

**REBUILD
BY
DESIGN**

A DELTA OF RESILIENCY DISTRICTS



MIT CAU + ZUS + URBANISTEN
75B + DELTARES + VOLKER INFRA



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PHOTOCREDITS: IWAN BAAN

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COMMISSIONED BY



EXECUTIVE SUMMARY

The team of MIT with ZUS+Urbanisten proposes a grouping of resiliency districts at the edges of the flood zones of the metro area of NY-NJ.

REGIONAL URBAN LANDSCAPE

Our project departs from a reading of hazard and risk as an imperfect alignment between urbanization patterns and changing ecological dynamics.

Although resiliency is largely dependent on the capacity of inhabitants to cope with extreme weather, adjustments to the built environment can mitigate risk of damage, injury, and death.

Within the vast urban region between Boston and Washington, the New York Metropolitan region represents the most extreme confluence of population density, concentration of value creation, vital infrastructural networks and exposure to various hazardous elements of which extreme weather events are only one.

MULTI CRITERIA HAZARD ANALYSIS

The impact of Sandy revealed a region wide exposure to multiple hazards and risks. The power black-out, severely contaminated stormwaters and the shut down of the public transport system are just a few examples the systemic nature of risk.

Therefore our proposal was based on a thorough analysis and interreferencing various hazards in the region. Through layering maps of these risks we created, what we call, “ **the hazard sandwich** “. The hazards sandwich allows us to determine where an intervention could have the most impact for each dollar spent and create site specific solutions based of several variables.

REGIONAL STRATEGY:

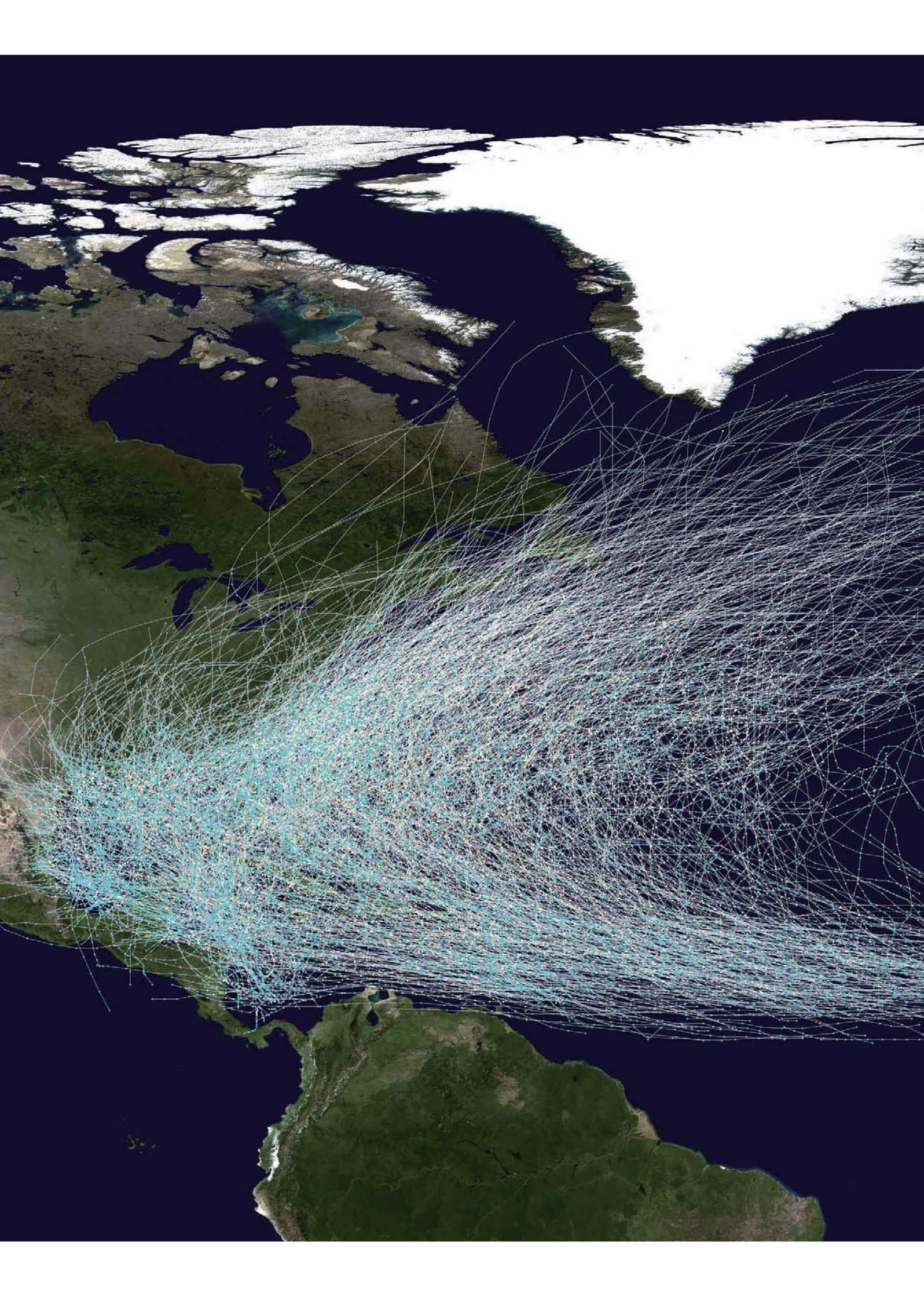
DELTA OF RESILIENCY DISTRICTS

Through these mappings several locations were emphasized where interventions are urgent but also present opportunities to achieve multiple benefits simultaneously.

These resiliency districts are defined by a series of layers combining emergency infrastructure, evacuation capacity, ecological protection/ absorption landscape infrastructure; as well as a development mix of light manufacturing/warehousing with residential. This definition follows from an assumption about sound policy, namely that every dollar of federal investment should help address a wide portfolio of risks – storm surge, rainwater events, and heat islands; and cover a spectrum of vulnerabilities – economic, social, and pollution.

5 DESIGN OPPORTUNITIES

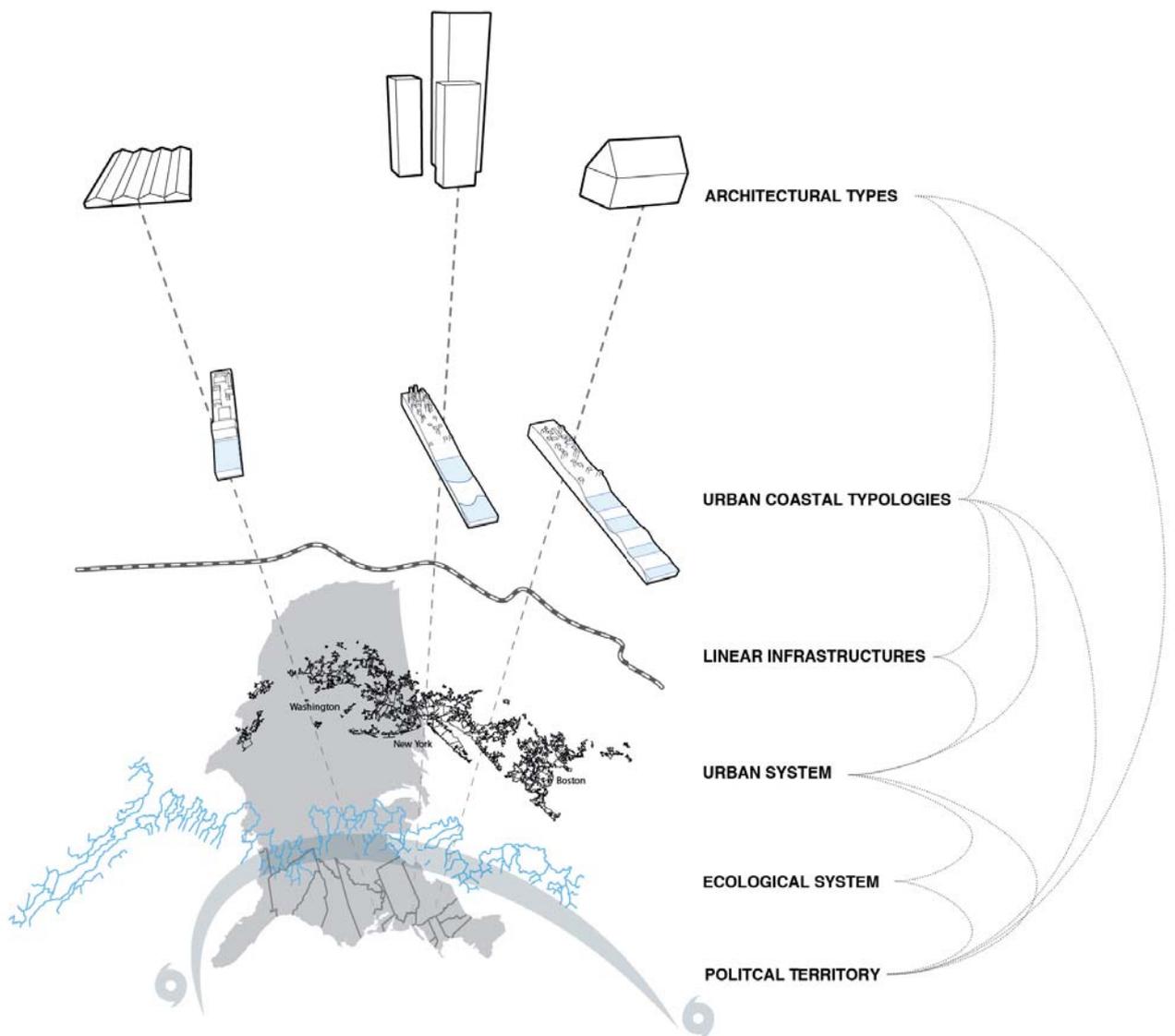
Next to the overall regional strategy four opportunity districts were determined: several areas in the Meadowlands with a close proximity of residential, wetland, and industrial land uses. New Jersey Hoboken, where various vital infrastructures cross the Hudson and connect New Jersey and New York. The lower east side on Manhattan, where persistent drainage issues will exacerbate as flood barriers are raised and water cannot leave the island. And New Town Creek, where pollution of an old industrial legacy in the floodplain necessitates intervention.

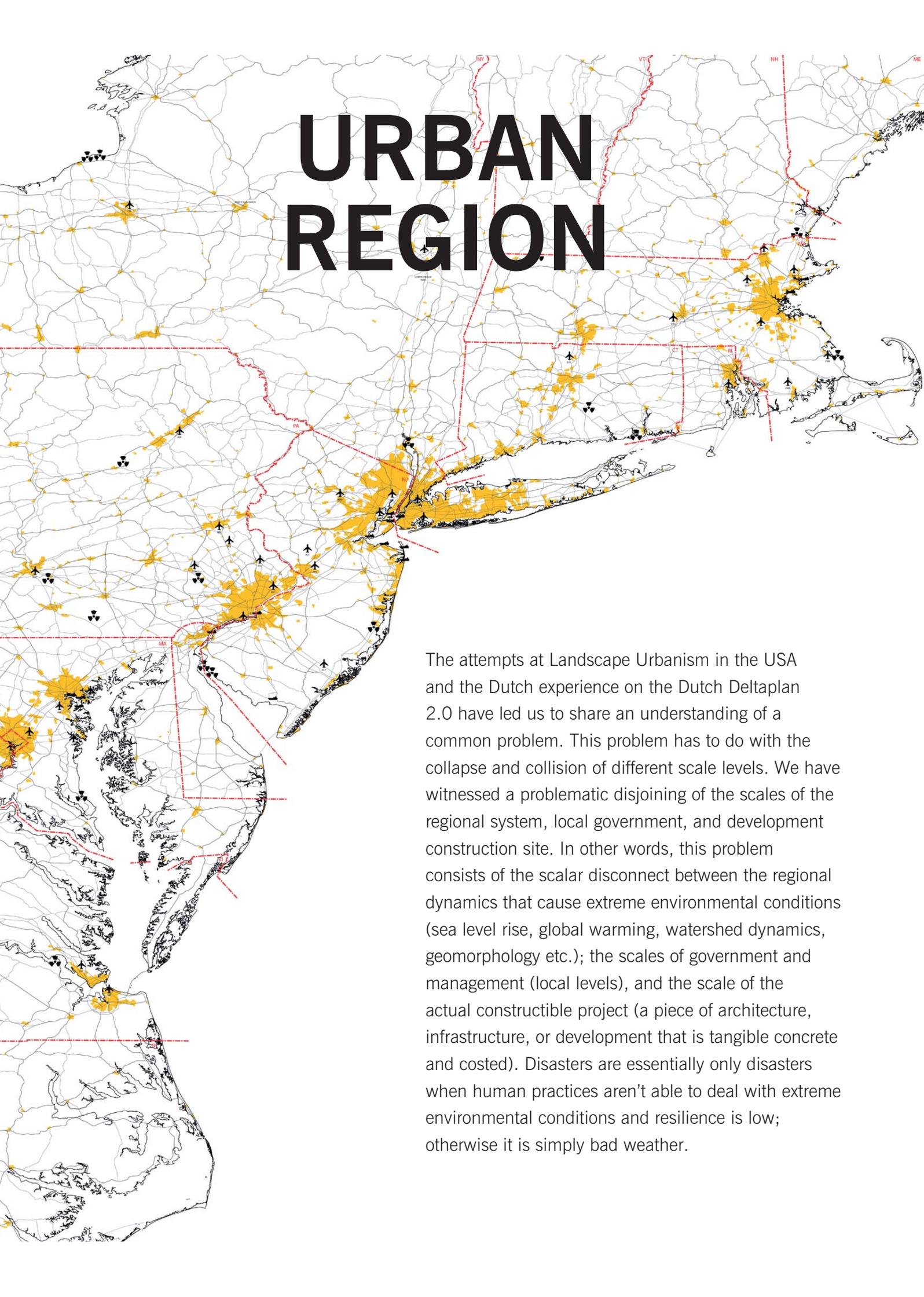


REGIONAL PROTECTION LOCAL ADAPTATION

This proposal seeks to link a regional understanding of the Hurricane region with the ecological and urban network of the North Atlantic Seaboard instead of simply focusing on either the region or the community scale as often happens because of disciplinary specialization.

The aim is to be able to develop proposals that are hybrids between generically engineered solutions and local adaptations. This means we will work on the abstract regional scale and the local specific level simultaneously.





URBAN REGION

The attempts at Landscape Urbanism in the USA and the Dutch experience on the Dutch Deltaplan 2.0 have led us to share an understanding of a common problem. This problem has to do with the collapse and collision of different scale levels. We have witnessed a problematic disjoining of the scales of the regional system, local government, and development construction site. In other words, this problem consists of the scalar disconnect between the regional dynamics that cause extreme environmental conditions (sea level rise, global warming, watershed dynamics, geomorphology etc.); the scales of government and management (local levels), and the scale of the actual constructible project (a piece of architecture, infrastructure, or development that is tangible concrete and costed). Disasters are essentially only disasters when human practices aren't able to deal with extreme environmental conditions and resilience is low; otherwise it is simply bad weather.

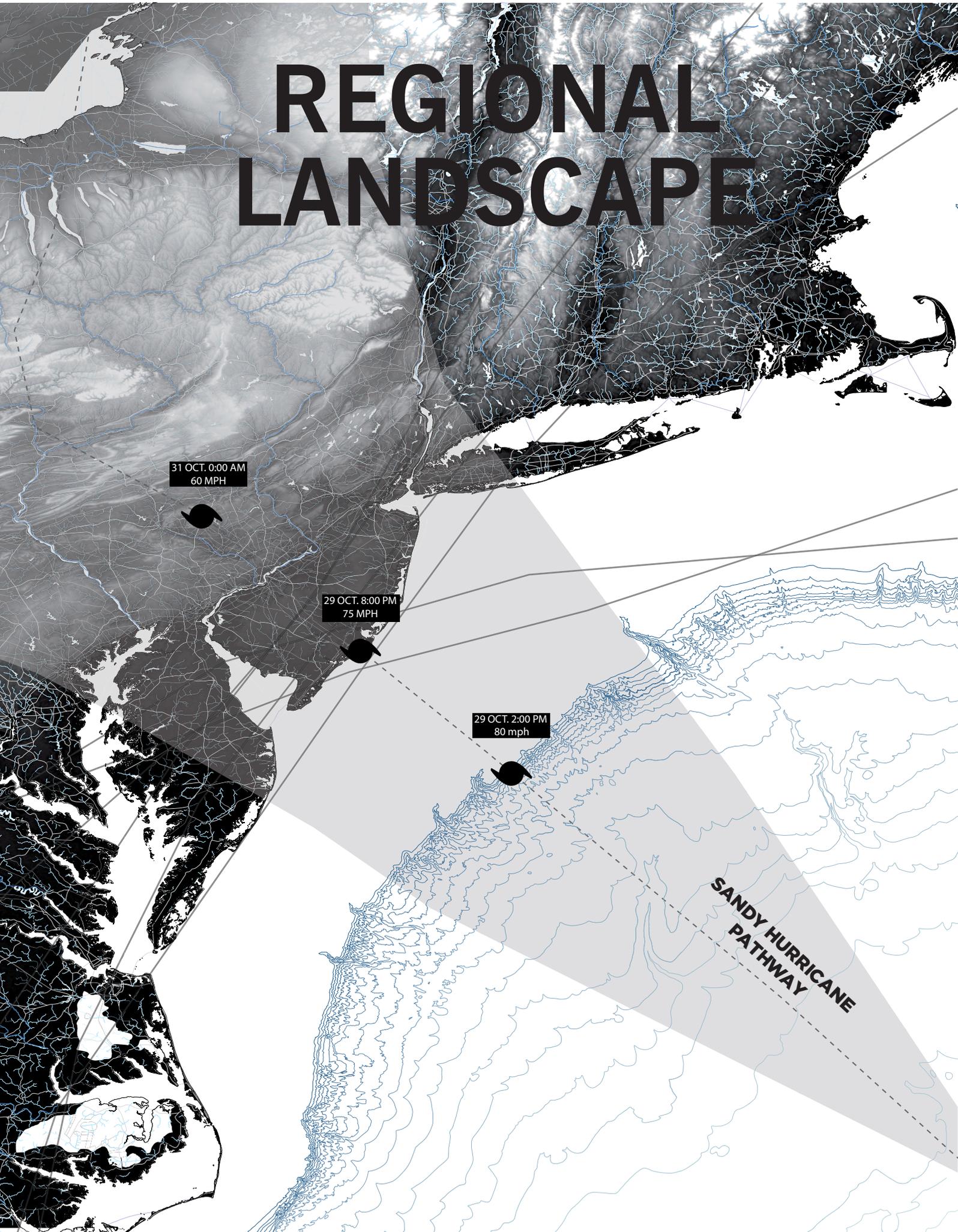
REGIONAL LANDSCAPE

31 OCT. 0:00 AM
60 MPH

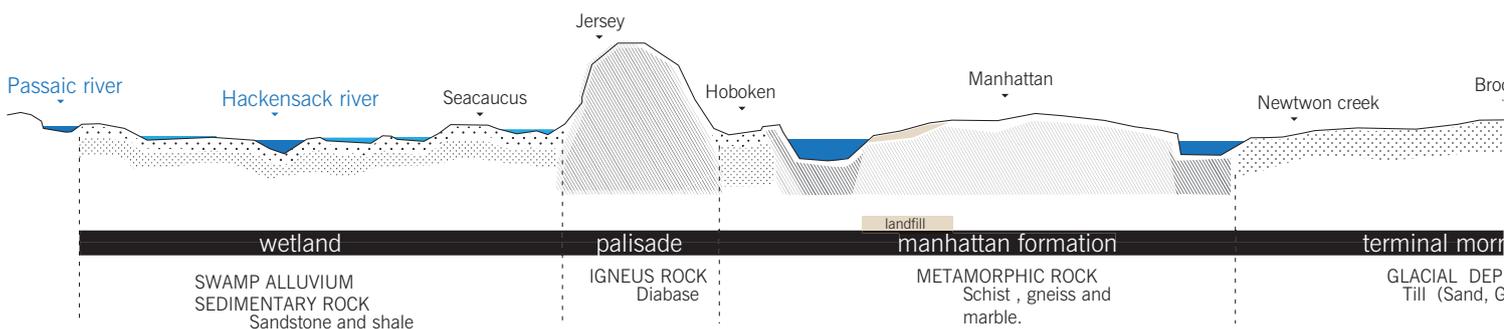
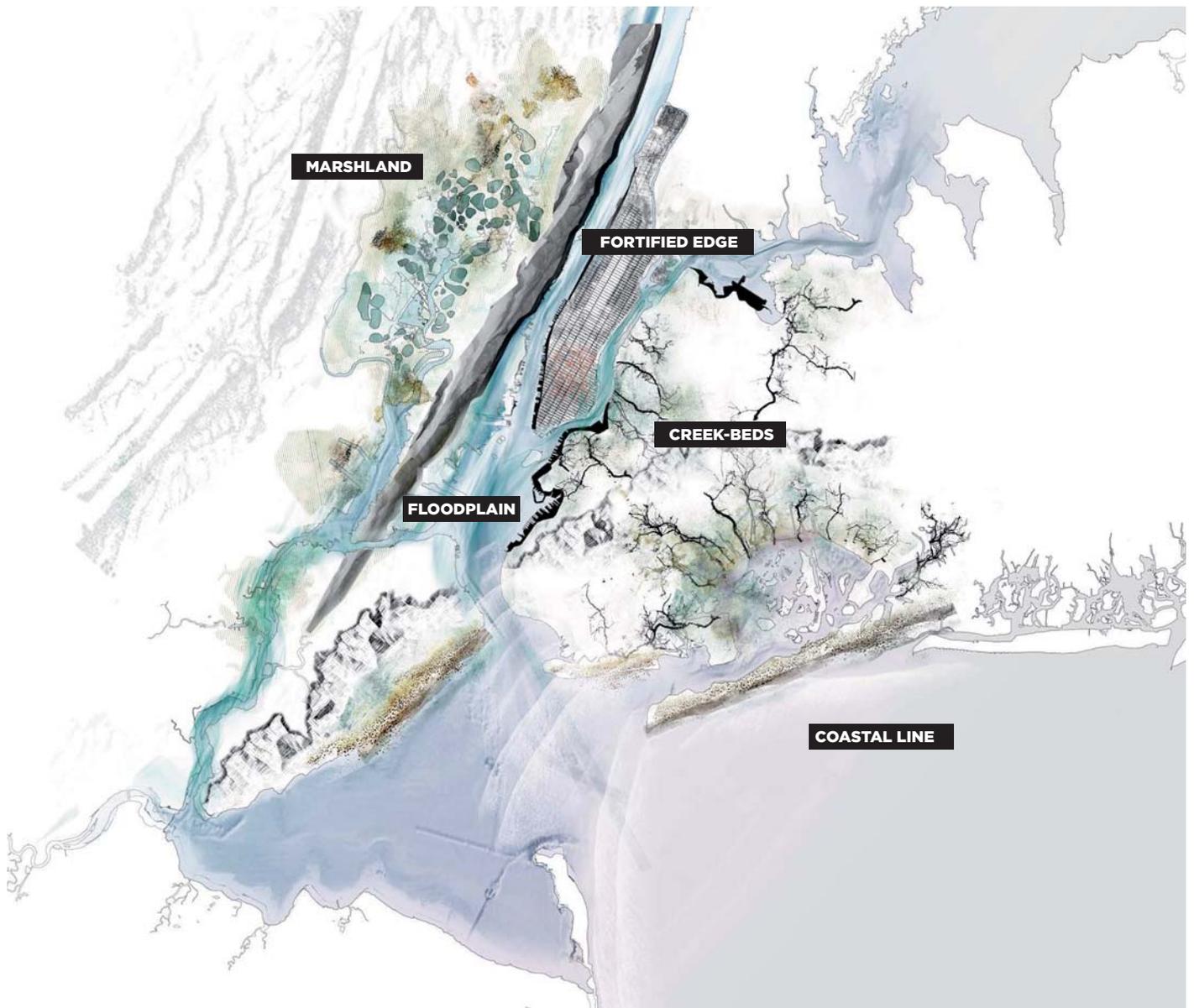
29 OCT. 8:00 PM
75 MPH

29 OCT. 2:00 PM
80 mph

SANDY HURRICANE
PATHWAY



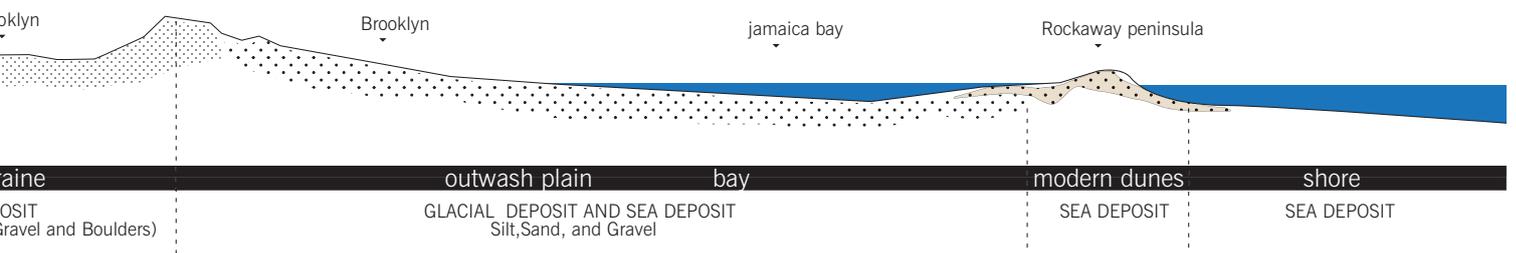
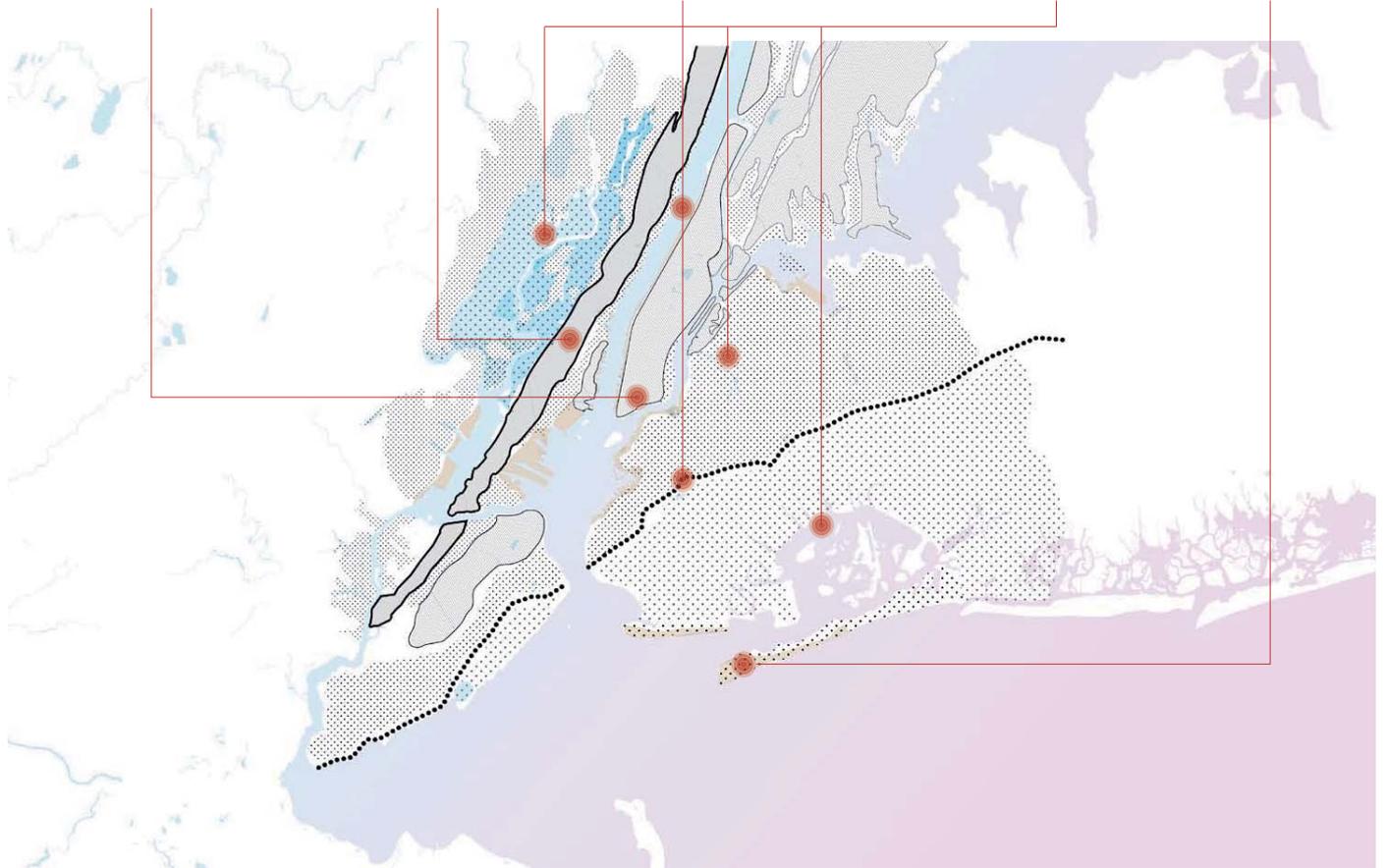
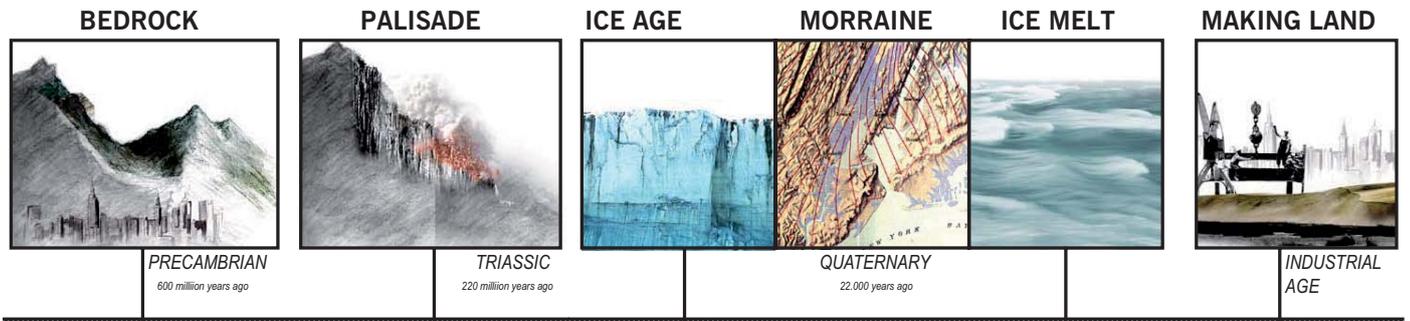
REGIONAL FLOODSCAPES



