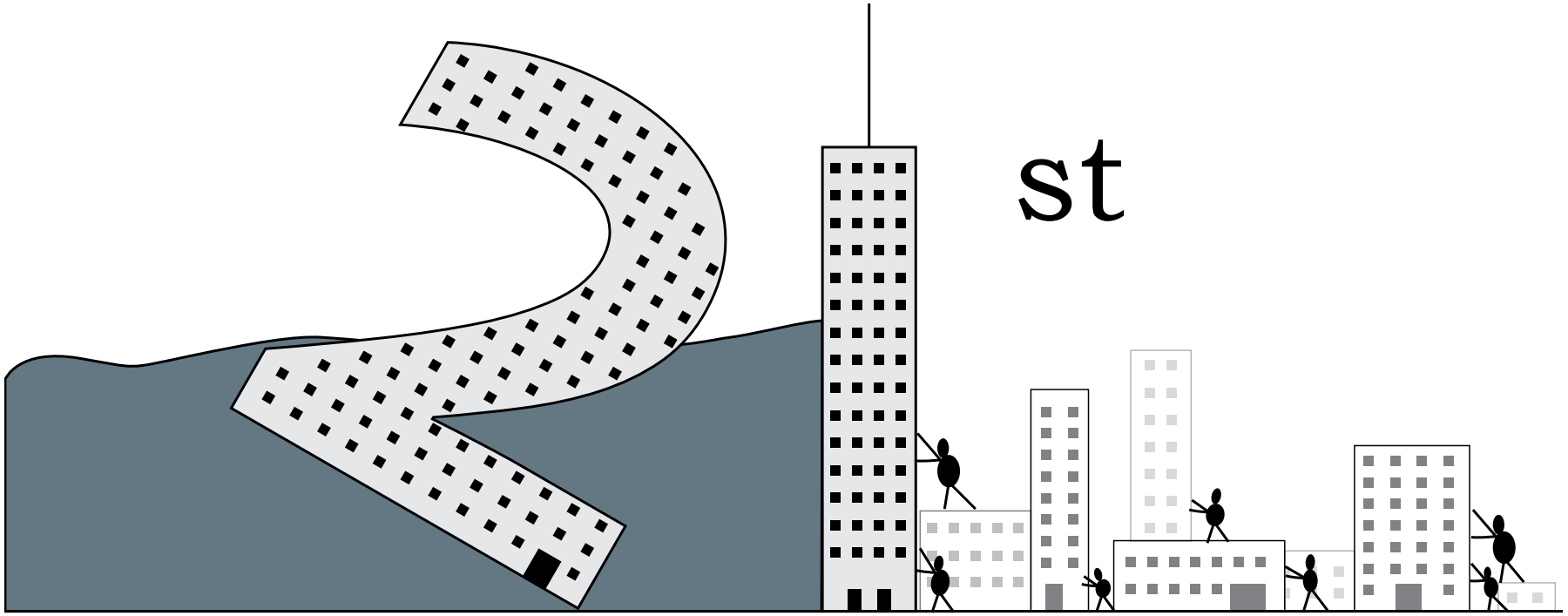
Surges of the



21st Century

P5 Presentation Donald Böing
29-06-18

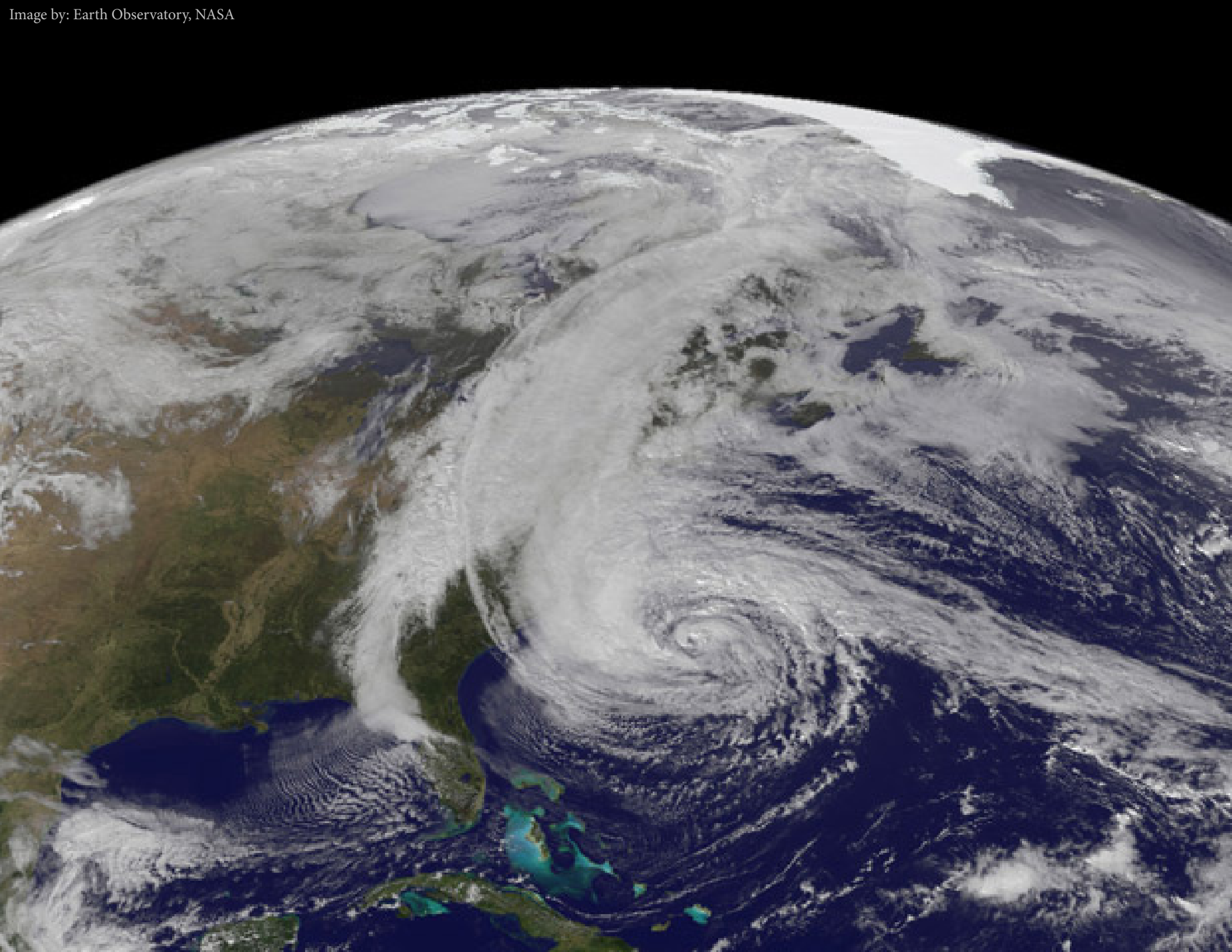
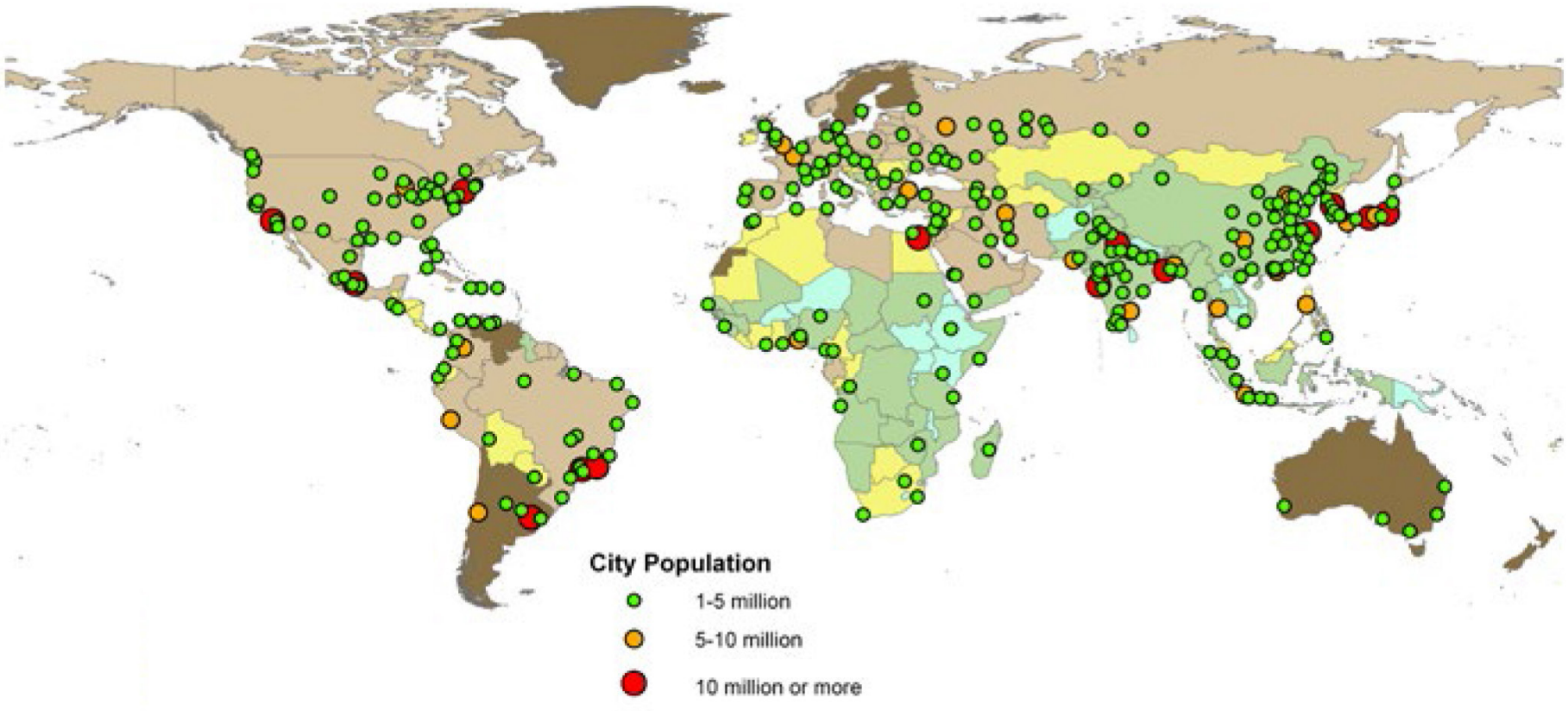


Image by: Earth Observatory, NASA

Figure 1.1: Global patterns of urbanization, 1995

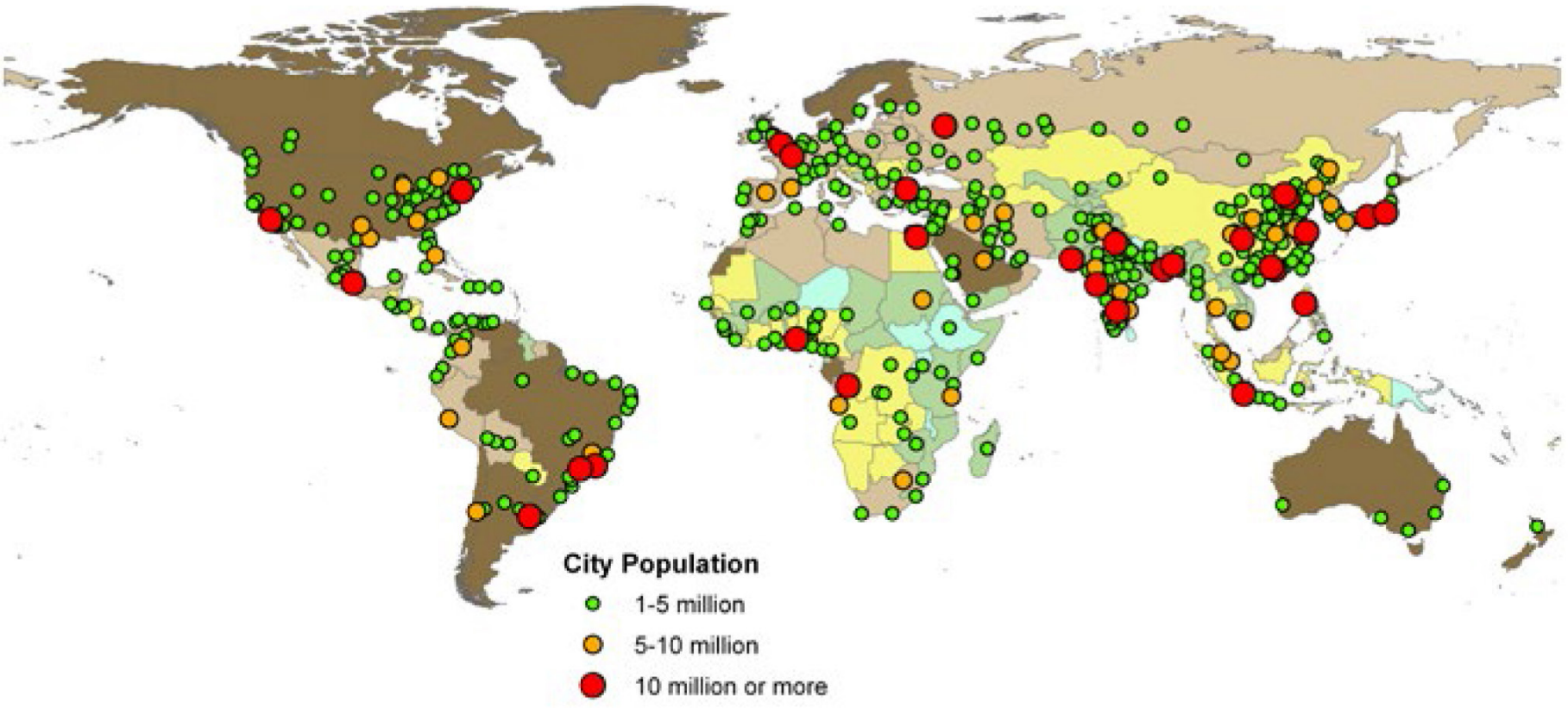
Source: Based on United Nations, 2014b.



Global Patterns of Urbanization
United Nations Human Settlements Programme

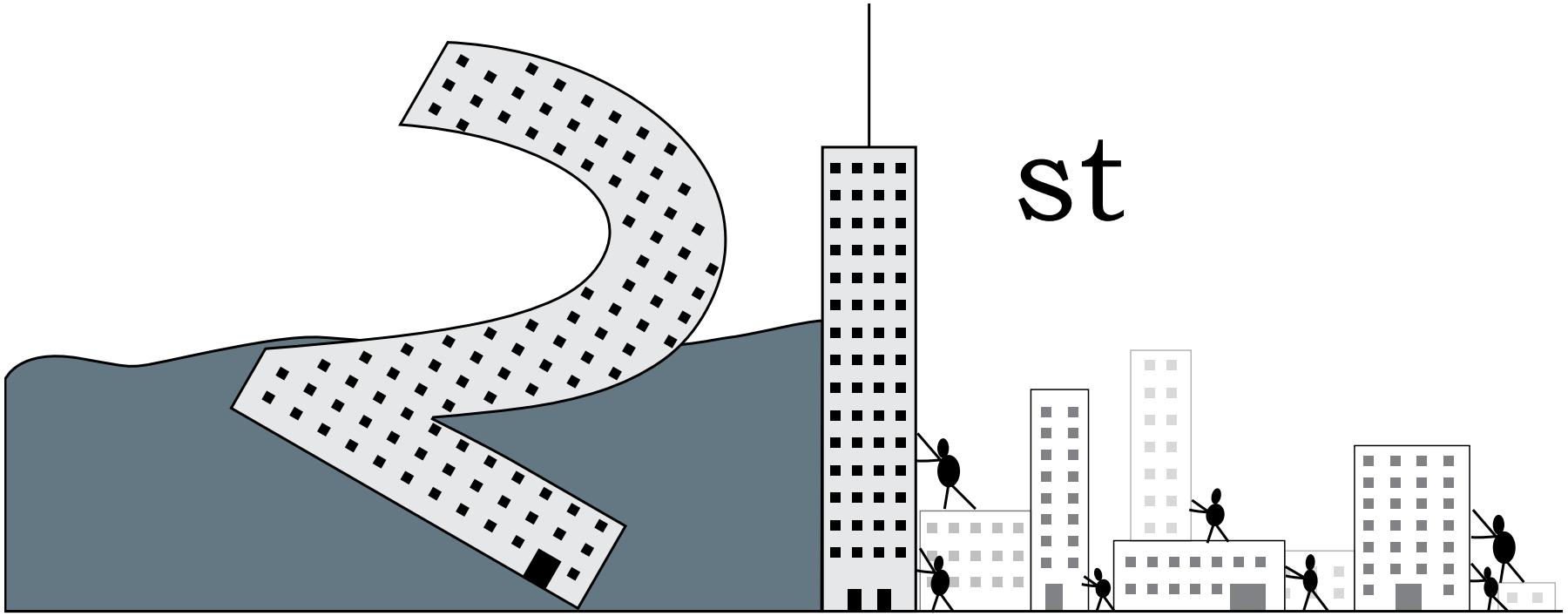
Figure 1.2: Global patterns of urbanization, 2015

Source: Based on United Nations, 2014b.



Global Patterns of Urbanization
United Nations Human Settlements Programme

Surges of the 21st Century



Structure

Problem field

Methodology

Analyses

Dynamics of the New York Bay

Plansite

Design

Conclusion

Problem field

Current top 3 cities with most exposed assets are all North-American

Numbers to grow exponentially until 2070

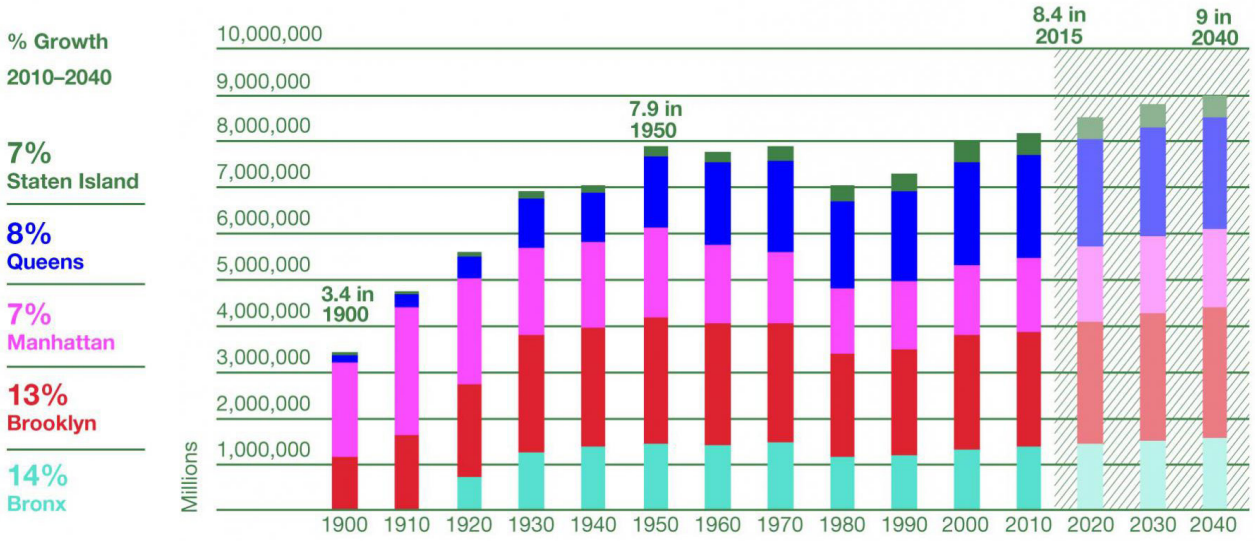
NYC is one of the most densely populated coastal areas

Population projected to increase, Brooklyn and the Bronx to contribute most

Additional pressure on the terrain

Rank	Country	Urban Agglomeration	Exposed Assets Current ($Billion)	Exposed Assets 2070 ($Billion)
1	USA	Miami	416.29	3,513.04
2	USA	New York-Newark	320.20	2,147.35
3	USA	New Orleans	233.69	1,013.45
4	JAPAN	Osaka-Kobe	215.62	968.96
5	JAPAN	Tokyo	174.29	1,207.07
6	NETHERLANDS	Amsterdam	128.33	843.70
7	NETHERLANDS	Rotterdam	114.89	825.68
8	JAPAN	Nagoya	109.22	623.42
9	USA	Virginia Beach	84.64	581.69
10	CHINA	Guangzhou	84.17	3,357.72
11	CHINA	Shanghai	72.86	1,771.17
12	INDIA	Mumbai	46.20	1,598.05
13	THAILAND	Bangkok	38.72	1,117.54
14	CHINA,	Hong Kong	35.94	1,163.89
15	INDIA	Kolkata (Calcutta)	31.99	1,961.44
16	CHINA	Tianjin	29.62	1,231.48
17	EGYPT	Alexandria	28.46	563.28
18	VIETNAM	Ho Chi Minh City	26.86	652.82
19	CHINA	Ningbo	9.26	1,073.93
20	CHINA	Qingdao	2.72	601.59

Top 20 cities in terms of assets exposed to coastal flooding. (Hanson et al., 2011)

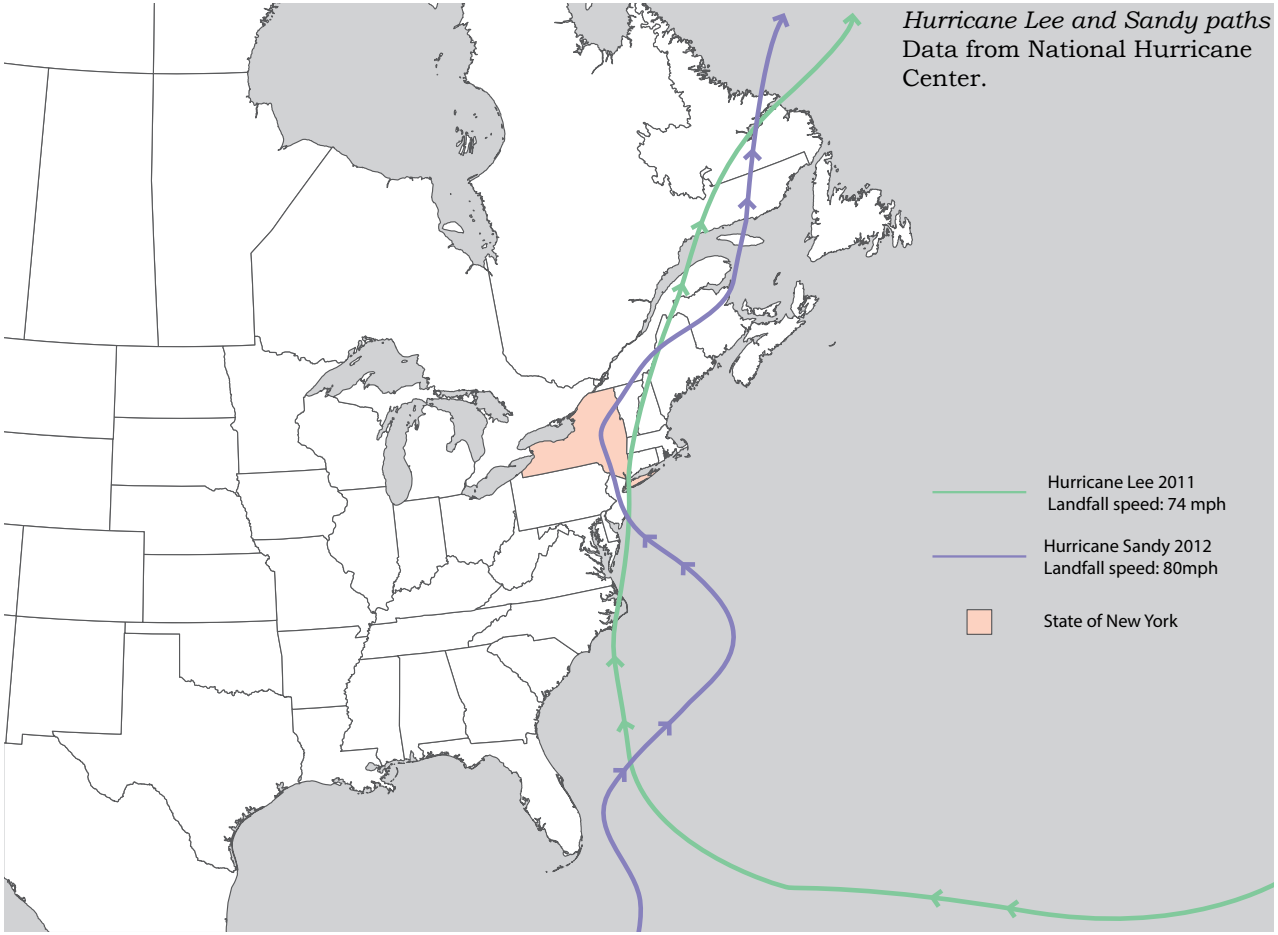


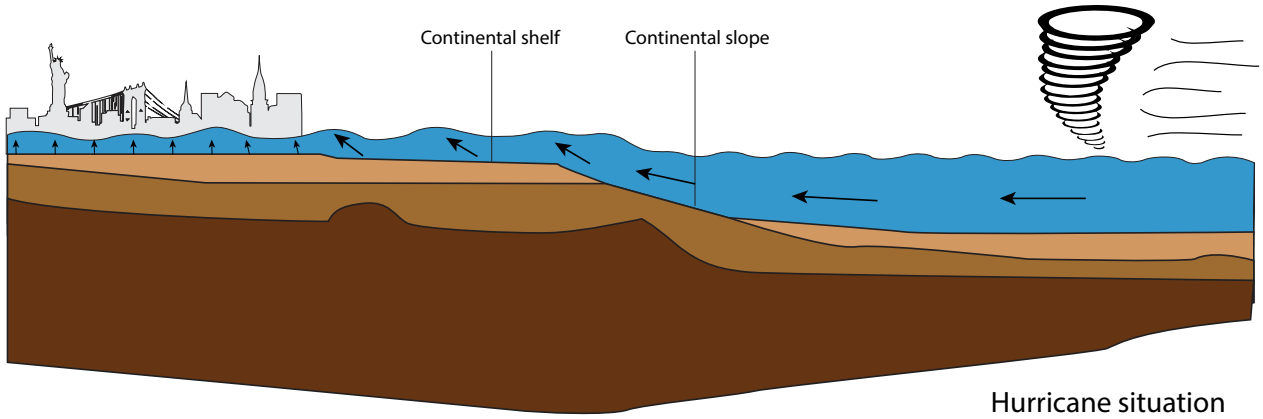
NYC population. NYC Gov, 2017

East coast of the US deals with Hurricanes, Tropical storms and Nor'easters

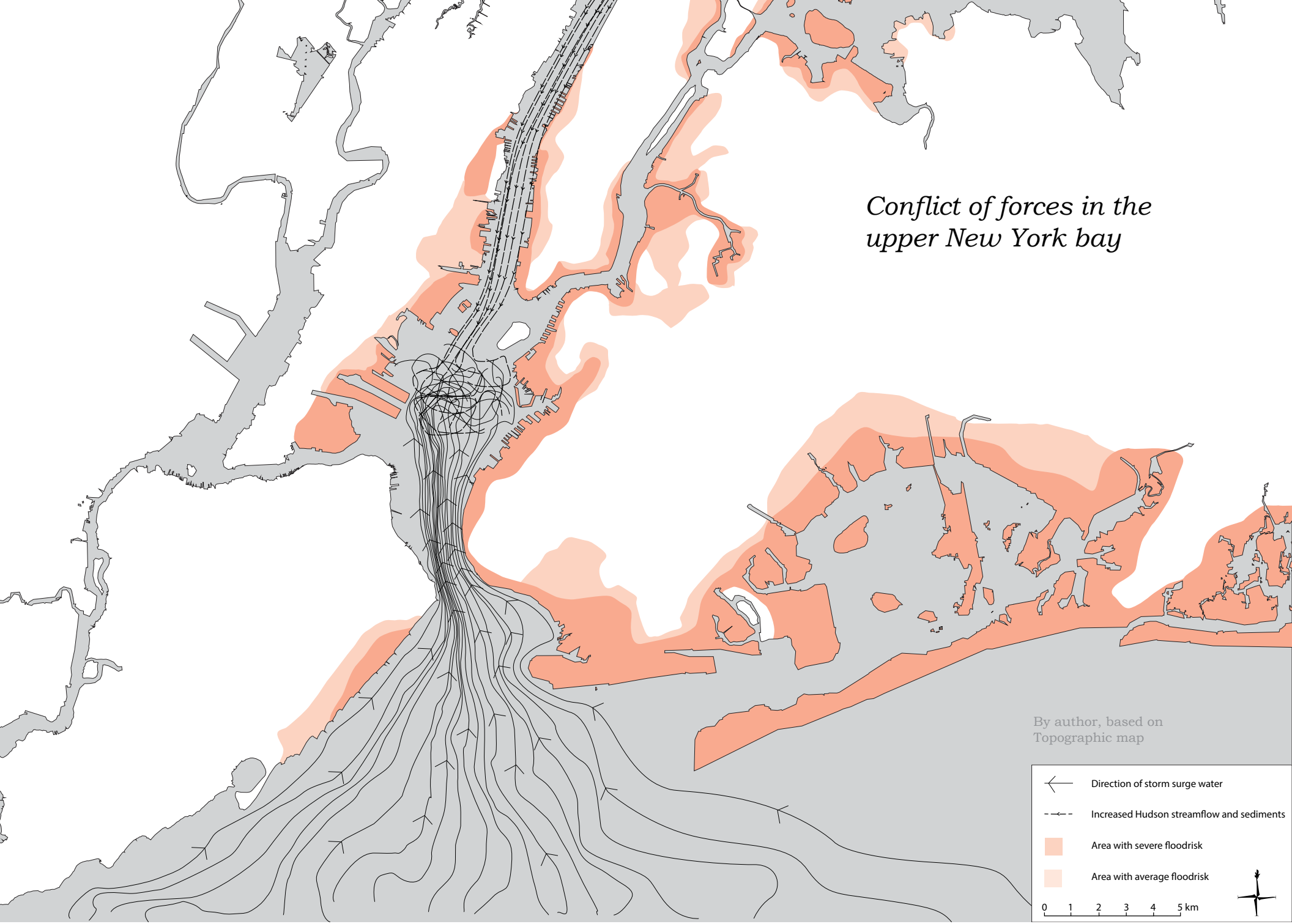
Hurricanes making landfall in NYC push water into the bay

