Resilient communities

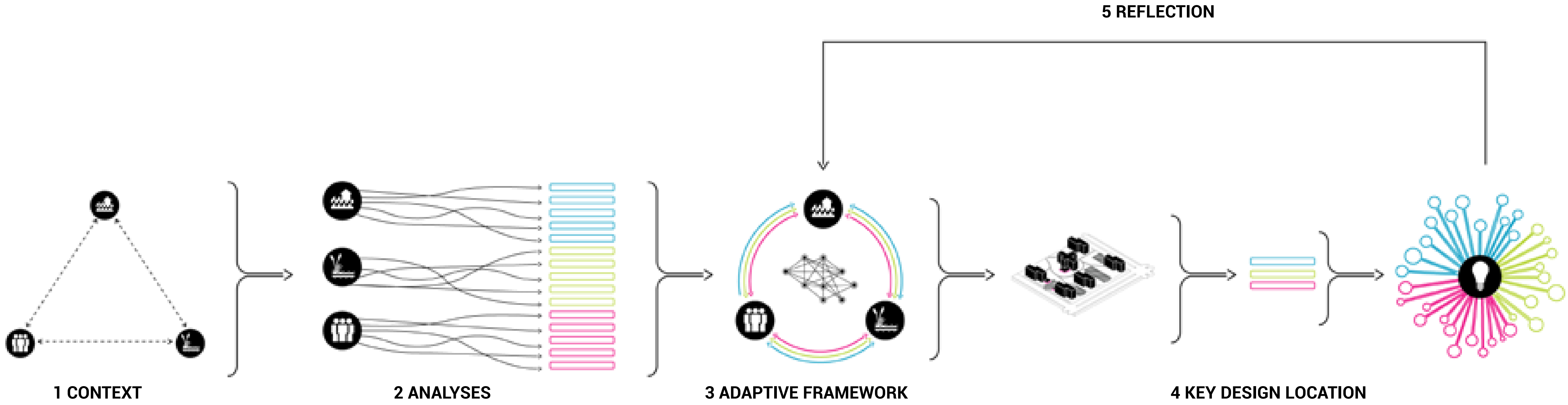
How can a spatial framework contribute to resilient flood-risk protection, while improving the living quality of communities?

Faculty of Architecture, dept. of Urbanism

Graduation studio " Delta Interventions"

Final presentation: Bram Willemse - 4164733 - b.willemse@student.tudelft.nl

PRESENTATION SET UP



TU Delft Delft University of Technology

Faculty of Architecture, dept. of Urbanism

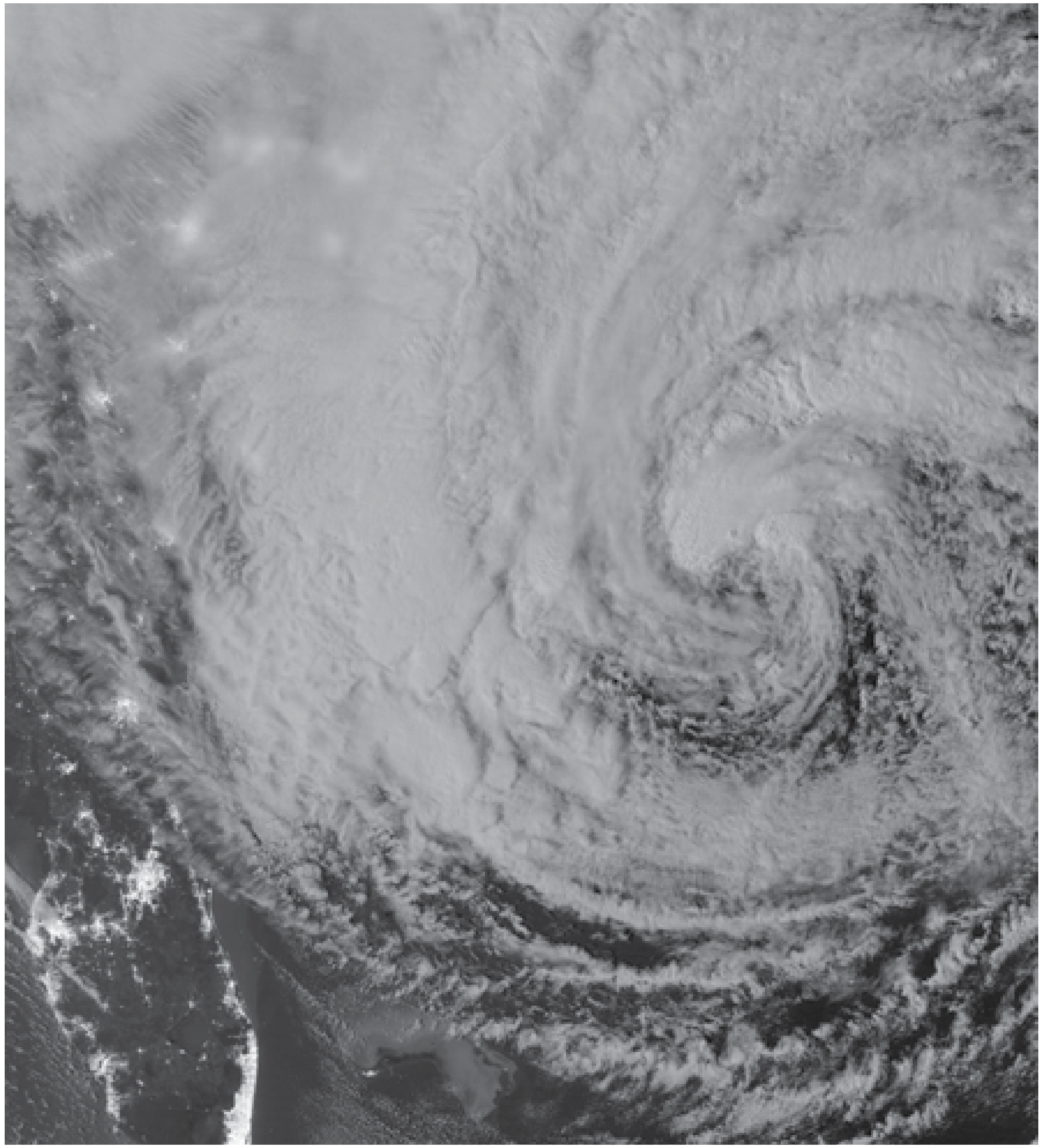
Graduation studio " Delta Interventions"

P5 Presentation: Bram Willemse

b.willemse@student.tudelft.nl

CONTEXT

The effect a short storm has on the living quality of the communities on the long term.



SOURCE: http://www.telegraph.co.uk/Hurricane-Sandy-of-destruction.html, 2013.

SOURCE: http://rebuildbydesign.org, 2013.

PROBLEM STATEMENT

The lack of means and expertise of inhabitants to protect themselves against flood-risk.

SOURCE: http://www.telegraph.co.uk/Hurricane-Sandy-of-destruction.html, 2013.

SOURCE: http://rebuildbydesign.org, 2013.

PROBLEM STATEMENT

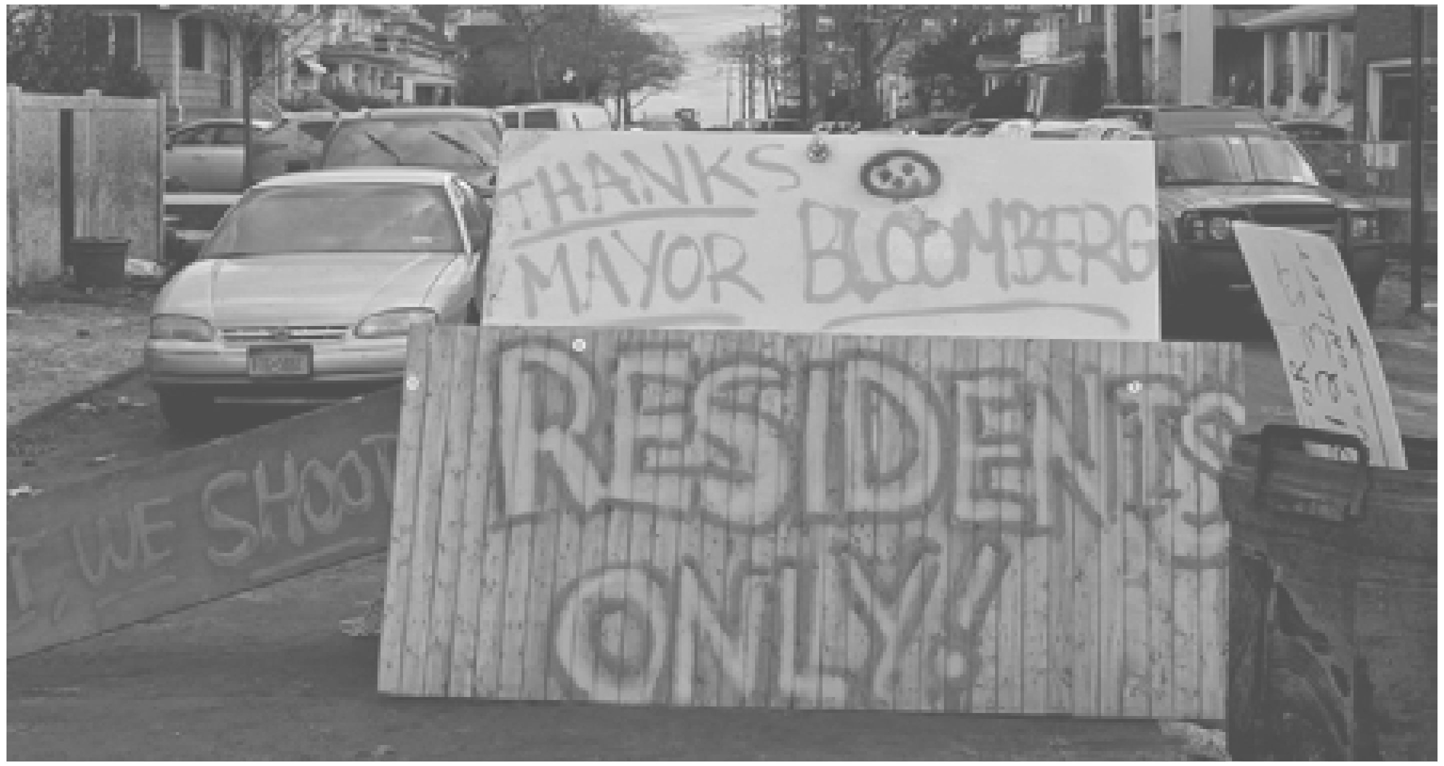
Large scale protection measures from higher governmental levels could also have a negative impact on both ecology and the living quality of communities.

SOURCE: (Royal Haskoning, 2013) http://www.royalhaskoning.com/

SOURCE: (Royal Haskoning, 2013) http://www.royalhaskoning.com/

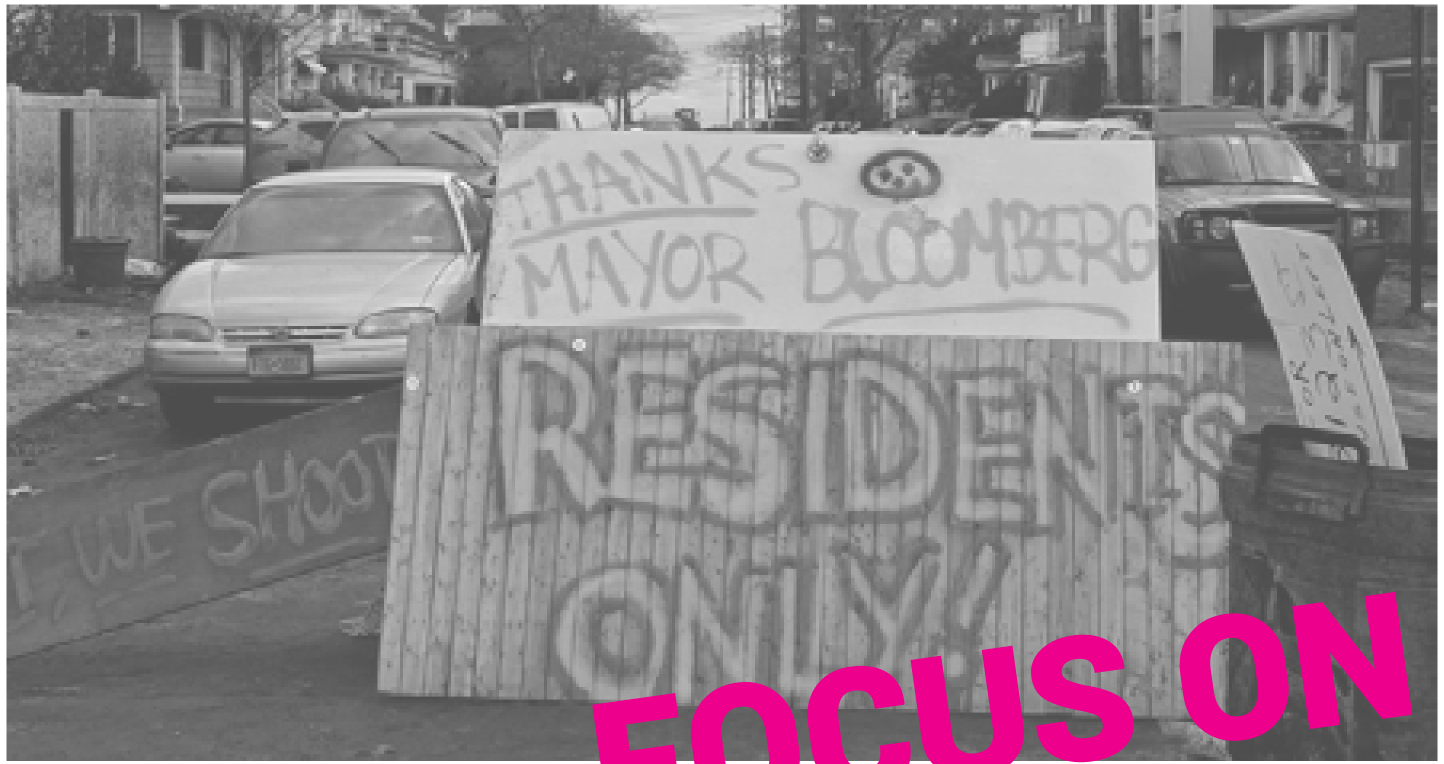
ROLE OF THE URBANIST

Complex waterfronts within the city, all with different qualities, threats and opportunities.



ROLE OF THE URBANIST

Urbanism is the field of expertize needed to integrate site specific conditions, ecological issues and the living quality of communities with protection measures.



FOCUS ON ONE ISSUE

AIM OF PROJECT

A spatial design that will decrease the **flood-risk** while increasing the **living quality** of communities.

Protection measures **adapted to the context** of the communities

By increasing the **social and spatial quality** of the different communities

A **flexible strategy** on location that will form the **framework** for development.

Design on a key location will **provide knowledge** for development of other flood-prone communities.

LOCATION: Coney Island

Heavily impacted by hurricane Sandy

Diversity of communities

Different types of water hazards

SOURCE: https://www.flickr.com/photos/tags/coneyisland/, 2014.

KEY DESIGN LOCATION: Coney Island Creek

Most vulnerable communities Most exposed to flood-risk Serves a greater area

SOURCE: https://www.flickr.com/photos/tags/coneyisland/, 2014.

RESEARCH QUESTIONS

Main research question

How can a spatial framework contribute to resilient flood-risk protection,

while improving the living quality of communities?

RESEARCH QUESTIONS

Sub research questions

1 What type of water hazards contribute to flood-risk (a), and which contribute to flood-risk of the communities of Coney Island (b)?

2 What elements of a community make it vulnerable to flood-risk (a), and how vulnerable are the communities of Coney Island (b)?

6 How can the spatial quality benefit from flood-risk protection measures (a), and how can they contribute to the spatial quality of Coney Island (b)?

7 What is the role of self-organization of communities to create a resilient flood-risk management system?

3 What are resilient measures against flood-risk (a), and how can they be implemented in the context of Coney Island (b) ?

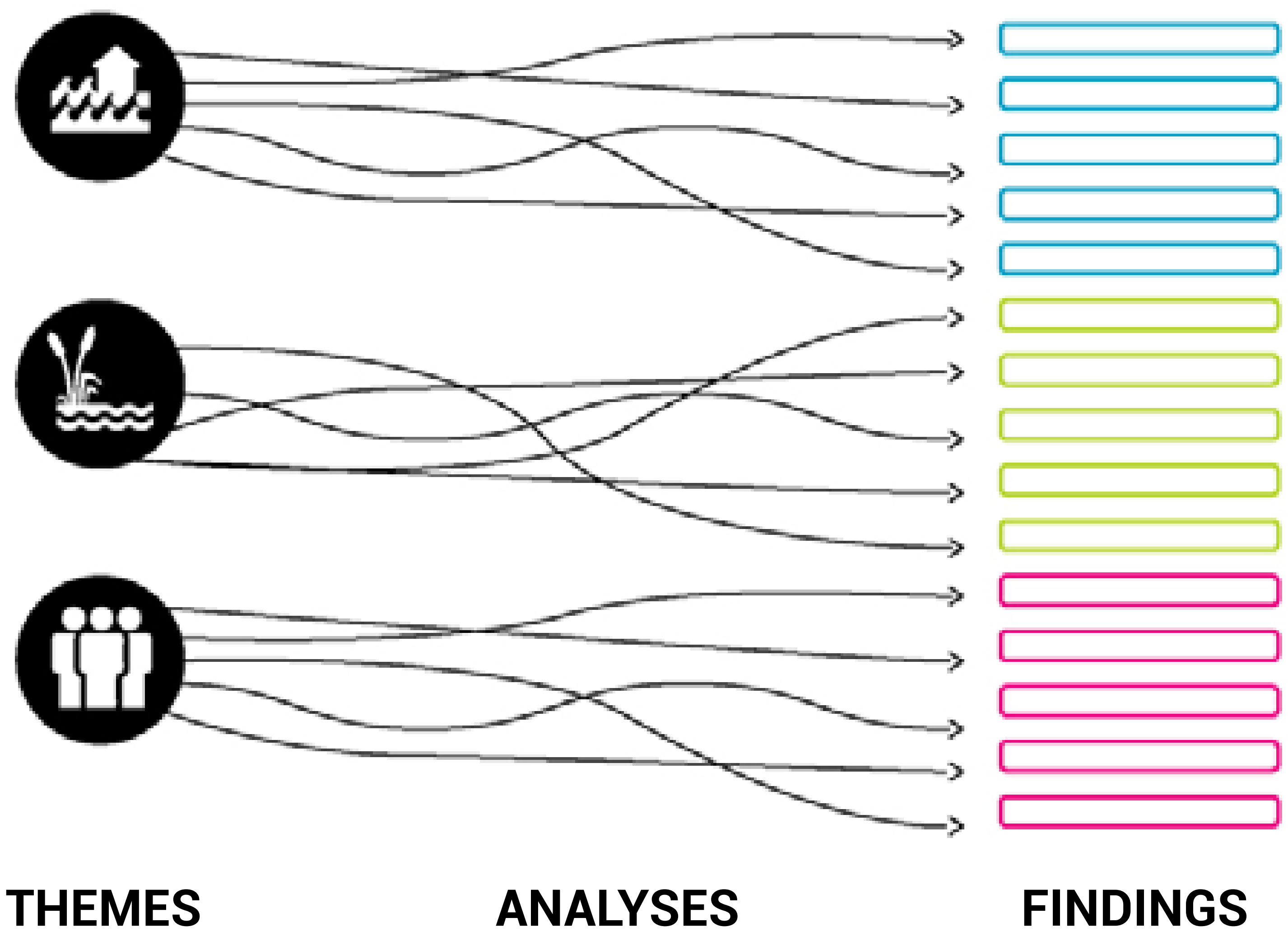
4 How can flood-risk protection measures increase the ecological quality of the area (a), and how could this contribute to the ecological quality of Coney Island (b)?