THE ORIGIN OF TODAY'S TERRITORIAL SHAPE

Originally, as a consequence of the formation of the ancient supercontinent, New York-Jersey area was a mountain system. The heritage of these time is what nowadays we name Manhattan bedrock. During Pangaea Rifting, The Jersey palisade emerged. Lava erupted through the rift valleys, creating igneous rocks formations after getting cooled. Events from the last ice sheet in North America, the Wisconsin Glaciation, finished the creation of the current New York-Jersey estuary geomorphology. By bringing enormous amounts of glacial deposits, the glacier traced the

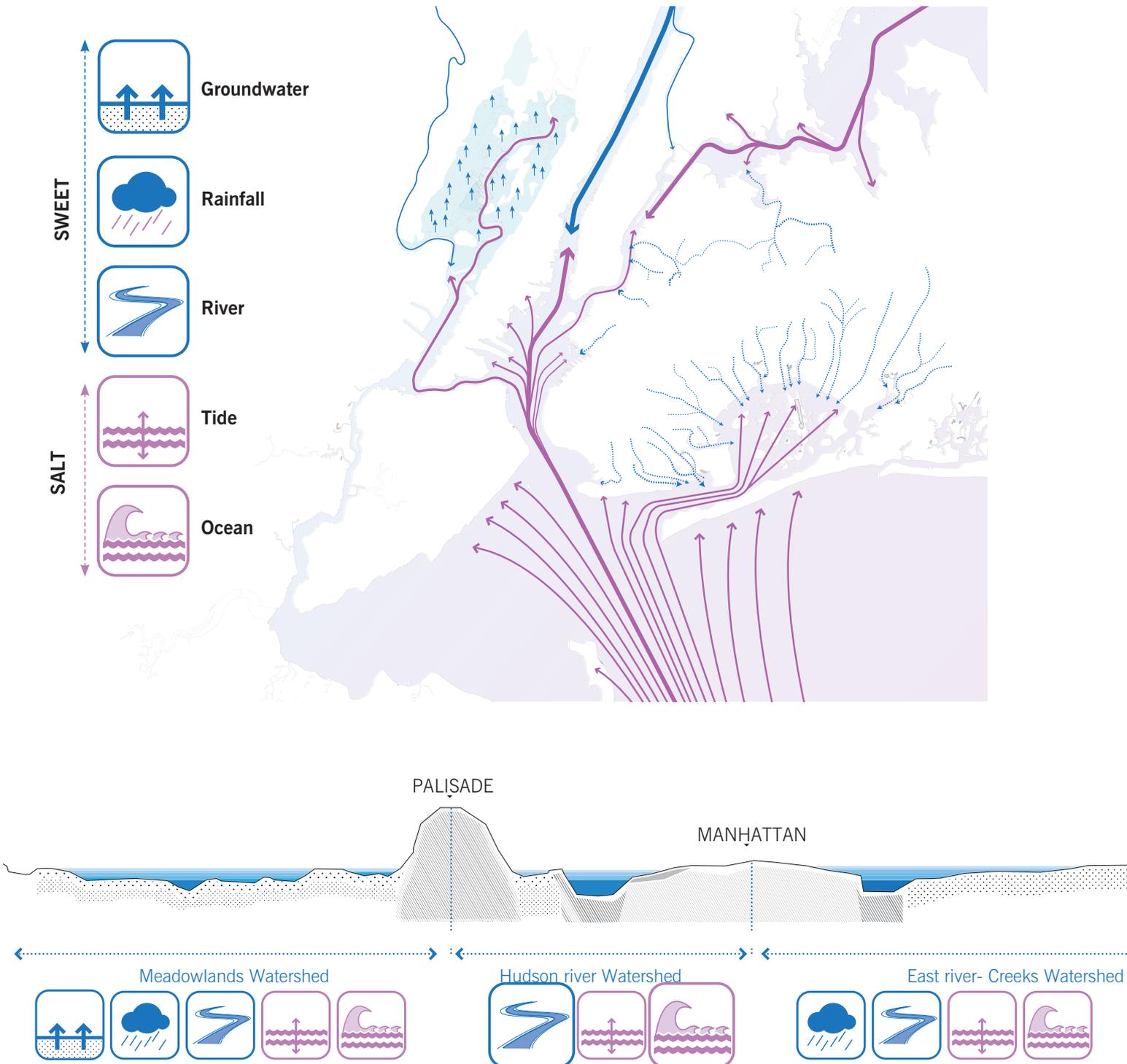
Hudson U-shape, the Brooklyn-Queens hills, and the original outwash shoreline. The posterior recession movement and melting process of the glacier caused the present waterbodies of the region. Wetlands, floodplains, creeks, bays and shorelines are an important heritage of the natural history of the estuary. After the Industrial Revolution, the need to create new infrastructure in order to expand the urban system, has modified the natural geomorphology



FLOOD DIRECTIONS

NY-NJ Metropolitan area is characterized by its coastal position where the Hudson River and the Atlantic Ocean meet. Here, in between the land and the ocean, people can benefit from this profitable position but have to take into account its unpredictable dynamics as well. The continental sweet water discharge and the strong

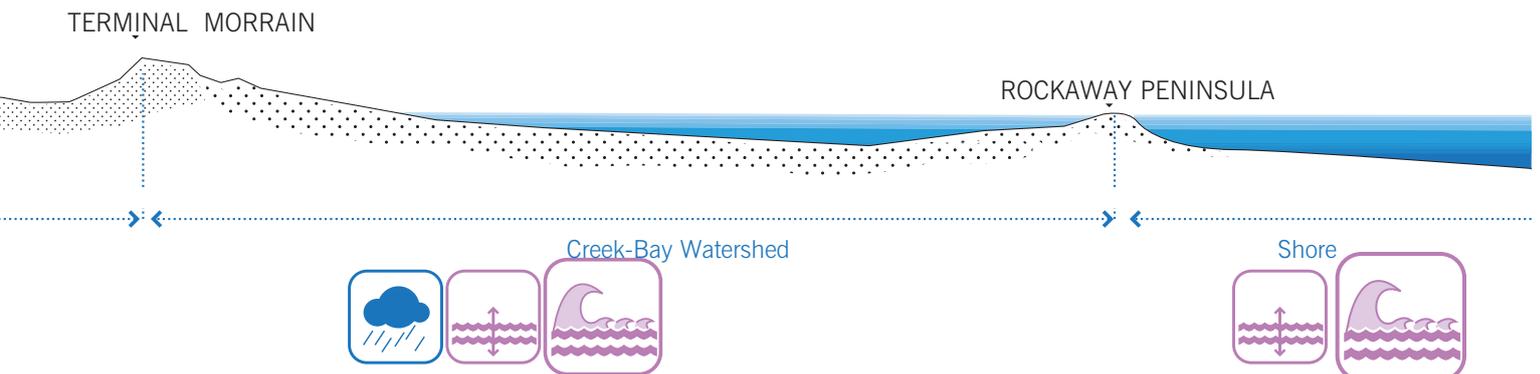
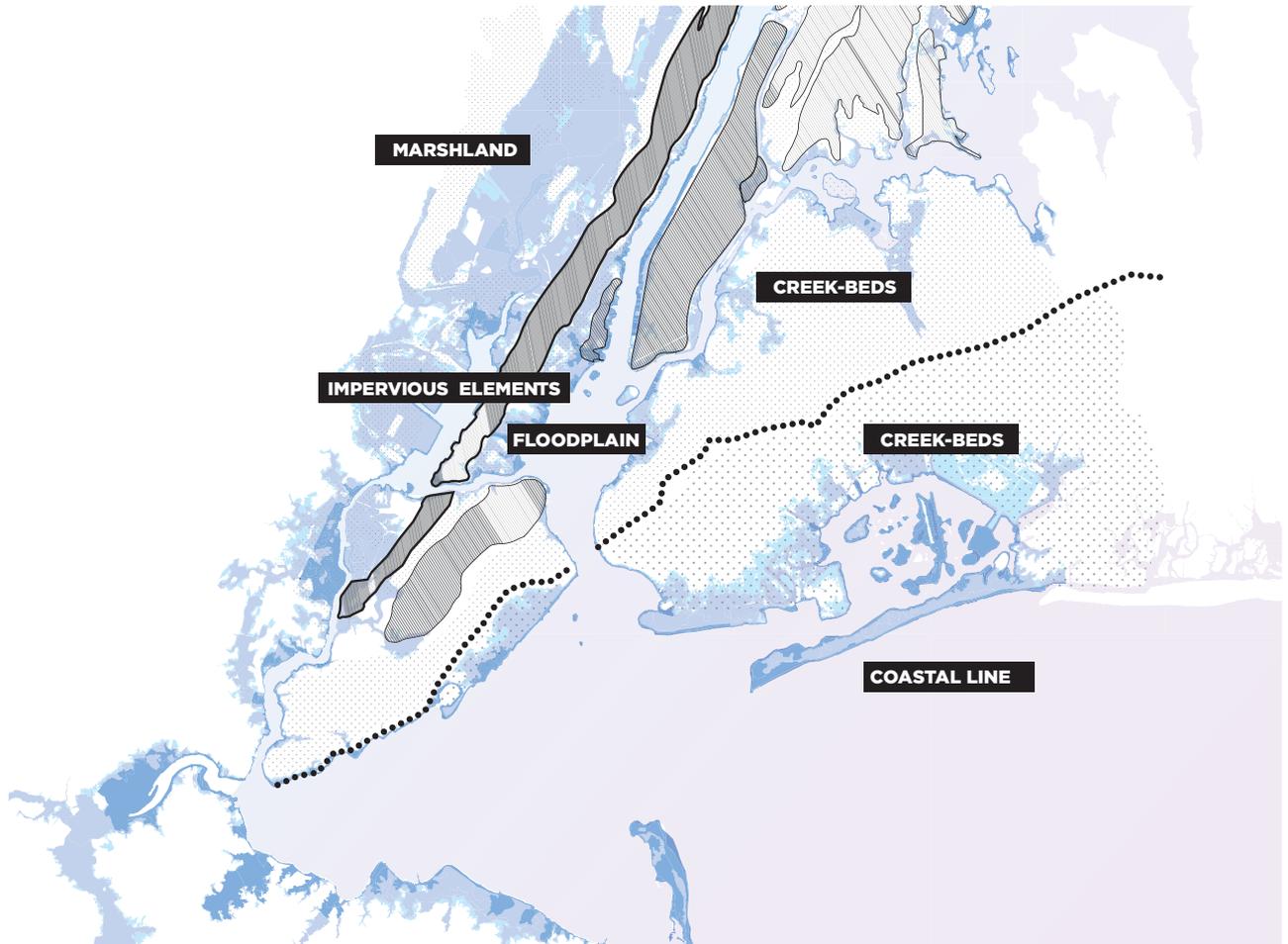
ocean influence have formed along the history the extended variety of water bodies and flood landscapes we find along the region. Marshlands, bays, creeks, river floodplains...are formed, fed and modified by their particular water influences.



FLOOD PATTERN

Imagine the geomorphology of the estuary as a huge mould on which NY / NJ metropolitan area is settled but also where the sweet and salt water meet every day, filling and emptying the low lying areas. When a great flood comes this process multiplies its effect and proofs the importance and the differences between the flood

landscape typologies. The flood does not flow in the same way through the marshlands as it does across the river flood plains so Adaptive measures and the resilient system should understand these differences and act accordingly.



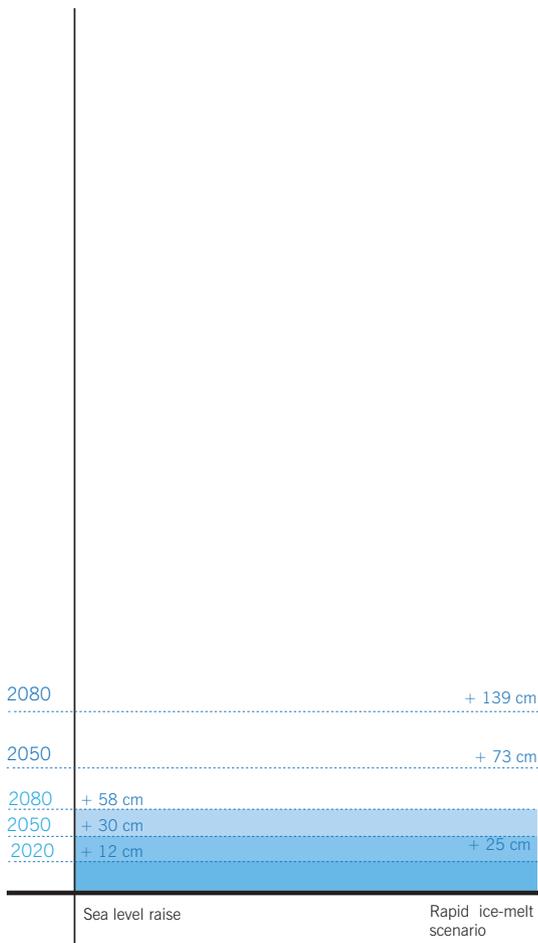
HOW MUCH FLOOD WE ARE TALKING ABOUT?

CONTINUOUS PROCESS

OCASIONAL EVENTS

WATER FROM THE SEA

SEA LEVEL RISE



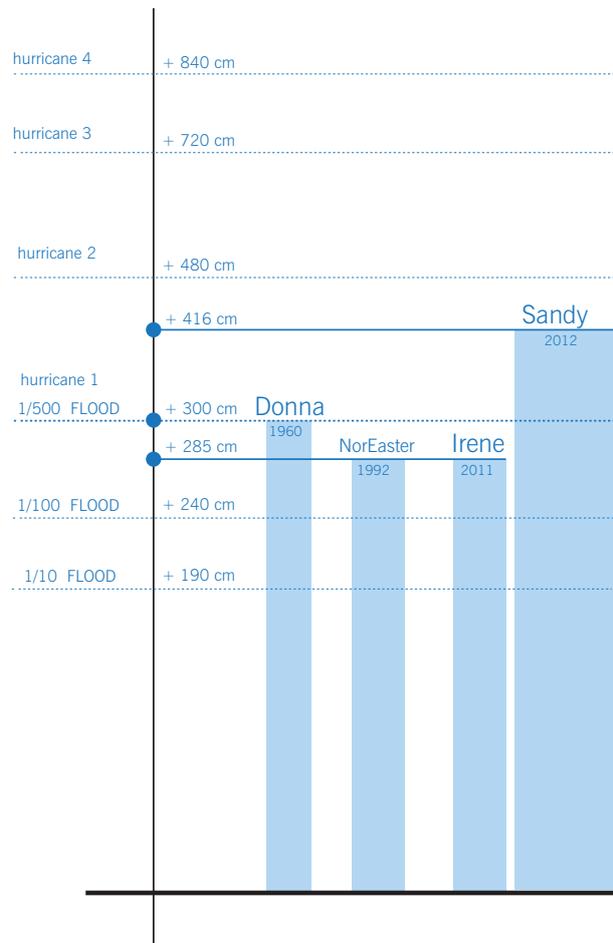
SOURCE

Annals of the New York Academy of Sciences
 Issue: New York City Panel on Climate Change 2010 Report
 Lead authors
 Radley Horton, Vivien Gornitz, and Malcolm Bowman and Reginald Blake
 Columbia University Center of Climate Systems Research.
 School of marine and Atmospheric sciences
 Physics Department, New York City College of Technology, Brooklyn.

Information about data

All the figures belong to the worst scenario of the range.

COASTAL STORM AND HURRICANES SURGE



SOURCE

Annals of the New York Academy of Sciences
 Issue: New York City Panel on Climate Change 2010 Report

Palisade bay

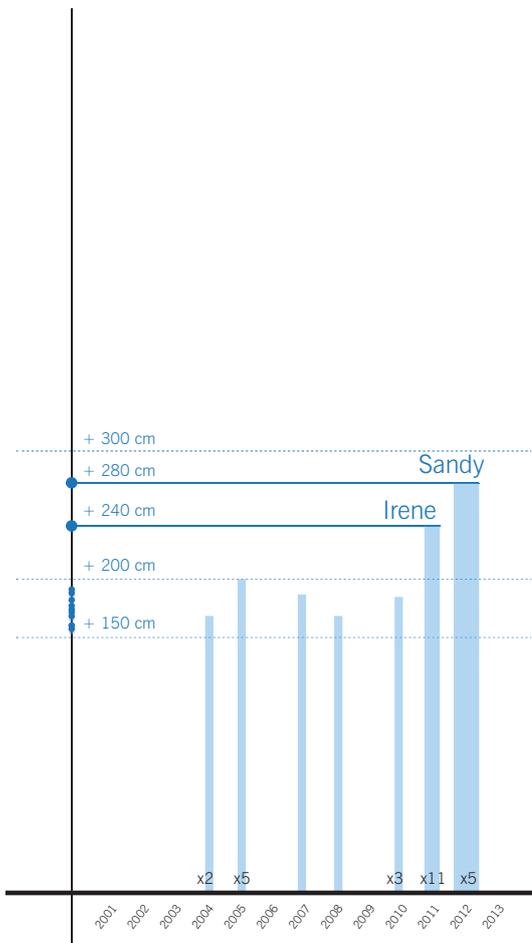
Information about data

All the data refers to particular events belongs to Battery park Gauge
<http://water.weather.gov/ahps2/hydrograph.php?wfo=okx&gage=batn6>

WATER FROM THE RIVER

RIVER FLOODING

From 2000-2013



26 events above 150 cm high water levels

SOURCE

__ NOAA - National Oceanic and Atmospheric Administration

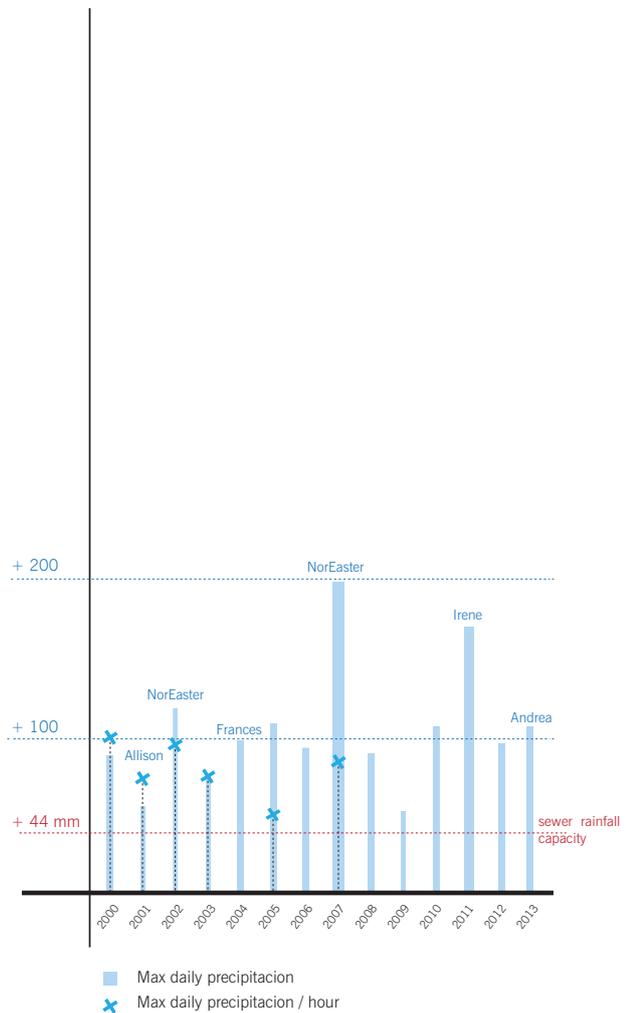
Information about data

__ All the data refers to particular events belongs to Historical Crests for Hudson River below Poughkeepsie
<http://water.weather.gov/ahps2/hydrograph.php?wfo=aly&gage=poun6>
 80 km new york upstream

WATER FROM THE SKY

HEAVY RAINFALL FLOODING

From 2000-2013



SOURCE

__ NOAA - National Oceanic and Atmospheric Administration
<http://www.erh.noaa.gov/okx/stormtotals.html>

__ New york Natural Hazard Mitigation Plan
http://www.nyc.gov/html/oem/downloads/pdf/hazard_mitigation/section_3j_flooding_haz_ard_analysis.pdf

Information about data

__ All the max daily data refers to particular events belongs to Central park Gauge
<http://www.climatestations.com/new-york-city-2/>



UNLEARNING FROM THE NETHERLANDS



TOWARDS REGION SPECIFIC STRATEGIES

The Dutch are internationally often seen as the masters of controlling floods. Even the saying “God created the Earth and the Dutch created the Netherlands” refers to their famous history of fighting and conquering nature and water in particular. It goes without saying that this Dutch history is fascinating and the land taken from the sea by collectively creating polders is impressive. But this system has its downside as well. Polders below sea level remain a vulnerable location for settlement. The dikes around them have to be raised until eternity and the land itself tends to sink. By pumping water out, the soil –especially peat- tends to oxidate and shrink in size. This actually means that the Dutch are pumping themselves deeper and deeper below sea level, while at the same time this sea level is rising due to climate change. The dikes thus constantly need maintenance, upgrading and reinforcements, a pretty expensive system.

Throughout history dike breaches have occurred and have always had a big impact on Dutch society. The last serious one to happen was in 1953. During a heavy winter storm on many places dikes in the provinces of Zeeland and South-Holland broke, water flooded the land and swallowed thousands of houses and more than 1800 persons. After this the national government decided “never again” and installed the first Deltaworks. This meant serious further reinforcement of sea dikes and a large network of dams and barriers to block the waves from the sea for good. Only the harbour of Rotterdam was equipped with a flexible storm surge barrier to ensure a free passage for the regions’ main economy. This first Deltaworks made sure that the front door was sturdily closed and has been a logical continuation of the Dutch history of fighting floods.

The downside of this system became seriously apparent towards the end of the century when river runoff from Germany became an increasingly large problem and this water could not go anywhere fast because the “closed

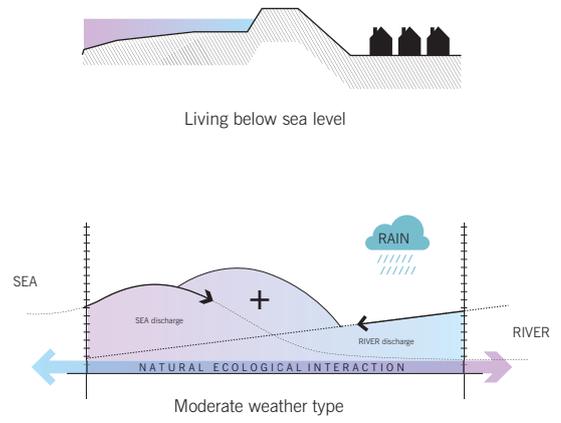
front door” also kept the water in that came in from the “back door”. Suddenly the river dikes became an urgent problem. At the same time the Dutch population was not familiar with the water anymore, because for generations the water had been kept out everywhere. Culturally and economically the Dutch gradually had lost their connection to the water. This led to a courageous decision to make more “room for the river”. Instead of only raising dikes, river beds were widened, land was deliberately flooded and bypasses and new riverbeds were created. The new Deltaworks 2.0 had begun.

In the next centuries a more adaptive Delta management will be implemented to the Netherlands. It will be a mixture of raising defense systems such as dikes, dams and barriers, as well as applying more adaptive measures like floating real estate, allowing some land to be flooded and applying smart evacuation strategies. Still the entire Dutch system will need a constant maintenance throughout time, which will be a reoccurring costly operation for the national government.

What now could the Americans learn from the Dutch? Certainly not “to do as we did”, but to learn from what we took us some decades to find out: adaptive measures will last longer, create less dependencies and keep people aware. Certainly in the US where weather conditions are more extreme than they are in the Netherlands and where the topography creates so many safe places by itself. The vulnerable locations in the New York / New Jersey region are relatively much more limited in size, while their economic value is very high. It should not be difficult to focus the attention to create some tailor made specific sustainable solutions for certain areas instead of creating an overall defense system that will always create its own new problems. So here we propose to jump immediately to a Deltaworks 3.0 in which all the lessons that can be learned from the Dutch to immediately create a more resilient system of adaptive solutions.

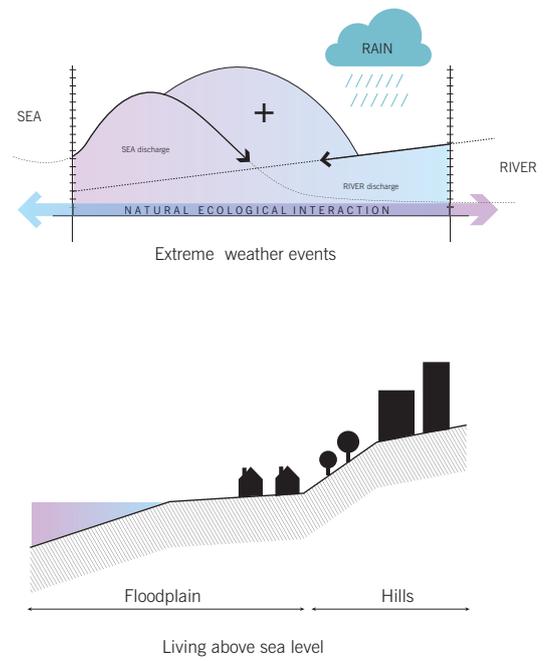
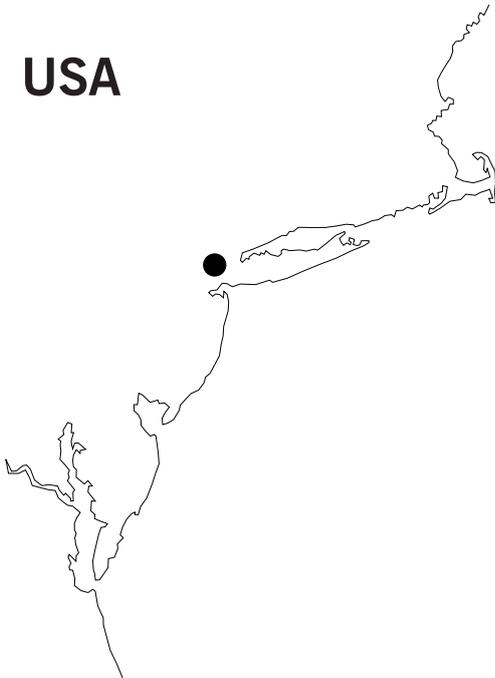


NL



Original situation

USA



GAME CHANGER

The 1953 Flood



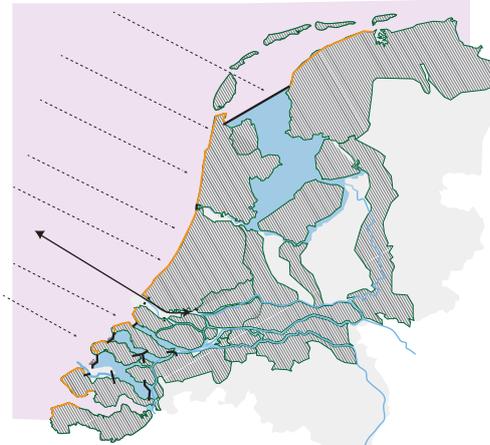
- Storm surge 5.6 m
- Casualties 1836
- Economic losses 3.1 Billions

(Source : Klijn & De Grave, 2008)

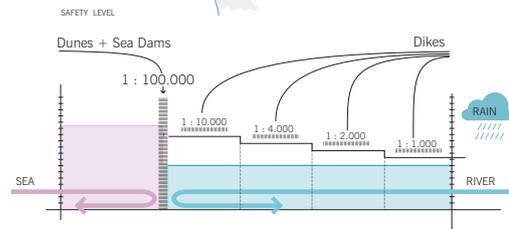
PREVENTIVE SYSTEM // Delta works 1.0

Delta works construction_ Close off from the sea

Construction of a closed system of dams, dunes and dikes to protect the country



Safety level concept



(Source : Ministry of infrastructure and environment)

NL
USA

1953



1953
Carol

\$ 0,46 billions

1955
Connie

370 mm

1959



1960
Donna

+ 2.0 m (Total)

1971
Doria

200 mm

1972
Agnes

\$ 0.7 billions (NY)
 25 (NY)
 300 mm

1976
Belle

\$ 0.9 Billions (Total)
 1 (NY)
 150 mm
 + 2.3 m

1985
Gloria

\$ 0.98 billions (Total)
 88 mm

1991
Bob

\$ 0,075 billions (NY)
 2 (NY)
 125 mm



REBUILD System



INSURANCE POLICY PRICE

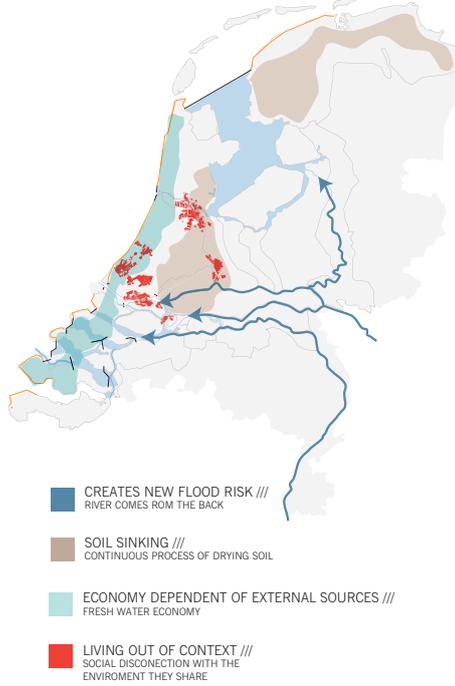
Finish deltaworks

New problems arise

Estimated capital invested in the construction : € 4,5 Billions

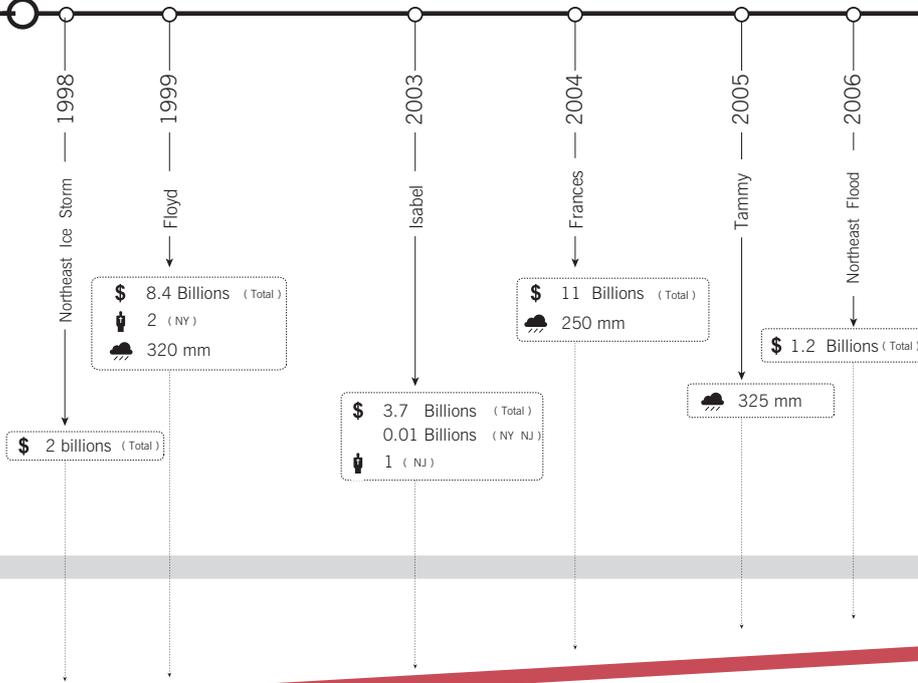


The solution creates new problems to be solved



1997

(Source : Ministry of infrastructure and environment)

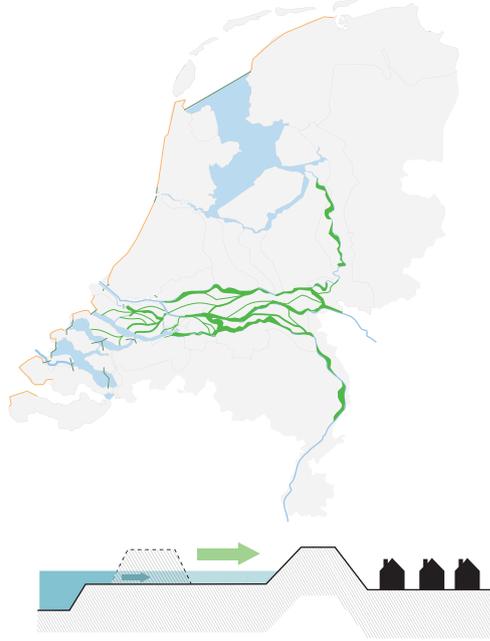


ADAPTIVE SYSTEM // Delta works 2.0

ROOM FROM THE RIVER

More adaptive solutions are needed.
Estimated capital invested :

€ 2,3 Billions



(Source : Ministry of infrastructure and environment)

NL

USA

2009
Northeast Flood

\$ 1.6 Billions (Total)

2011
Irene

\$ 10 Billions (Total)
5 (NJ)
150 mm

2012

SANDY



FLOOD AREA INSURANCE PRICES

• NO PROTECTION
\$ \$ 9.500 / YEAR

• 3 ft PROTECTED
\$ 1.410 / YEAR

• 7 ft PROTECTED
\$ 427 / YEAR

SOURCE: SWISS RE

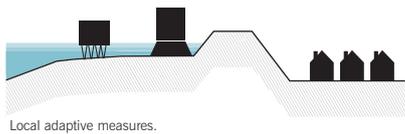
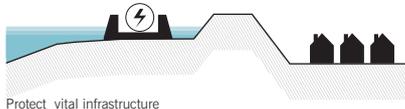
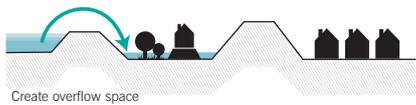
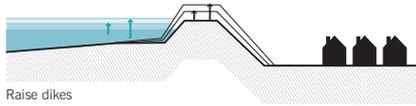
Ⓢ Storm surge 4.8 m
 Ⓜ Casualties 43 (NY state) + 12 (NJ)
 Ⓢ Economic losses 65 Billions total
 NY city 19 Billions
 NY state 32 Billions
 NJ state 30 Billions

GAME CHANGER

DELTA PROGRAMMA MEASURES IMPLEMENTATION

Continuous process of upgrading the system.
Planned capital investment from 2020 on.

