SYMBIOTIC

URBAN VOIDS

/ A RESILIENT ECOLOGICAL FRAMEWORK FOR ROTTERDAM THROUGH ITS URBAN VOIDS /

GRADUATION PRESENTATION

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MASTER THESIS 2020-21

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Prof.dr.ir. A. van Timmeren

TU Delft

LANDSCAPE ARCHITECTURE

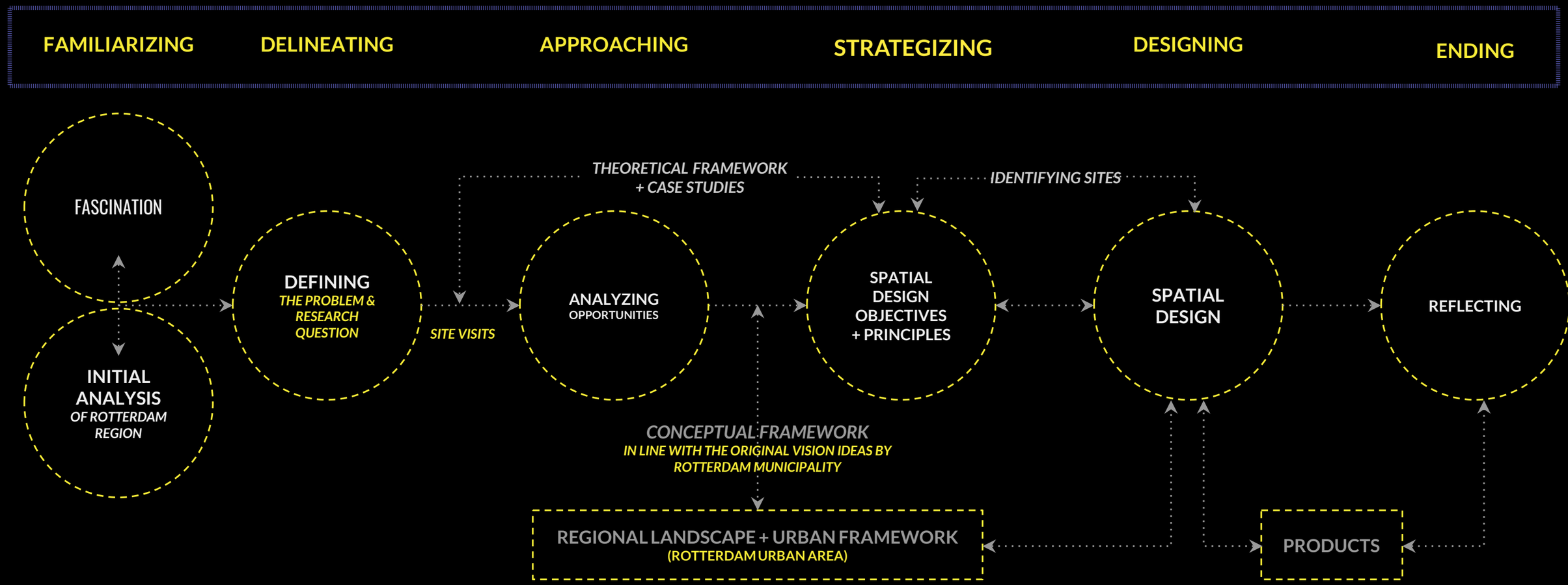
Urbanism

ACADEMIC THESIS

RESEARCH & DESIGN LAB

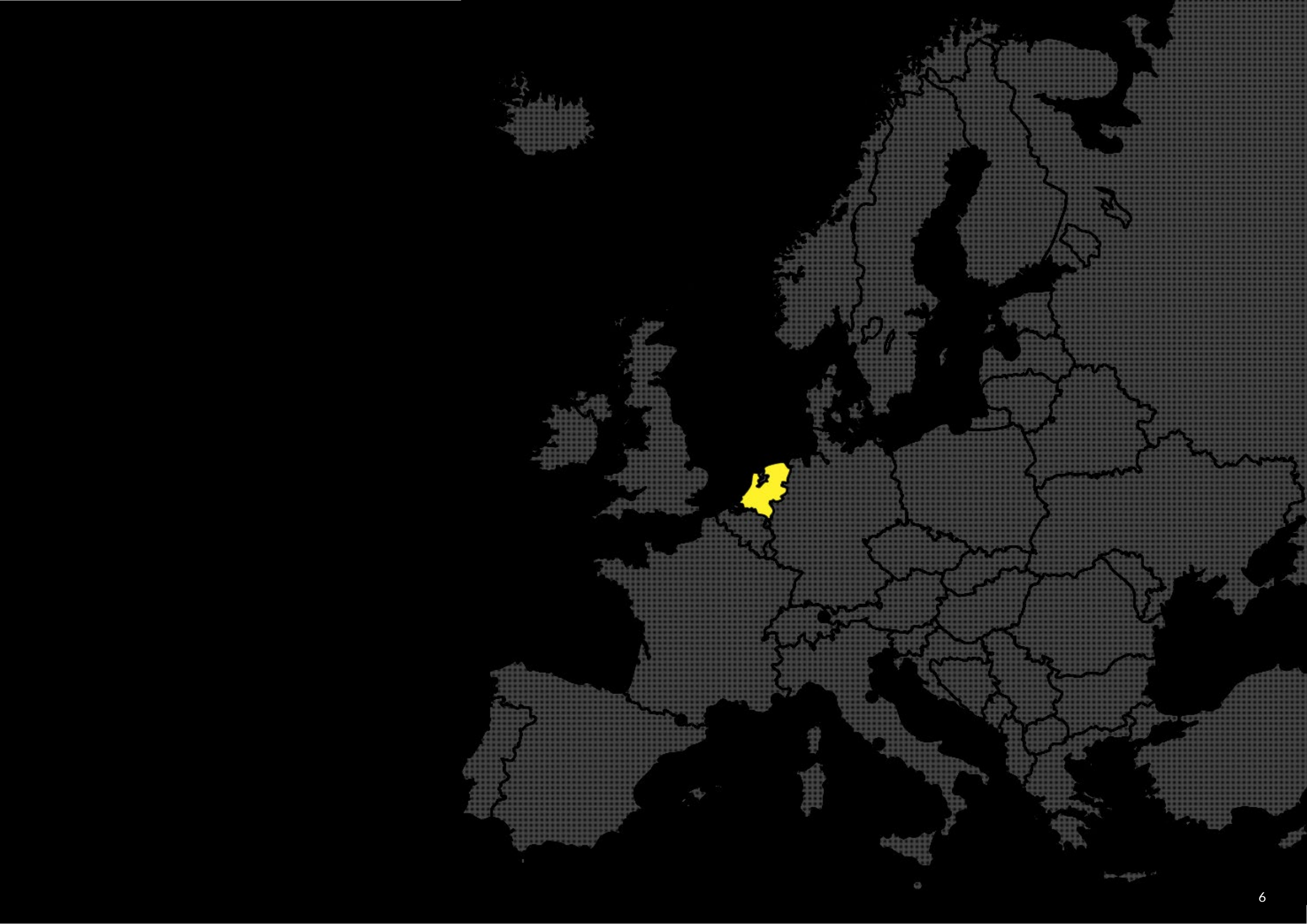
URBAN ECOLOGY AND ECOCITIES

A novel cross domain lab (TU Delft Urbanism + Landscape Architecture) which uses the lens of urban ecology to improve quality of life and environmental performance in cities through planning, especially design and engineering.


FAMILIARIZING
DELINEATING
APPROACHING
STRATEGIZING
DESIGNING
ENDING
FASCINATION
INITIAL ANALYSIS
OF ROTTERDAM REGION
DEFINING
THE PROBLEM & RESEARCH QUESTION
SITE VISITS
THEORETICAL FRAMEWORK + CASE STUDIES
ANALYZING
OPPORTUNITIES
SPATIAL DESIGN OBJECTIVES + PRINCIPLES
IDENTIFYING SITES
SPATIAL DESIGN
REFLECTING
CONCEPTUAL FRAMEWORK
IN LINE WITH THE ORIGINAL VISION IDEAS BY ROTTERDAM MUNICIPALITY
REGIONAL LANDSCAPE + URBAN FRAMEWORK
(ROTTERDAM URBAN AREA)
PRODUCTS

FAMILIARIZING


ARCTIC OCEAN
Queen Elizabeth Islands
Ellesmere Island
Nares Strait
GREENLAND
(Kalaallit Nunaat)
DENMARK
Greenland Sea
Svalbard
Franz Josef Land
North Land
LAPTEV SEA
CHUKCHI SEA
BEAUFORT SEA
Parry Islands
Parry Channel
Banks Island
Victoria Island
Baffin Bay
Baffin Island
Davis Strait
King Christian X Land
King Christian IX Land
NORWEGIAN SEA
BARENTS SEA
KARA SEA
New Zemlya
Spitsbergen
North East Land
Edge Island
New Siberian Islands
EAST SIBERIAN SEA
Taymyr Peninsula
North Siberian Lowland
Central Siberian Plateau
West Siberian Plain
Ural Mountains
ALASKA
UNITED STATES OF AMERICA
CANADA
Hudson Bay
Gulf of Alaska
BERING SEA
LABRADOR SEA
ICELAND
NORWAY
SWEDEN
FINLAND
RUSSIAN FEDERATION
Scandinavian Mountains
Aleutian Islands
SEA OF OKHOTSK
KAZAKHSTAN
MONGOLIA
Gobi Desert
NORTH ATLANTIC OCEAN
PACIFIC OCEAN
UNITED STATES OF AMERICA
MEXICO
Gulf of Mexico
Greater Antilles
CUBA
CARIBBEAN SEA
UNITED KINGDOM
IRELAND
GERMANY
POLAND
BELARUS
UKRAINE
ESTONIA
LATVIA
LITHUANIA
FRANCE
SPAIN
PORTUGAL
ITALY
BLACK SEA
TURKEY
MEDITERRANEAN SEA
Alps
Pyrenees
UZBEKISTAN
TURKMENISTAN
KYRGYZSTAN
TAJIKISTAN
Kunlun Shan
Himalaya
CHINA
JAPAN
S. KOREA
N. KOREA
SEA OF JAPAN
YELLOW SEA
EAST CHINA SEA
SYRIA
IRAQ
IRAN
AFGHANISTAN
PAKISTAN
SAUDI ARABIA
Arabian Peninsula
EGYPT
LIBYA
ALGERIA
MOROCCO
WESTERN SAHARA
Sahara
MAURITANIA
MALI
NIGER
CHAD
NIGERIA
CAMEROON
N. SUDAN
ETHIOPIA
SOMALIA
ERITREA
YEMEN
OMAN
ARABIAN SEA
INDIA
Bay of Bengal
MYANMAR (BURMA)
LAOS
THAILAND
VIETNAM
CAMBODIA
SOUTH CHINA SEA
PHILIPPINE SEA
PHILIPPINES
MALAYSIA
INDONESIA
Borneo
Sumatra
Java Sea
PAPUA NEW GUINEA
Arafura Sea
KIRIBATI
MARSHALL ISLANDS
FEDERATED STATES OF MICRONESIA
Caroline Islands
PALAU
Northern Mariana Is.
SOUTH INDIAN OCEAN
Gulf of Guinea
GABON
CONGO
DEM. REP. OF CONGO
CENTRAL AFRICAN REPUBLIC
S. SUDAN
KENYA
TANZANIA
ANGOLA
ZAMBIA
MALAWI
NAMIBIA
BOTSWANA
ZIMBABWE
MOZAMBIQUE
MADAGASCAR
SOUTH AFRICA
Cape Town
Cape of Good Hope
SEYCHELLES
MAURITIUS
Great Sandy Desert
Great Victoria Desert
Great Australian Bight
AUSTRALIA
TASMAN SEA
NEW ZEALAND
Kangaroo Island
SOUTH PACIFIC OCEAN
SOUTHERN OCEAN
BRAZIL
PERU
BOLIVIA
PARAGUAY
CHILE
URUGUAY
ARGENTINA
Amazon
Patagonia
Cape Horn
Strait of Magellan
Falkland Islands
South Georgia
South Shetland Islands
ANTARCTICA
AMUNDSEN SEA
BELLINGSHAUSEN SEA
WEDDELL SEA
Ellsworth Land
Palmer Land
Wilkes Land
George V Land
Queen Maudland
ROSS SEA
0 km 1000 2000 3000 km



The Iconic Windmills and Tulips

Source: goway.com

Raised Road

Farms and Crops on a Polder

Windmills Pump water from one level to another

Dike

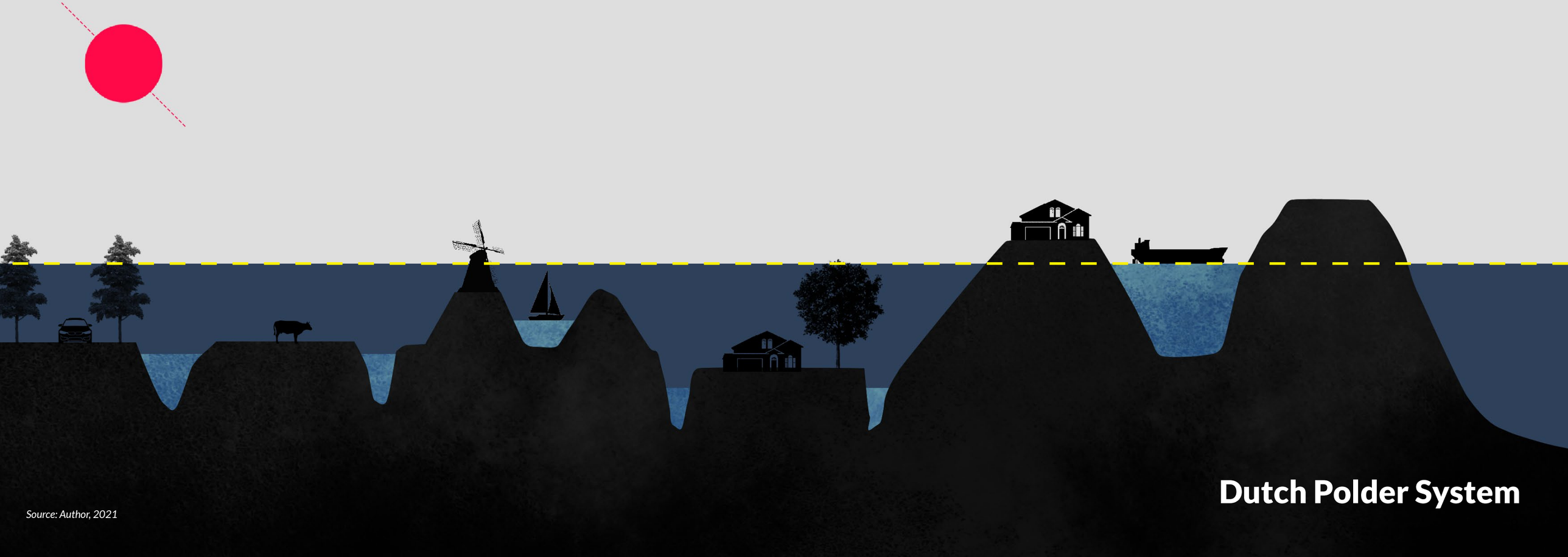
Settlement on a Polder

Settlement

Heavy Shipping through a Large Canal

Dike

North sea



Dutch Polder System

Source: Author, 2021

Rotterdam

Source: Author, 2021

Rotterdam Urban Core

A View of the Harbour, Rotterdam 1890

Source: Photoglob AG

Rotterdam Port, 2021

Source: Port of Rotterdam

World Renowned Port

Source: U.S. Defense Visual Information Center

Rotterdam centre after the 1940 bombing of Rotterdam.

The Urban Center along the Nieuwe Maas River

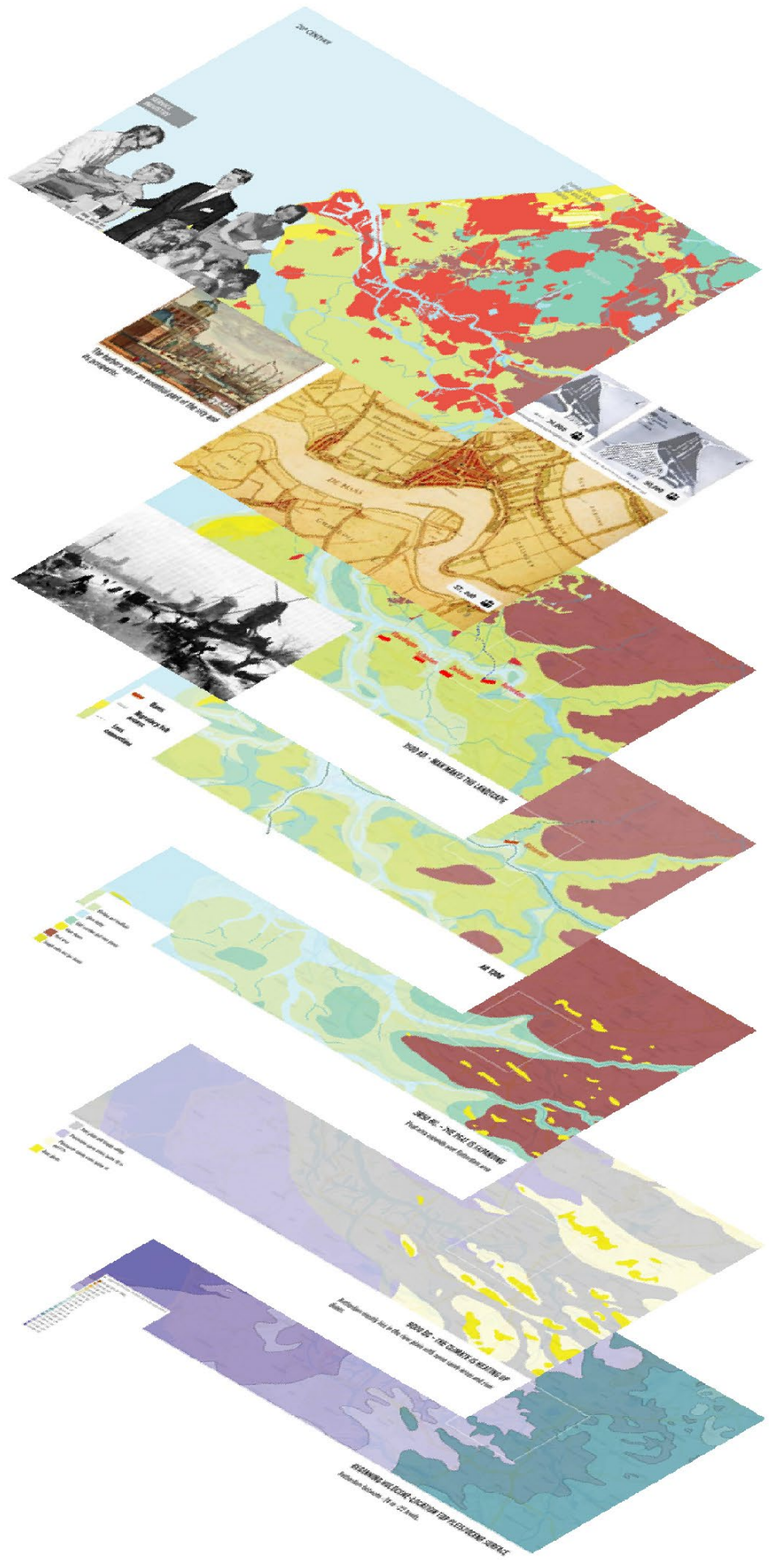
Source: U.S. Defense Visual Information Center

Markthal-MVRDV

Erasmus Bridge

Cube House

Every Landscape Has a Story



Europoort, Maasvlakte and a Service Oriented Society (1950-2020)
The city grew outward as the inner core became congested and there was no more space to build.

Rapid Urbanization (1500-1700)
Rotterdam stars to grow as an important port in 16th century. Many tradesmen lived and worked in Rotterdam. The harbors were an essential part of the city and its prosperity.

Man makes the Landscape (1500 AD)
Dutch made more and more progress in the fight against water. The windmills had began to play an important role in water drainage.

The Human Landscape (1300-1500 AD)
Around 1300 A dam was built along Rotte river giving rise to the name Rotterdam. This is where the first inhabitants settled. Peat was drained with ditches to make the land suitable for farming. And peat itself was also used as a fuel.

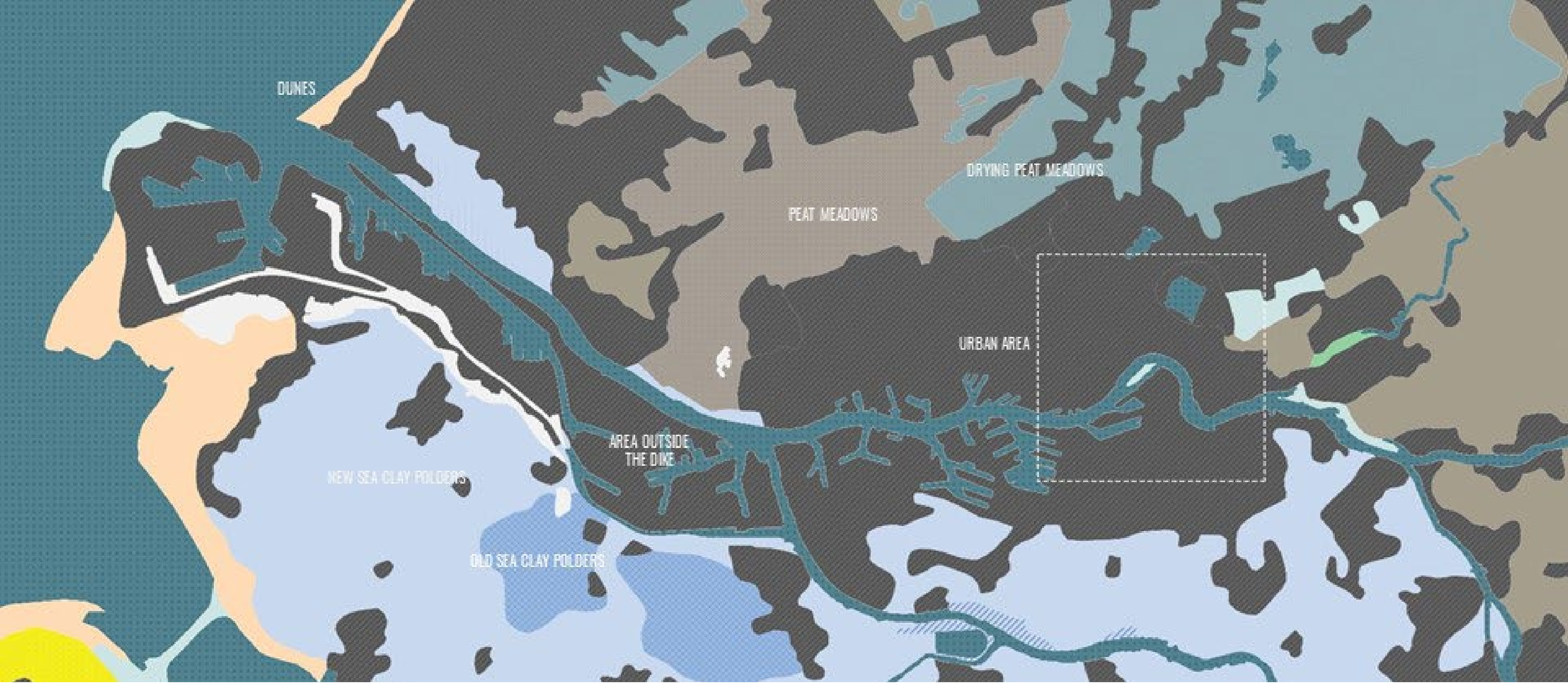
Rhine-Muse Estuary & Peat Growth (3000 BC)
Sea flows into peat area of Midden Delfland area during high tide. Sea clay polders on south side was also influenced by these dynamics. Creating a channel-plate landscape condition. some of which silted up high and covered with peat.

The Climate is heating up. (5000 BC)
River plains and valleys created along the course of water bodies (Meuse and Rhine). Sediments deposited along the ways, creating landmasses.

The Beginning (9000 BC)
The Rotterdam region of today was covered by water between -24 and -12m below sea.

