretary of Housing and Urban Development, was on vacation in Berlin when he decided to detour to the Netherlands. He wanted to get a firsthand sense of the famed Dutch approach to water management. Hurricane Sandy struck six weeks before, and in the aftermath, President Obama asked him to lead a task force, whose objective was not just to rebuild but also to radically rethink the region’s infrastructure in light of climate change.

In the Netherlands, a man named Henk Ovink offered to be Donovan’s guide. Ovink was the director of the office of Spatial Planning and Water Management, meaning, essentially, that it was his job to keep the famously waterlogged country dry. As he learned about various Dutch innovations, Donovan was struck by the fact that Ovink looked at water as much in cultural as in engineering terms, which was a function of the centuries-old need of the Dutch to act together for protection.

For his part, Ovink said it dawned on him during Donovan’s visit that the post-Sandy turmoil in the U.S. was an opportunity. Dutch water-management experts have done such a good job of protecting their country that they rarely get to practice with water crises — whereas America was facing something monumental that as a culture it didn’t yet grasp. When Donovan arrived back in the U.S., he opened an email from Ovink that said, in effect, “I hope this isn’t too forward, but could I come work with you?”

Henk Ovink
Now this guy’s all wet.
Winning Proposal

LIVING BREAKWATERS
SCAPE / Landscape Architecture
Staten Island, New York

Hunts Point Lifelines
PennDesign/OLIN
Bronx, New York

Resist, Delay, Store, Discharge: A Comprehensive Strategy for Hoboken
OMA
Hoboken, New Jersey

New Meadowlands: Productive City + Regional Park
MIT CAU + ZUS + URBANISTEN
The Meadowlands, New Jersey

Living with the Bay: A Comprehensive Regional Resiliency Plan for Nassau County’s South Shore
Interboro Team
Long Island, New York

BIG U
BIG TEAM
New York, New York

REBUILD BY DESIGN
An Initiative of the President’s Hurricane Sandy Rebuilding Task Force
In Collaboration With
NYU’s Institute for Public Knowledge
Municipal Art Society
Regional Plan Association
Van Alen Institute

Lead Supporter
The Rockefeller Foundation
With Support From
Deutsche Bank Americas Foundation
Hearst Foundation
Surdna Foundation
The JPB Foundation
The New Jersey Recovery Fund
Scape's team proposes a necklace of breakwaters along the South Shore of Staten Island to buffer against wave damage, flooding, and erosion. A "reef street" would host finfish, shellfish, and lobsters. The team also modeled the breakwater system at a macro scale to understand how and where they could most effectively protect communities.

Image courtesy Rebuild by Design

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Rebuild by Design Redesigns Sandy-Battered Shore

WXY Architecture and Urban Design and West 8 avoided high flood walls by proposing a series of protective sand islands that would run along the Atlantic seacoast from Cape Cod, Massachusetts, to Cape May, New Jersey.

Image courtesy Rebuild by Design

View Related Story »
In URBAN LANDSCAPE AND CLIMATE CHANGE the results of the competition Rebuild by Design that responds to Hurricane Sandy, will take prominent place.

Superstorm Sandy
On October 29 2012, after a ravaging ride that started in the Caribbean and would eventually cause the death of at least 266 people in seven different countries, Superstorm Sandy slammed into New Jersey and New York with unprecedented force. The chaos that followed was just as unprecedented. The world’s most important metro region remained completely dysfunctional for days. 8.5 million people were without electricity, 650,000 houses and over 100,000 companies were damaged or destroyed. Estimates as of June 2013 assess the damage at over 68 billion US dollars.
Fig. 1 "Lego Wall planned for NYC business district".

**Physical Resiliency**
New infrastructure can help reduce the risk to our neighborhoods, critical services, businesses, and vulnerable populations.

Integrated Flood Protection Systems
### Risk Reduction Structural Solution Sets

<table>
<thead>
<tr>
<th>Benefits/Processes</th>
<th>Performance Factors</th>
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</thead>
</table>
| **Levees**         | • Levee height, crest width, and slope  
| • Surge and wave attenuation and/or dissipation  
| • Reduced flooding  
| • Reduced risk for vulnerable areas | • Levee height, crest width, and slope  
| • Wave height and period  
| • Water level | |
| **Storm Surge Barriers** | • Barrier height  
| • Wave height  
| • Wave period  
| • Water level | |
| **Seawalls and Revetments** | • Wave height  
| • Wave period  
| • Water level  
| • Scour protection | • Groin length, height, orientation, permeability, and spacing  
| • Depth at seaward end  
| • Wave height  
| • Water level  
| • Longshore transportation rates and distribution |
| **Groins** | • Breakwater height and width  
| • Breakwater permeability, proximity to shoreline, orientation, and spacing |
## Risk Reduction Nature-Based Solution Sets