5 What is the distinction between the communities of Coney Island?

8 What principles of the design of Coney Island can be used for future development of flood-prone communities?

SOURCE: Diagram by author, 2014.

2 ANALYSES



SOURCE: Diagram by author, 2014.

DEFINITION OF FLOOD-RISK

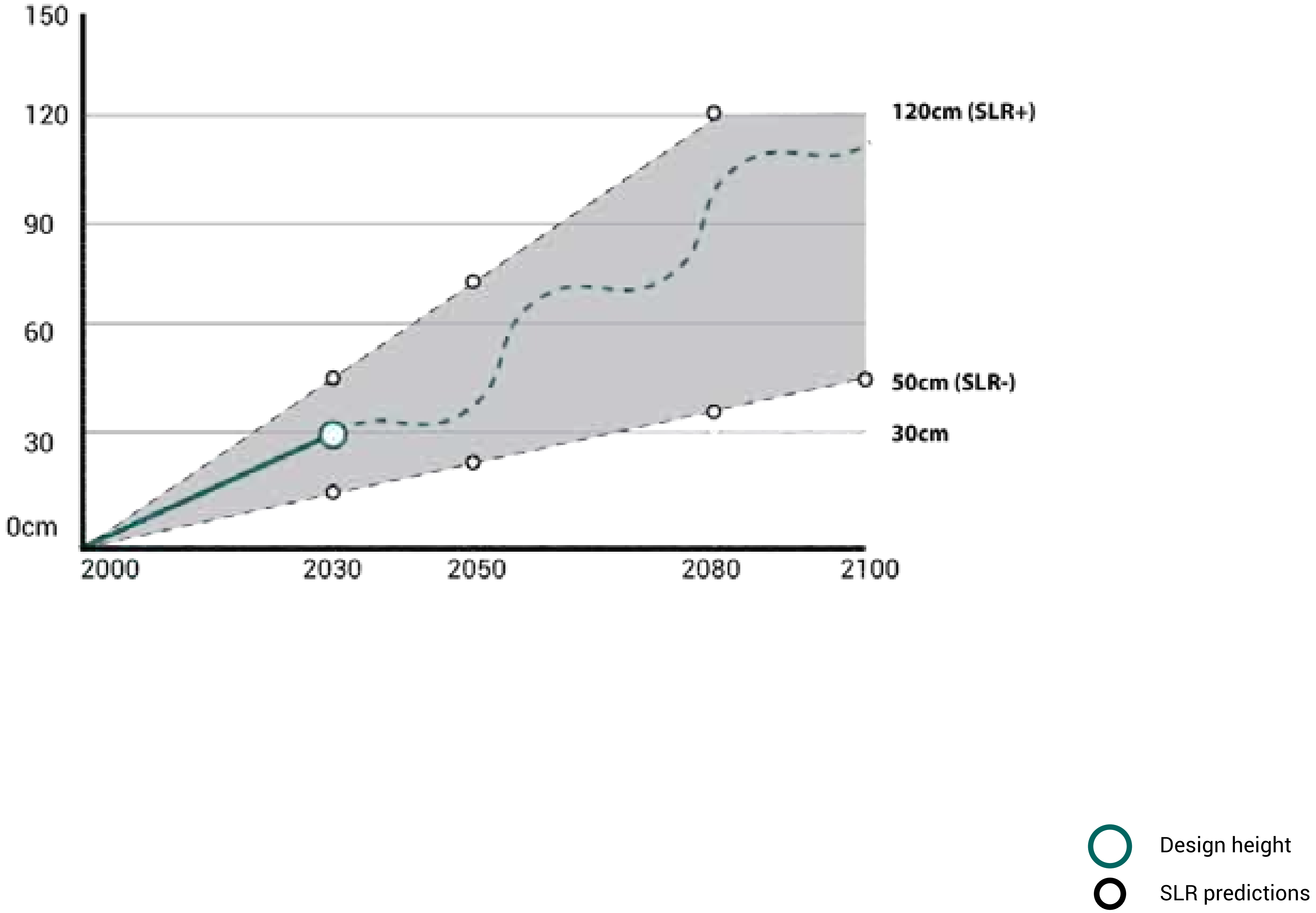
(Flood)risk = Probability x Consequence

	Probability	Consequence
	Flood event	*Effect of flooding*
	Increased by sea level rise More frequent and intense storms	Increased by higher vulnerability of area Increased by assets and people at risk
	Decreased by protection measures	**Decreased by reducing vulnerability**
	Examples: Heighten levees Storm surge barriers Restoration of dunes	*Examples: Increasing quality of public space to stimulate social activities. Relocation of vulnerable assets*

SOURCE: MCCARTHY, J., CANZIANI, O., LEARY, N. A., DOKKEN, D. J. & WHITE, K. S. 2001. Impacts, Adaptation and Vulnerability. IPPC Working Group II: Climate Change Cambridge: Cambridge University Press.
Planning principels on flood-risk, OMA:[Online]. http://www.rebuildbydesign.org/ [Accessed 11 January 2014].

SEA LEVEL RISE

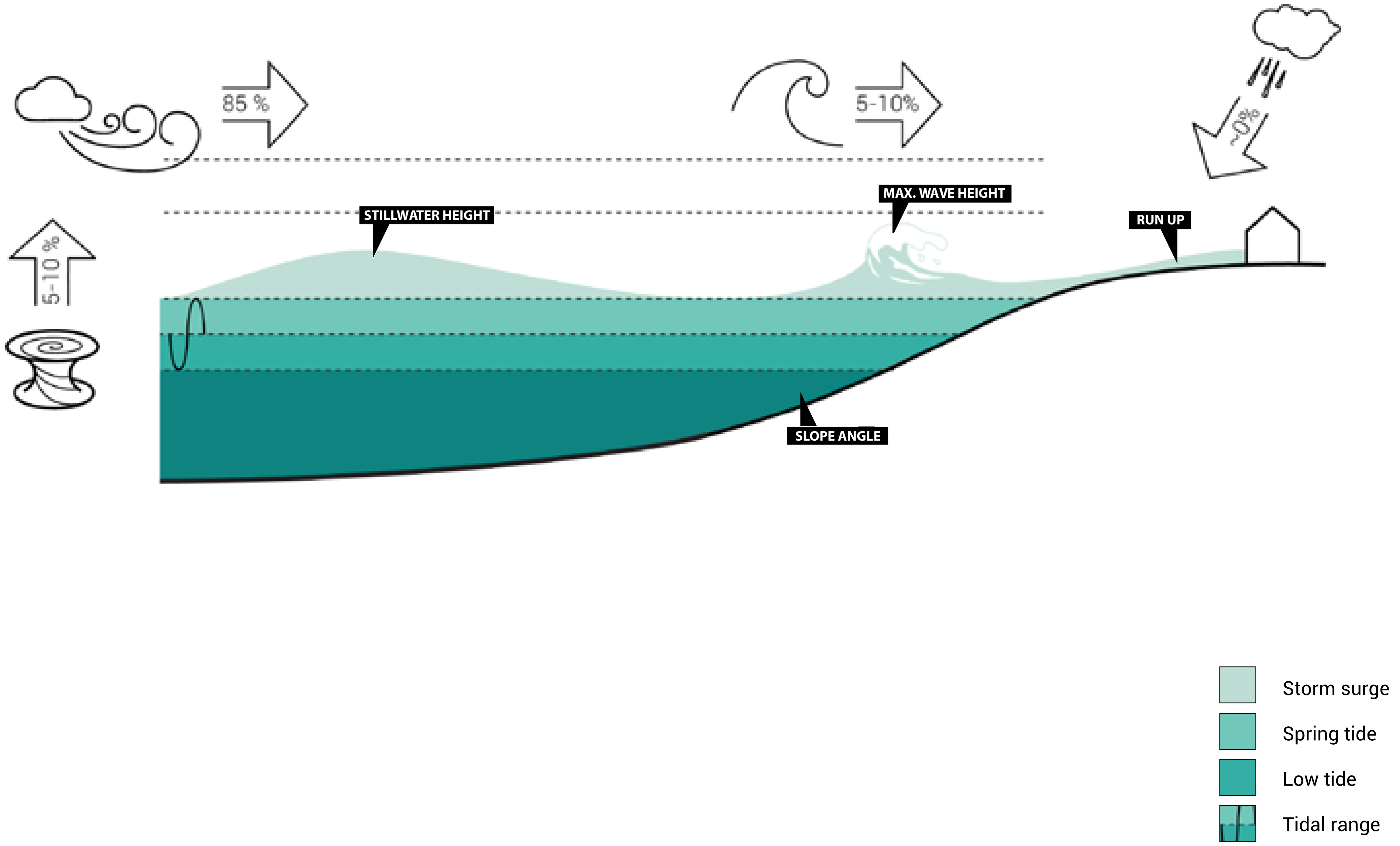
The flexibility and adaptivity of a strategy is more important than a high safety level.



GORNITZ, V., COUCH, S. & HARTIG, E. 2002. Impacts of Sea Level Rise in the New York City Metropolitan Area. Global and Planetary Changes, 32, 27.

FLOOD RISK PROTECTION REQUIREMENTS

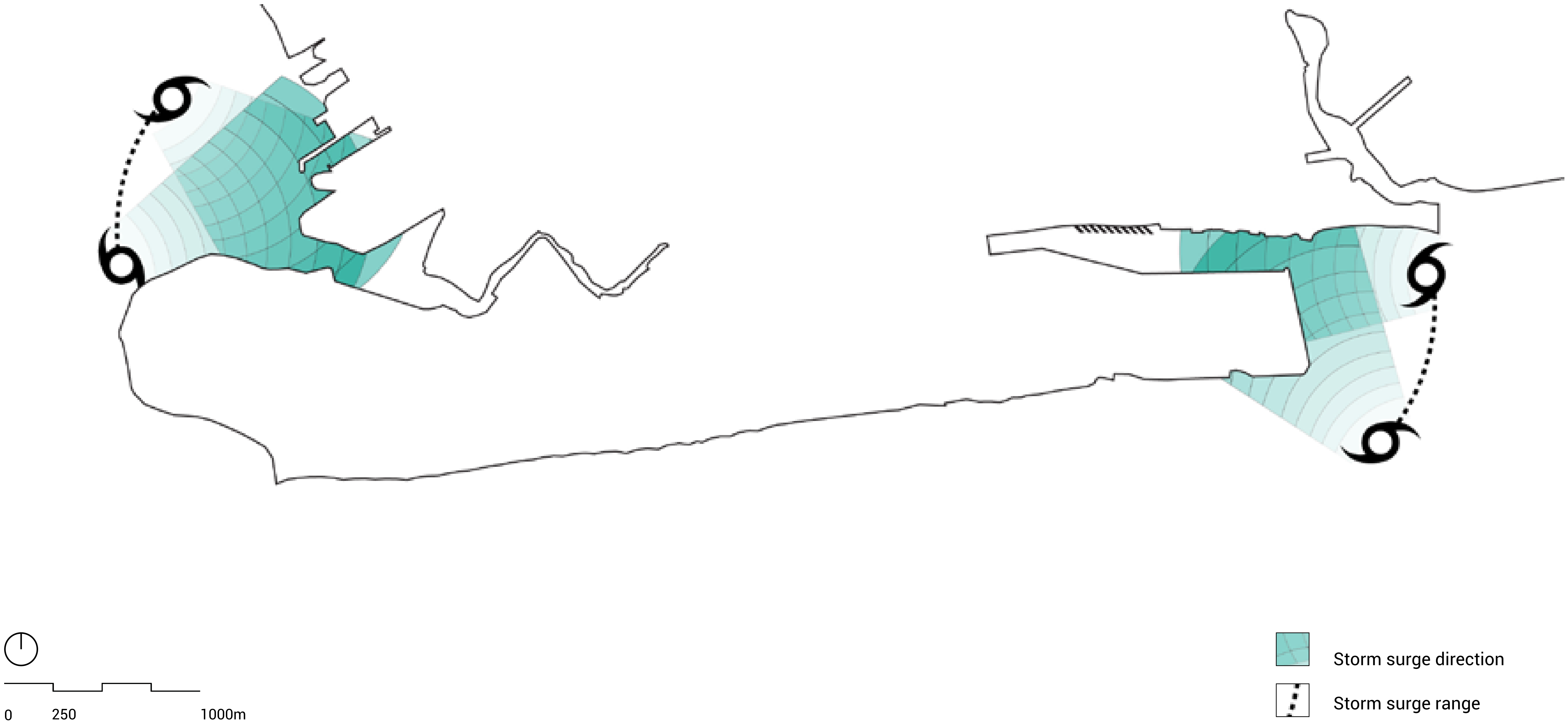
Workings of a storm surge



SOURCE: Diagram by author, 2014. Information from http://www.nhc.noaa.gov/surge/surge_intro.pdf.

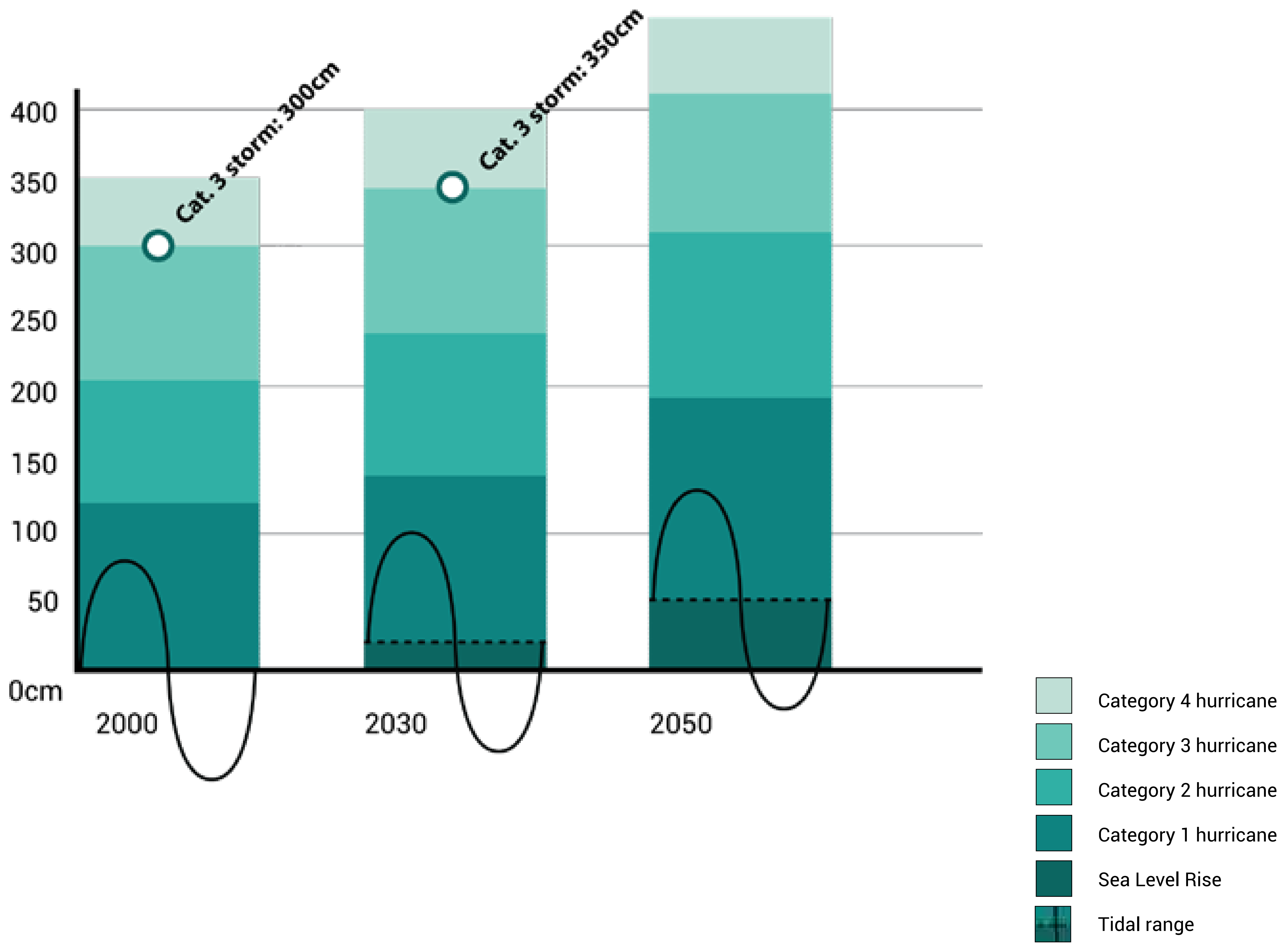
EXPOSURE TO STORM SURGES

The shape of the bay, angle of the slope and typology of the waterfront are most important factors.



SOURCE: Diagram by author, 2014.

