# AP IMPACT: Will NYC act to block future surges?

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Think Sandy was just a 100-year storm that devastated New York City? Imagine one just as bad, or worse, every three years.

Prominent planners and builders say now is the time to think big to shield the city's core: a 5-mile barrier blocking the entryway to New York Harbor, an archipelago of man-made islets guarding the tip of Manhattan, or something like CDM Smith engineer Larry Murphy's 1,700-foot barrier - complete with locks for passing boats and a walkway for pedestrians - at the mouth of the Arthur Kill waterway between the borough of Staten Island and New Jersey.

Act now, before the next deluge, and they say it could even save money in the long run.

These strategies aren't just pipe dreams. Not only do these technologies already exist, some of the concepts have been around for decades and have been deployed successfully in other countries and U.S. cities.

So if the science and engineering are sound, the long-term cost would actually be a savings, and the frequency and severity of more killer floods is inevitable, what's the holdup?

Political will.

Like the argument in towns across America when citizens want a traffic signal installed at a dangerous intersection, Sandy's 43 deaths and estimated $26 billion in damages citywide might not be enough to galvanize the public and the politicians into action.

"Unfortunately, they probably won't do anything until something bad happens," said CDM Smith's Murphy. "And I don't know if this will be considered bad enough."

Sandy and her 14-foot surge not bad enough? By century's end, researchers forecast up to four feet higher seas, producing storm flooding akin to Sandy's as often as several times each decade. Even at current sea levels, Sandy's floodwaters filled subways, other tunnels and streets in parts of Manhattan.

Without other measures, rebuilding will simply augment the future destruction. Yet that's what political leaders are emphasizing. President Barack Obama himself has promised to stand with the city "until the rebuilding is complete."

So it might take a worse superstorm or two to really get the problem fixed.

The focus on rebuilding irks people like Robert Trentlyon, a retired weekly

newspaper publisher in lower Manhattan who is campaigning for sea barriers to protect the city: "The public is at the woe-is-me stage, rather than how-do-we-prevent-this-in-the-future stage."

He belongs to a coterie of professionals and ordinary New Yorkers who want to take stronger action. Though pushing for a regional plan, they are especially intent on keeping Manhattan dry.

The 13-mile-long island serves as the country's financial and entertainment nerve center. Within a 3-mile-long horseshoe-shaped flood zone around its southernmost quadrant are almost 500,000 residents and 300,000 jobs. Major storms swamp places like Wall Street and the site of the World Trade Center.

Proven technology already exists to blunt or virtually block wind-whipped seas from overtaking lower Manhattan and much of the rest of New York City, according to a series of Associated Press interviews with engineers, architects and scientists and a review of research on flooding issues in the New York metropolitan area and around the globe.

These strategies range from hard structures like mammoth barriers equipped with ship gates and embedded at entrances to the harbor, to softer and greener shoreline restraints like man-made marshes and barrier islands.

Additional landfill, the old standby once used to extend Manhattan into the harbor, could further lift vulnerable highways and other sites beyond the reach of the seas.

Even more simply, the rock and concrete seawalls and bulkheads that already ring lower Manhattan could be built up, but now perhaps with high-tech wave-absorbing or wave-reflecting materials.

Seizing the initiative from government, business and academic circles have fleshed out several dramatic concepts to hold back water before it tops the shoreline. Two of the most elaborate proposals are:

- A rock causeway, with 80-foot-high swinging ship gates, would sweep five miles across the entryway to inner New York Harbor from Sandy Hook, N.J., to Breezy Point, N.Y. To protect Manhattan, another shorter barrier is needed to the north, where the East River meets Long Island Sound, and another small blockage would go up near Sandy Hook. This New Jersey-side barrier and a network of levees on both ends of the causeway could help protect picturesque beach communities like Atlantic Highlands, in New Jersey to the west, and the Rockaways, in New York City to the east. This so-called outer barrier option was conceived for a professional symposium by the engineering firm CH2M HILL, which last year finished building a supersized 15-mile barrier guarding St. Petersburg, Russia, from Baltic Sea storms.

- An extensive green makeover of lower Manhattan would install an elaborate drainage system beneath the streets, build up the very tip by 6 feet, pile 30-foot earthen mounds along the eastern edge, and create perimeter wetlands and a phalanx of artificial barrier islets - all to absorb the brunt of a huge storm surge.

Plantings along the streets would help soak up runoff that floods the city sewers during heavy rains. This concept was worked up by DLANDSTUDIO and Architecture Research Office, two city architectural firms, for a museum project.