<table>
<thead>
<tr>
<th>Dunes and Beaches</th>
<th>Vegetated Features</th>
<th>Oyster and Coral Reefs</th>
<th>Barrier Islands</th>
<th>Maritime Forests/Shrub Communities</th>
</tr>
</thead>
</table>
| **Benefits/Processes** | • Breaking of offshore waves  
  • Attenuation of wave energy  
  • Slow inland water transfer  
  • Increased infiltration | **Benefits/Processes** | • Breaking of offshore waves  
  • Attenuation of wave energy  
  • Slow inland water transfer | **Benefits/Processes** | • Wave attenuation and/or dissipation  
  • Sediment stabilization  
  • Shoreline erosion stabilization  
  • Soil retention |
| **Performance Factors** | • Berm height and width  
  • Beach slope  
  • Sediment grain size and supply  
  • Dune height, crest, and width  
  • Presence of vegetation | **Performance Factors** | • Marsh, wetland, or SAV elevation and continuity  
  • Vegetation type and density | **Performance Factors** | • Island elevation, length, and width  
  • Land cover  
  • Breach susceptibility  
  • Proximity to mainland shore | **Performance Factors** | • Vegetation height and density  
  • Forest dimension  
  • Sediment composition  
  • Platform elevation |
Locator map of the village of Monster on the south west coast of the Netherlands, where beach dune enhancements are the current mode of coastal protection.
Swinging the camera to the right shows the seaside village of Strand Monster safely tucked in behind the high dunes. The downside is that the view of the ocean is lost. So the residents have traded the view for security.
Josh Robin of News 1 NY interviews Prof. Jeroen Aerts of the University of Amsterdam who explains how enhanced beach dunes protect the tourist community of Noordwijk, The Netherlands.
Tourist hotels are located well back, behind the dunes, but still enjoy a good view.
View of a segment of the Delta Project, the Netherlands. The system is composed of a mixture of elevated natural sand dunes, tidal gates (normally open), elevated highways and shipping gates <http://www.deltawerken.com/English/10.html?setlanguage=en>. The image is taken during flooding (incoming) tides.
Fig. 2: Dutch storm surge barrier at Maeslant
The Thames River Barrier was opened in 1982 and has been used many times to prevent the City of London from flooding.
Plan view of St Petersburg, Russia, storm surge protection system, consisting of elevated multi-lane highways (blue), harbor barriers with sluice gates (blue) and shipping gates (red arrow).
Taintor gates in open position at the St Petersburg storm barrier system.
Taintor gates in closed position at the St Petersburg storm barrier system.
Schematic diagram for location of the Outer Harbor Gateway (red arrow) with enhanced extension dunes (green) and storm surge barriers (red line) to protect NY City. A second barrier would be necessary across the upper East River (red arrow) to block surges from penetrating from western Long Island Sound into the Harbor. Note the outer gateway (with extension) protects Manhattan, JFK airport, the outer boroughs of Staten Island, Brooklyn & Queens, Port Elizabeth, Newark Airport, LaGuardia Airport and all points within the ring of protection.
Artist's impression of the proposed New York Outer Harbor Gateway, stretching 5 miles across the Sandy Hook – Far Rockaway transect. The red arrows show locations of sluice gates to allow free flow of the tides (next slide). The green arrows point to the three shipping gates (second slide on).
Developing a Threat Index

Take our cue from the Europeans. Decide that the wreckage of Sandy must never happen again. Determine to protect Metro New York against a 1/1,000 storm. Make this the gold standard. Plug in various suggestions solutions and mitigations appropriate to a descending scale of threats.

<table>
<thead>
<tr>
<th>Threat</th>
<th>Response</th>
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</thead>
<tbody>
<tr>
<td>1/1000 yr storm</td>
<td>Storm surge barriers, enhanced sand berms</td>
</tr>
<tr>
<td>1/500 year storm</td>
<td>Storm surge barriers, enhance sand berms</td>
</tr>
<tr>
<td>1/250 year storm</td>
<td>New building codes, raise all critical systems</td>
</tr>
<tr>
<td>1/100 year storm</td>
<td>Build better resilience, retire old building codes</td>
</tr>
<tr>
<td>1/25, 1/50 year storms</td>
<td>Enhance wetlands, oyster beds, local barriers</td>
</tr>
</tbody>
</table>
So if the Russians, the Italians, the Dutch, the Brits, the New Englanders and the Louisianans can do it right, why can’t we New Yorkers show our mettle?

Thank you!