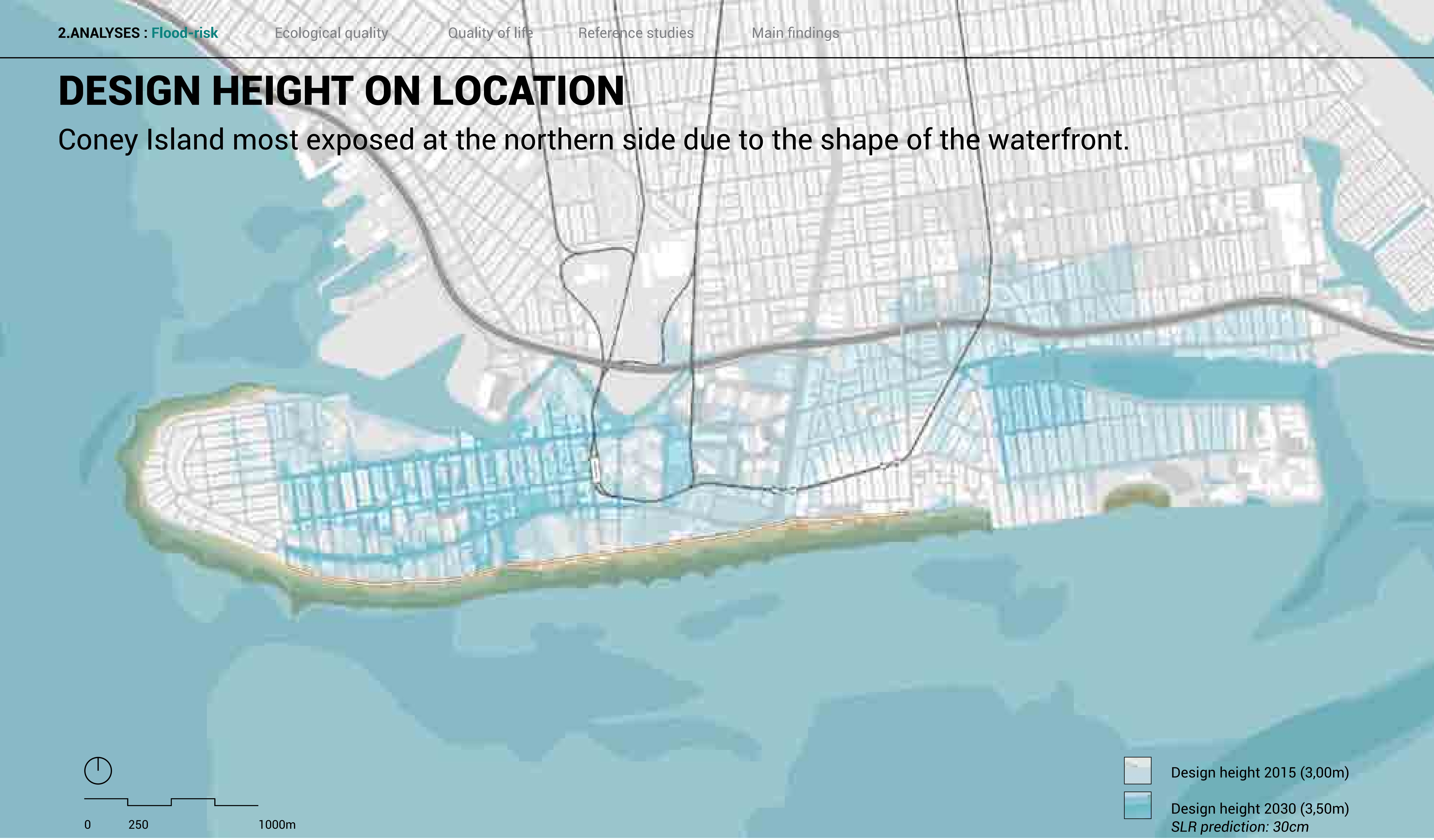
DESIGN HEIGHT / SAFETY LEVEL



SOURCE: www.nyc.gov/.../Ch17_SouthernBrooklyn_FINAL_HurricaneFAQ, 2014.

DESIGN HEIGHT ON LOCATION

Coney Island most exposed at the northern side due to the shape of the waterfront.



SOURCE: Map by author, 2014.
Information from: http://sealevel.climatecentral.org/surgingseas/NYC

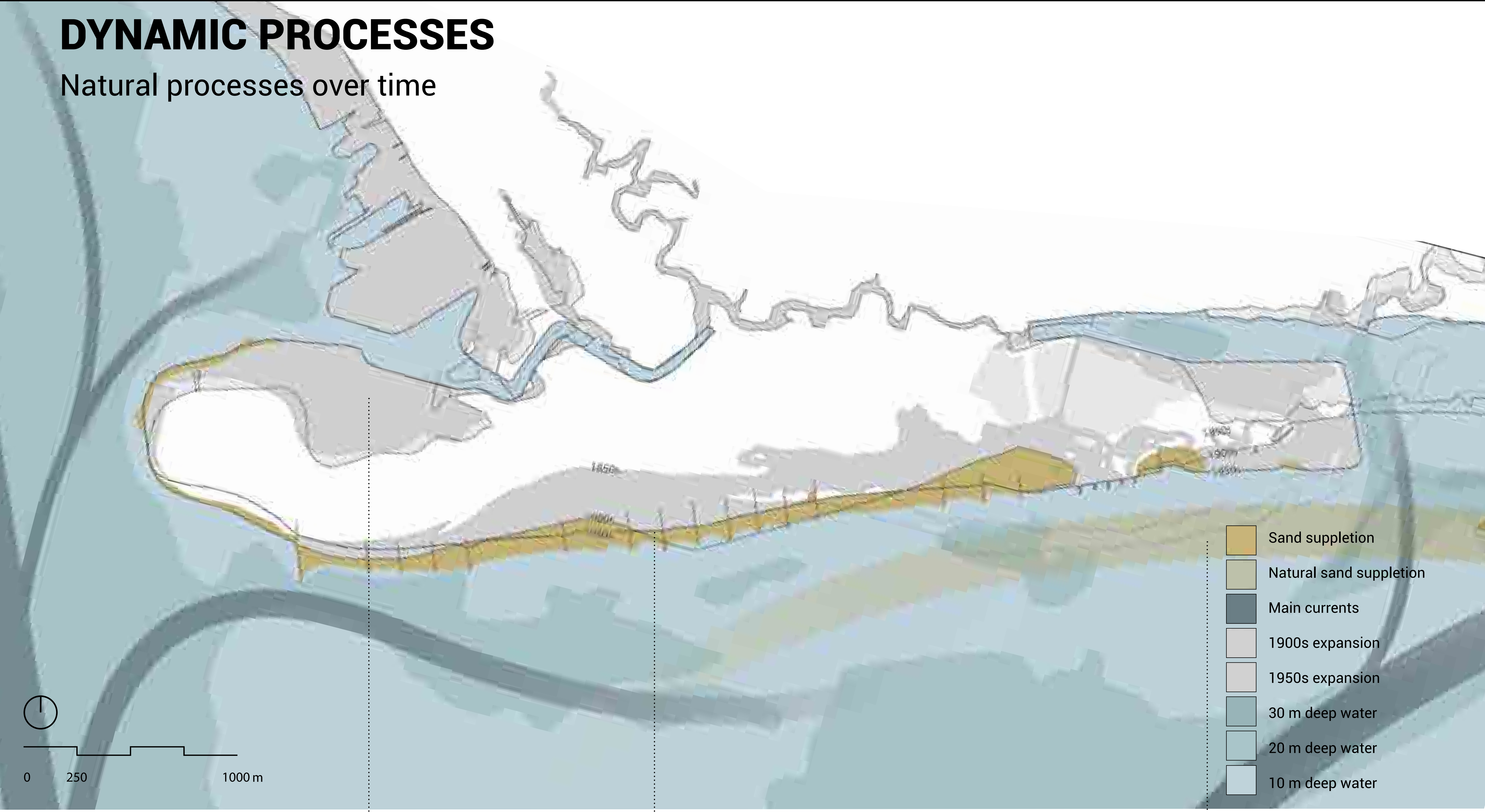
ECOLOGICAL QUALITY

A mix of different habitats all related to the mix of sweet and salt water.

SOURCE: NYC PLANNING 2010. Waterbody/Watershed Facility Plan, Coney Island Creek. In: PROTECTION, D. O. E. (ed.). New York City.

DYNAMIC PROCESSES

Natural processes over time



Destruction of marshland by land-fill

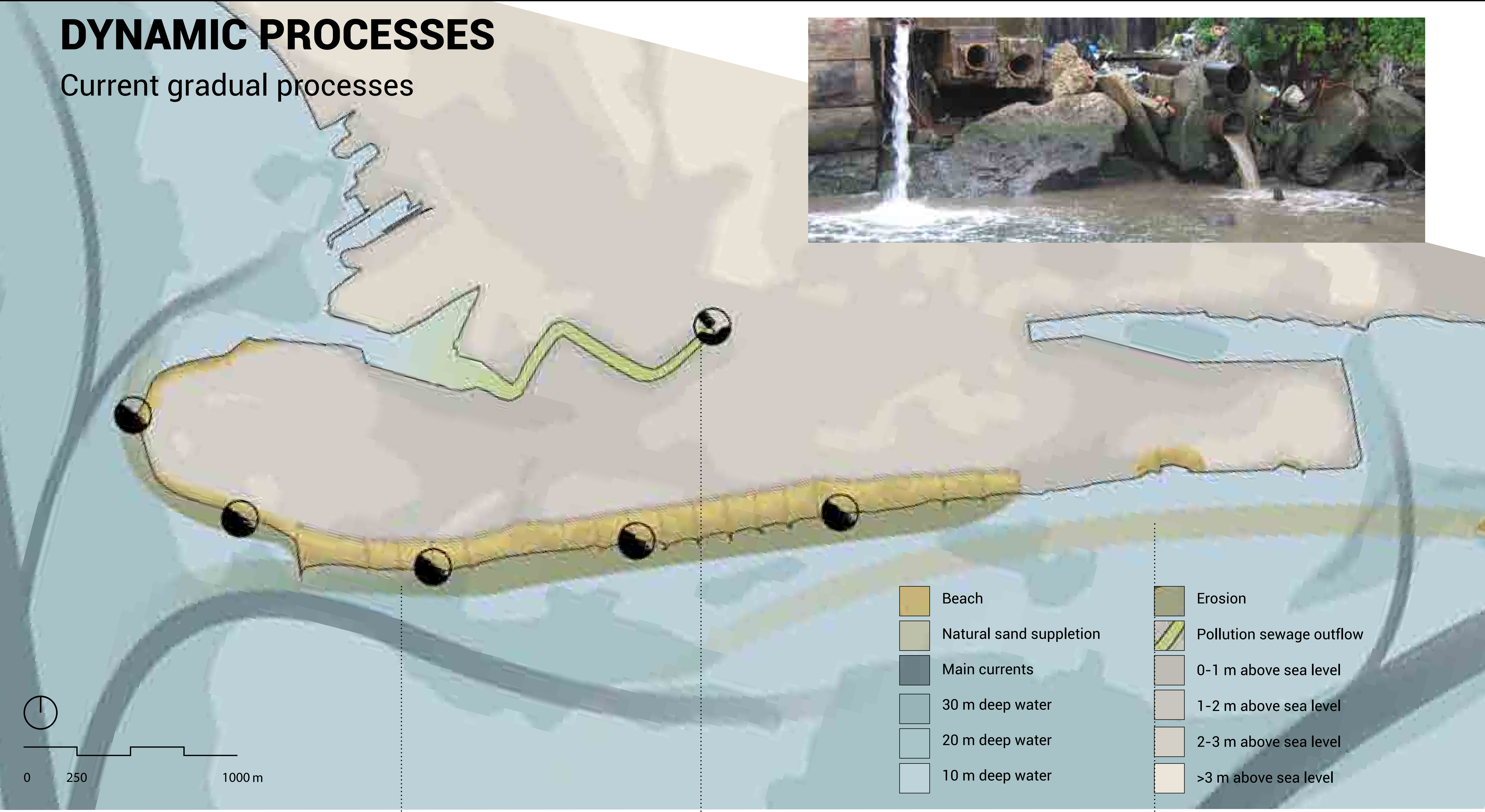
Natural extension from sand suppletion

Suppletion from marhslands of Jamaica Bay

SOURCE: Map by author, 2014.

DYNAMIC PROCESSES

Current gradual processes



Erosion of beach

Sewage outflow results in the pollution of the creek.

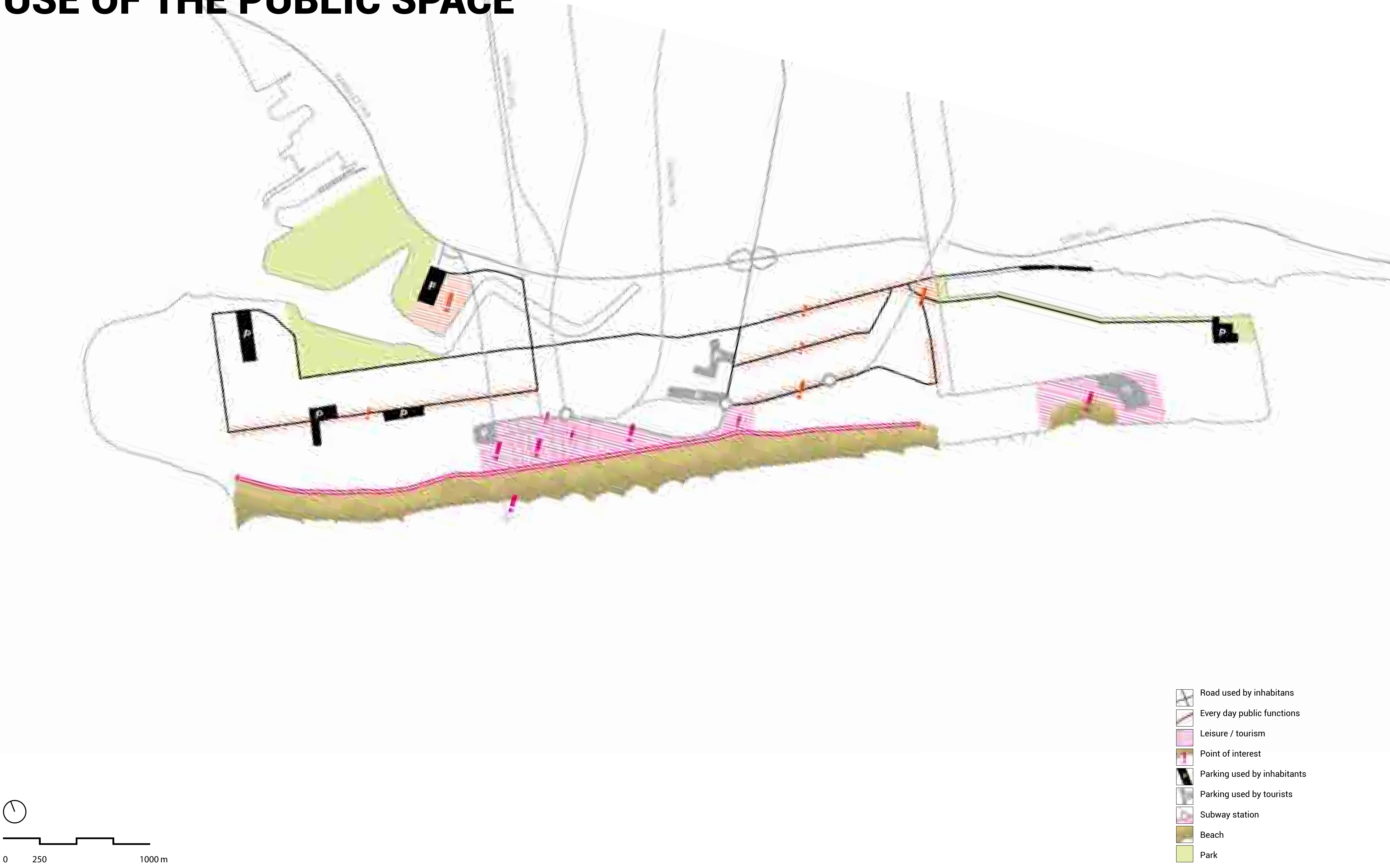
Less suppletion due to destruction of marhslands.

SOURCE: Map by author, 2014.

QUALITY OF LIFE IN CONEY ISLAND

Quality of live within the communities of Coney Island

USE OF THE PUBLIC SPACE



MAIN ISSUES WITHIN THE URBAN FABRIC

Disconnection between communities

MAIN ISSUES WITHIN THE URBAN FABRIC

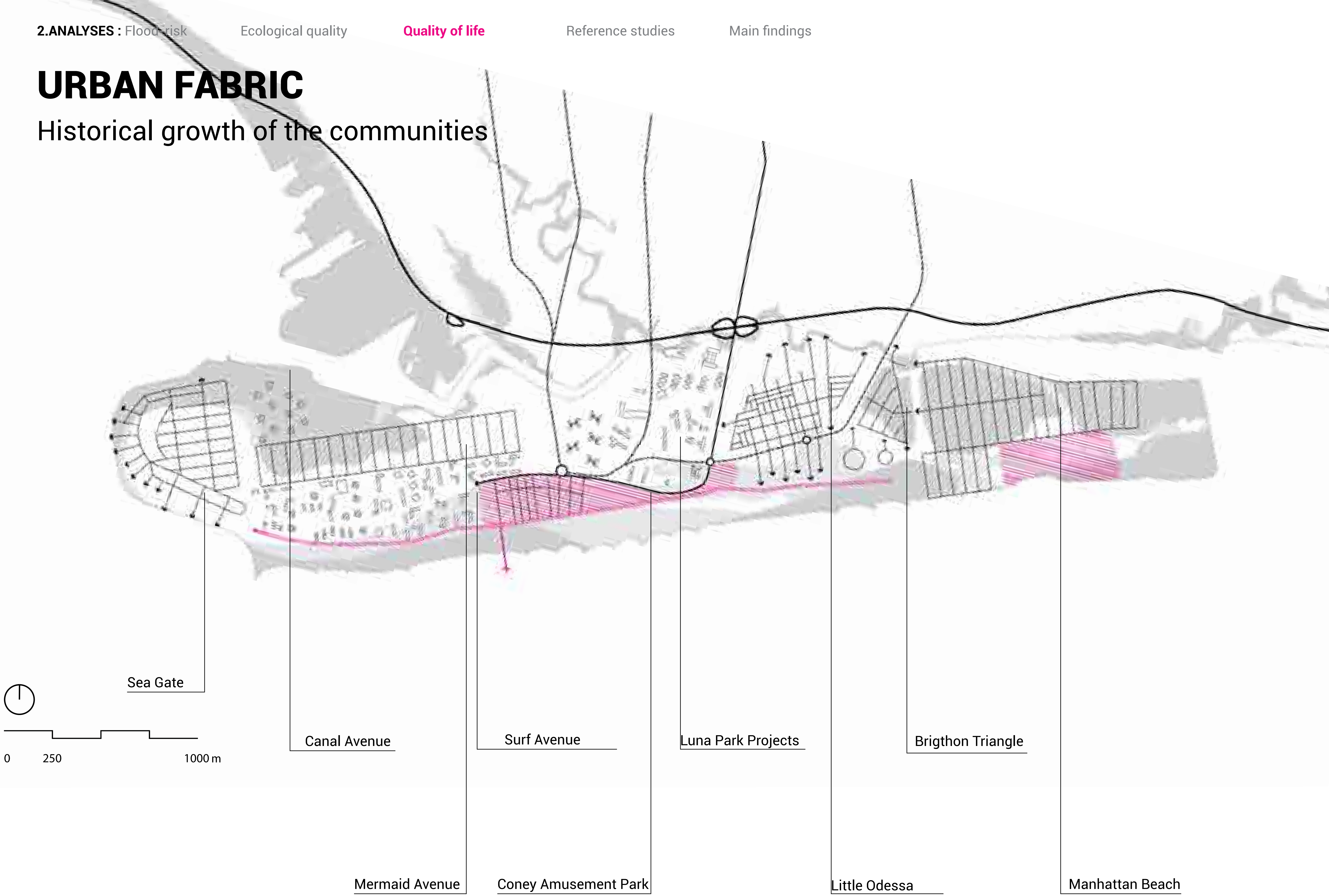
Disconnection with the waterfront

MAIN ISSUES WITHIN THE URBAN FABRIC

Underuse of public space

URBAN FABRIC

Historical growth of the communities



SOURCE: Map by author, 2014.