Geology of the Atlanctic ocean contributes to rise in waterlevel





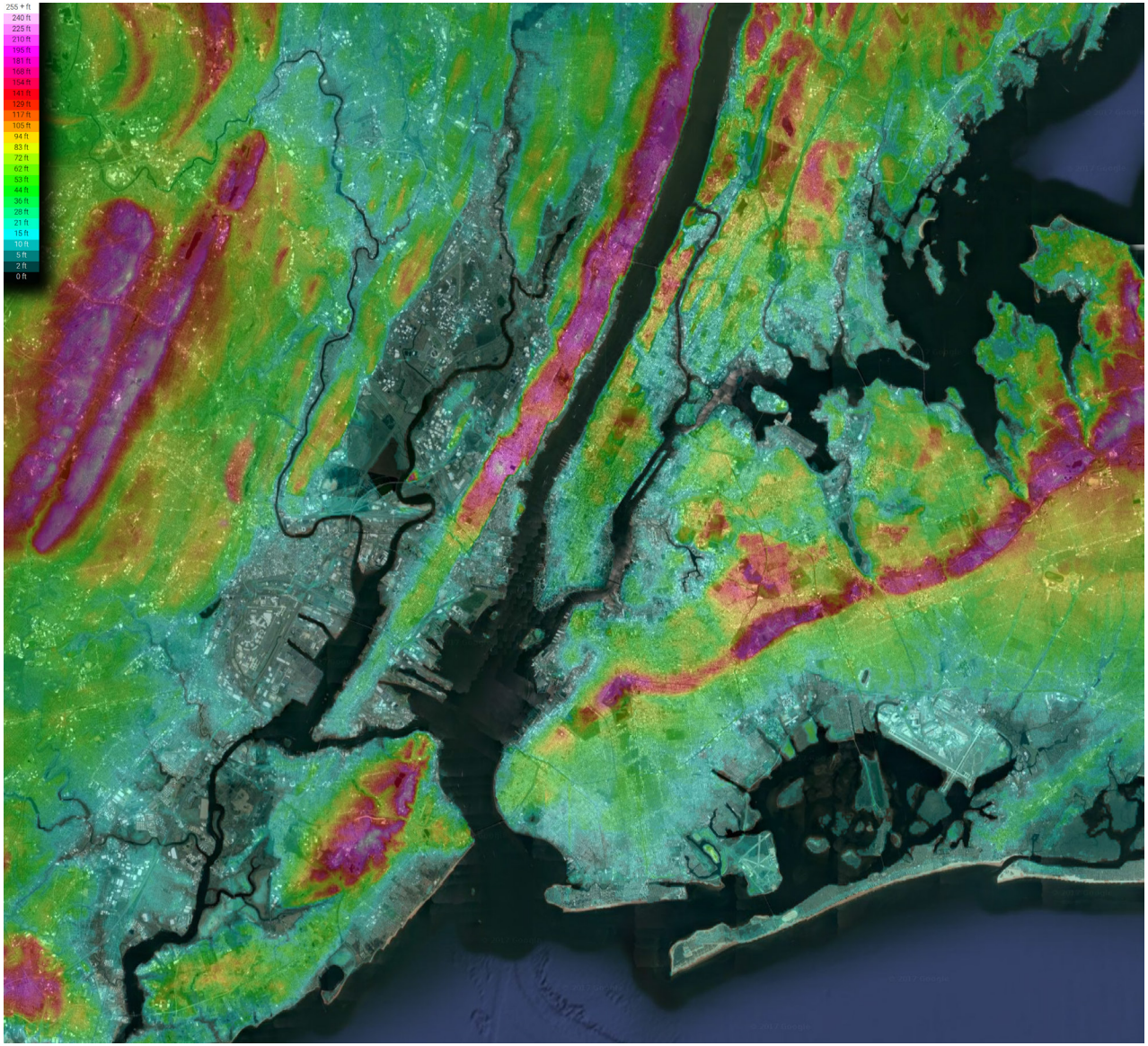
Hurricane situation


Conflict of forces in the upper New York bay
By author, based on Topographic map
Direction of storm surge water
Increased Hudson streamflow and sediments
Area with severe floodrisk
Area with average floodrisk
0 1 2 3 4 5 km

Low-lying land directly exposed to the Atlantic ocean

Especially around the Upper bay, the lowest lying areas are found

Red Hook is one of the most vulnerable neighbourhoods on the Upper bay



NYC elevations map
data from Topographic map

Red Hook was founded by the Dutch in 1636 as ´Roode Hoek´

Peninsula is almost completely landfilled

Around 1840 one of the largest harbours in the world

Area fell in decline after port activity decreased

Red Hook location. (By author)

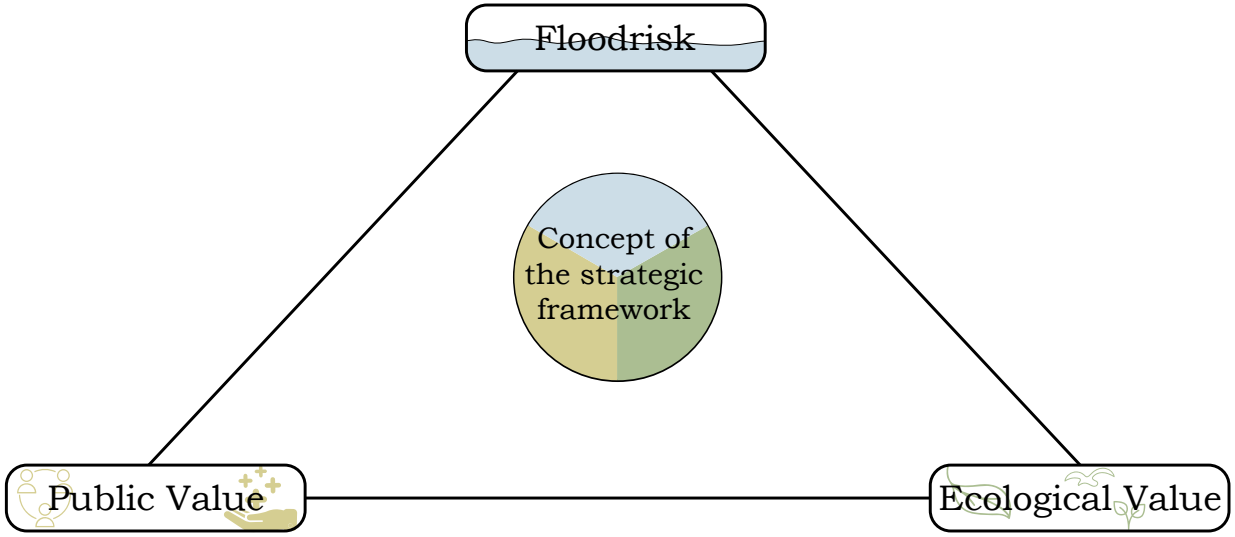
Methodology

Strategy

To combat the two surges of the 21st century, a strategic framework is developed

This approach is applicable on other urbanized coastal areas as well, and was tested on Red Hook as pilot site

3 components:
Flood risk
Public Value
Ecological Value



Concept of the strategic framework. (By author)

Research questions

How can **flood risk**, **public**- and **ecological value** be addressed coherently through urban regeneration, in which socio-economic pressure and flood risk are both successfully reduced?

Flood Risk

How can the effects of coastal, tidal, fluvial and pluvial flooding both individually and in combination, be assessed in reciprocity to public- and ecological value?

Public Value

How can spatial interventions regarding flood risk reduction be integrated in existing restructuring plans to increase public value?

Ecological Value

In which conditions does ecological value de- or increase?

What conditions can be created to increase ecological value in urbanized waterfronts?

Main research question and three components with sub-questions. (By author)

Analyses existing conditions

Land use

Landuse is industry dominated

No access to waterfront

Limited public space

Data from: NYC Department of City Planning (2014). *Red Hook Transportation Study*

Natural elevation

Natural elevation of the area, many flood prone areas

Dutch dunes are our coastal defence, and are around 10 meters high.

Data from: NYC Mayor's Office of Recovery and Resiliency. (2017). *Red Hook Coastal Resilience Public Meeting rapport.*

Flood zones

A; AE; AO Zone have a 1% annual flooding chance

Coastal A Zone, 1% annual flooding chance and high wave energy

Higher areas host a 0,2% annual flooding chance

Data from: NYC Department of City Planning, NYC Mayor's Office. (2014). *Existing conditions and brownfields analysis Red Hook, Brooklyn.*

Sandy surge extent

Sandy aftermath shows why Red Hook is evacuation zone A

Inundation as high as 3 meters at specific places

Data from: NYC Department of City Planning, NYC Mayor's Office. (2014). *Existing conditions and brownfields analysis Red Hook, Brooklyn.*

Hurricane Sandy, by Daniel Krieger

Density

Density shows less people in Red Hook because of industrial character

Most people live in the Red Hook Houses

Social housing project to facilitate harbour workers

Data from: NYC Department of City Planning (2014). *Red Hook Transportation Study*

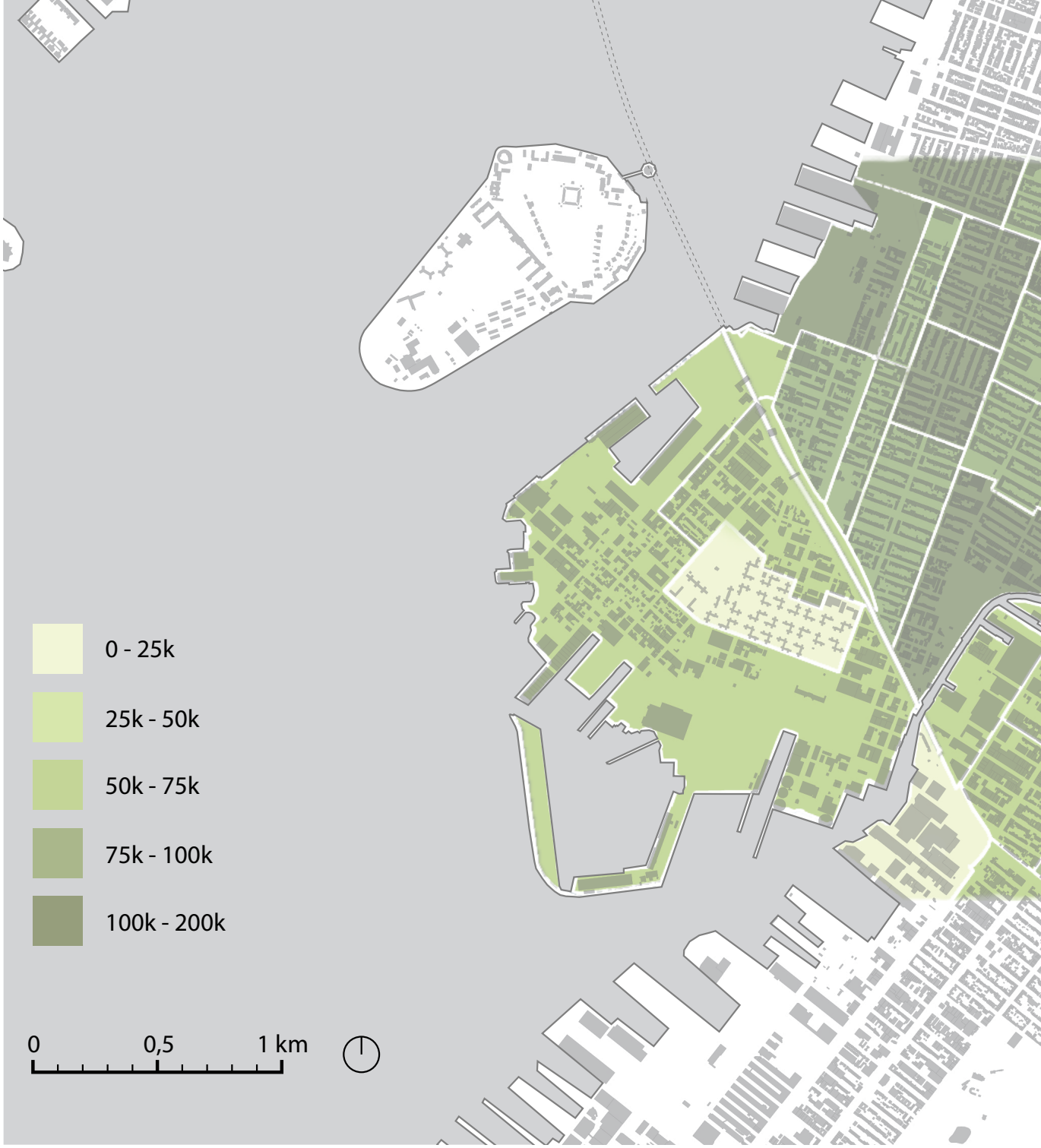
Red Hook Houses

Image from: NYC Department of City Planning (2014). *Red Hook Transportation Study.* p.12

Annual income

Big difference in income

RHH residents make less than 25k average



Data from: NYC Department of City Planning (2014).
Red Hook Transportation Study

Historic ecosystems

Red Hook used to be mostly water

Like most of NYC, natural ecosystems are replaced by hard man-made infrastructure

Tidal marshland provided natural habitat for diverse ecosystems.

Data from: NY Rising Community Reconstruction Plan (2014). *Red Hook - NY Rising Community Reconstruction Plan*

‘The big oyster’

New Yorkers ate a million oysters a day in the 19th centuary

Pearl street paved with crushed oyster shells

Industrial pollution and over-consumption completely exhausted oyster numbers

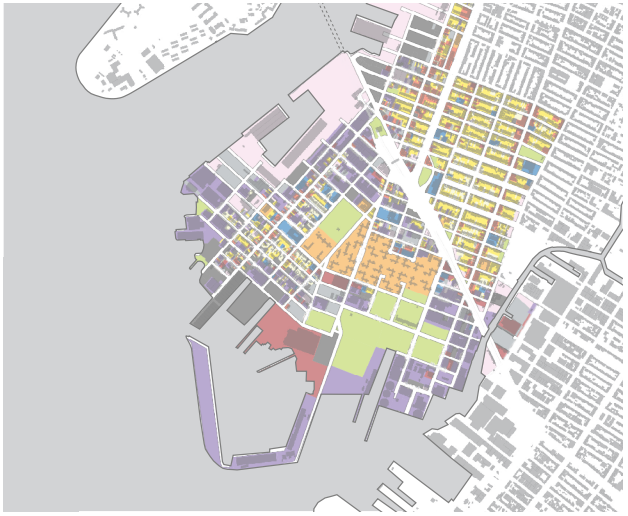
Reduce wave and surge energy

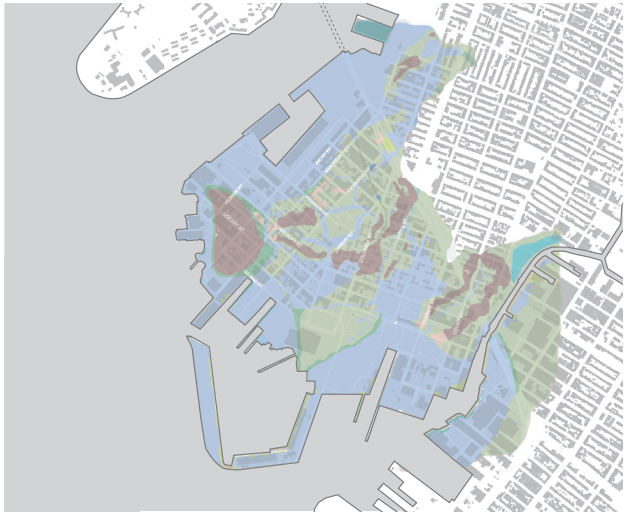
Cleaning water, capturing CO2

> “Two centuries ago, reefs composed of 3 trillion oysters were a “natural seawall” that served as a first line of defense for Manhattan against storms fiercer than 2012’s Hurricane Sandy,”
>
> Paul Greenberg

Image from: https://www.6sqft.com

Image from: https://99percentinvisible.org





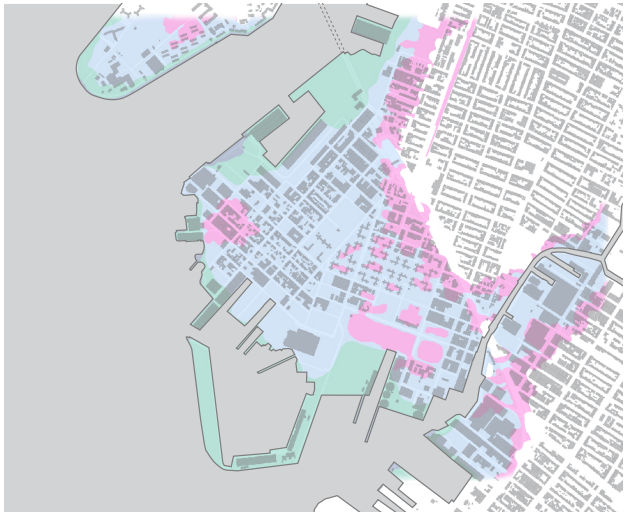


Image: 6sqft

Floodrisk

Public Value

Ecological Value

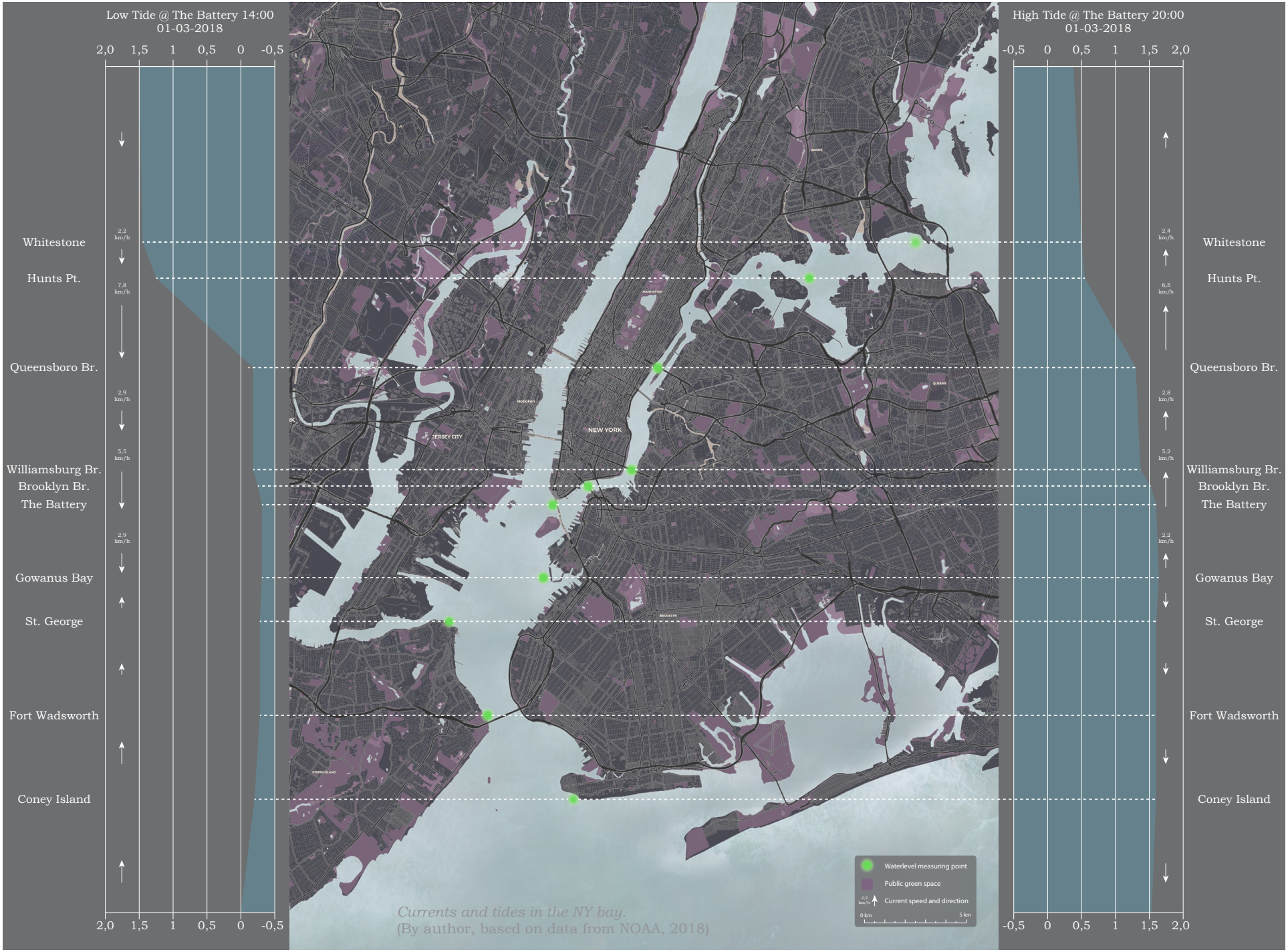
Dynamics of the New York Bay

Natural ecosystems

Wildlife habitats and natural waterfront

Red Hook stepping stone

Graphics by author, based on NYC DOCP vision 2020



Currents and tides in the NY bay.
(By author, based on data from NOAA, 2018)

Flow directions and salinity

Influences of tides

Gowanus bay area has a high salinity

Flow directions and salinity. (By author, based on MIT CAU + ZUS + De Urbanisten, 2014)

Sedimentation processes

Erosion and deposition of sediments in Hudson river

Large amounts are being deposited in front of Red Hook

Sedimentation erosion and deposition. (By author, data from Ralston, Geyer, Warner, Wall, 2015)

Bathymetry

Underwater island base is already established

Dredging of waterways is an ongoing project

Building the island will save money compared to using offshore dumping sites

Bathymetry of the New York Bay.
(By author, data from NOAA Bathymetry, 2018)

The plansite

Fieldwork

Edgar Westerhof, Flood risk & Resiliency Arcadis US

Ray Hall, Operations manager Van Brunt street warehouses

Edgar Westerhof Image from nareim.org, others by author


STOP
NO SMOKING
King Kong
G.C. Inc.
575 3rd AVE.
BROOKLYN NY 11215
TEL: 718-595-0330
CELL: 917-567-8848
LIC#: 032467


3303


27
VAN DYKE ST
SCHOOL BUS
STOP

The plansite

3 focus areas

Nearshore, Waterfront and Inland area

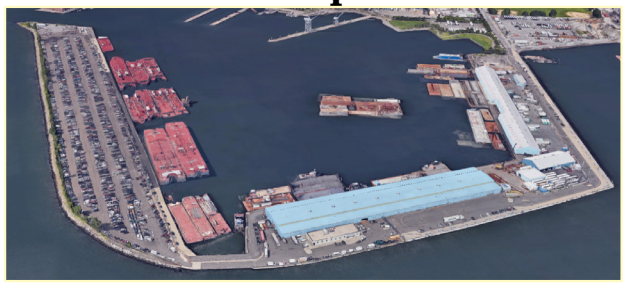
Three focus areas of the layered approach. (By author)