Landscape Evolution


NORTH SEA
NETHERLANDS
Amsterdam-Rijnkanaal
Nieuwe Waterweg
Hollandsche IJssel
Nieuwe Maas
Lek
Nederrijn
Pannerdensch Kanaal
28.6%
Scheur
Oude Maas
Noord
BM
Boven-Merwede
Waal
Spui
Haringvliet
DK
NM
Maas
Waal
Rhine
100%
Hollands Diep
Volkerak
Rotterdam
Rhine-Meuse Delta



Source: Author, 2020

0 5 km 10 km

Urban Area

Wadden and Mudplains > Urban Areas

Beach Walls & Low Dunes

Peat Area

Salt Marshes & River Plains > Reclaimed Land

Green Heritage (Estates/Forestry Commission Areas etc)

National level Geological Value

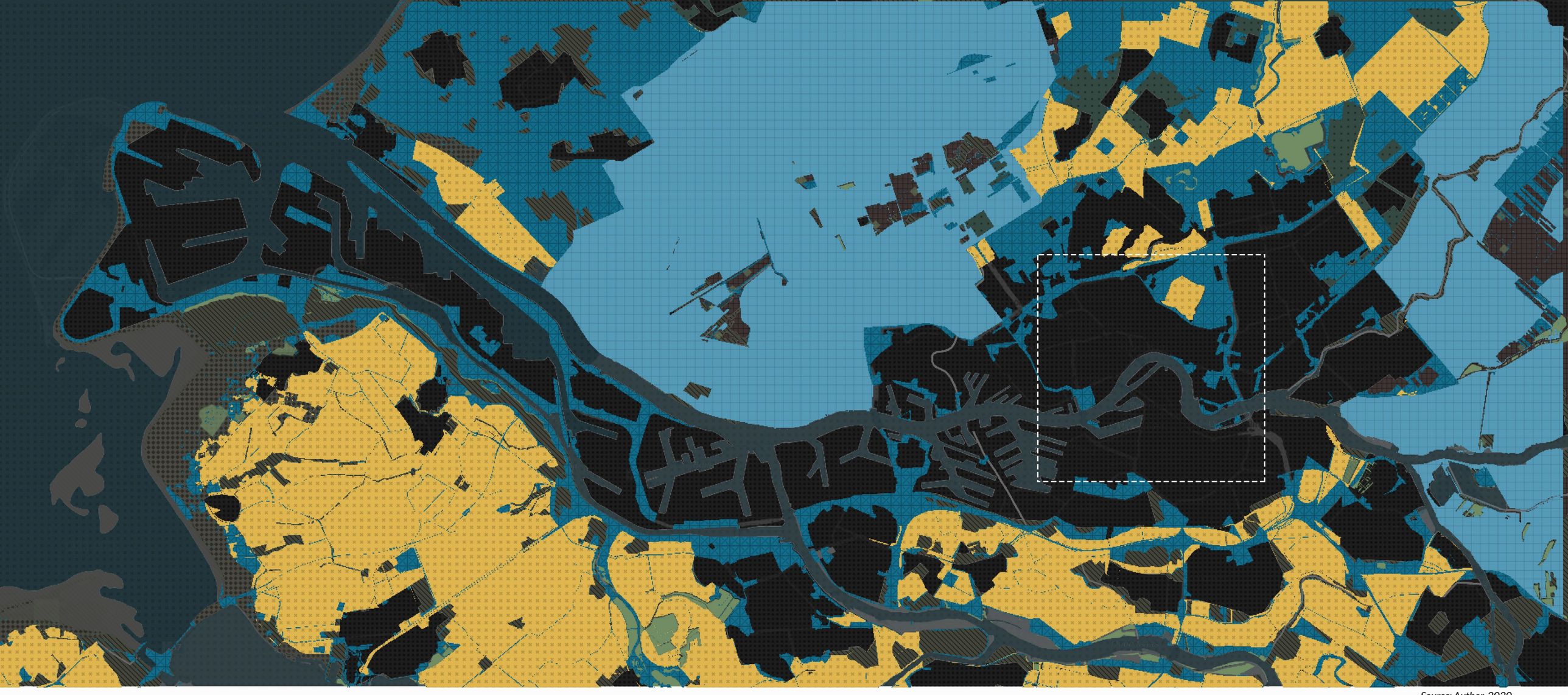
Provincial Level Geological Value

Regional Level Geological Value

Special Value

Source: Author, 2020

0 5 km 10 km



- Urban Area
- Wadden and Mudplains > Urban Areas
- Beach Walls & Low Dunes
- Peat Area
- Salt Marshes & River Plains > Reclaimed Land
- Green Heritage (Estates/Forestry Commission Areas etc)
- Moist meadow bird grassland
- River and stream accompanying forest
- Water Based Habitats

Source: Author, 2020

0 5 km 10 km

Habitat Types

0 1 2 km

0 5 km 10 km

Urbanization

- Urban Area
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- Beach Walls & Low Dunes
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Source: Author, 2020

0 5 km 10 km

The Landscape Now

FAMILIARIZING

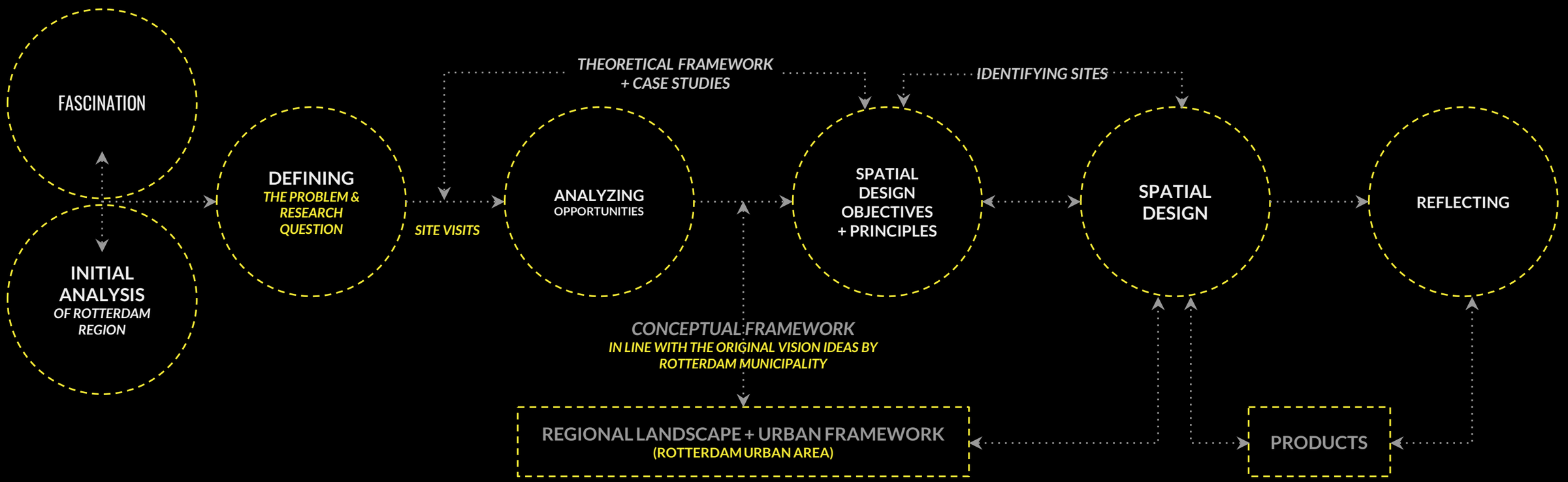
DELINEATING

APPROACHING

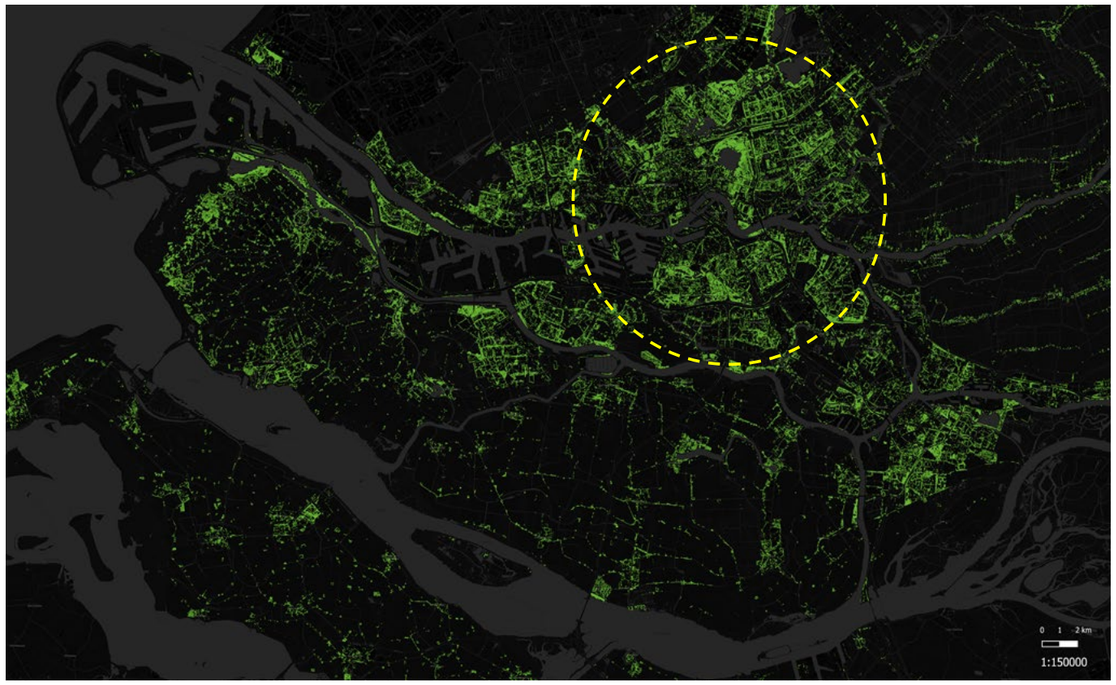
STRATEGIZING

DESIGNING

ENDING



DELINEATING



Map of green cover in the Rotterdam area. (Source: GIS mapping by Author)

Green per neighbourhood in Rotterdam (Source: ArcGIS Klimaateffectatlas)

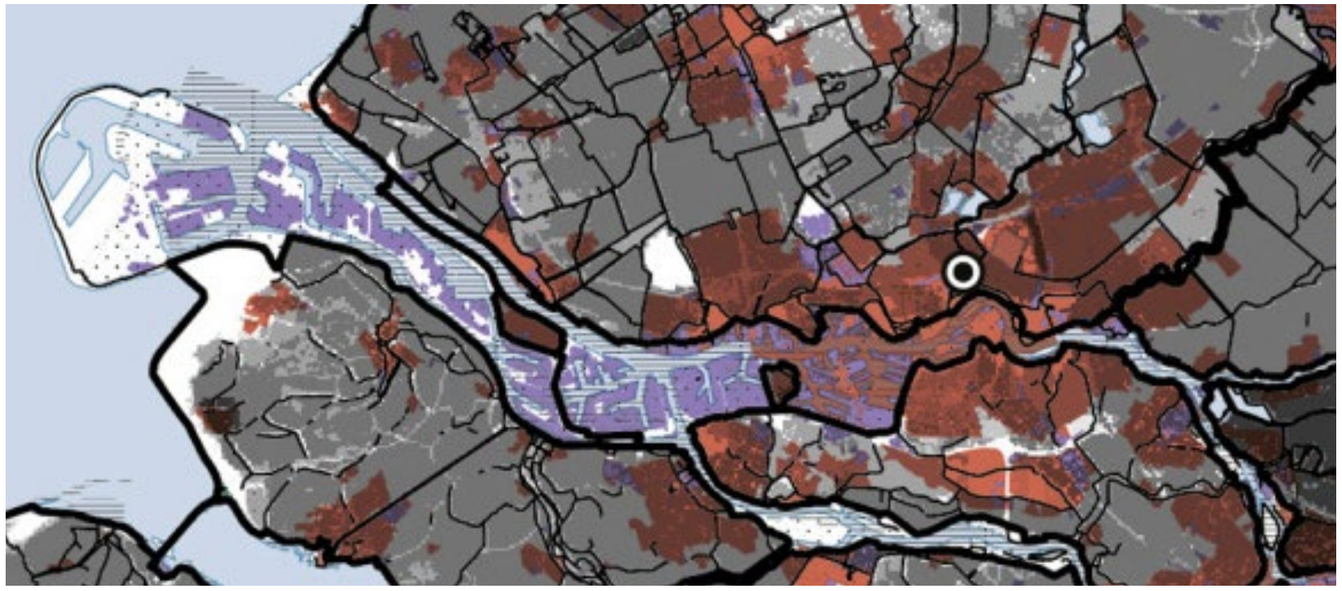
So much green, yet so little.

Green edges along the Rotte river outside the urban periphery. (Source: Google Maps)

Hard and stoney edges along the Rotte river in the urban core. (Source: Google Maps)

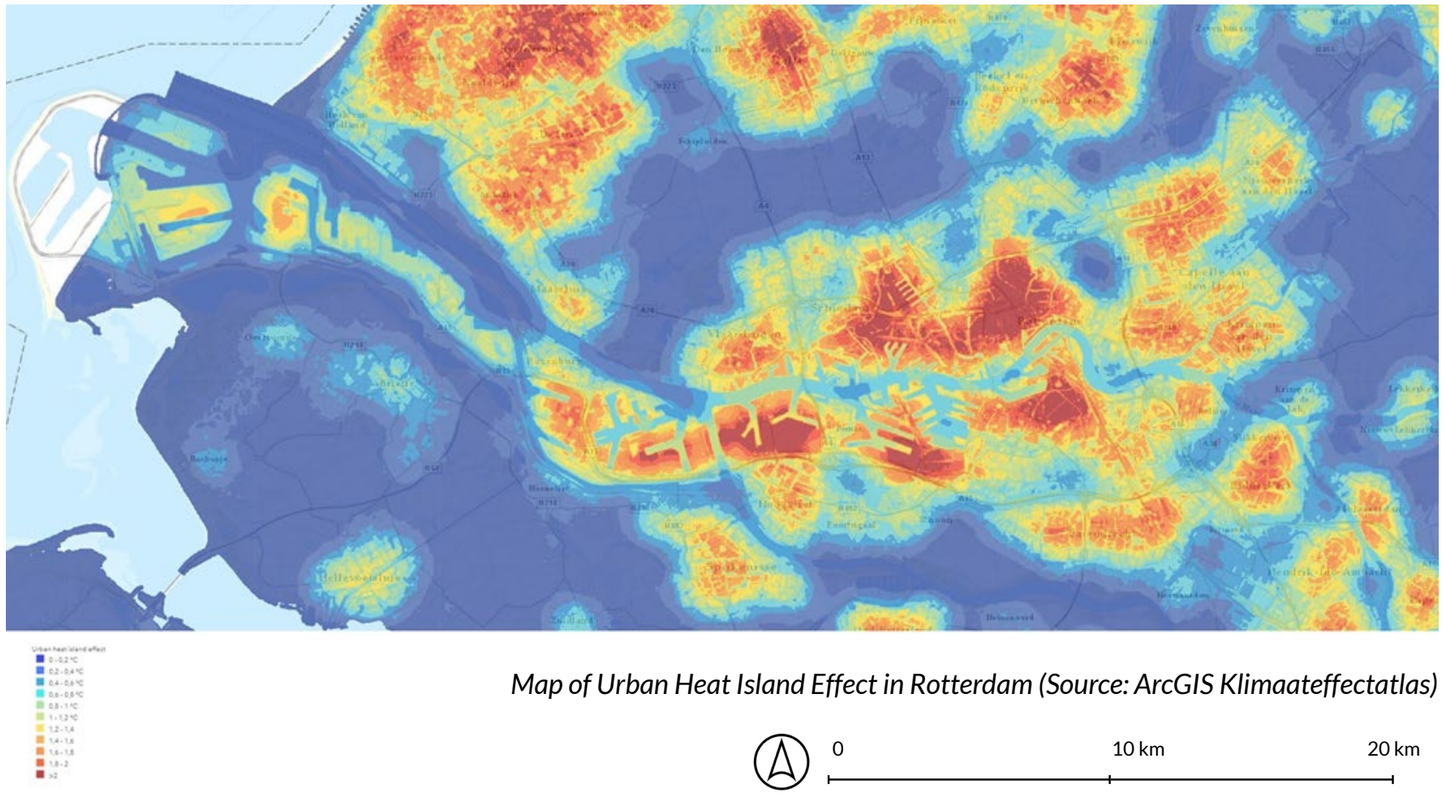
Monoculture of trees that do not offer much space to accommodate biodiversity along the urban roads. (Source: Google Maps)

CLIMATE CHANGE

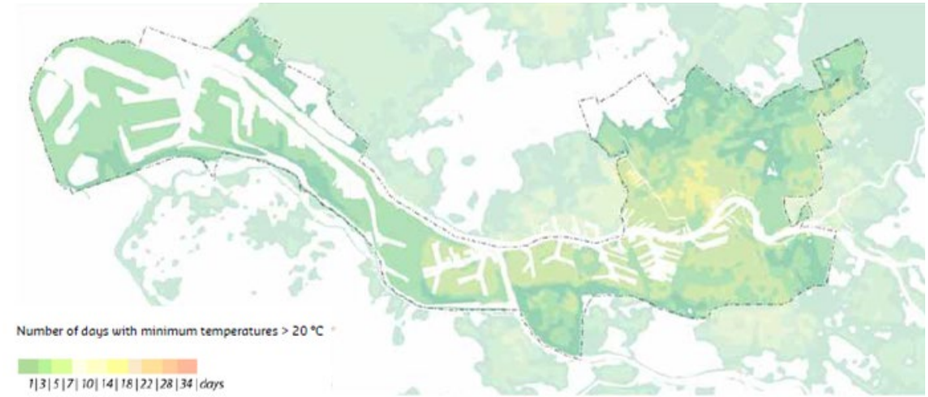


Flood-prone Areas: flood depth in gray, build area in red and industrial areas in blue (Source: Dutchdikes.net)

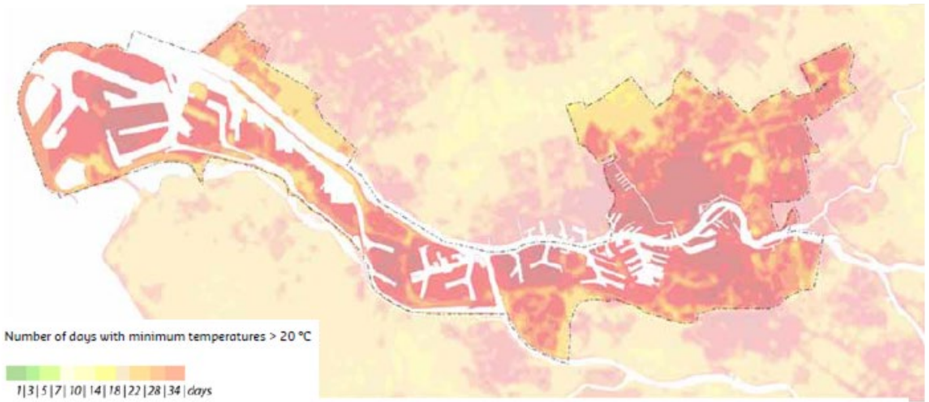
Rotterdam flooding and water stagnation. (Source: Rotterdam Climate Change Adaptation Strategy)



Map of Urban Heat Island Effect in Rotterdam (Source: ArcGIS Klimaateffectatlas)



Urban Heat Islands 2021



Urban Heat Islands Scenario 2050

Map of hard Paved areas in Rotterdam (Source: ArcGIS Klimaateffectatlas)

Urban Heat Islands

Map of Urban Heat Island Effect in Rotterdam (Source: ArcGIS Klimaateffectatlas)

Heaviliy paved area in Waalhaven, Rotterdam (Source: Fundainbusiness.nl)

VOIDS?

The Urban ‘Unbuilt’

BIODIVERSITY IN THE CITIES

Source: Making Urban Nature (J. Vink, P. Vollaard, N. de Zwarte)

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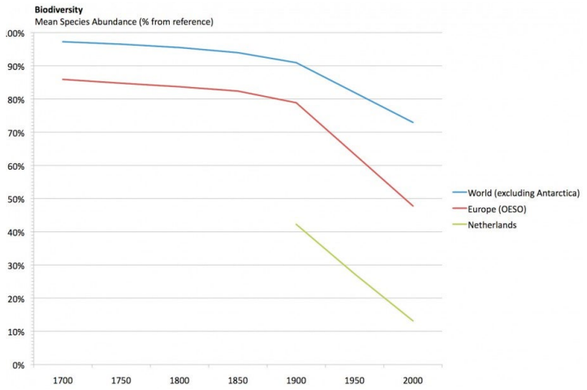
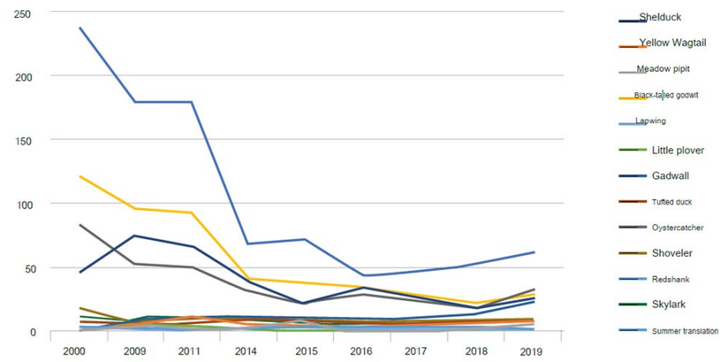


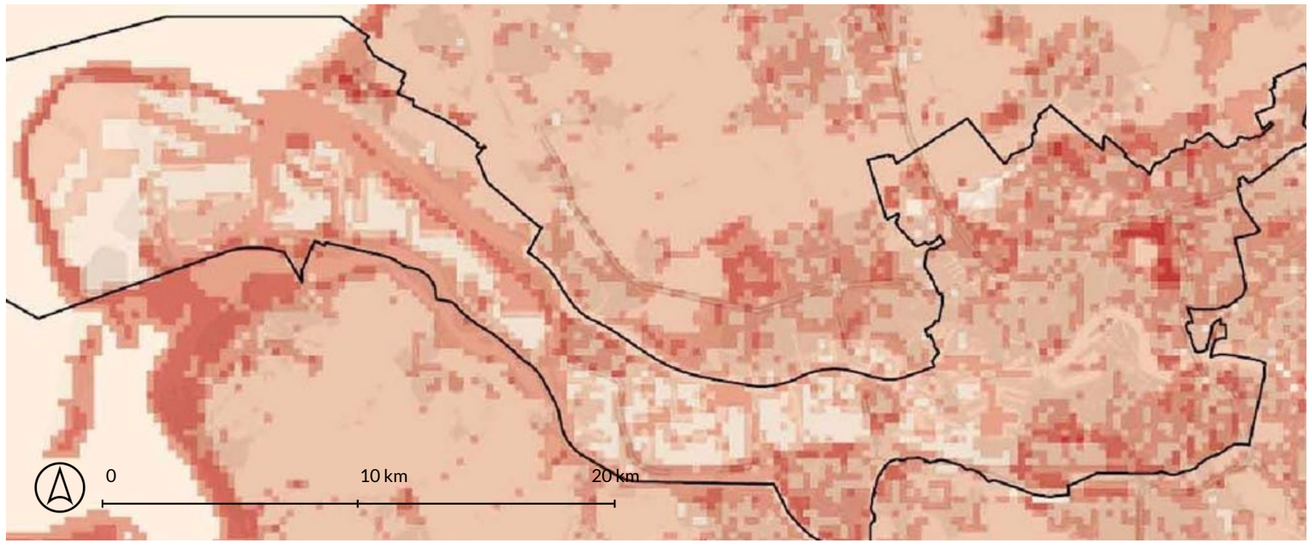
Graph showing biodiversity trend in urban areas.

