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New York Is Lagging as Seas and Risks Rise, Critics Warn



Michael Kamber for The New York Times

Sea walls, marshes and trees in Brooklyn Bridge Park, part of efforts by New York City agencies to cope with rising seas.

By MIREYA NAVARRO

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With a 520-mile-long coast lined largely by teeming roads and fragile infrastructure, New York City is gingerly facing up to the intertwined threats posed by rising seas and ever-more-severe storm flooding.

GRAPHIC: An Expanding Flood Zone

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So far, Mayor Michael R. Bloomberg has commissioned exhaustive research on the challenge of **climate change**. His administration is expanding wetlands to accommodate surging tides, installing green roofs to absorb rainwater and prodding property owners to move boilers out of flood-prone basements.

But even as city officials earn high marks for environmental awareness, critics say New York is moving too slowly to address the potential for flooding that could paralyze transportation, cripple the low-lying financial district and temporarily drive hundreds of thousands of

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Michael Appleton for The New York Times
 Battery Park after Hurricane Irene, by then a tropical storm, hit a year ago. Low-lying areas of New York City are vulnerable to storms.

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Michael Kamber for The New York Times
 Raised ventilation grates, like these in Lower Manhattan, are intended to deal with flooding in the subway system during severe storms.

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people from their homes.

Only a year ago, they point out, the city shut down the subway system and ordered the [evacuation](#) of 370,000 people as [Hurricane Irene](#) barreled up the Atlantic coast. Ultimately, the hurricane weakened to a [tropical storm](#) and spared the city, but it exposed how New York is years away from — and billions of dollars short of — armoring itself.

“They lack a sense of urgency about this,” said Douglas Hill, an engineer with the [Storm Surge Research Group](#) at Stony Brook University, on Long Island.

Instead of “planning to be flooded,” as he put it, city, state and federal agencies should be investing in protection like sea gates that could close during a storm and block a surge from Long Island Sound and the Atlantic Ocean into the East River and New York Harbor.

Others express concern for areas like the South Bronx and Sunset Park in Brooklyn, which have large industrial waterfronts with chemical-manufacturing plants, oil-storage sites and garbage-transfer stations. Unless hazardous materials are safeguarded with storm surges in mind, some local groups warn, residents could one day be wading through toxic water.

“A lot of attention is devoted to Lower Manhattan, but you forget that you have real industries on the waterfront” elsewhere in the city, said Eddie Bautista, executive director of the New York City Environmental Justice Alliance, which represents low-income residents of industrial areas. “We’re behind in consciousness-building and disaster planning.”

Other cities are also tackling these issues, at their own pace.

New shoreline development around San Francisco Bay must now be designed to cope with the anticipated higher sea levels under new regional regulations imposed last fall. In Chicago, new bike lanes and parking spaces are made of permeable pavement that allows rainwater to filter through it. Charlotte, N.C., and Cedar Falls, Iowa, are restricting development in flood plains. Maryland is pressing shoreline property owners to plant marshland instead of building retaining walls.

Officials in New York caution that adapting a city of eight million people to climate change is infinitely more complicated and that the costs must be weighed against the relative risks of flooding. The last time a hurricane made landfall directly in New York City was more than a century ago.

Many decisions also require federal assistance, like updated flood maps from the Federal Emergency Management Agency that incorporate sea level rise, and agreement from dozens of public agencies and private partners that own transportation, energy, telecommunications and other infrastructure.

“It’s a million small changes that need to happen,” said Adam Freed, until August the deputy director of the city’s Office of Long-Term Planning and Sustainability.

“Everything you do has to be a calculation of the risks and benefits and costs you face.”

And in any case, Mr. Freed said, “you can’t make a climate-proof city.”

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So city officials are pursuing a so-called resilience strategy that calls for strengthening the city's ability to weather the effects of serious flooding and recover from it.

Flooding Threat Grows

Unlike New Orleans, New York City is above sea level. Yet the city is second only to New Orleans in the number of people living less than four feet above high tide — nearly 200,000 New Yorkers, according to the research group [Climate Central](#).

The waters on the city's doorstep have been rising roughly an inch a decade over the last century as oceans have warmed and expanded. But according to scientists advising the city, that rate is accelerating, because of environmental factors, and levels could rise two feet higher than today's by midcentury. More frequent flooding is expected to become an uncomfortable reality.

With higher seas, a common storm could prove as damaging as the rare big storm or hurricane is today, scientists say. Were sea levels to rise four feet by the 2080s, for example, 34 percent of the city's streets could lie in the [flood-risk zone](#), compared with just 11 percent now, a 2011 study commissioned by the state said.