1. Historic warehouses

2. Brownfield area

3. IKEA terrain

4. NYPD auto impound



Images by Google maps, map by author

Jan Gehls quality criteria

12 criteria in 3 categories: Protection, Comfort and Enjoyment

1 = no
2 = in between
3 = yes

TWELVE URBAN QUALITY CRITERIA

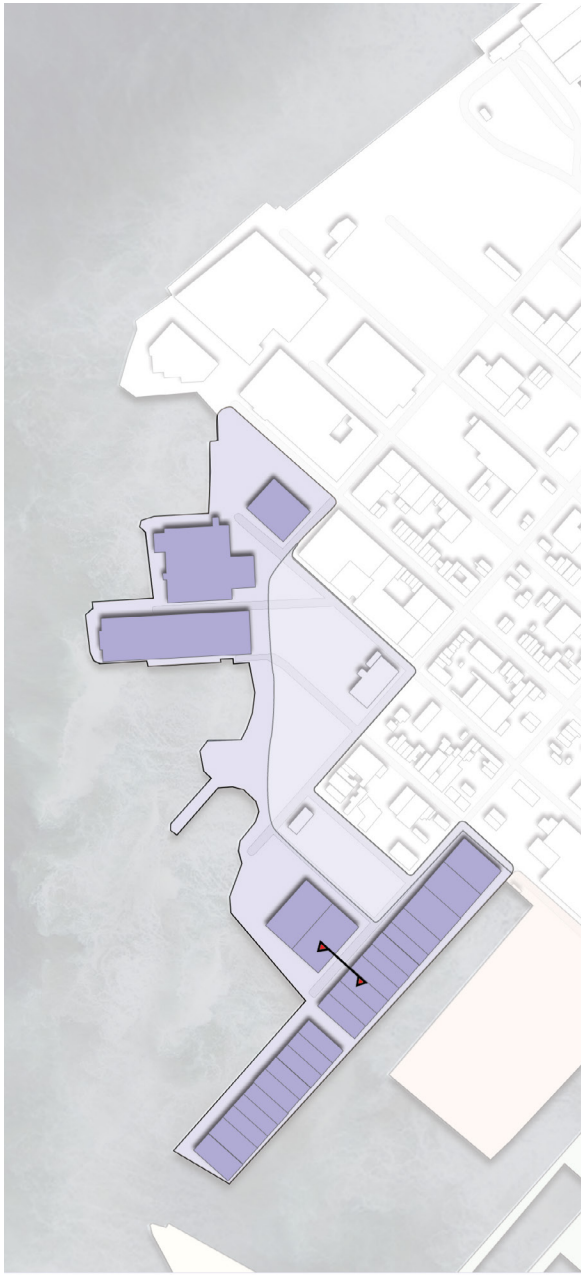
LOCATION:

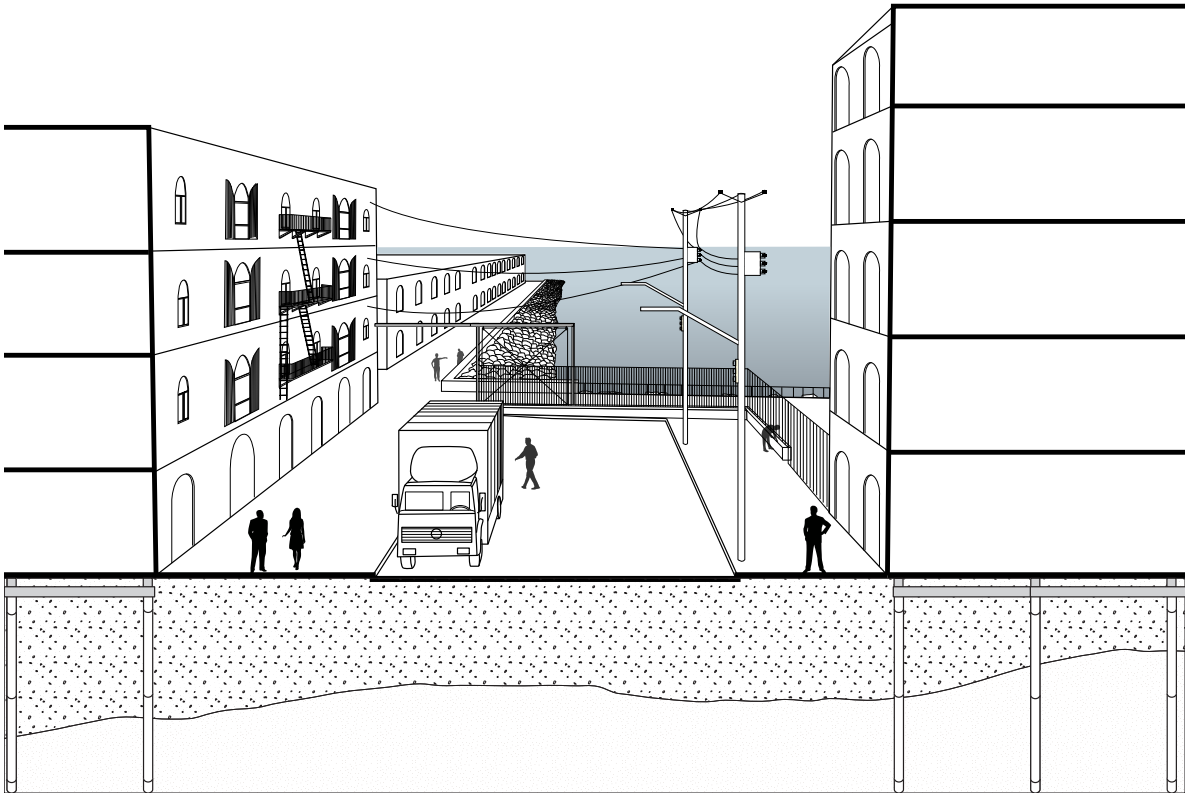
3 = YES
2 = IN BETWEEN
1 = NO

Protection	**Protection against traffic and accidents.** Do groups across age and ability experience traffic safety in the public space? Can one safely bike and walk without fear of being hit by a driver?	**Protection against harm by others.** Is the public space perceived to be safe both day and night? Are there people and activities at all hours of the day because the area has, for example, both residents and offices? Does the lighting provide safety at night as well as a good atmosphere?	**Protection against unpleasant sensory experience.** Are there noises, dust, smells, or other pollution? Does the public space function well when it's windy? Is there shelter from strong sun, rain, or minor flooding?
Comfort	**Options for mobility.** Is this space accessible? Are there physical elements that might limit or enhance personal mobility in the forms of walking, using of a wheelchair, or pushing a stroller? Is it evident how to move through the space without having to take an illogical detour?	**Options to stand and linger.** Does the place have features you can stay and lean on, like a façade that invites one to spend time next to it, a bus stop, a bench, a tree, or a small ledge or niche?	**Options for sitting.** Are there good primary seating options such as benches or chairs? Or is there only secondary seating such as a stair, seat wall, or the edge of a fountain? Are there adequate non-commercial seating options so that sitting does not require spending money?
	Options for seeing. Are seating options placed so there are interesting things to look at?	**Options for talking and listening/ hearing.** Is it possible to have a conversation here? Is it evident that you have the option to sit together and have a conversation?	**Options for play, exercise, and activities.** Are there options to be active at multiple times of the day and year?
Enjoyment	**Scale.** Is the public space and the building that surrounds it at a human scale? If people are at the edges of the space, can we still relate to them as people or are they lost in their surroundings?	**Opportunities to enjoy the positive aspects of climate.** Are local climatic aspects such as wind and sun taken into account? Are there varied conditions for spending time in public spaces at different times of year? With this in mind, where are the seating options placed? Are they located entirely in the shadows or the sun? And how are they oriented/ placed in relation to wind? Are they protected?	**Experience of aesthetic qualities and positive sensory experiences.** Is the public space beautiful? Is it evident that there is good design both in terms of how things are shaped, as well as their durability?

Twelve urban quality criteria. (Jan Gehl, 2011)

Typology 1: Historic warehouses





TWELVE URBAN QUALITY CRITERIA — Total score: 30

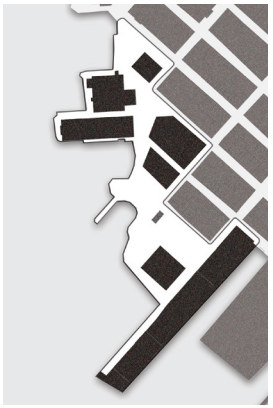
LOCATION: Historic warehouses, waterfront

Protection	Protection against traffic and accidents. 3	Protection against harm by others. 2	Protection against unpleasant sensory experience. 1
Comfort	Options for mobility. 3	Options to stand and linger. 2	Options for sitting. 3
	Options for seeing. 3	Options for talking and listening/ hearing. 3	Options for play, exercise, and activities. 2
Enjoyment	Scale. 3	Opportunities to enjoy the positive aspects of climate. 2	Experience of aesthetic qualities and positive sensory experiences. 3

TWELVE URBAN QUALITY CRITERIA — Total score: 19

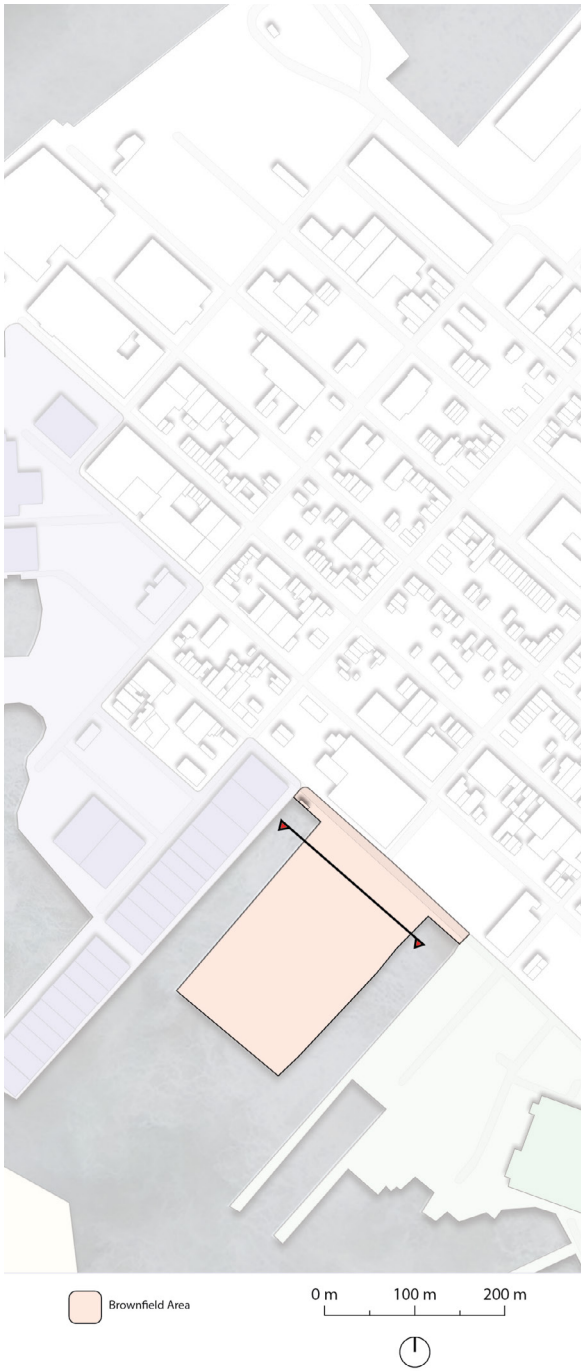
LOCATION: Historic warehouses, streets

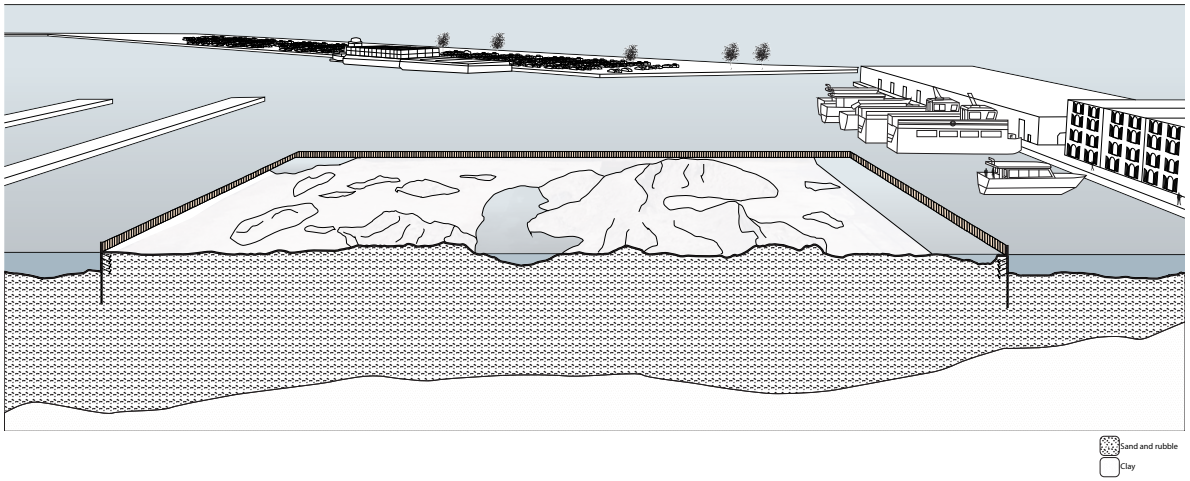
Protection	Protection against traffic and accidents. 1	Protection against harm by others. 2	Protection against unpleasant sensory experience. 2
Comfort	Options for mobility. 3	Options to stand and linger. 1	Options for sitting. 1
	Options for seeing. 2	Options for talking and listening/ hearing. 1	Options for play, exercise, and activities. 2
Enjoyment	Scale. 2	Opportunities to enjoy the positive aspects of climate. 1	Experience of aesthetic qualities and positive sensory experiences. 1



Graphics by author

Typology 2: Brownfield area

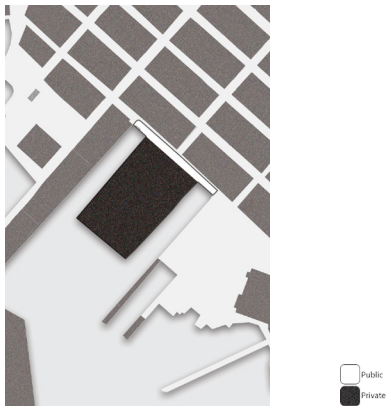




TWELVE URBAN QUALITY CRITERIA Total score: 13

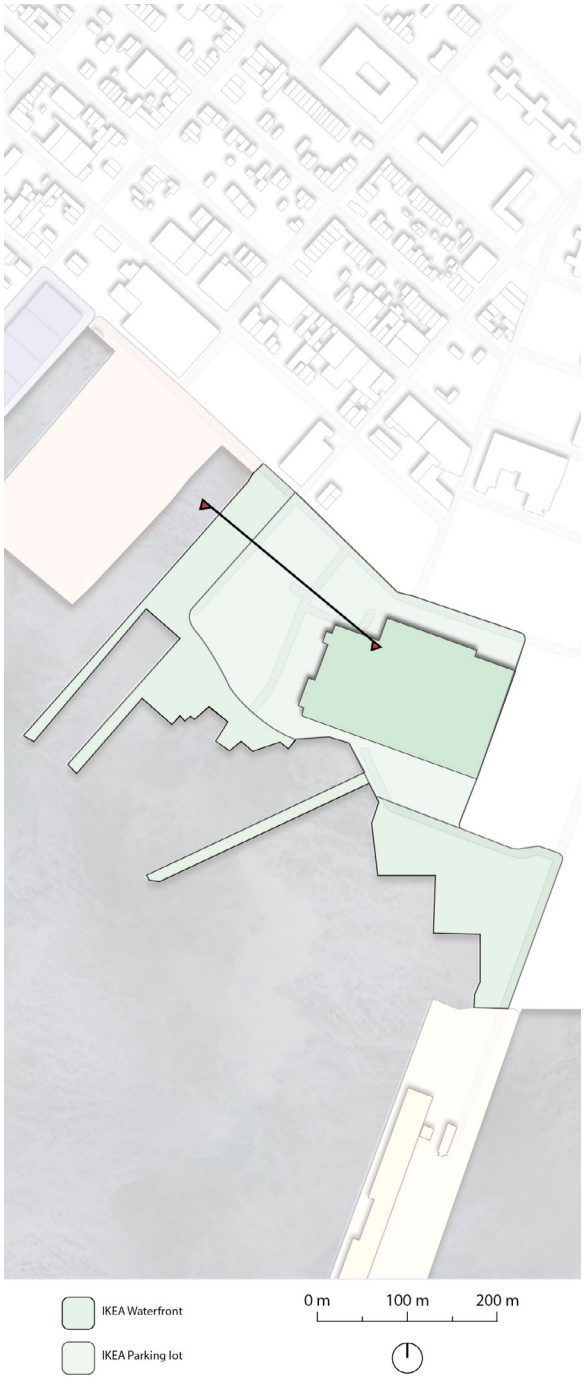
LOCATION: Brownfield Area

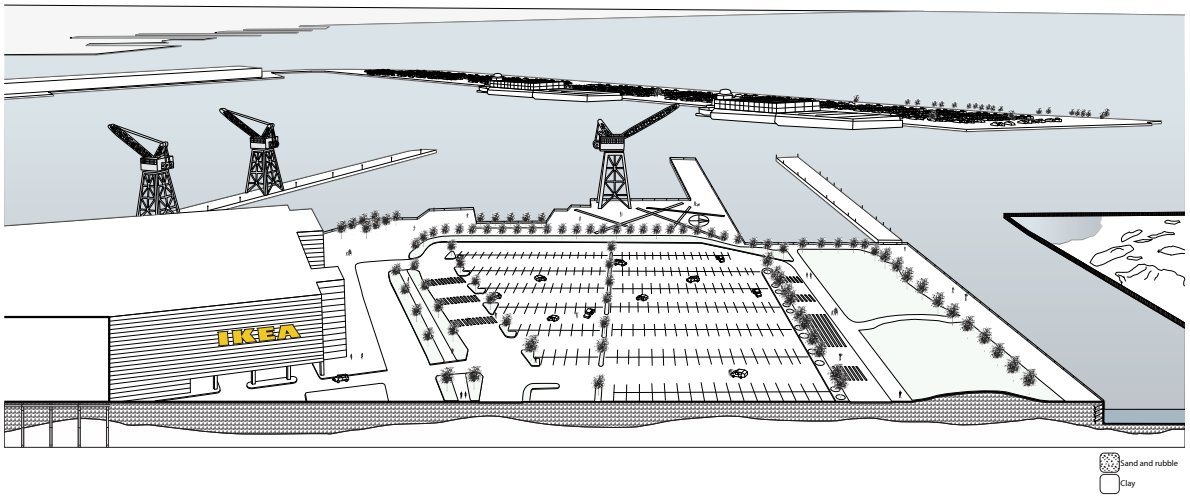
Protection	Protection against traffic and accidents. 1	Protection against harm by others. 1	Protection against unpleasant sensory experience. 1
Comfort	Options for mobility. 1	Options to stand and linger. 1	Options for sitting. 1
	Options for seeing. 2	Options for talking and listening/ hearing. 1	Options for play, exercise, and activities. 1
Enjoyment	Scale. 1	Opportunities to enjoy the positive aspects of climate. 1	Experience of aesthetic qualities and positive sensory experiences. 1



Graphics by author

Typology 3: IKEA terrain





TWELVE URBAN QUALITY CRITERIA — Total score: 29

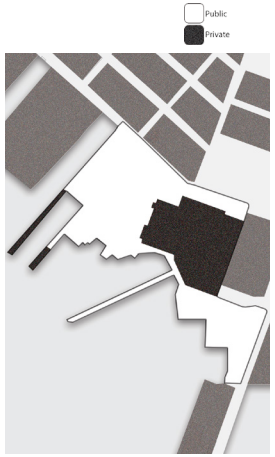
LOCATION: IKEA waterfront

Protection	Protection against traffic and accidents. 3	Protection against harm by others. 2	Protection against unpleasant sensory experience. 2
Comfort	Options for mobility. 3	Options to stand and linger. 2	Options for sitting. 3
	Options for seeing. 3	Options for talking and listening/ hearing. 3	Options for play, exercise, and activities. 2
Enjoyment	Scale. 2	Opportunities to enjoy the positive aspects of climate. 2	Experience of aesthetic qualities and positive sensory experiences. 2

TWELVE URBAN QUALITY CRITERIA — Total score: 19

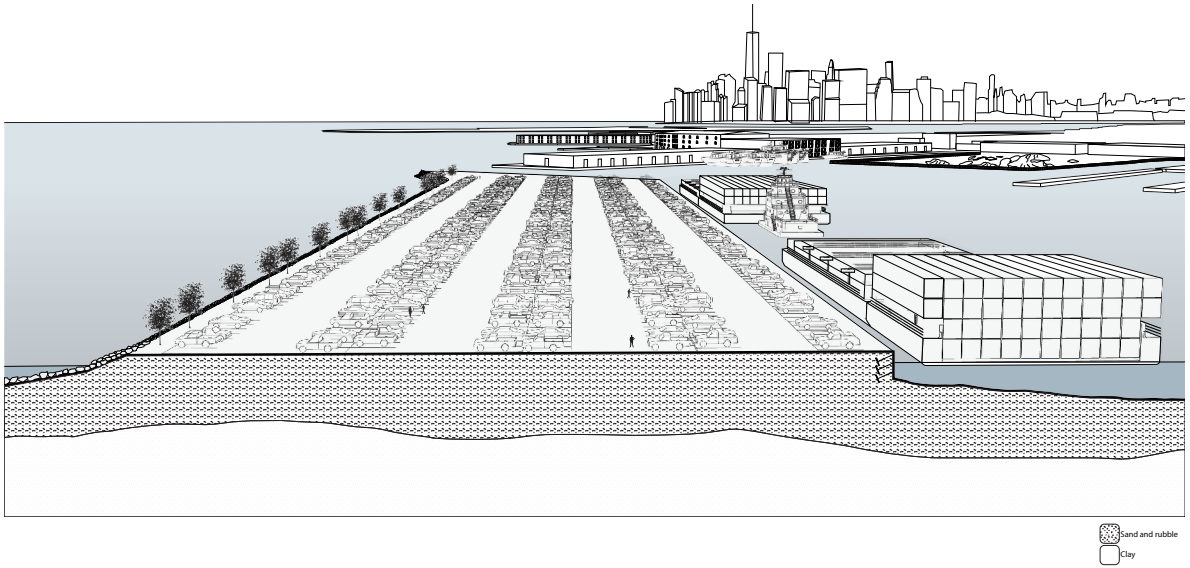
LOCATION: IKEA parking lot

Protection	Protection against traffic and accidents. 2	Protection against harm by others. 2	Protection against unpleasant sensory experience. 2
Comfort	Options for mobility. 3	Options to stand and linger. 2	Options for sitting. 1
	Options for seeing. 1	Options for talking and listening/ hearing. 1	Options for play, exercise, and activities. 1
Enjoyment	Scale. 1	Opportunities to enjoy the positive aspects of climate. 2	Experience of aesthetic qualities and positive sensory experiences. 1



Graphics by author

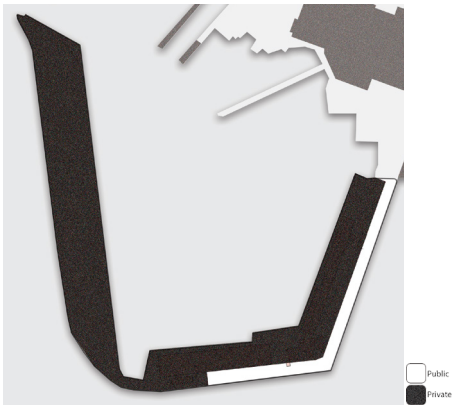
Typology 4: NYPD Auto Impound



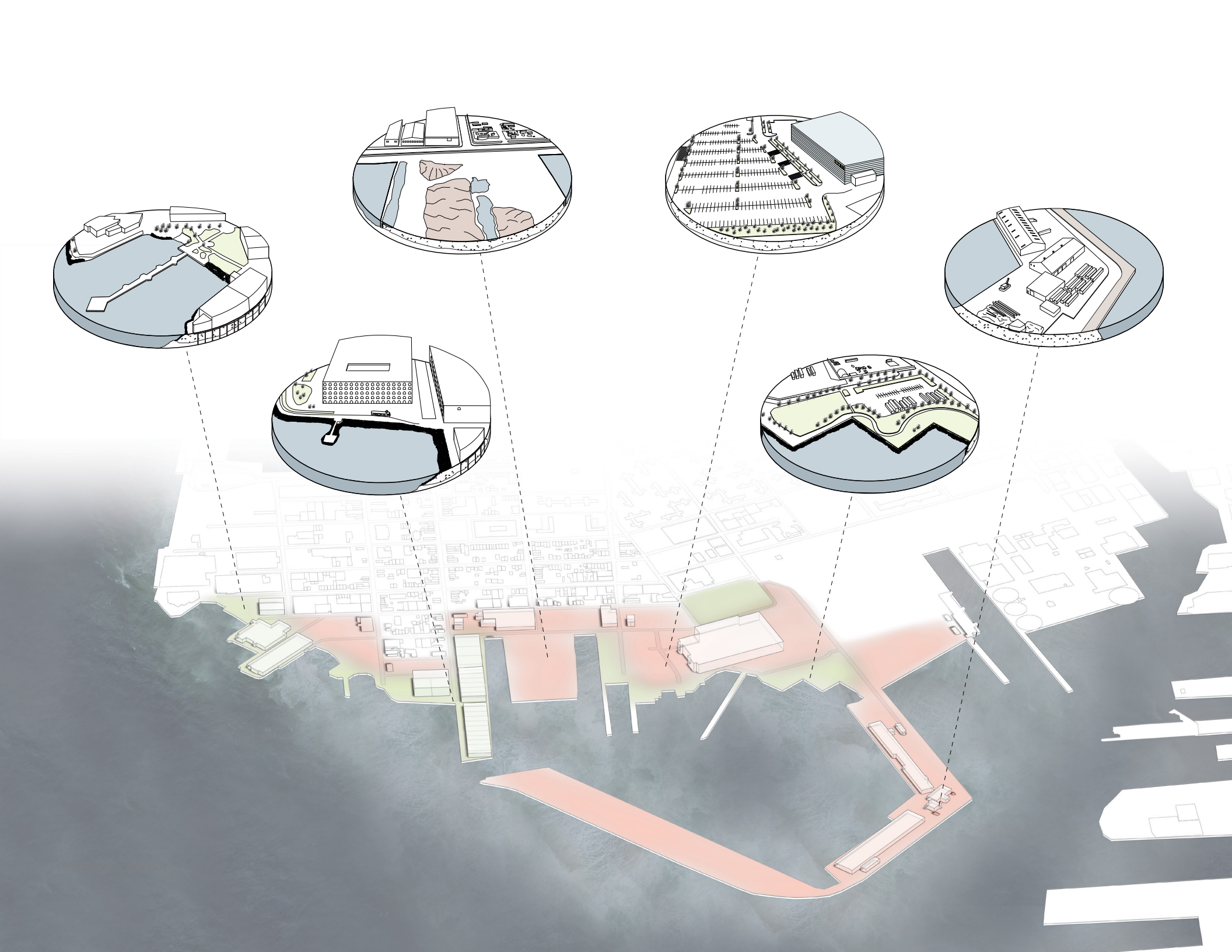
TWELVE URBAN QUALITY CRITERIA Total score: 17