DIVERSITY OF CONEY ISLAND

Sea Gate

Canal Avenue

Mermaid Avenue

Surf Avenue

Luna Park

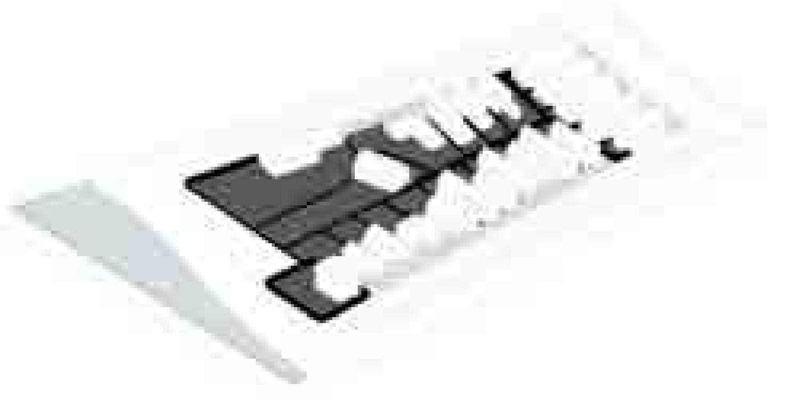
Little Odessa

Ocean Terrace

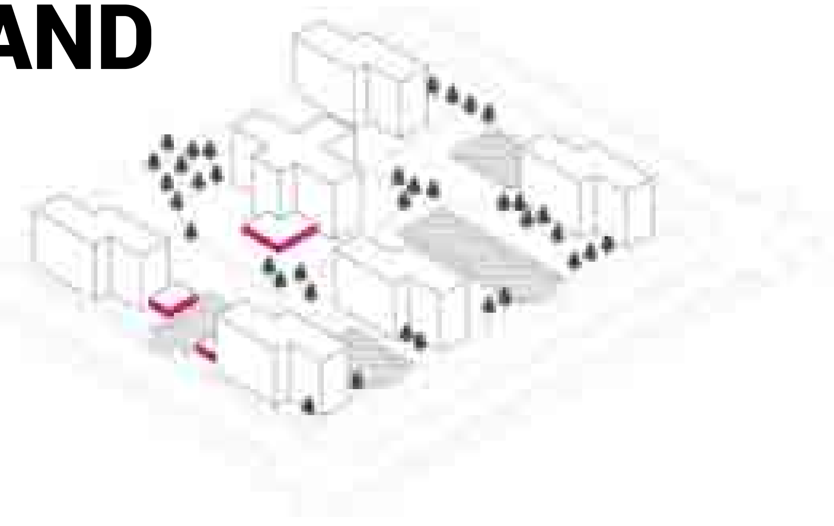
Brighton Triangle

Manhattan Beach

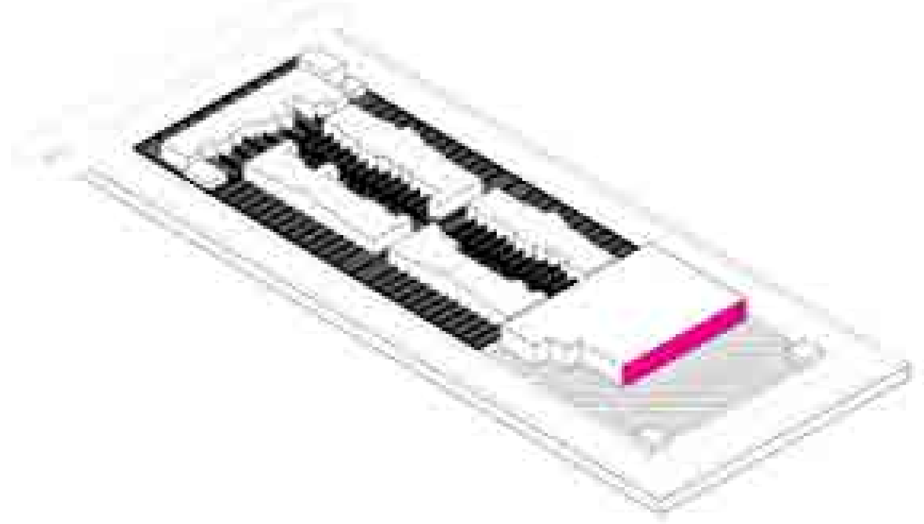
DIVERSITY OF CONEY ISLAND



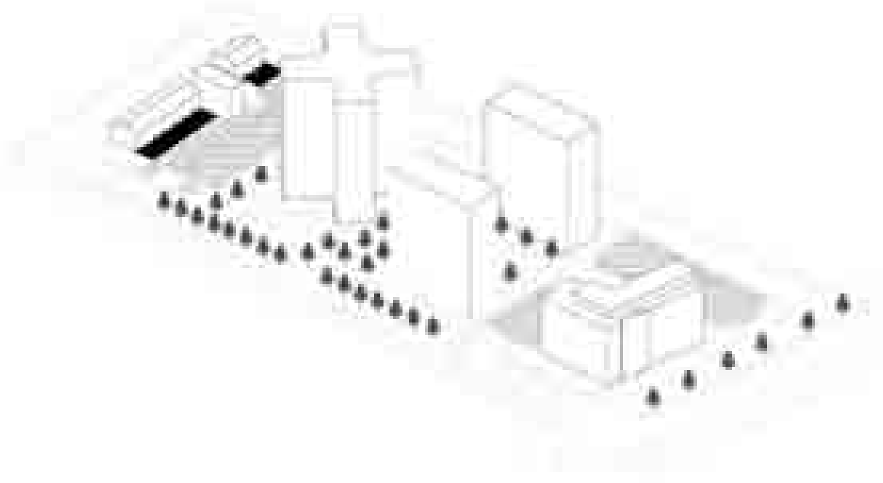
Sea Gate



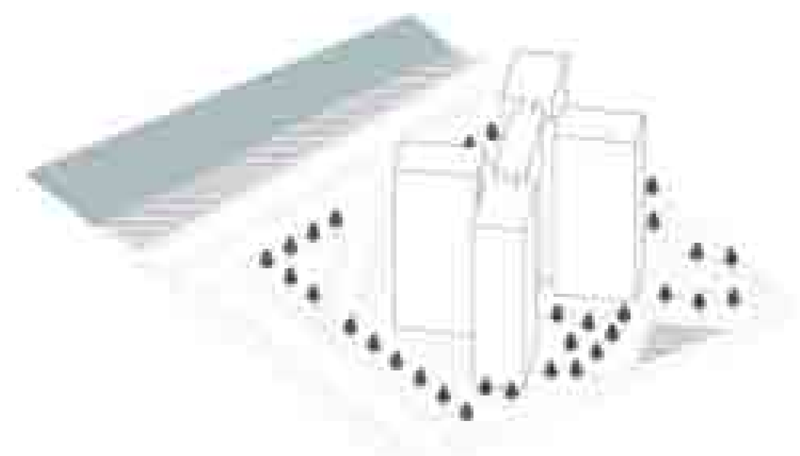
Canal Avenue



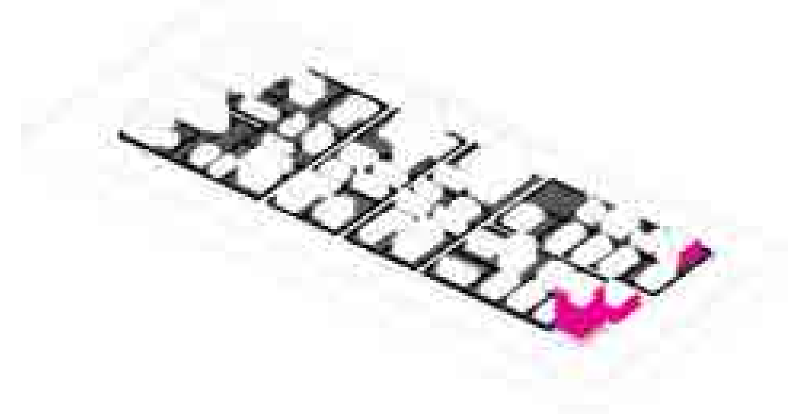
Mermaid Avenue



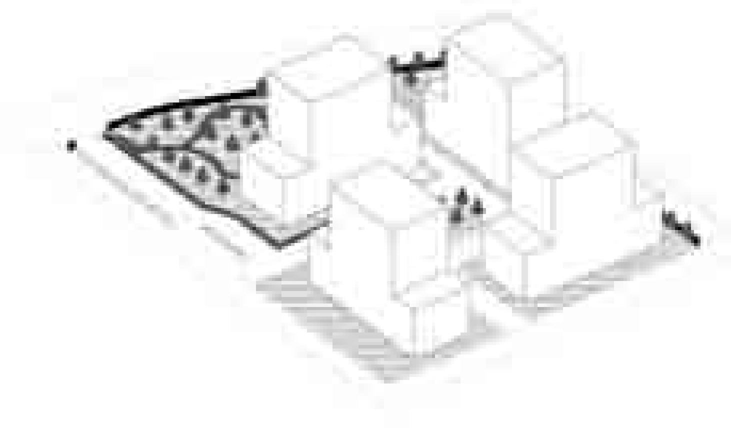
Surf Avenue



Luna Park

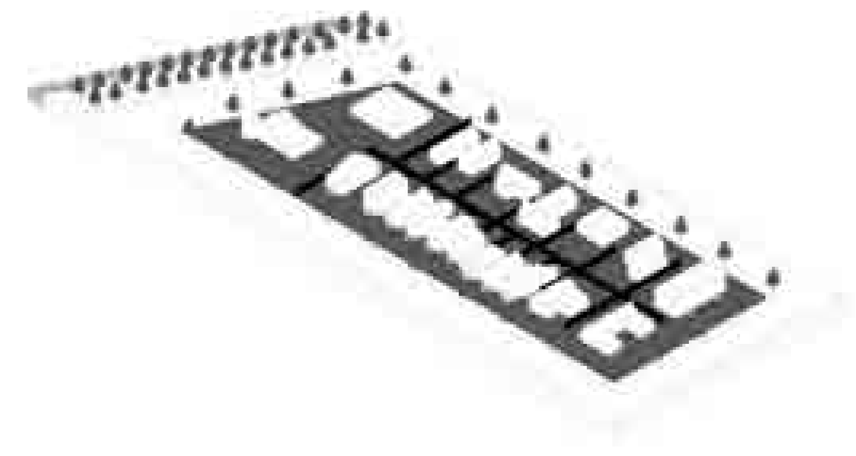


Little Odessa



Ocean Terrace

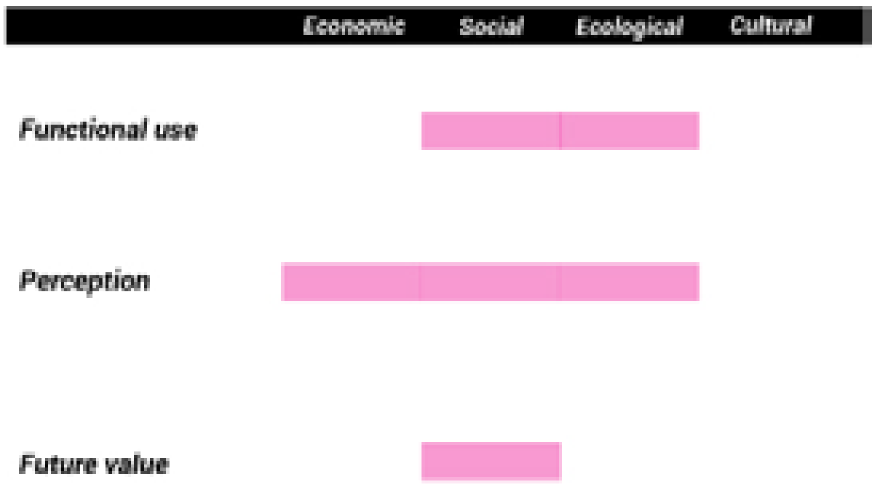
Brighton Triangle



Manhattan Beach

SOURCE: Diagrams by author, 2014.

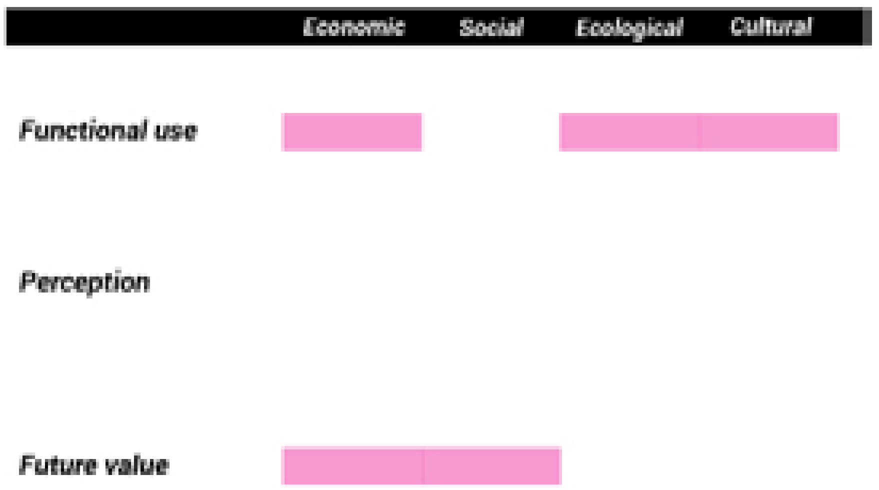
INTERPRETATION OF SPATIAL QUALITY



Sea Gate

Canal Avenue

Mermaid Avenue



Surf Avenue

Luna Park

Little Odessa

Ocean Terrace

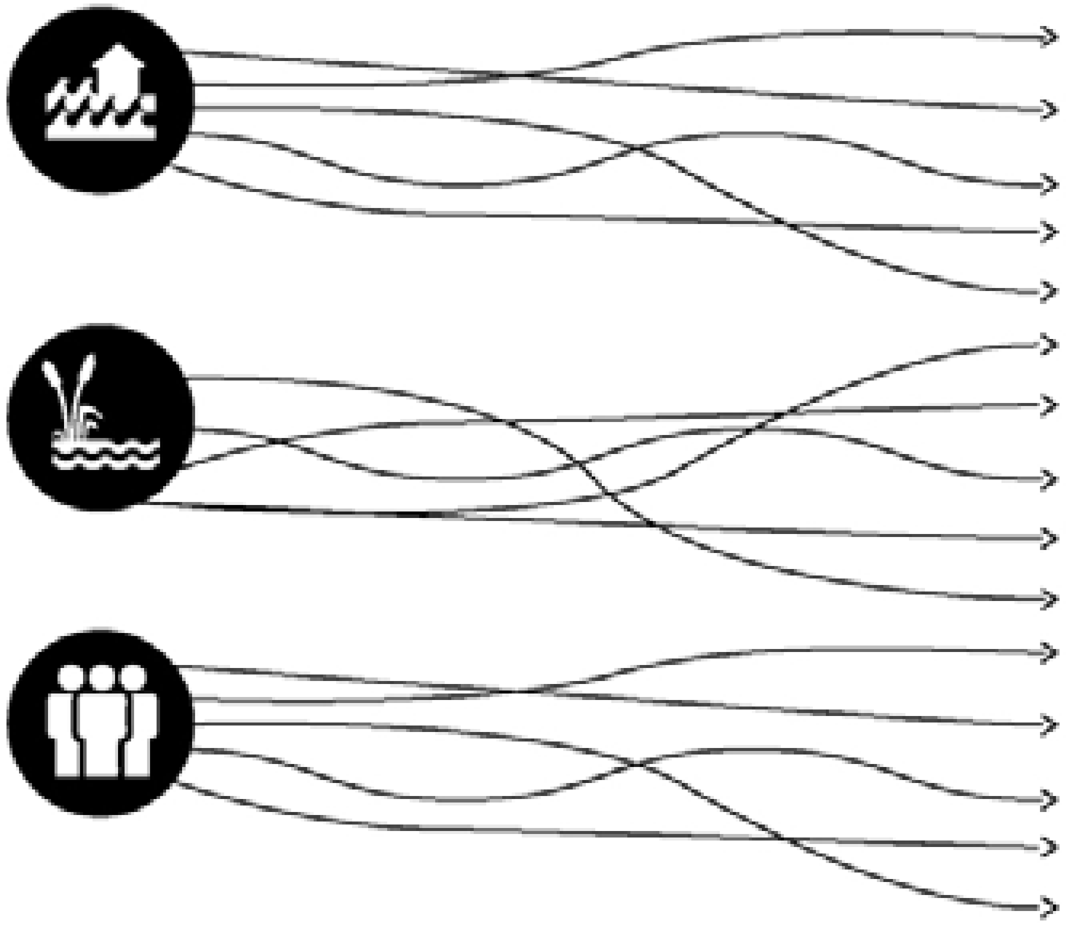
Brighton Triangle

Manhattan Beach

SOURCE: Kwaliteit in meervoud' by Habiform (Hooimeijer et al., 2001).