Source:
Implementation agenda Biodiversity-Rotterdam Municipality, 2020



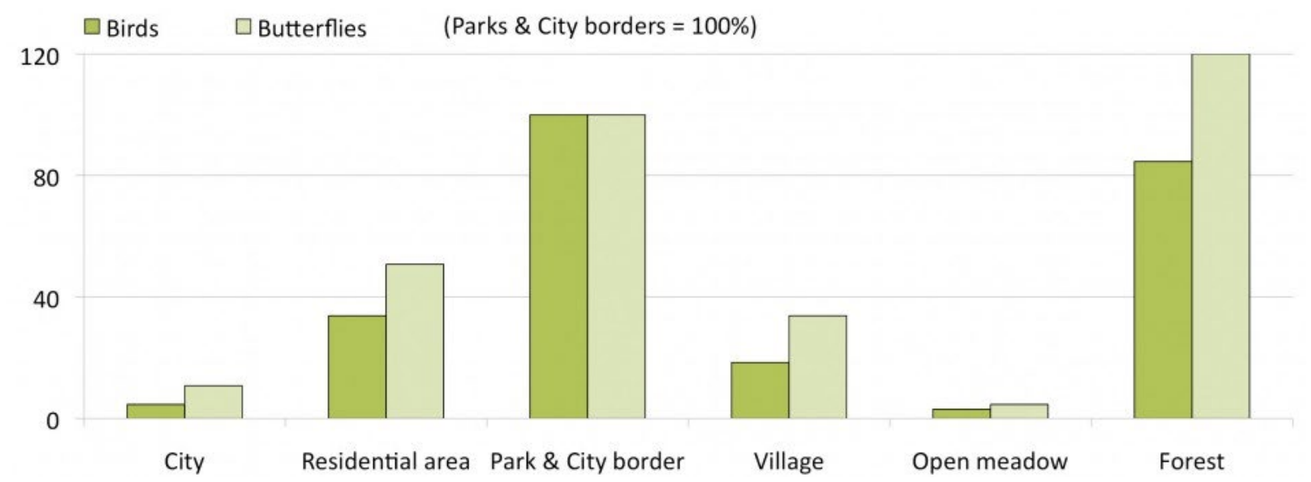
Number of meadow birds in Polder Schieveen 2000-2019

Source:
Netwerk Ecologische Monitoring



Biodiversity spread in the Rotterdam Area.

Source: Naturemap Rotterdam 2014



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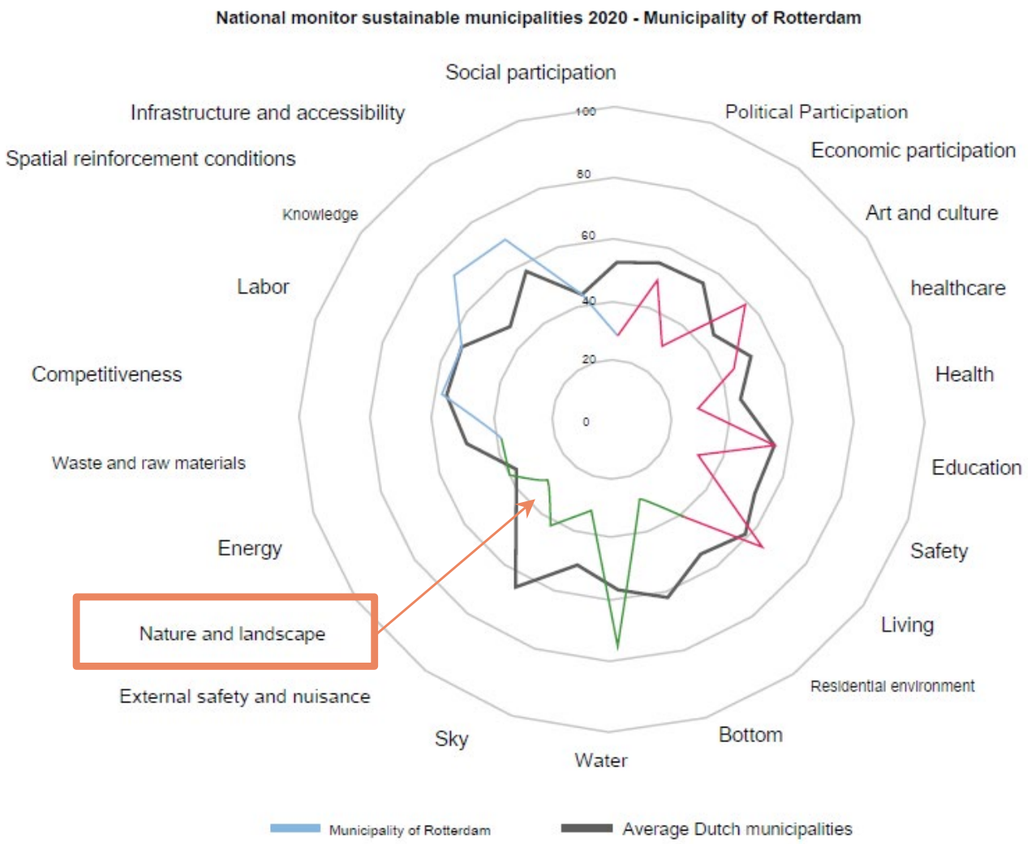


Rotterdam's economic, socio-cultural and ecological capital.

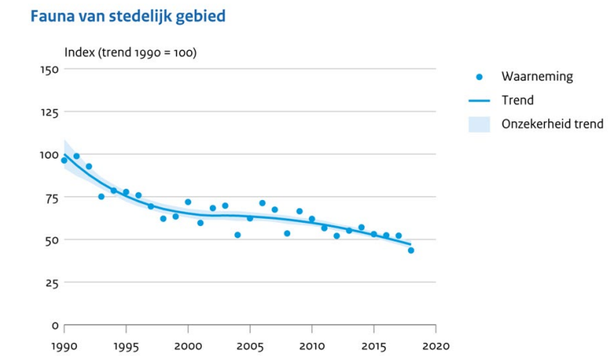
Source: https://www.clo.nl

Soort	Gebieds-doel	Functie	Aantal in	13/14	14/15	15/16	16/17	17/18	18/19	trend	Start trend	Trend sinds start	Trend sinds 07/08
Aalscholver		f	seiz. gem.	131	155	142	136	120	147	grafiek	1991	+	-
Brandgans		f	seiz. gem.	2052	2231	2404	1595	1383	1558	grafiek	1989	++	~
Goudplevier		f	seiz. gem.	160	216	?	138	271	147	grafiek	1980	-	-
Grauwe Gans		f	seiz. gem.	1327	1811	1810	1744	1503	1995	grafiek	1980	++	~
Grutto		f	seiz. gem.	82	60	28	58	45	74	grafiek	1991	--	--
Kievit		f	seiz. gem.	1266	1921	1928	1130	1810	1193	grafiek	1987	0	0
Kleine Rietgans		f	seiz. gem.	65	91	53	104	30	23	grafiek	1980	++	~
Kleine Zwaan		f	seiz. gem.	1	3	2	3	?	2	grafiek	1990	--	--
Knobbelzwaan		f	seiz. gem.	215	224	230	236	289	282	grafiek	1980	++	0
Kokmeeuw		f	seiz. gem.	1166	1221	1201	600	808	826	grafiek	1991	-	-
Kolgans		f	seiz. gem.	3932	4351	4938	2751	3260	2641	grafiek	1980	++	~
Lepelaar		f	seiz. gem.	3	3	3	4	7	?	grafiek	1991	+	~
Meerkoet		f	seiz. gem.	1056	1085	1134	1176	1466	1166	grafiek	1989	0	0
Slobeend		f	seiz. gem.	70	119	131	93	126	161	grafiek	1989	-	0
Wulp		f	seiz. gem.	592	540	617	332	378	386	grafiek	1980	0	-
Zilvermeeuw		f	seiz. gem.	301	232	186	146	262	98	grafiek	1991	-	-

Winter migratory birds statistics 2013-2019

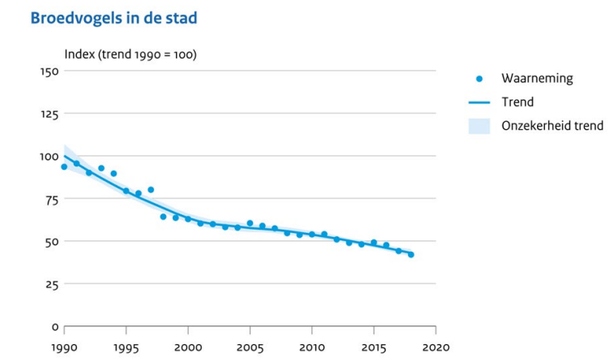
Source: Netwerk Ecologische Monitoring

Rotterdam scores are extremely low in nature and landscape category in the nation's ecological capital criteria graph. The statistics indicate that number of migratory birds has also declined considerably. This is also directly related to the decline in urban fauna and other dependent breeding birds and insect populations n the city.



Source: https://www.clo.nl

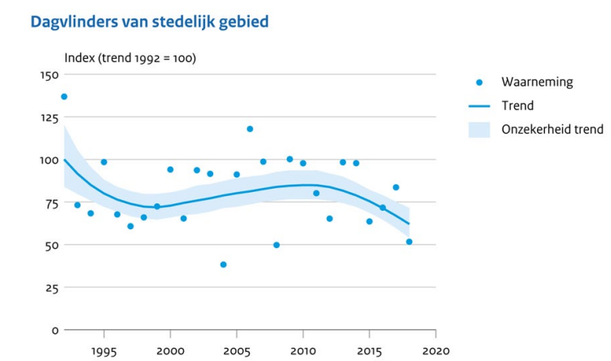
Fauna of urban areas, 1990-2018



Source: https://www.clo.nl

Breeding Birds of urban areas, 1990-2018

Greenfinch | Great Tit | Long Tailed Tit | Crested lark



Source: https://www.clo.nl

Butterflies of urban areas, 1990-2018

EXISTING VISION FOR THE REGION

Legenda

- Hoofdgroenstructuur
- Regionaal landschap binnen gemeentegrens
- Rivier Maas, Rotte en Schie
- Dijk en Buitendijks: programma rivie
- Tuinsteden
- Recreatieve hoofdstructuur (fiets)

0 5 km 10 km

Source: Natuurkaart Rotterdam

Rotterdam Vision Map

PROBLEM FIELD & RESEARCH QUESTION

Problem Statement

The Rotterdam urban fabric is built in an area of amalgamation of very interesting landscape conditions surrounding it. These are home to different habitats for a variety of flora and fauna. The urban core however, disconnects these areas due to lack of ecology supporting green and blue networks. The urban core of Rotterdam is abundant with characterless and unused spaces, that can be termed as urban voids. The paved and stony surfaces in these spaces heat up the unbuilt (or are they really ‘unbuilt’) spaces and creates hotter environments. This, with the changing climate also poses a risk of disasters like flooding, heat islands and habitat loss. These Urban voids are not designed for ecology and resilience to the changing climate.

The urban fabric of Rotterdam disconnects the ecological network around it by creating identity-less and unused voids that are not welcome for biodiversity. Such spaces also pose a threat of disasters like flooding and heat islands.

Research Question

How to create an ecological spatial design framework for biodiversity through landscape architectural principles for the urban fabric of Rotterdam by making use of the urban voids, thereby also making it resilient to climate change?

1. *What are the theories on urban voids, biodiversity and ecological resilience?*
2. *What is the existing habitat typologies in the Rotterdam Urban core?*
3. *What are the urban voids that can be used to create a new network of ecological patches and corridors?*
4. *What ecosystem services can be combined through spatial design for ecology and resilience?*

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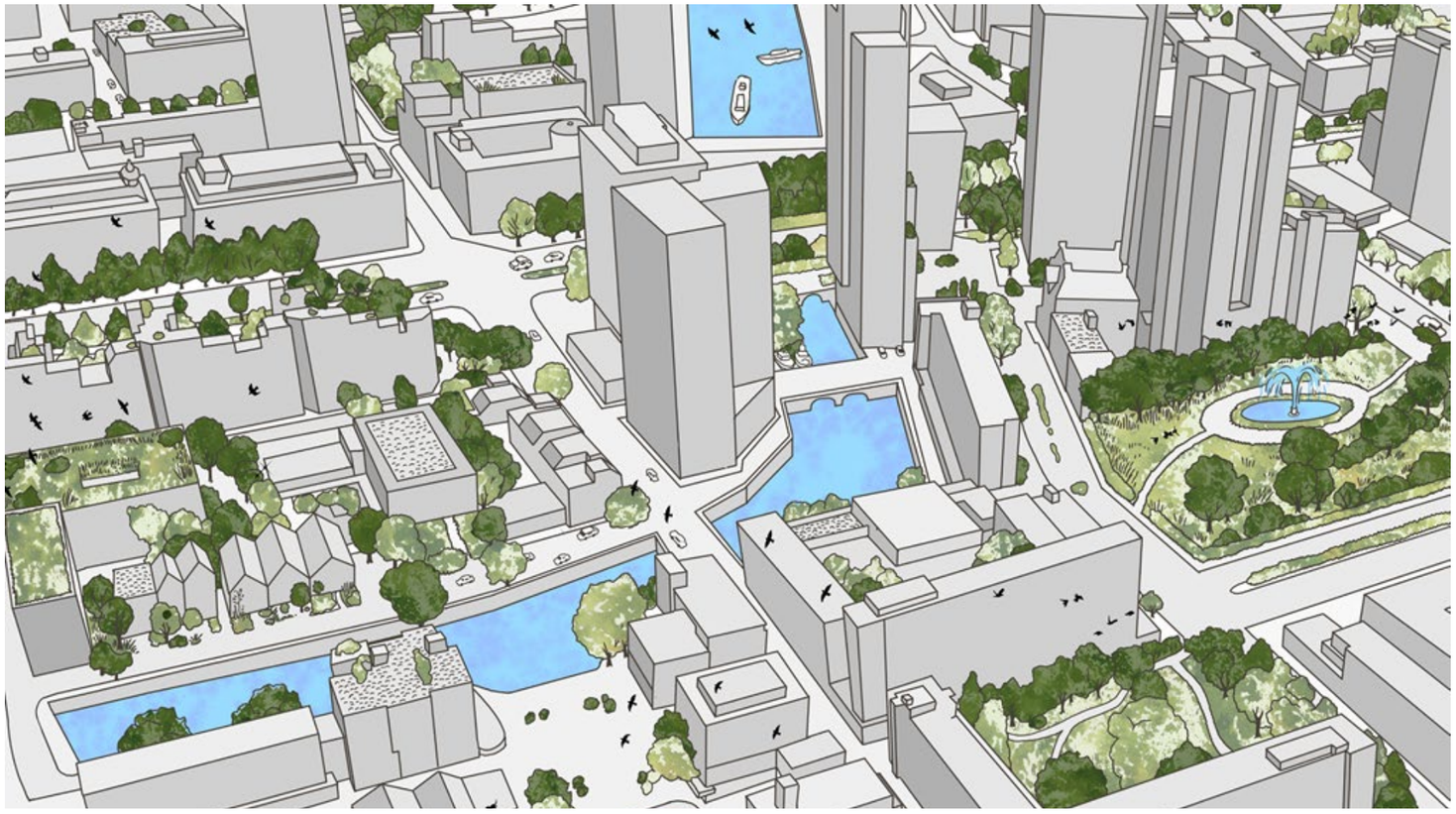
REGIONAL LANDSCAPE + URBAN FRAMEWORK
(ROTTERDAM URBAN AREA)

PRODUCTS

APPROACHING

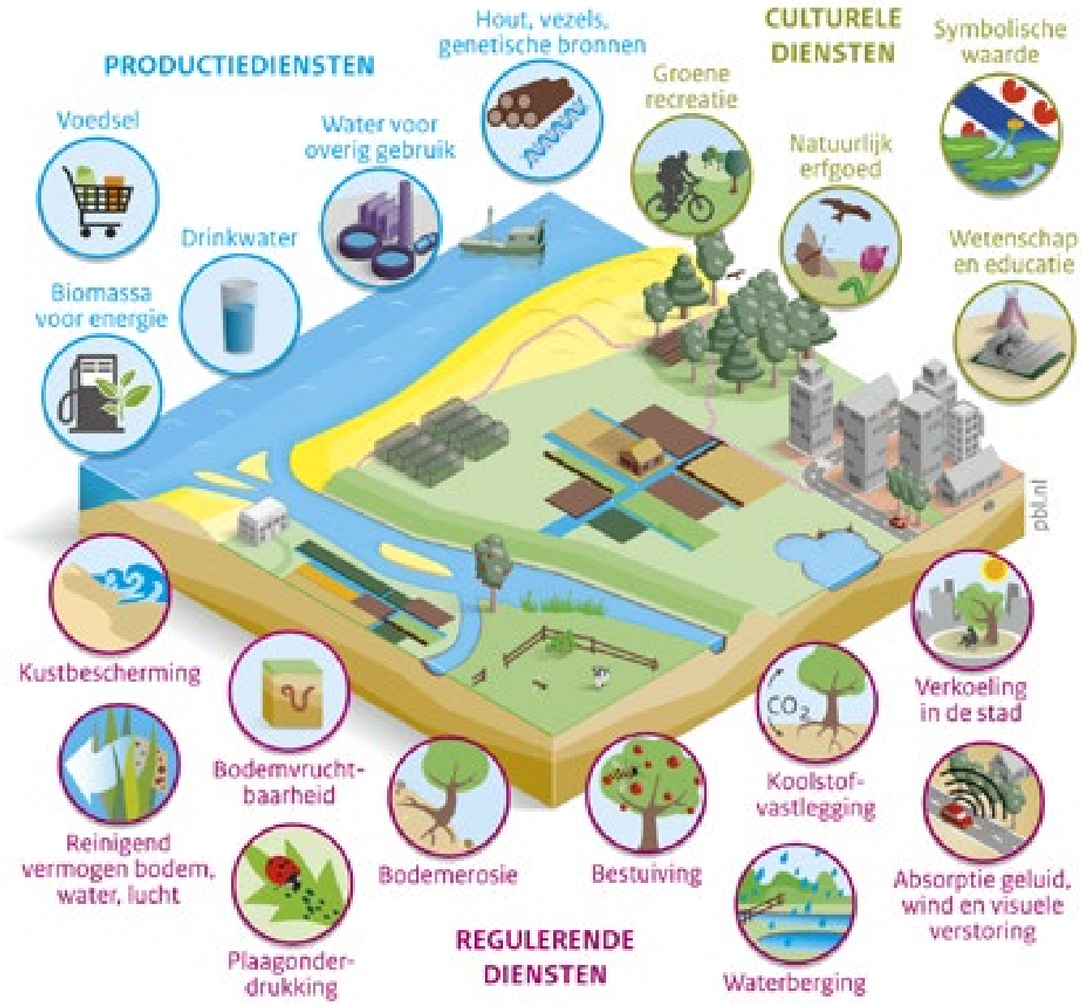
THEORETICAL FRAMEWORK

Source: City Nature Policy Note For a liveable and biodiverse The Hague

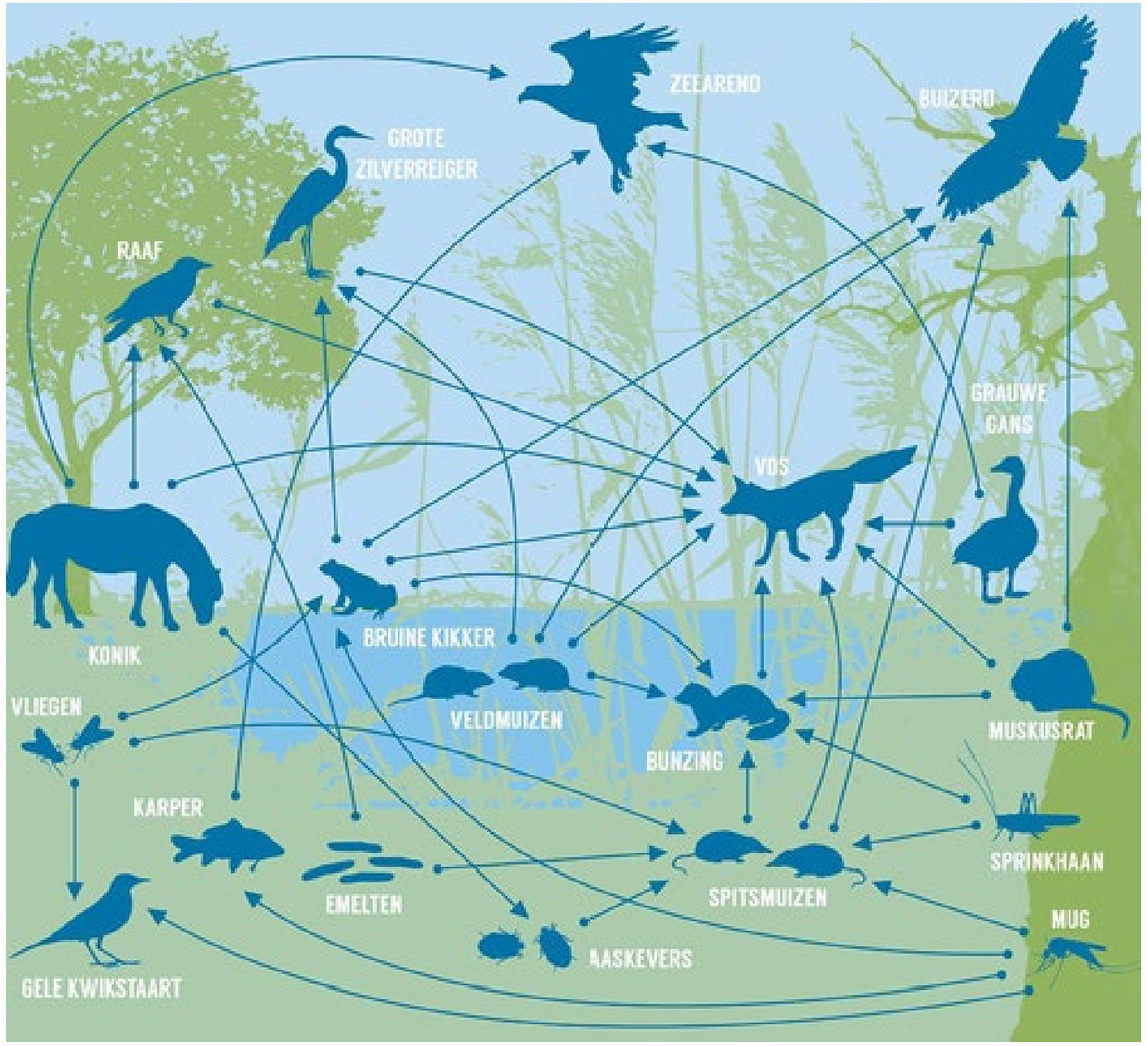


Source: Making Urban Nature- Jacques Vink, Piet Vollaard, Niels de Zwarte

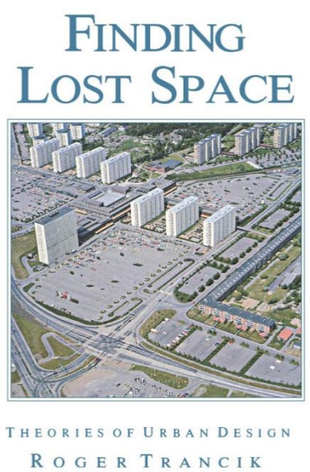
Urban Ecology: The city as an Ecosystem



Source: Tillie, N. (2020) Lecture

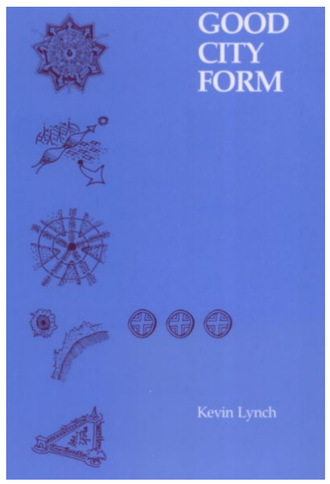


Source: Working together on rich Rotterdam urban nature Implementation agenda Biodiversity



Undesirable urban area that makes no positive contribution to the surroundings and which is ill-defined, without measurable boundaries and **fail to connect elements in a coherent way**, by calling them **'lost space'.**

Finding Lost Space, Trancik (1986)



Waste spaces are described as n**eglected, unused, dead spaces.** These spaces are created because of fixed functions spaces which **leftover spaces usually are located next to the spaces with fixed function** such as (highway, railway, under bridges…etc.).

He argues that these spaces have potential for reuse and relief by **increasing flexibility of spaces to appropriate all time's need.**

Good City Form, Kevin Lynch (1981)

Greenberg and other scholars have defined those abandoned lands as Temporarily Obsolete Abandoned Derelict Sites (TOADS).

Greenberg et al., 1990; Perera & Amin, 1996; Greenberg et al., 2000

On the other hand in declining industrial cities, due to suburbanization and decrease in population various 'vacant land' has emerged.