LOCATION: NYPD Auto Impound

Protection	Protection against traffic and accidents. 1	Protection against harm by others. 3	Protection against unpleasant sensory experience. 1
Comfort	Options for mobility. 3	Options to stand and linger. 1	Options for sitting. 1
	Options for seeing. 2	Options for talking and listening/ hearing. 1	Options for play, exercise, and activities. 1
Enjoyment	Scale. 1	Opportunities to enjoy the positive aspects of climate. 1	Experience of aesthetic qualities and positive sensory experiences. 1



Graphics by author



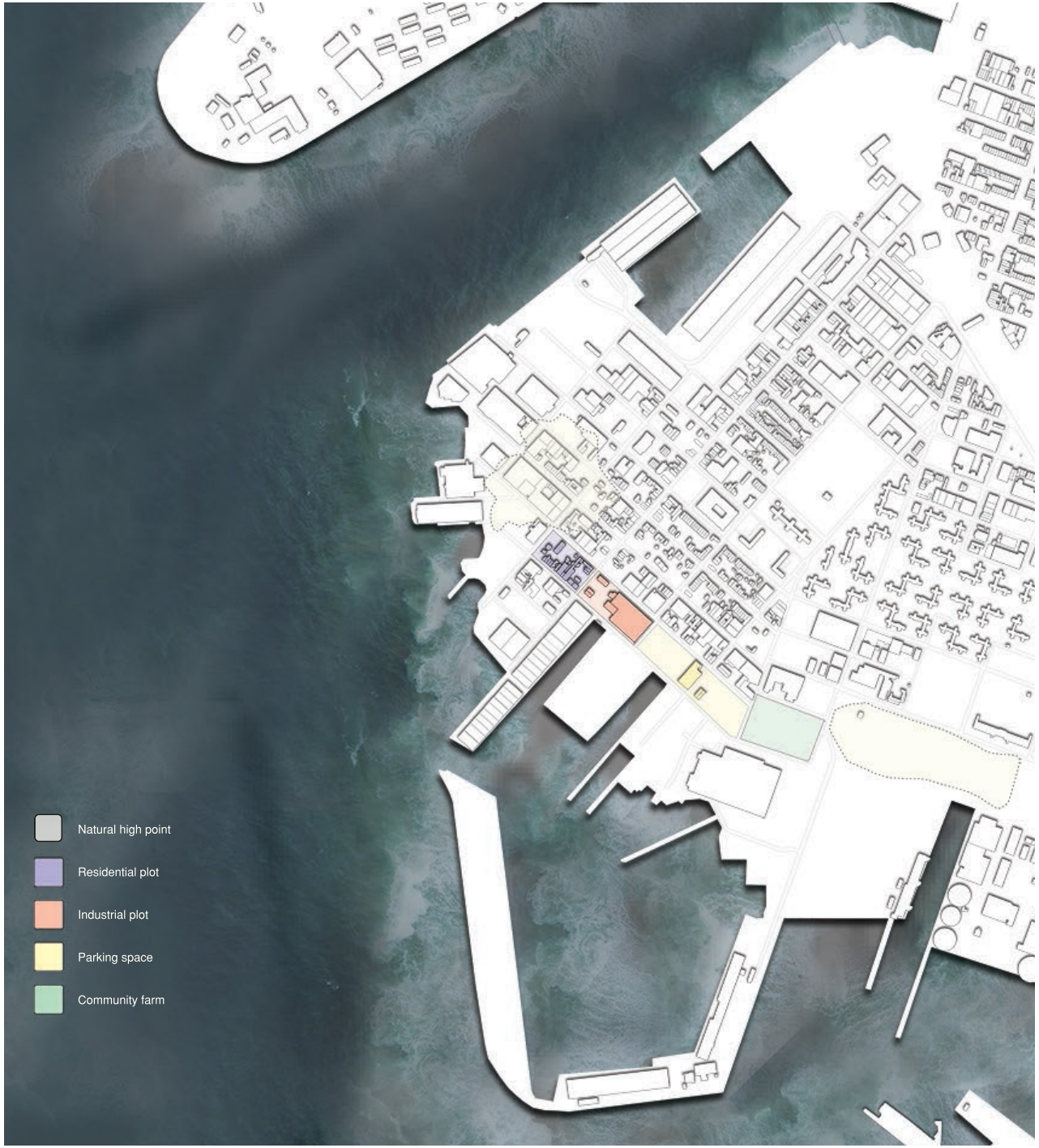
1. Residential plot

2. Industrial plot

3. Parking space

4. Community farm

Images by Google maps, map by author

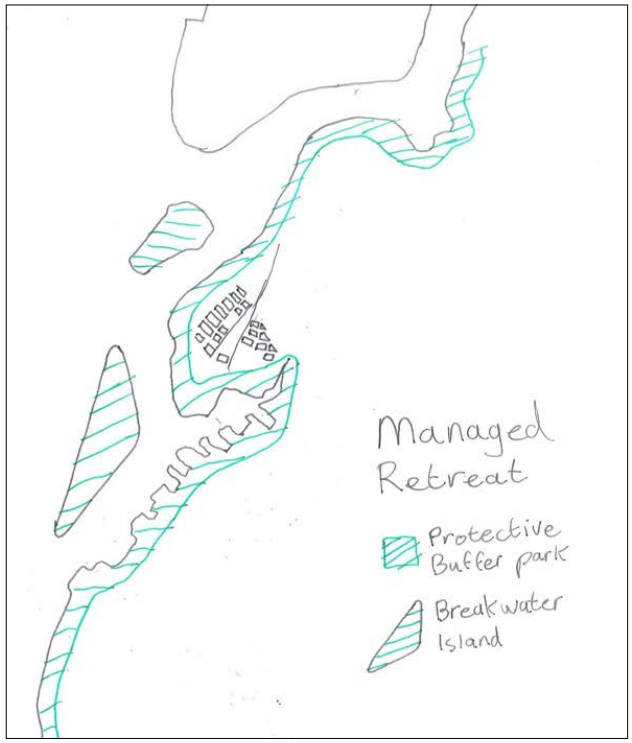


The design

Managed Retreat

=

Extreme flood risk reduction



Public Development

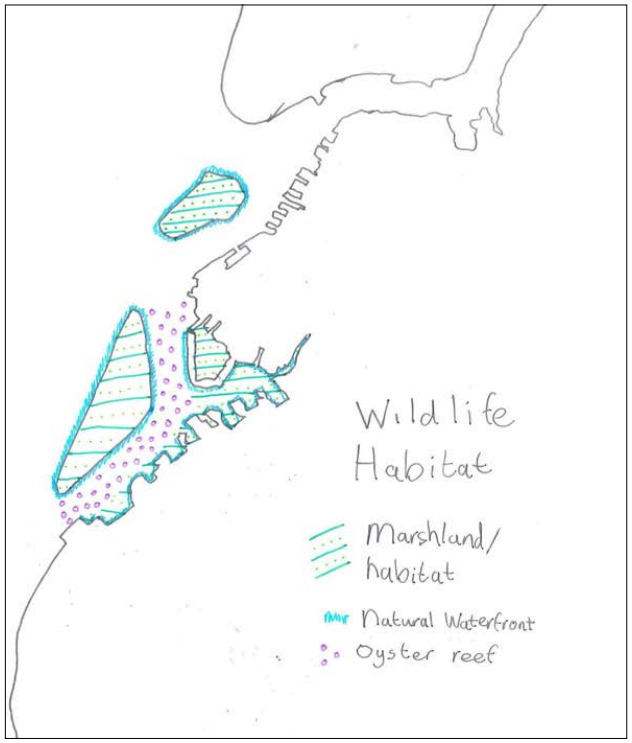
=

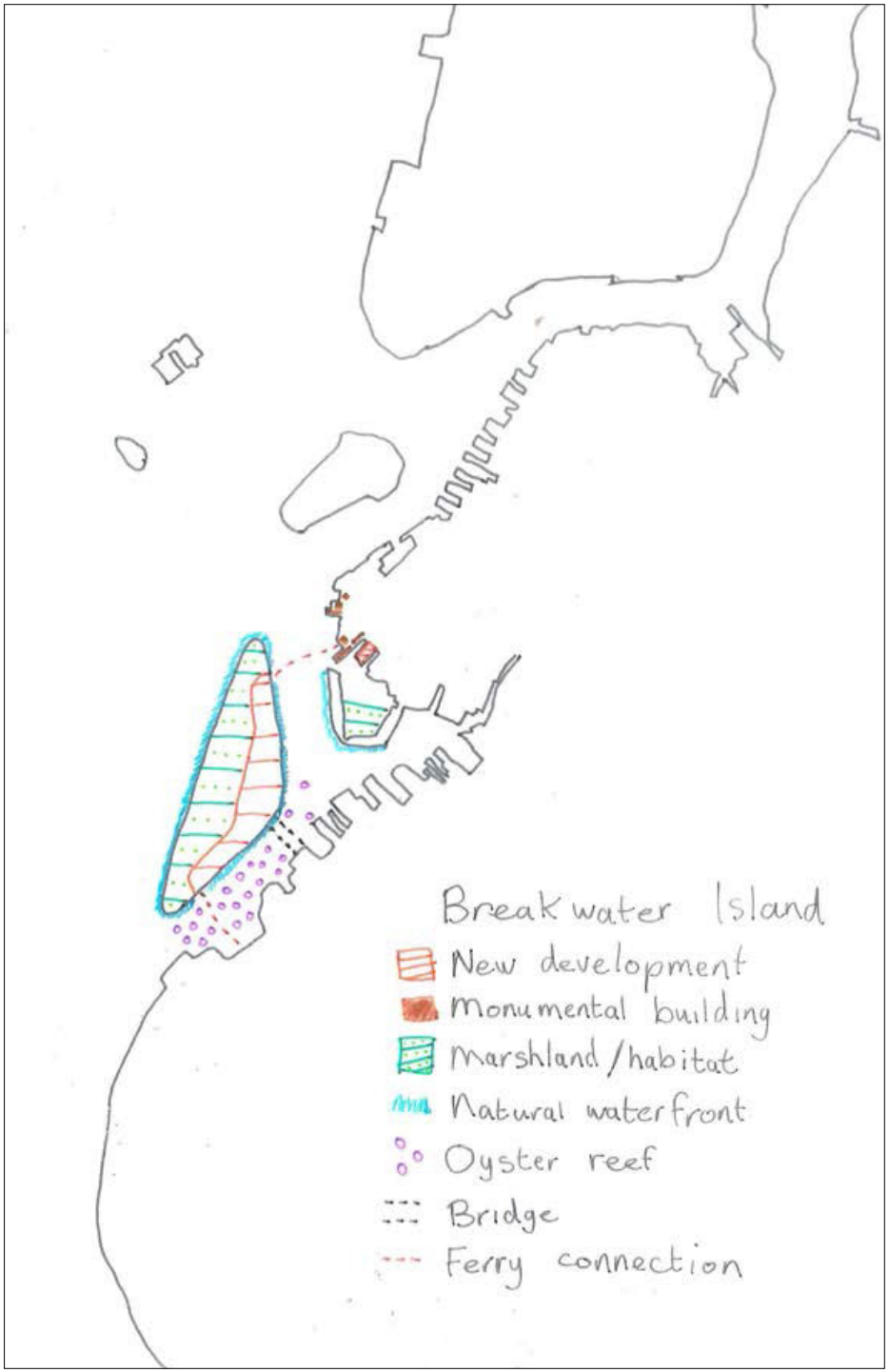
Extreme public value

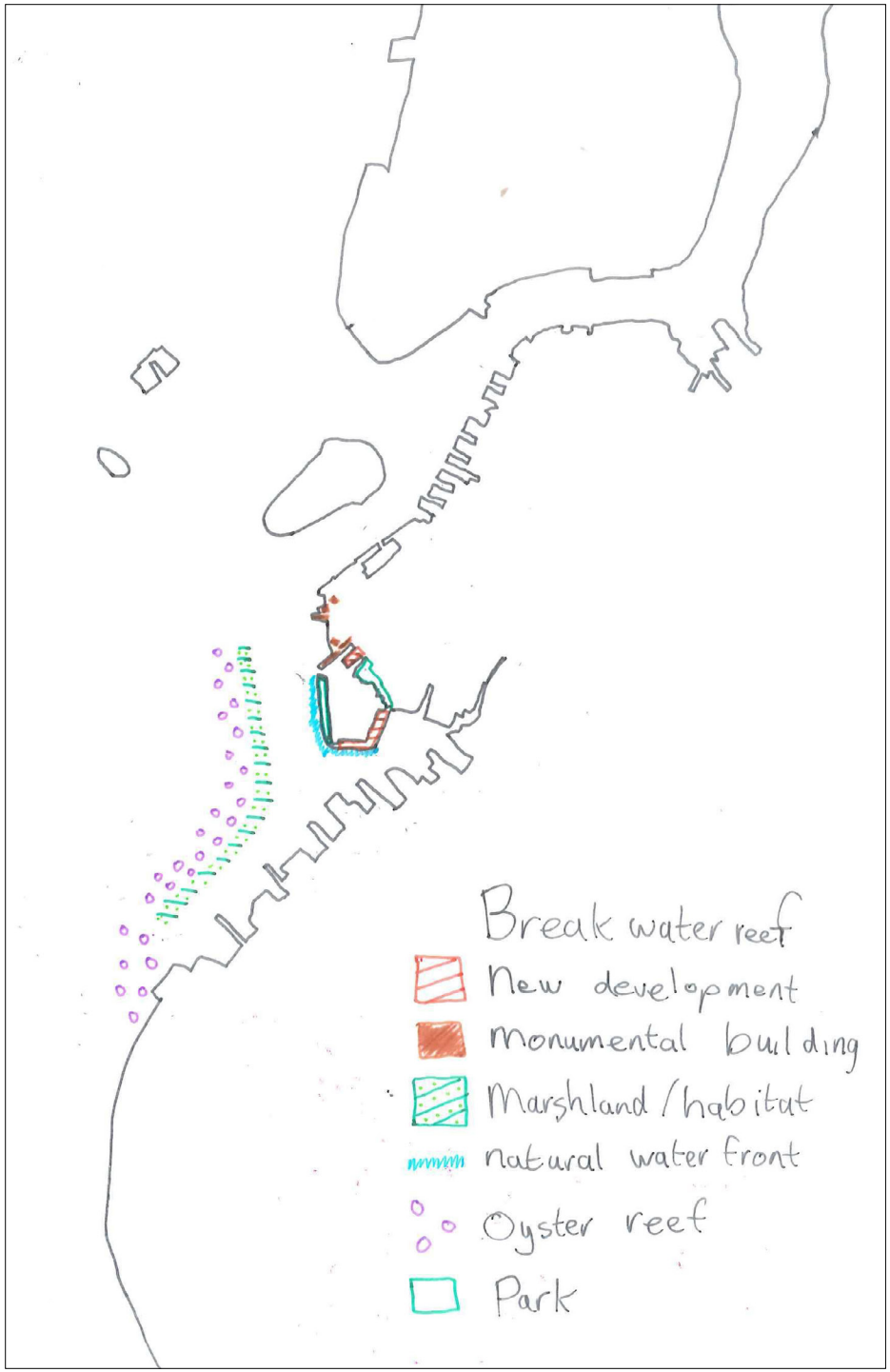
Wildlife Habitat

=

Extreme ecological value




Break water Island
New development
Monumental building
Marshland / habitat
Natural waterfront
Oyster reef
Bridge
Ferry connection


Break water reef
New development
Monumental building
Marshland / habitat
natural water front
Oyster reef
Park

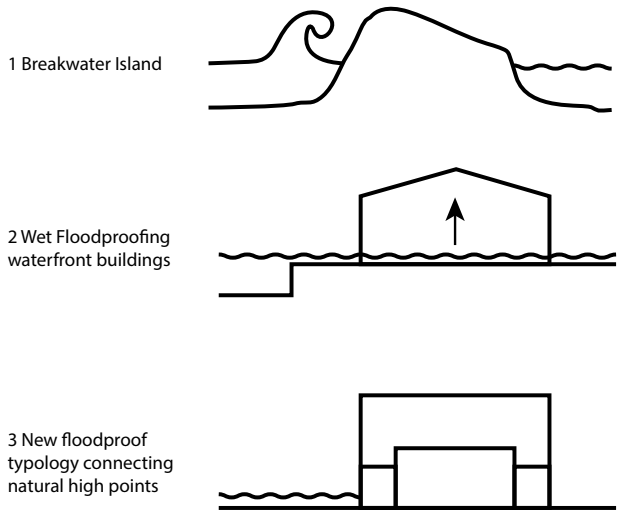
Areas of development

Nearshore, Waterfront and Inland area all have own characteristic opportunities and limitations

Slowing down wave energy in Nearshore area

Wet floodproofing Waterfront area

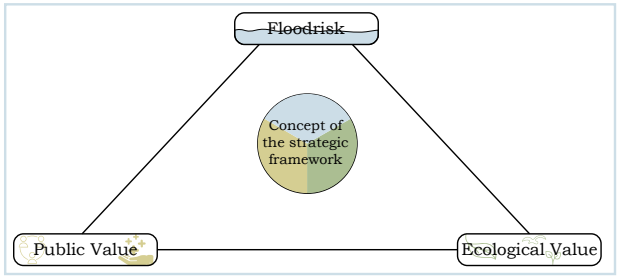
Floodproof typology Inland area

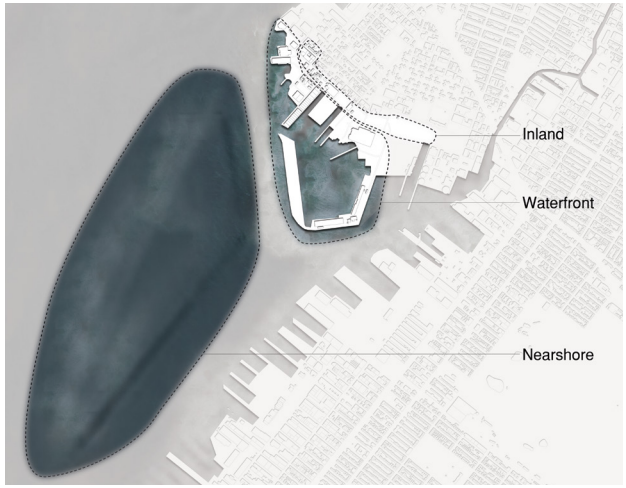


Planmap and three layers of flood protection. (By author)

3 components, 3 focus areas

Components of strategic approach; Flood risk, Public- and Ecological value are addressed across the 3 areas





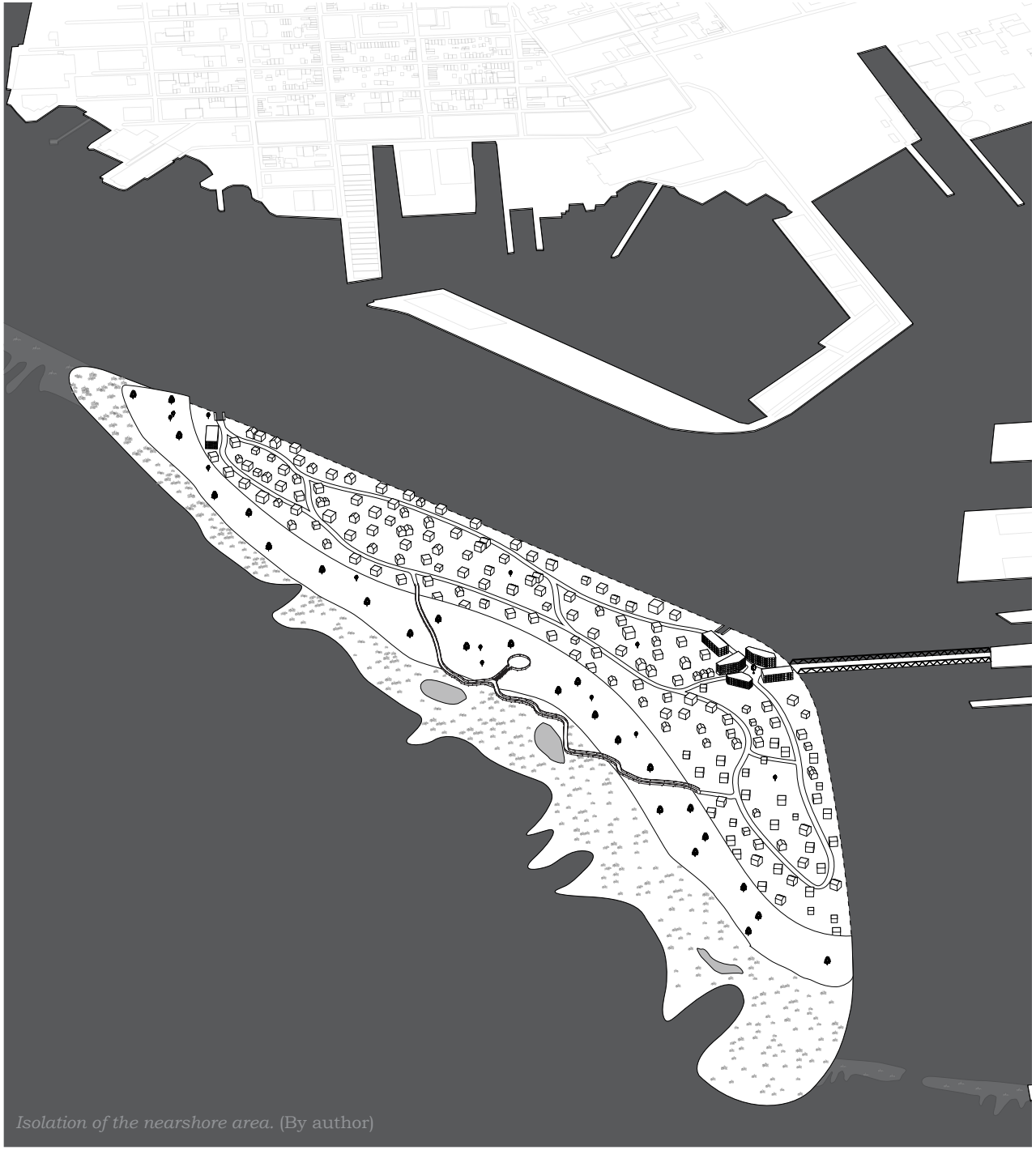
Framework, focus areas and planmap isometric. (By author)

Isometric overview of the design. (By author)

Floodrisk

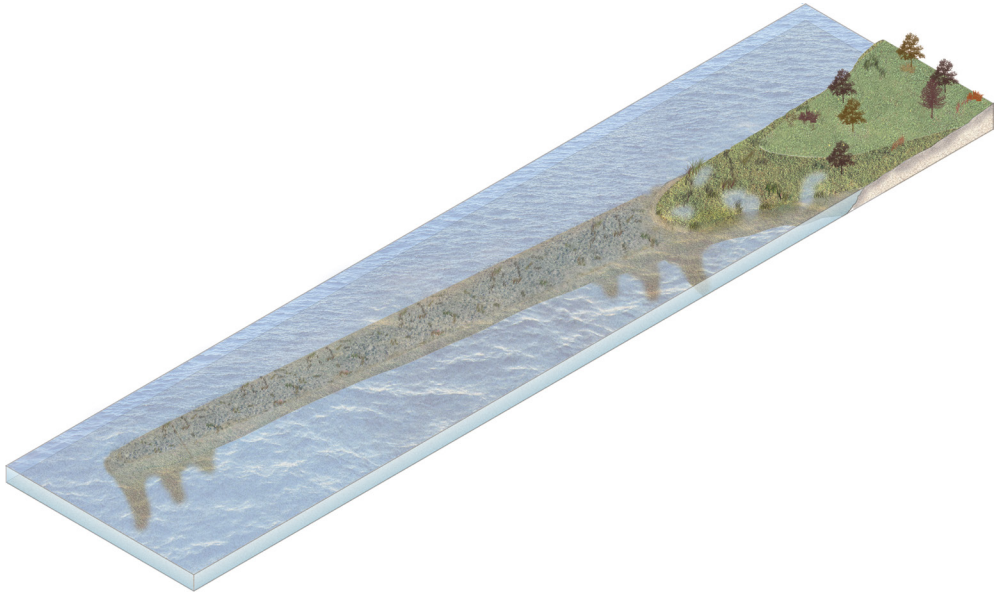
Public value

Ecological value

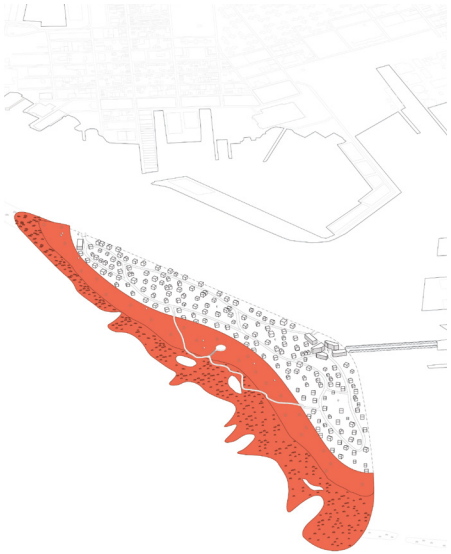


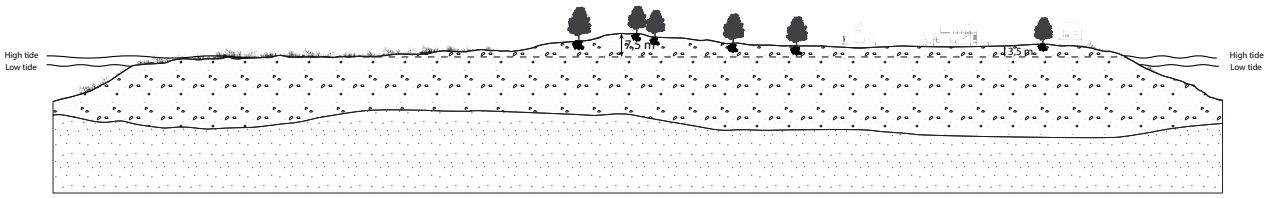
Isolation of the nearshore area. (By author)