MAIN FINDINGS

Need to be taken into account in the strategy



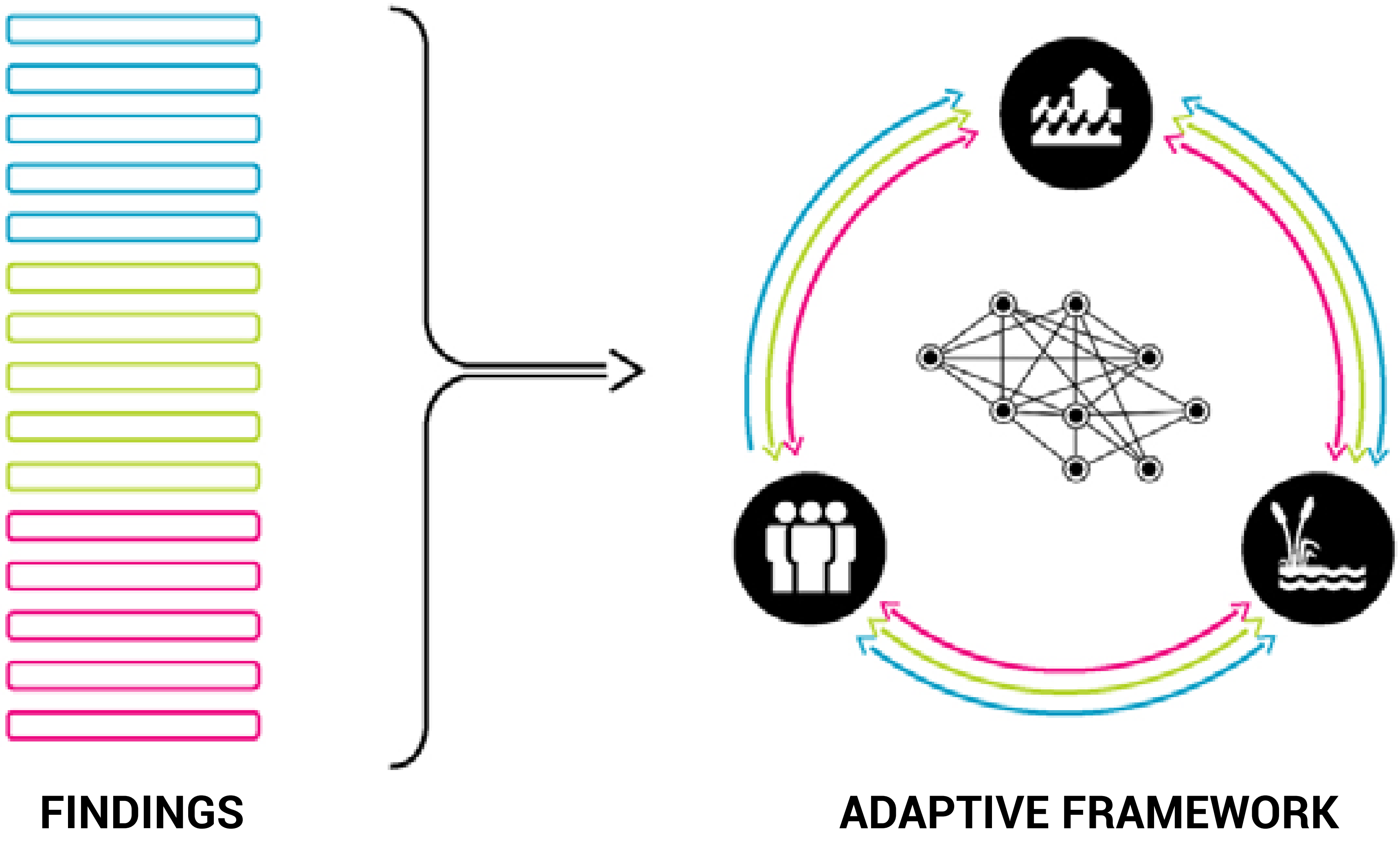
Natural processes can provide flexibility towards flood-risk.

Design conditions to create new habitats.

Adapted to the context of the communities.

Increasing social quality decreases flood-risk.

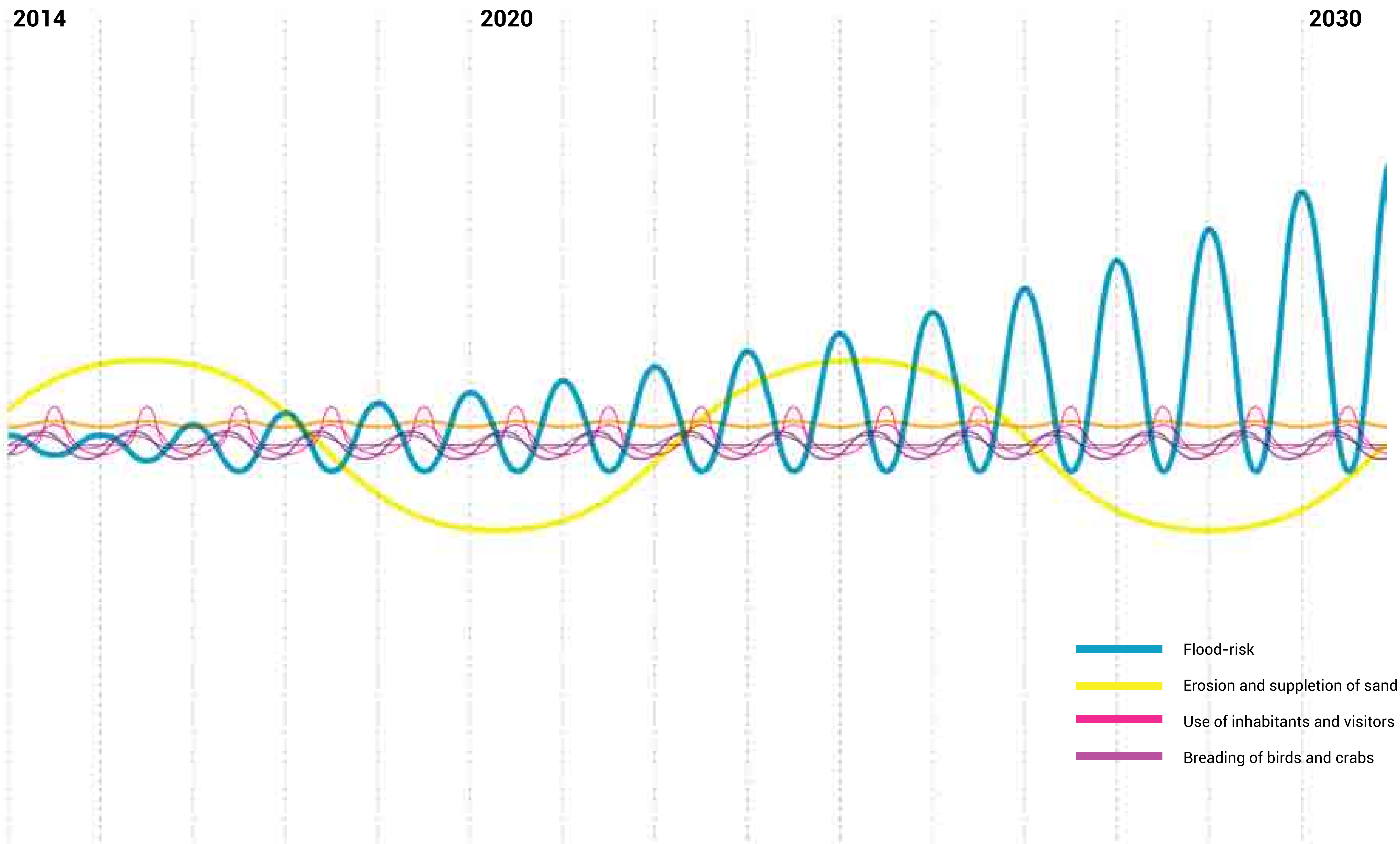
3 ADAPTIVE FRAMEWORK



SOURCE: Diagram by author, 2014.

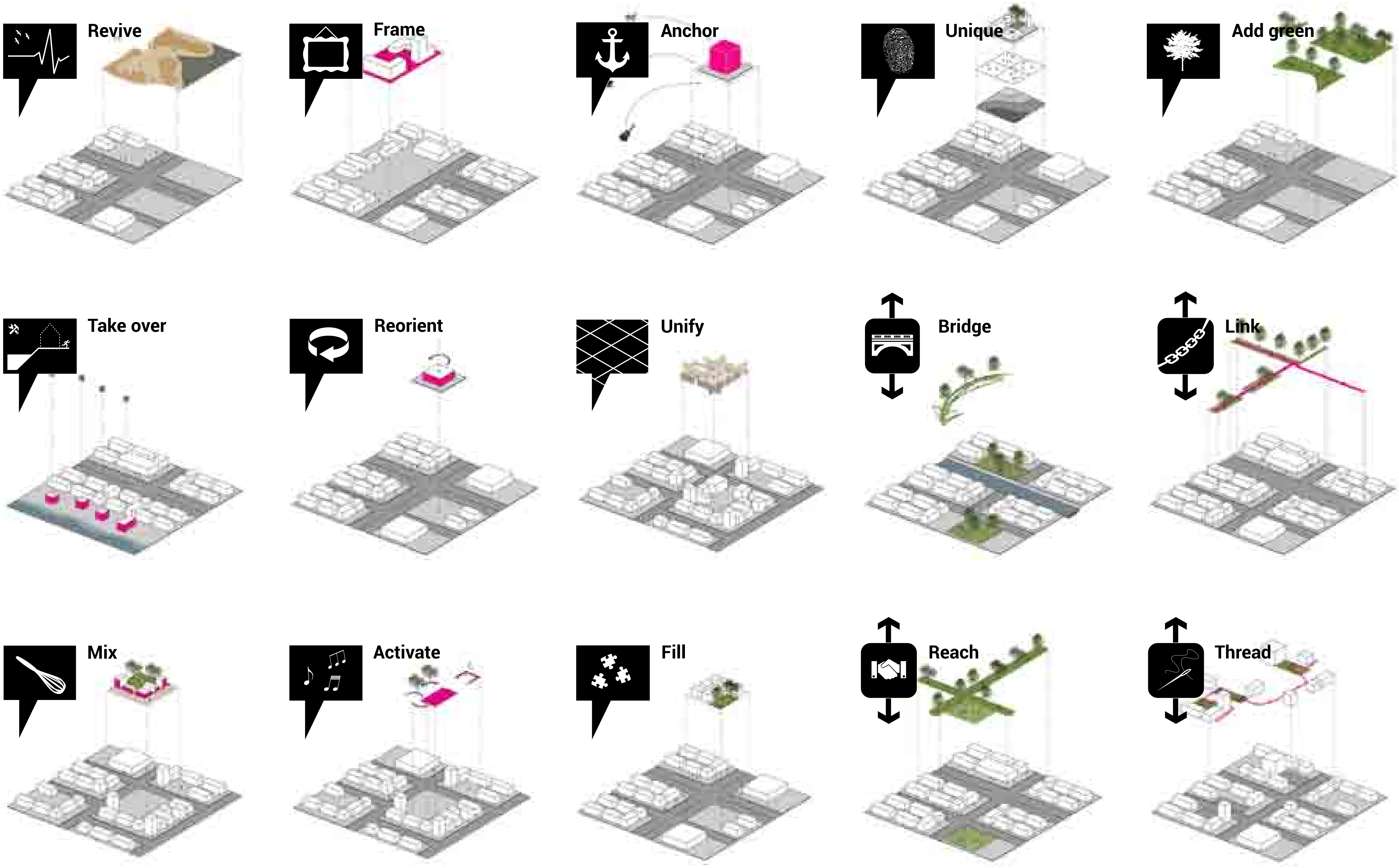
CONCEPT

The rhythm of Coney Island



SOURCE: Flexible and fitting to the timeframe of the issues involved. Diagram by author, 2014.

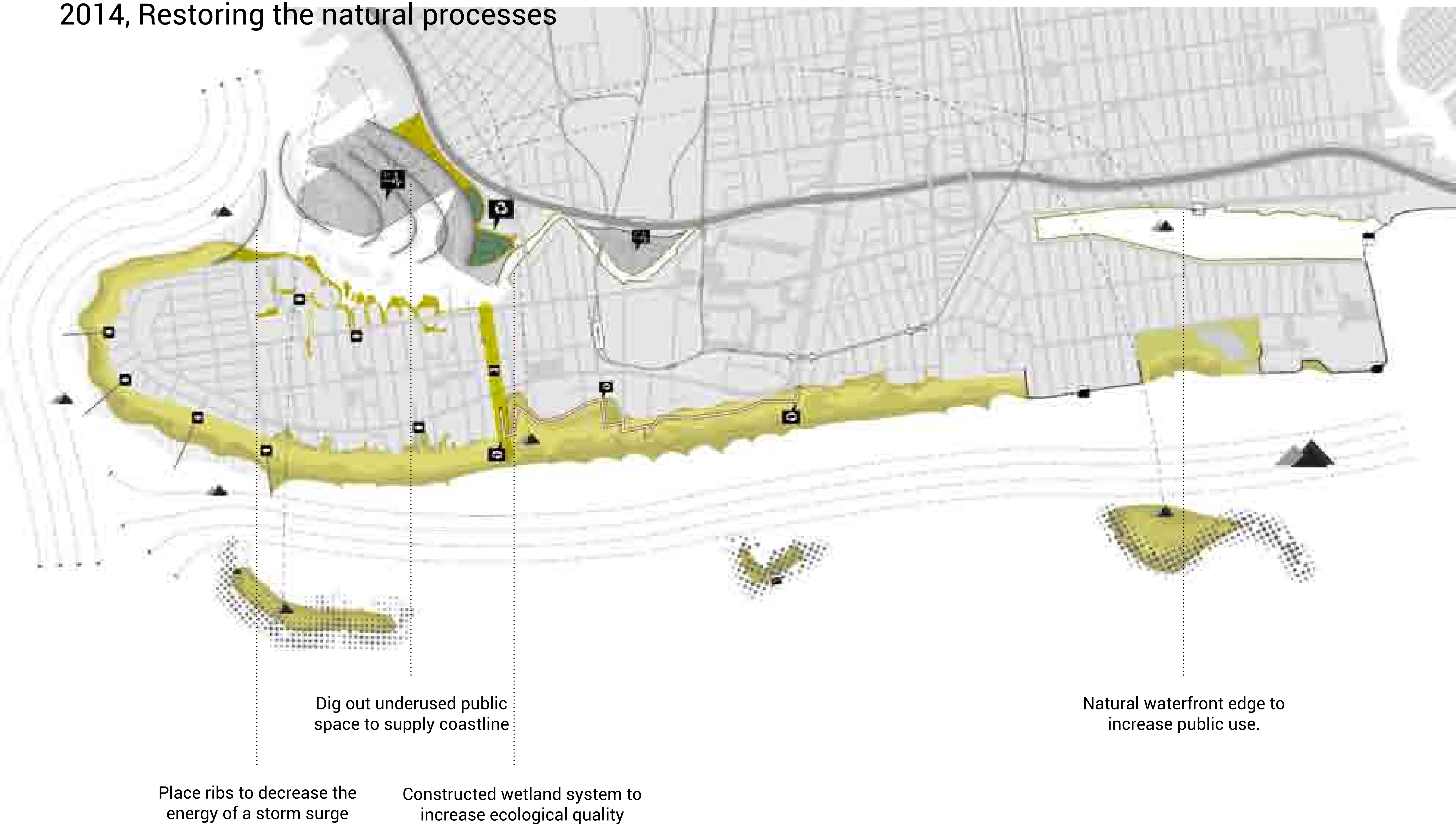
DEVELOPMENT PRINCIPLES



SOURCE: Define oppertunities for transformation. Diagrams by author, 2014.

PHASING

2014, Restoring the natural processes



SOURCE: Map by author, 2014.

PHASING

2014-2030, Urban Interventions

Wetlands serve as green connectors between old communities and waterfront.

Extending reintroduced marshlands into the communities

Extending these communities towards the accessible and natural waterfront.

New focus points will be developed to increase the use of the waterfront.

SOURCE: Map by author, 2014.

PHASING

2030, Maintaining the balance

Combination of sweet and salt water create variety in habitats.

Sand motor counteracts erosion of shoreline.

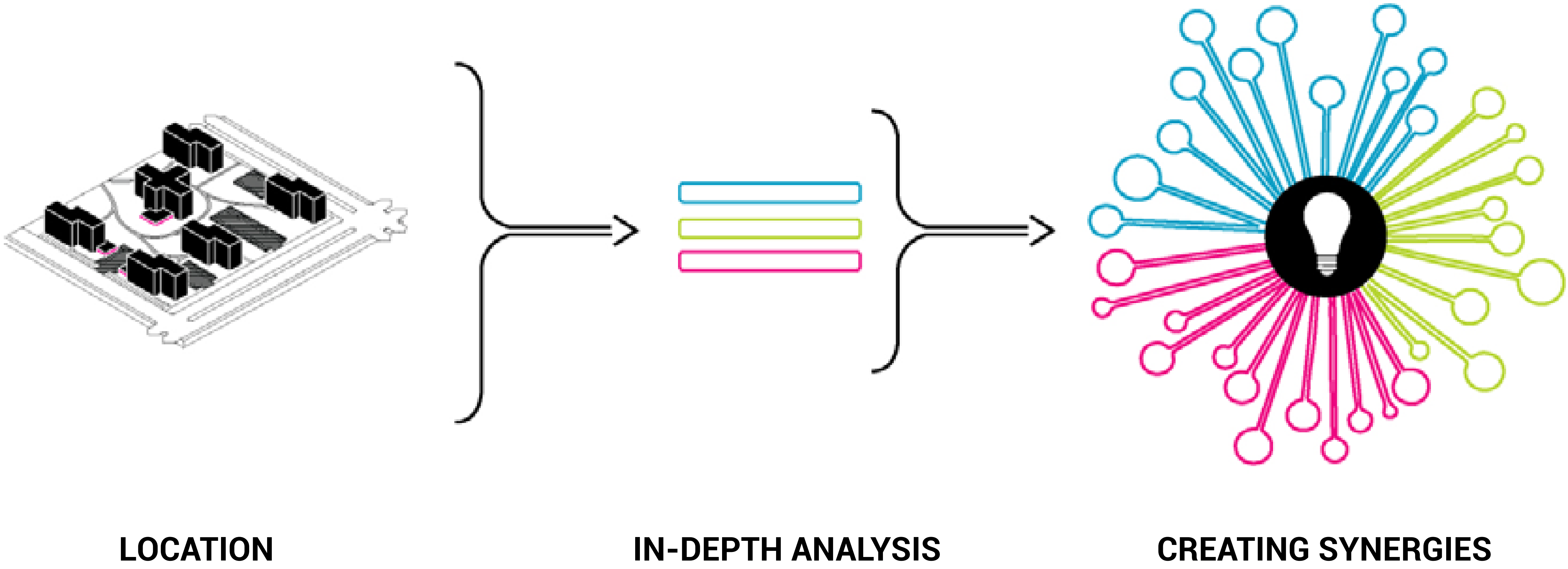
SOURCE: Map by author, 2014.