What's missing is not viable ideas or proposals, but determination. Massive projects protecting other cities from the periodic ravages of stormy seas usually happened after catastrophes on a scale eclipsing even Sandy.

It took the collapse of dikes, drowning deaths of more than 1,800 people, and evacuation of another 100,000 in 1953 for the Dutch to say "Never again!" They have since constructed the world's sturdiest battery of dikes, dams and barriers. No disaster on that scale has happened since.

It took the breach of levees, a similar death toll, and flooding of 80 percent of New Orleans from Hurricane Katrina in 2005 to marshal the momentum finally to build a two-mile barricade against the Gulf of Mexico.

A handful of seaside New England cities - Stamford, Conn.; Providence, R.I.; and New Bedford, Mass. - have built smaller barriers after their own disasters.

However, New York City, which mostly lies just several feet above sea level, has so far escaped the horrors visited elsewhere. Its leaders have been brushing off warnings of disaster for years.

Retired geologist Jim Mellet of New Fairfield, Conn., recalls hearing a story told to him by the late Bill A. O'Leary, a retired city engineer at the time: He and other engineers, concerned about battering floods, had approached power broker Robert Moses more than 80 years ago to ask him to consider constructing a gigantic barrier to hold back storm tides at the entrance to the city's Upper Bay.

Moses supposedly squashed the idea like an annoying bug. "According to Bill, he stood there uninterested, with his arms folded on his chest, and when they finished the presentation, he just said, `No, it will destroy the view.'" Or perhaps he was already mulling other plans for the same site, where he would build the Verrazano Narrows Bridge years later.

Many city projects, like the Westway highway plan of the 1970s and 1980s, died partly because of the impact they would have on the cherished view of water from the congested cityscape. Imagine, then, the political viability of a project that might further block access to the harbor or the view of the Statue of Liberty from the tip of Manhattan.

"I can assure that many New Yorkers would have strong opinions about high seawalls," said an email from a retired New York commander of the U.S. Army Corps of Engineers, Bud Griffis, who was involved in the permitting process for the failed Westway.

However, global warming and its rising sea levels now make it harder simply to shrug off measures to shield the city from storms. Sandy drove 14-foot higher-than-

normal seas - breaking a nearly 200-year-old record - into car and subway tunnels, streets of trendy neighborhoods, commuter highways and an electrical substation that shorted out nearly all of lower Manhattan.

The late October storm left 43 dead in the city, and City Council Speaker Christine Quinn estimated at least $26 billion in damages and economic losses. The regional cost has been estimated at $50 billion, making Sandy the second most destructive storm in U.S. history after Katrina.

Yet heavier storms are forecast. A 1995 study involving the U.S. Army Corps of Engineers envisioned a worst-case storm scenario for New York: High winds rip windows and masonry from skyscrapers, forcing pedestrians to flee to subway tunnels to avoid the falling debris. The tunnels soon flood.

With its dense population and distinctive coastline, New York is especially vulnerable, with Manhattan at the center.

The famous island can be pounded by storm surges from three sides: from the west via the Arthur Kill, from the south through the Upper Bay, and from the Long Island Sound through the East River. Relatively shallow depth offshore allows storm waters to pile up; the north-south shoreline of New Jersey and the east-west orientation of Long Island further channel gushing seas right at Manhattan.

Some believe that Sandy was bad enough at least to advance more serious study of stronger protections. "I think the superstorm we had really put the fear of God into people, because no one really believed it would happen," said urban planner Juliana Maantay at Lehman College-City University of New York.

But nearly all flood researchers interviewed by the AP voiced considerable skepticism about action in the foreseeable future. "In a half year's time, there will be other problems again, I can tell you," said Dutch urban planner Jeroen Aerts, who has studied storm protections around the world.

William Solecki, a Manhattan-based Hunter College planner who has been at the center of city and state task forces on climate change, guessed that little more will be done to prevent future flooding beyond "nibbling at the edges" of the threat.

In recent years, the city has been enforcing codes that require flood-zone builders to keep electrical and other critical systems above predicted high water from what was until recently thought to be a once-in-a-century storm. Sealing other key equipment against water has been encouraged. The city has tried to keep storm grates free of debris and has elevated subway entrances. The buzz word has been making things more "resilient."