Breakwaters



Marshland and berm

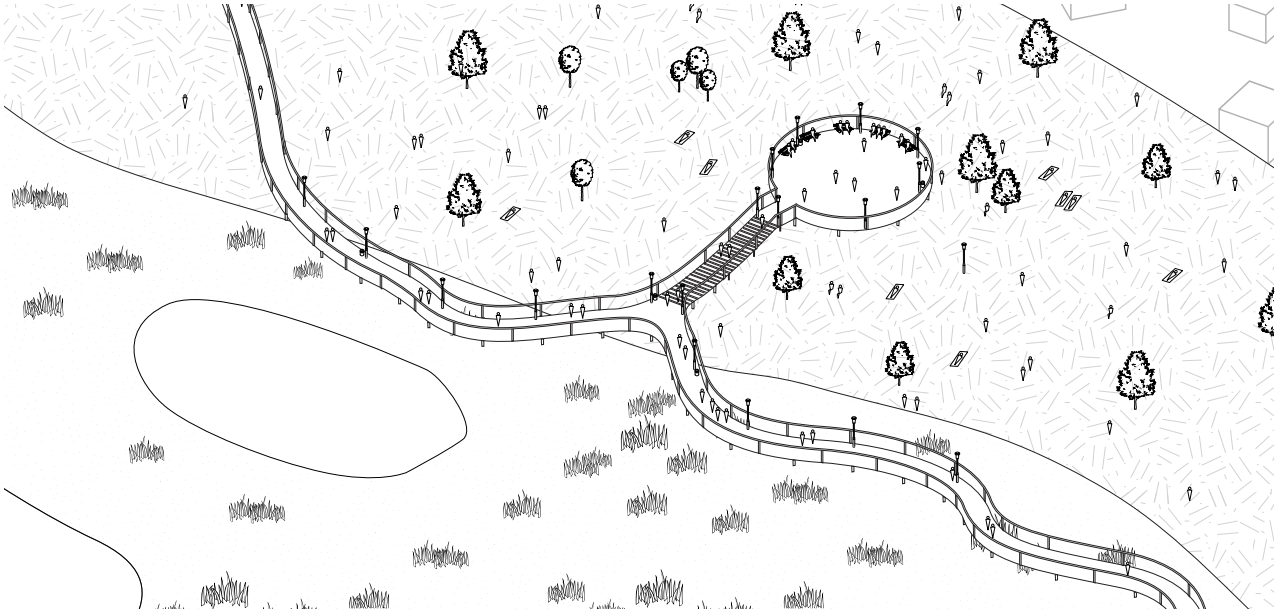




Graphics by author

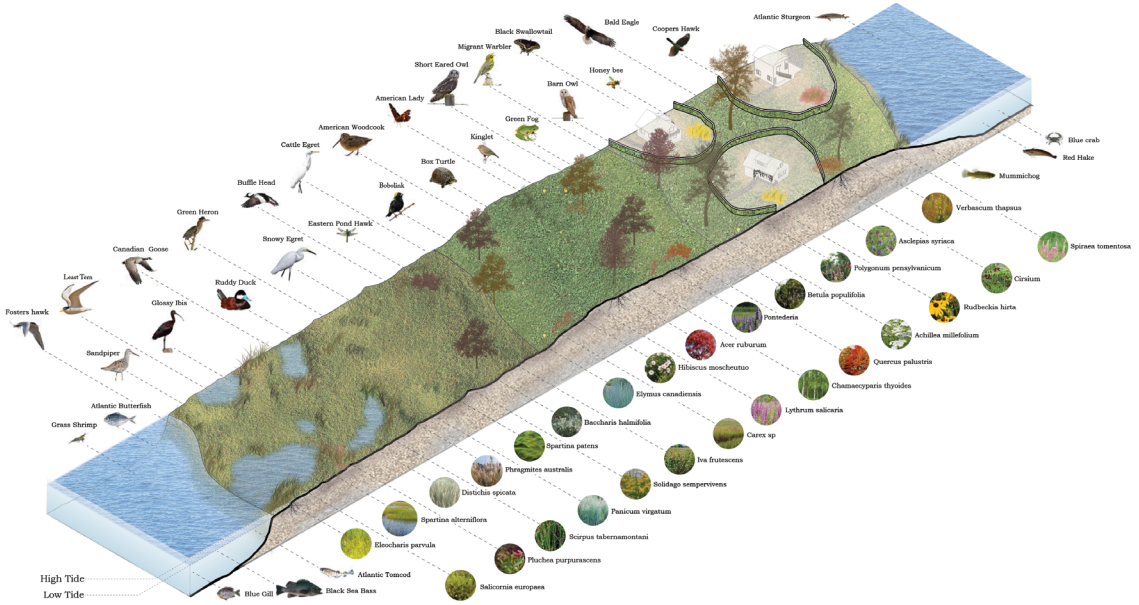
Free development plots

Walking promenade

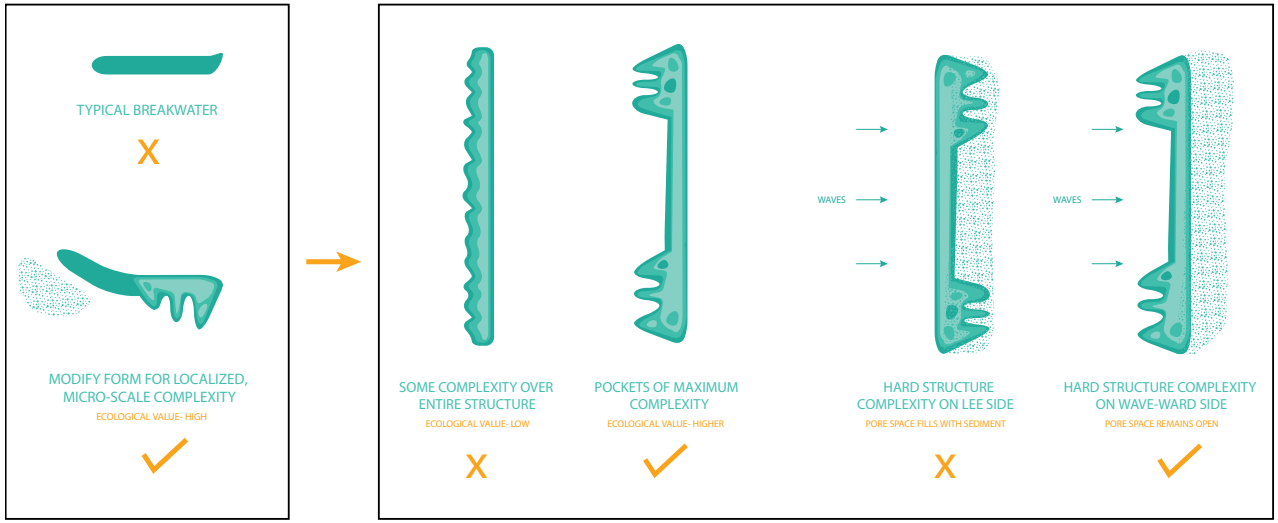


Graphics by author

Marshland



Breakwaters



Graphics by author

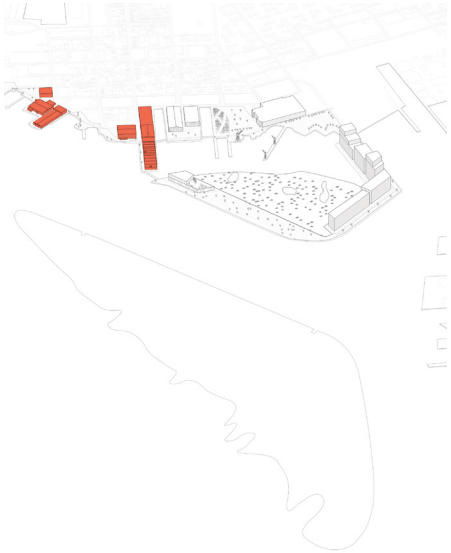
Floodrisk

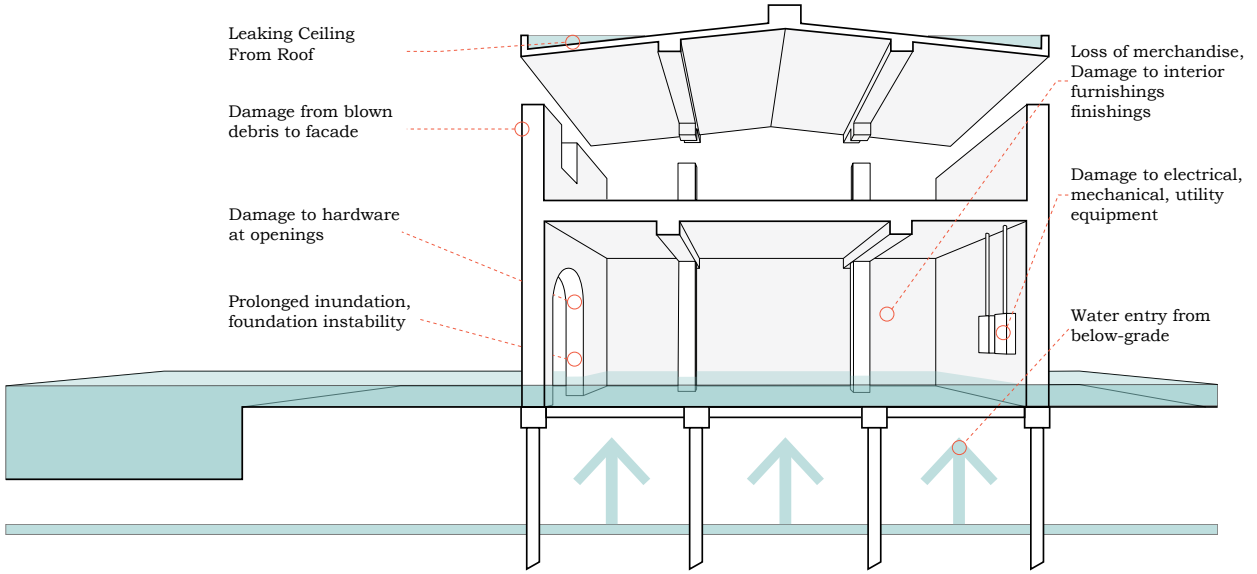
Public value

Ecological value

Isolation of the waterfront area. (By author)

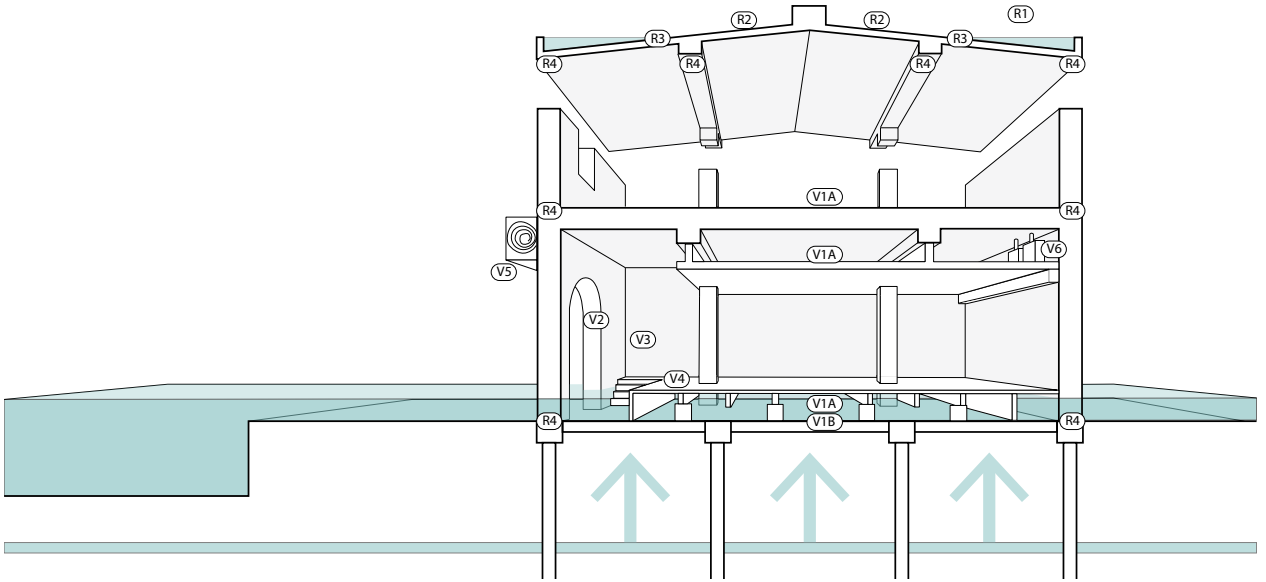
Floodproofing warehouses





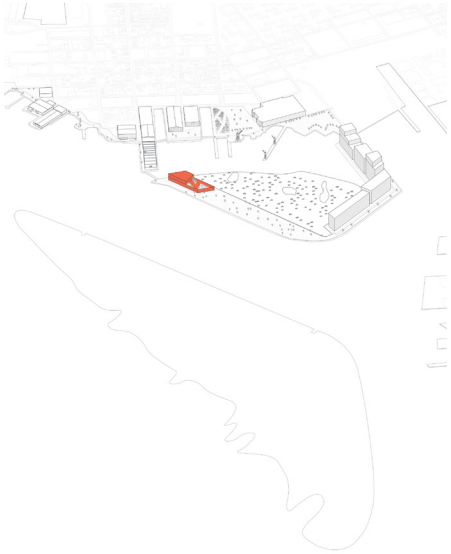
R1: Anchor roof-mounted gear
R2: Seal roof deck
R3: Retrofit w/ ring shank nails
R4: Hurricane straps (Simpson ties)

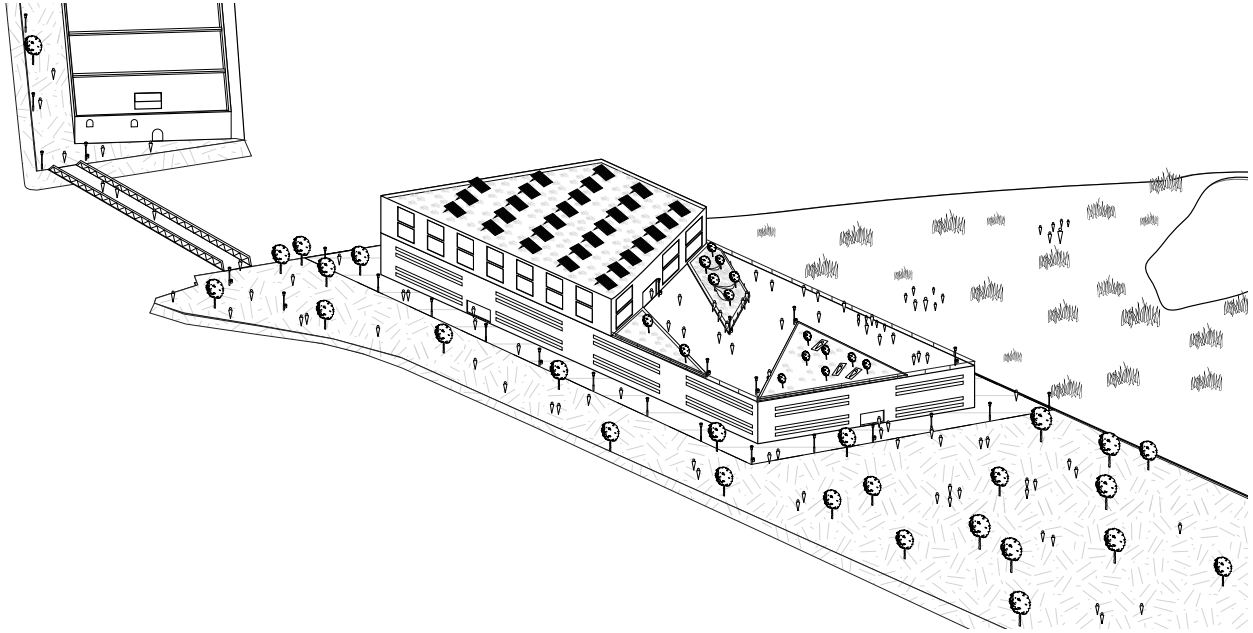
V1A: Mezzanine/attic/2nd floor
V1B: Pulley & Backflow valve
V2: Caulking and sealants
V3: Water resistant int. finishes
V4: Elevate 1st floor
V5: Roll down door
V6: Raise electrical outlet/boxes



Weaknesses and interventions warehouses. (Based on HR&A Advisors, Cooper, Robertson & Partners, 2014)

Waterfront museum

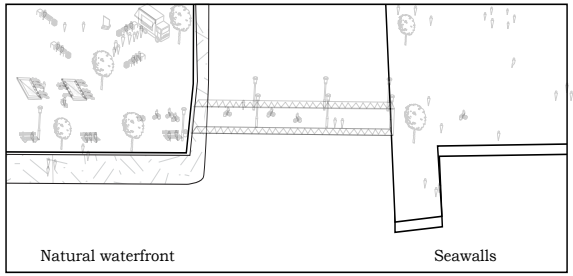


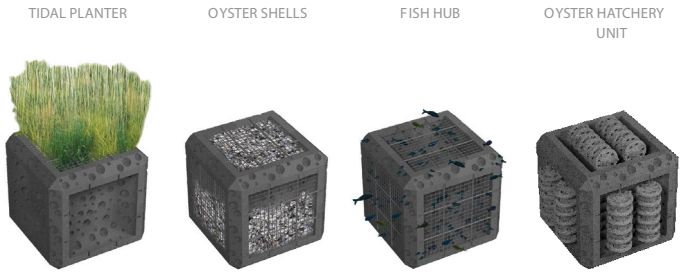


Waterfront parks

Graphics by author

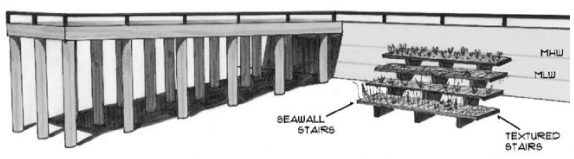
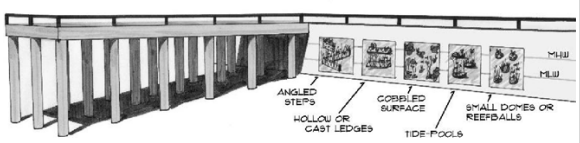
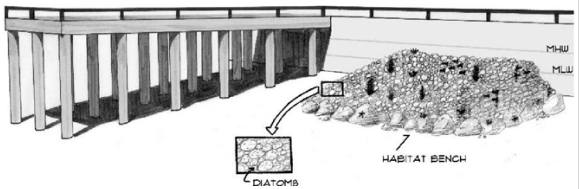
Ecological waterfronts



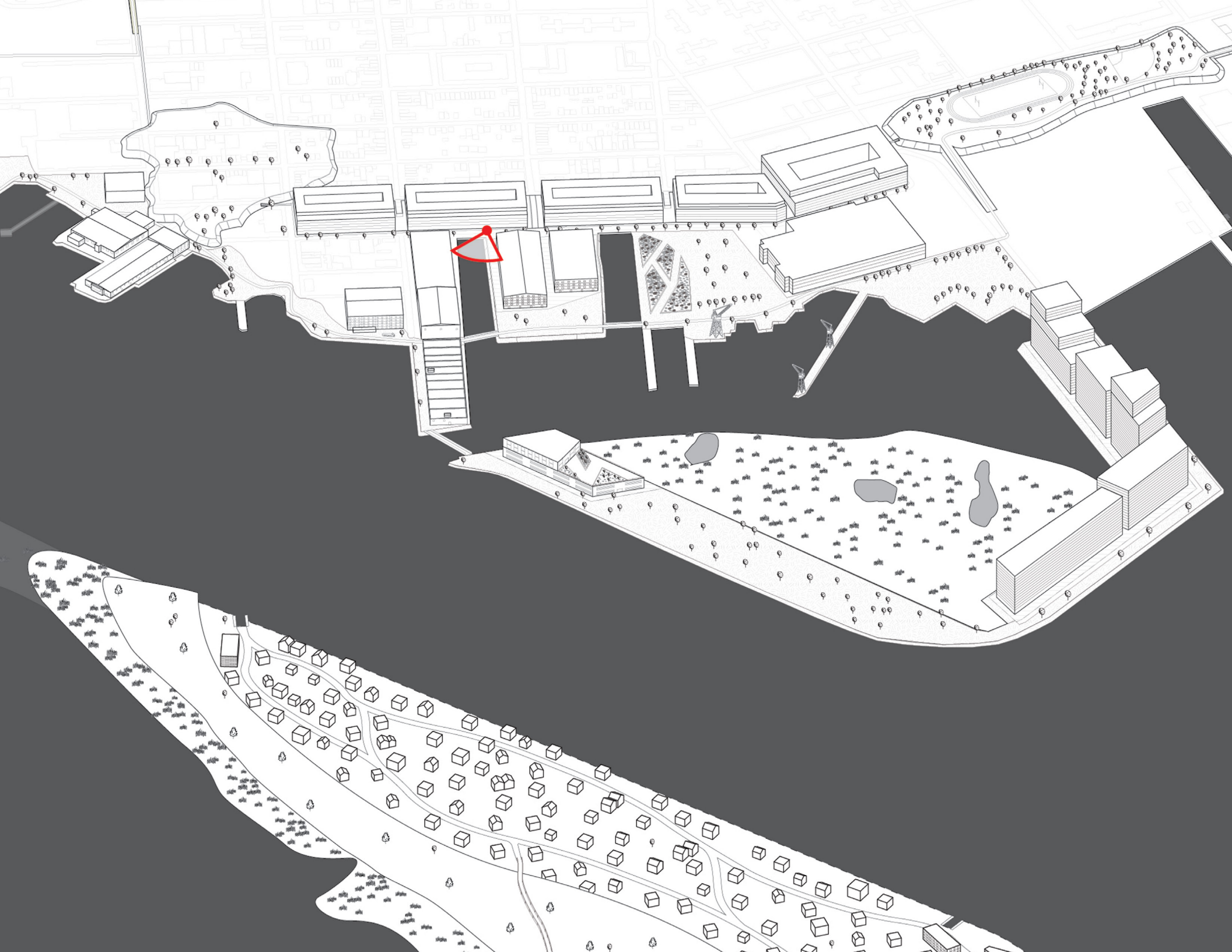


Econcrete units. (Scape / Landscape Architecture PLLC, 2014)

Altenative options for creating biodiversity in seawall environments

	Impression	Key benefits	Succesful examples	References
Seawall stairs		- Reintroduce microhabitats through tidepools - Increase intertidal habitat - Reintroduce shallow water habitat to benefit fish, vegetation, etc.	Vancouver Convention Center	Slogan, 2011 EBA, 2011
Seawall texturing		- Reintroduce microhabitats through tidepools - Create diverse surface orientations (horizontal, diagonal, vertical).	Seattle Seawall	Goff, 2008 Goff, 2010
Habitat benches		- Increase intertidal habitat - Reintroduce shallow water habitat to benefit fish, vegetation, etc - Protect seawall structural integrity from erosion	Olympic Sculpture Park Seattle	Toft et al., 2012 Toft et al., 2013

Ecological waterfront options. (Dyson & Yocom, 2014)



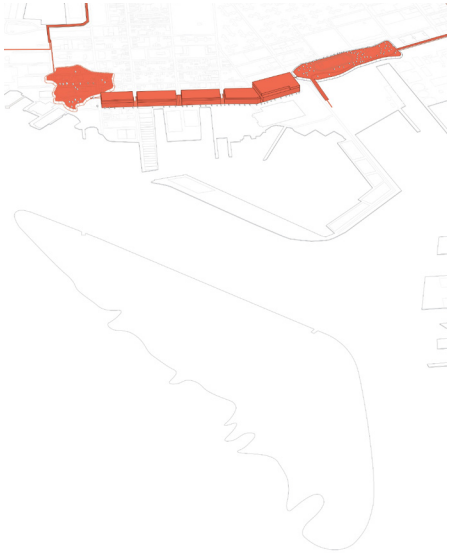
Floodrisk

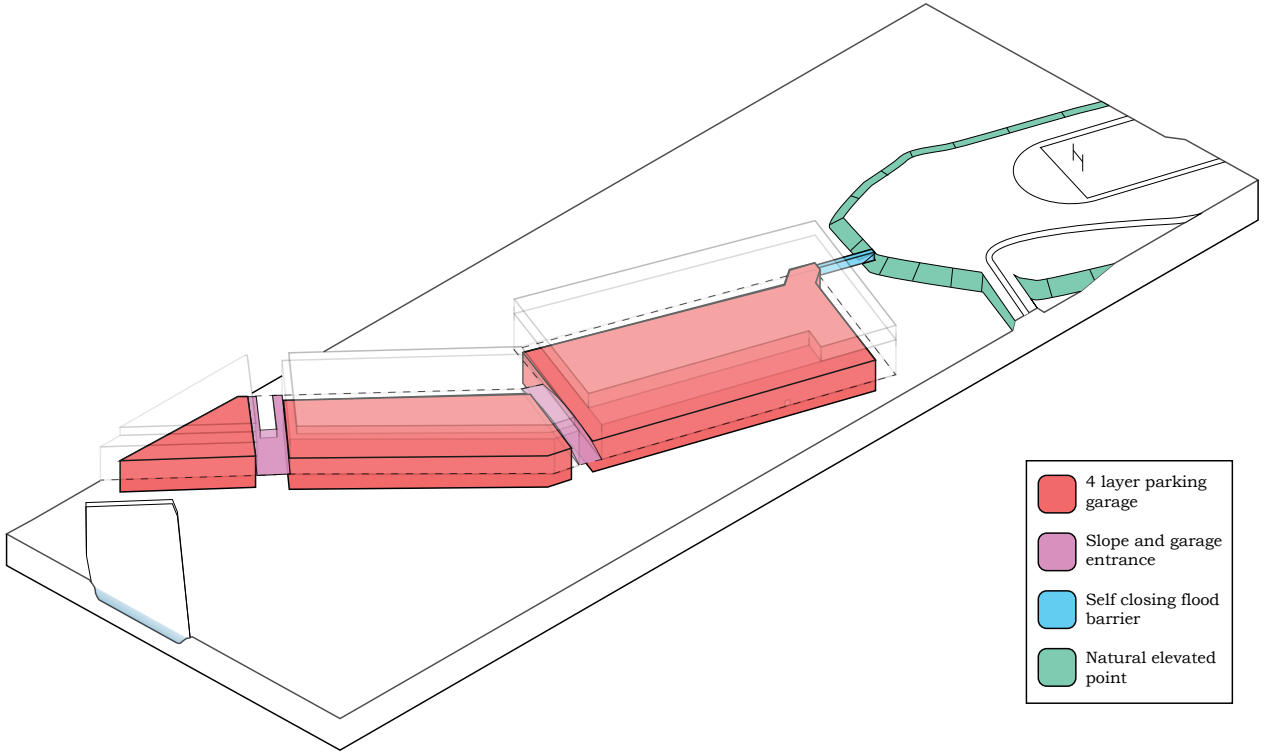
Public value

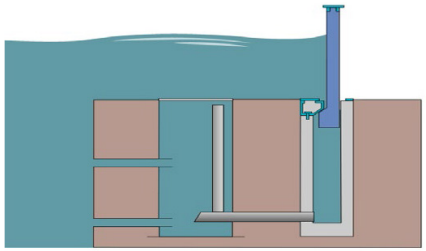
Ecological value

Isolation of the inland area. (By author)