ADAPTIVE URBAN FRAMEWORK

Water depth <10m
Water depth 10 - 20m
Water depth >20m
Parking
Urbanized area
Buildings
Elevated subway tracks
Parkway
Treeline
Park / recreation
Sand / coastline
Design height 2014 (3m)
Design height 2030 (3,5m)
Main currents
To be linked areas / evacuation routes
To be realized in phase 1
To be realized in phase 2

IMPROVEMENTS IN THE URBAN FABRIC

4 KEY DESIGN LOCATION



SOURCE: Diagram by author, 2014.

QUALITY OF LIFE

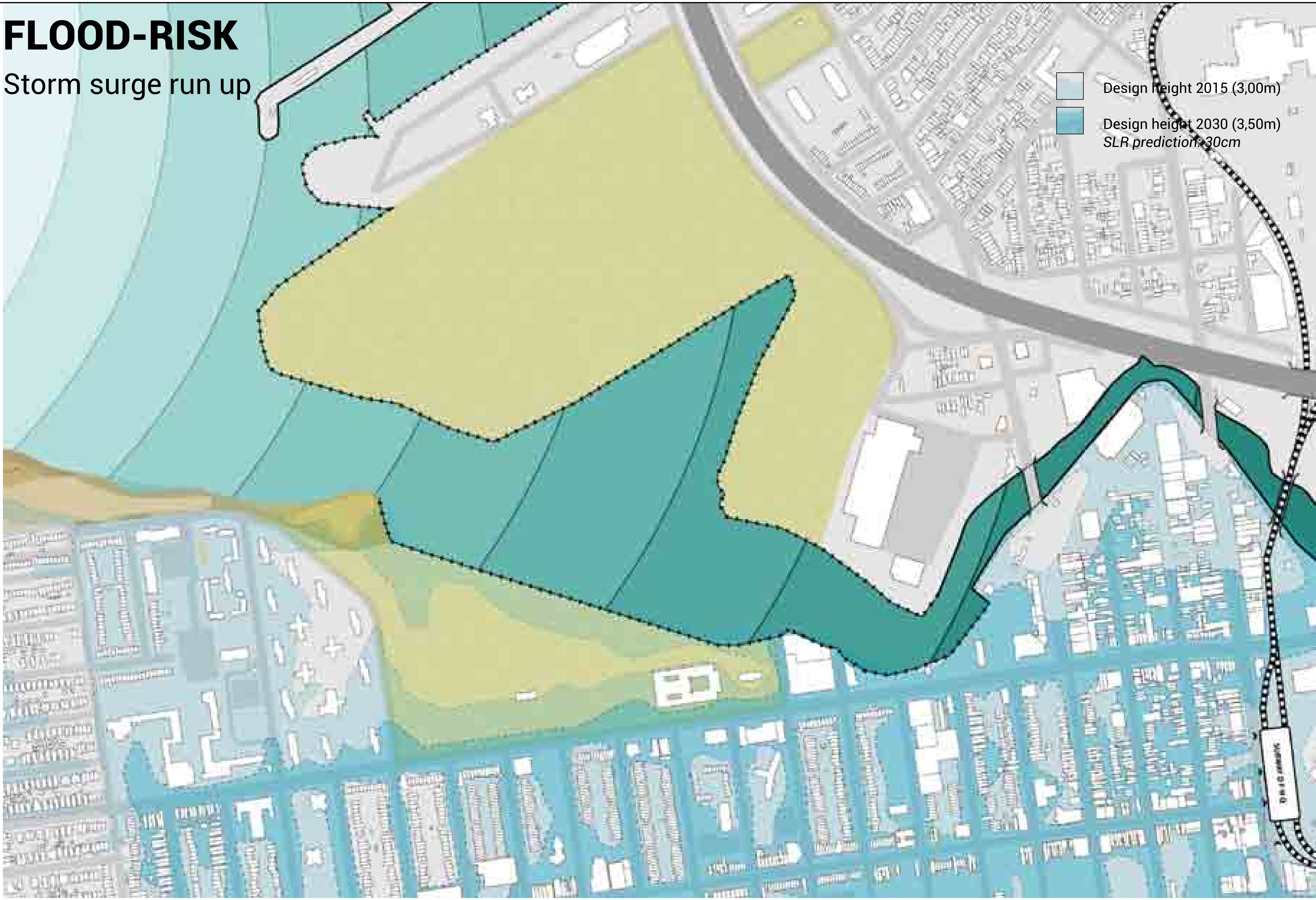
Great potential

QUALITY OF LIFE

Inaccessible for the public

FLOOD-RISK

Storm surge run up

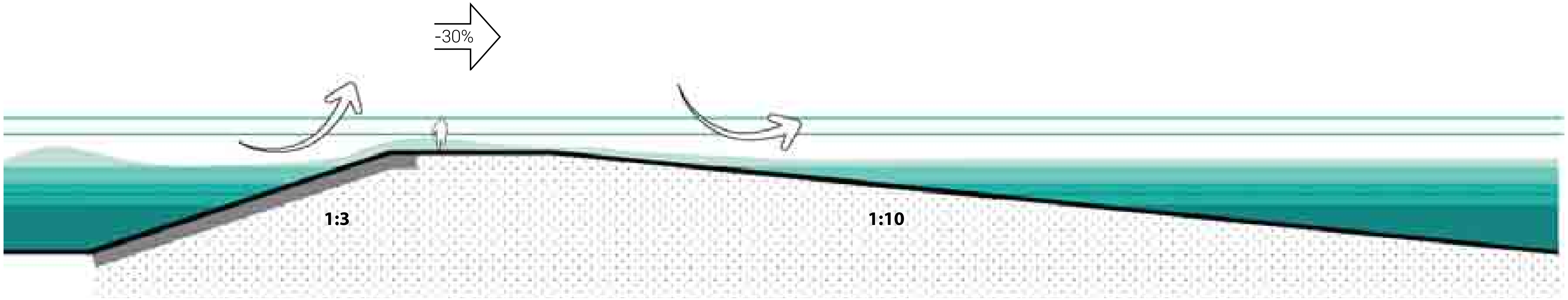


SOURCE: Map by author, 2014.

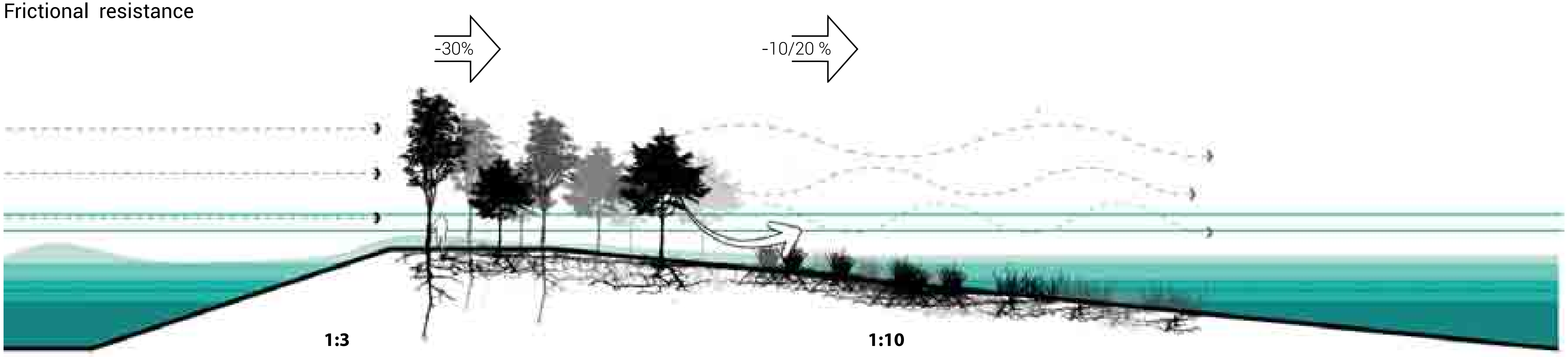
CONCEPT

Decrease the run up distance and energy of a storm surge

Physical resistance



Frictional resistance



SOURCE: Diagram by author, 2014.
Wamsley, T., Cialone, M., Smith, J., Atkinson, J., Rosati, J. . (2010). The potential of wetlands in reducing storm surge. Ocean Engineering, 37, 9.

rules of thumb

Position of the ribs in the Creek

s = Storm surge height at impact in meters (3,00m in 2015, 3,50m in 2015-2030, and 4,00m after 2030)

p = percentage of energy loss due to physical resistance (30%)

n = number of ribs in between storm surge and communities.

fplants = percentage of energy loss due to plants (10%)

wland= width of land above average sea level in meters

ftrees = percentage of energy loss due to plants (10%)

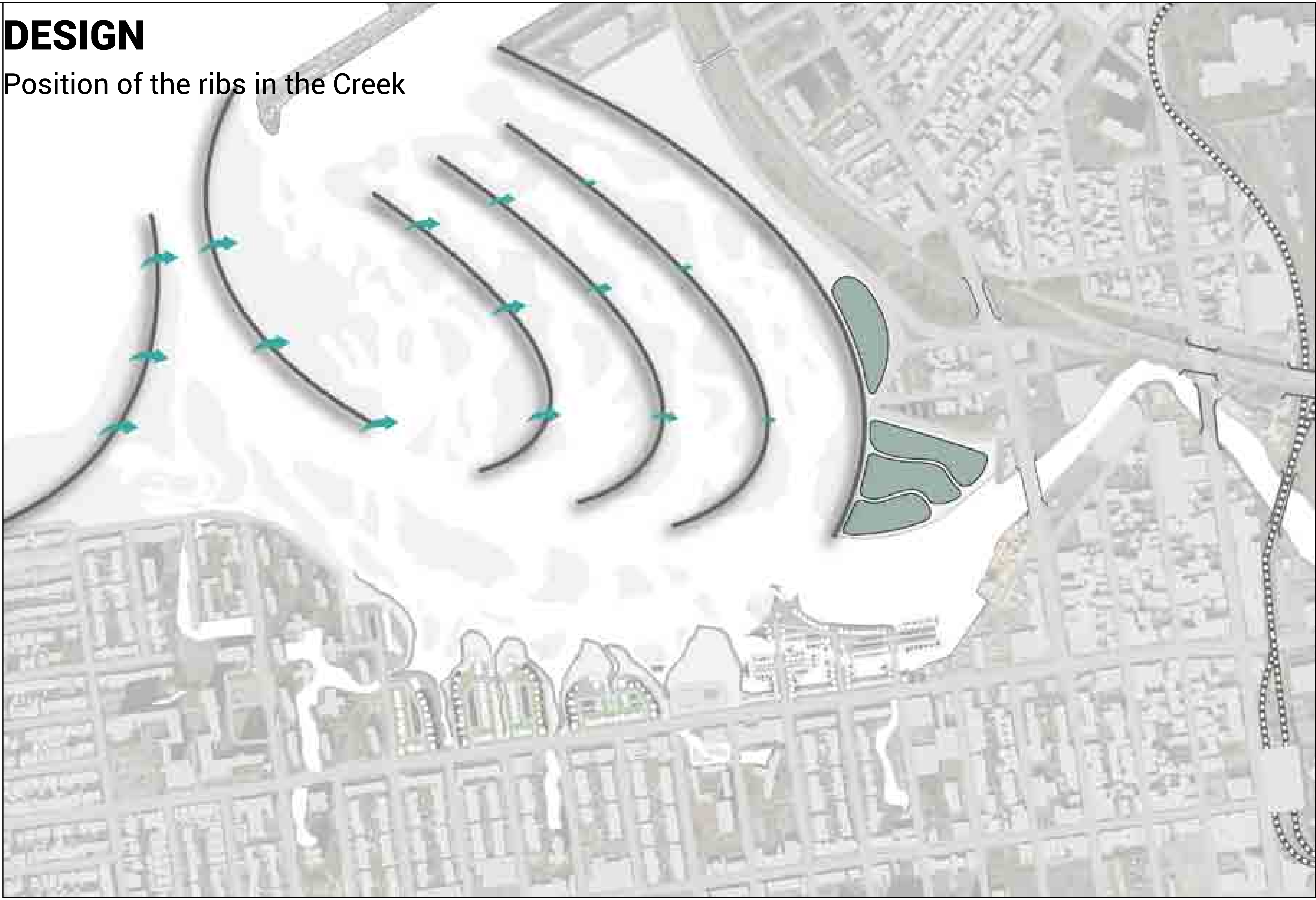
wforest = width of forest in meters.

Safety level = height of surge after protection measures in meters

$$\text{Safety level} = s * (100\% - p)^{n} * (100\% - f_{land}) W^{plants} / 500 * (100\% - f_{trees}) W^{forest} / 50$$

DESIGN

Position of the ribs in the Creek



SOURCE: Map by author, 2014.

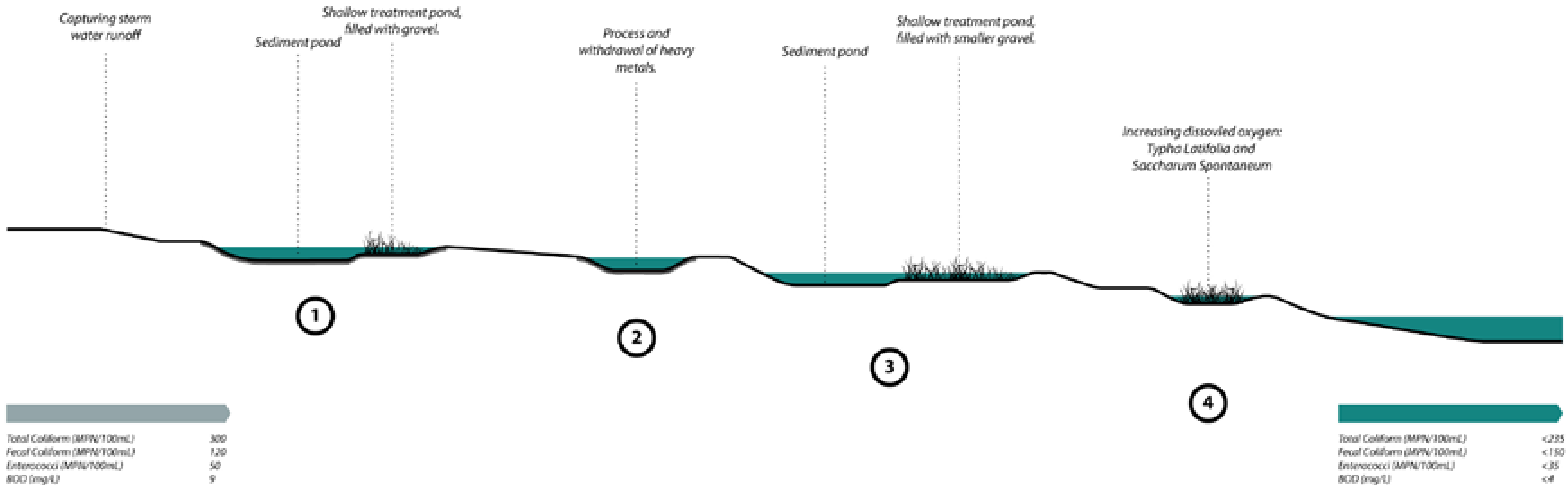
ECOLOGICAL QUALITY

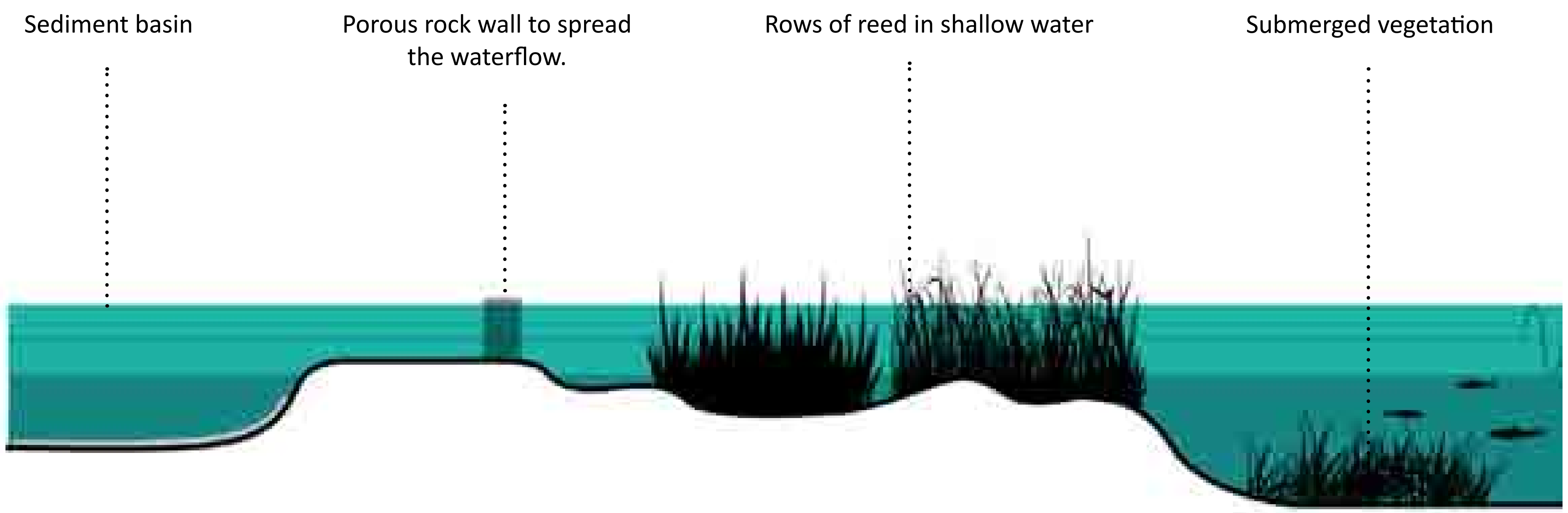
Causes of pollution

SOURCE: Map by author, 2014.

CONCEPT

Replacing CSO and storm water pipes with constructed wetland filters.





SOURCE: Dordio, A., Palace-Carvalho, A. J., Pinto, A. (2013). Wetlands: Water “living filters”? , University of Évora, Évora, Portugal.