New York has added bike lanes, required large buildings to track and reduce their energy use, banned the dirtiest home heating oils, and taken other steps to reduce the emissions that contribute to global warming. But with shoreline development that ranges from public beaches to towering high rises — and a complex mix of rivers, estuaries, bays and ocean — the city needs to size up the various risks posed by rising seas before plunging ahead with vast capital projects or strict regulations, city officials argue.

Yet the city's plan for waterfront development dismisses any notion of retreat from the shoreline. Curbing development or buying up property in flood plains, as some smaller cities have done, is too impractical here, city officials say, especially because the city anticipates another million residents over the next two decades.

Rather, the city and its partners are incorporating flood-protection measures into projects as they go along.

Consolidated Edison, the utility that supplies electricity to most of the city, estimates that adaptations like installing submersible switches and moving high-voltage transformers above ground level would cost at least \$250 million. Lacking the means, it is making gradual adjustments, with about \$24 million spent in flood zones since 2007.

Some steps taken by city agencies have already subtly altered the city's looks. At Brooklyn Bridge Park, a buffer between the East River and neighborhoods like Dumbo, porous riprap rock and a soft edge of salt-resistant grass have been laid in to help absorb the punch of a storm surge. Sidewalk bioswales, or vegetative tree pits that can fill up with rainwater to reduce storm water and sewage overflows and also minimize flooding, are popping up around the city.

Over all, the city is hoping to funnel more than \$2 billion of public and private money to such environmental projects over the next 18 years, officials say.

"It's a series of small interventions that cumulatively, over time, will take us to a more natural system" to deal with climate change, said Carter H. Strickland, the city's environmental commissioner.

Planning experts say it is hard to muster public support for projects with uncertain or distant benefits.

"There's a lot of concern about angering developers," said Ben Chou, a water-policy

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analyst at the Natural Resources Defense Council.

New York planners have proposed requiring developers to assess the climate-change risks faced by new buildings so they can consider protection like retractable watertight gates for windows. But no such requirements have been imposed so far.

While some new buildings are being elevated or going above current required flood protections — like a new recycling plant on a Brooklyn pier and the Port Authority's transit hub at the World Trade Center site — most new construction is not being adapted to future flood risks yet, industry representatives said.

Some experts argue that the encounter with Hurricane Irene last year and a flash flood in 2007 underscored the dangers of deferring aggressive solutions.

Klaus H. Jacob, a research scientist at [Columbia University's Earth Institute](#), said the storm surge from Irene came, on average, just one foot short of paralyzing transportation into and out of Manhattan.

If the surge had been just that much higher, subway tunnels would have flooded, segments of the Franklin D. Roosevelt Drive and roads along the Hudson River would have turned into rivers, and sections of the commuter rail system would have been impassable or bereft of power, he said.

The most vulnerable systems, like the subway tunnels under the Harlem and East Rivers, would have been unusable for nearly a month, or longer, at an economic loss of about \$55 billion, said Mr. Jacob, an adviser to the city on climate change and an author of the 2011 state study that laid out the flooding prospects.

"We've been extremely lucky," he said. "I'm disappointed that the political process hasn't recognized that we're playing Russian roulette."

With more rain and higher seas, some envision more turmoil — like mile after mile of apartment buildings without working elevators, lights or potable water.

"That's a key vulnerability," said Rafael Pelli, a Manhattan architect who serves on a climate-change committee that advises the Department of City Planning. "If you have to relocate 10,000 people, how do you do that?"

Barriers to Block Tides

Some New Yorkers argue that the answer lies not in evacuation, but in prevention, like armoring city waterways with the latest high-tech barriers. Others are not so sure.

At a recent meeting of Manhattan community board leaders in Harlem, Robert Trentlyon, a resident of Chelsea, argued for sea gates.

A [2004 study](#) by Mr. Hill and the Storm Surge Research Group at Stony Brook recommended installing movable barriers at the upper end of the East River, near the Throgs Neck Bridge; under the Verrazano-Narrows Bridge; and at the mouth of the Arthur Kill, between Staten Island and New Jersey. During [hurricanes](#) and northeasters, closing the barriers would block a huge tide from flooding Manhattan and parts of the Bronx, Brooklyn, Queens, Staten Island and New Jersey, they said.

City officials say that sea barriers are among the options being studied, but others say such gates could interfere with aquatic ecosystems and with the flushing out of pollutants, and may eventually fail as sea levels keep rising.

And then there is the cost. Installing barriers for New York could reach nearly \$10 billion.

There is more agreement on how to protect the subway system. Several studies have advised the Metropolitan Transportation Authority to move quickly to increase pumping capacity at stations, raise entrances and design floodgates to block water from entering.