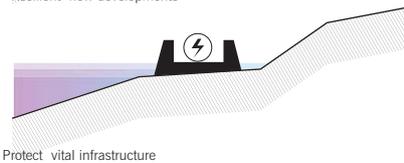
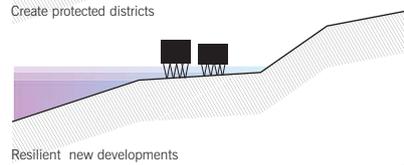
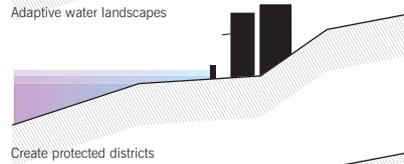
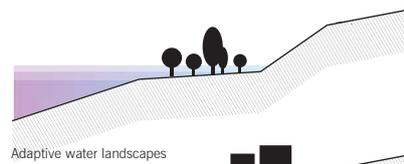
€ 1 Billion / year



2013

(Source : Ministry of infrastructure and environment)

2014



REBUILD BY DESIGN

Estimated capital invested in adaptive measures

\$ 5 Billion [Total Sandy Task Force 50 Billion]

ADAPTIVE SYSTEM // Delta works 3.0

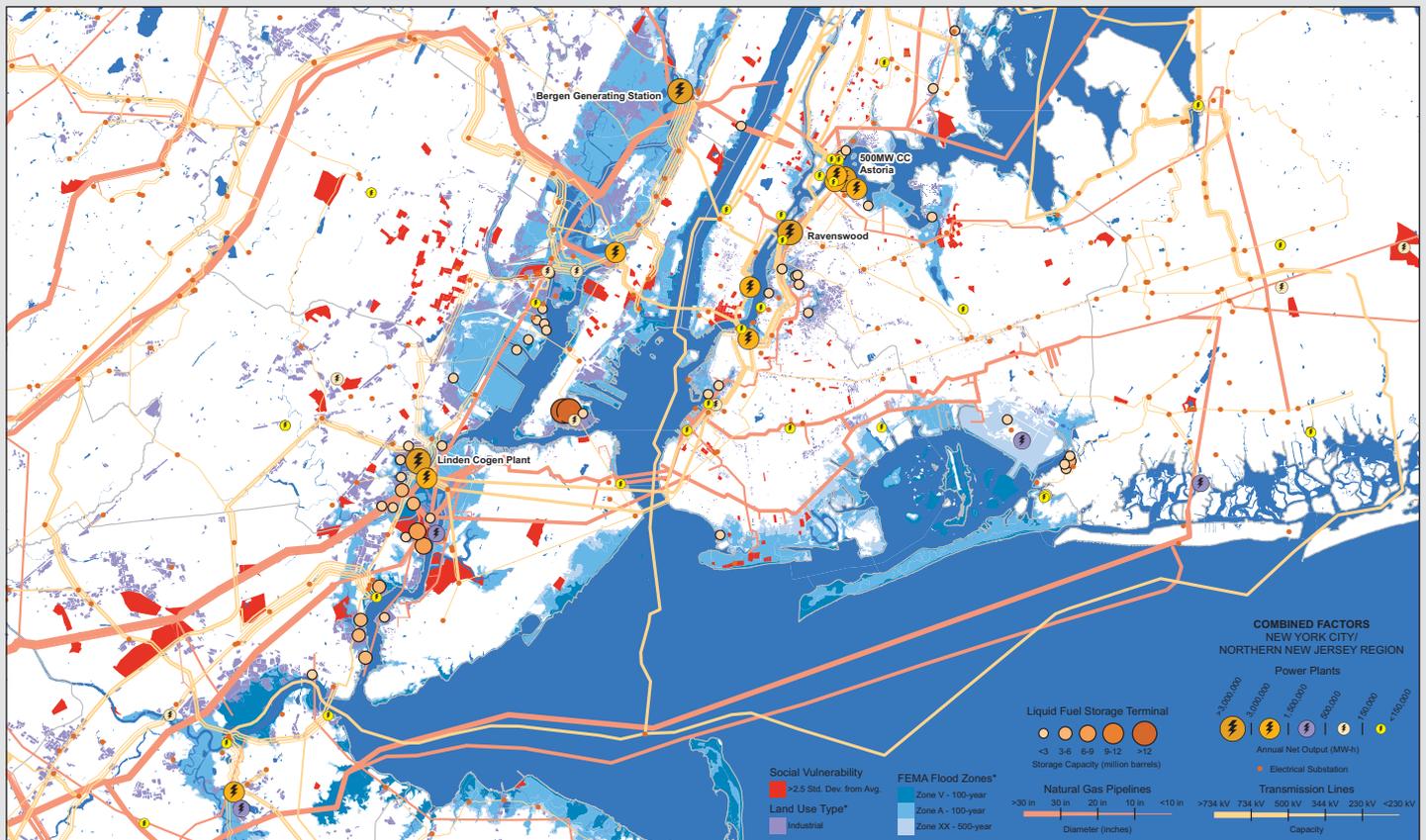
A DELTA OF RESILIENCY DISTRICTS

The team of MIT with ZUS+Urbanisten proposes a grouping of resiliency districts at the edges of the flood zones of the metro area of NY-NJ. A resiliency district is defined by a series of layers combining emergency infrastructure, evacuation capacity, ecological protection/absorption landscape infrastructure; as well as a development mix of light manufacturing/warehousing with residential. This definition follows from an assumption about sound policy, namely that every dollar of federal investment should help address a wide portfolio of risks – storm surge, rainwater events, and heat islands; and cover a spectrum of vulnerabilities – economic, social, and pollution. This may sound evident, but today no such policy mechanism is in existence yet. With the proposed delta of resiliency districts we hope to make investment beneficial to a spectrum of people; foster economic growth without falling into the trap of gentrification; and to protect vital areas, while returning others back to nature and the water. Combining geo-referenced data on both risk and vulnerability spectra, we conclude that crucial investments are at river deltas, where rising seawater can penetrate inward and urban storm water flows outward. Most importantly, the low-lying flood zones of these deltas contain, almost without exception, a disturbing combination of critical infrastructures, polluted land and compromised ecosystem services, and vulnerable neighborhoods. The densest juxtapositions can be found in the metropolitan area

of NY-NJ. Roughly 2.5 million people live in the flood zone in New York City /Greater Jersey Area (Source : US Census 2010 data and FEMA Flood Zone). Roughly 66% of the most vulnerable populations (2.5 Standard deviations from the mean) live 1/2 mile from the FEMA Flood Zone. About 29% of the most vulnerable populations (2.5 Standard deviations from the mean) live in the FEMA Flood Zones (Source : NOAA Social Vulnerability Index 2006). 39 of the 52 liquid fuel storage terminals in the NY/ NJ area are located within the flood plain and these contain 80% of the total area fuel. 75% of the net annual generation (MH-h) comes from 27 power stations that are in flood zones (Source : FEMA, NREL, PLATTS, OPUS, EPA).

Across the metro area we have identified crucial flood zone landscapes whose performance and ecosystem dynamics have been lost over time due to development pressures. These landscapes are in the Meadowlands (NJ), the western edge of the Hudson River (NJ), parts of lower Manhattan (NY), and the creeks of Brooklyn/Bronx (NY).

The projects for both Meadowlands and Newtown Creek foresee a mix of logistics respectively light manufacturing, with residential and urban uses. While along the east coast, we are accustomed to see this mix as unlikely (suburban clusters of each are more typical, occurring in isolation from each other), this is a result of status quo zoning policies.



(Source : FEMA, NREL, PLATTS-2008, OPUS, EPA, NOAA -2006)

There is an emerging consensus among planners and geographers that as America begins to develop a new manufacturing base, it will make sense to build this base in an urban environment. In addition, northern Europe is experimenting with models for urban manufacturing, and we can learn from those models.

The first opportunity concerns the continuation and elaboration of our regional study, in order to enhance the connection between flood zones, whilst simultaneously providing evacuation routes to the ridges and high points between these zones. We propose to upgrade, adapt, and transform the flood zones and their edges into an armature for our resiliency districts, concentrating and adding development in specific opportunity zones along these edges, while building out a robust ecological landscape infrastructure for the flood zones at large.

One-and-a-half million new inhabitants are projected to join NYC over the next 26 years. It makes sense

from an energy and sustainability point of view to invite them to join the urban compact zones. While one could argue that new residents should settle on high ground away from the city. Such a decision, while fine in theory, does not take into the punishing commutes that would follow from this decision for those who come to the NY-NJ metro area for its economic opportunity. Therefore, as long as people can make free location choices, these more remote settlements will not work. Finally, implementing resiliency measures for existing populations will come at a high cost. It makes sense to make these investments pay back by increasing the density of protected areas, and adding some of the projected new inhabitants to these districts. Locating them in the few remaining open low-lying areas without major upgrades to its design and performance is not an intelligent choice. That is why we propose to address and accept nature's flood zones, while protecting and densifying their edges into multifunctional productive districts.



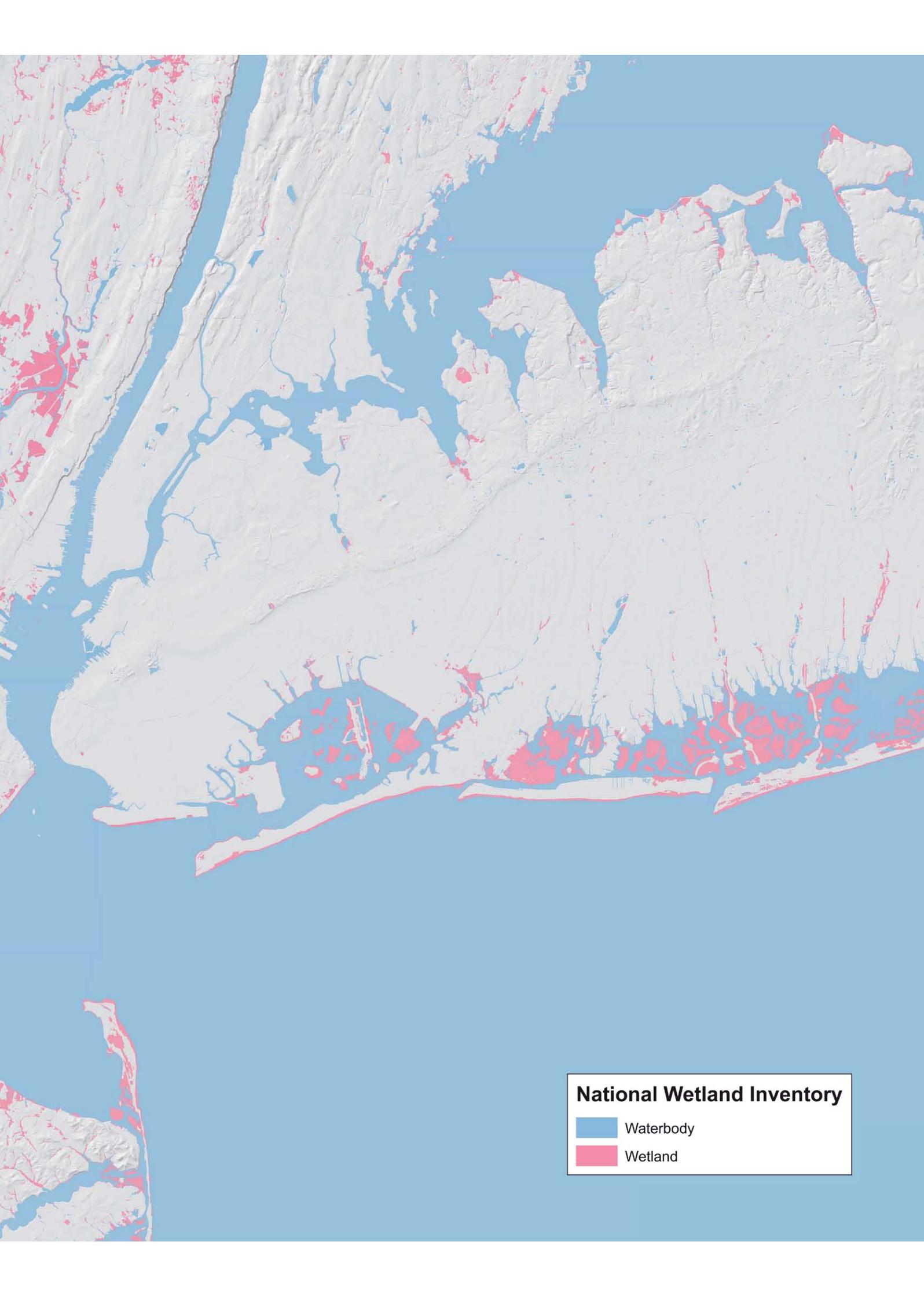




WETLANDS

85%
OF THE
REGIONAL
HISTORIC
WETLANDS
HAS BEEN
DEVELOPED
OR LOST

SOURCE : RPA HISTORIC WETLAND, AND NWI



National Wetland Inventory

	Waterbody
	Wetland

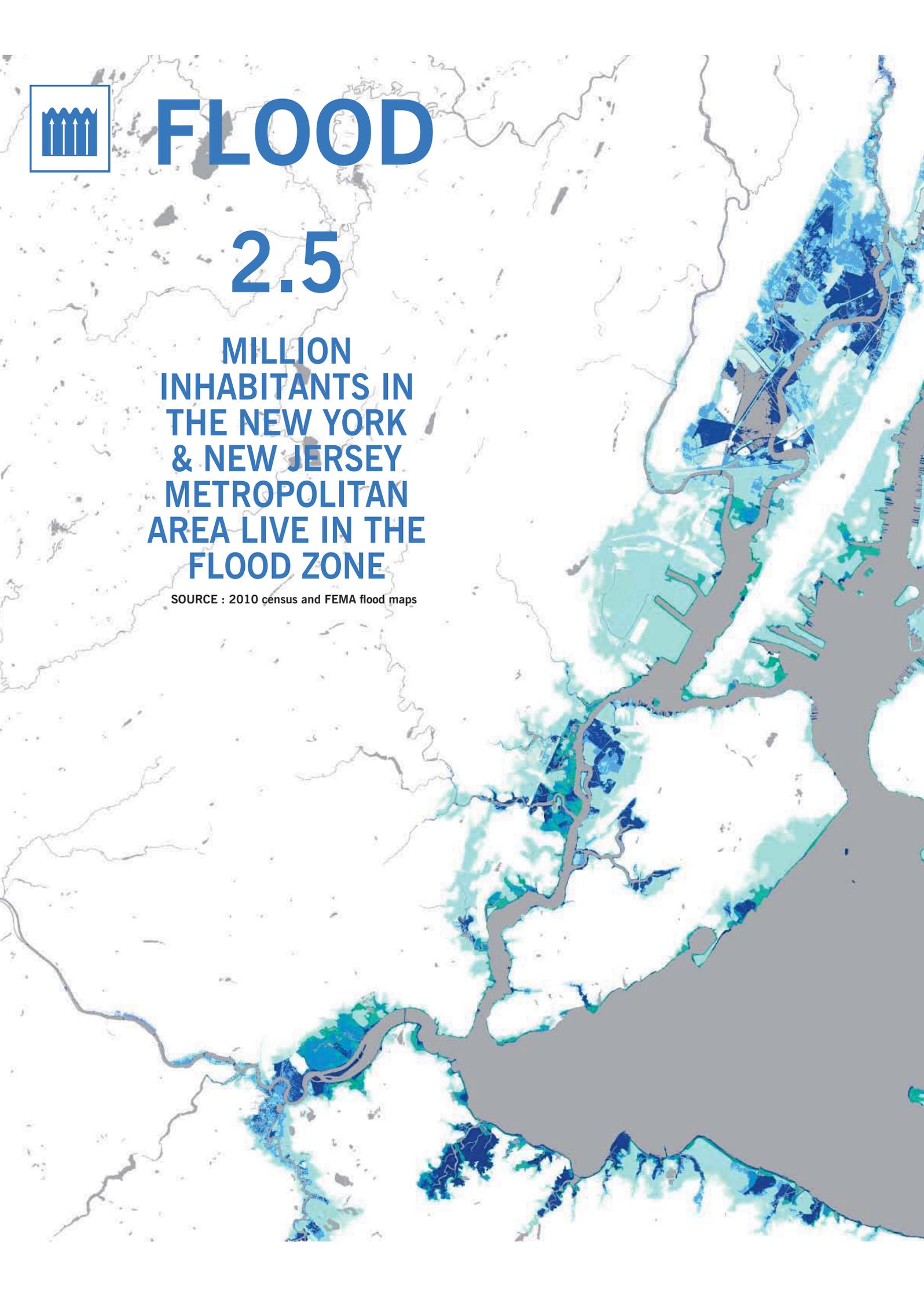


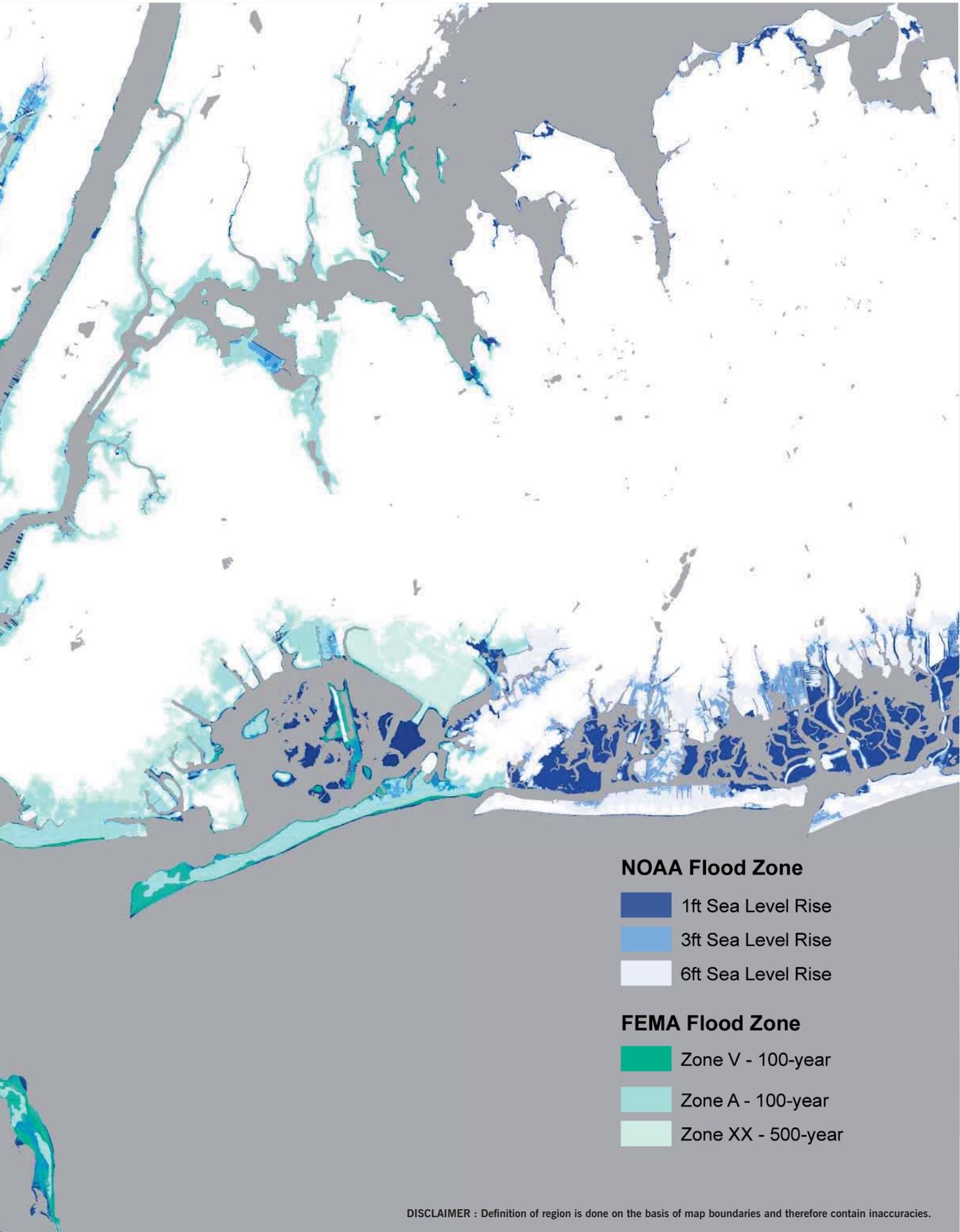
FLOOD

2.5

**MILLION
INHABITANTS IN
THE NEW YORK
& NEW JERSEY
METROPOLITAN
AREA LIVE IN THE
FLOOD ZONE**

SOURCE : 2010 census and FEMA flood maps





NOAA Flood Zone

- 1ft Sea Level Rise
- 3ft Sea Level Rise
- 6ft Sea Level Rise

FEMA Flood Zone

- Zone V - 100-year
- Zone A - 100-year
- Zone XX - 500-year

DISCLAIMER : Definition of region is done on the basis of map boundaries and therefore contain inaccuracies.

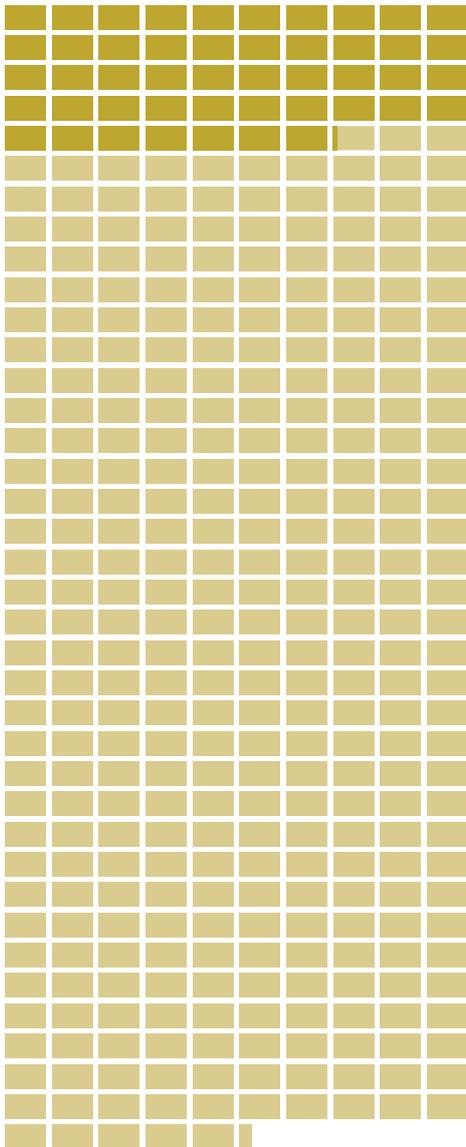


FLOOD

NYC / NJ LAND USE IN FEMA FLOOD ZONES

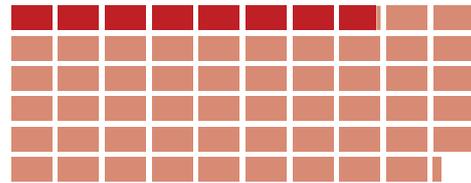
NYC, Bergen, Union, Essex, Monmouth, & Middlesex counties