According & Johnson, 2000

Vacant land refers to many different types of unutilized and underutilized parcels with abandoned buildings and structures.

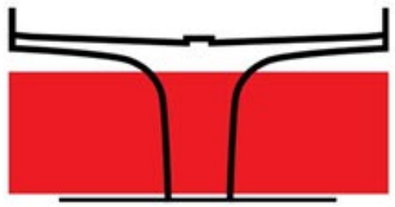
Pagano & Bowman, 2000

Edge/Buffer Voids

Setbacks between spaces, marginal and residual spaces. Urban Edges. Indefinite spaces caused by action/expansion.

Transportation Voids

Oversized streets/oversupplied streets. Improper distribution of space. No regard for ecology. Same specie of trees in row.



Infrastructural Voids

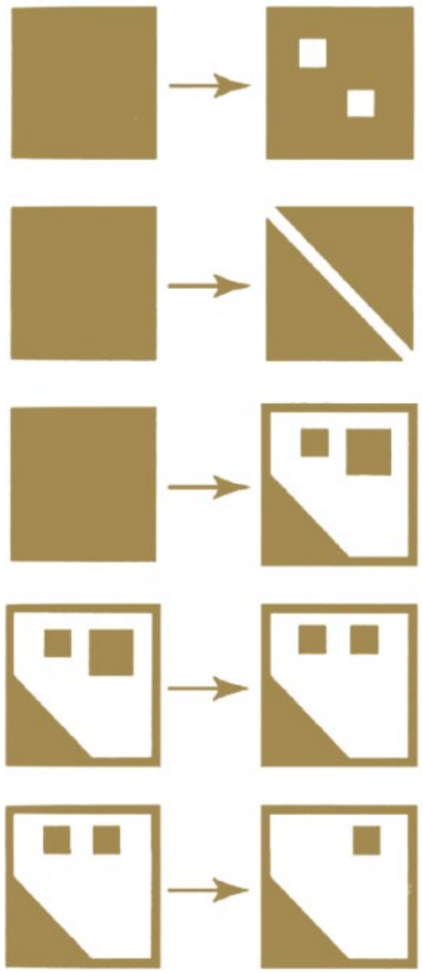
Dead spaces in and around public infrastructure. Waste of useable space. Runs through the larger landscape connecting them. Creates contextual gap.

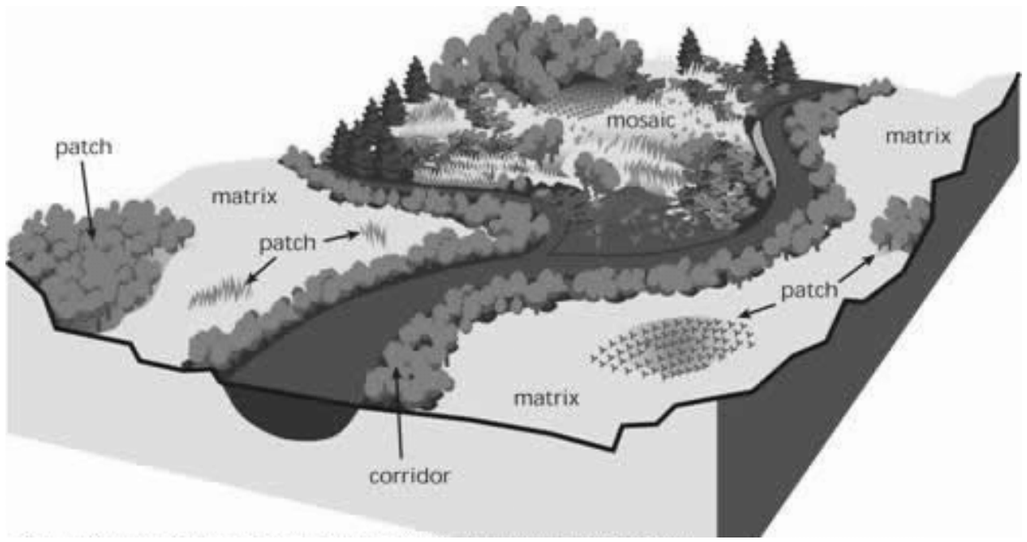
Large Scale Plots

Parking Lots create heat islands, unused lands, abandoned areas like industries. Not for people or ecology.

Pattern based Landscape Models

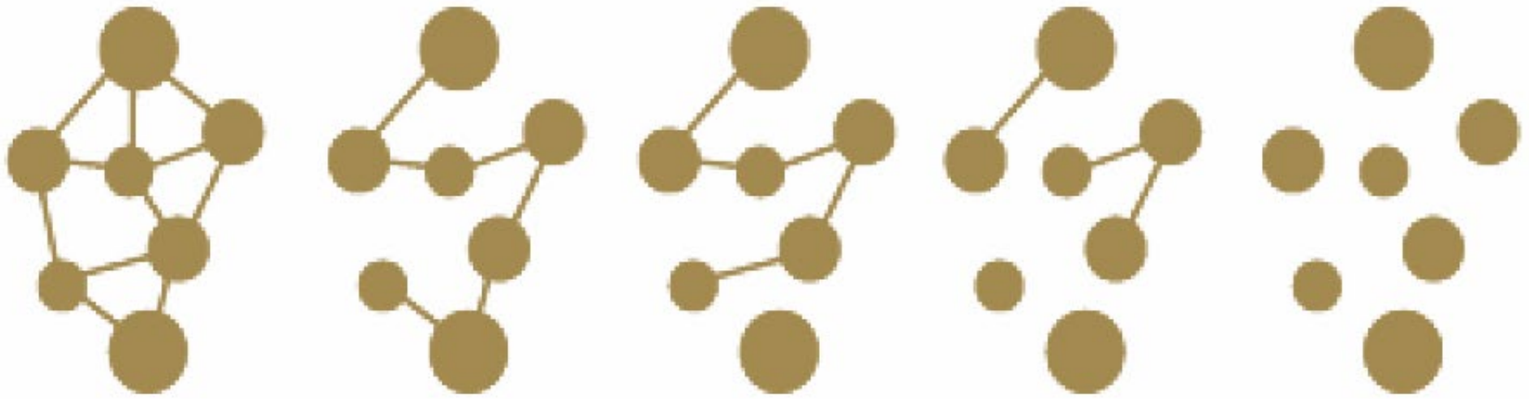
Recognizing patterns of Landscape Change



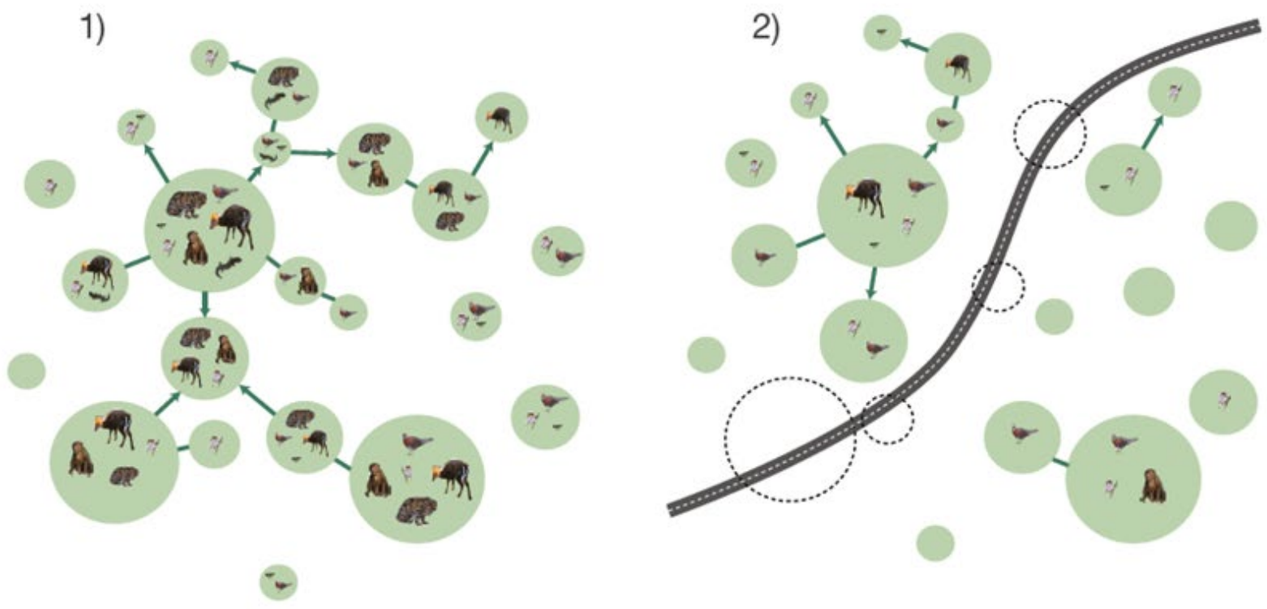


Source: Richard TT Foreman, 1995
Landscape Patterns-Environmental Quality Analysis, Oldman Watershed Council, 2013

Patch-Matrix-Corridor Theory



The probability of survival of a species decreases as network connections decreases.



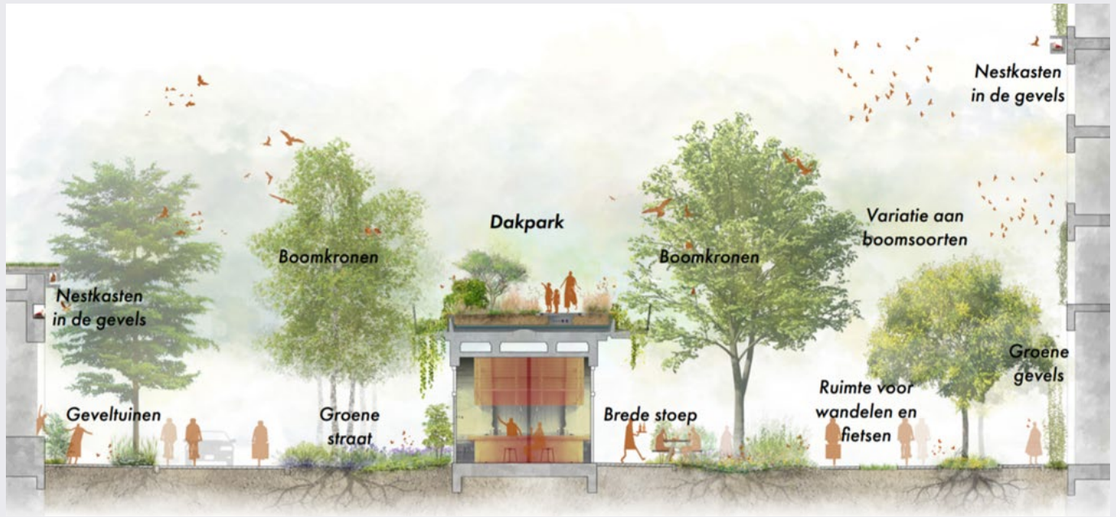
Landscape with high patch connectivity.
Landscape Fragmented by Road.

CASE STUDIES & PATTERN LANGUAGE

DESIGN TOOLBOX

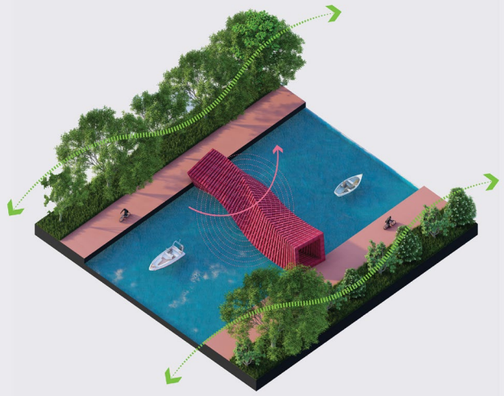
Infrastructural

New Chouteau Greenway Plan Knits Together Diverse Neighborhoods In St. Louis
Source: Stoss Landscape Urbanism

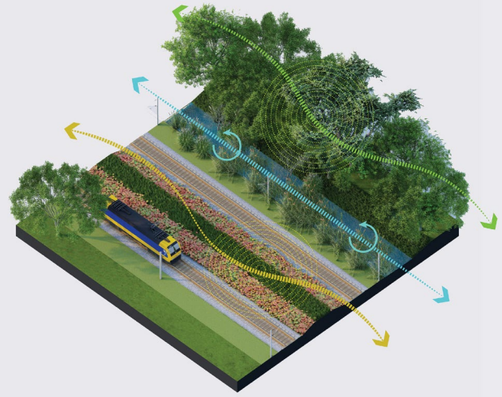


Derelict Rotterdam train tracks being made over into a luscious green park.
Source: De Urbanisten, Lanschapsarchitecten

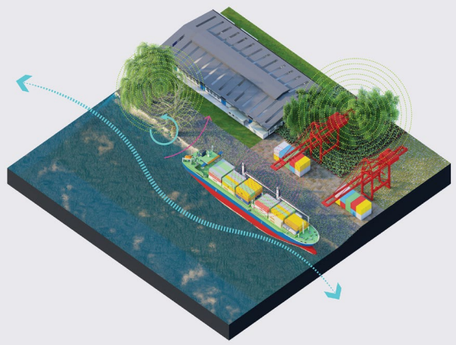
Design Pattern Language



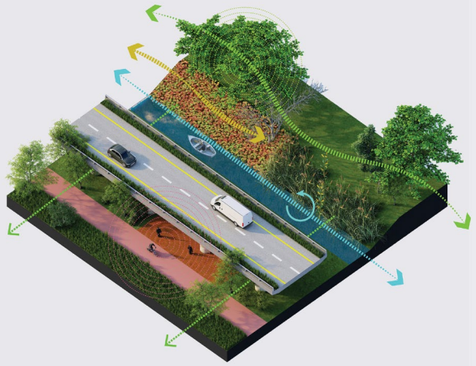
Slits on bridges for bats.



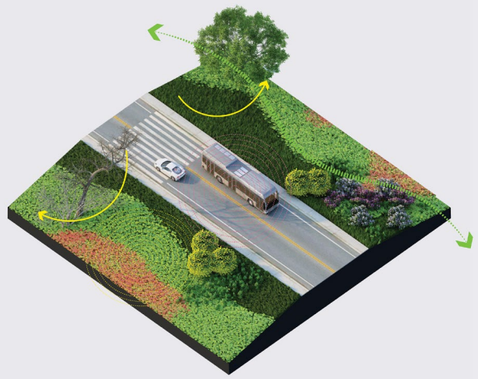
Greening Tram/Train lines.



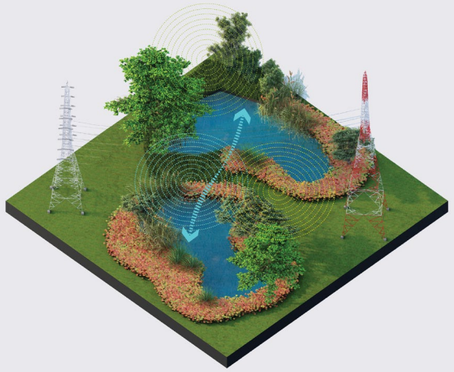
Using gradient water edges.



Using the Flyover bottoms.



Gradients along roads.



Power line green corridors.

Industrial/Brownfield

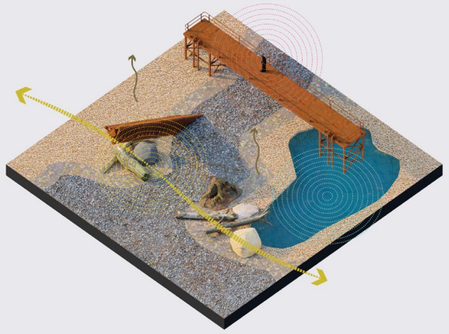
Landschaftspark Duisburg-Nord
Source: Making Urban Nature, (J. Vink, P. Vollaard, N. Zwarte)

Flowery meadow under the pylons at the port of Rotterdam
Source: Making Urban Nature, (J. Vink, P. Vollaard, N. Zwarte)

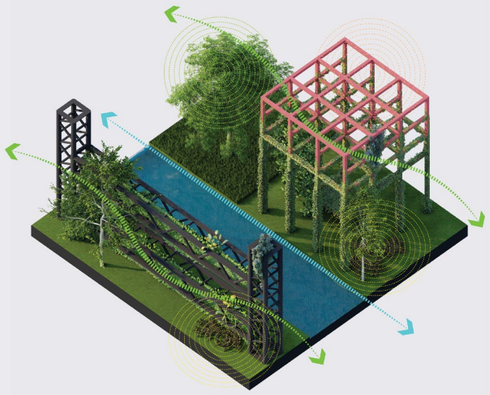
Design Pattern Language

Tall structures for birds.

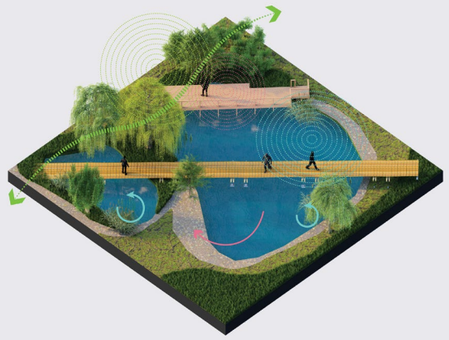
Riparian zones.



Dry Sand for insects.



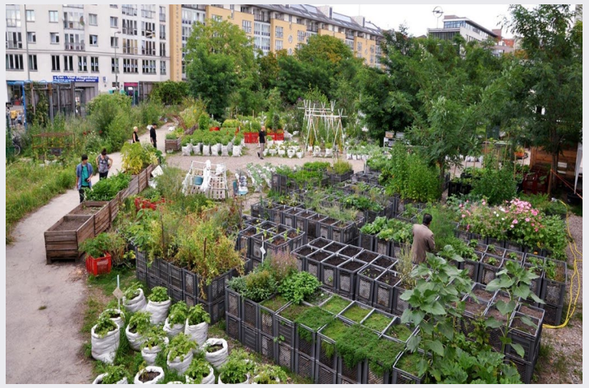
Truss/Metal structure for green.



Small ponds for frogs/toads.

Pioneer Species surprises

City District/ Garden Cities



Urban Farming in Princess gardens, Berlin

Source: Making Urban Nature, (J. Vink, P. Vollaard, N. Zwarte)

Water Square Rotterdam, De Urbanisten

Source: Making Urban Nature, (J. Vink, P. Vollaard, N. Zwarte)

Eco Cathedral-Louis Le Roy

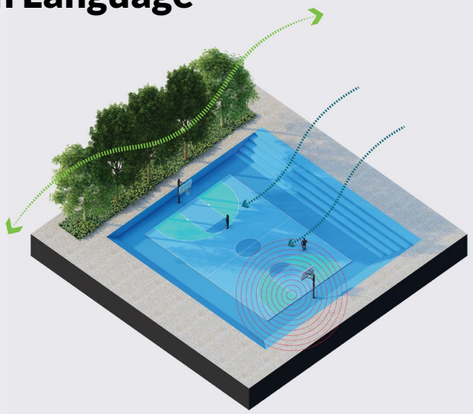
Source: Making Urban Nature, (J. Vink, P. Vollaard, N. Zwarte)

EVA-Lanxmeer neighbourhood Orchards

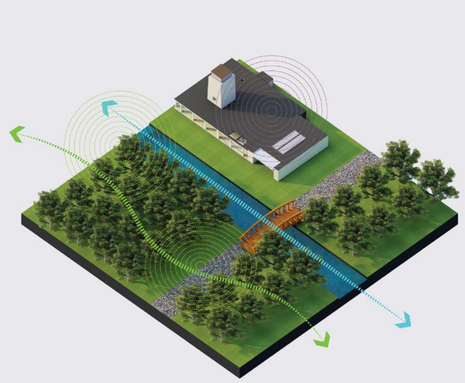
Source: Making Urban Nature, (J. Vink, P. Vollaard, N. Zwarte)

Design Pattern Language

Rooftop Gardens

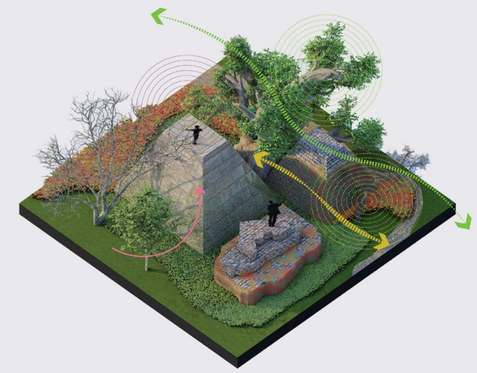


Water squares



Community Orchards

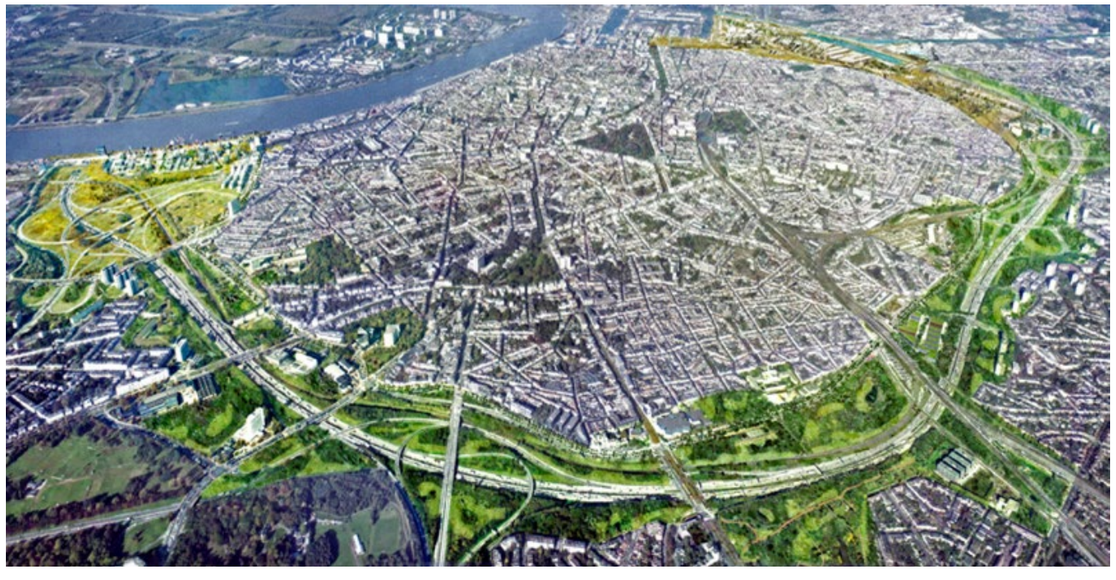
Urban Forests



Eco Cathedrals

Forest Gardens

Regional Level

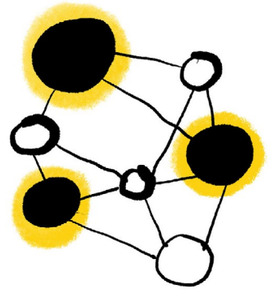


Groene Singel, Antwerpen. Green Singel, Antwerp (BE). Design: MAHK.
Source: Making Urban Nature, (J. Vink, P. Vollaard, N. Zwarte)

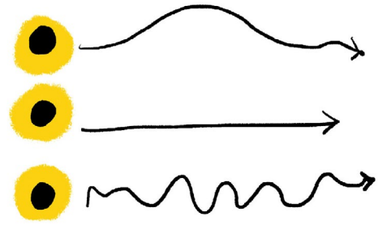
Utrecht Ringpark
Source: Provincie Utrecht

Crown State Masterplan, London

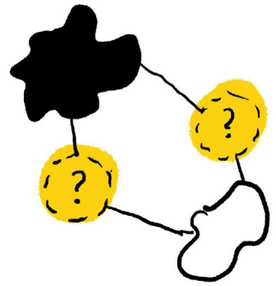
Design Pattern Language



Creating Patch-Corridor system



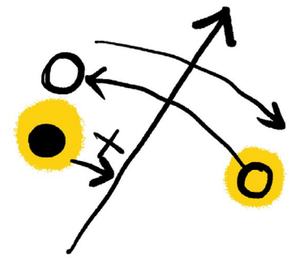
Follow/ Guide Landscape and Development Patterns



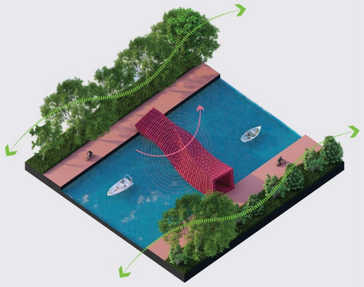
Functional Voids/ Natural Voids

Designing through scales

Adapted to context.