But this approach does little to stop swollen waters of a gigantic storm from pouring over lower Manhattan. "Resiliency means if you get knocked down, this is how you get back up again," huffs activist Trentlyon. "They just were talking about what you do afterward." He said Sandy's flood water rose to 5 feet at street level in Chelsea, where he lives on the western side of lower Manhattan.

The city has at least toyed with the idea of barriers and even considered various locations in a 2008 study. "I have always considered that flood gates are something we should consider, but are not necessarily the immediate answer to rush toward," said Rohit Aggarwala, a Stanford University teacher who is former director of the New York mayor's Office of Long-Term Planning and Sustainability.

Unswayed by Sandy, Mayor Michael Bloomberg and his assistants have been blunter. Bloomberg said barriers might not be worthwhile "even if you spent a fortune."

Deputy Mayor Cas Holloway said no specific measures - whether more wetlands, higher seawalls or harbor barriers - have been ruled out because "there's no one-size-fits-all solution." But he compared sea barriers to the Maginot Line, the fortified line of defenses that Germany quickly sidestepped to conquer France at the beginning of World War II.

"The city is not going to be totally stormproof, but I think it can be very adaptable," he added. He said that new flood maps informed by Sandy are being drawn up, and he suspects they will extend the zones where new developments must install critical equipment above flood level.

Computer simulations indicate that hard barriers, which have worked elsewhere around the world, would do a good job of shielding New York neighborhoods behind them. But they'd actually make flooding worse just outside the barriers, where surging waters would pile up with nowhere to go.

The patriarch of this research is Malcolm Bowman, a native New Zealander who leads a passionate cadre of barrier researchers at Stony Brook University on the northern shore of Long Island. His warnings have mostly gone unheeded. "I feel like a biblical prophet crying in the wilderness: `The end is near!'" Bowman said.

Unbowed, he continues to preach against incremental measures. "If you get a storm and a big oak tree falls on your house, then whether you fix your gutter doesn't matter," he said.

In recent years, his logic has finally begun to resonate a bit more. Nicholas Kim, an oceanographer with engineering firm HDR HydroQual who studied with Bowman in the 1980s, said his mentor has been thinking about barriers since then: "Everybody said, `You're crazy!' But now it's becoming clear that we need protection."

Even massive structures don't shield everyone, though. A 2009 four-barrier study co-authored by Kim found that in a simulated storm, barriers still failed to protect large swaths of Queens and sections of other outlying boroughs with a total of more than 100,000 people.

Researchers also have predicted at least a modest additional one-foot rise of stormy seas as water piles up outside the barriers. "If you're the guy just outside the barrier, and you're paying taxes and you're not included, you're not going to be

very happy," said oceanographer Larry Swanson at Stony Brook University.

How such barriers would affect water movement, silt and marine life also remains an open question requiring further study for each case.

The scale and costs of hard barrier schemes have further put off many critics. After flooding from Hurricane Irene last year, city representatives asked Aerts, the Dutch planner, to compare the cost and benefits of barriers to existing approaches. His initial analysis will not be finished until February, but his early cost estimate for barriers and associated dikes for New York City is $15 billion to $27 billion - comparable to that of the record-setting $24 billion Big Dig that reshaped Boston's waterfront - not to block storms, but to unblock traffic and views of the waterfront.

Barrier defenders counter by pointing to the cost of storm damages. Stony Brook meteorologist Brian Colle said: "When you think of the cost of a Sandy, which is running in the billions, these barriers are basically going to pay for themselves in one or two storms." Advocates say tolls on trains or cars riding atop a barrier could help finance the project.

While appealing for rebuilding, Council Speaker Quinn also has said that "the time for casual debate is over" and called for a bold mix of resiliency with grander protective structures. She has estimated the cost of her plan at $20 billion.

Other massive protection schemes, like the green makeover of lower Manhattan, also would probably run into the billions. And soft protections are meant only to defuse, not stop, rising waters. Sandy battered parts of Long Island behind barrier islands and wetlands.

Nor is it clear that Manhattan has enough space to fashion more extensive wetlands of the sort that help protect the Gulf Coast, however imperfectly. "New York is too far gone for wetlands," said Griffis, the retired Army Corps commander for New York.

Sen. Charles Schumer, D-N.Y., has announced he will spearhead efforts to request a corps study of whether barriers or other options would work better. However, it remains unclear if Congress would be willing to fund such a study, which would undoubtedly take several years and cost millions of dollars.

And even before a dime has been appropriated, the corps is lowering expectations. Says spokesman Chris Gardner: "You can't protect everywhere completely at all times."

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