RESIDENTIAL



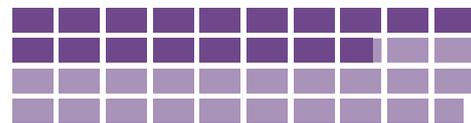
47, 111 Flood Acres
375,348 Total Acres

COMMERCIAL



7,949 Flood Acres
59,273 Total Acres

INDUSTRIAL



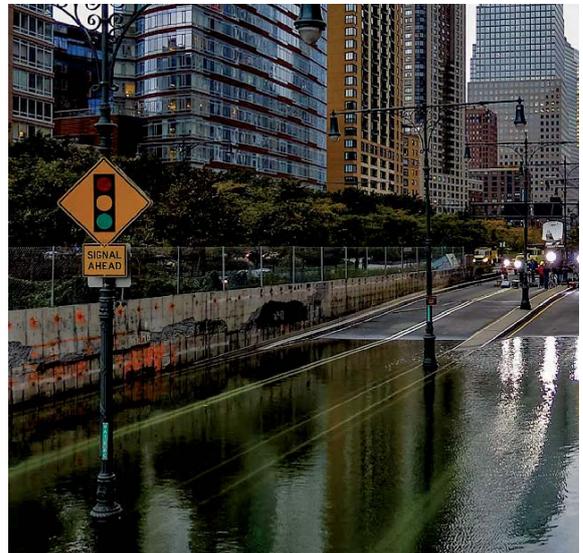
17,797 Flood Acres
39,703 Total Acres

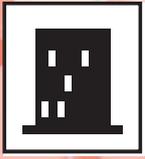
TRANSPORTATION + UTILITIES



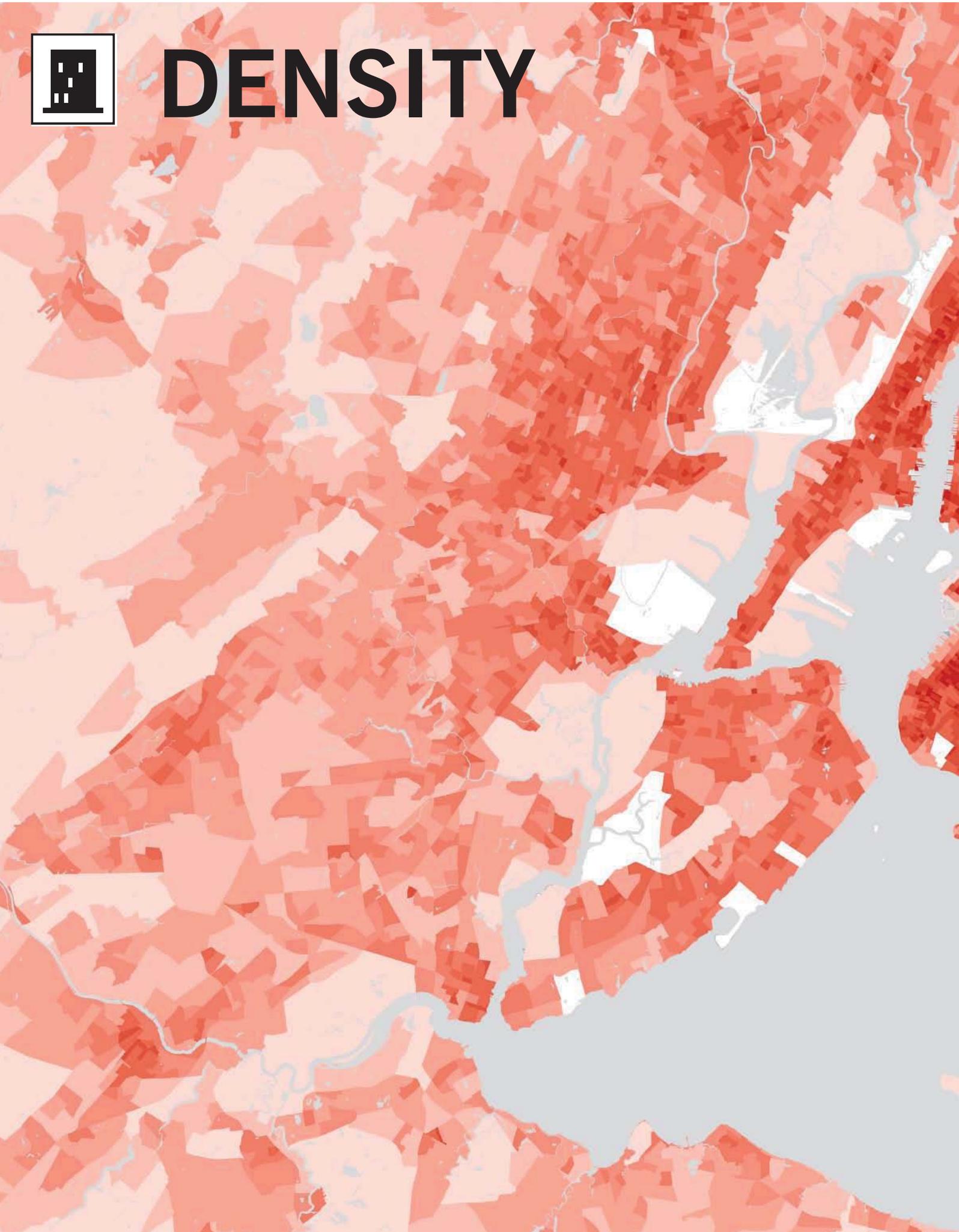
15,848 Flood Acres
21,453 Total Acres

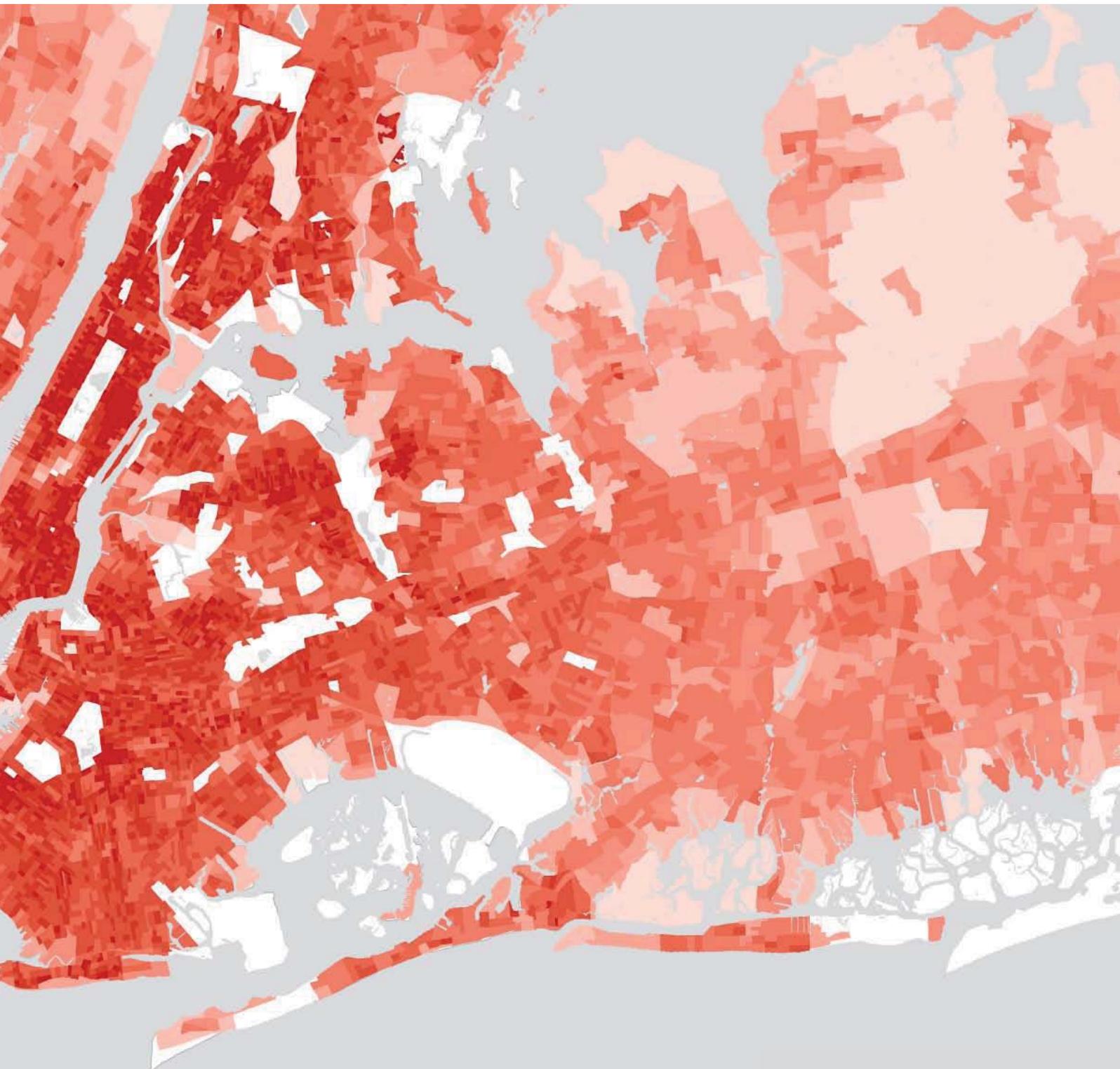
1000 ACRES



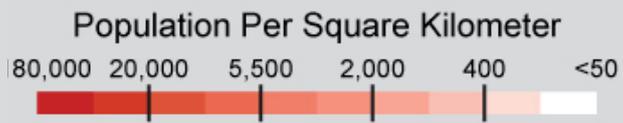


DENSITY





POPULATION DENSITY
NEW YORK CITY /
NORTHERN NEW JERSEY REGION



2007 - 2011 American Community Survey 5-year Data



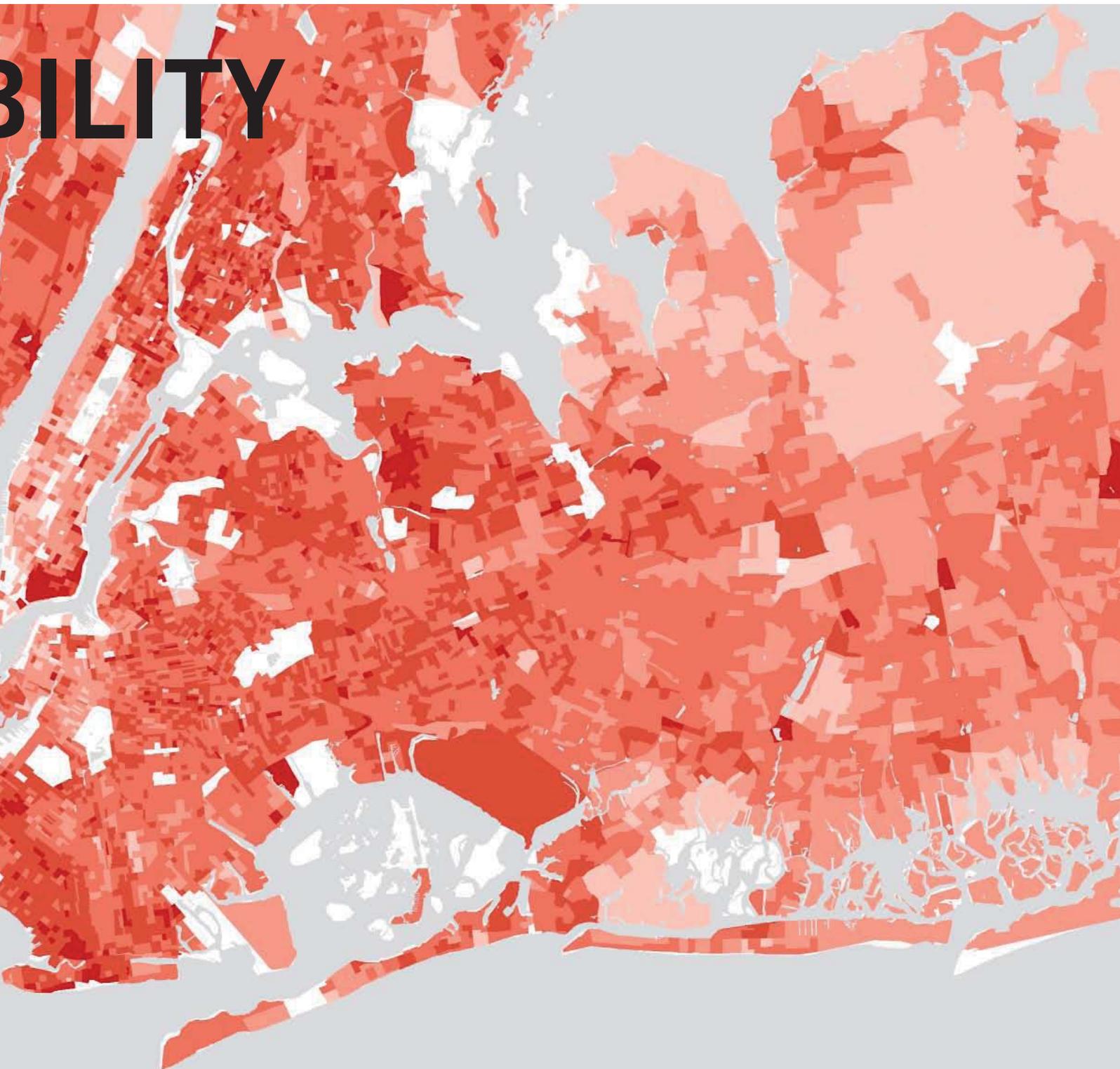
SOCIAL VULNERABLE

66%

**OF THE MOST
VULNERABLE
COMMUNITIES LIVE
WITHIN A 1/2 MILE OF
THE FLOOD ZONE**

SOURCE : NOAA social vulnerability index 2006

BILITY



SOCIAL VULNERABILITY INDEX
NEW YORK CITY/
NORTHERN NEW JERSEY REGION



(NOAA) ©2013

DISCLAIMER : Definition of region is done on the basis of map boundaries and therefore contain inaccuracies.

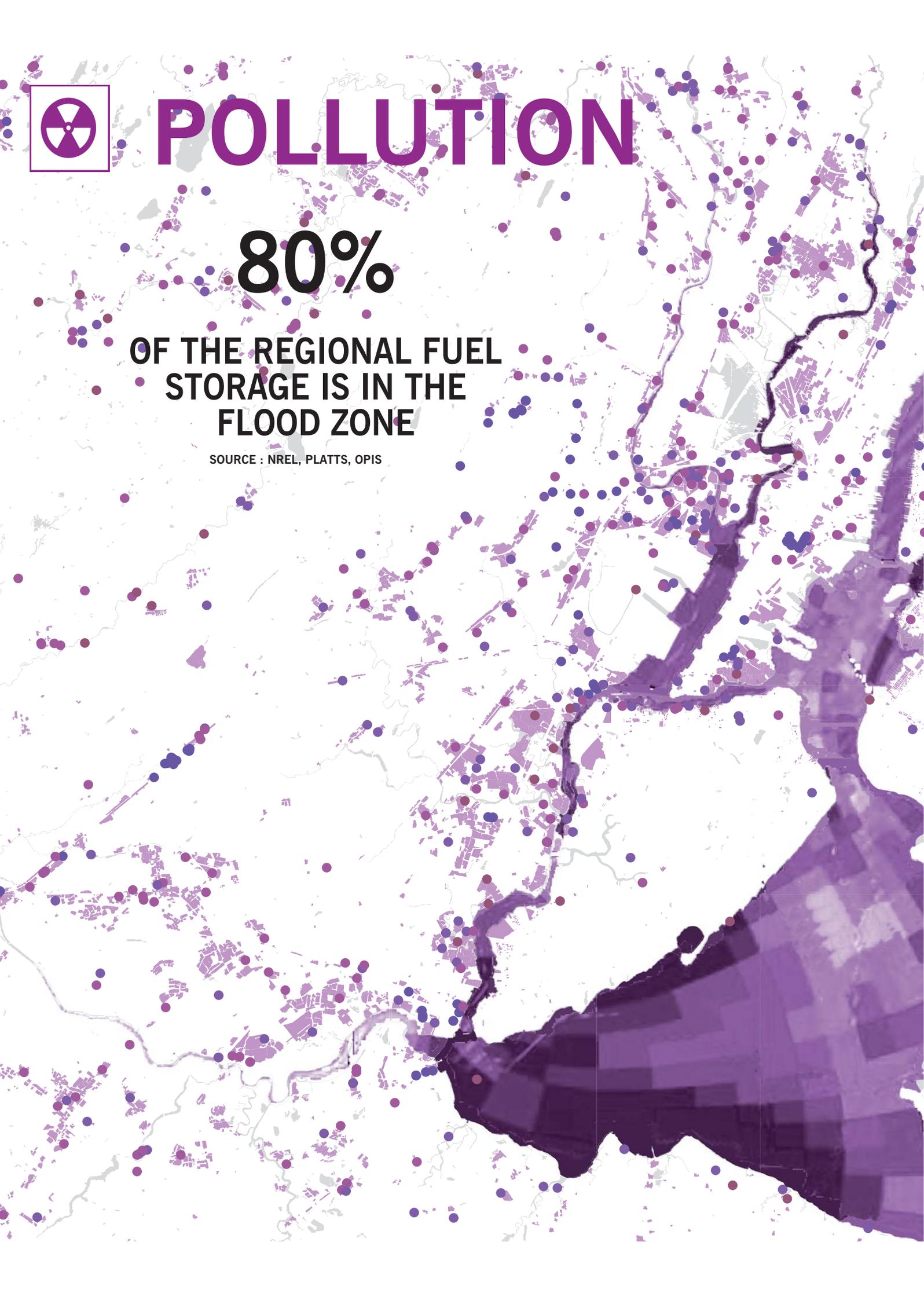


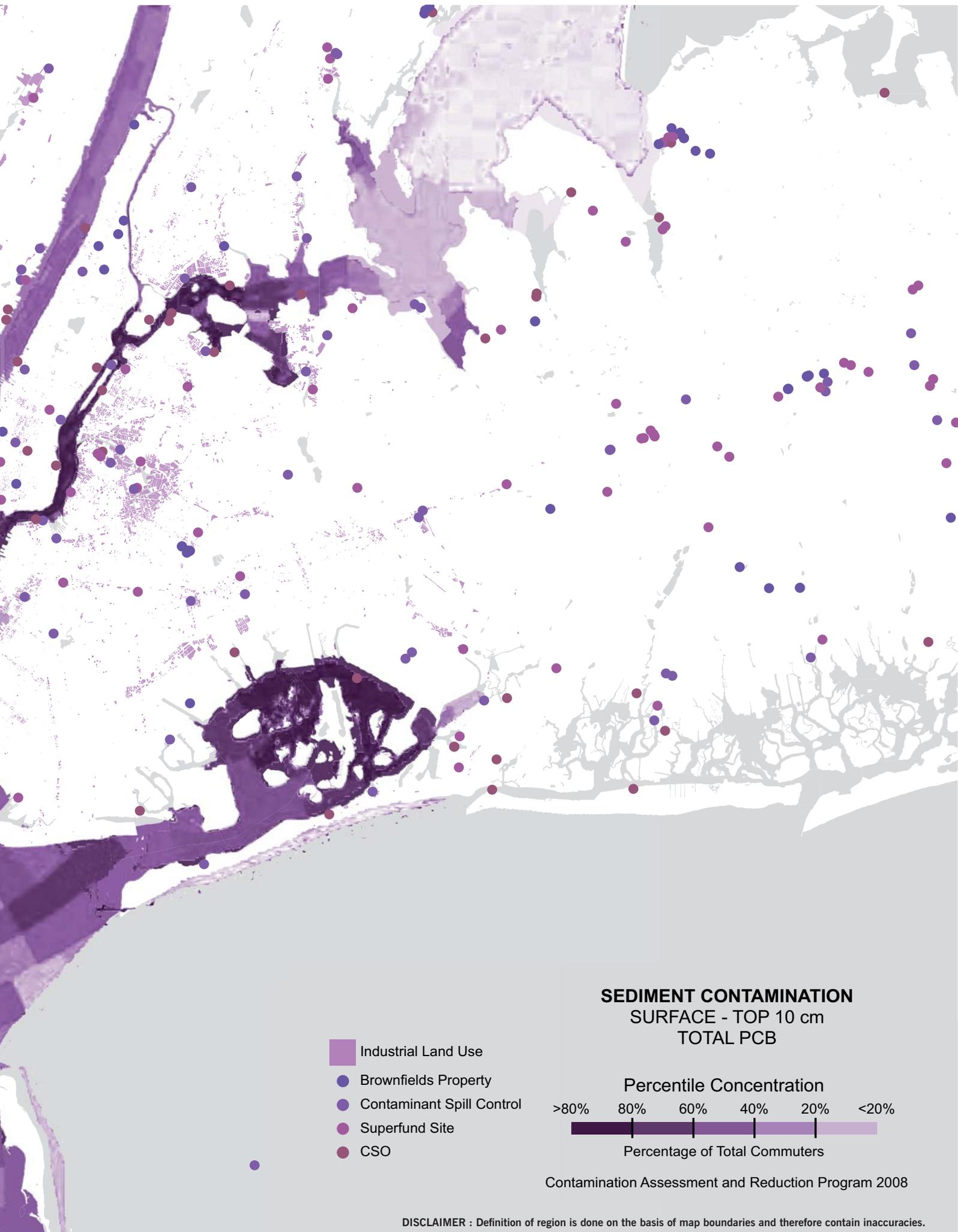
POLLUTION

80%

**OF THE REGIONAL FUEL
STORAGE IS IN THE
FLOOD ZONE**

SOURCE : NREL, PLATTS, OPIS





DISCLAIMER : Definition of region is done on the basis of map boundaries and therefore contain inaccuracies.

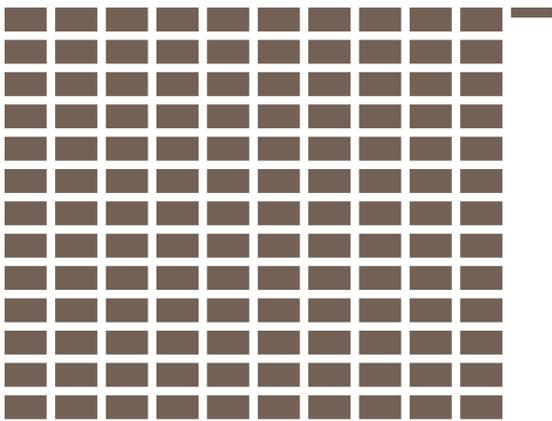


POLLUTION

NJ HAZARDOUS WASTE + CONTAMINATED

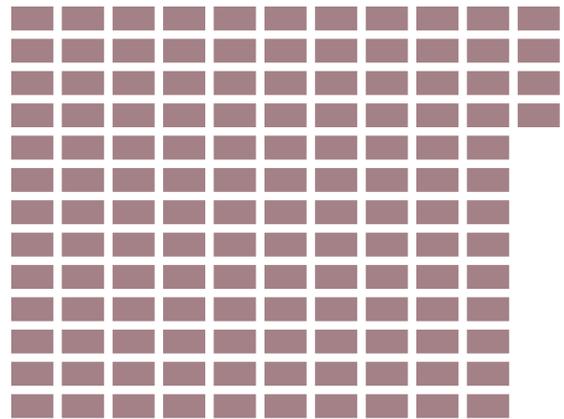
Bergen, Union, Hudson, Essex NJ Counties

EPA BROWNFIELDS



1.04 MILLION ACRES

GASOLINE + DIESEL



1.2 MILLION ACRES

LAND IN FEMA FLOOD ZONE

OF STORAGE FACILITY SITES

340

CONDITIONALLY EXEMPT
SMALL QUANTITY GENERATORS

250

HAZARDOUS WASTE STORAGE

208

LARGE QUANTITY GENERATORS

173

SMALL QUANTITY GENERATORS

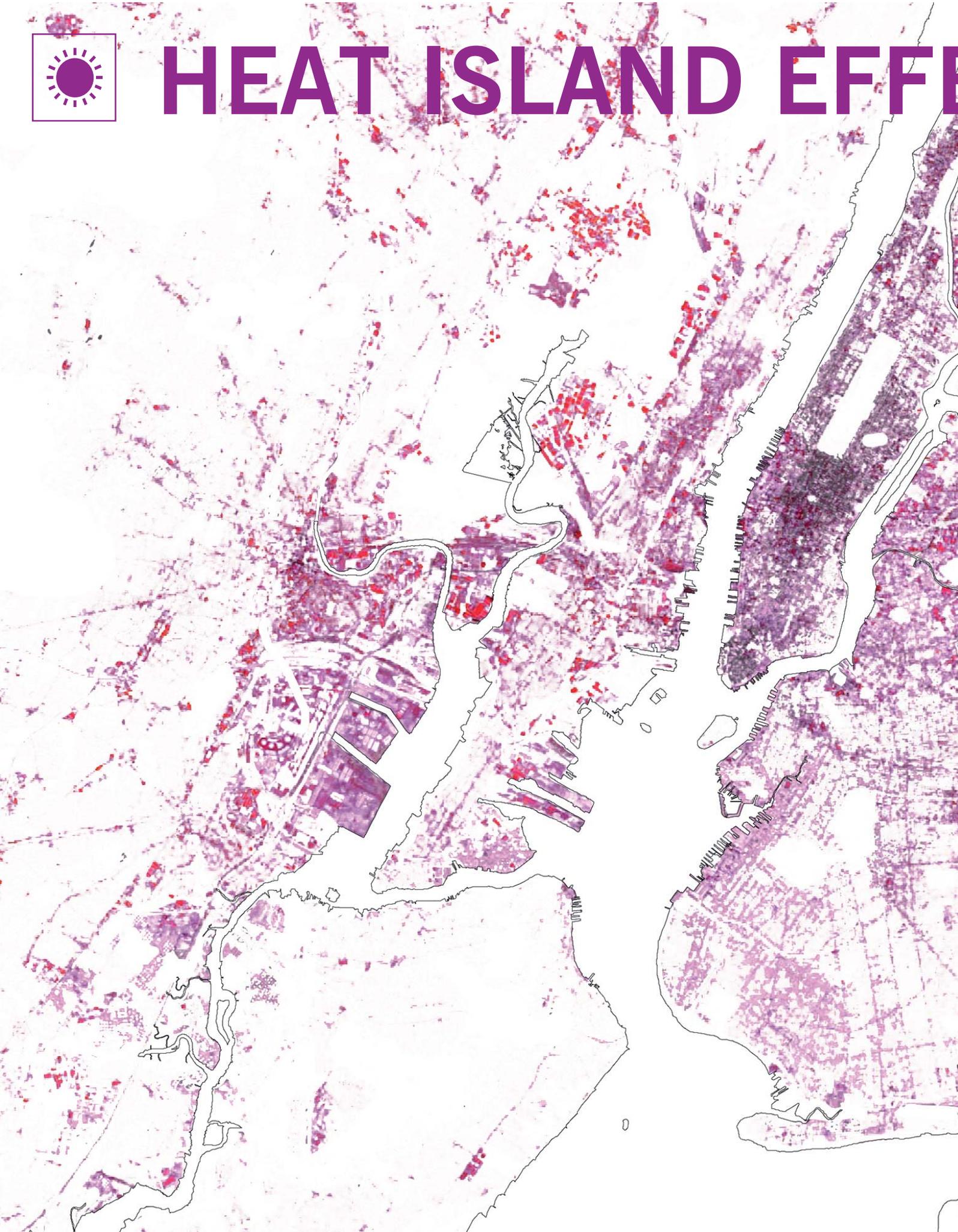
25

OIL FACILITIES

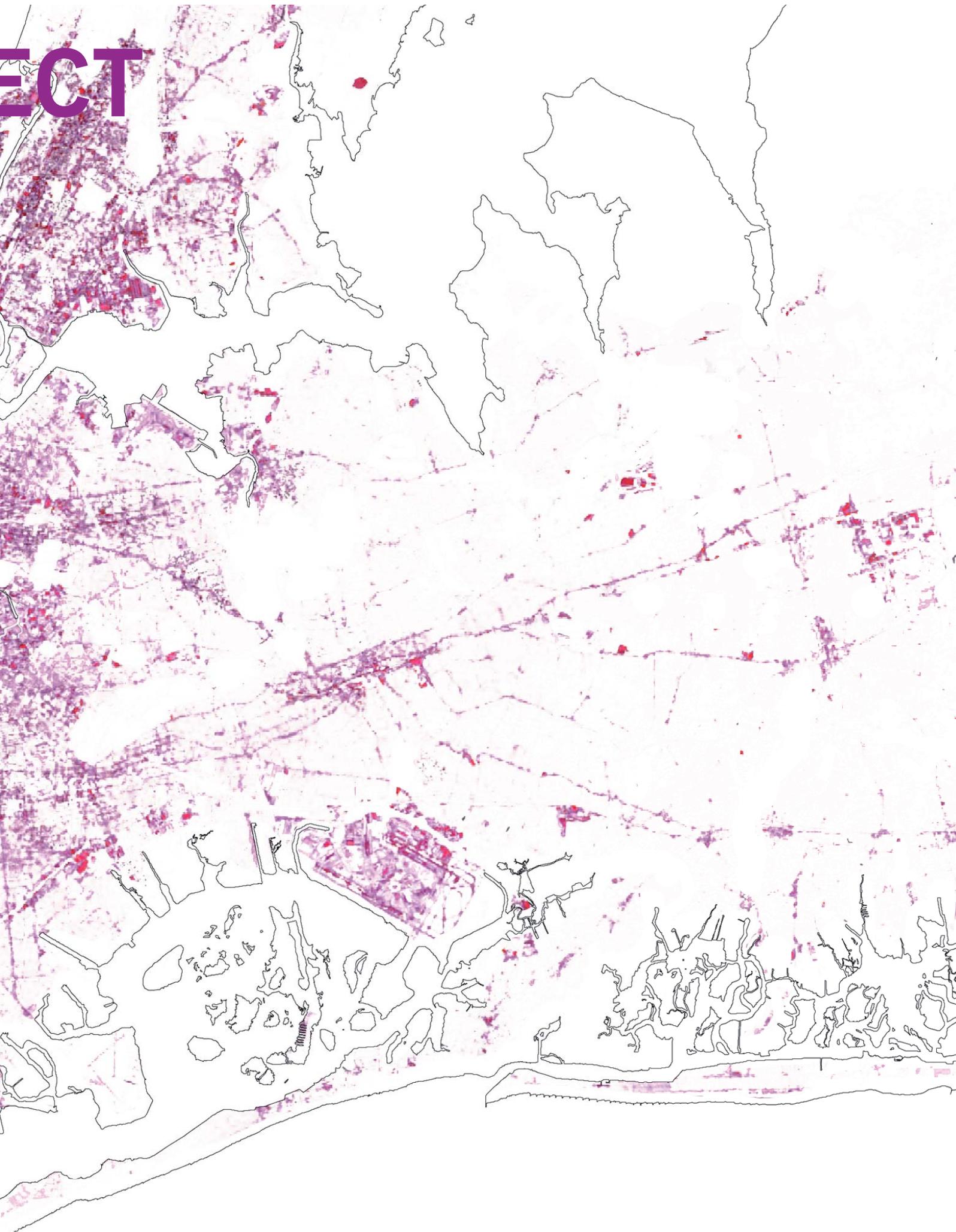
SOURCE: FEMA FLOOD ZONES, NJ-EPA WASTE AND HAZARDOUS STORAGE



HEAT ISLAND EFFECT



ECT



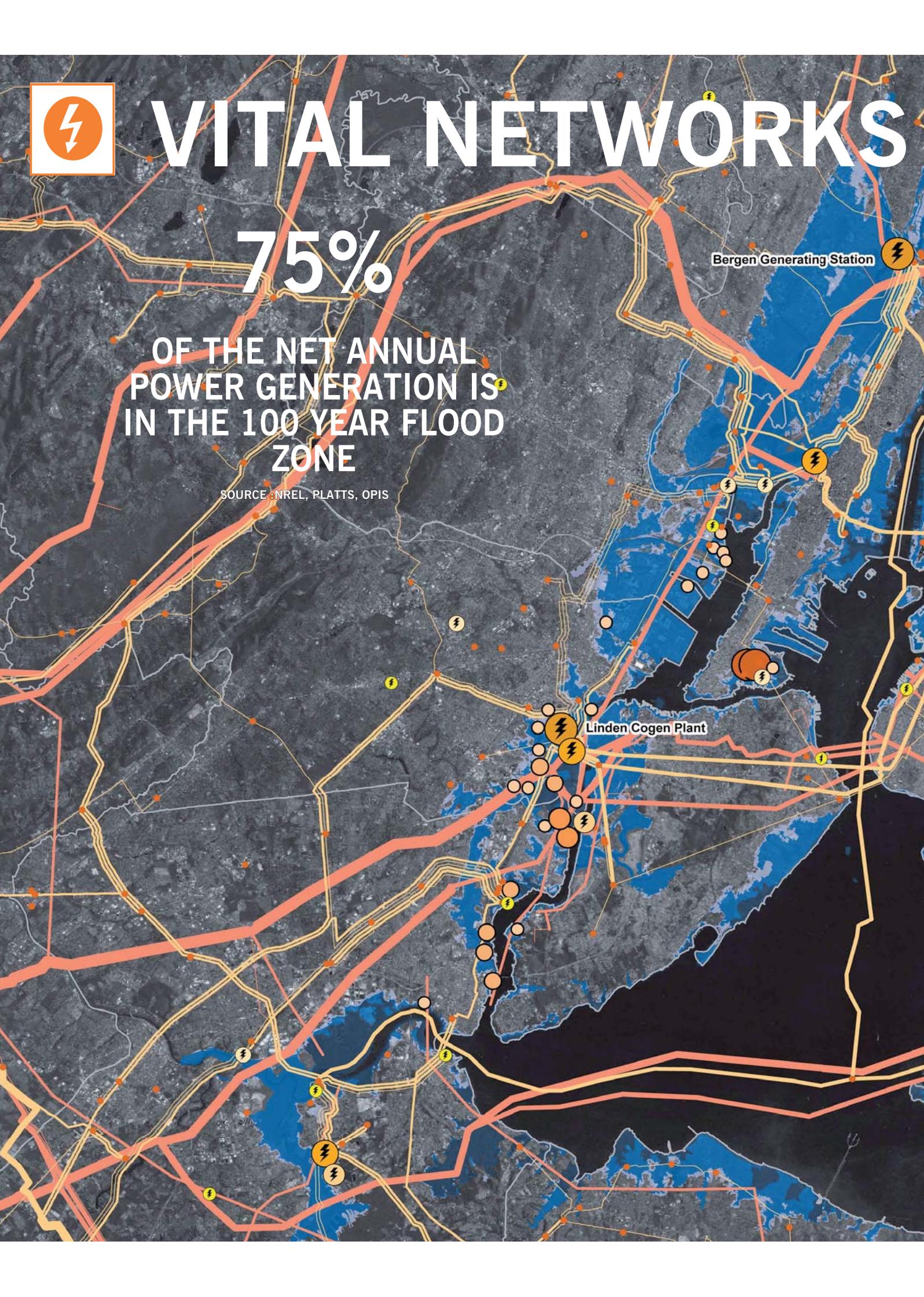


VITAL NETWORKS

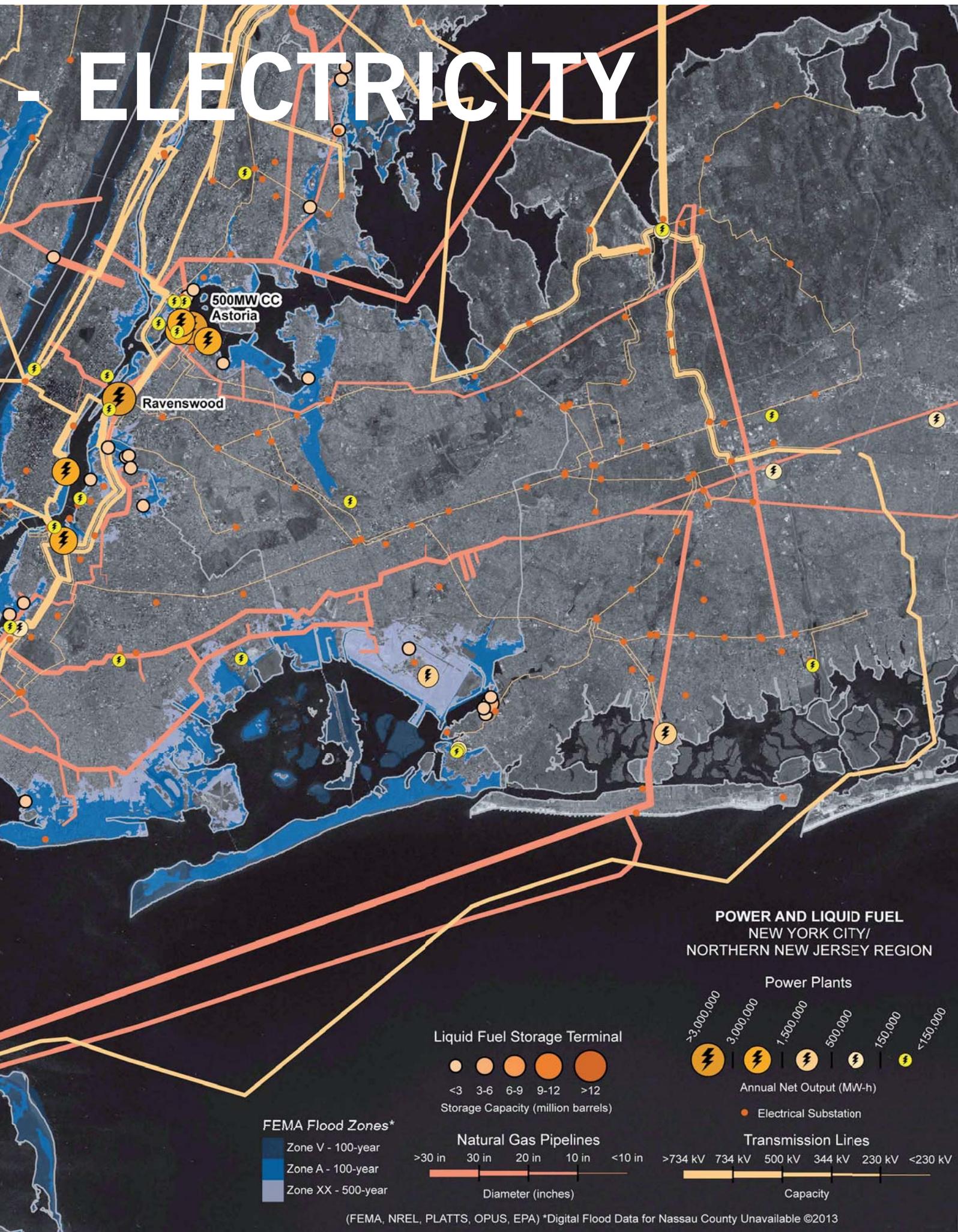
75%

OF THE NET ANNUAL
POWER GENERATION IS
IN THE 100 YEAR FLOOD
ZONE

SOURCE: NREL, PLATTS, OPIS



ELECTRICITY





VITAL NETWORKS

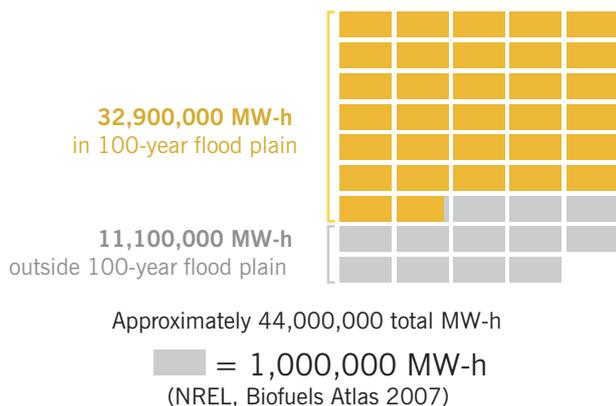
POWER SUPPLY

63 Power generation stations are in the immediate New York City/Northern New Jersey area

27 of these are located WITHIN the 100-year flood plain

75 % of the total net annual generation (MW-h) From these 63 stations comes from these 27

CRITICAL NODES ON THE GRID



(NREL, PLATTS, OPIS)

1 IN 4 Electric substations are located in the flood plain.

LIQUID FUEL STORAGE

52 Liquid Fuel Storage Terminals are in the New York / New Jersey area



39 are located **WITHIN** the flood plain and they contain roughly **80 %** of the total area fuel.