In 2009, a [commission](#) warned that global warming posed “a new and potentially dire challenge for which the M.T.A. system is largely unprepared.”

Five years ago, a summer-morning deluge brought about 3 1/2 inches of rain in two hours and paralyzed the [system](#) for hours, stranding 2.5 million riders.

That prompted the transit agency to spend \$34 million on improvements like raising some ventilation grates nine inches above sidewalks and building steps that head upward, before descending, at flood-prone stations. All the money came from the agency’s capital budget, which also pays for subway cars and buses.

“This is a vicious circle of the worst kind,” Projjal Dutta, the transportation agency’s director of sustainability, said of the financial effect. “You’re cutting public transportation, which cuts down greenhouse gases, to harden against climate change.”

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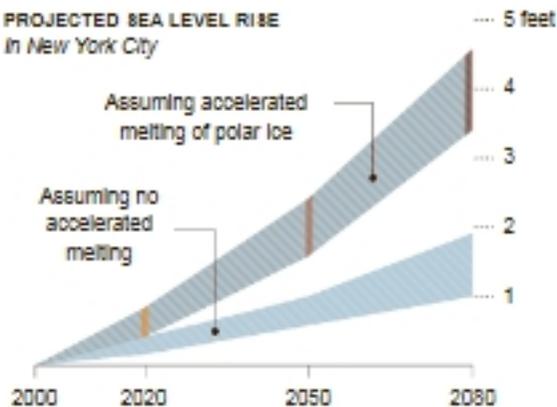
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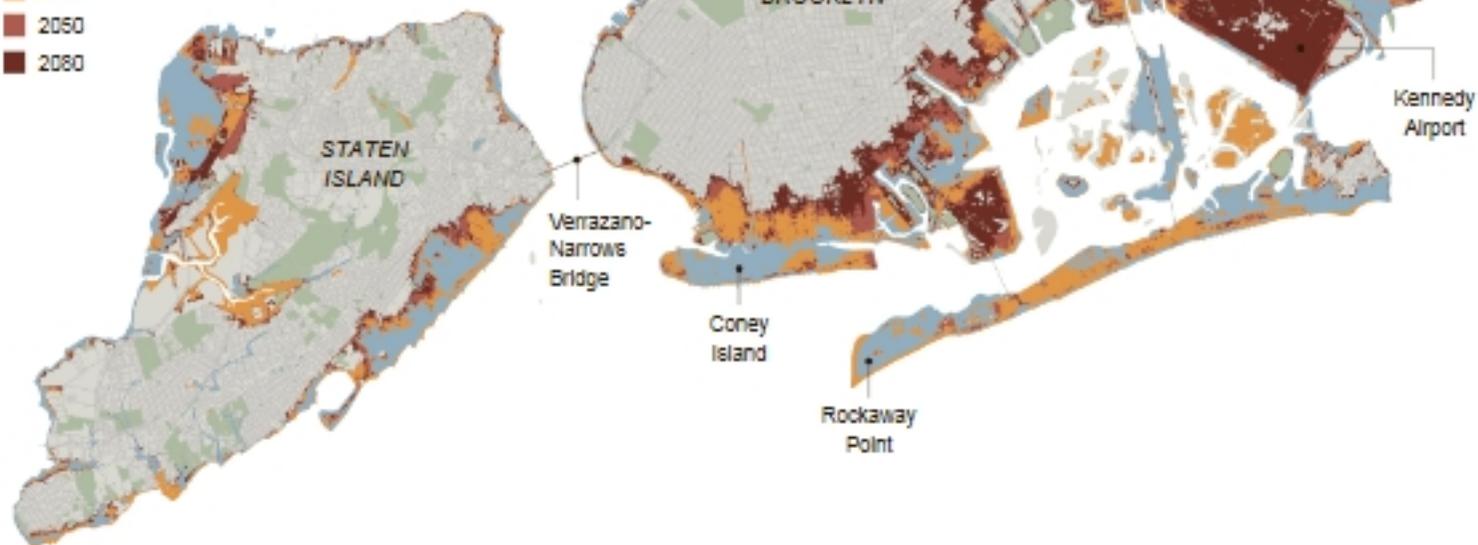
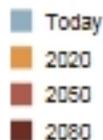
Current projections of sea level rise suggest that New York City will become increasingly vulnerable to catastrophic storm surges and flooding.

PROJECTED SEA LEVEL RISE in New York City



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Michael Appleton for The New York Times

Battery Park after Hurricane Irene, by then a tropical storm, hit a year ago. Low-lying areas of New York City are vulnerable to storms.



Michael Kamber for The New York Times

Raised ventilation grates, like these in Lower Manhattan, are intended to deal with flooding in the subway system during severe storms.