Forest Gardens



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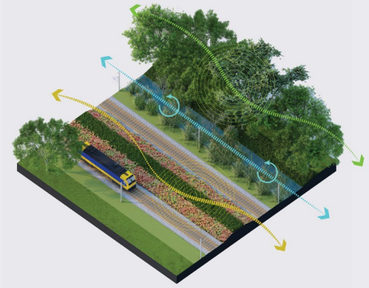

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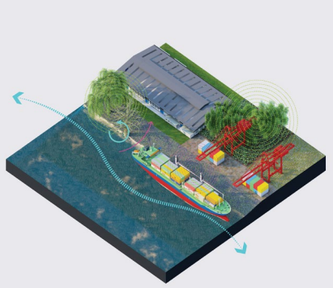
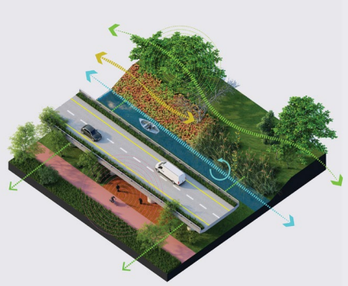


Using gradient water edges.



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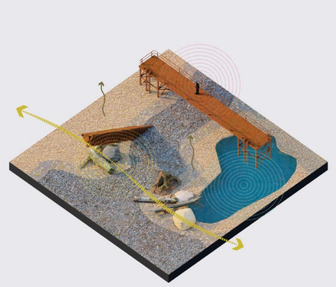

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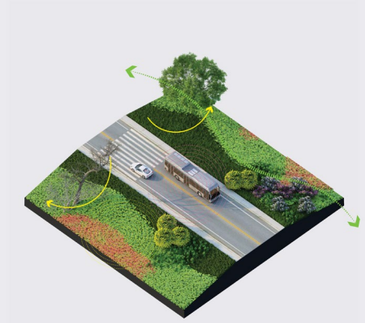
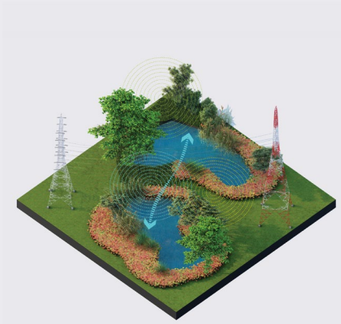


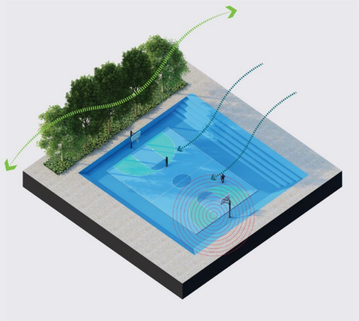
Gradients along roads.



Power line green corridors.

Small ponds for frogs/toads.

Rooftop Gardens



Water squares

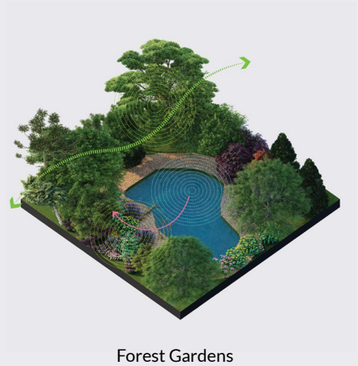
Riparian zones.

Community Orchards

Urban Forests

Truss/Metal structure for green.

Eco Cathedrals

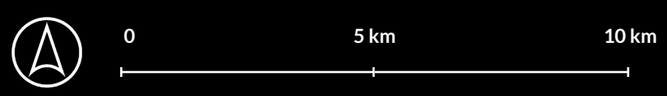


Forest Gardens

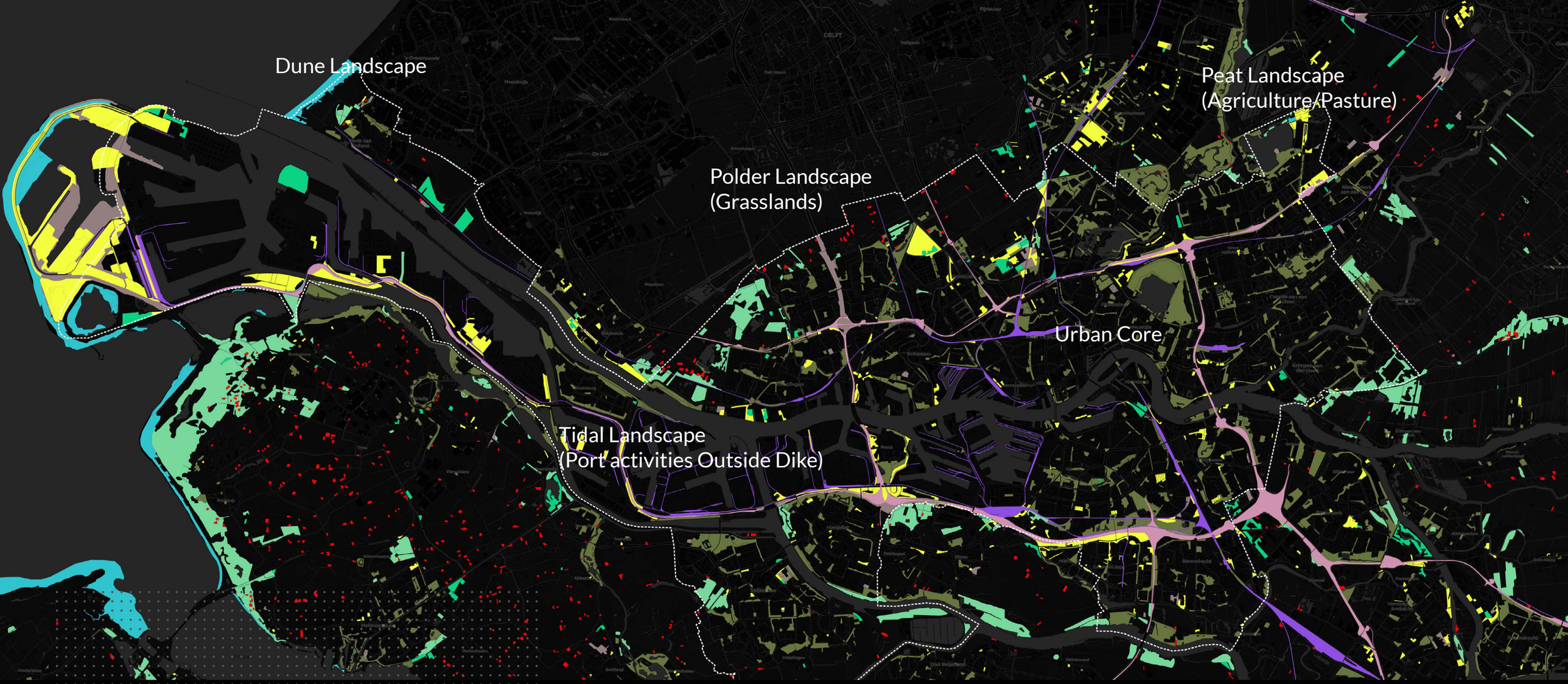
Pioneer Species surprises

MAPPING VOIDS

Source: Louisa van den Brink, 2020



Regional level Void Patterns



Source: Author, 2020

- Construction sites
- Fast transit roads and associated land
- Forests
- Green urban areas
- Isolated structures
- Land without current use
- Mineral extraction and dump sites
- Open spaces with little or no vegetation (beaches, dunes, bare rocks, glaciers)
- Railways and associated land

0 5 km 10 km

Urban Scale Voids

FAMILIARIZING

DELINEATING

APPROACHING

STRATEGIZING

DESIGNING

ENDING

FASCINATION

INITIAL ANALYSIS
OF ROTTERDAM REGION

DEFINING
THE PROBLEM & RESEARCH QUESTION

THEORETICAL FRAMEWORK + CASE STUDIES

SITE VISITS

ANALYZING
OPPORTUNITIES

IDENTIFYING SITES

SPATIAL DESIGN OBJECTIVES + PRINCIPLES

SPATIAL DESIGN

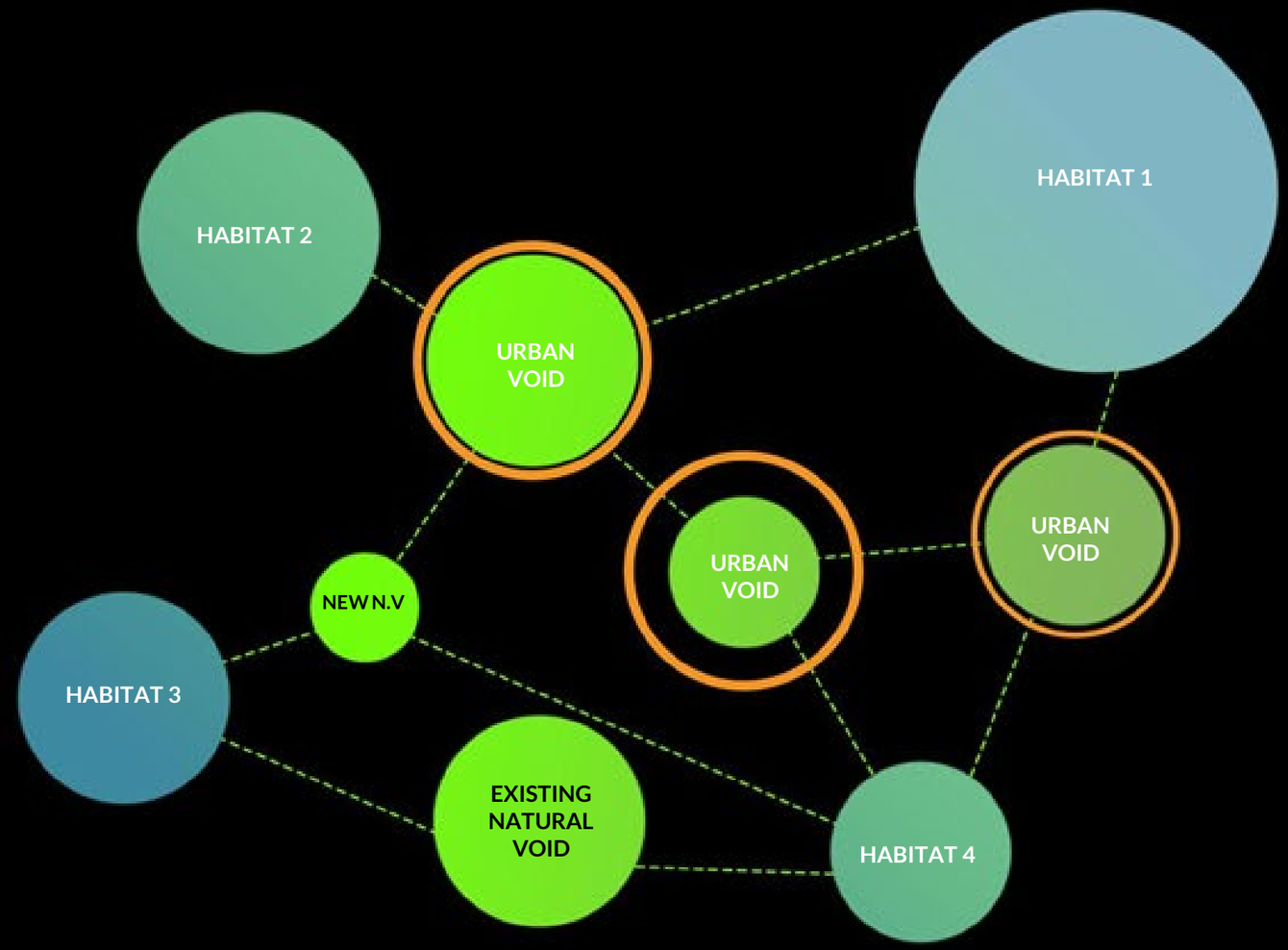
REFLECTING

CONCEPTUAL FRAMEWORK
IN LINE WITH THE ORIGINAL VISION IDEAS BY ROTTERDAM MUNICIPALITY

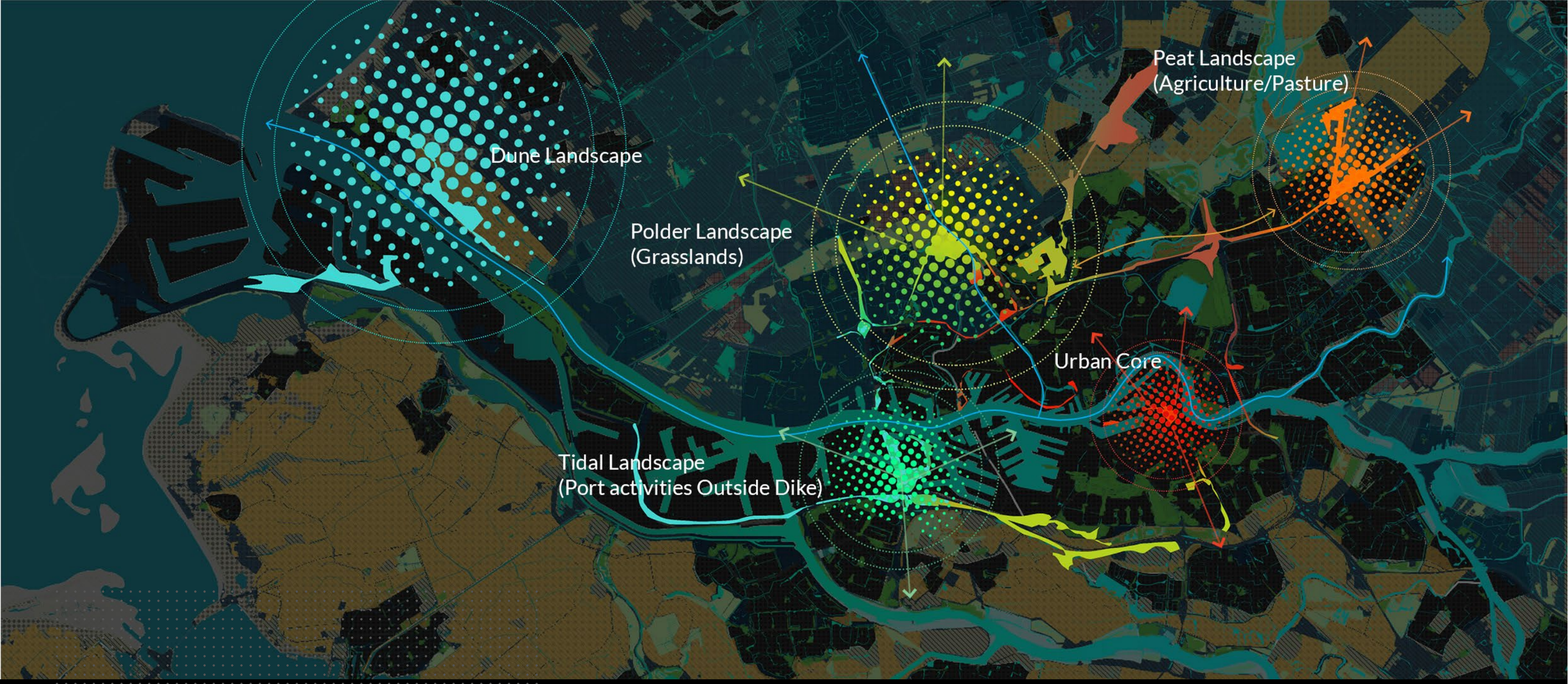
REGIONAL LANDSCAPE + URBAN FRAMEWORK
(ROTTERDAM URBAN AREA)

PRODUCTS

STRATEGIZING



Void-Habitat Network



Source: Author, 2021

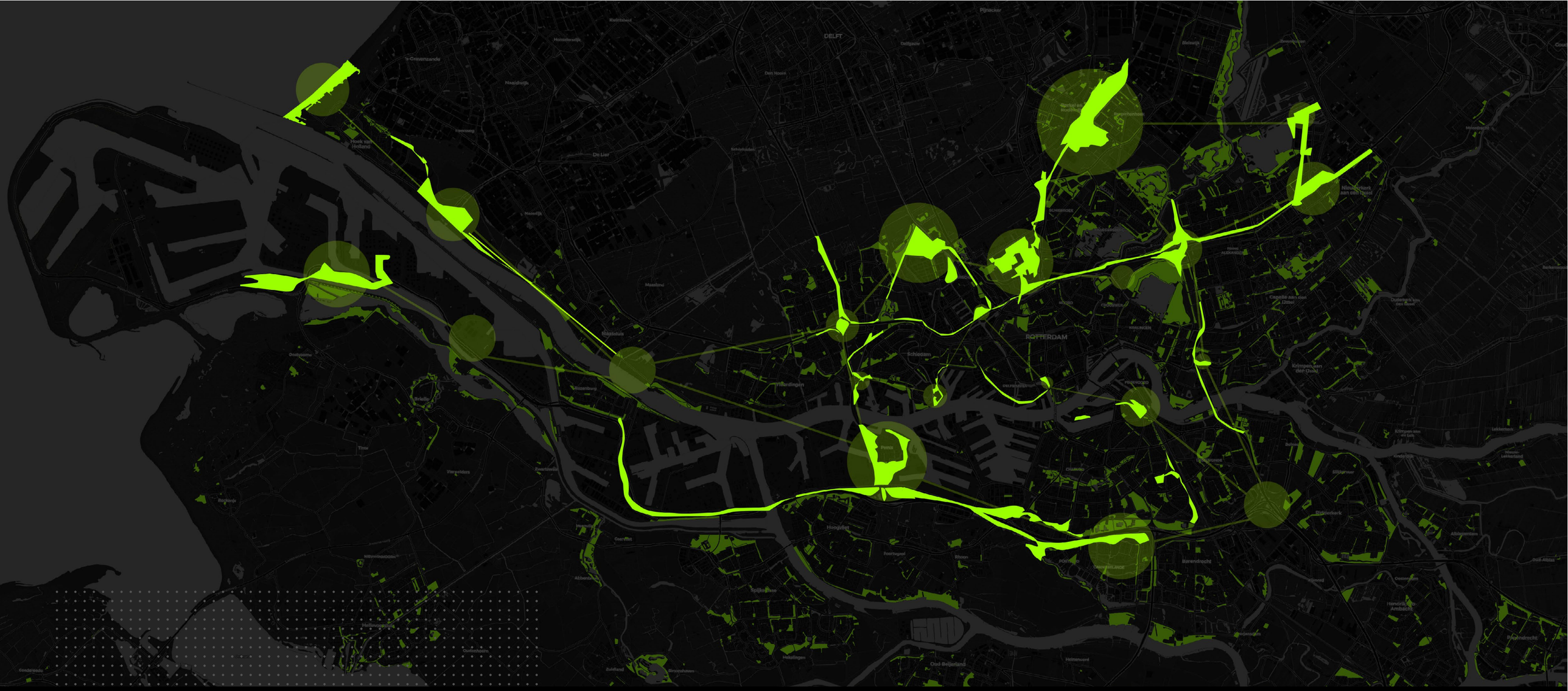
0 5 km 10 km

The Urban Ecological Gradient

Source: Author, 2021

0 5 km 10 km

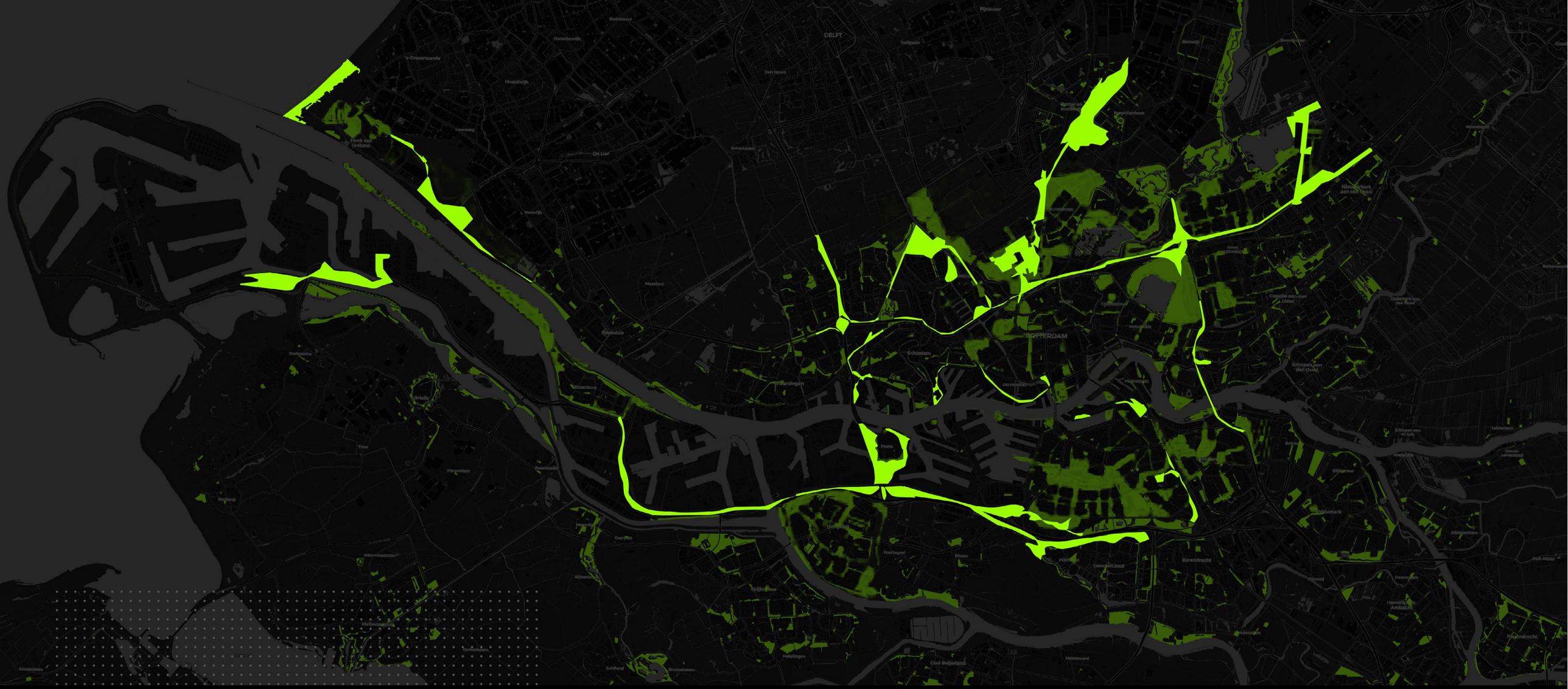
Patch-Matrix-Corridor Scheme for Rotterdam



Source: Author, 2021

A New Network connecting Voids

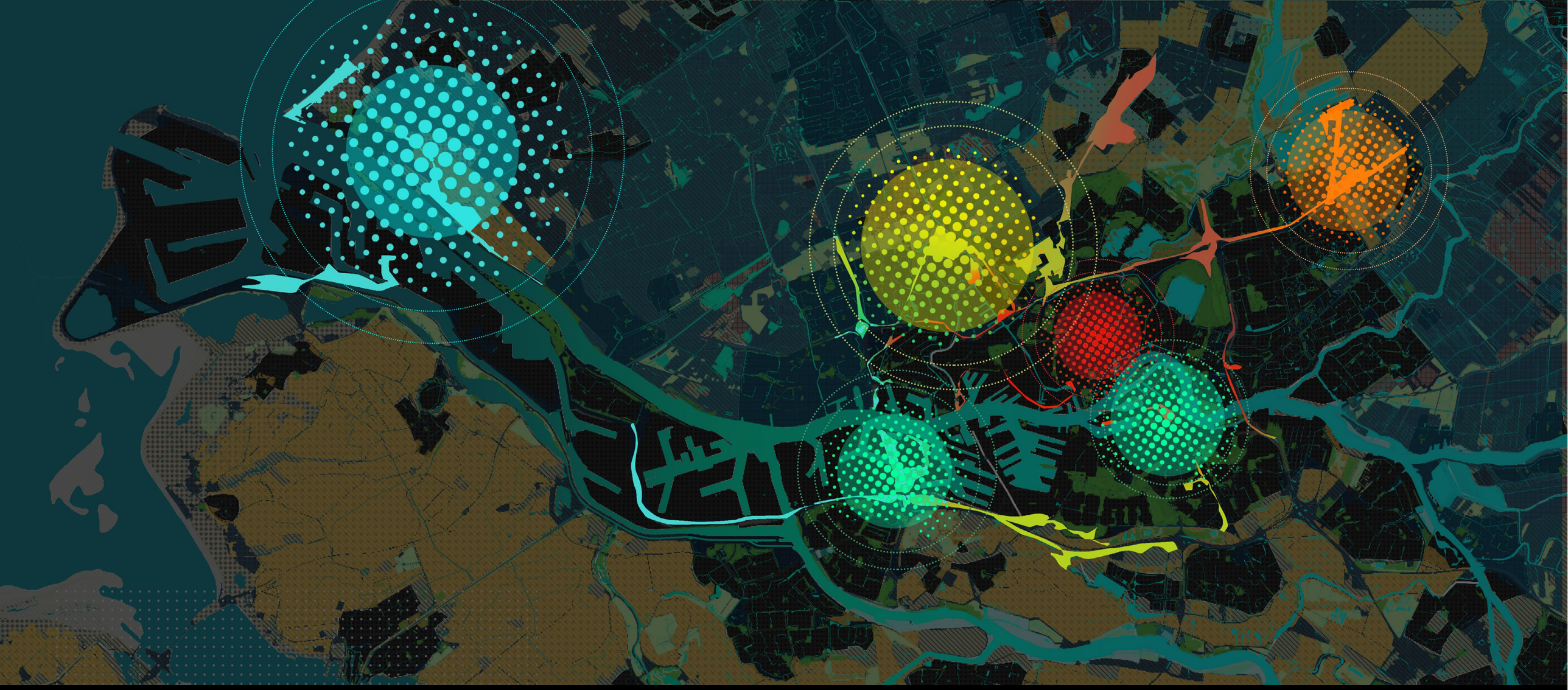
This new network makes use of the regional level patterns mapped and the local level voids. A new green fabric of these voids is envisioned.