The **REMAINDER** is directly adjacent to the flood plain.



VITAL NETWORKS

1.600.000

**PEOPLE COMMUTE
TO MANHATTAN
ON A DAILY BASIS**



- TRAFFIC



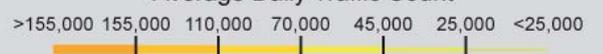
PUBLIC TRANSIT AND TRAFFIC COUNTS NEW YORK CITY/ NORTHERN NEW JERSEY REGION

— MTA, NJ Transit + PATH Rail Lines

Average Weekday Ridership by Station

- < 7,000 Riders
- 7,000 - 20,000 Riders
- 20,000 - 45,000 Riders
- 45,000 - 90,000 Riders
- 90,000 - 182,000 Riders

Average Daily Traffic Count



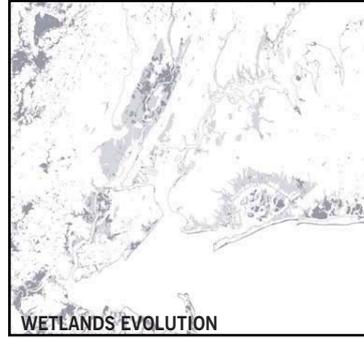
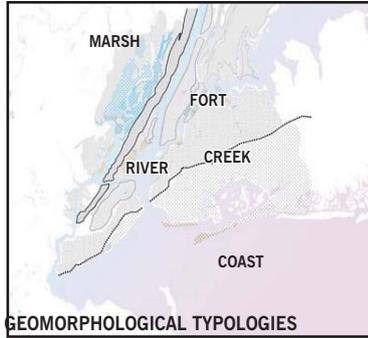
(FEMA, MTA, PATH, NJ TRANSIT) *Digital Flood Data for Nassau County Unavailable ©2013

DISCLAIMER : Definition of region is done on the basis of map boundaries and therefore contain inaccuracies.

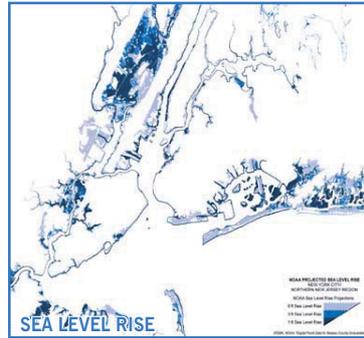
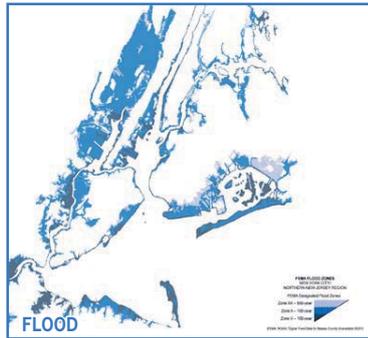
MULTIPLE VULNERABILITIES // THE HAZARD SANDWICH

		MARSH	RIVER	FORT	CREEK	COAST	
 	GEOGRAPHY						
	DENSITY						
 	INUNDATION						+
	WAVES						
 	SOCIAL VULNERABILITY						+
	ECONOMIC LOSS						
 	POLLUTION						+
	HEAT EFFECT						
 	VITAL NETWORKS						+
	TRANSPORT NETWORKS						

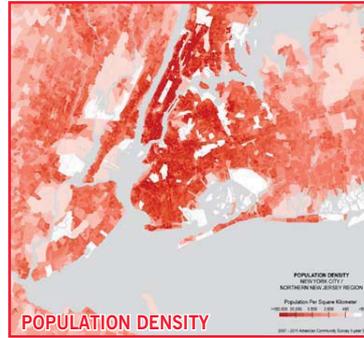
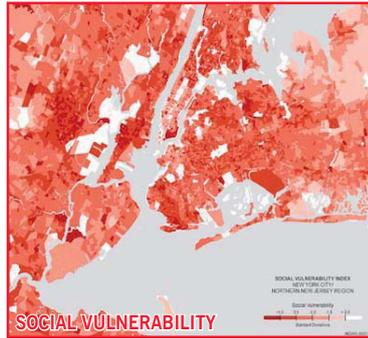
REGIONAL ANALYSIS



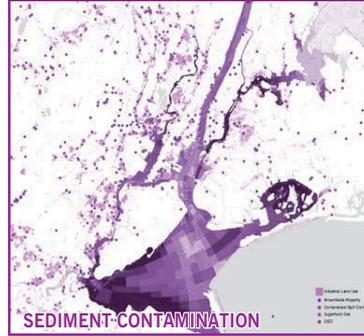
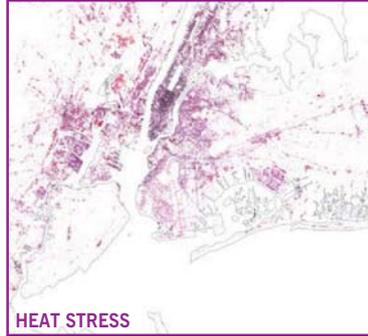
85%
OF THE REGIONAL
HISTORIC WETLANDS
HAS BEEN DEVELOPED
OR LOST



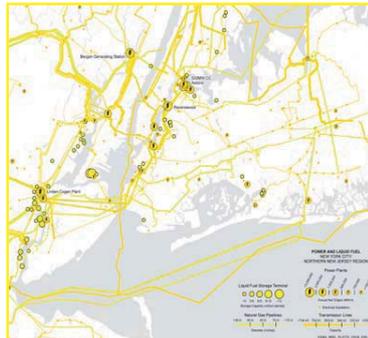
2.5
MILLION INHABITANTS
IN THE NEW YORK
& NEW JERSEY
METROPOLITAN AREA
LIVE IN THE FLOOD
ZONE



66%
OF THE MOST
VULNERABLE
COMMUNITIES LIVE
WITHIN A 1/2 MILE OF
THE FLOOD ZONE

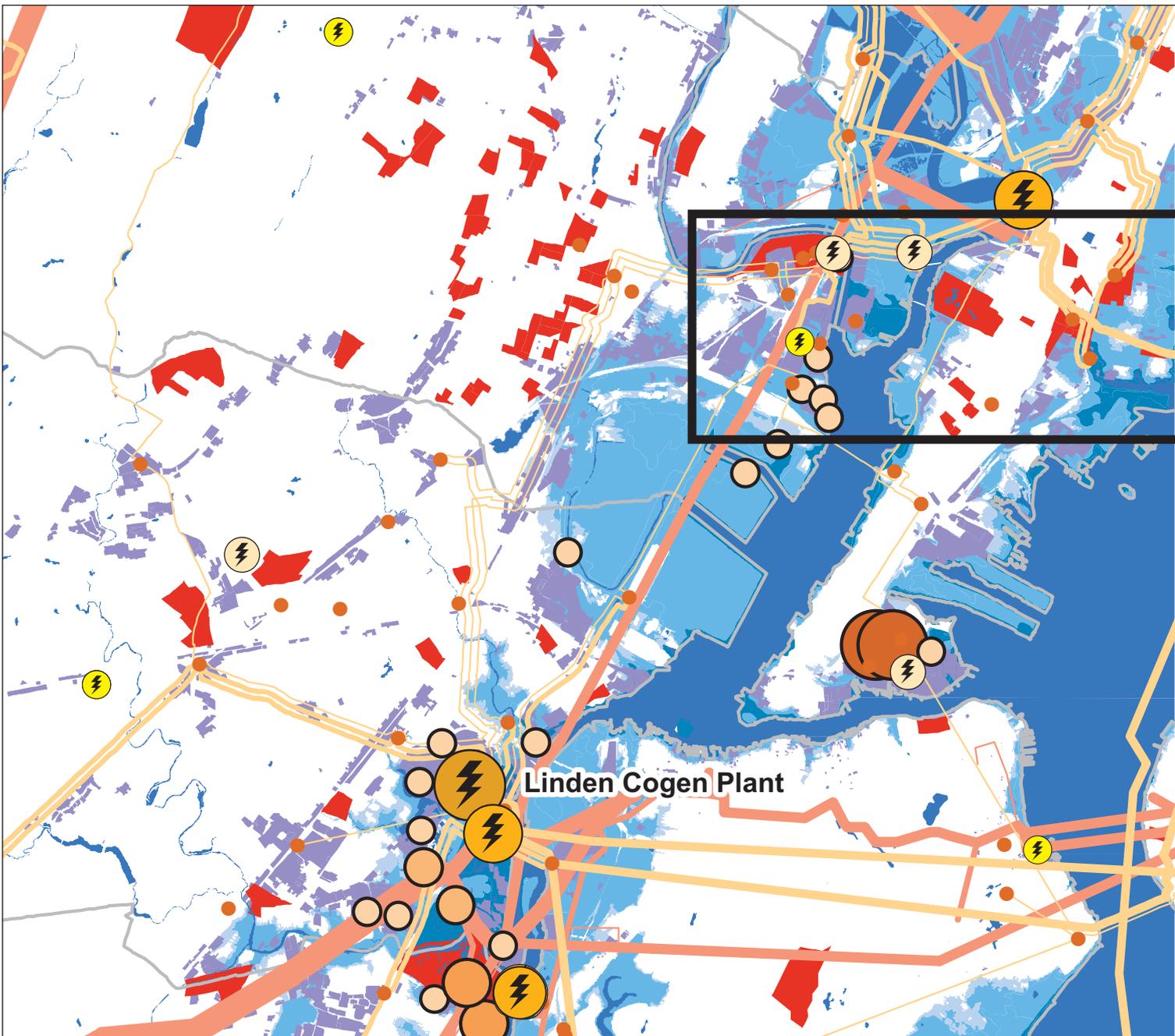


80% OF
THE REGIONAL FUEL
STORAGE IS IN THE
FLOOD ZONE

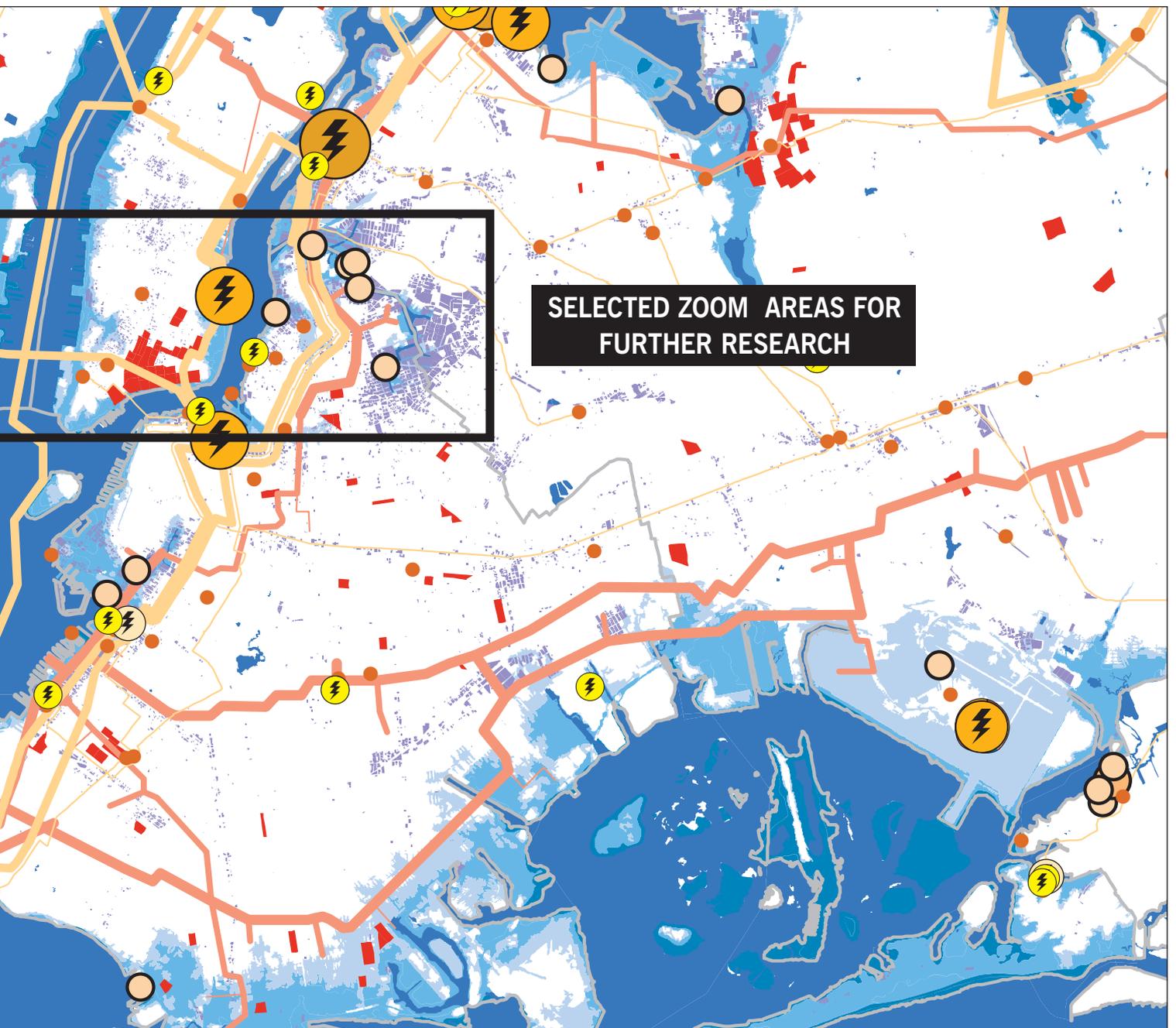


75%
OF THE NET ANNUAL
POWER GENERATION IS
IN THE 100 YEAR
FLOOD ZONE

CRITICAL REGIONAL BACKBONE



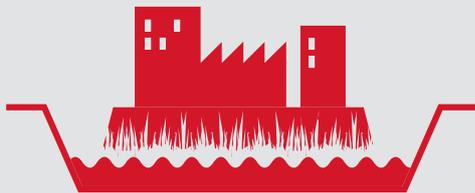
**THROUGH OVERLAPPING THE VARIOUS HAZARDS MAPS
LOCATIONS CAN BE DETERMINED THAT WOULD BENEFIT
MOST FROM RESILIENCY MEASURES.
THIS UNPACKED PERSPECTIVE ON RISK CREATES A
MULTIPLIER EFFECT ON THE IMPACT OF EACH DOLLAR
SPENT.**



5

PHASED DESIGN OPPORTUNITIES

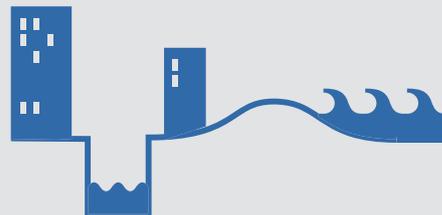
MEADOWLANDS
6 TH
BOROUGH



HOBOKEN-JERSEY
RIVER ISLANDS



LOWER EAST SIDE
MANHATTAN
WATER
MACHINE



NEWTOWN CREEK

SUPERUSE
DISTRICT



REGIONAL RESILIENCY STRATEGY

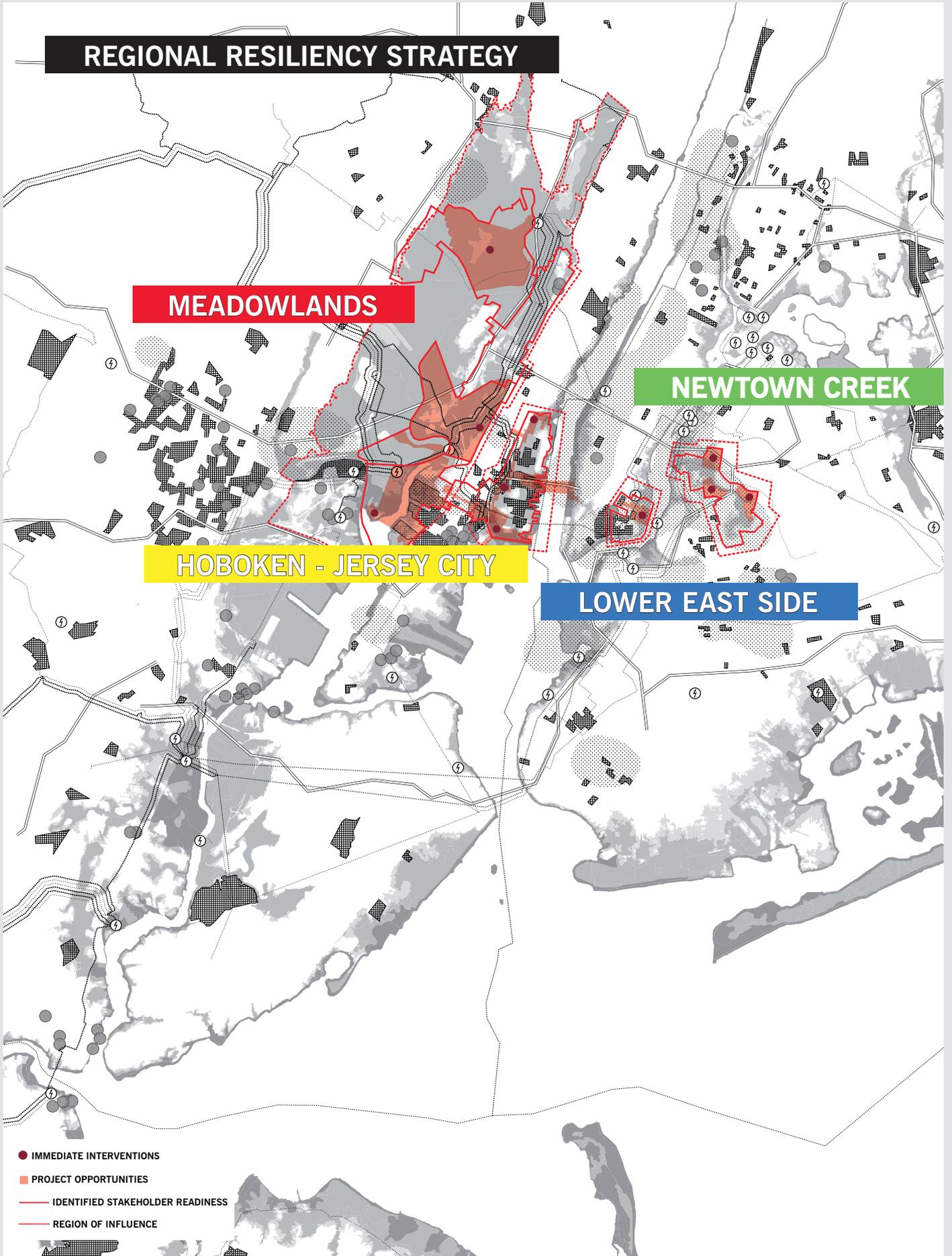
MEADOWLANDS

NEWTOWN CREEK

HOBOKEN - JERSEY CITY

LOWER EAST SIDE

- IMMEDIATE INTERVENTIONS
- PROJECT OPPORTUNITIES
- IDENTIFIED STAKEHOLDER READINESS
- REGION OF INFLUENCE



A DELTA OF RESILIENCY DISTRICTS

MEADOWLANDS

HOBOKEN - JERSEY CITY

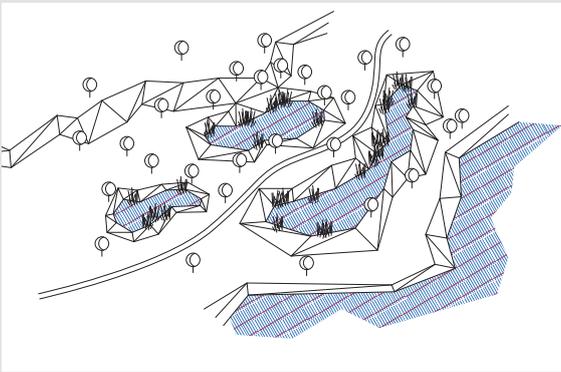


LOWER EAST SIDE

NEWTOWN CREEK



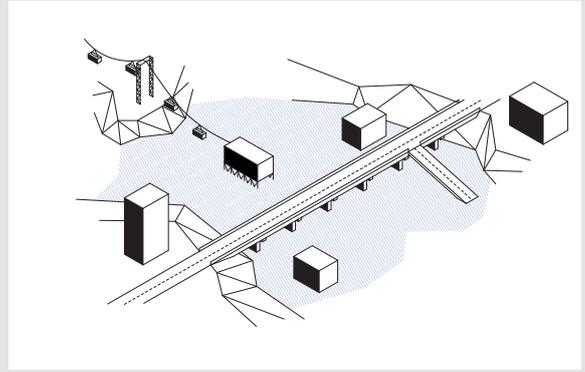
REGIONAL RESILIENCY STRATEGY



1

INCREASE LANDSCAPE ABSORPTION CAPACITY

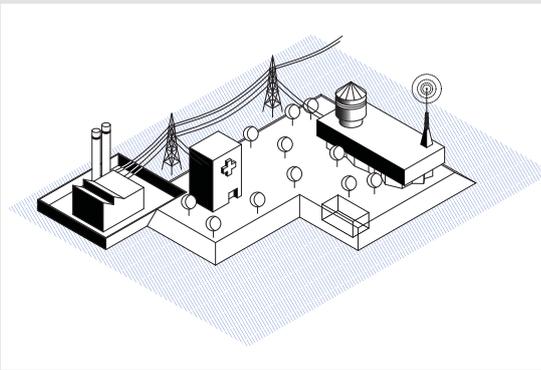
Before the development of the NYC metropolitan region wetlands in the area buffered a lot of the climatic dynamics through their absorbing capacity. Today ubiquitous use of asphalt has thwarted this natural mediative system. Through designing smart interventions at the right locations some of the absorption capacity can be restored.



2

MULTIPLY EVACUATION ROUTES

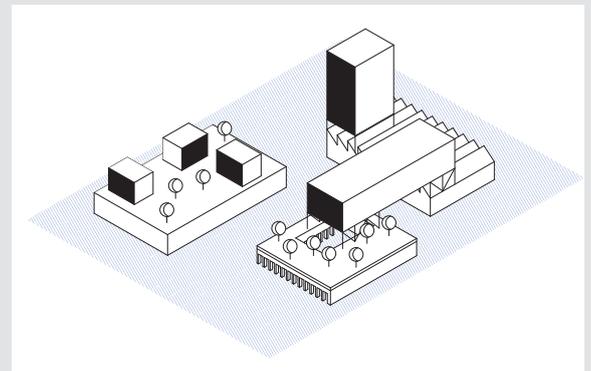
Development in vulnerable areas around NYC can be seen as inevitable. These areas therefore should always have multiple robust evacuation routes. Access and egress are here equally important. Through clearly articulating these routes resiliency will increase both for rescue and aid workers as for individuals fleeing to safe ground.



3

CONSOLIDATE PUBLIC DISTRESS AMENITIES

In relation to these evacuation routes certain public amenities should be designed to accommodate emergency situations. The structures should be smartly laminated onto other more regular uses so that they aren't wasteful but also are able to gain a prominent location in the civic structure of the region.



4

MIX LIGHT MANUFACTURING AND LIVING

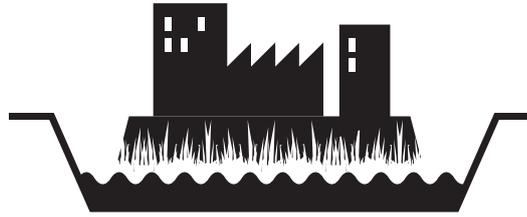
During the segregation of production and the city centre that took place over the last decades, industrial lands are typically found in vulnerable lands. Besides concerns over pollution many services were unavailable months after the Sandy. Given many industries have become much lighter and cleaner in the last decades, a re-integration into the urban fabric is possible. This could increase resilience systematically across the region.

6TH BOROUGH MEADOWLANDS

The Meadowlands emerged from the maximum risk / maximum vulnerability research as a priority candidate for investment in resilient infrastructure, landscape, and development. The area has a unique profile and its Commission is a case study in inter-municipal collaboration, positioning it well for a future coalition-building effort. The Meadowlands have seen extensive flooding, major pollution problems, social and economic vulnerability nearby, and development pressure seems somewhat stuck in a tension between residential and logistics. Furthermore, before Sandy, a tension between ecological agendas and the development pressures in this area may have contributed to making both less than they can be. Our proposal will contribute to a new balance, by continuing to rebuild the ecosystem while creating new development areas along the edges

of the Meadowlands. First of all, there is a real opportunity to realize the aggregation of landfills and marshes in the Meadowlands in to a regional landscape park, programmed with recreational and sports opportunities. This park will function as a sponge for floodwaters and in doing so, will contribute to the safety of adjacent areas and the metro area at large. A successful park requires a clear perimeter, with multiple access points and a visible address to the region. Such a park would act as added value for the adjacent land. A re-defined, strengthened protective edge will enable existing and new development along the Meadowlands to flourish. Overall, we foresee developments that contain a mix of logistics/warehousing, and residential. Such districts will offer job opportunities to citizens without college degrees; foster business; and create places to live for people that will join





the metro area or are interested in relocating. We would be interested in bringing recent experiments in Northern Europe to design districts that bring logistics / manufacturing together with residential, both through vertical integration and detailed analysis of truck/logistical requirements in relation to the public space needs for a successful residential district.

There are several fragments within the broader Meadowlands area that are prime candidates for an immediate project. The Carlstadt area (northern edge of the ML) saw severe flooding, has a vital logistics district as well as socially vulnerable neighborhoods. Initial probing suggests that a project to re-define this edge is possible and can be activated on short term.

Second, around Secaucus Junction, any future scenario requires resolving the conflicting

presence of the area's most intensively used mass transit transfer station, and the logistics programs (warehousing and railroad yards) in the immediate vicinity. Both are at high flood risk. The development of a TOD (transit-oriented development) around a green protective infrastructure for protection and absorption makes sense. For other uses, a transfer of development rights to an adjacent area would in that case be advisable.

Most critical is the southern edge of the Meadowlands. The west half of Jersey City and eastern Kearny are strategically located for flood control while also carrying the burden of urbanization pressure emanating from Manhattan. Several project processes are already underway along the Hackensack riverfront – from Route 440, over various park designs, to empty warehouses







BACKGROUND MEADOWLANDS

waiting for a better insurance against risk. Fitting these into a bigger project, and infusing them with resiliency measures, will unlock this strategic location with benefits for the entire region. This borough also contains critical logistics and utility clusters. In this collusion of pressures, we believe an important project is possible; and today is the moment to build a coalition for its realization. These are just 3 of several fragments that appear in the Meadowlands as possible candidates for a concrete project that can be realized in the next few years. We propose to work on these as concrete project opportunities, that each will contain shared genetic material that realizes a part of the overall

vision. The essence of that vision is: create a 6th borough around a regional landscape park. Work on several of these fragments would lead to a gradual conversion of substantial parts of the Meadowlands into a regional landscape infrastructural park that protects the edges from floods and rebuilds biodiversity lost over the past century; absorbs water; and hosts recreational, civic programs. Along the edges, a mix of new residential density and other uses could take advantage of the park as a civic amenity. This scenario will maximize benefits from the close proximity to Manhattan but keep the area attractive and desirable to a mix of audiences.