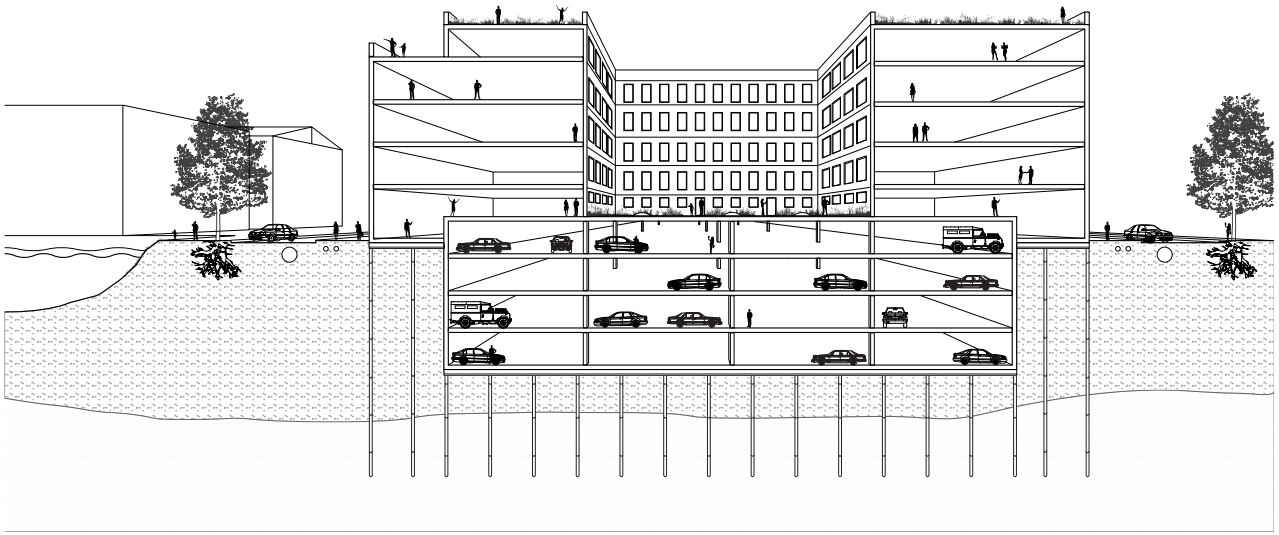
Floodproof typology



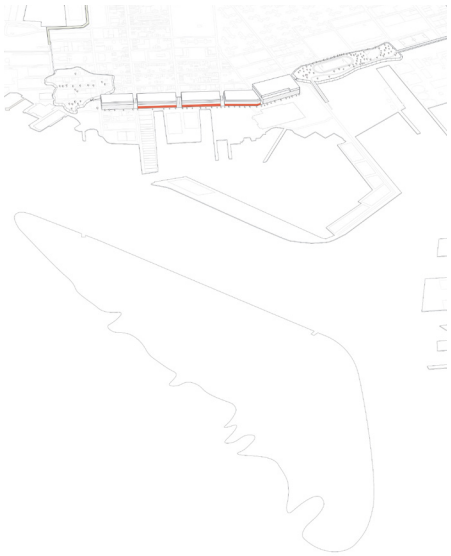


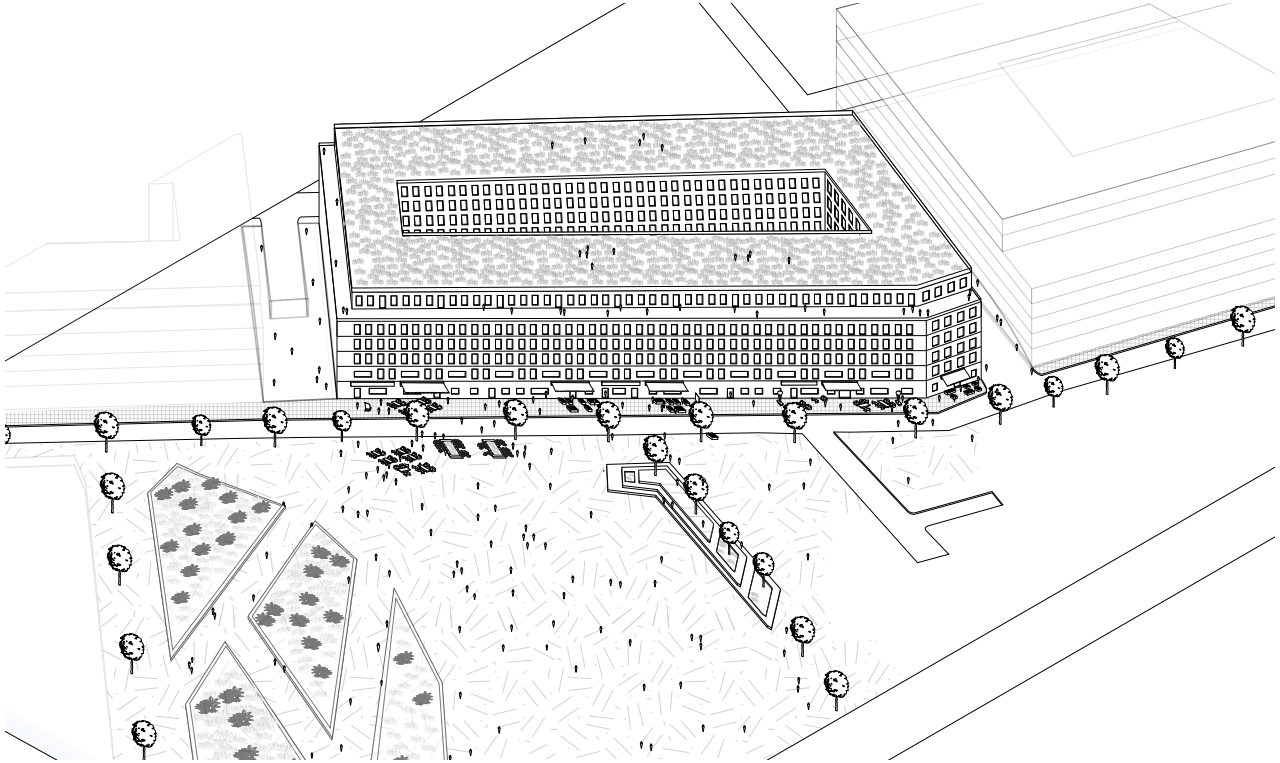


Working of SCFB. (Aggeres, 2013)

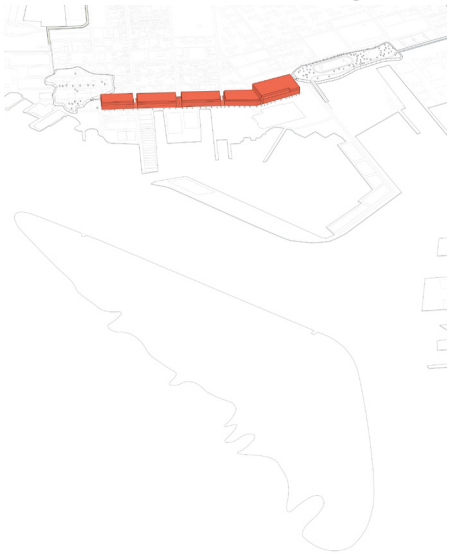


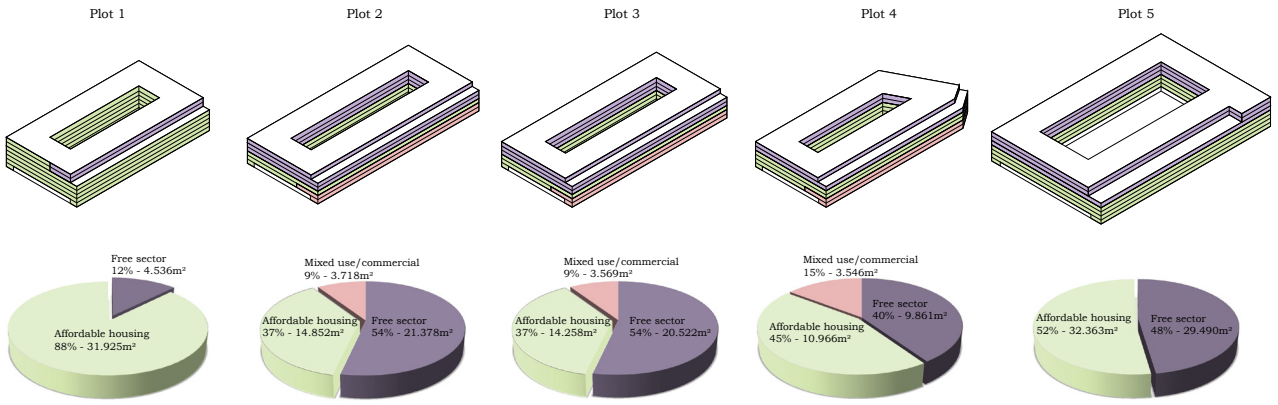
Shops and public facilities





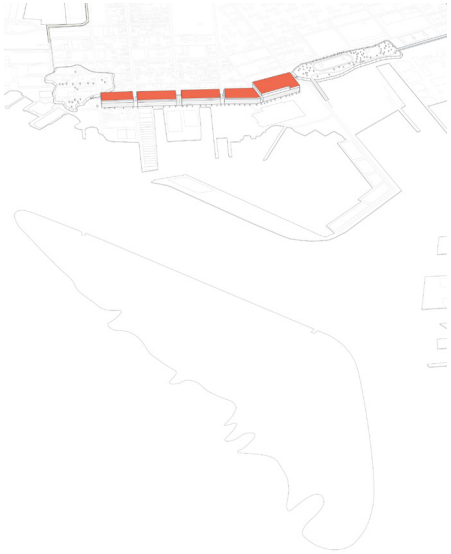
Affordable housing

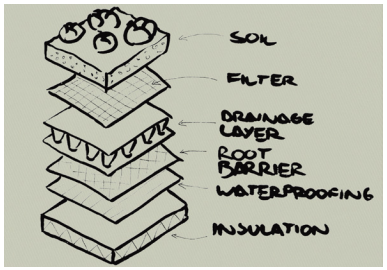




Graphics by author

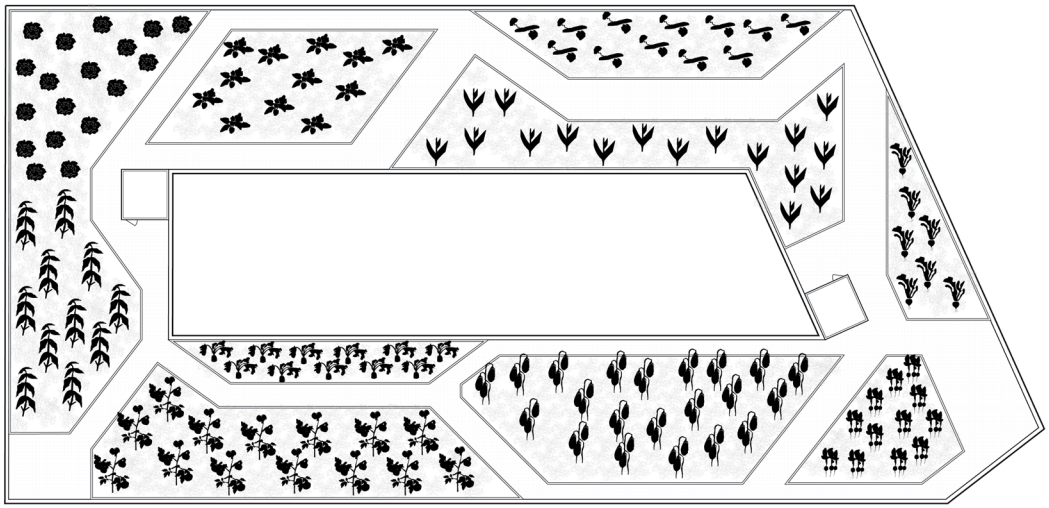
Rooftop farms

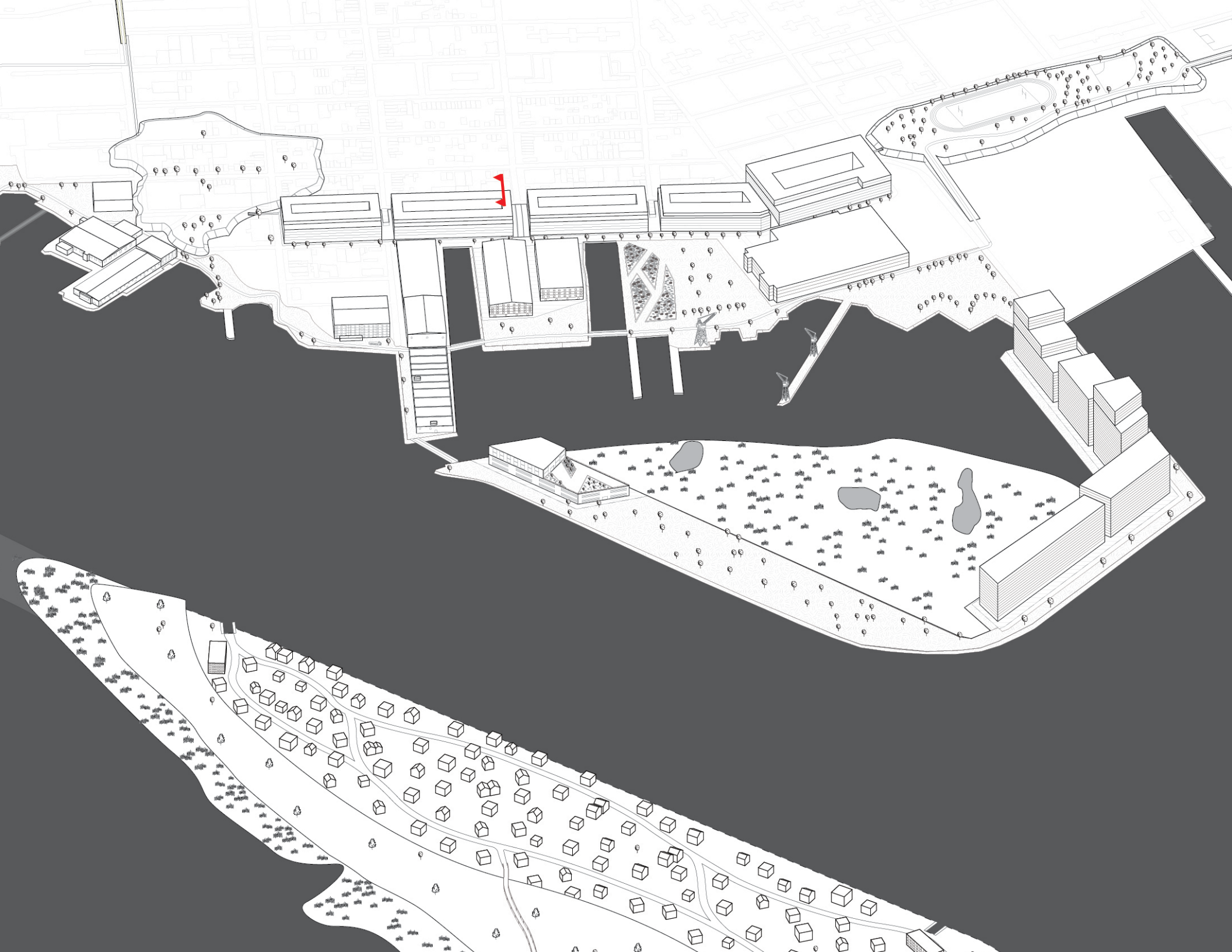




Rooftop farming layers.
(Le & Vischer, 2014)

Vegetable	Root depth
Lettuce	15-30 cm
Beans	20-30 cm
Spinach	15-30 cm
Tomatos	5-20 cm
Corn	10-20 cm
Radish	5-15 cm
Cucumber	3-13 cm
Eggplant	3-8 cm
Carrot	15-30 cm
Onion	20-30 cm



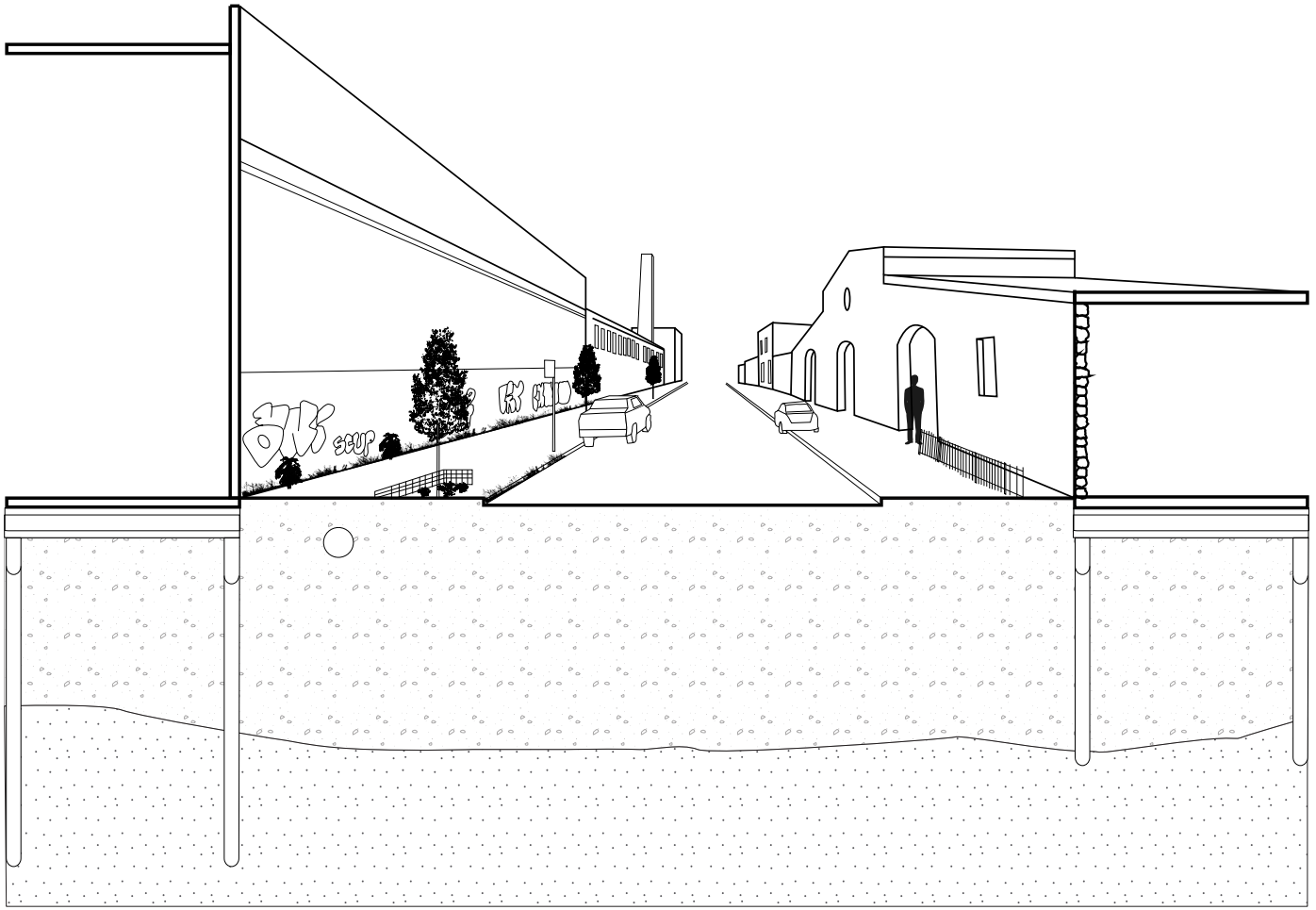


Van Dyke street current situation

Very limited interaction
between building and street

Blind facade

Graffiti and wildgrowing plants

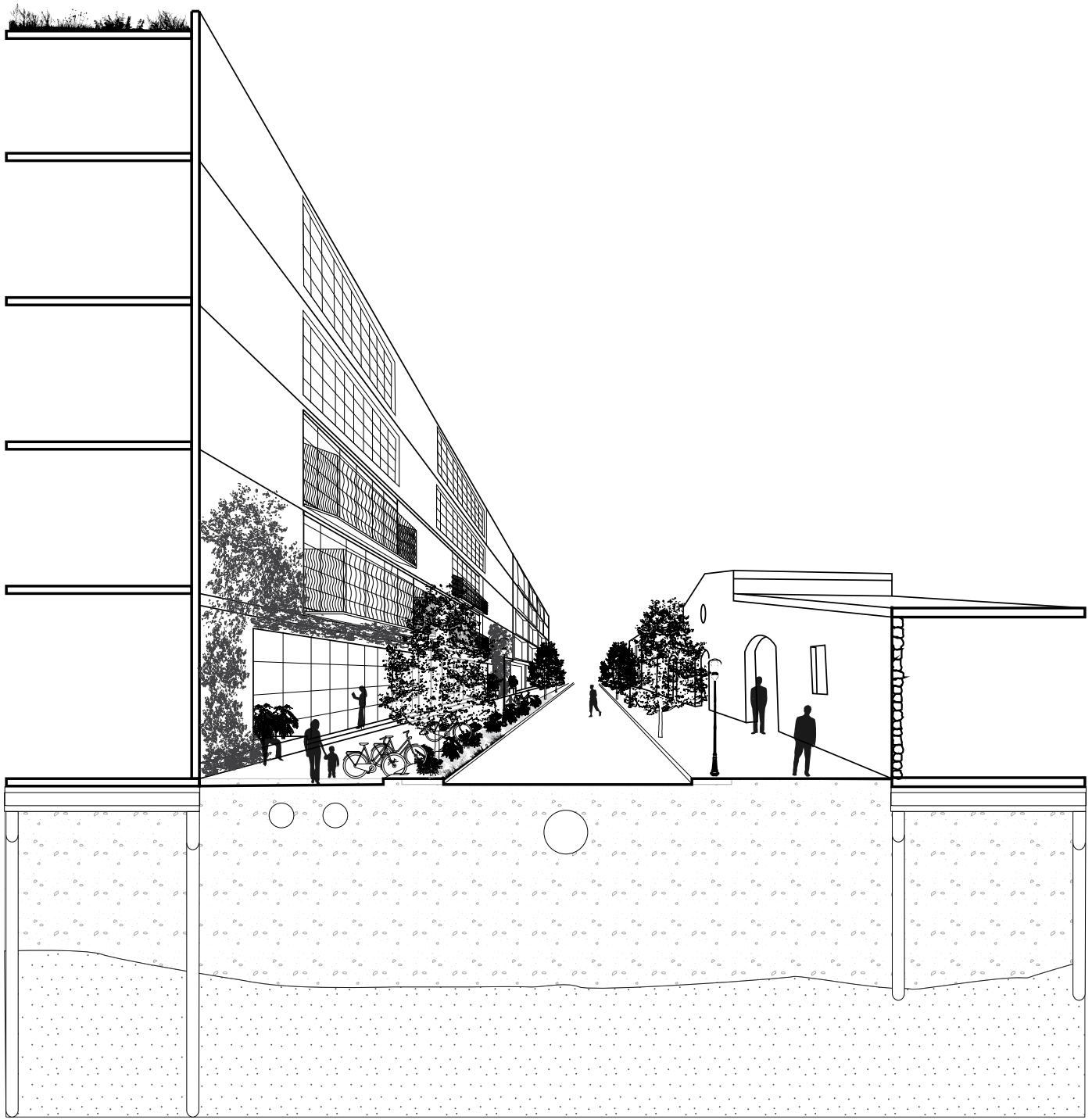


Van Dyke street
new situation

Interaction because of public functions and setback on ground floor

Connecting with Brooklyn architecture

Harbour identity with steel elements



References

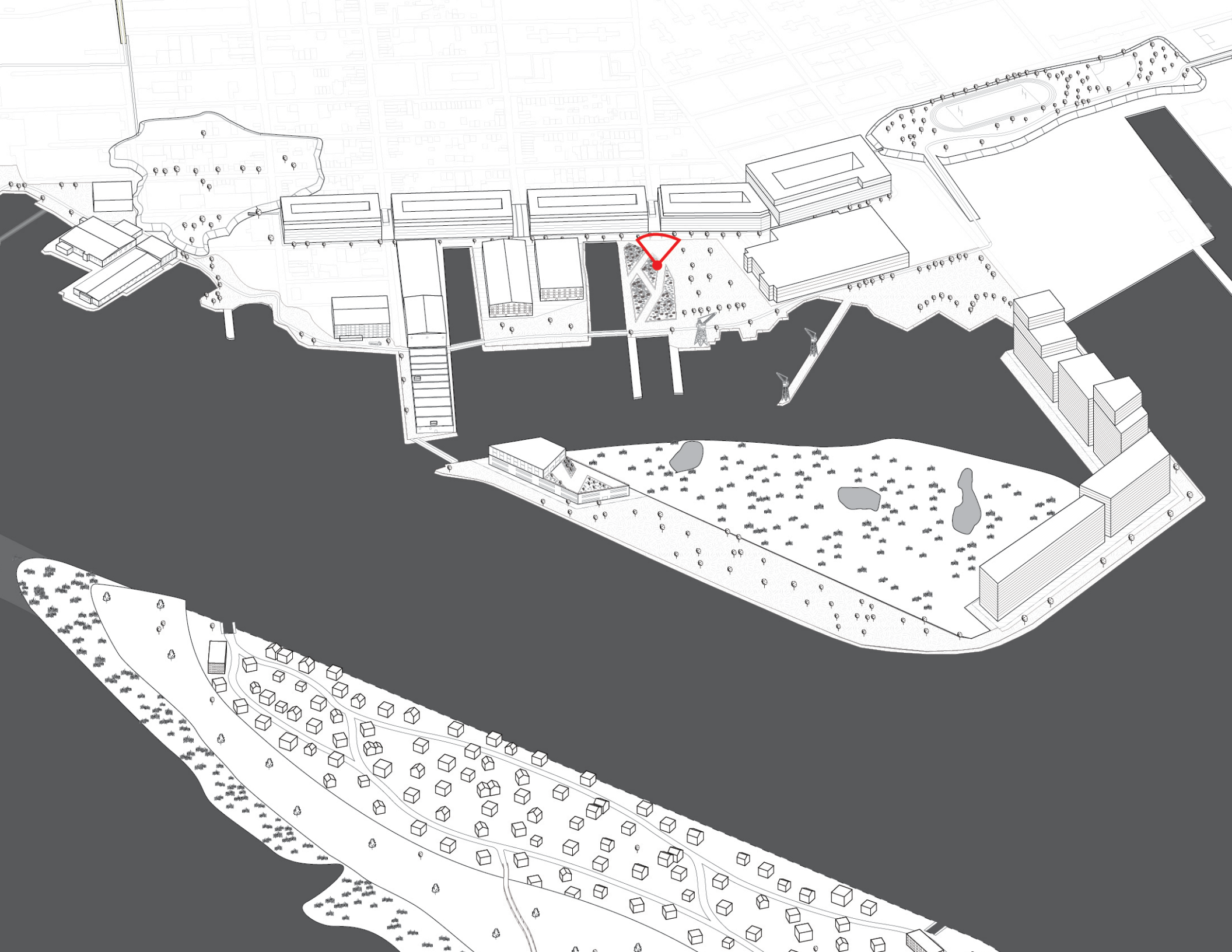
Brooklyn townhouses

Little C, Rotterdam

Little Coolhaven, Rotterdam. (CULD)