Source: Author, 2021

0 5 km 10 km

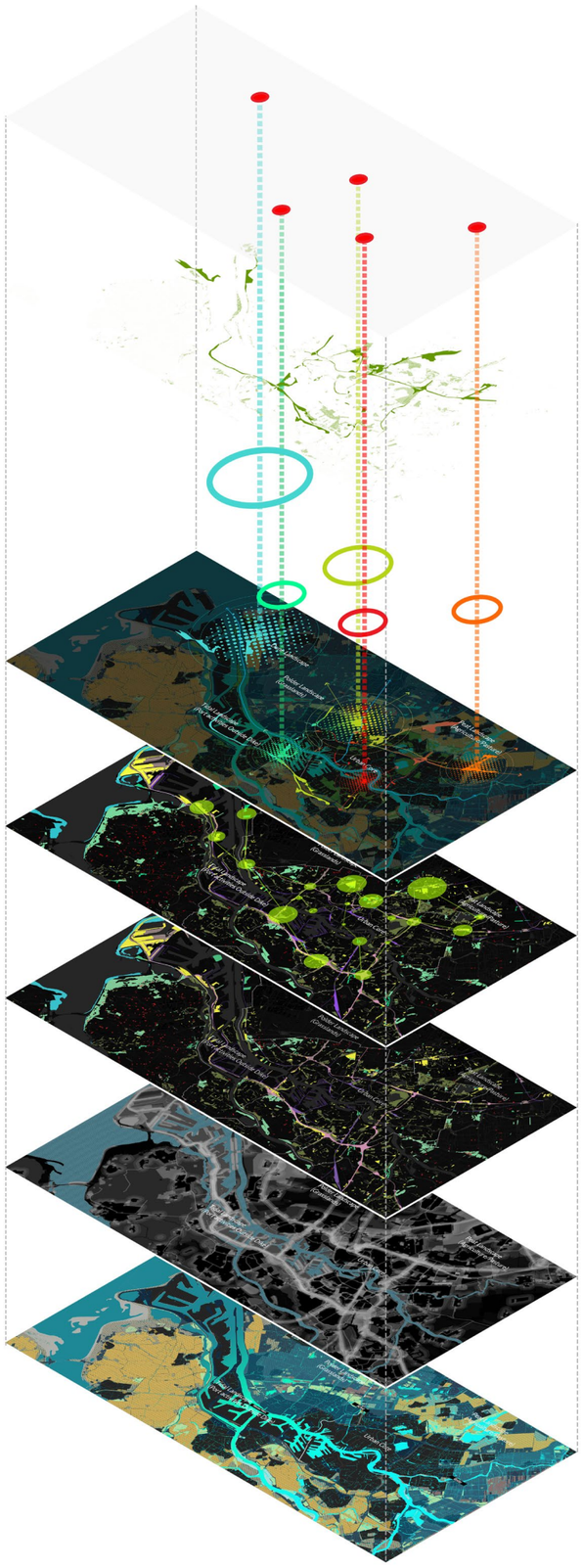
Proposed Network vs Rotterdam Vision



Source: Author, 2021

0 5 km 10 km

Urban Gradients & Test Sites



SITE LEVEL DESIGN

Site level interventions and application of design principles.

NEW GREEN NETWORK

A new green network adding to the existing green-blue structure.

LOCAL ECOLOGY

Understanding the ecology and choosing target species for each biotope.

URBAN SCALE GRADIENT

Connecting the outer habitats through a gradient urban ecological network.

VOID NETWORK

Envisioning a new ecological void network within the urban core.

LOCAL VOIDS

Identifying local voids in the urban tissue.

REGIONAL VOIDS

Defining void patterns in the regional level.

HABITATS

Understanding the underlying and existing habitat network of the region.

Design Framework for the project.

Source: Author, 2021

FAMILIARIZING

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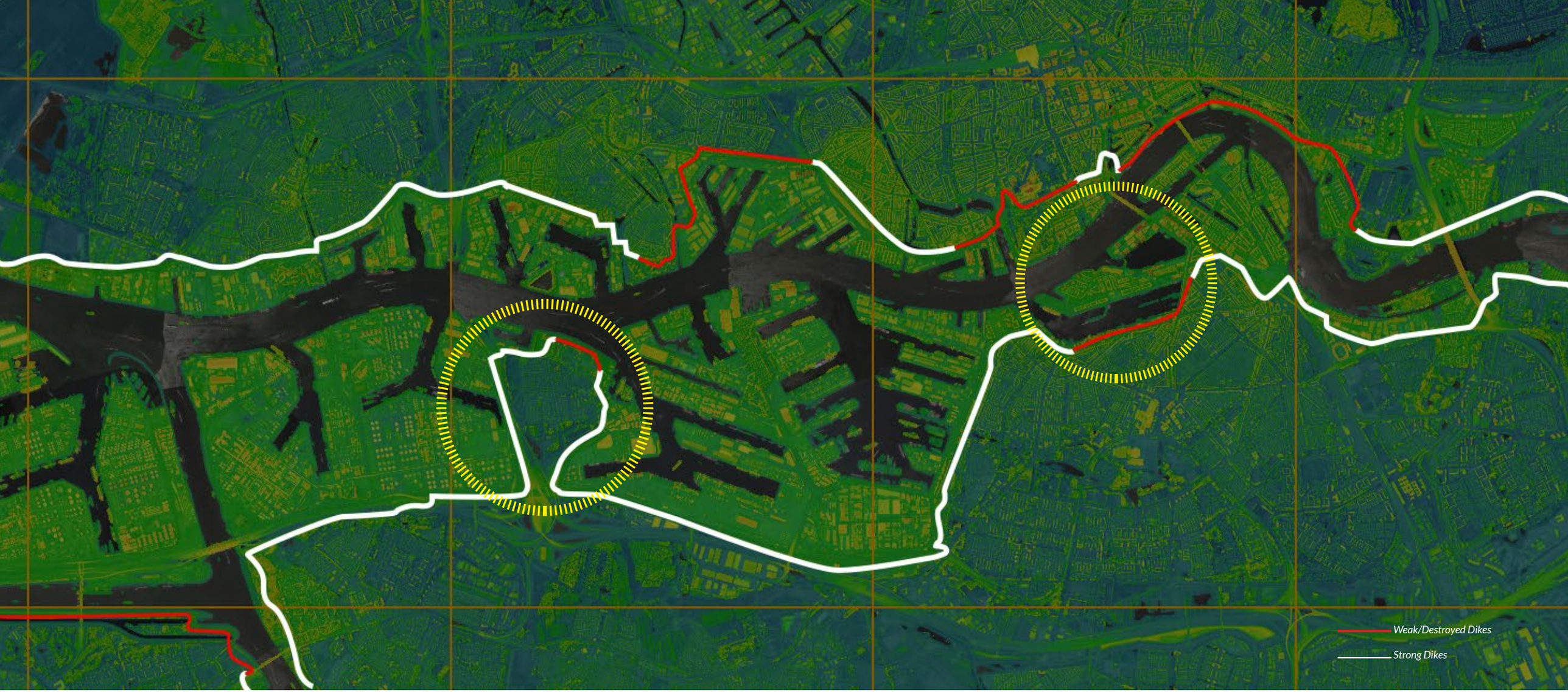
Source: Author, 2021

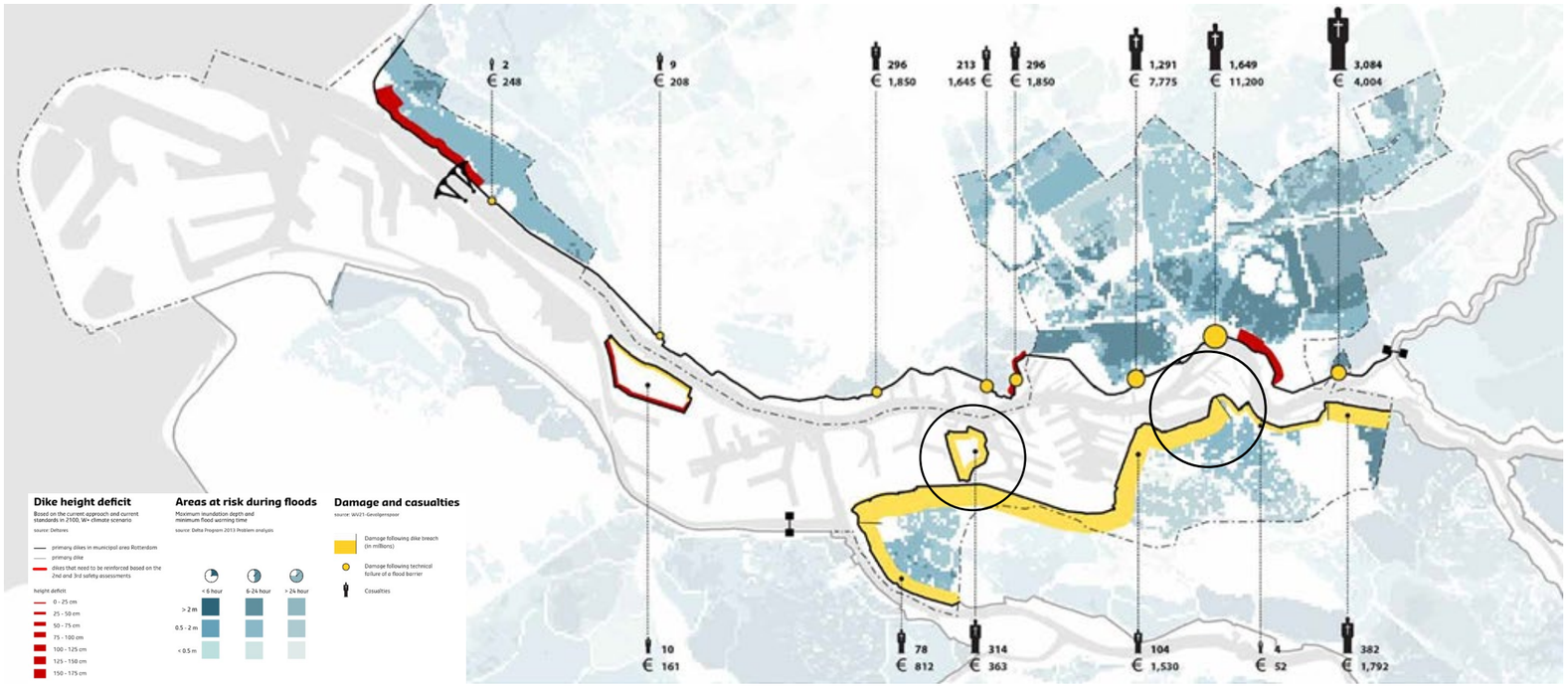
A New Tidal Nature

Dike Layout (Satellite)

Dike Vulnerability



Dike Layout (Satellite)



Flooding Map

Source: Rotterdam Climate Change Adaptation Strategy

Heat Island Map

Source: Rotterdam Climate Change Adaptation Strategy

Flood Damage and Heat Islands

- The A4 Highway runs adjacent to the Pernis.
- Built structures mainly consist of neighbourhoods of houses and warehouses for port functions.
- Paved surface dominates the area. Result of the Industrial/Port Use.
- Water in the Nieuwe Maas affected by tidal water from the North Sea

  The green structure is primarily flat grass lawns.
- Composite Site at Pernis

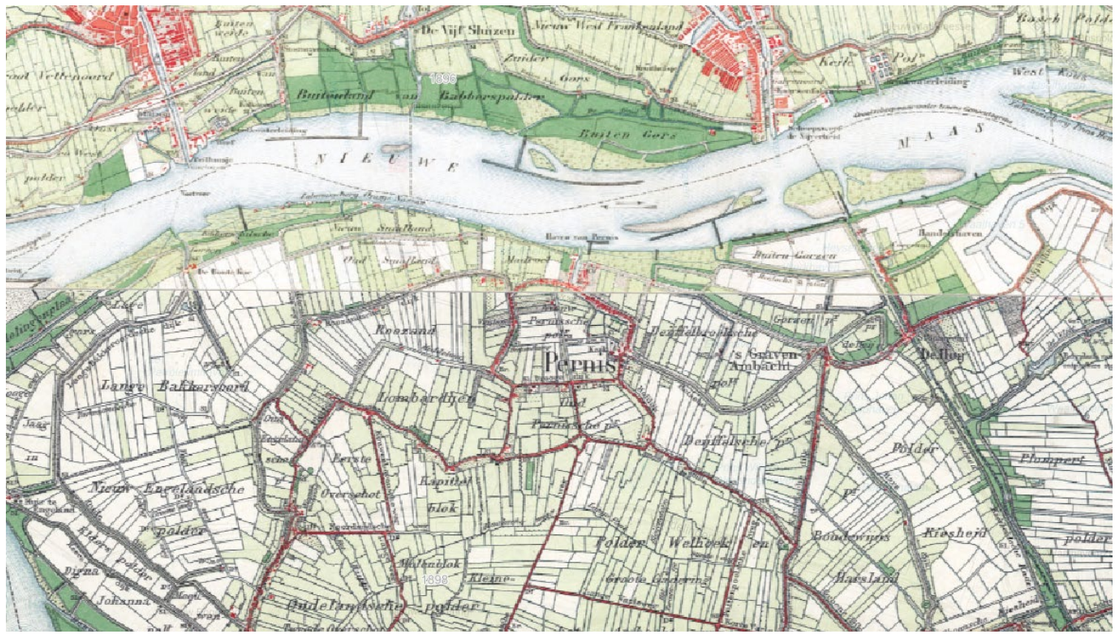
Source: Author, 2021

- The RijnHaven/Maashaven Stations, S122 Road go adjacent. The Erasmus bridge is a landmark.
- Built structures mainly consist of neighbourhoods of houses, industries, commercial areas and warehouses for port functions.
- Paved surface dominates the area. Result of the Industrial/Port Use.
- Water in the Nieuwe Maas affected by tidal water from the North Sea

  The presence of green is very scarse. Dominated by port activities.
- Composite Site at Kop Van Zuid

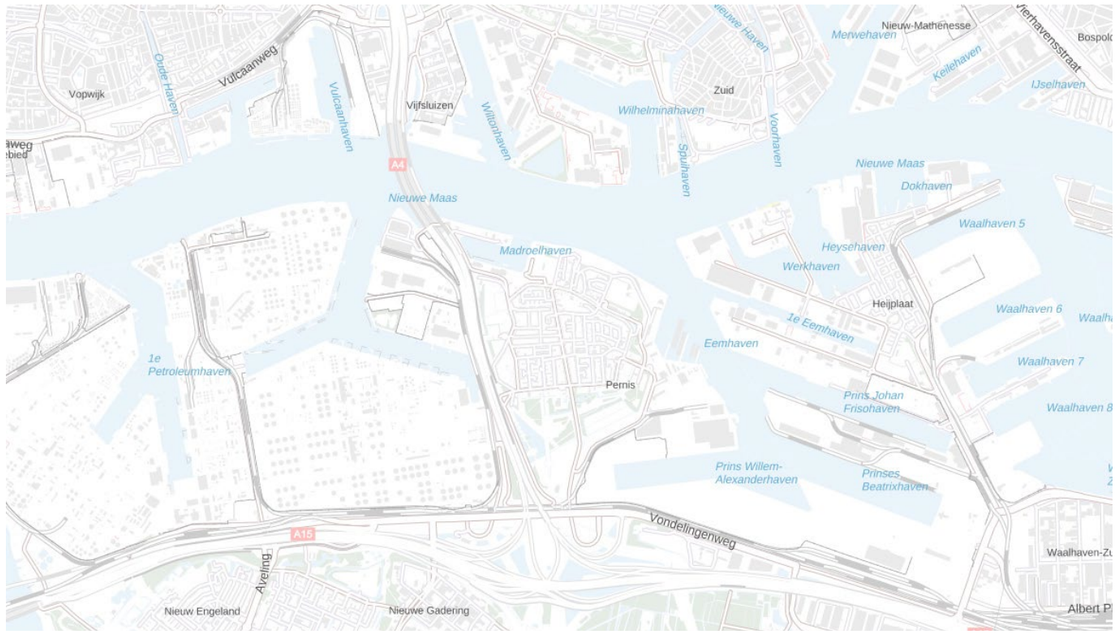
Site Structure-Pernis

Site Structure-Kop van Zuid



Pernis in 1900

Source: CultGIS



Pernis in 2021

Source: CultGIS

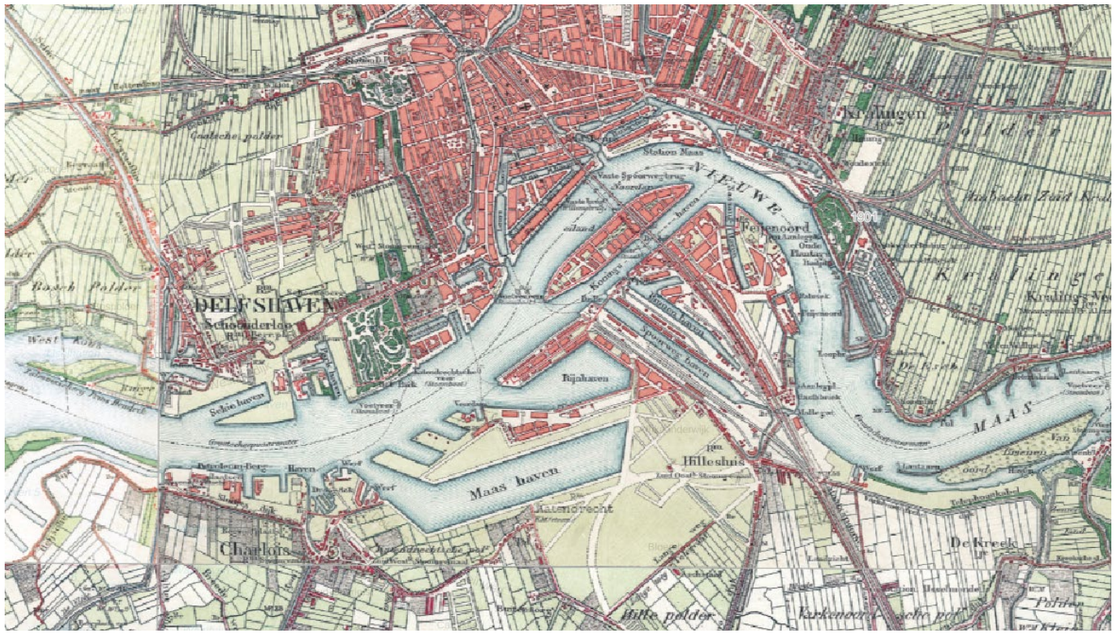
Pernis in 1959

Source: Anneke Krak (Pinterest)

Pernis in 2021

Source: Siebe Swart

Development over Time: Pernis



Kop van Zuid in 1900

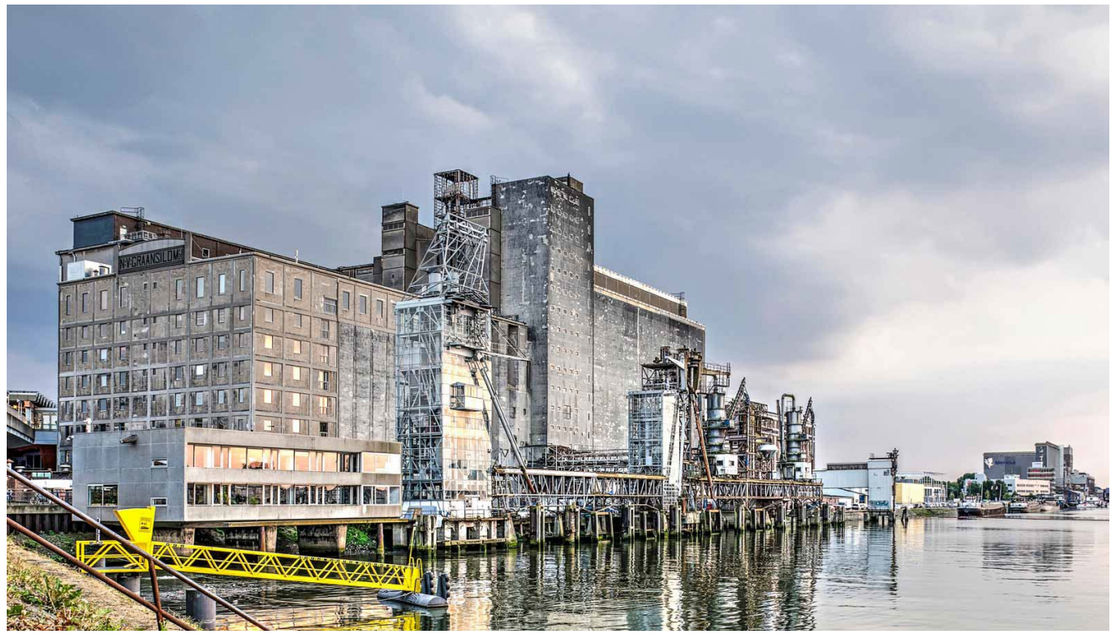
Source: CultGIS

Maashaven (Kop van Zuid) in 1920's

Source: https://architizer.com/projects/maashaven/

Kop van Zuid in 2021

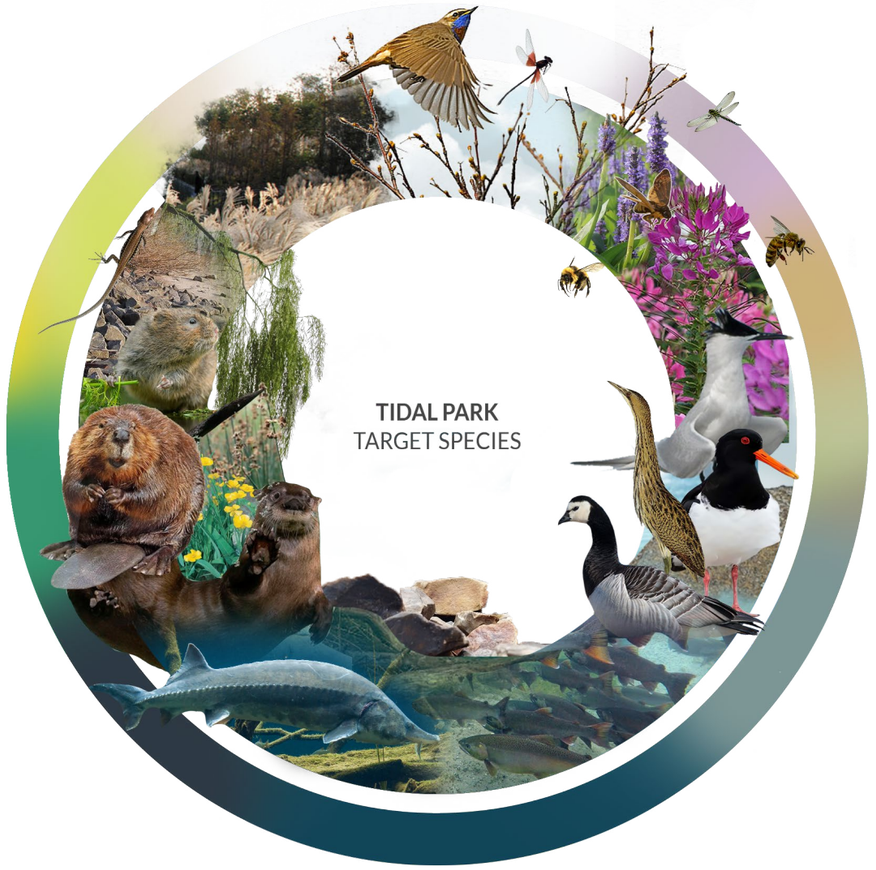
Source: CultGIS



Maashaven (Kop van Zuid) in 2021

Source: Frans Blok 3develop.nl

Development over Time: Kop van Zuid

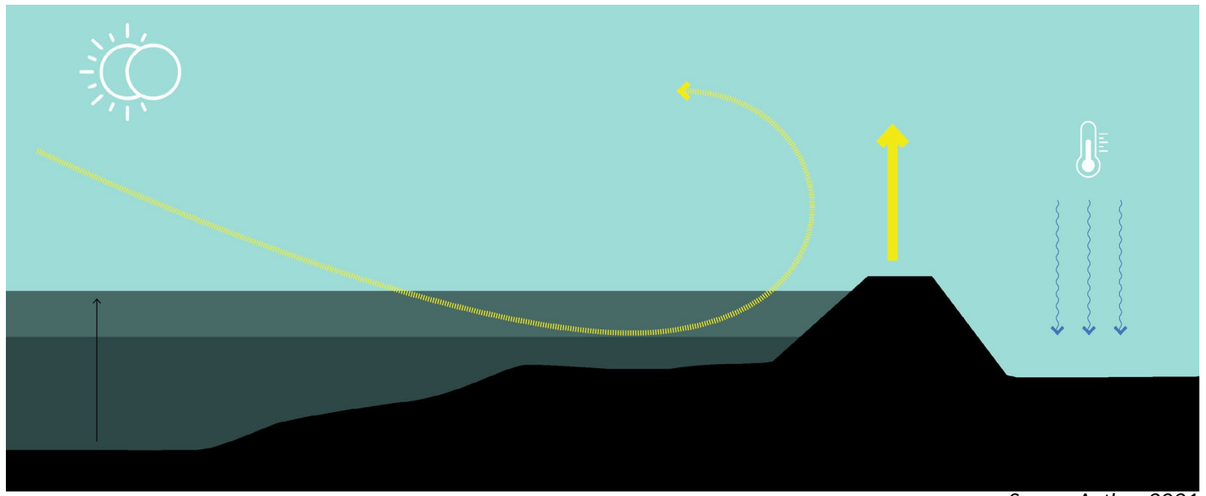


Source: Author, 2021

Sturgeon	Beavers	Oyster Catcher	Bumblebees	Lizard
Salmon	Barnacle Goose	Arctic Vole	Reeds	Moths
Otters	Sandwich Tern	Blue Throat	Spider Flower	Cattails