A BLINDSPOT IN THE NY/NJ REGION



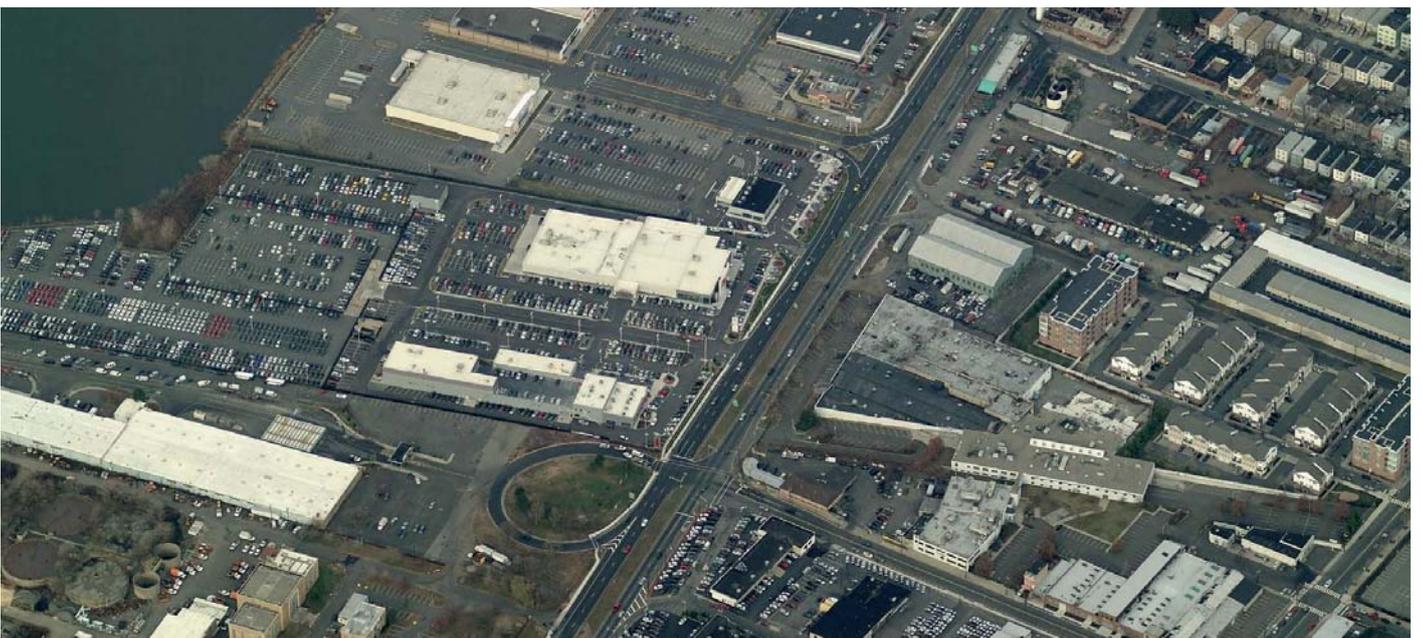
Aerial meadowlands wetlands with recreational program

VITAL NETWORKS IN THE FLOODZONE



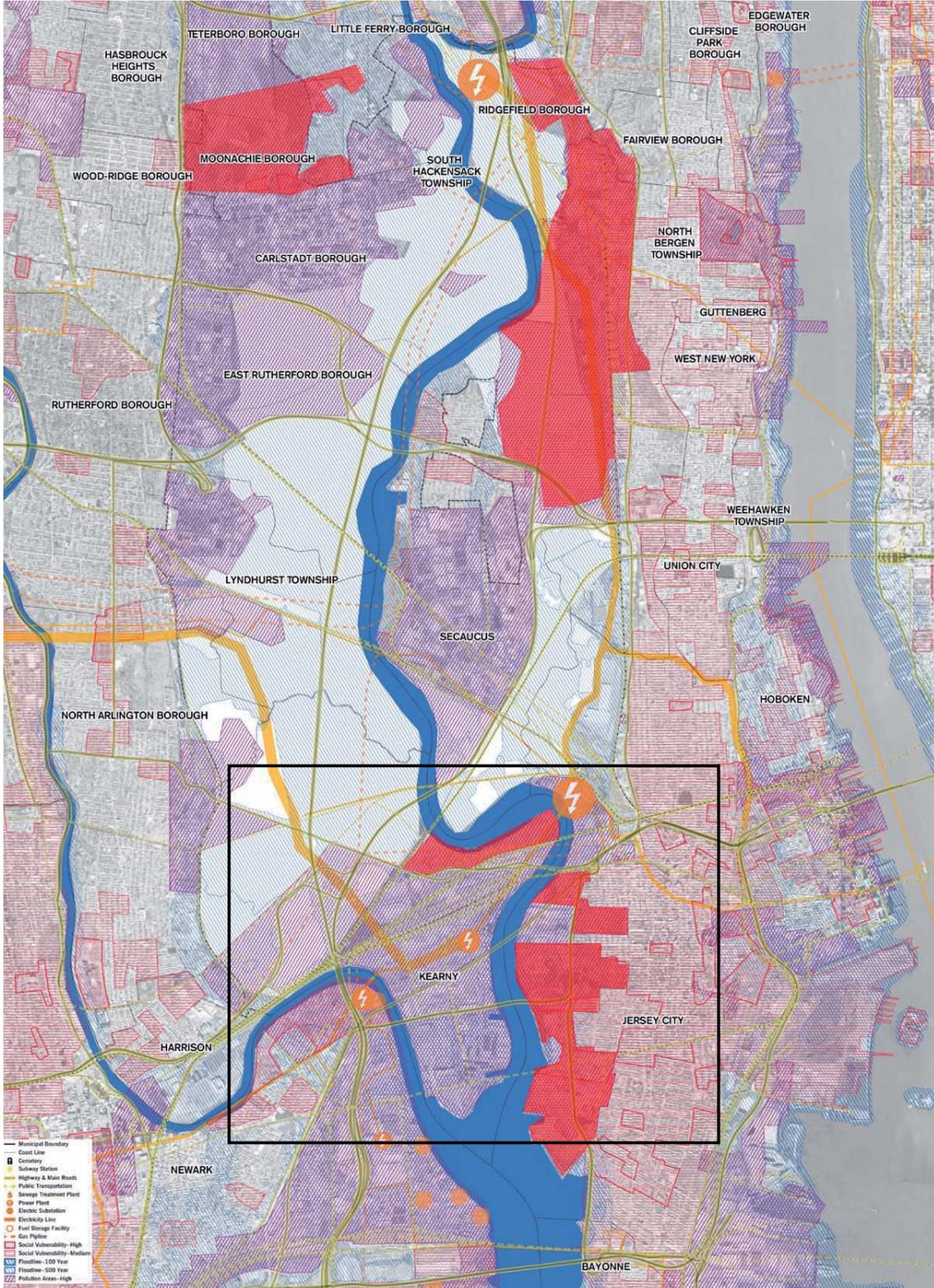
Vital Power and Logistics services in the floodplains of the meadowlands

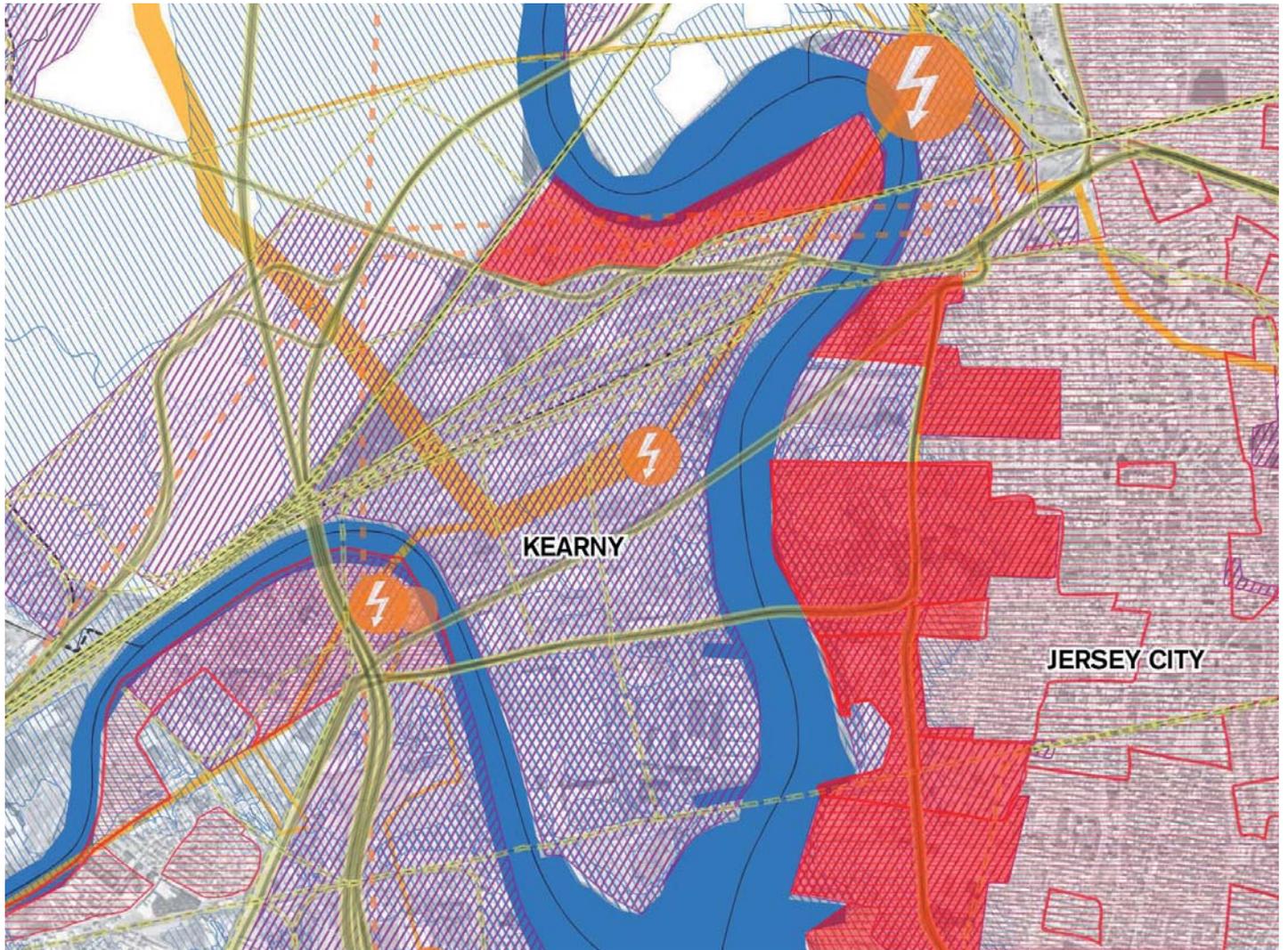
INDUSTRY, HOUSING, POLLUTION



Aerial view from Kearney - Close proximity of bigbox manufacturing and housing

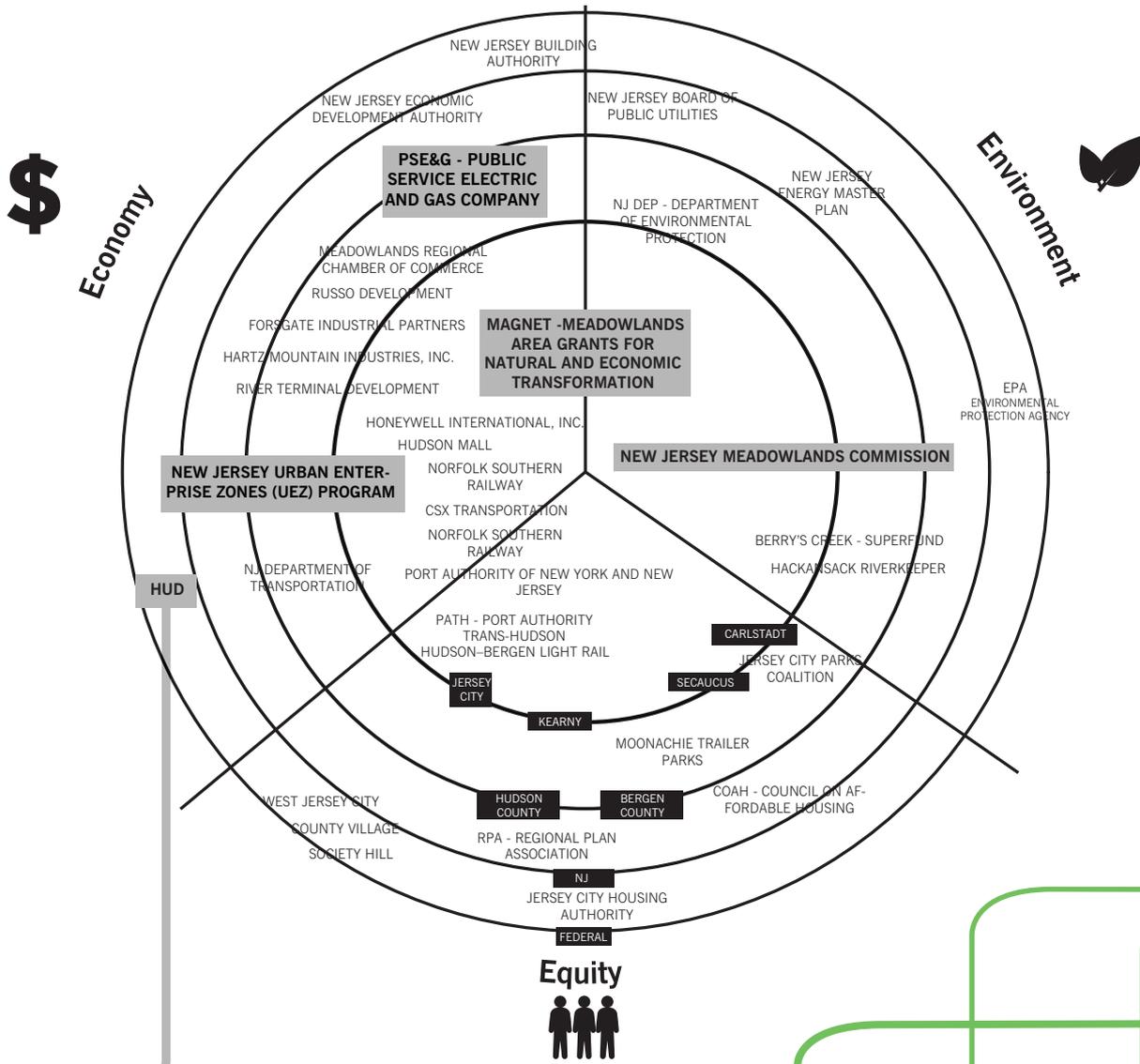
VULNERABILITIES





- Municipal Boundary
- - - - Coast Line
- ☠ Cemetery
- Subway Station
- Highway & Main Roads
- - - - Public Transportation
- 🔥 Sewege Treatment Plant
- ⚡ Power Plant
- Electric Substation
- Electricity Line
- Fuel Storage Facility
- - - - Gas Pipline
- ▨ Social Vulnerability--High
- ▩ Social Vulnerability--Medium
- ▧ Floodline--100 Year
- ▨ Floodline--500 Year
- ▨ Pollution Areas--High

ALLIANCES

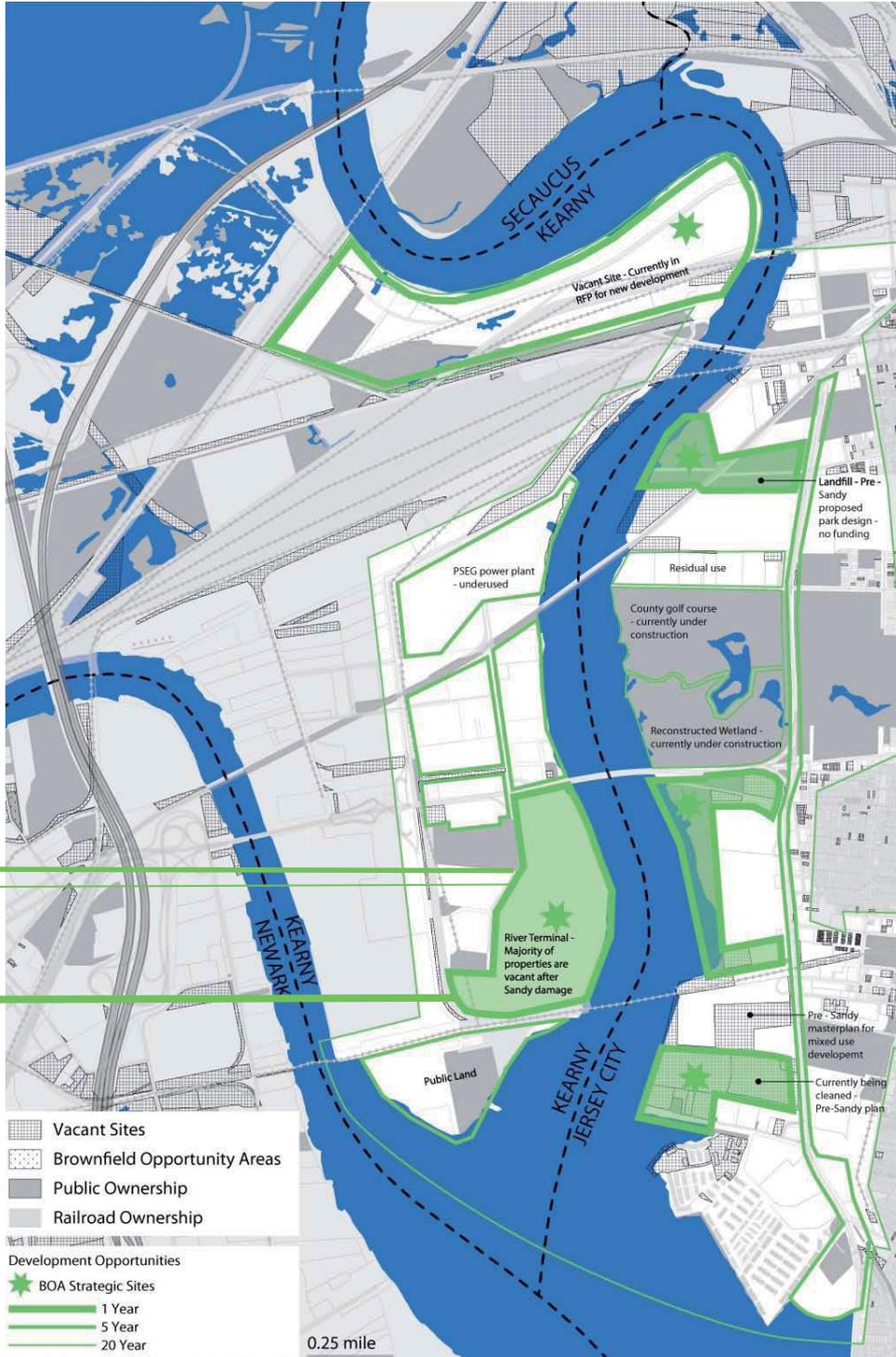


1st year 5 years 20 years

2014 Rebuild By Design

- 1968 NEW JERSEY MEADOWLANDS COMMISSION ESTABLISHED
- 2004 NJMC - NEW MASTER PLAN FOR THE MEADOWLANDS
- 2007 NJMC - RENEWABLE ENERGY MASTER PLAN FOR THE YEAR 2020

OPPORTUNITIES



2013 : BROWNFIELD AND BLIND SPOT

2023: PRODUCTIVE CITY - REGIONAL PARK

WATER INFLUENCE



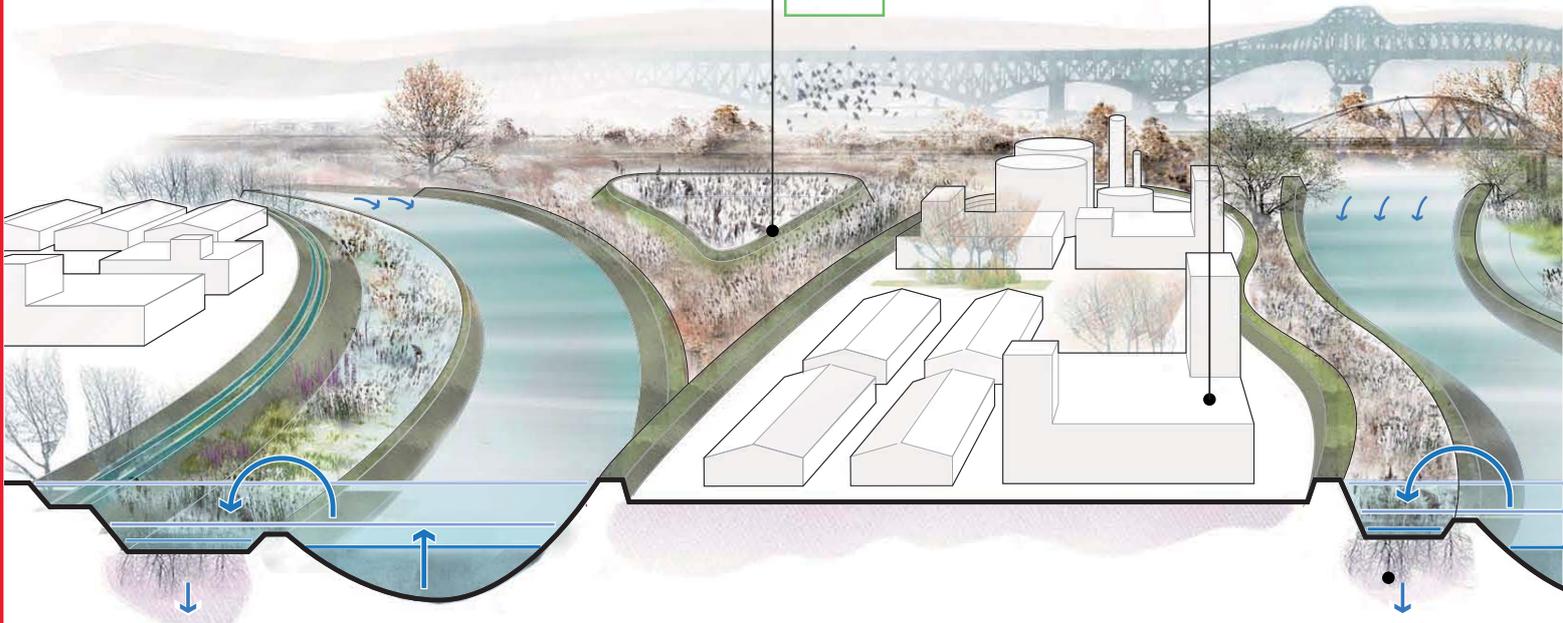
AN INNOVATIVE MIX OF RESIDENTIAL AND INDUSTRIAL

Kearny Peninsula new development opportunities. Mini dike provides high frequency flooding protection and offers high quality park edge to upgrade industrial site into mixed urban environment.



SPONGING THE MEADOWLANDS

Create more space for water, ecology, wetland restoration, detoxing soil, high quality environment, recreational and development potential.





LIVE IN A RESILIENT COMMUNITY

New housing developments connect to Hackensack river park and to Jersey City. Logistic infrastructure and protective dike can be combined to improve quality of living and guarantee truck accessibility.

PROTECT & CLEAN & ABSORB

Hackensack river park provide extra space for water / flooding protection (room for rivers), ecological quality and purification services. These stepwise inundation beds also provide potential for redevelopment of properties because they provide higher water safety and high quality accessible waterfront spaces.

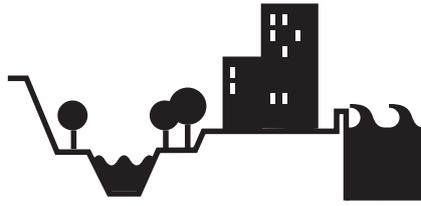


HOBOKEN & JERSEY CITY

While eastern Jersey City and Hoboken have flooded substantially, Jersey City also saw this occur for a substantial share of socially vulnerable neighborhoods. Pollution is somewhat less dramatic than in the Meadowlands or New Town Creek; but this zone nevertheless occupies an important place in the regional vision, as its location provides the connective tissue from adjacent flood zones (western Jersey City, Meadowlands) and Lower Manhattan, to safe ground along the ridges of

Jersey City and northwards to the I-95 and the Palisades. We see design opportunities along Montgomery Street in Jersey City, as it descends from the Armory (on the ridge) to City Hall, connecting various vulnerable neighborhoods and empty lots. Montgomery Street forms an important evacuation corridor to the top of the ridge from the flood zones of both western and eastern Jersey City. Many of the socially vulnerable neighborhoods and HUD properties are clustered along Montgomery





Street. Rather than studying each property in isolation from each adjacent one, it would make sense to accelerate an integrated study. Parallel to the Hudson river, along the eastern edge of the ridge we propose to buffer extreme (low frequency) flood overflow away from the residential districts. This should be done in addition to a first defense line along the Hudson to keep out high frequency flooding (1:100 or more frequent). This defense line can be limited to a modest seating height because

of the good topographical conditions here. Extreme events will be captured by overflow points that lead the water into a floodable zone. This zone can become a high quality park area to add value to its surroundings and offer potential for redevelopment in high densities. This park will serve a double water storage function as a storm water buffer that provides Jersey and Hoboken with a cleaner storm water circuit. This circuit can be extended into some higher situated streets to implement clean







BACKGROUND

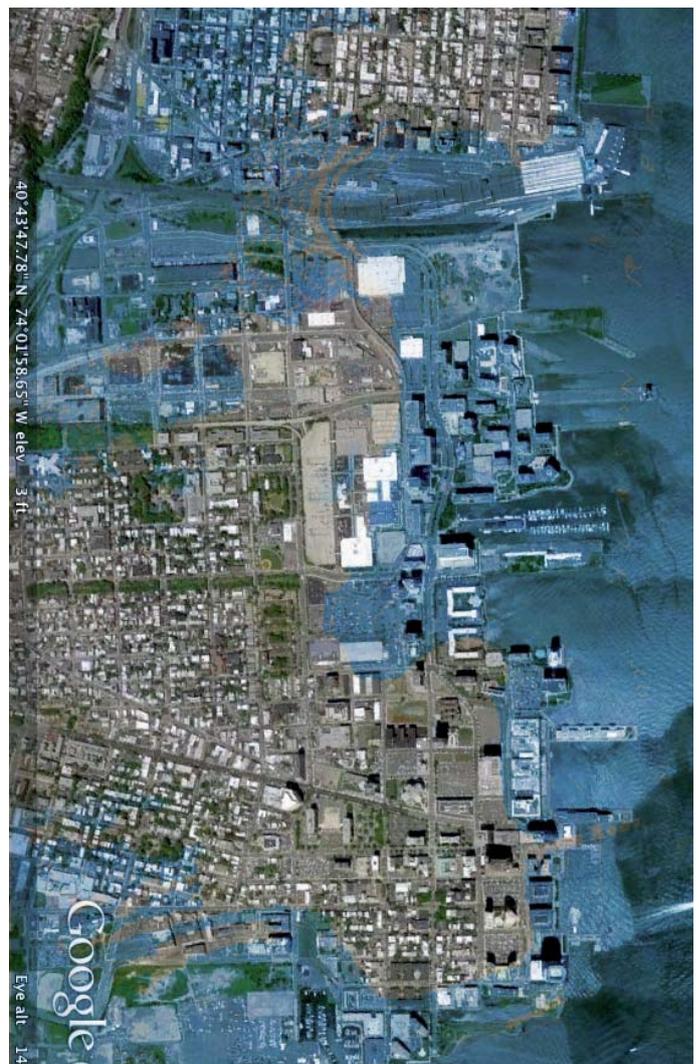
JERSEY CITY & HOBOKEN

water circulation, a completely split sewage system and an upgrade of the larger residential environment. The park zone would largely correspond to the inland floodlines.

Finally, it might make sense to study a bridge connection from Lower Manhattan to the ridges of Jersey City. This proposal is important to provide a westward evacuation for Lower Manhattan: currently there is no such possibility, as all means

of crossing the Hudson are by tunnel.

Ultimately, when all other systems collapse, height (elevation) remains a guaranteed, basic protection against flooding. However we would not envision this connection only as an evacuation route, but also as means of access and connection to the heights of Jersey City and from there, to a regional landscape park Meadowlands to the city on a daily basis.



Original floodplain and its flood consequences.