Brooklyn houses with stairs. (By Stefan Jeremiah)

Little Coolhaven, ground floor and balconies. (CULD)

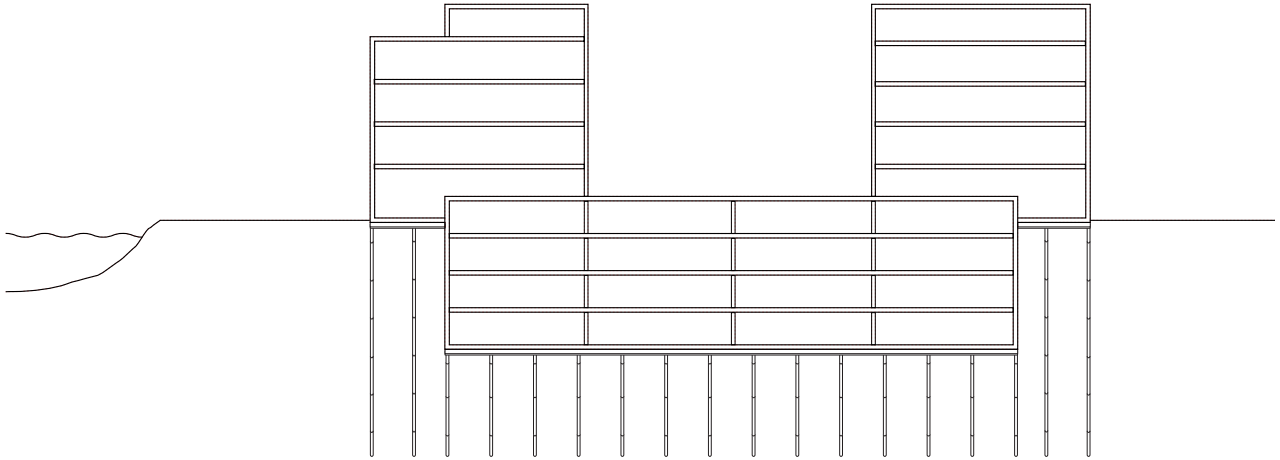



STOP

Building development options

Floodproof typology contributes to reducing both floodrisk and socio-economic pressure

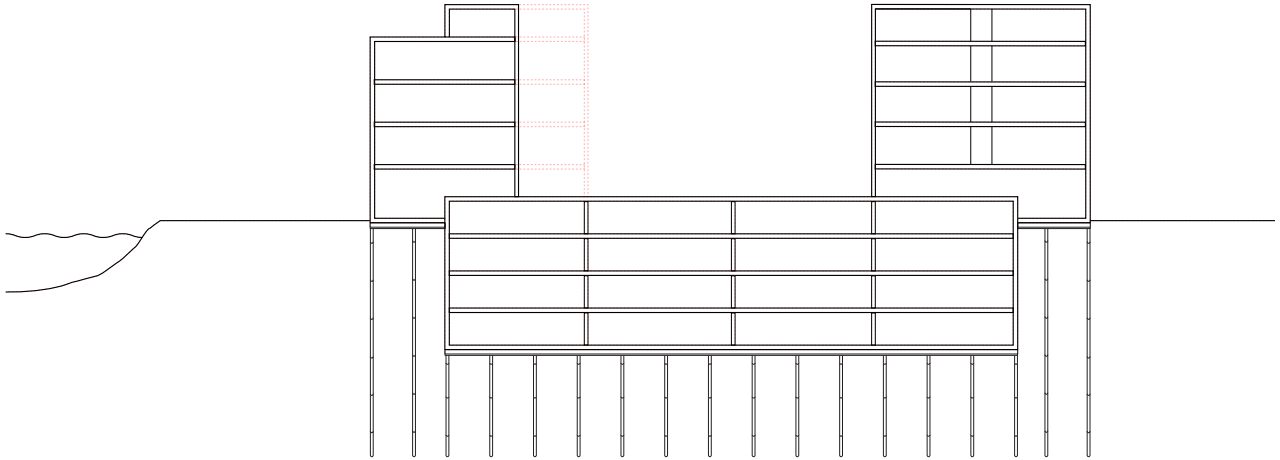
The buildings host affordable housing



1. Original concept

Variations on original concept provide flexibility for developer

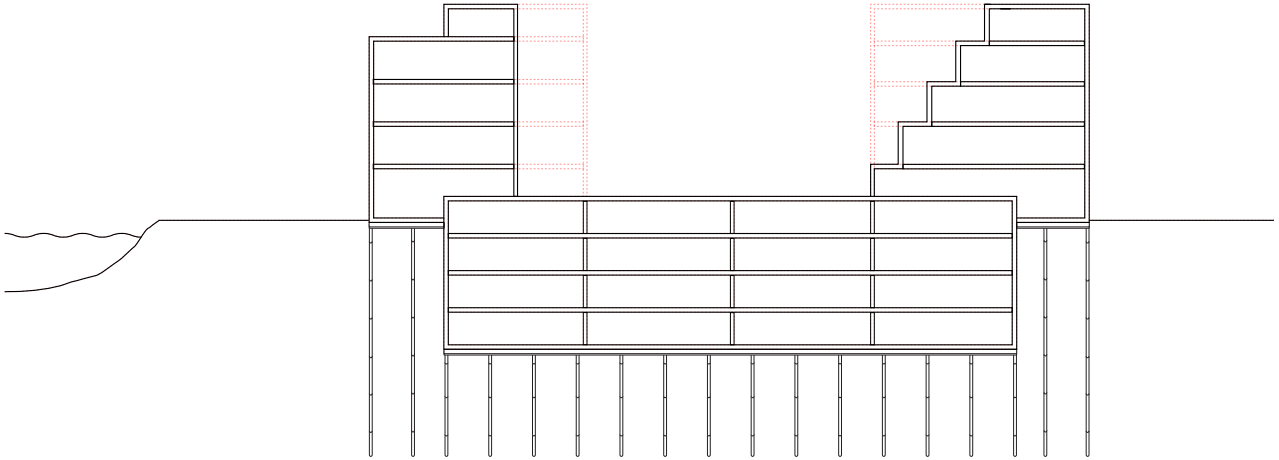
Setback in facade and extra apartments with corridor connection



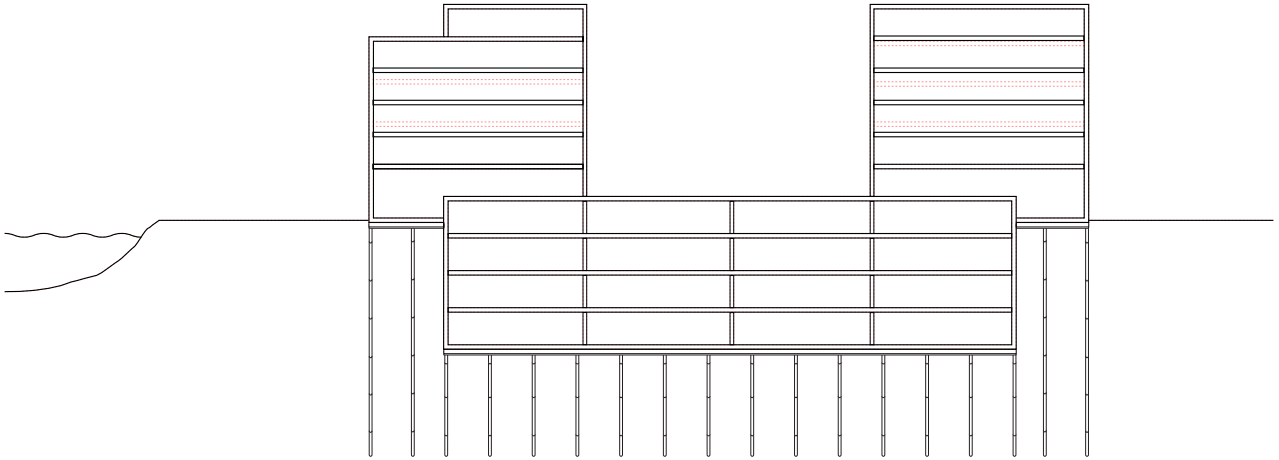
2. Setback and corridor split

Setback and steps in facade

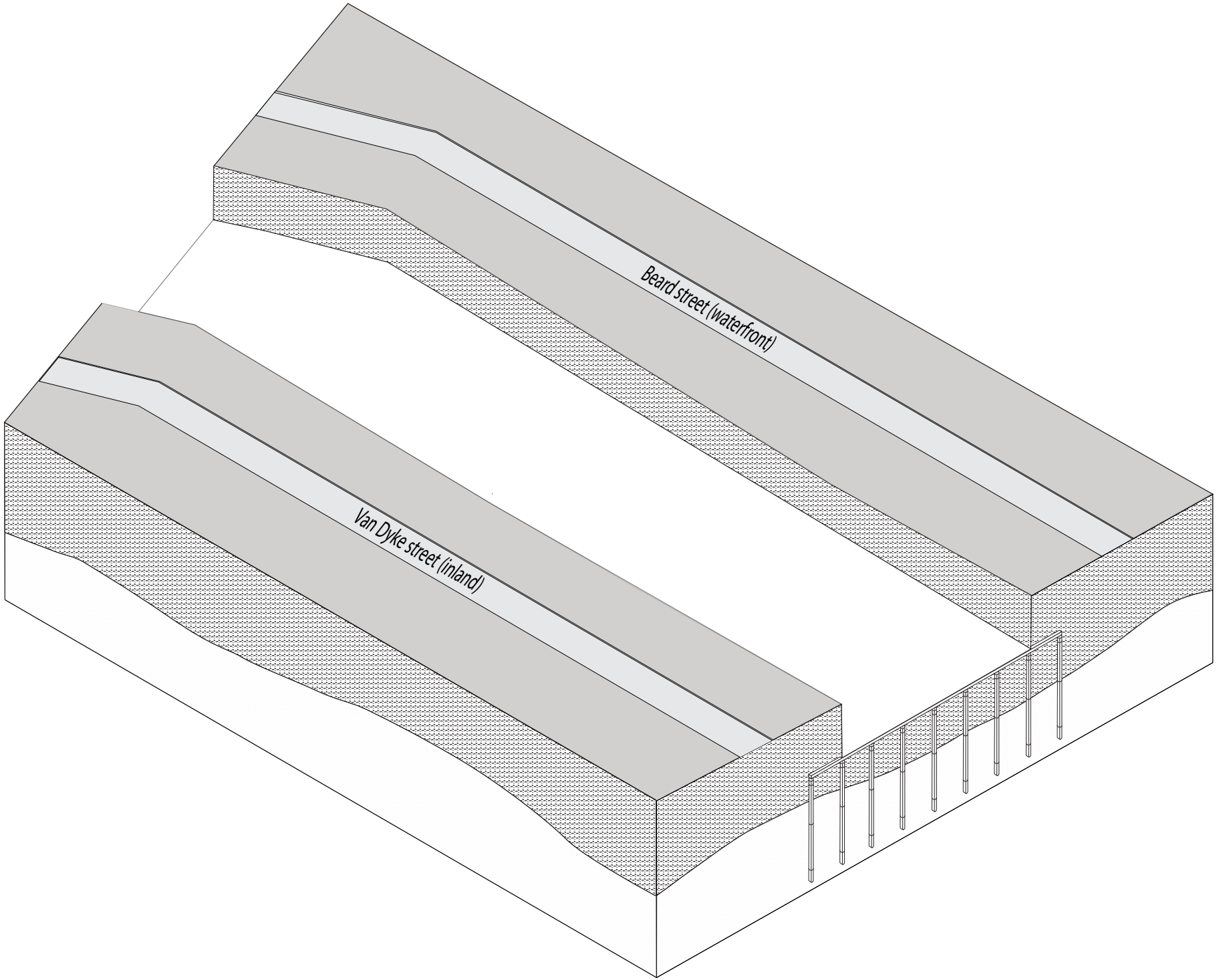
Extra floors by lowering the floor height

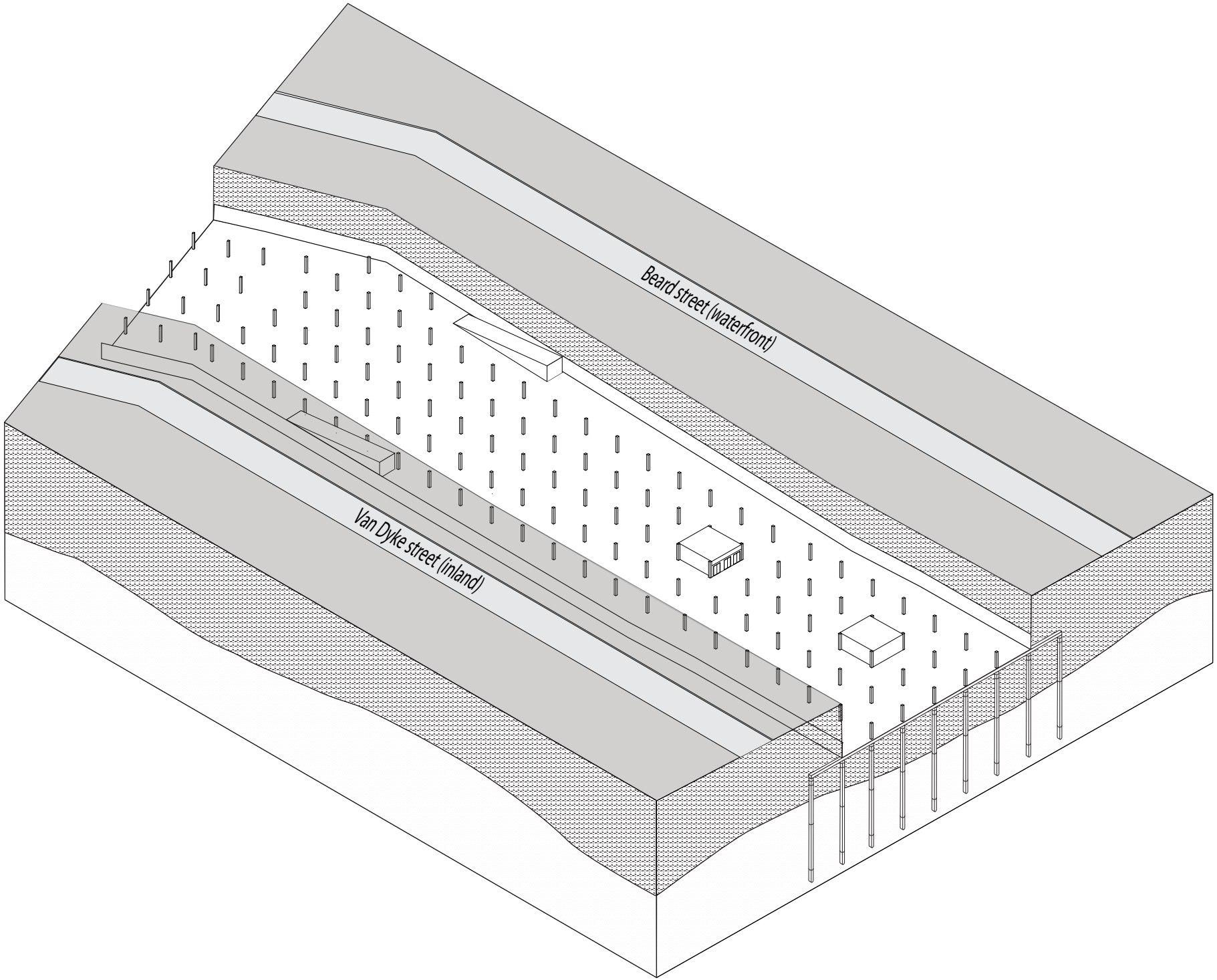


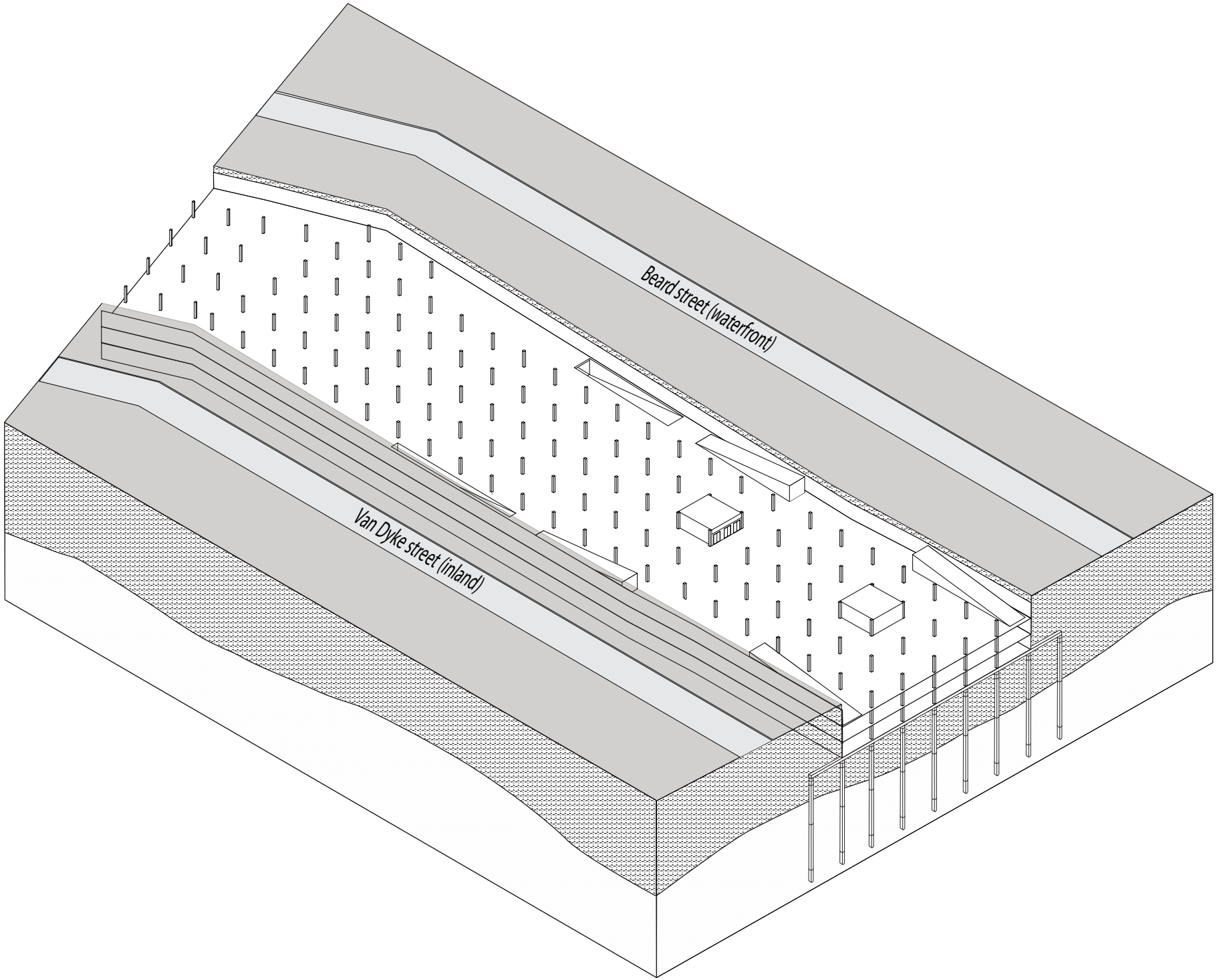
3. Setback and steps

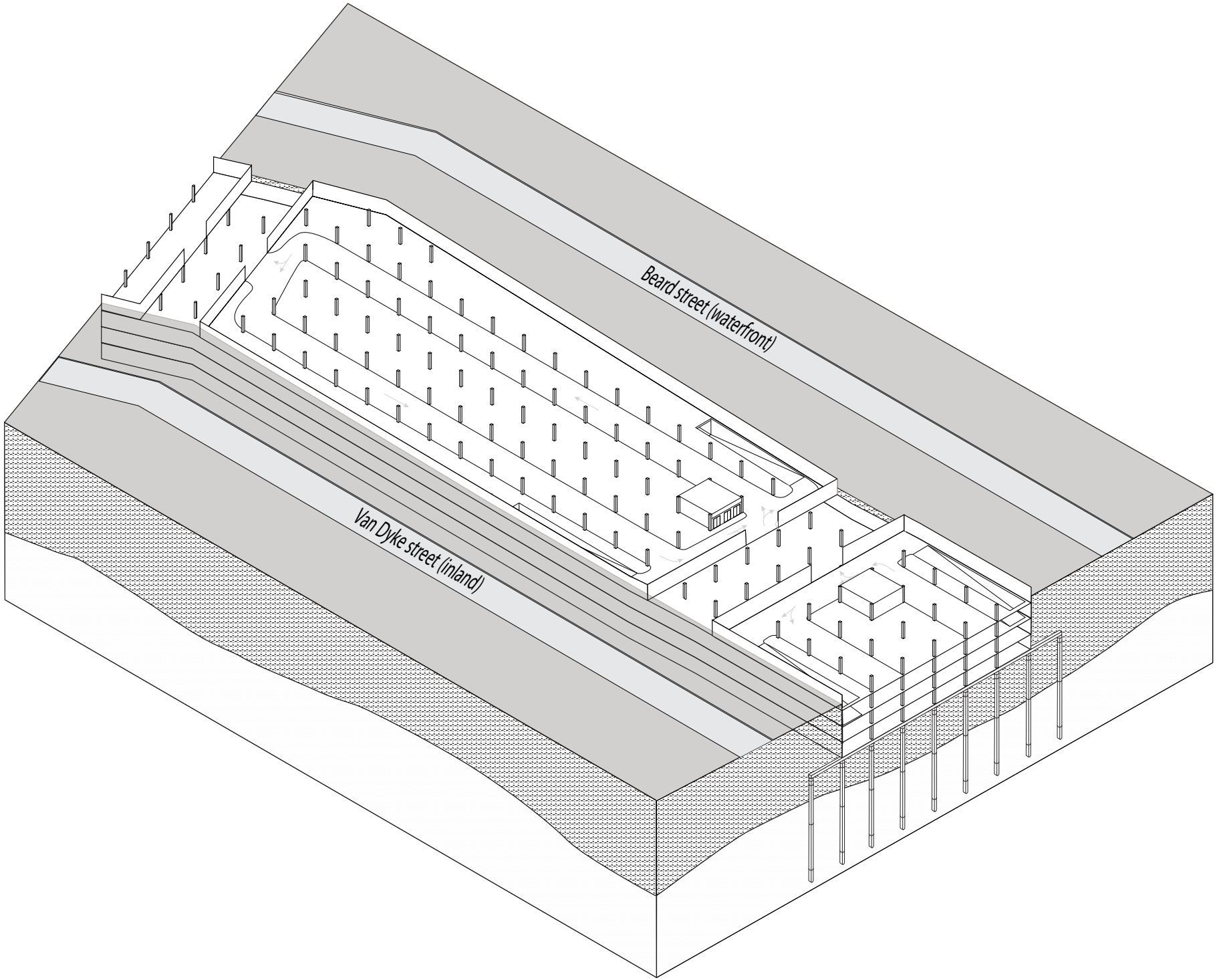


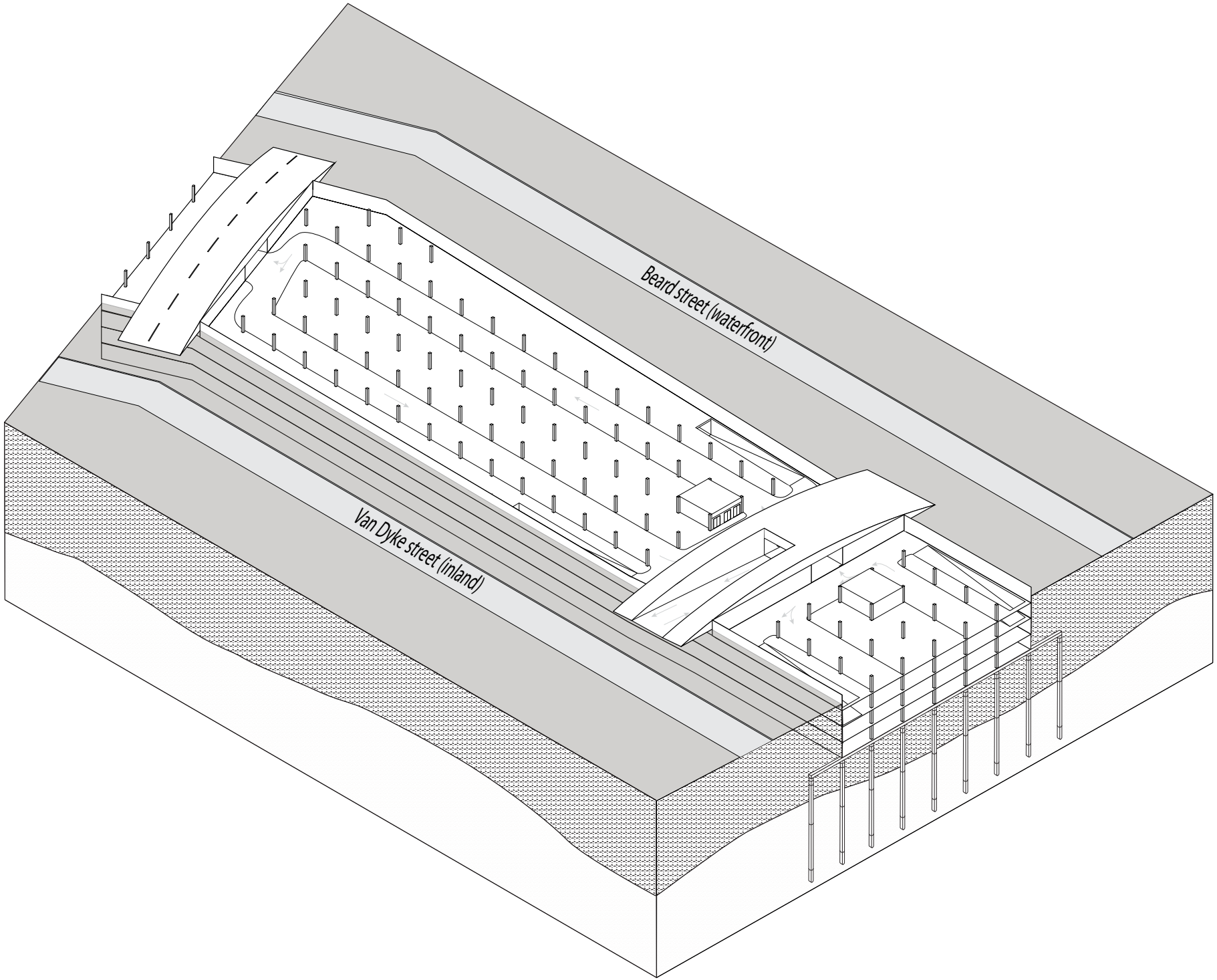
4. Extra floor, lower floor height


Beard street (waterfront)
Van Dyke street (inland)