DESIGN

Constructed wetland filters.

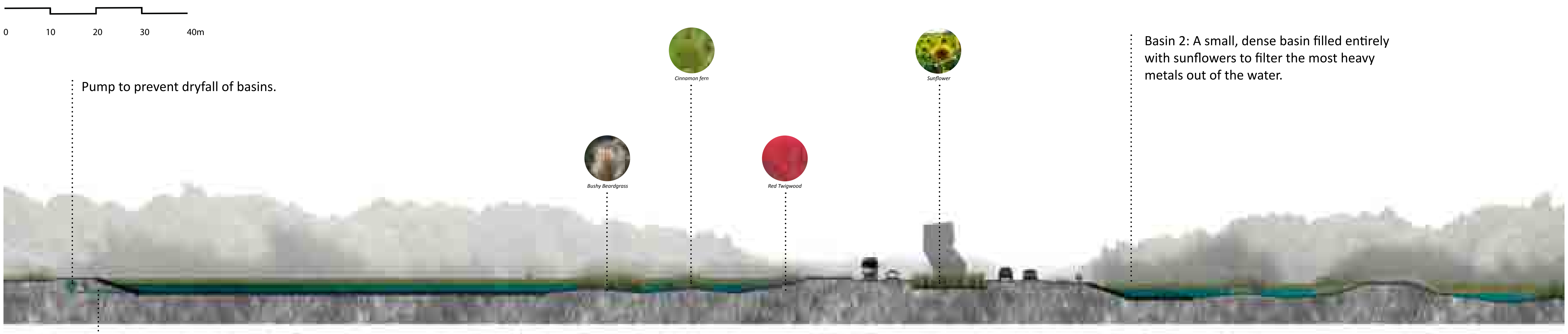
SOURCE: Map by author, 2014.

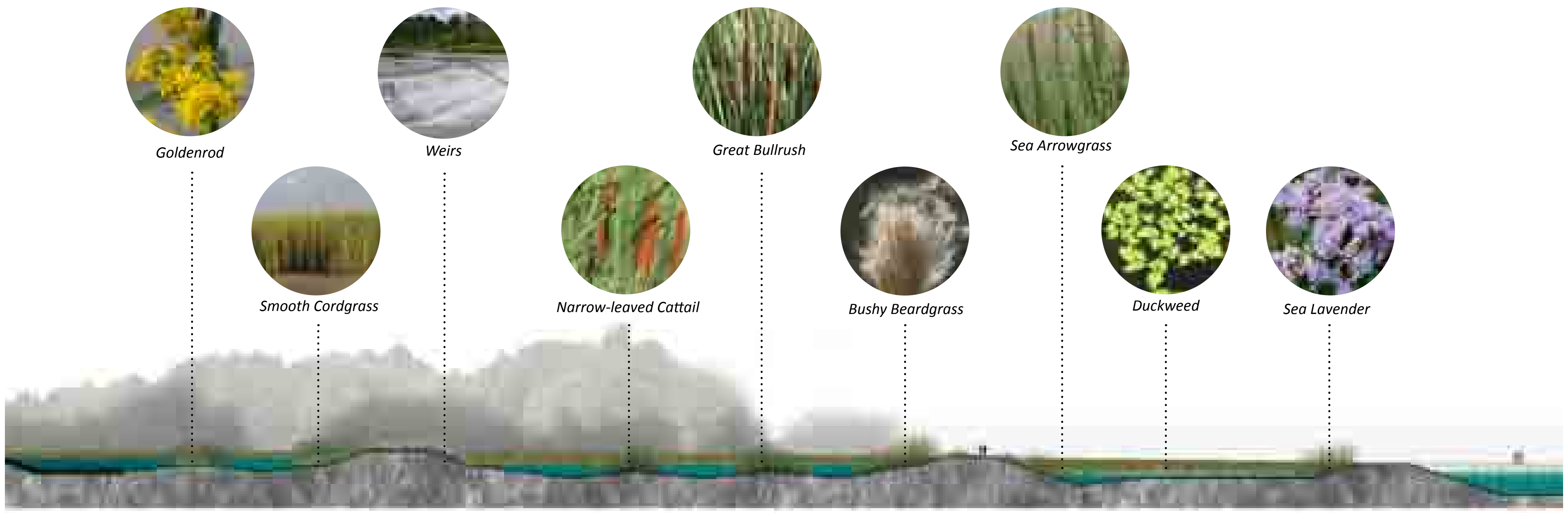
SOURCE: Map by author, 2014.

DESIGN

Constructed wetland filters.

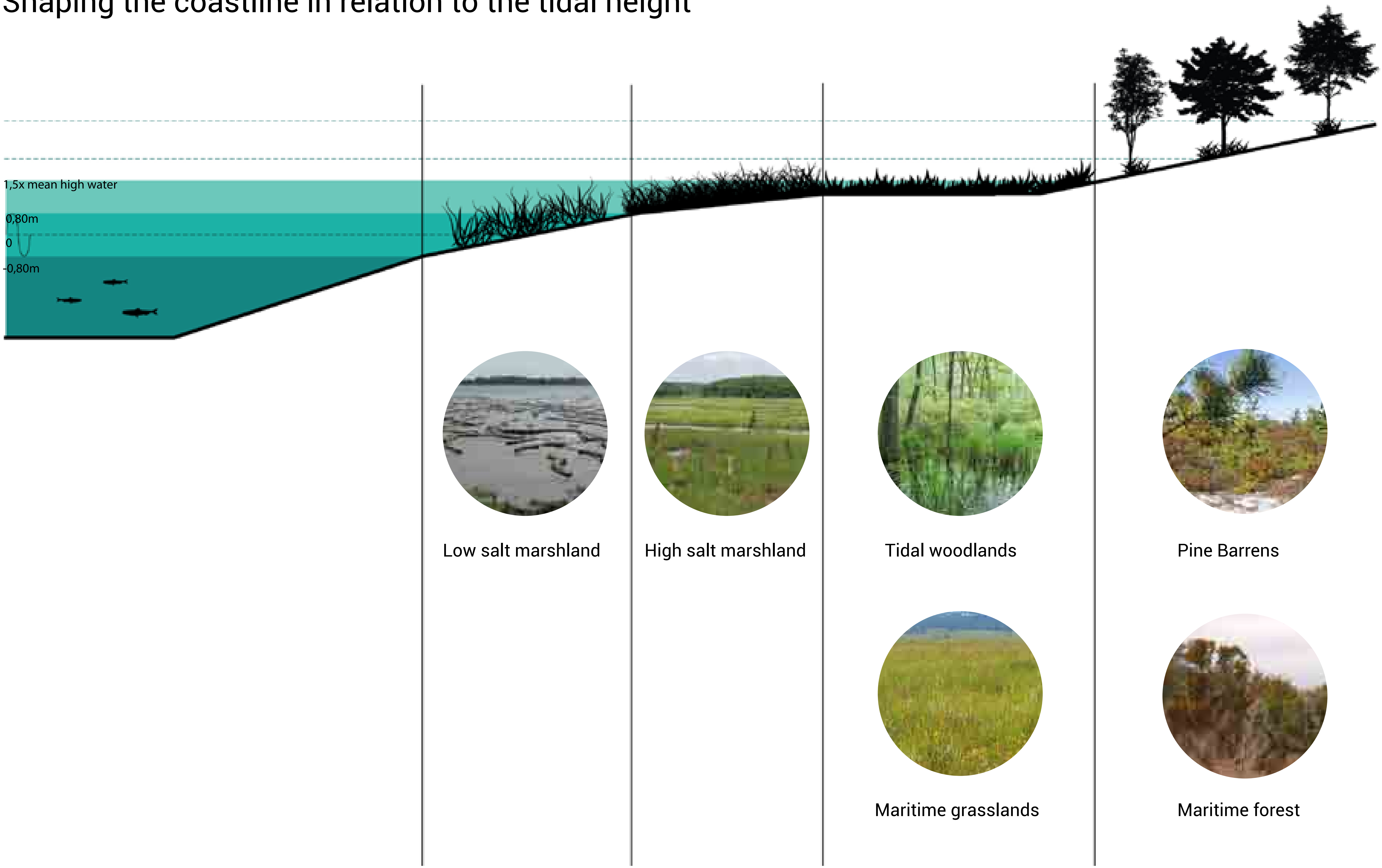
The closed basin constructed wetland





CONCEPT

Shaping the coastline in relation to the tidal height



SOURCE: Diagram by author, 2014.

DESIGN

Combination of sweet and salt water

SOURCE: Map by author, 2014.

PLANT CATALOGUE

Species that work on multiple levels.

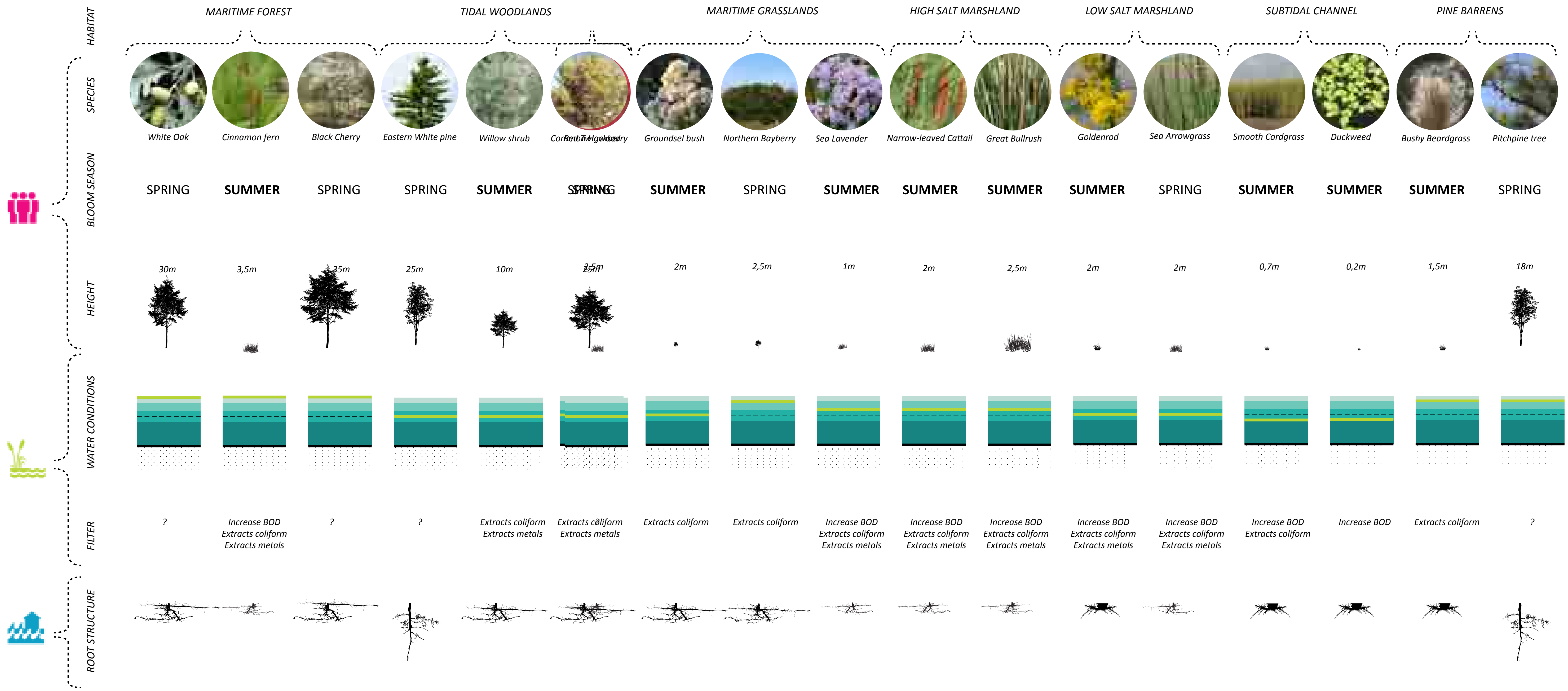
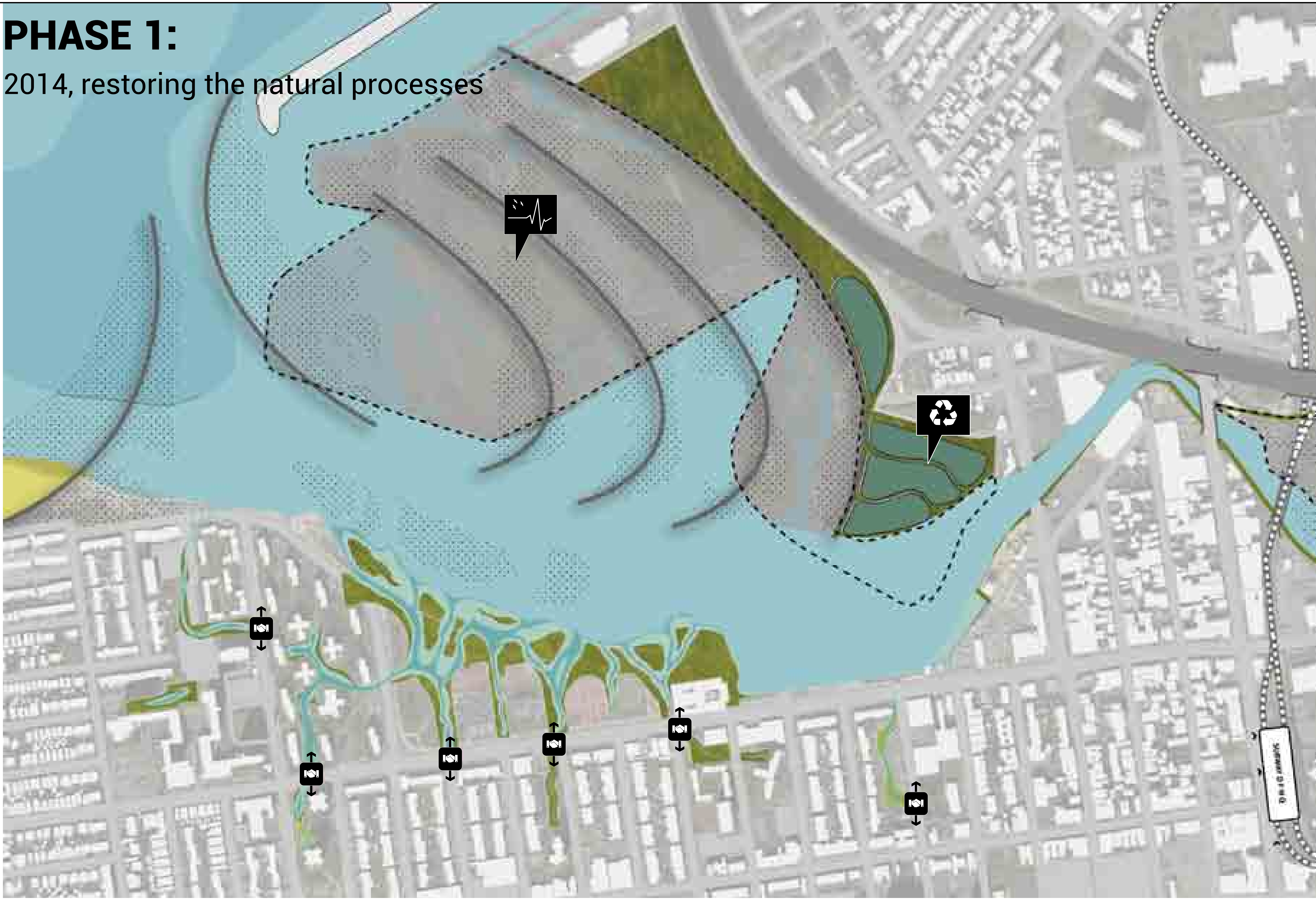


Illustration 119: Catalogue of plant species. SOURCE: Image by author, 2014.
Information from DORDIO, A., PALACE-CARVALHO, A. J., PINTO, A. 2013. Wetlands: Water “living filters”? , University of Évora. MATSIL, M. A. 2001. Native Species Planting Guide, New York, The Arsenal. WAMSLEY, T., CIALONE, M., SMITH, J., ATKINSON, J., ROSATI, J., ATKINSON, J., CIALONE, M., GRZEGORZEWSKI, A., DRESBACK, K., KOLAR, R. & WESTERINK, J. 2012. Influence of wetland degradation on surge. Nature, 500, 12.

PHASE 1:

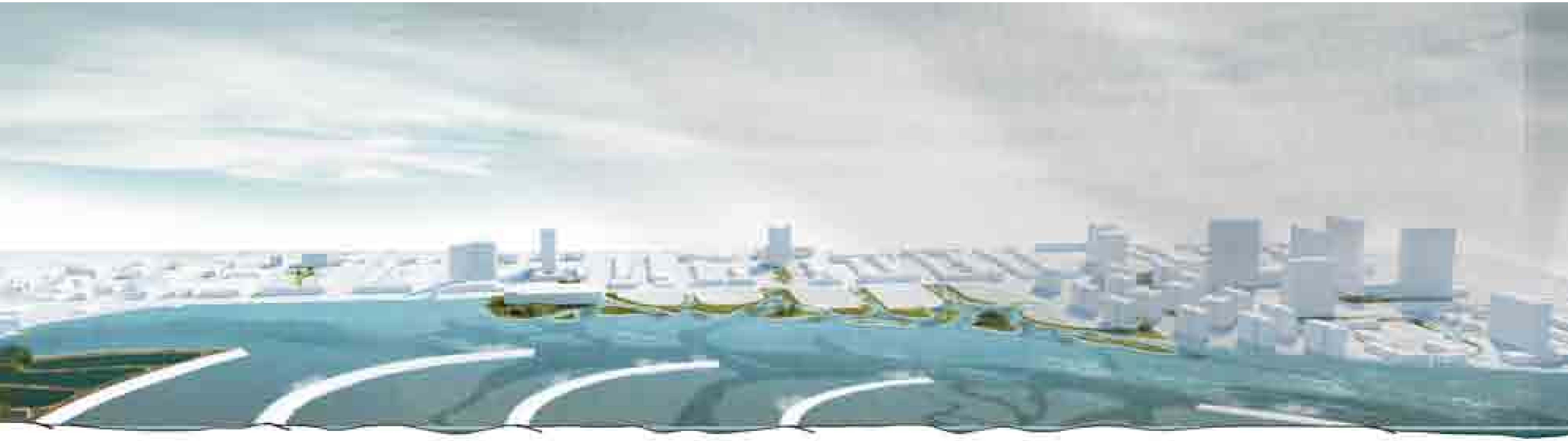
2014, restoring the natural processes



SOURCE: Map by author, 2014.