VITAL NETWORKS IN THE FLOODPLAIN

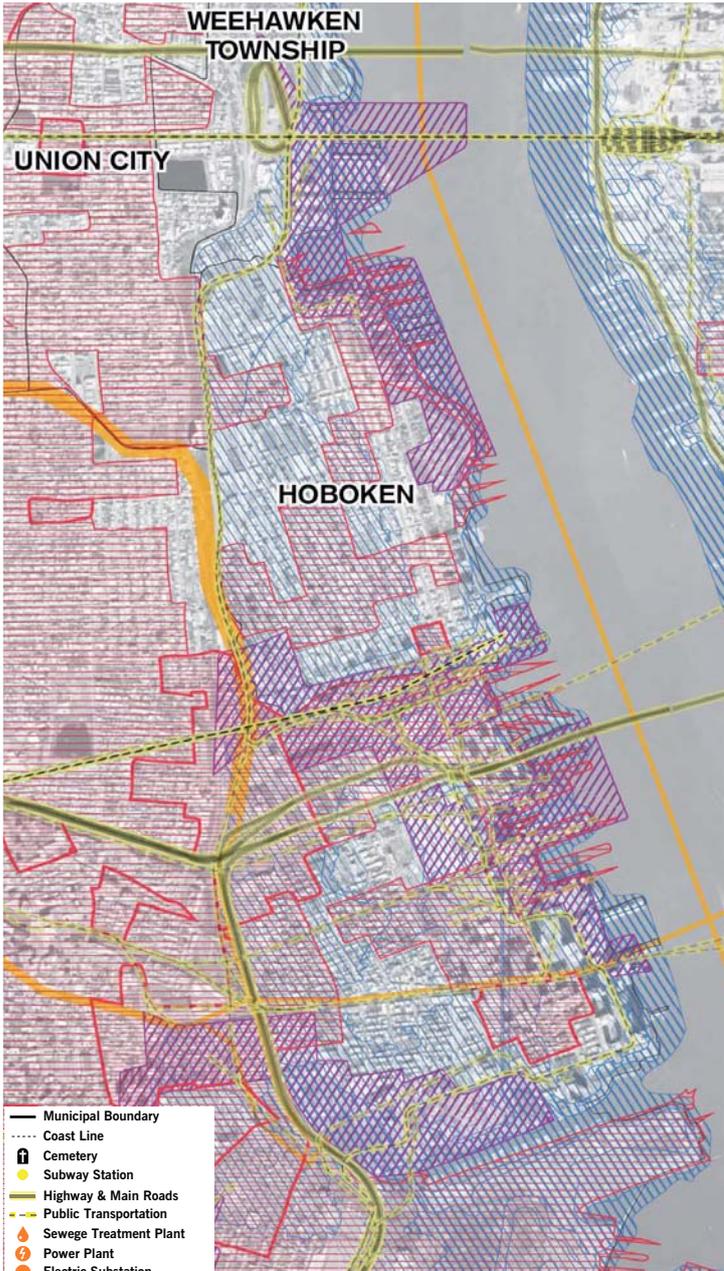


The Hudson River swells and rises over its banks flooding the Lackawanna train station



Taxis submerged in Flooding, Hoboken, New Jersey

VULNERABILITIES



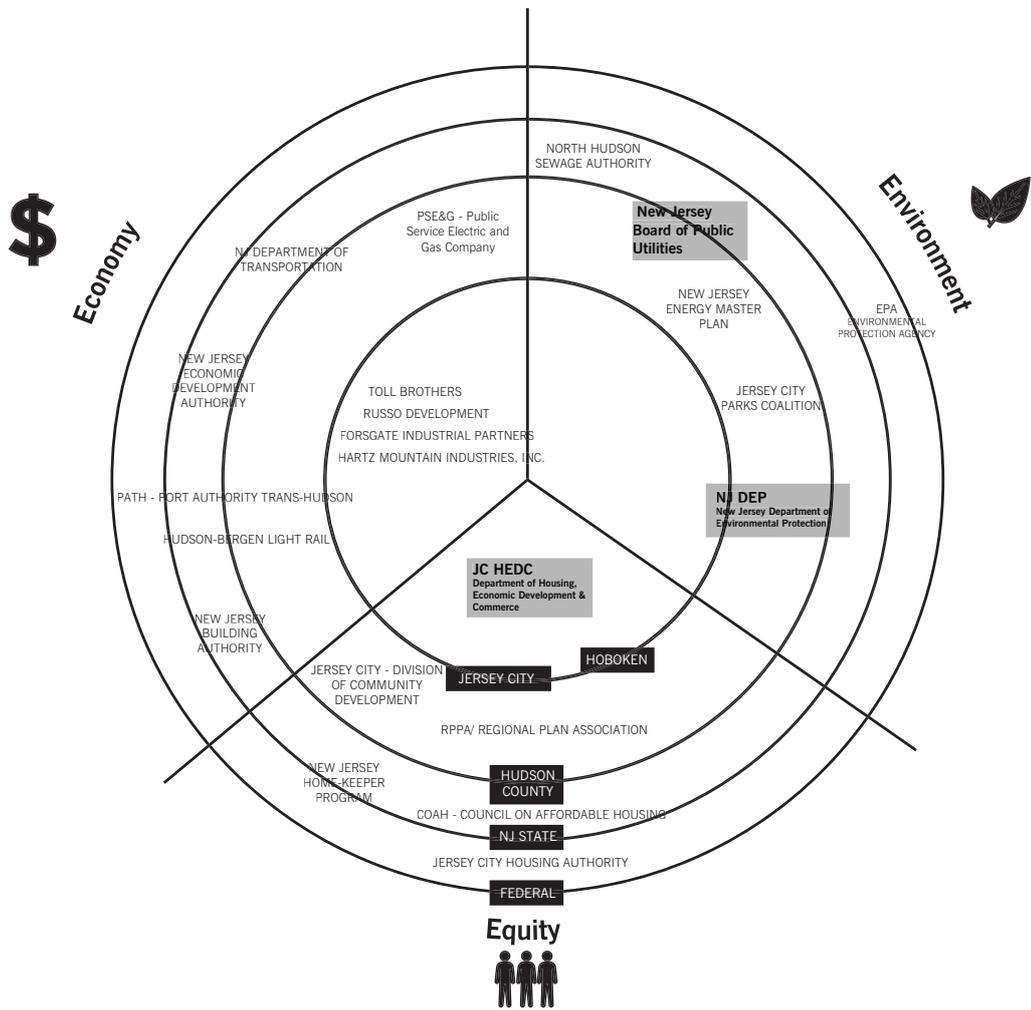
- Municipal Boundary
- Coast Line
- ☠ Cemetery
- 🚇 Subway Station
- 🛣 Highway & Main Roads
- 🚏 Public Transportation
- 💧 Sewage Treatment Plant
- ⚡ Power Plant
- 🔌 Electric Substation
- ⚡ Electricity Line
- 🛢 Fuel Storage Facility
- 🔴 Gas Pipeline
- 🔴 Social Vulnerability--High
- 🔴 Social Vulnerability--Medium
- 🌊 Floodline--100 Year
- 🌊 Floodline--500 Year
- 🌫 Pollution Areas--High

OPPORTUNITIES



- 🏠 Vacant Sites
- 🏠 Brownfield Opportunity Areas
- 🏠 Public Ownership
- 🏠 Railroad Ownership
- 🌟 Development Opportunities
- 🌟 BOA Strategic Sites
- 🟢 1 Year
- 🟢 5 Year
- 🟢 20 Year

ALLIANCES



2013 : RIVER ISLANDS

2023: MULTIPLE WATER BELT

WATER INFLUENCE



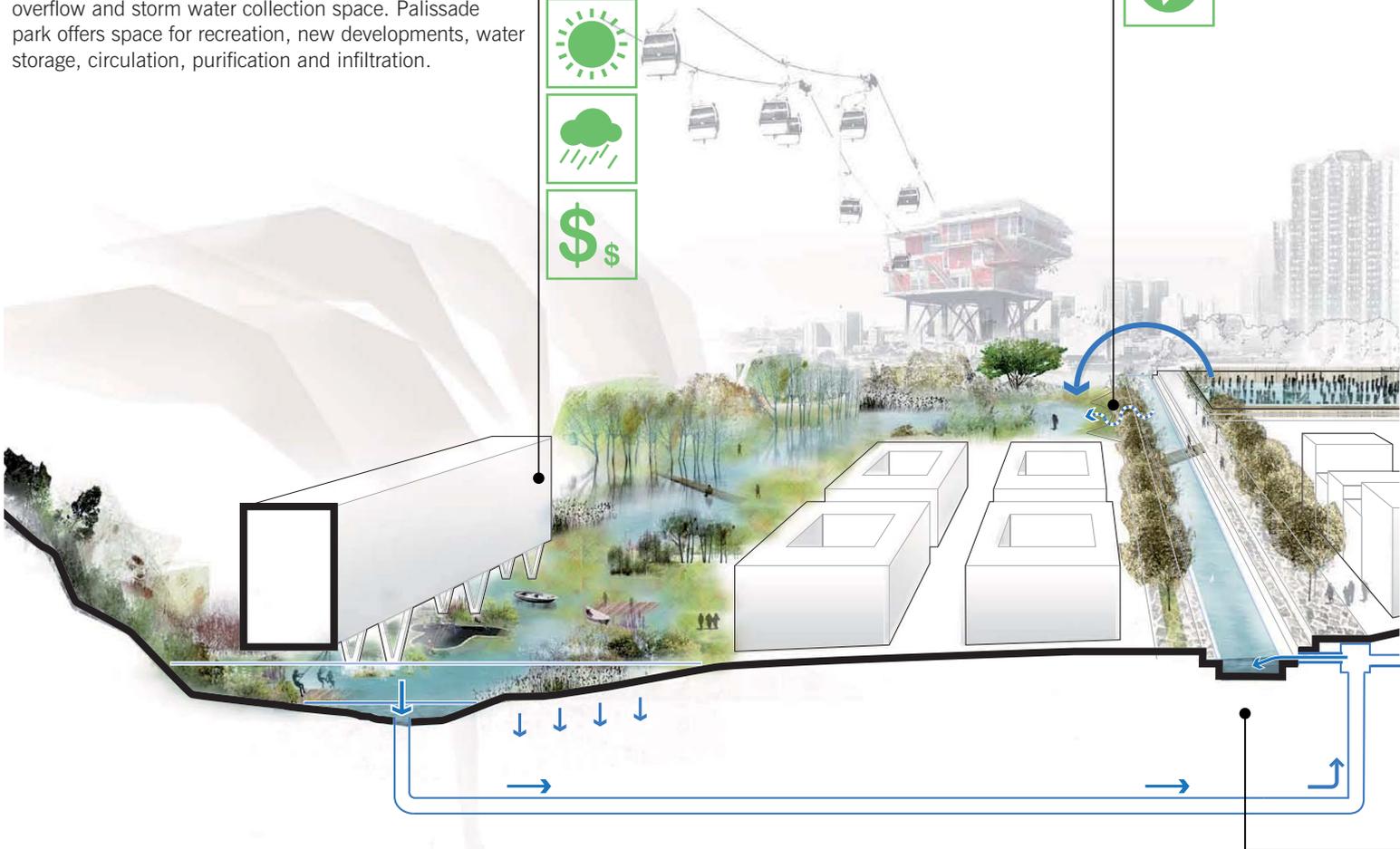
LOW FREQ FLOOD BUFFER

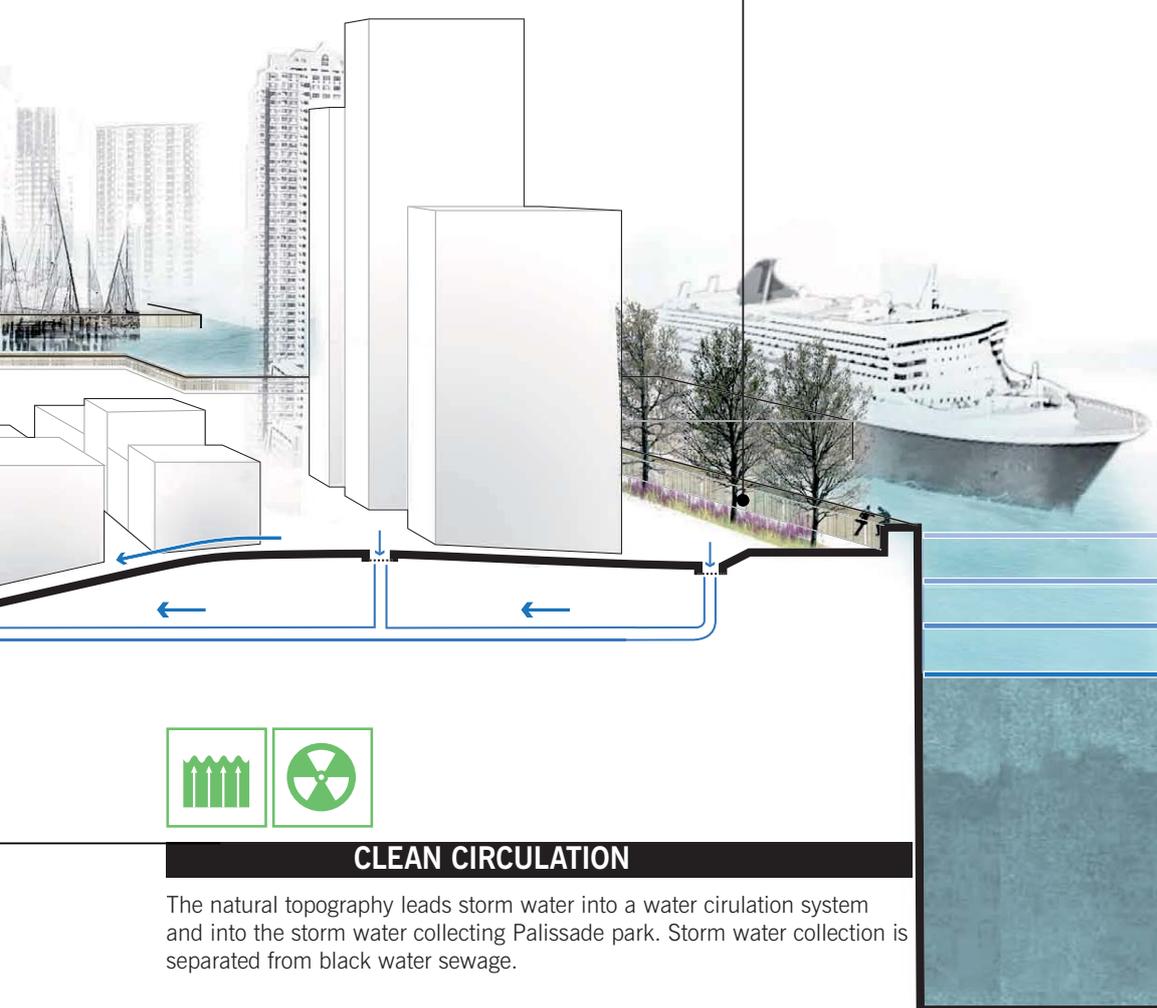
Water circulation system to collect storm water, improve water quality and add value for new developments. It connects Jersey City to the Palissade park. The overflow point accommodate low frequency floodings (<1/100 year). It breaks the waves and leads the water gently into the Palissade park.



LIVING IN A STORM // WATERBASIN PARK

New Palissade park is a high quality environment for redevelopment of housing schemes. It serves as a flood overflow and storm water collection space. Palissade park offers space for recreation, new developments, water storage, circulation, purification and infiltration.





HIGH FREQ FLOOD PROTECT

Friendly barrier (seating height) adds to the quality of the waterfront promenade. It blocks high frequency floodings (<1/100 year) and breaks the waves.



CLEAN CIRCULATION

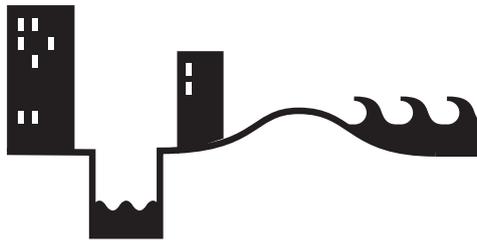
The natural topography leads storm water into a water circulation system and into the storm water collecting Palissade park. Storm water collection is separated from black water sewage.

LOWER EAST SIDE

The Lower East Side has a flooding vulnerability that is caused by both an inadequate sewer system and occasional storm water surges over the edge of the island. Elements of our proposed resiliency districts (public emergency amenity, technologically advanced absorption capacity, landscape infrastructural edges) will be integrated into the current blocks and river edge park structures, in order to address eventual emergency needs. In addition, new-elevated pedestrian connections may connect Lower Manhattan to new safe high points on the surrounding ridges (there are no bridges over

the Hudson currently) as evacuation routes. These evacuation routes would also foster civic life as well as actual urban growth on a daily basis. Specific to this site, the team proposes to redesign the public landscape around the housing blocks into a hilly urban dune that covers the blind ground floors and integrates the buildings into one protective playful park. This will block future floods and absorb local storm water. By fortifying this Manhattan edge, the need to solve the storm water catchment within Manhattan itself instead of transporting it into the Newtown Creek plant





becomes evident. We propose to split the Manhattan sewage in order to discharge cleaner water into the East River and lower the overall pollution level. This will require extra storm water storage capacity within Manhattan. Here we propose a mixture of measures ranging from storing water on private plots via incentives, to reusing abandoned underground infrastructures, to a very spectacular new typology: “the inverted skyscraper”. The inverted skyscraper is a deep storm water catchment facility and an adventurous urban space. Here mosses and small animals can nest and

become special ecological places that provide cool air to the streets of Manhattan. This space can be combined with a subway station, an urban lounge or parking facility. A very quick and dirty calculation exercise allows us to store approximately 60 million gallons of storm water into one inverted skyscraper. Five of these will replicate the capacity of the Newtown Creek plant, 35 could cover Manhattan.





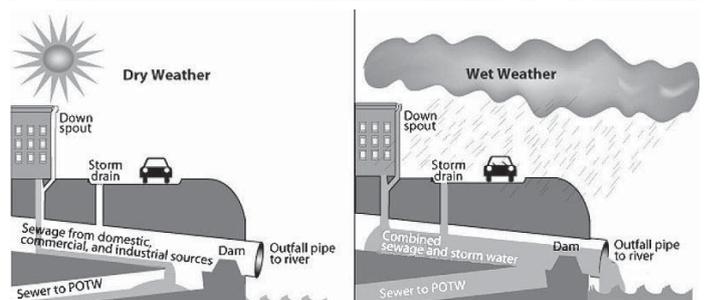


BACKGROUND LOWER EAST SIDE

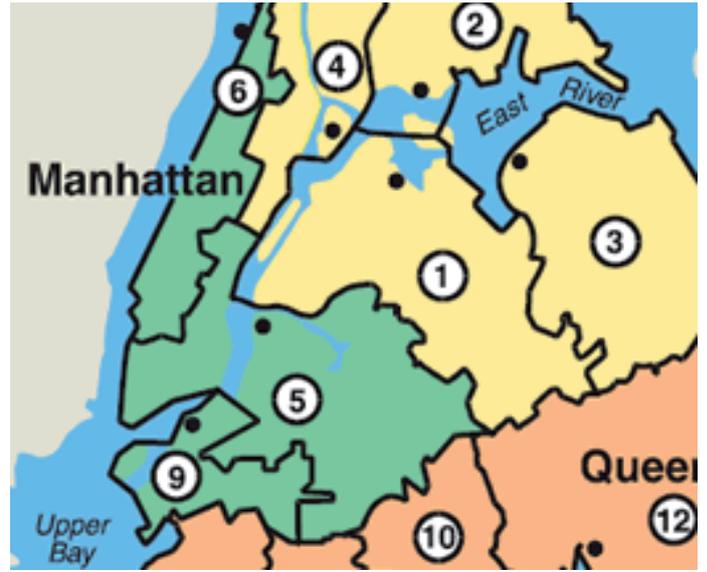
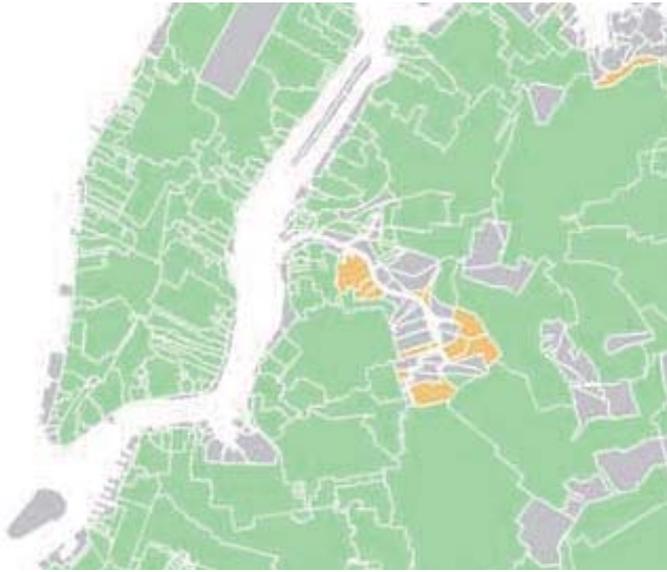
FORTIFYING AND DRAINING MANHATTAN



During heavy rainfall raw sewage spills over into the Hudson and East River.

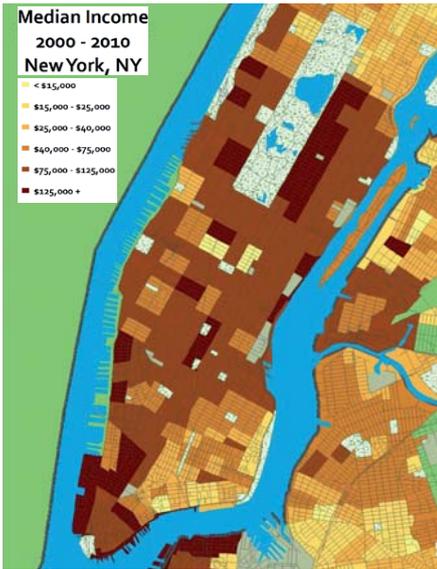


Sewage discharge into the Hudson and East River cause environmental and health risk with each rain event



Sewage compartment system. Lower east side belongs to Newtown Creek Water Treatment Plant area.

VULNERABILITY + FLOODING



Lower East side is the last remaining bastion of social/low income housing on Manhattan.



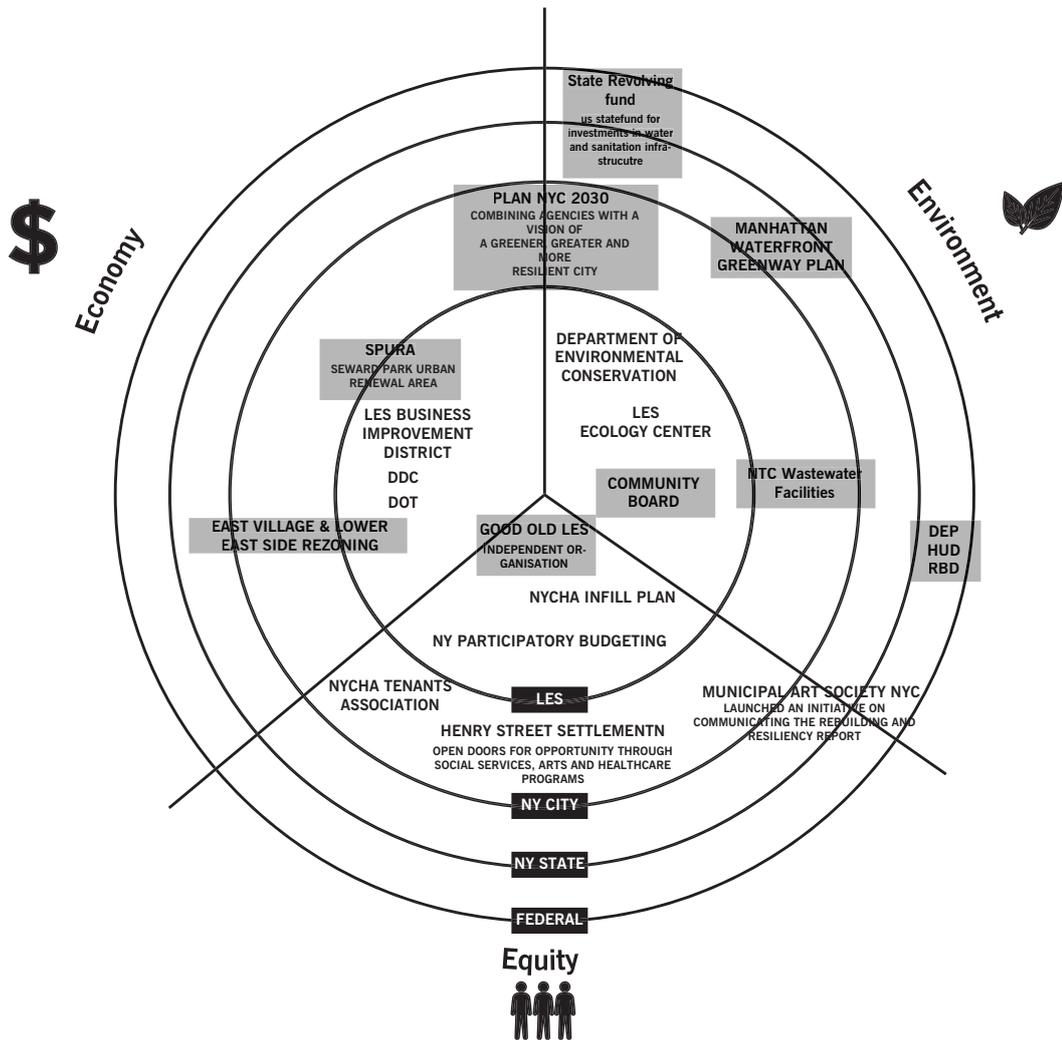
VULNERABILITIES



OPPORTUNITIES



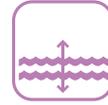
ALLIANCES



2013 : VULNERABLE SEWAGE SYSTEM

2023: MANHATTAN WATER MACHINE

WATER INFLUENCE



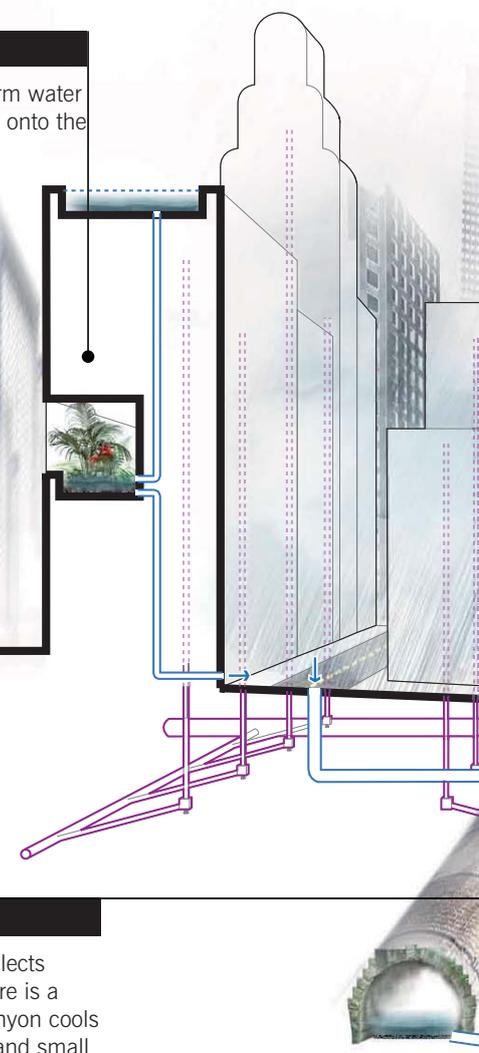
STORMWATER CASCADE

Each property owner can get incentives to apply the “storm water cascade”: delay, hold or reuse the rain before releasing it onto the street.



COOL STORAGE

The Central storm water canyon collects and redistributes. When it rains there is a spectacular waterfall. The moist canyon cools the air and is a habitat for mosses and small animals.





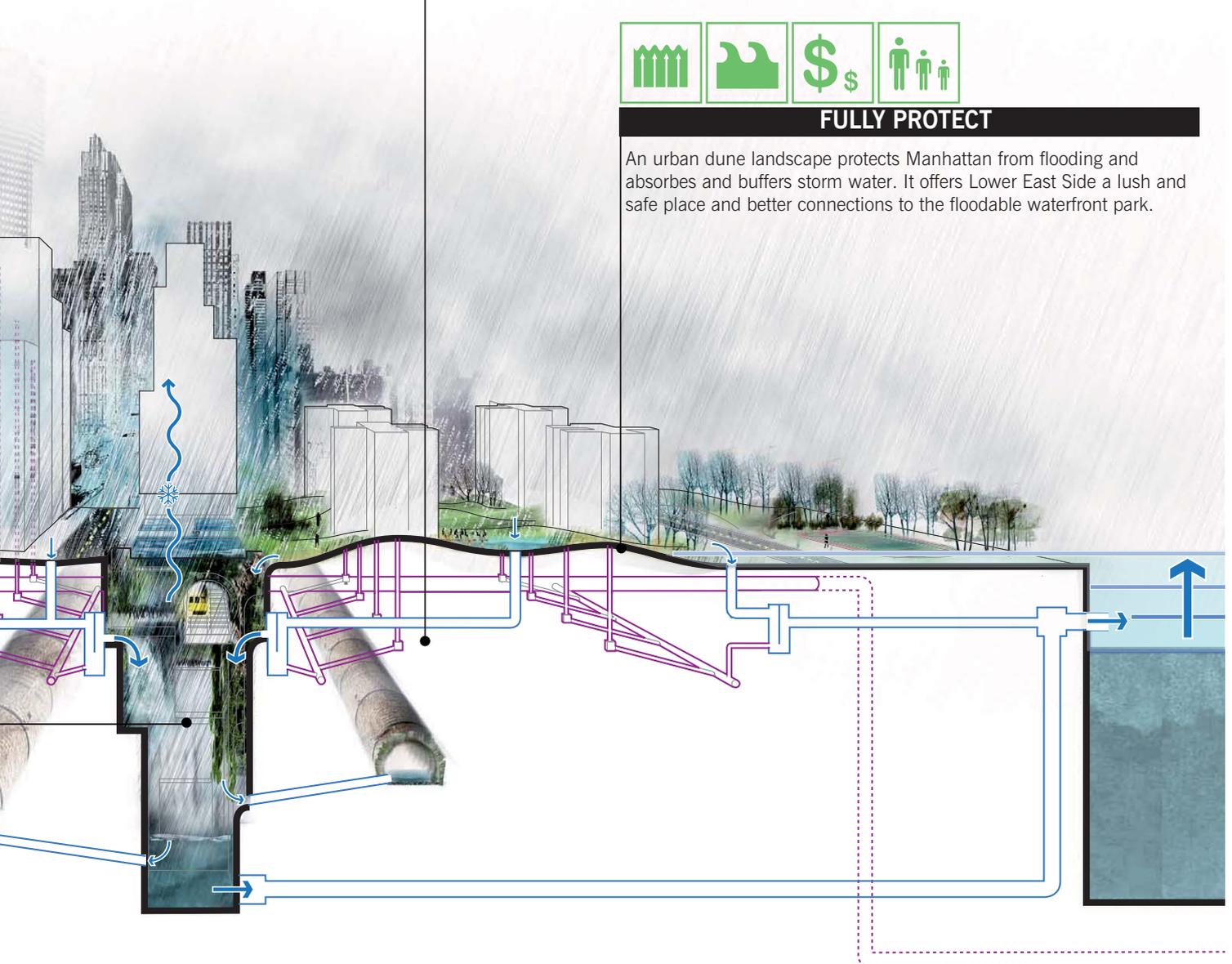
SPLIT SEWAGE SYSTEM

The polluted first flush from the rain goes into the black water sewage. When it keeps on raining the cleaner water flows into the storm water storage. The storm water overflowing into the East river will be much cleaner. The black water goes to New Town Creek. It will be less, so the plant has extra capacity to grow.



FULLY PROTECT

An urban dune landscape protects Manhattan from flooding and absorbs and buffers storm water. It offers Lower East Side a lush and safe place and better connections to the floodable waterfront park.



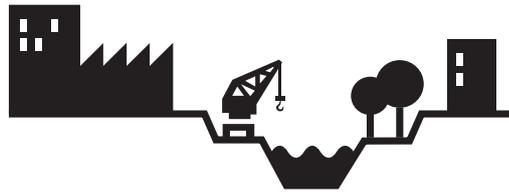
SUPERUSE DISTRICT NEWTOWN CREEK

Newtown Creek emerges from the maximum risk / maximum vulnerability analysis as a critical area for further study. This area faces severe flood risk, contains substantial pollution that problematizes its looming transformation; and sees a growing tension between manufacturing and residential uses; not to mention between local community life and new inhabitants (gentrification). These pressures are now coming together. Emerging consciousness after Sandy about the flood risk may be the key to unlocking the present equation, by designing a district that includes manufacturing and residential in a new balance. Several interlocking approaches will be key here. First, it is possible to increase the playing field by adding civic spaces that secure, absorb, improve health for all parties involved may help tremendously. Second, it is possible to think of residential design models that are not exacerbating gentrification (tower vs. neighborhood block), but interweave populations, creating new opportunities for all involved, and in fact contribute to a new

mesh. Third, there exist design models for the coexistence of manufacturing and an urban context. A contemporary light manufacturing district can be of a scale and grain that allows for not only co-existence but also for mutual profit with residential and other programs (e.g. reduced commuting distance).