Beard street (waterfront)
Van Dyke street (inland)


Beard street (waterfront)
Van Dyke street (inland)


Beard street (waterfront)
Van Dyke street (inland)


Beard street (waterfront)
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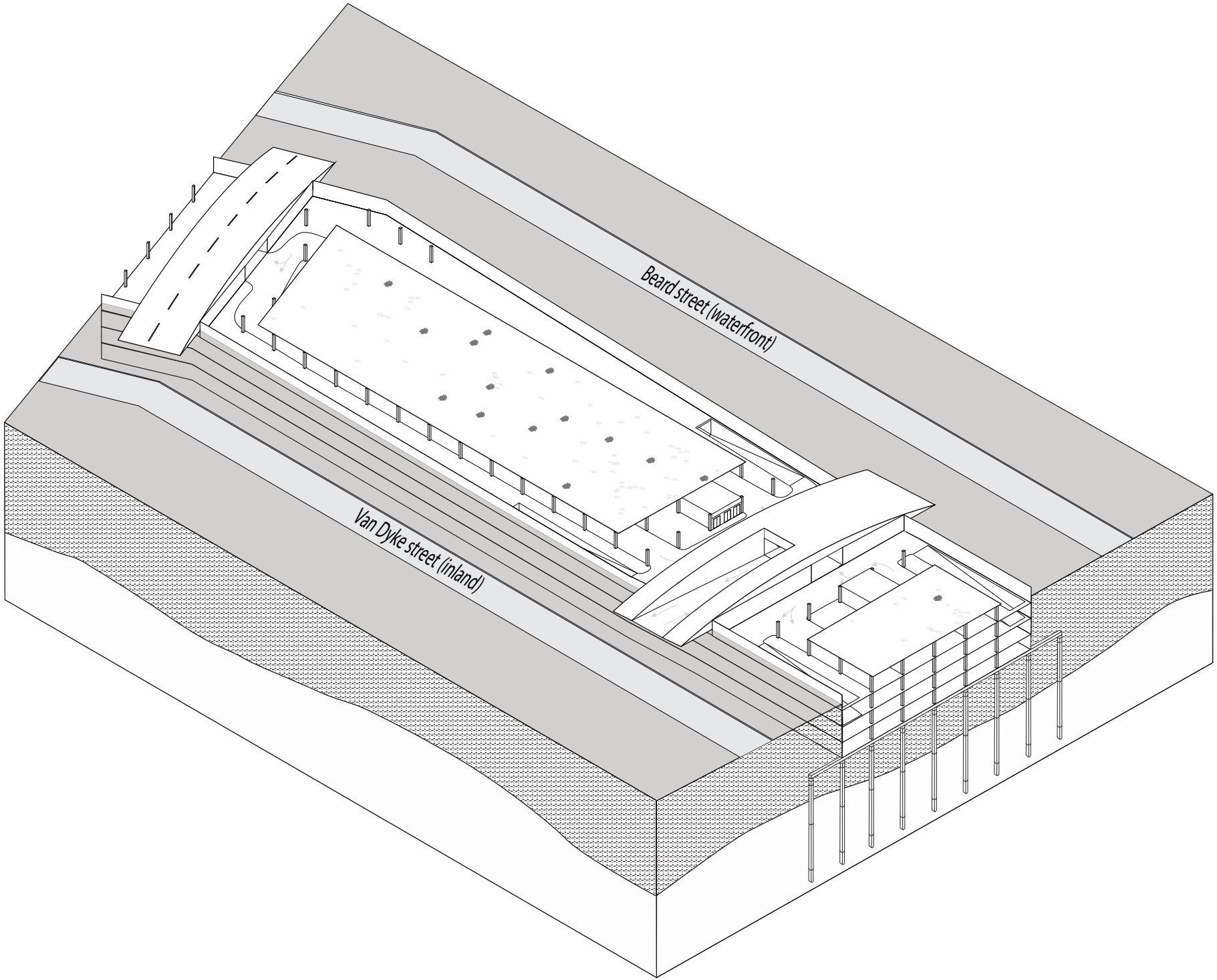
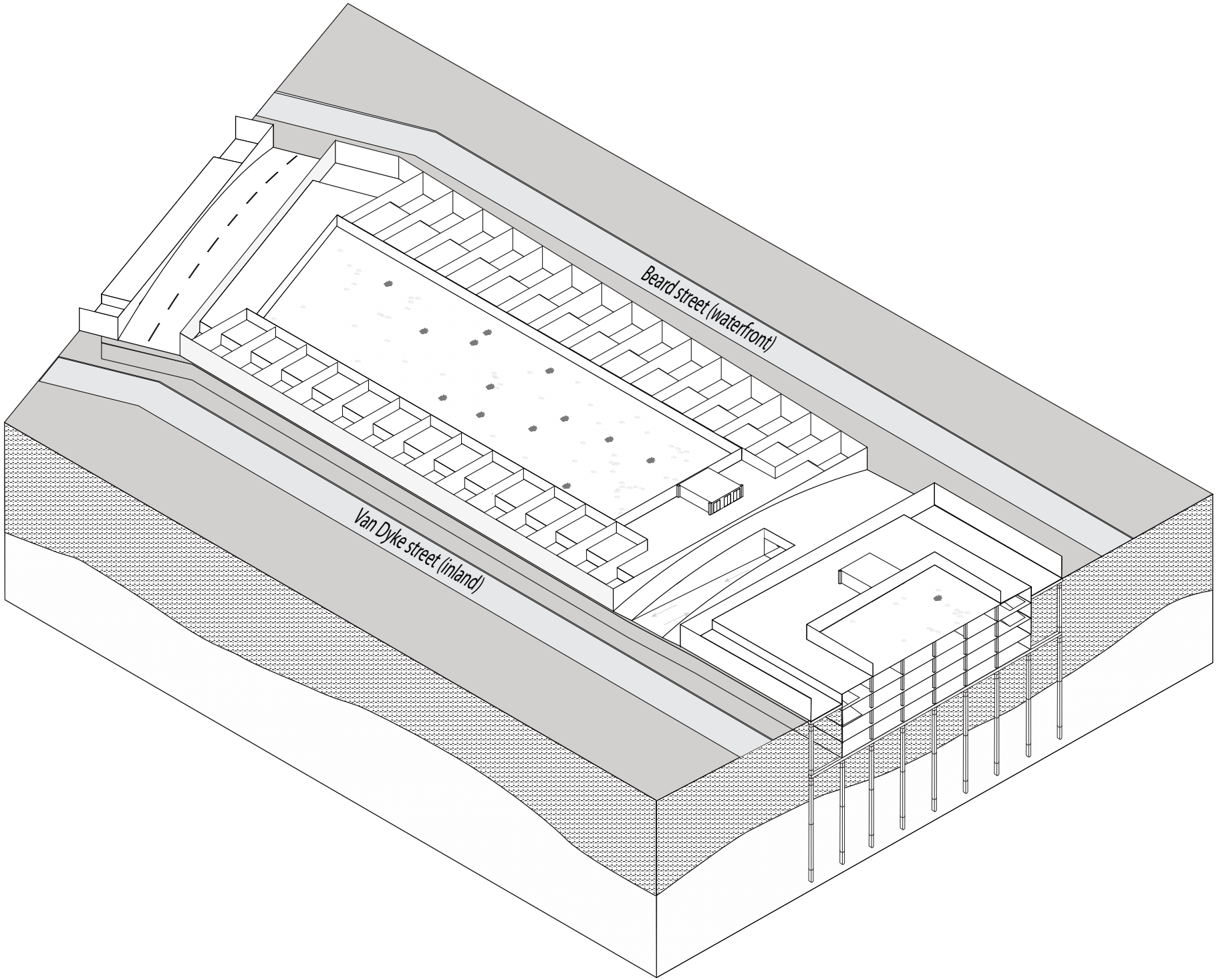
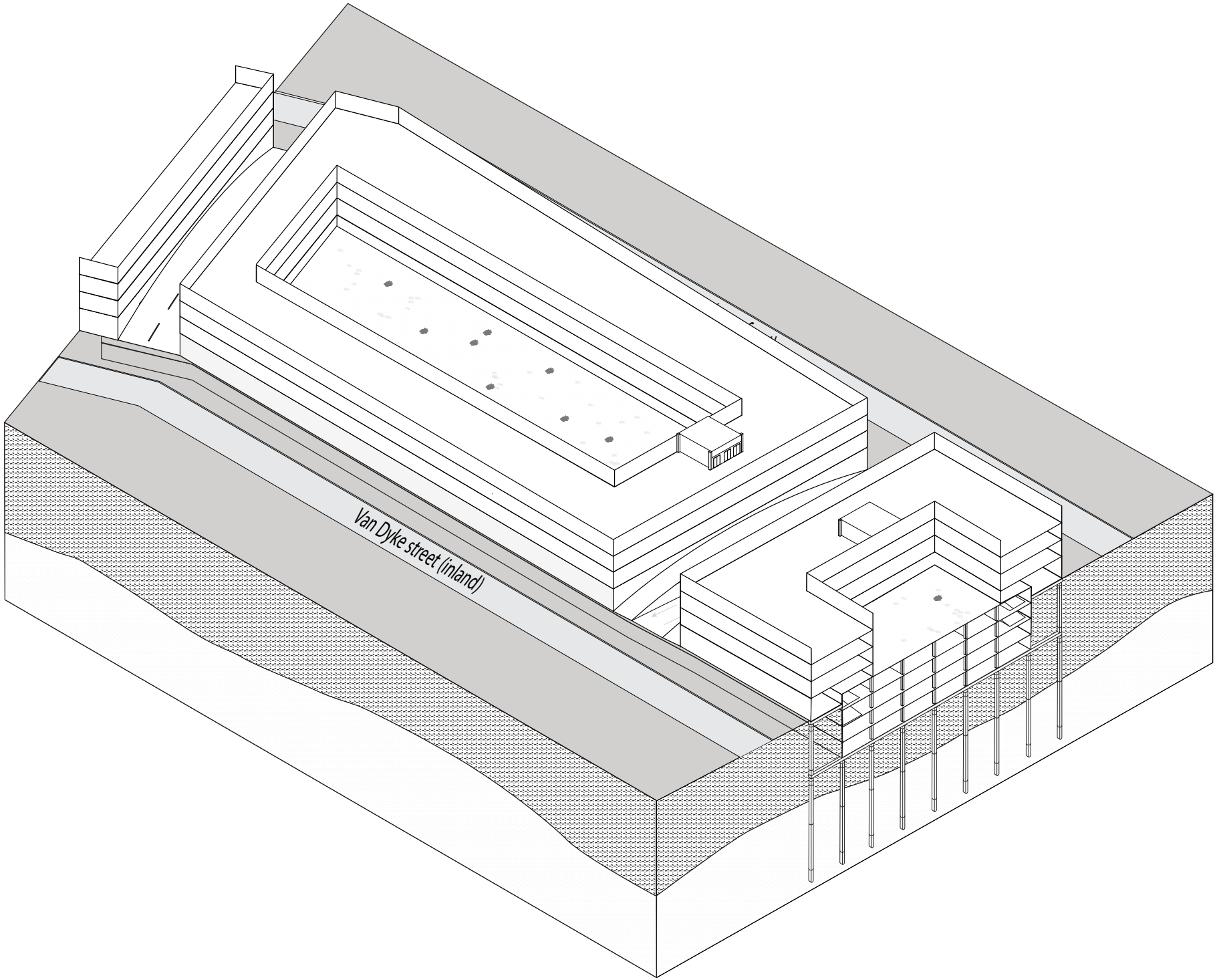
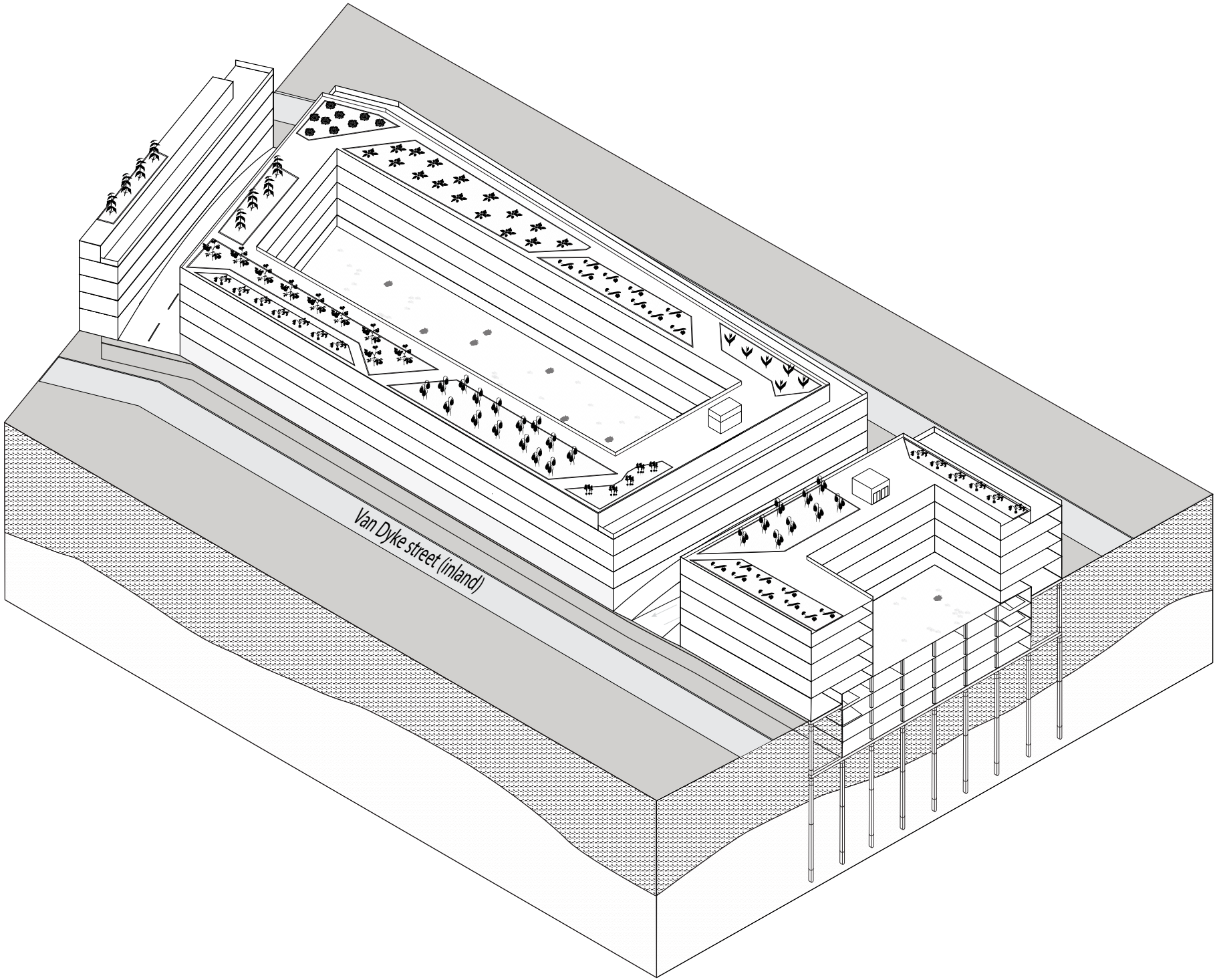
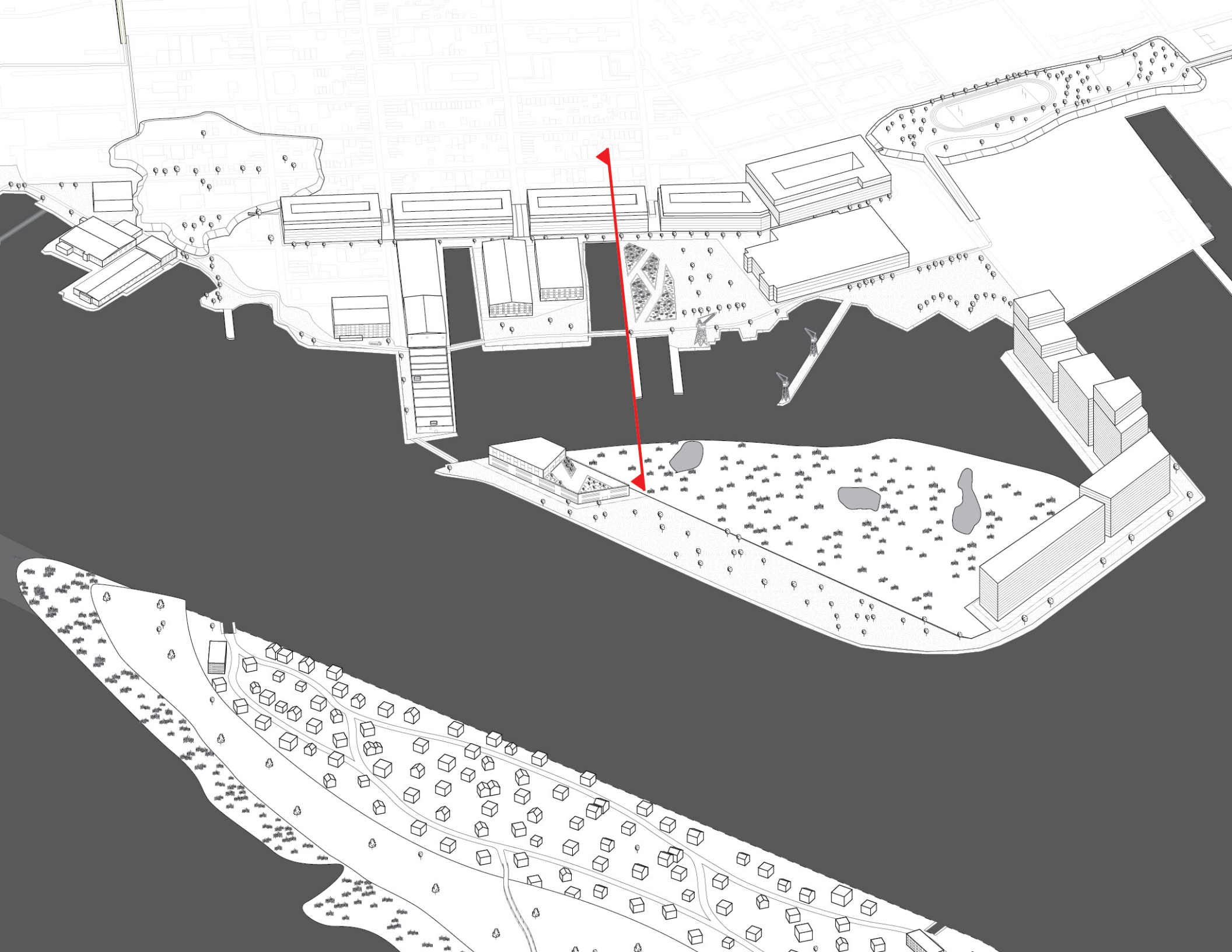
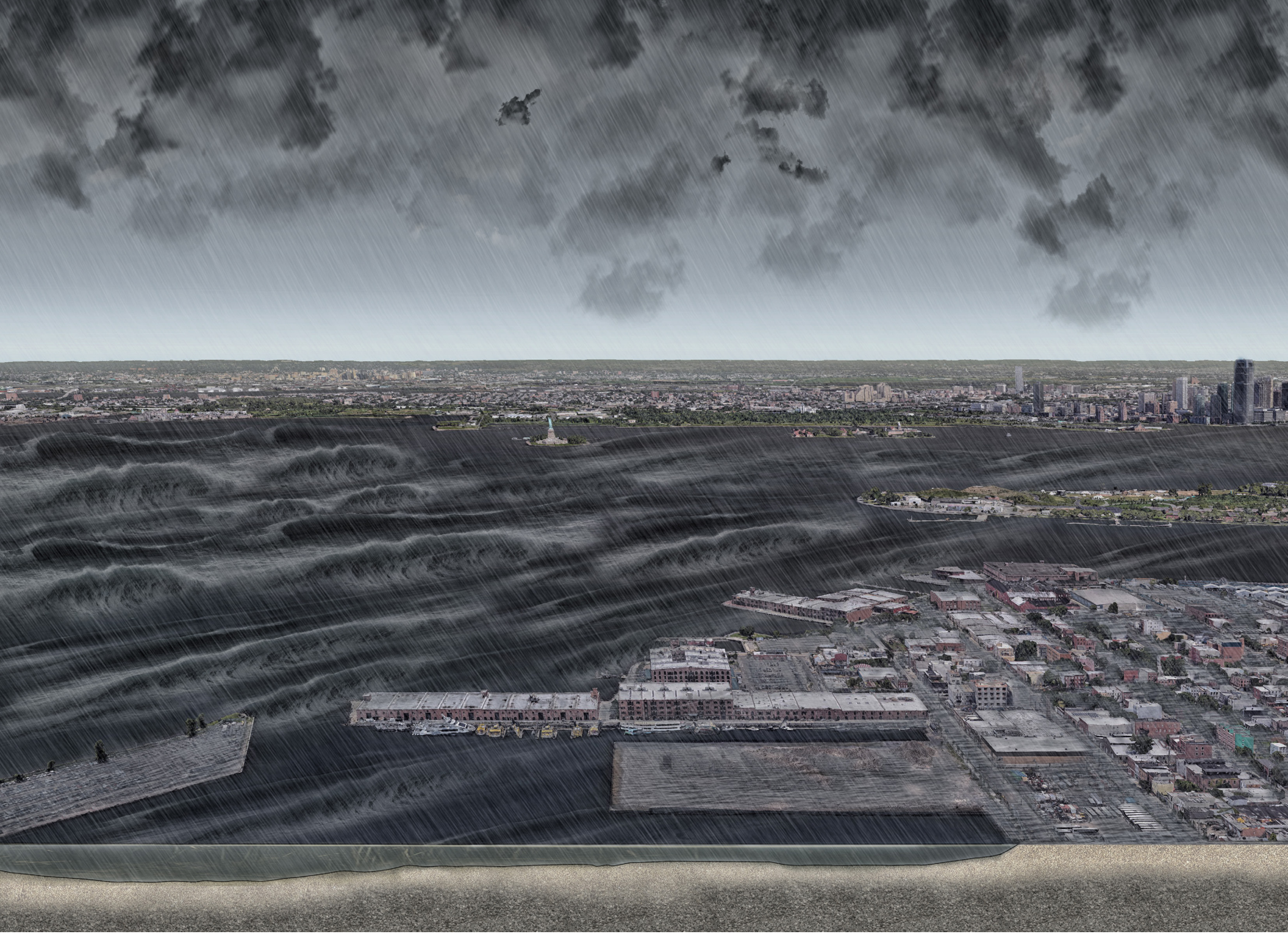

Beard street (waterfront)
Van Dyke street (inland)


Beard street (waterfront)
Van Dyke street (inland)


Van Dyke street (inland)


Van Dyke street (inland)



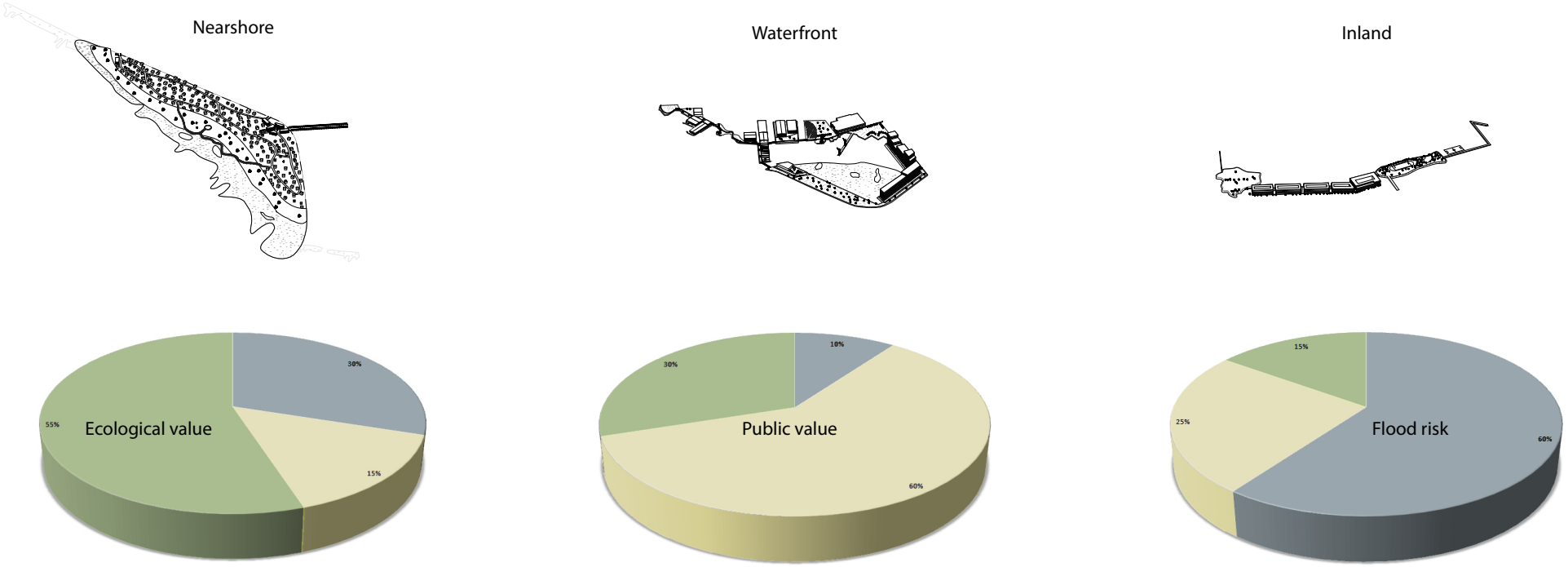


Conclusion & Reflection

Evaluation per area

Each area excels in contributing to one of the three components of the strategic approach

Comparative study recommended for further research



Evaluation of contribution to Flood risk, Public value and Ecological value per area. (By author)

Reflection

Flood risk, Public value and Ecological value have provided strong guidance for this thesis

Flood risk and socio-economic pressure have not been developed to the same degree.

Further research should dive deeper in the social needs and benefits for the Red Hook society

Surges of the 21st Century