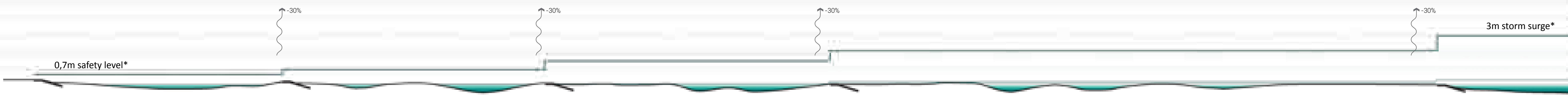
2015: DESIGN

Different species of plants protect against wave forces and erosion.



2015: Restoring the natural processes.

*Height of the storm surge scaled vertically 10x



SOURCE: Image by author, 2014.

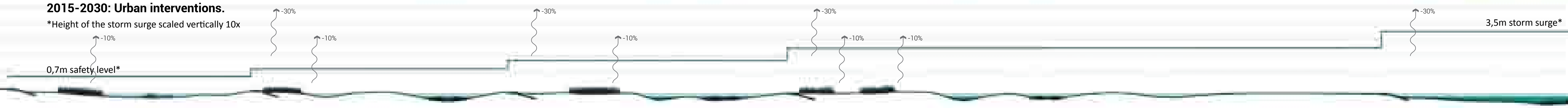
PHASE 2:

2015-2030, Urban Interventions

SOURCE: Map by author, 2014.

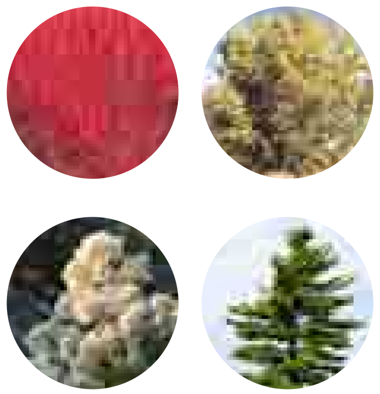
2015-2030: DESIGN

Different conditions result in a variety of habitats.

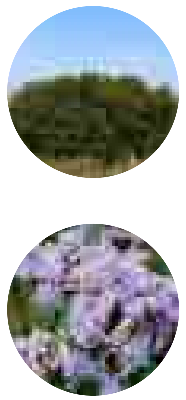


Maritime forest

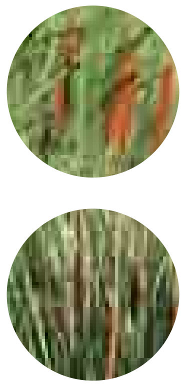
Tidal woodlands



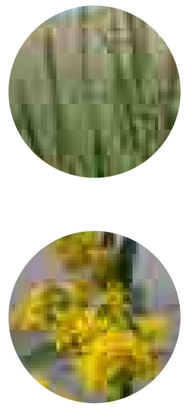
Maritime grasslands



High saltmarhsland



Low saltmarhsland



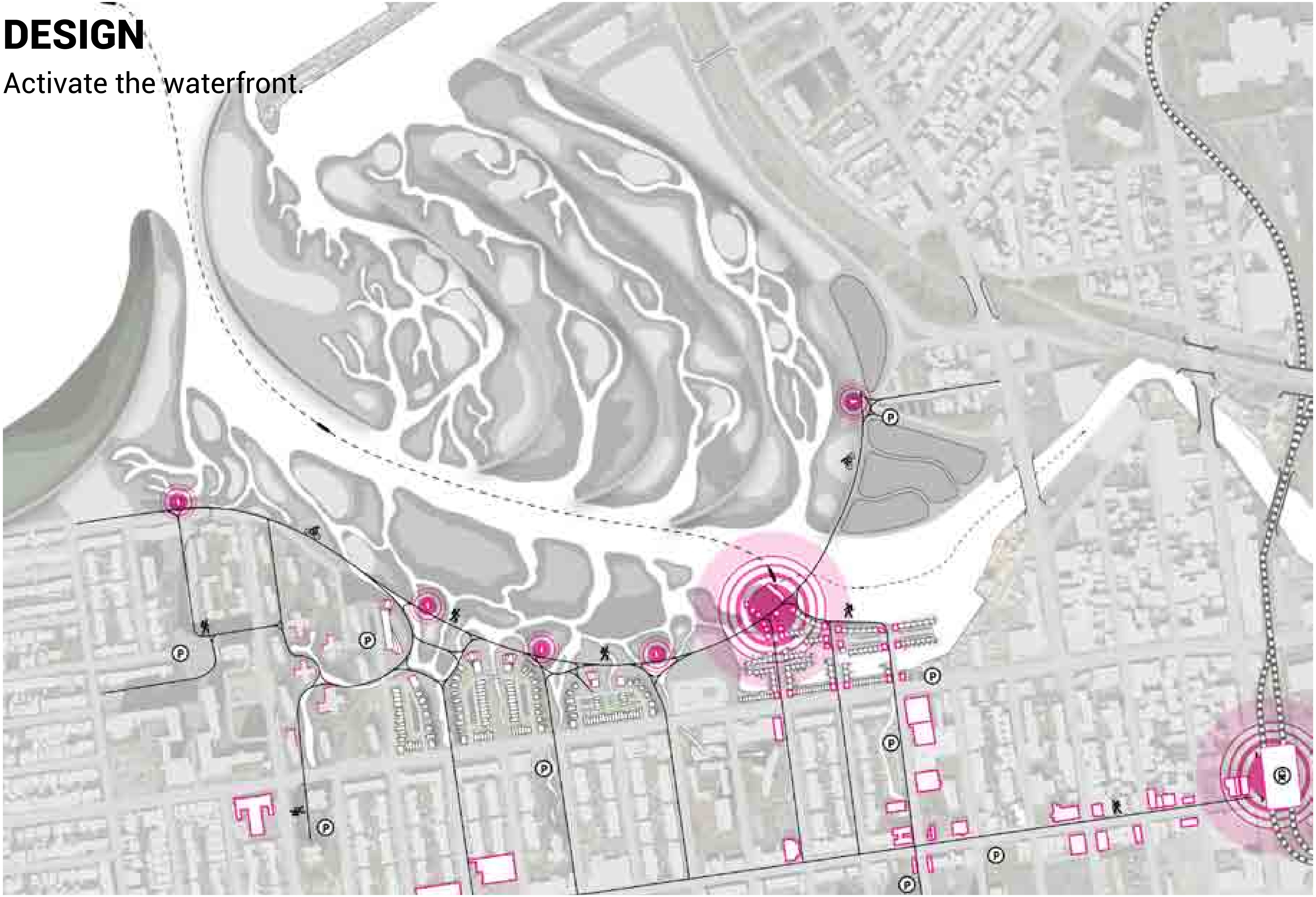
Subtidal channel

Pine Barrens

SOURCE: Image by author, 2014.

DESIGN

Activate the waterfront.



SOURCE: Map by author, 2014.

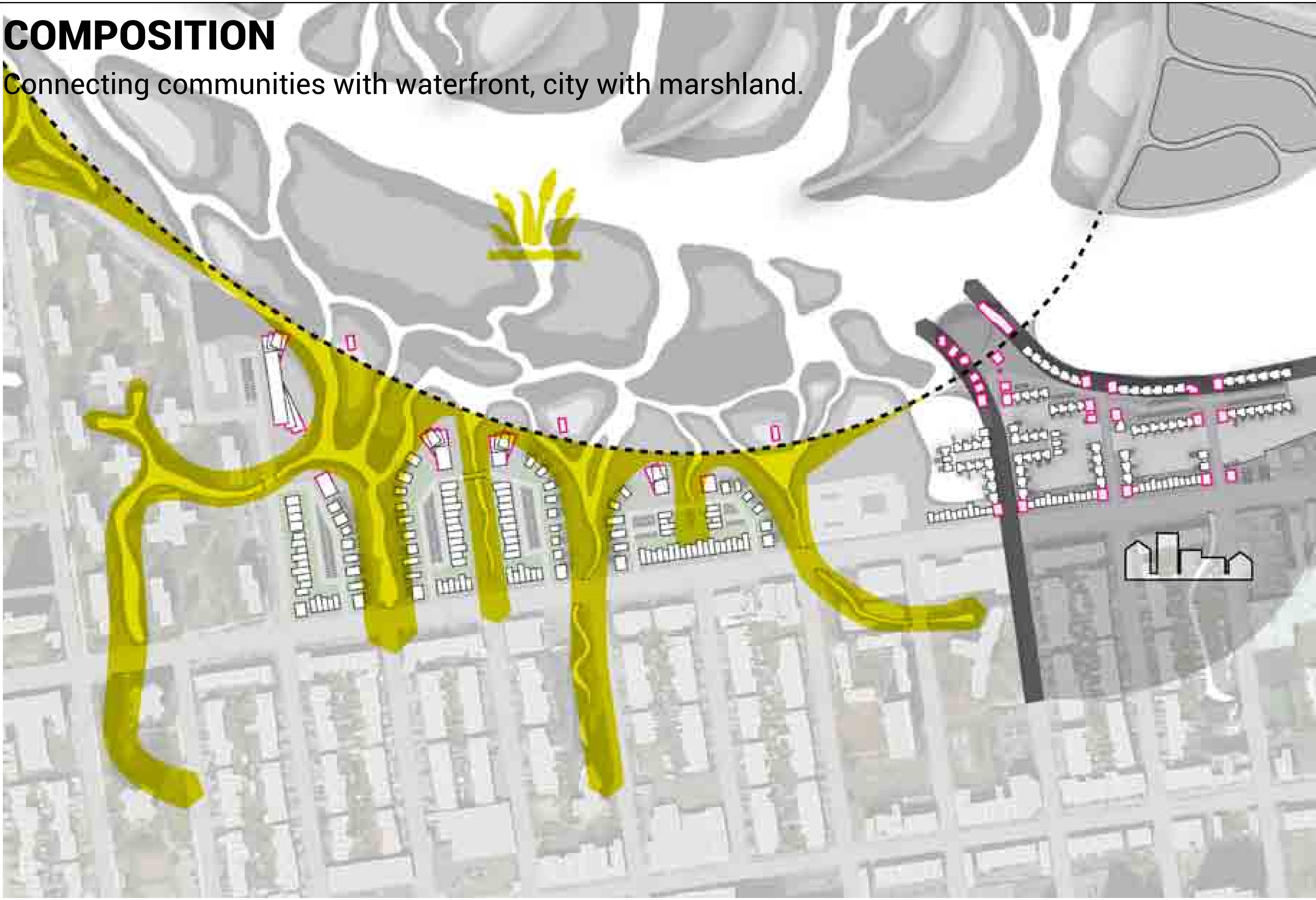
DESIGN

Leisure landscape

SOURCE: Map by author, 2014.

COMPOSITION

Connecting communities with waterfront, city with marshland.



SOURCE: Map by author, 2014.

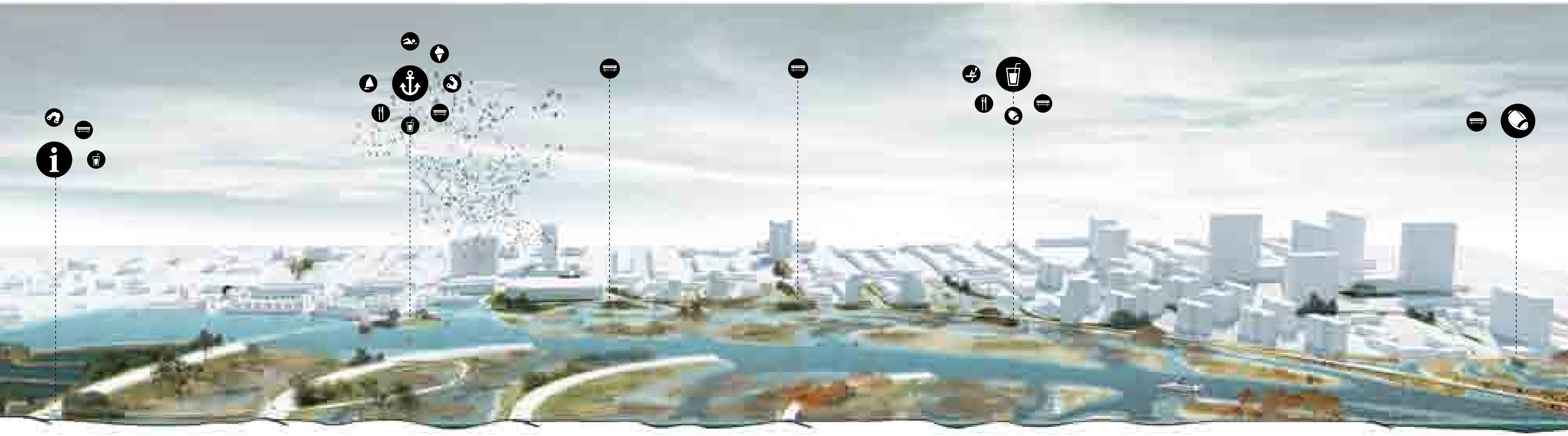
PHASE 3:

2030, Maintaining the balance

SOURCE: Map by author, 2014.

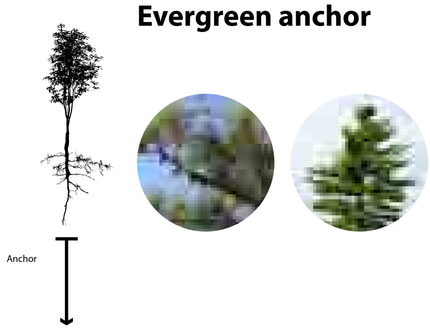
DESIGN

By using natural processes, synergy between flood-risk protection, ecological quality and quality of live is created. This results in a design that is flexible and can adapt to future needs and demands.

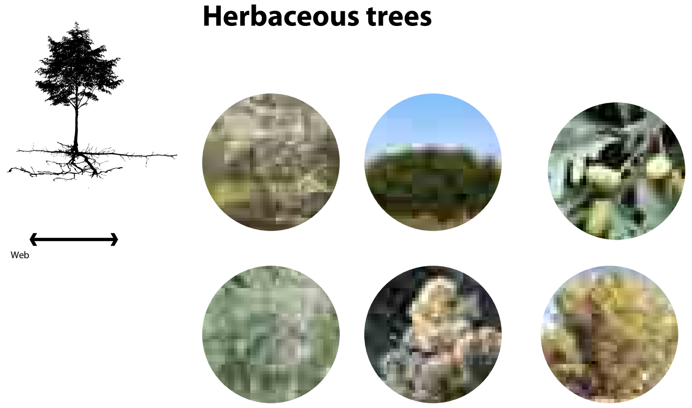


STORM SURGE FORMULE, WAT NU TEGEN KAN WORDEN GEHOUDEN, SS 10 % ETC. MISSCHIEN MOOIE DIAGRAM ACHTER SECTION?

Evergreen anchor

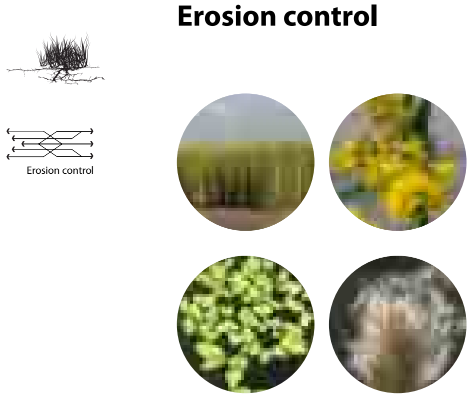


Herbaceous trees



Reed

Erosion control



SOURCE: Image by author, 2014.

DESIGN

View from the ferry towards the new urban waterfront.

SOURCE: Map by author, 2014.

DESIGN

View from the excisting communities towards the new residential area and waterfront.

SOURCE: Map by author, 2014.

DESIGN

View towards the new urban waterfront and ferry terminal

SOURCE: Map by author, 2014.

REFLECTION

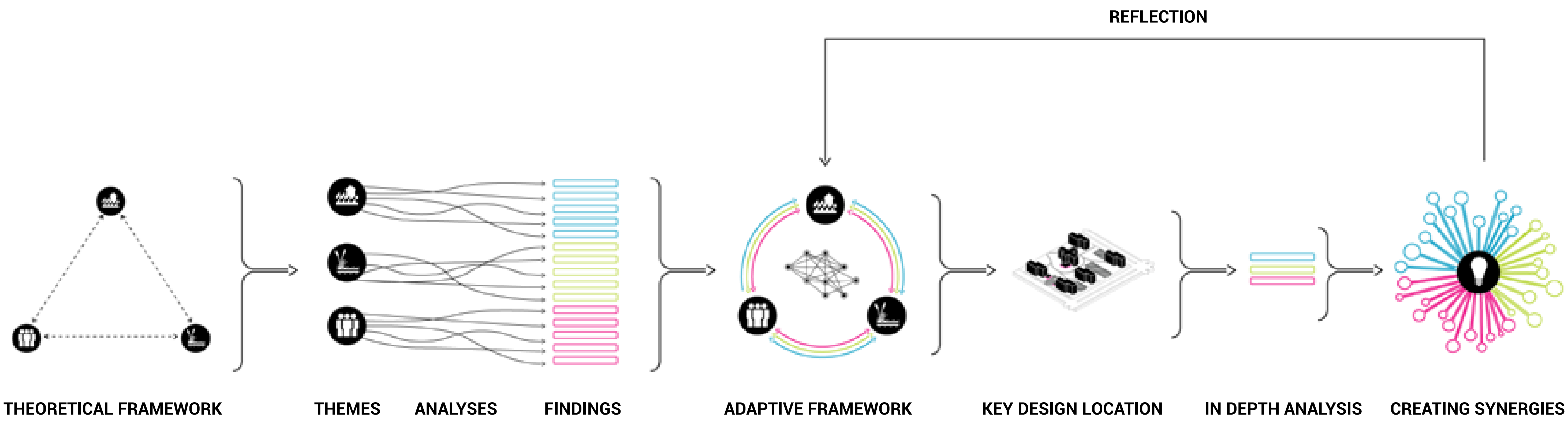
Adaptivity and flexibility of the strategy

Adressing multiple themes and timeframes

Good understanding of the excisting natural processes

PROCESS

Use of the results in other flood prone communities.



The methodology used shows the location, type of intervention or timeframe where a design can improve multiple issues at once.

SOURCE: Diagram by author, 2014.

Resilient communities

How can a spatial framework contribute to resilient flood-risk protection, while improving the living quality of communities?

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