Furthermore, Newtown is well positioned near the emerging technology innovation hub of Roosevelt Island, to take advantage from it. It is possible to imagine a NYC-region tech hub, in which Newtown Creek operates as a test site for small to medium-size spin-offs using innovative production techniques with relatively modest-size assembly lines. Learning from the MIT precedent, such businesses will bring highly and less highly educated people together. In such a scenario, Newtown Creek will have dollars invested pay back across generations and into several spheres of society – economy, neighborhood, innovation,

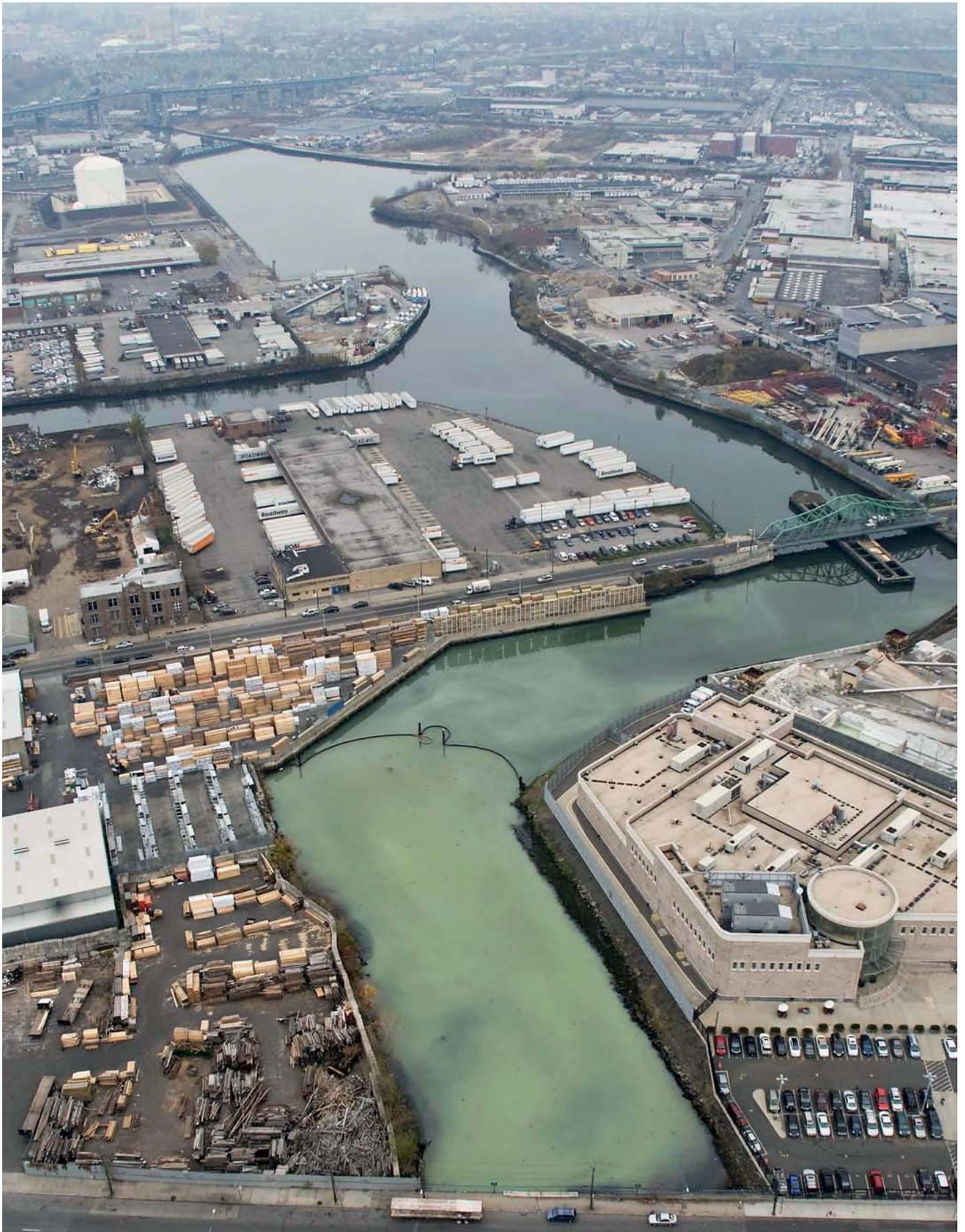




etc. Sandy has exposed the systemic vulnerability of the creek area. An early version of a proposal for Newtown creek is to create a continuous landscape infrastructural edge condition aligning the creek and its branches and further expanding into the surrounding neighborhoods as green bike friendly streets. The green creek edges can absorb rising flood levels, provide cleaning capacity for a part of the existing soil pollution and manifest a higher quality of public space and accessibility of the water. Here the areas' manufacturers can have their direct sale shops and meet each other in new waterfront bars. This landscape infrastructural investment will unlock the potentials of Newtown creek and allow for a gradual densification and mixing of uses. It addresses pollution problems on a parcel-by-parcel basis. Within Newtown creek, different scenarios can be imagined. Some parts (such as the Dutch Kills) could be master planned for a gradual but nevertheless relatively fast-paced densification with a light manufacturing/residential mix whereas others (near

the sewage plant) would need to undergo a slower process of adjustment, remediation, and cleanup. In both cases, the investment in the protective/absorptive landscape needs to happen first, but can be accompanied by immediate redevelopment opportunities that begin to pay back the infrastructure cost. Accordingly also levels of flood protection can vary throughout the area. Since the topography here creates a long line of vulnerable edges along the creek with less vulnerable, higher places as you move land inward, each edge condition could vary without endangering its hinterland. Finally, Newtown Creek has recently undergone a rezoning process and a comprehensive survey of contamination, positioning it well for next steps. We would envision collaboration with the Newtown creek BOA and other partners.





Aerial view of Newtown creek



Scrapyards, old boats, infrastructure crossing , abandoned tracks... an industrial landscape along the creek beds.

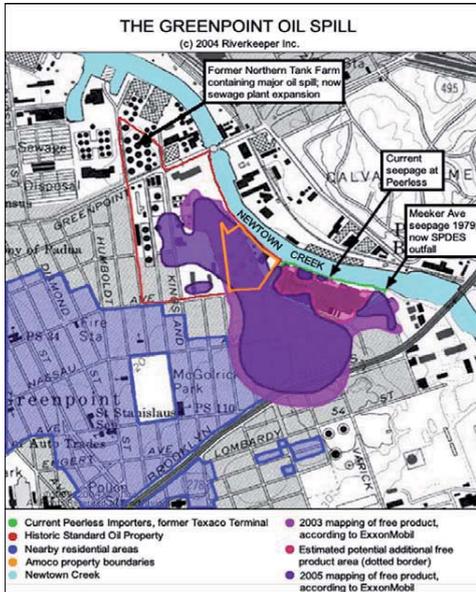
BACKGROUND NEWTOWN CREEK

INDUSTRIAL ENTREPRENEURSHIP



Aerial Newtown Creek Industry; home to some of United States biggest companies

TOXIC SIDE-EFFECTS



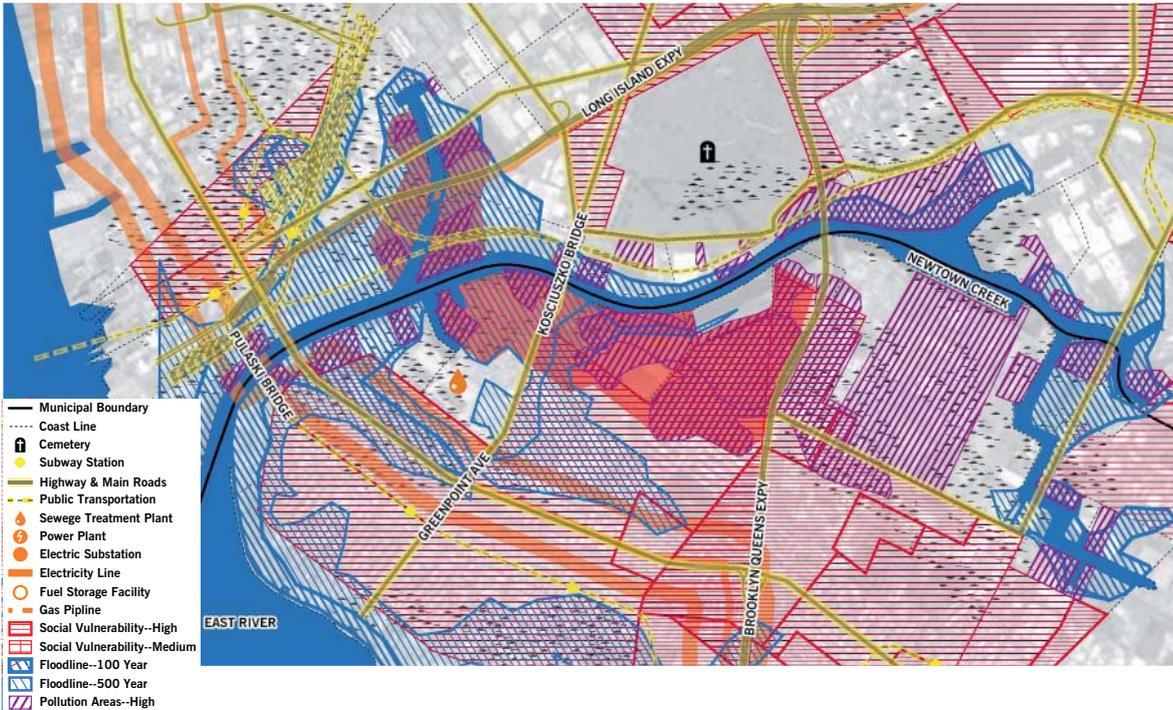
The industrial history of Newtown Creek has its present consequence of high polluted water.

GENTRIFICATION

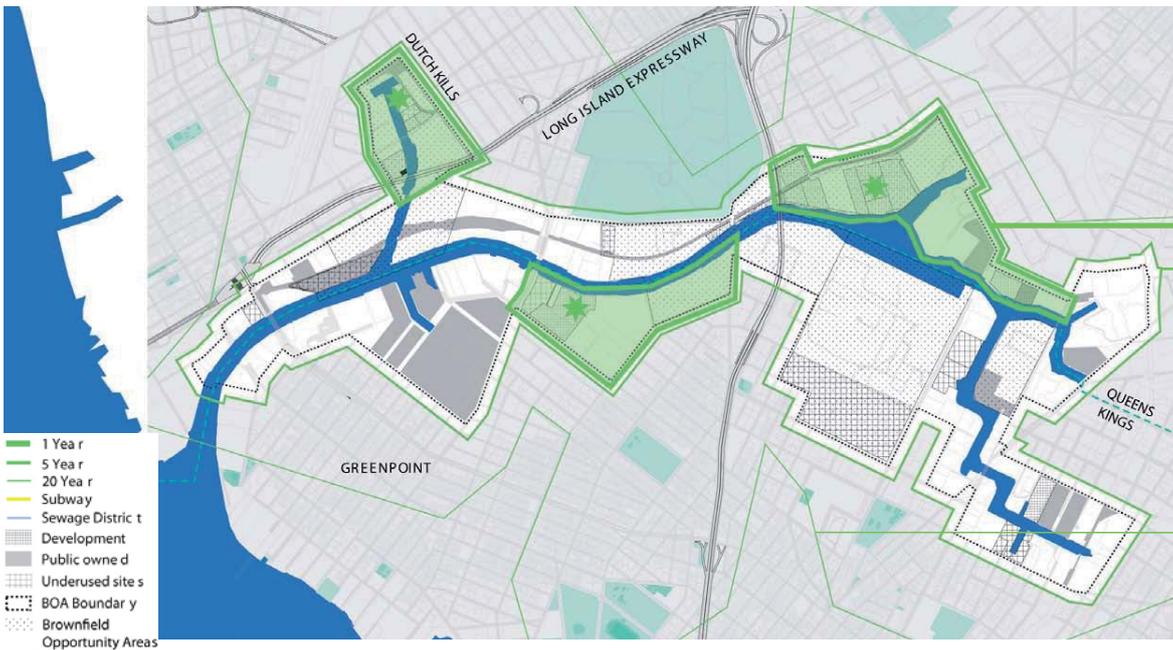


Newtown creek is an area with a controversial future development

VULNERABILITIES



OPPORTUNITIES



1960 RECEIPT AND REFINING OF CRUDE OIL

1974 LAST MAINTENANCE DREDGING

2004 COMPLETION NYC WATER TREATMENT PLANT

2005 REZONING WILLIAMSBURG GREENPOINT

2008 NTC DESIGNATION AS BOA

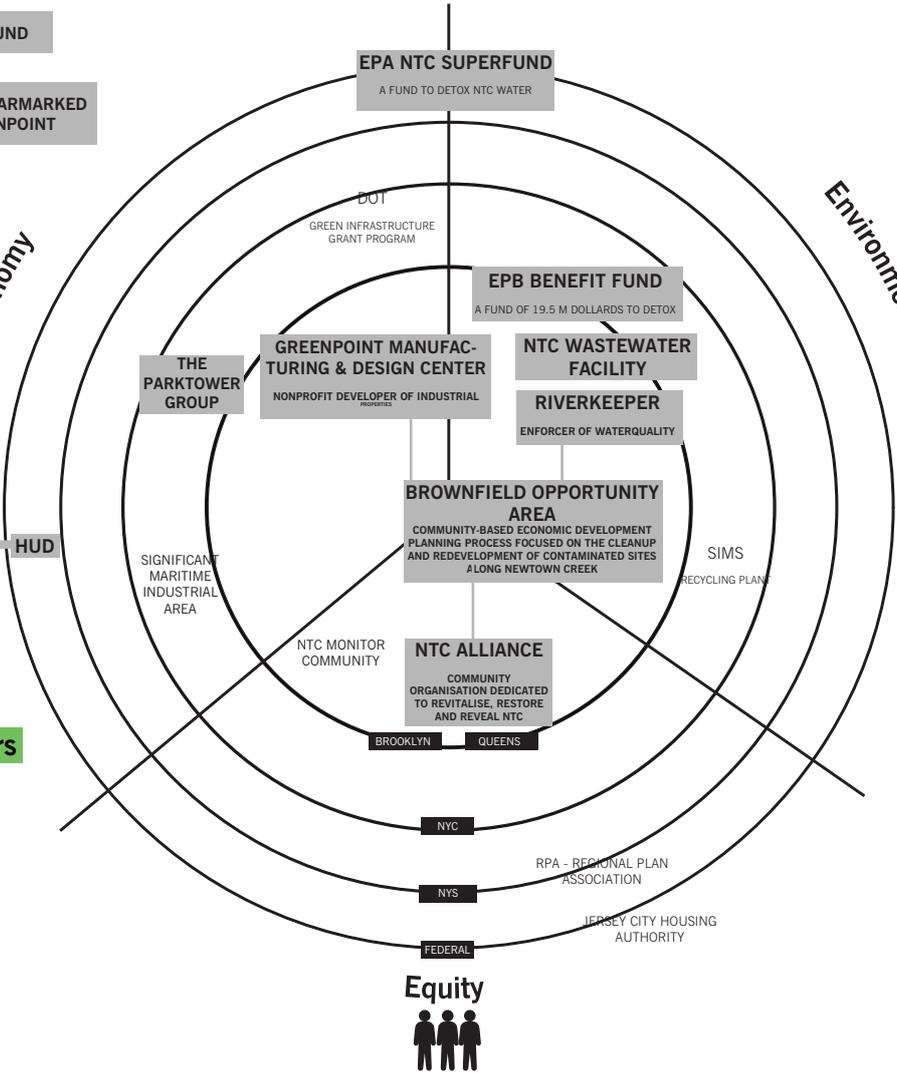
2010 DESIGNATION NTC AS FEDERAL SUPERFUND

2010 PENALTY EXXON MOBILE 25 M, 19.5 M EARMARKED FOR ENVIRONMENTAL PROJECTS GREENPOINT

ALLIANCES

Economy

Environment



2014 Rebuild By Design

1st year 5 years 20 years

2013 : HEAVY INDUSTRY AND POLLUTION

2023: MIXED USE, LIGHT MANUFACTURING, A GREEN INFRASTRUCTURE

WATER INFLUENCE



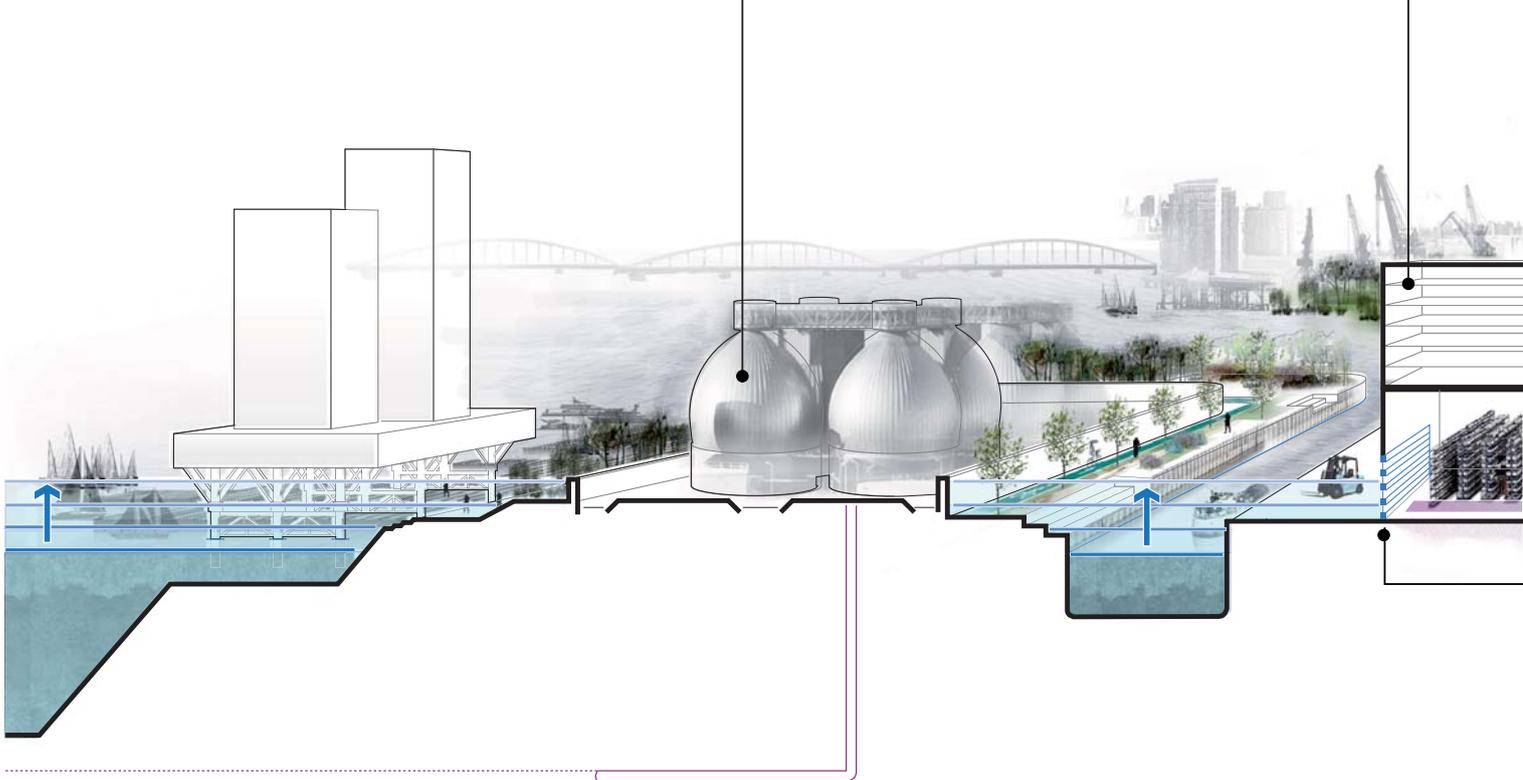
INNOVATIVE MIX OF MANUFACTURING AND LIVING

New housing developments on top of industrial heritage buildings will restore the urban area, by attracting new inhabitants and growing economies. The residential use is combined with light manufacturing & open workshops.



FULLY PROTECT

Protective wall secures the vital plant that treats the sewage from Manhattan and Brooklyn



GREEN BRANCHES

The creek branchises into the surrounding districts: greening, softening, cooling & connecting.



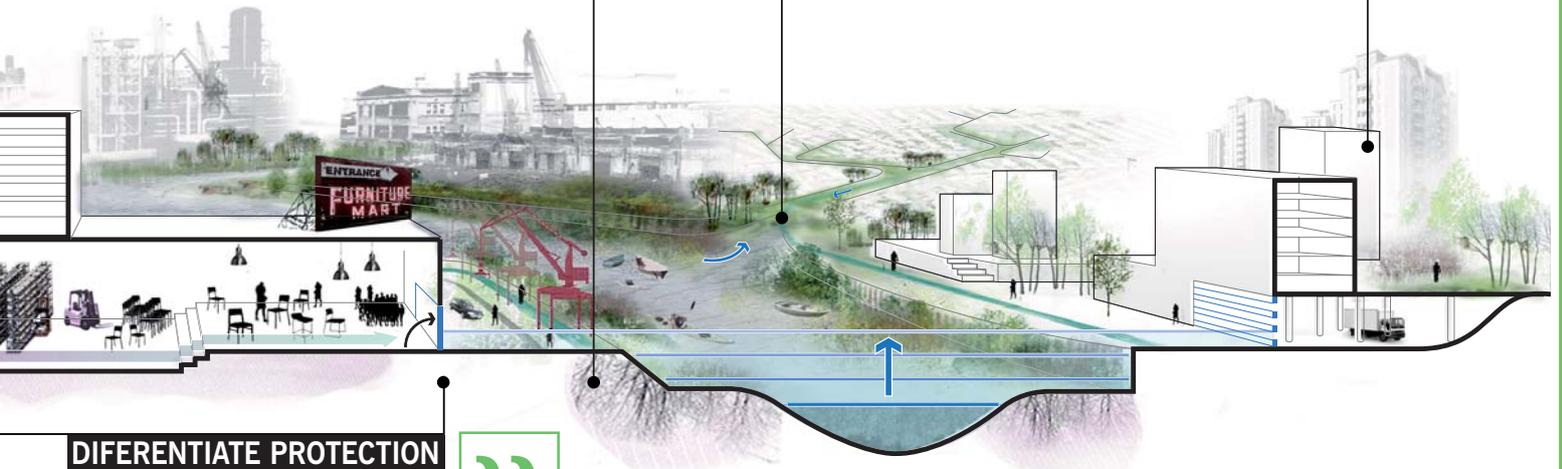
CLEAN & COVER

Superuse boulevard becomes shopping paradise and purifying park. It has a soft green (floodable) edge where you can drink a cappuchino.



RESILIENT MIXED TYPOLOGIES

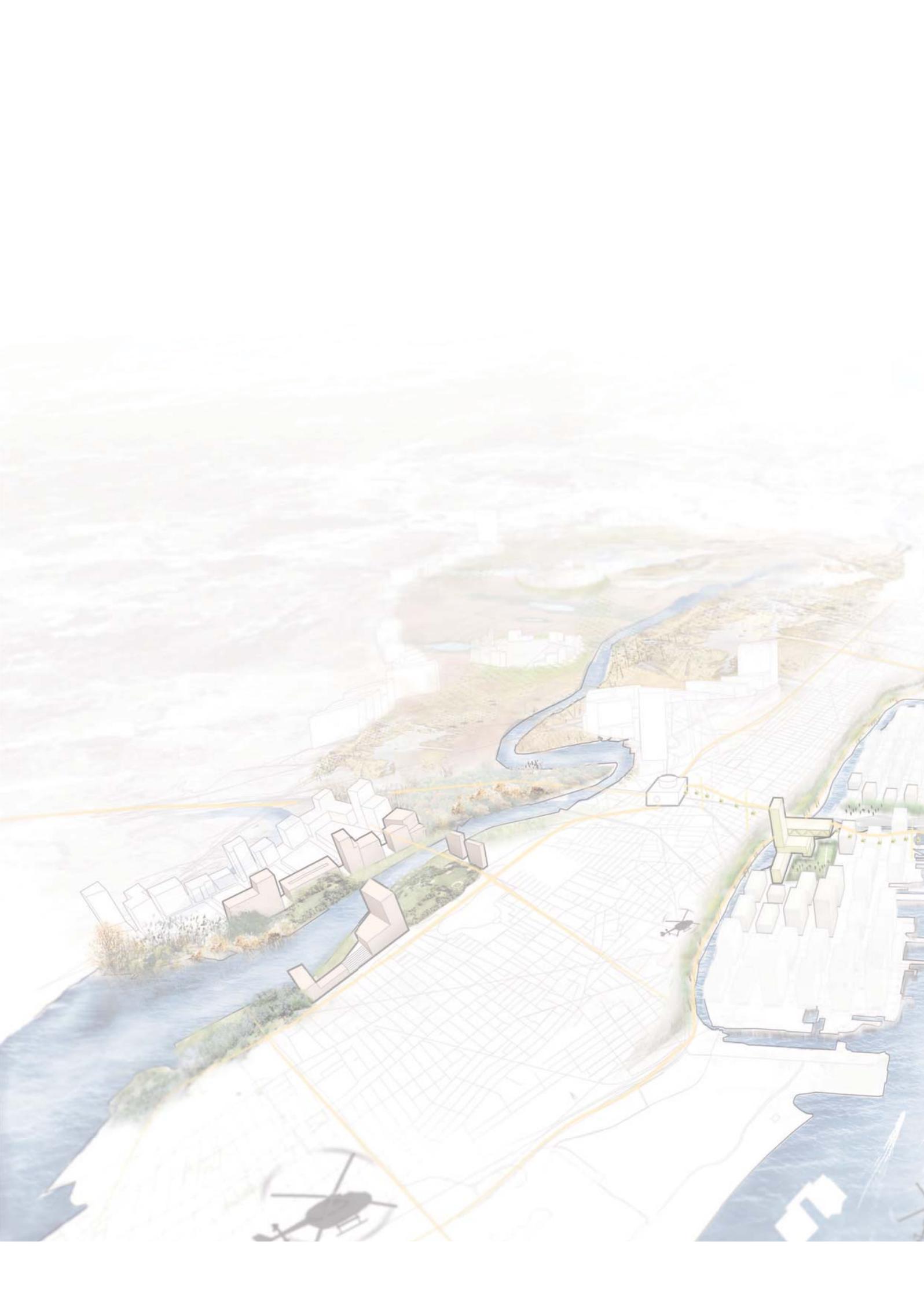
A differentiated landscape of flood levels and planting schemes adds a high quality environment for public circulation system.g.



DIFERENTIATE PROTECTION

Local water barriers will contain the flood at the light manufacturing level, while residential floors are uplifted and safe. The level of flood protection rises with the value of the property and goods it contains.





NOV / 2013

REBUILD BY DESIGN PHASE 2

COLOFON

MIT / CAU

Alexander D'Hooghe, Kobi Ruthenberg, Sarah Williams, James Wescoat, Alan Berger, Case Brown, Michael Foster, Kate Goldstein, Alexis Howland, Jonah Rogoff, Alicia Rouault, Wenfei Xu.

Z.U.S [Zones Urbaines Sensibles]

Kristian Koreman, Elma van Boxel, Christopher de Vries, Tim Peeters, Steven Hagen, Xuwei He.

De Urbanisten

Florian Boer, Dirk van Peijpe, Eduardo Marin, Jesus Martin, Jinyeong Seo.

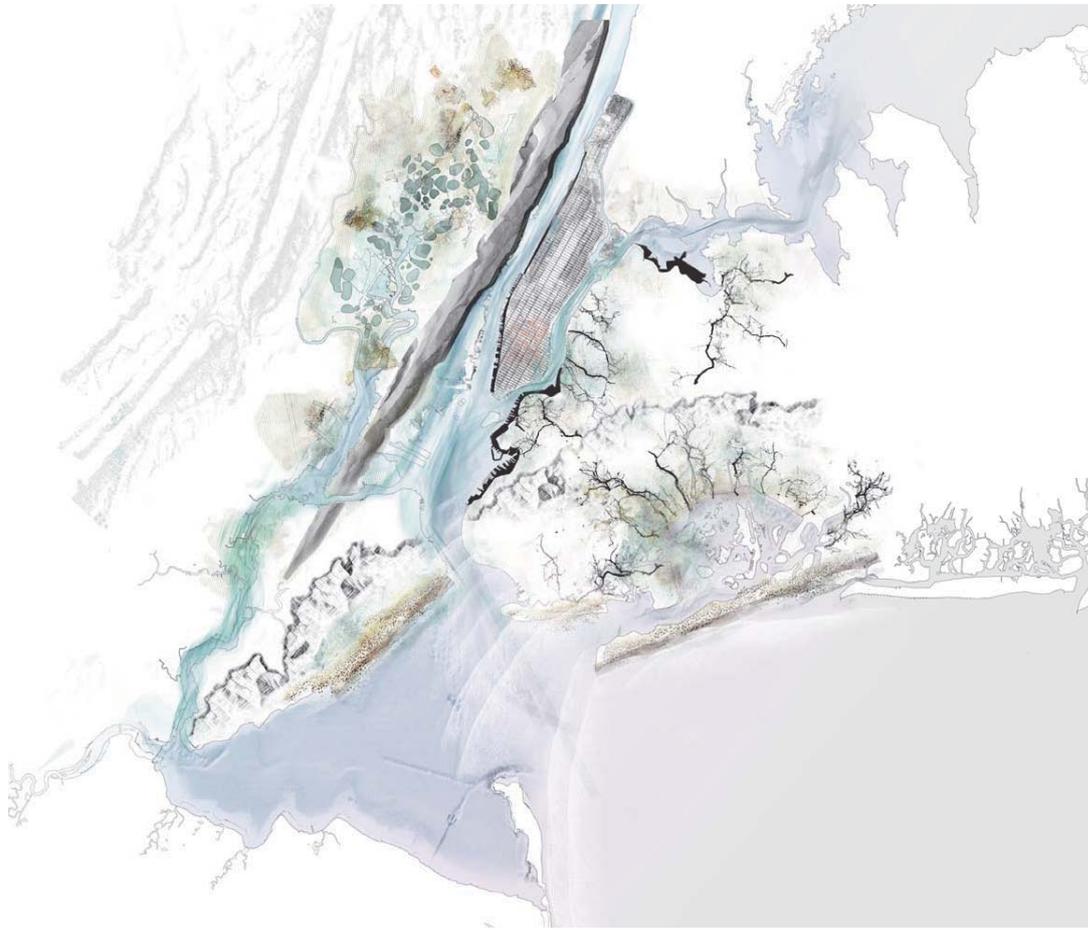
MIT Center for Advanced Urbanism

CAU



DE URBANISTEN

REBUILD BY DESIGN



MIT CAU + ZUS + URBANISTEN

75B + DELTARES + VOLKER INFRA