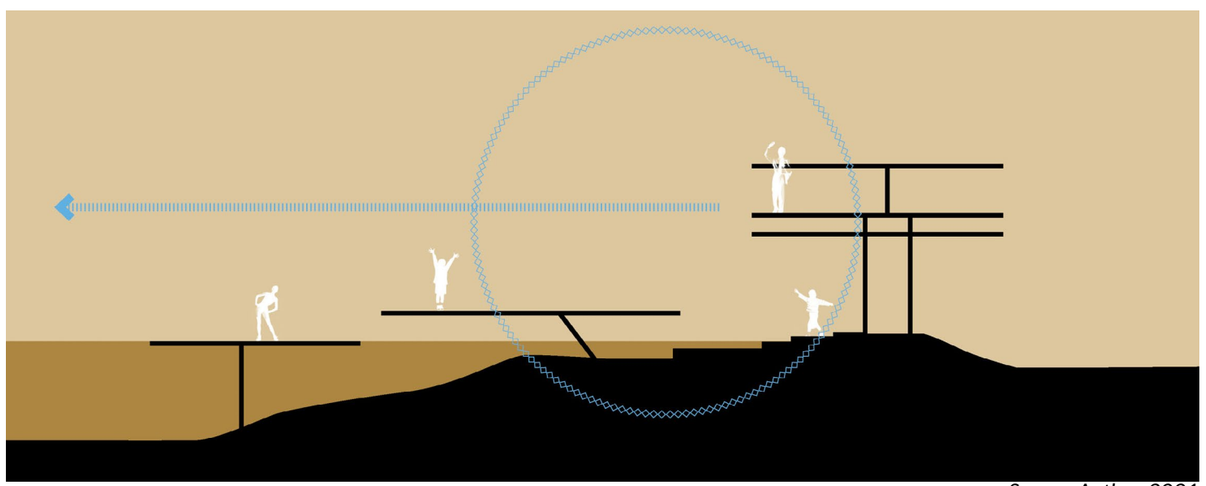
Source: Author, 2021

The site as an ecological hotspot.



Source: Author, 2021

The site as an agent of climate change resilience.



Source: Author, 2021

The site as a destination for recreation.

Test Site 01

Pernis

Source: Author, 2021

Spatial Combination 1

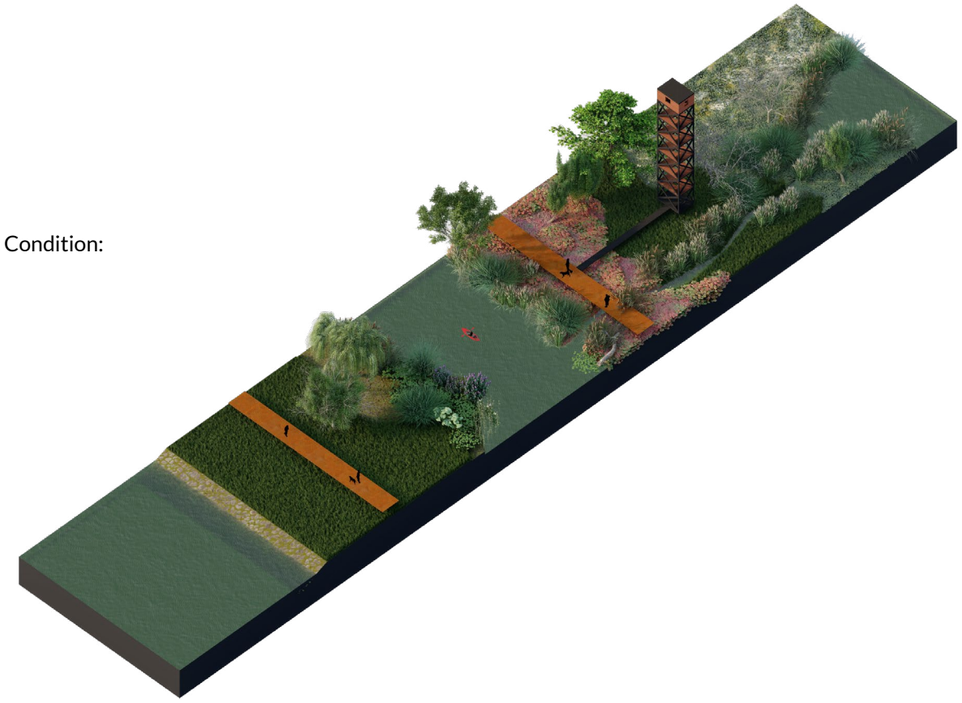
Low Tide Condition:

High Tide Condition:

Spatial Combination 2

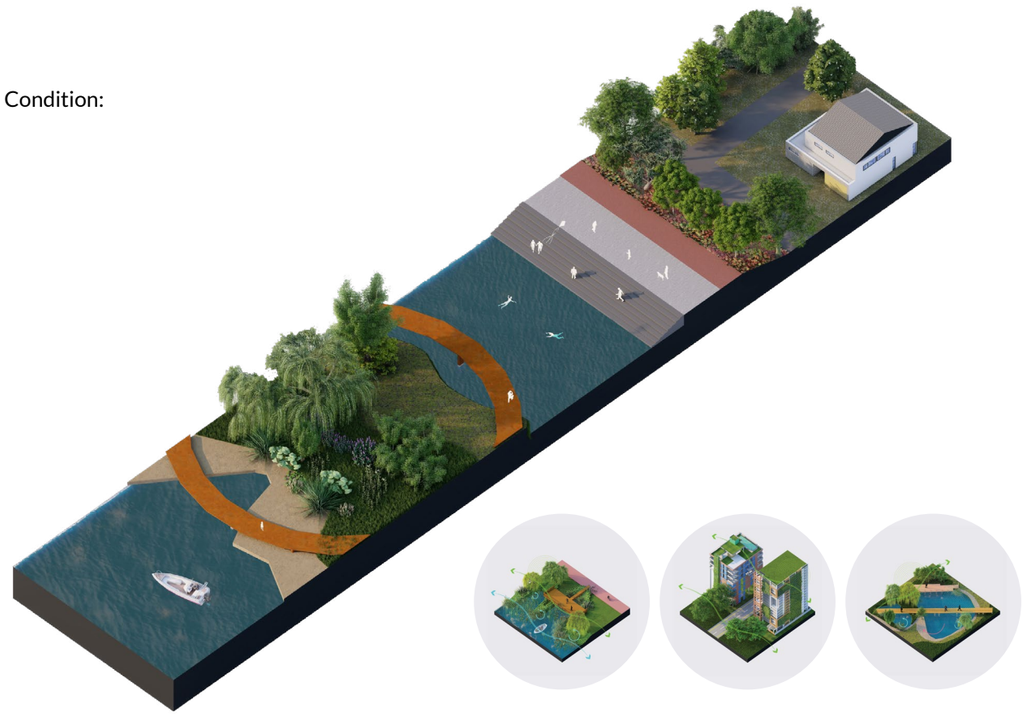
Low Tide Condition:

High Tide Condition:

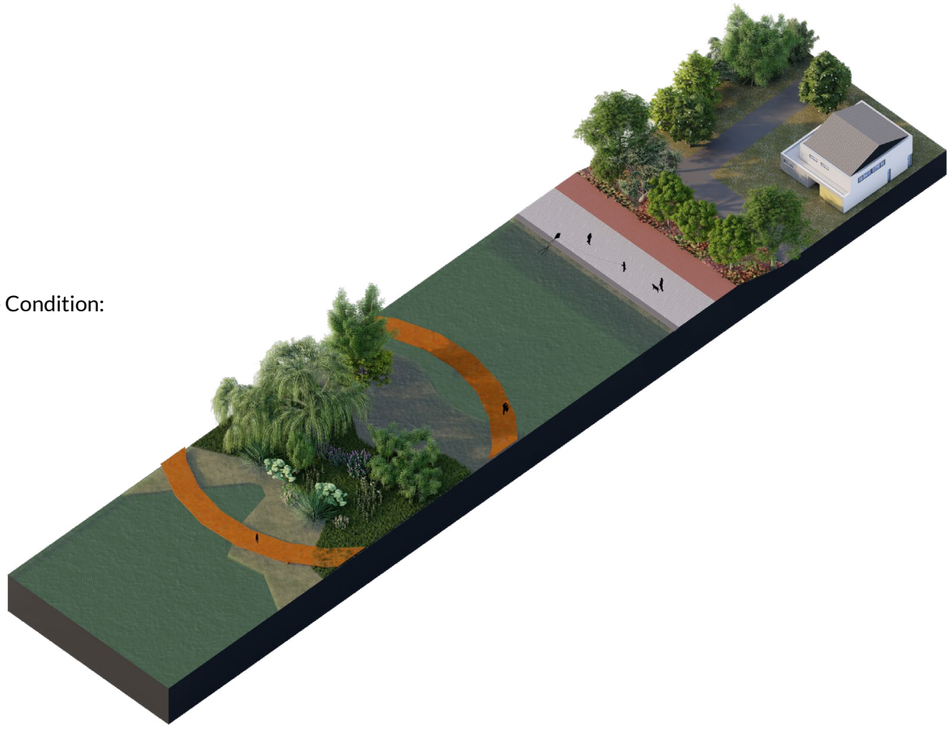


Spatial Combination 3

Low Tide Condition:



High Tide Condition:



Spatial Combination 4

Low Tide Condition:

High Tide Condition:

Source: Author, 2021

Source: Author, 2021

Aerial view of the Pernis Tidal Park

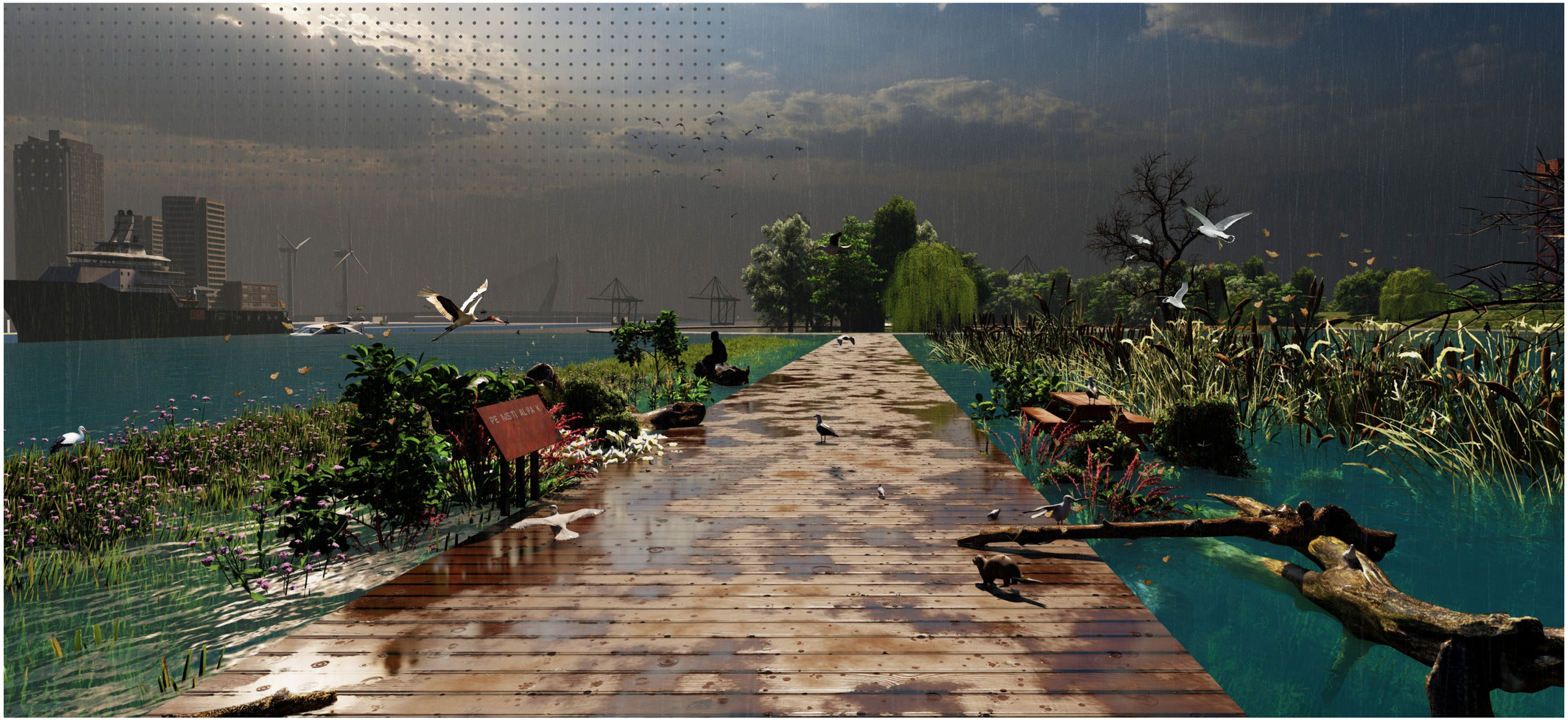
Source: Author, 2021

Impression of the new Pernis Tidal park spatial characters

Source: Author, 2021

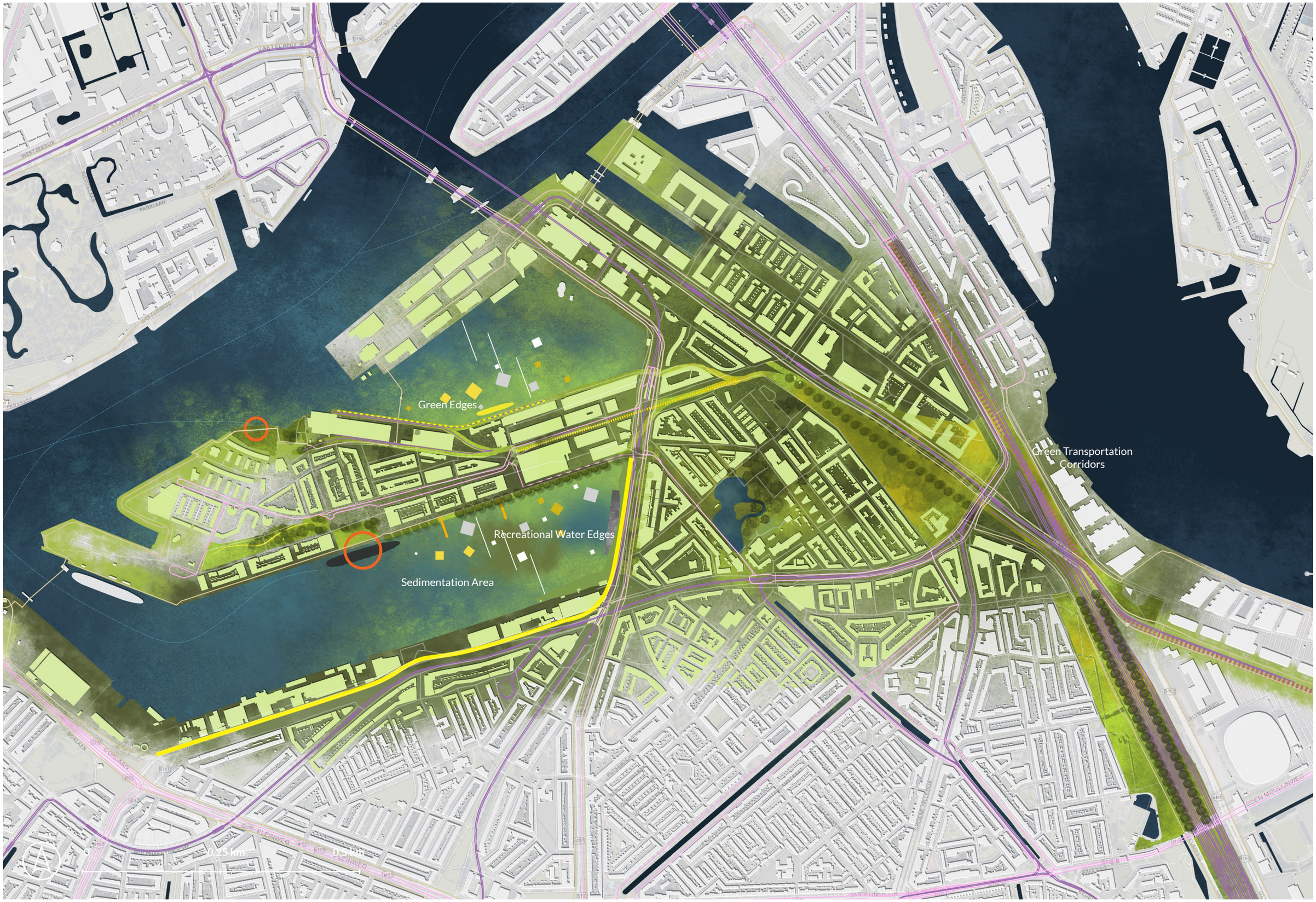
Impression of the new Pernis Tidal park during flooding

Source: Author, 2021

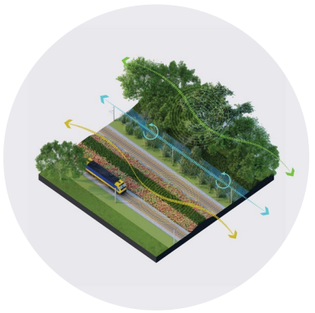


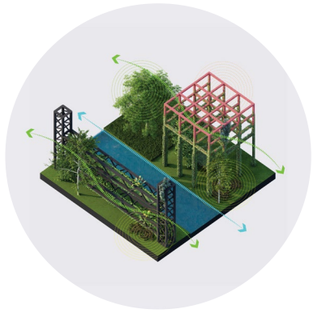
Test Site 01

Kop van Zuid

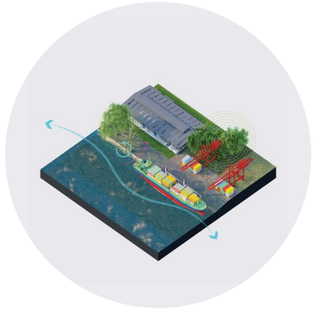

Green Edges
Recreational Water Edges
Sedimentation Area
Green Transportation Corridors
0 0.25 km 0.5 km

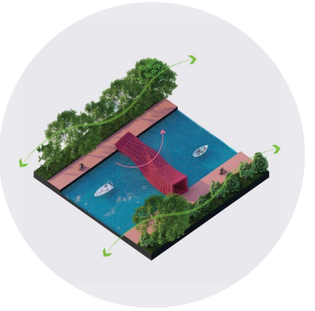
Low Tide Condition:



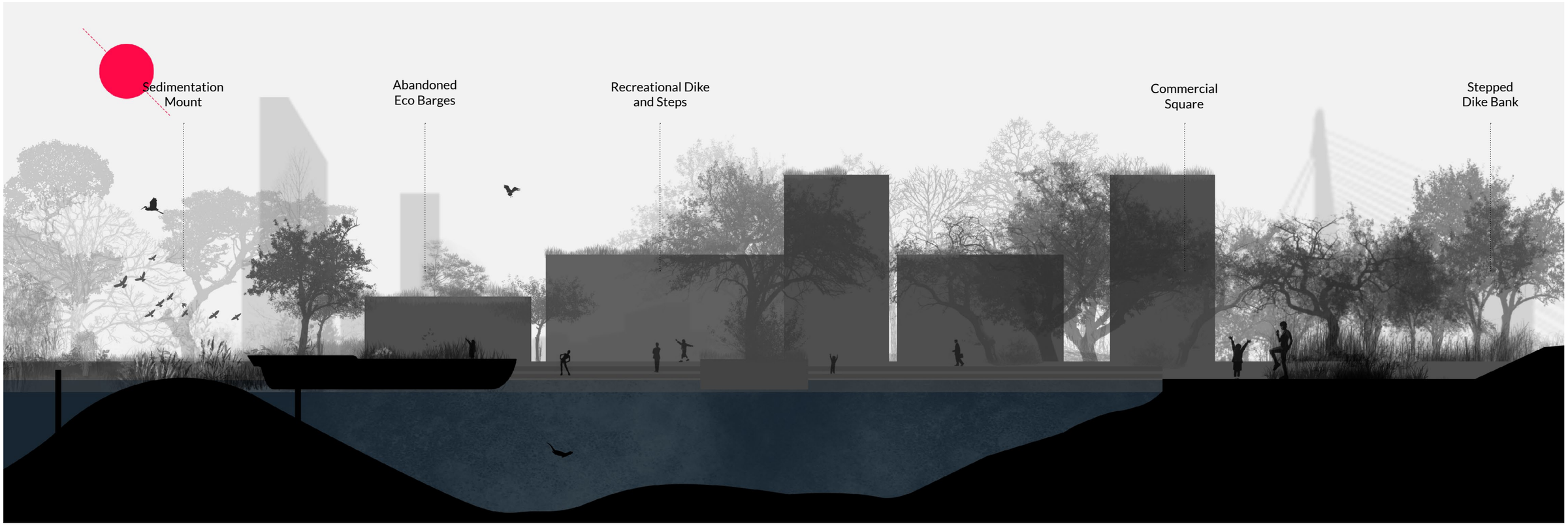


High Tide Condition:

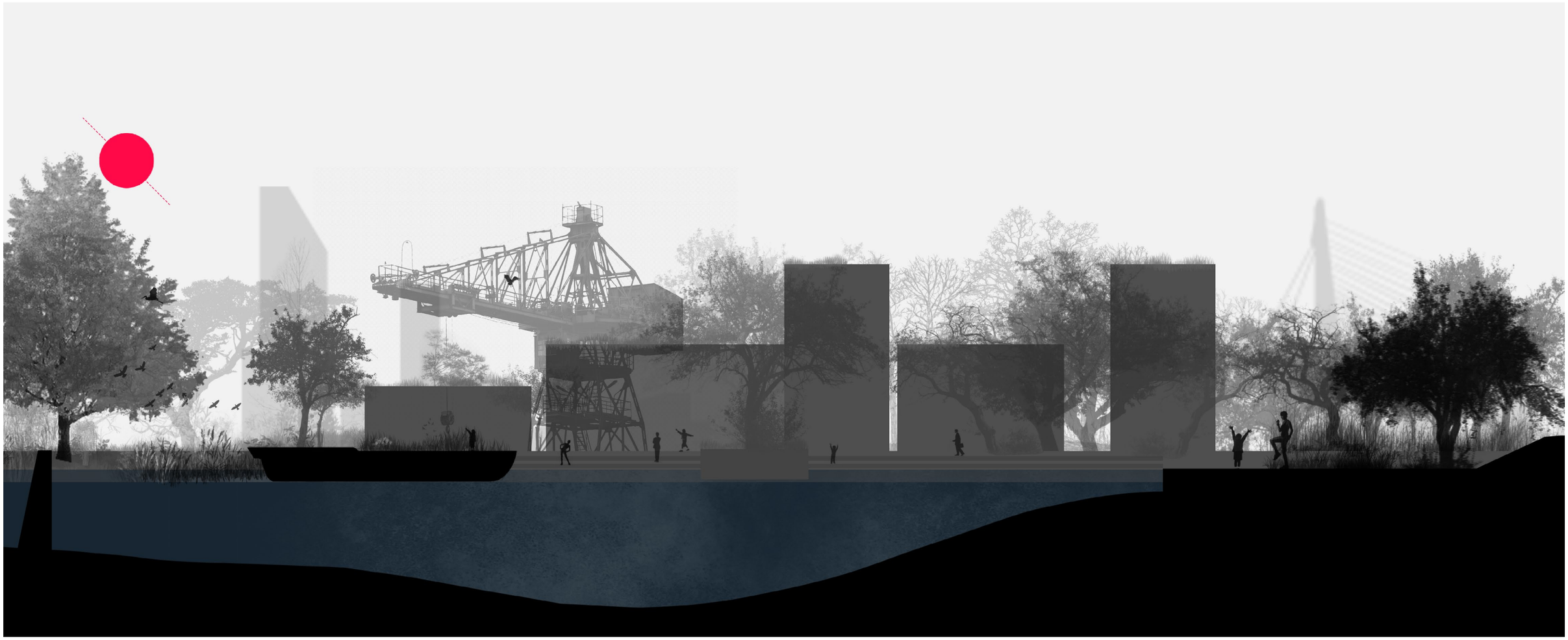




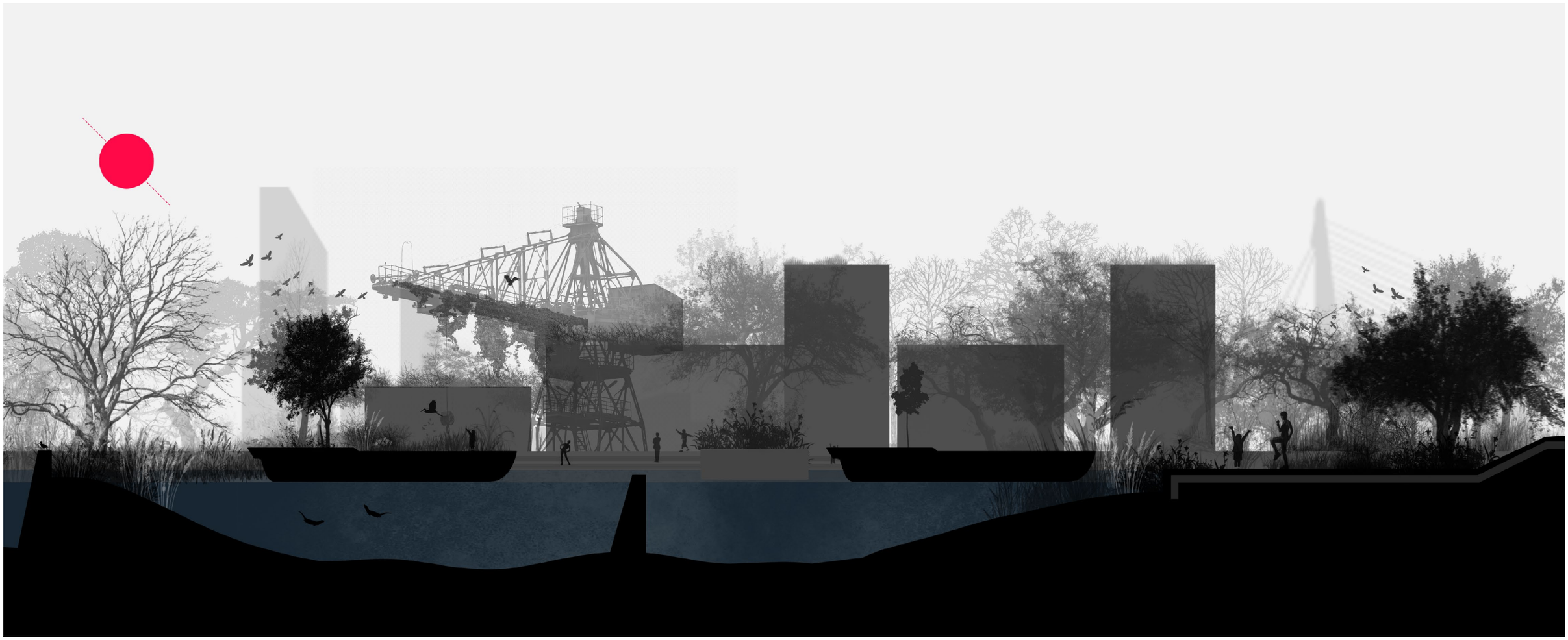

Existng Tram Line
S122 City road
Natural buffer
Abandoned Land turns into eco park


Sedimentation Mount
Abandoned Eco Barges
Recreational Dike and Steps
Commercial Square
Stepped Dike Bank

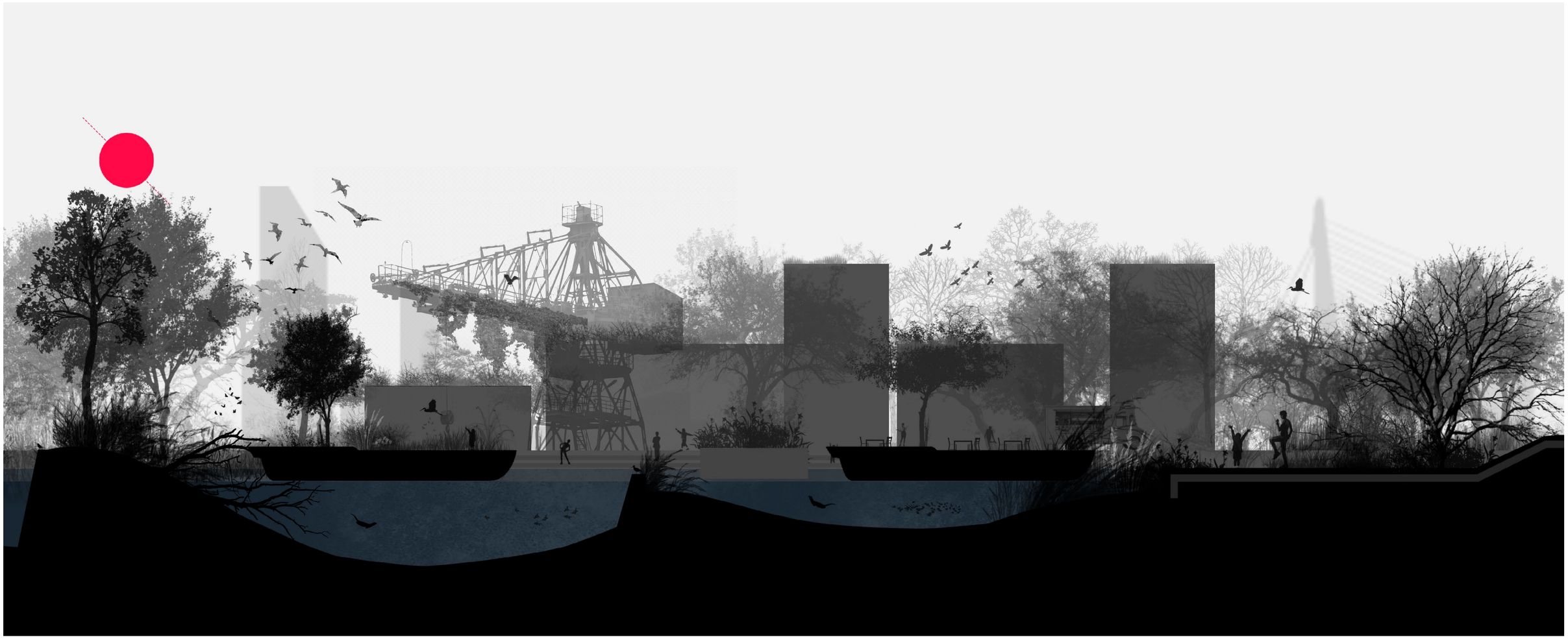
2021 Scenario

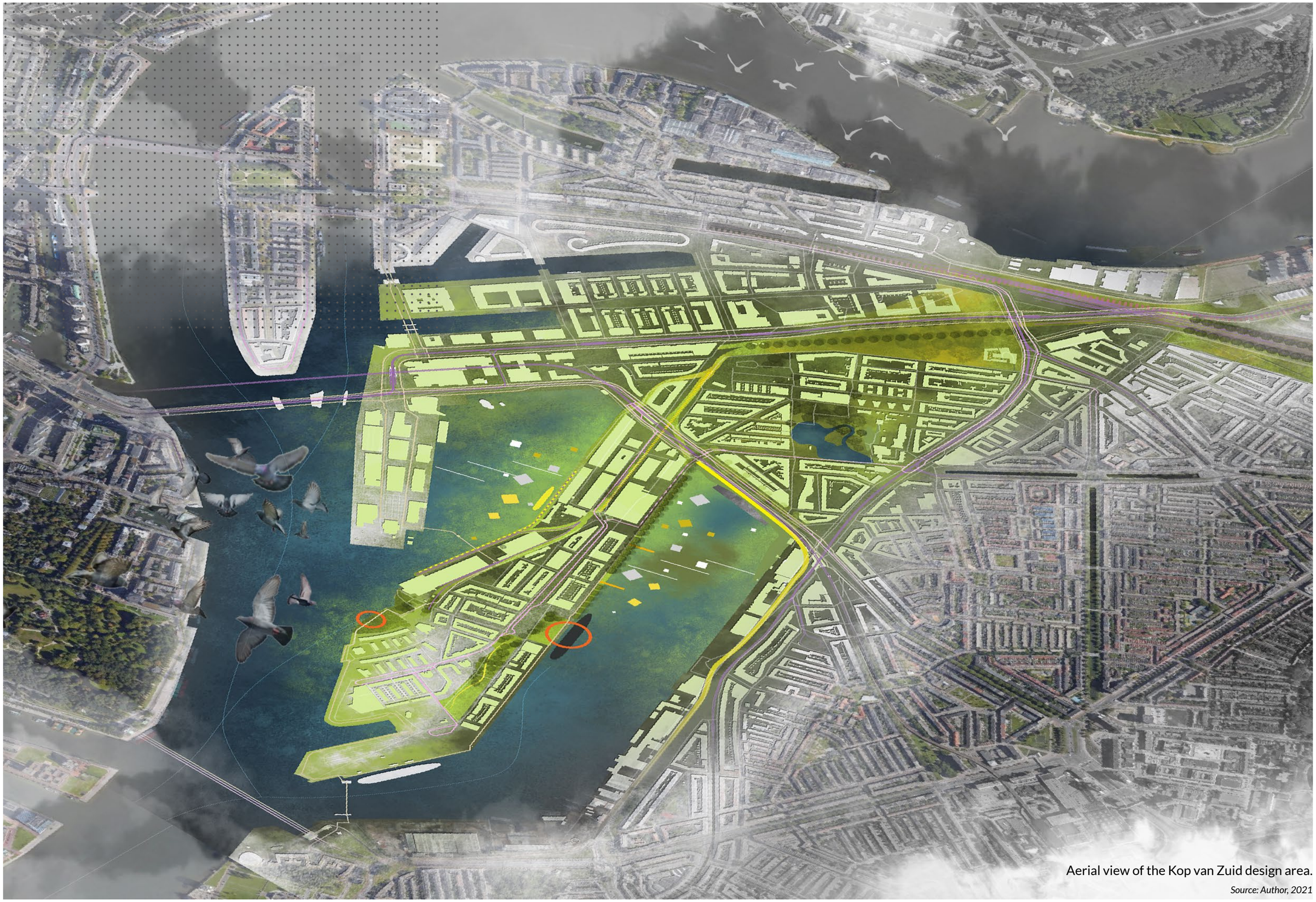


2030 Scenario: Sedimentation, Introduction of new Groynes



2050 Scenario: Creation of Wetland



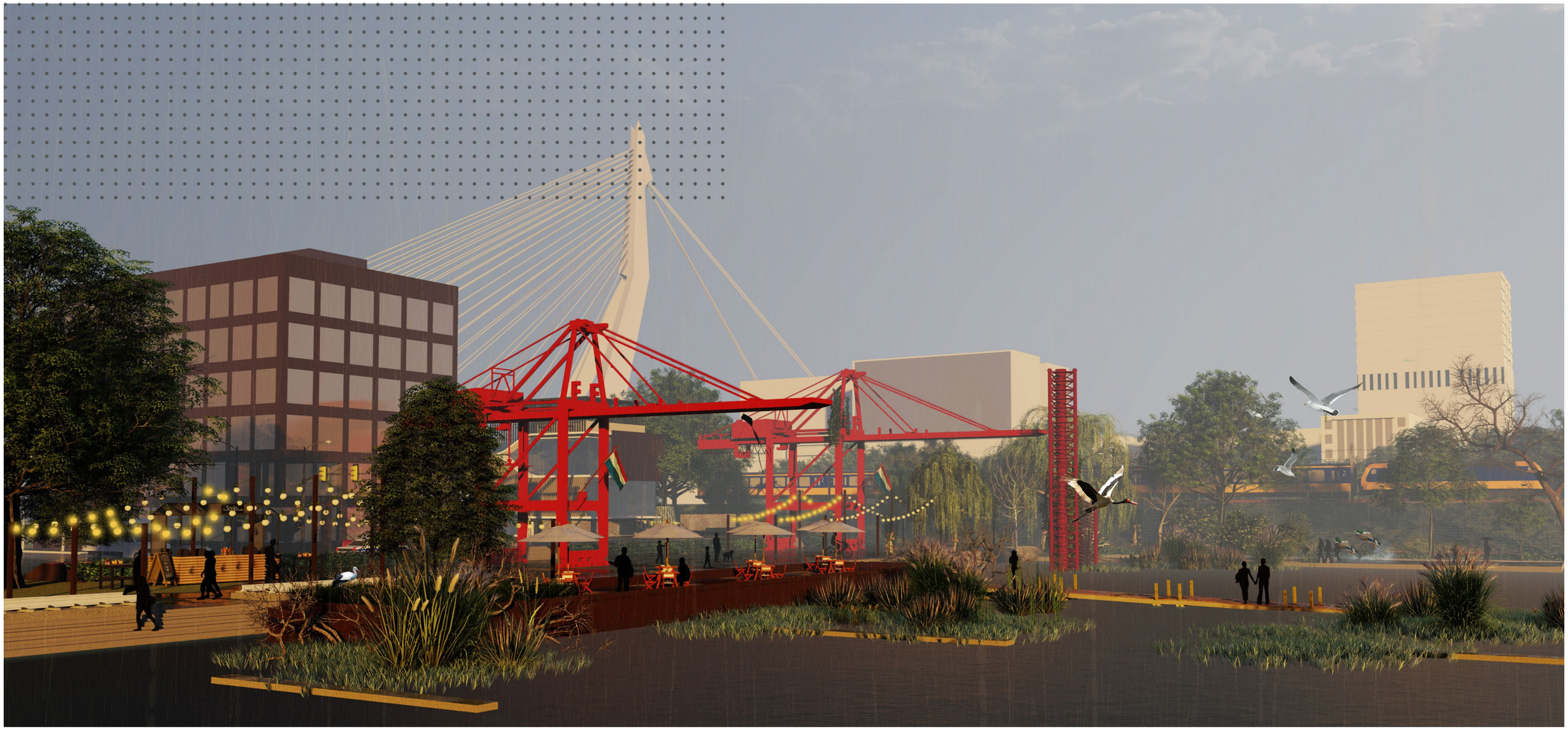


Aerial view of the Kop van Zuid design area.

Source: Author, 2021

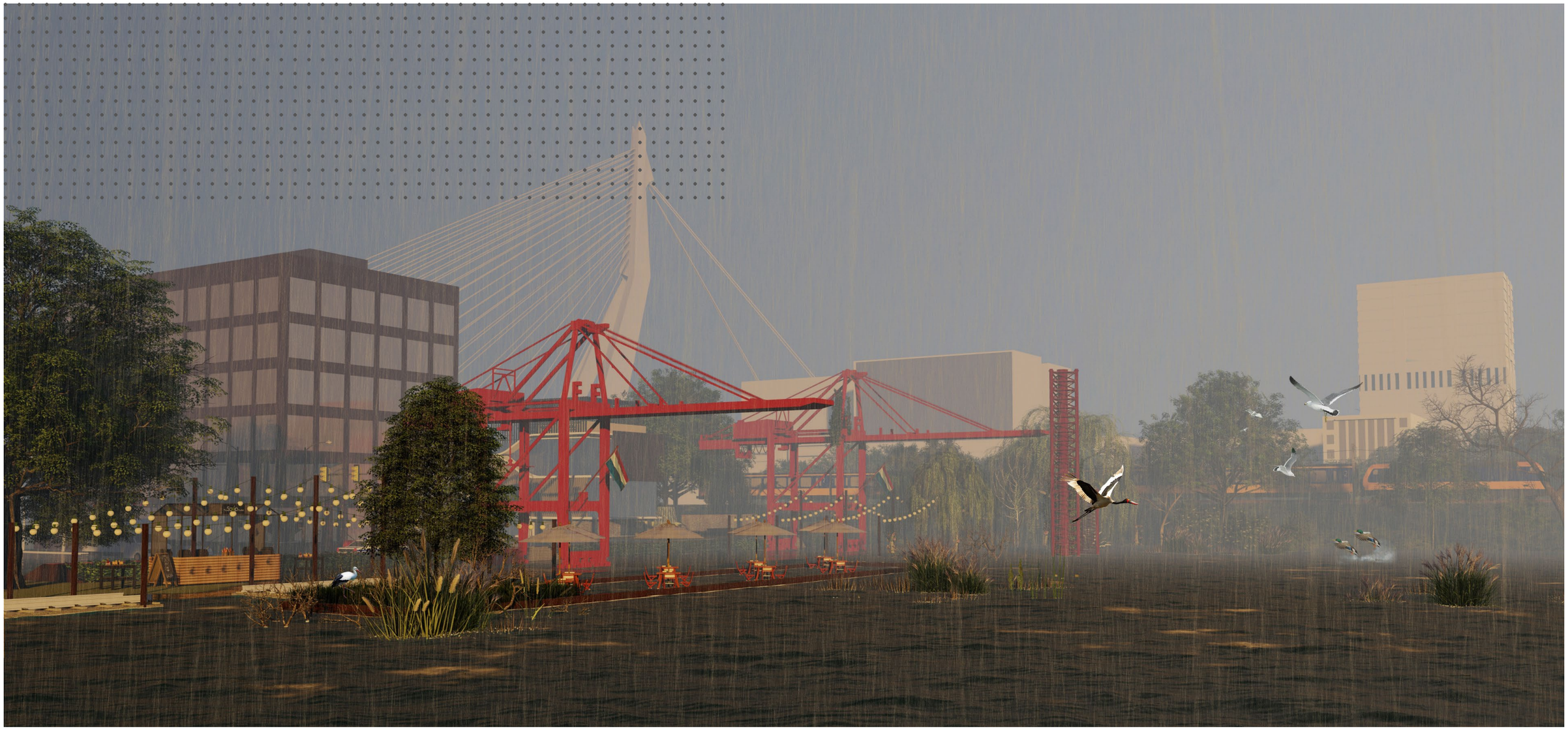
Maashaven Regular Scenario

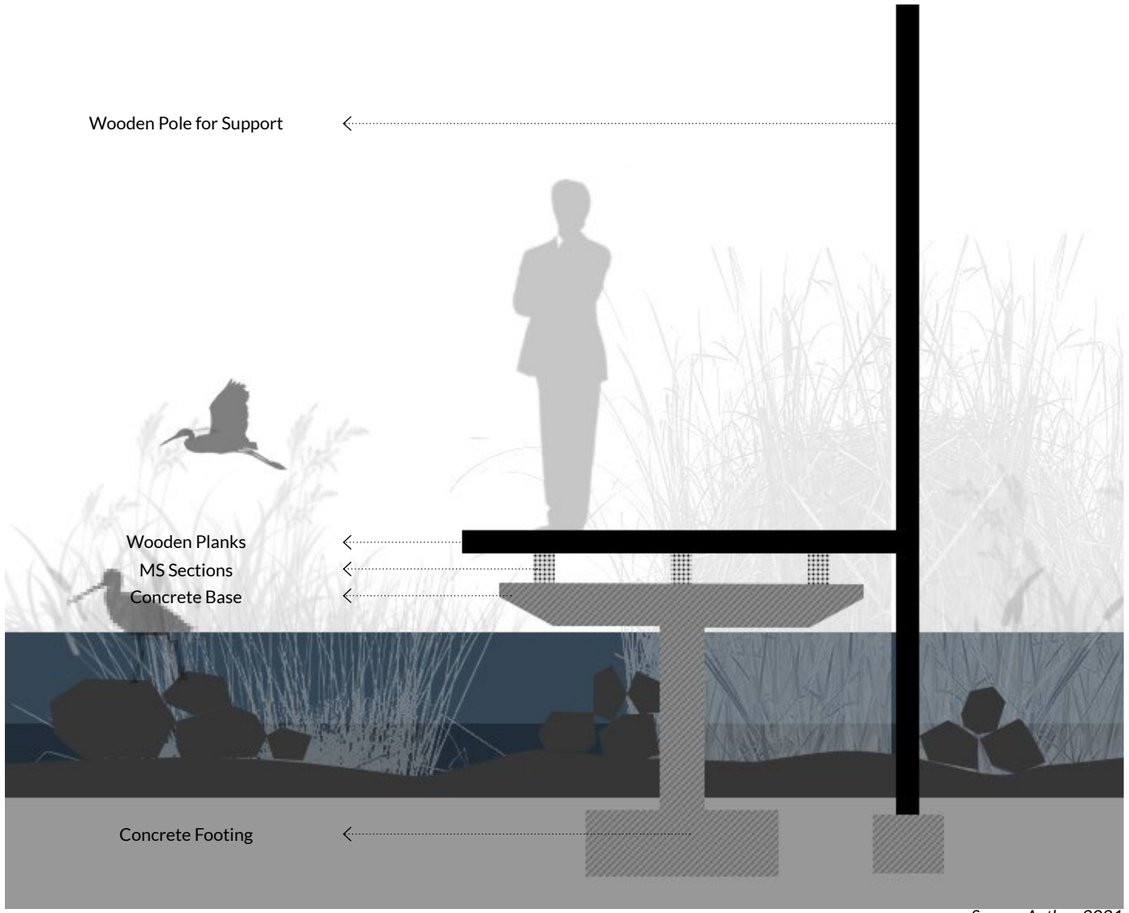
Source: Author, 2021



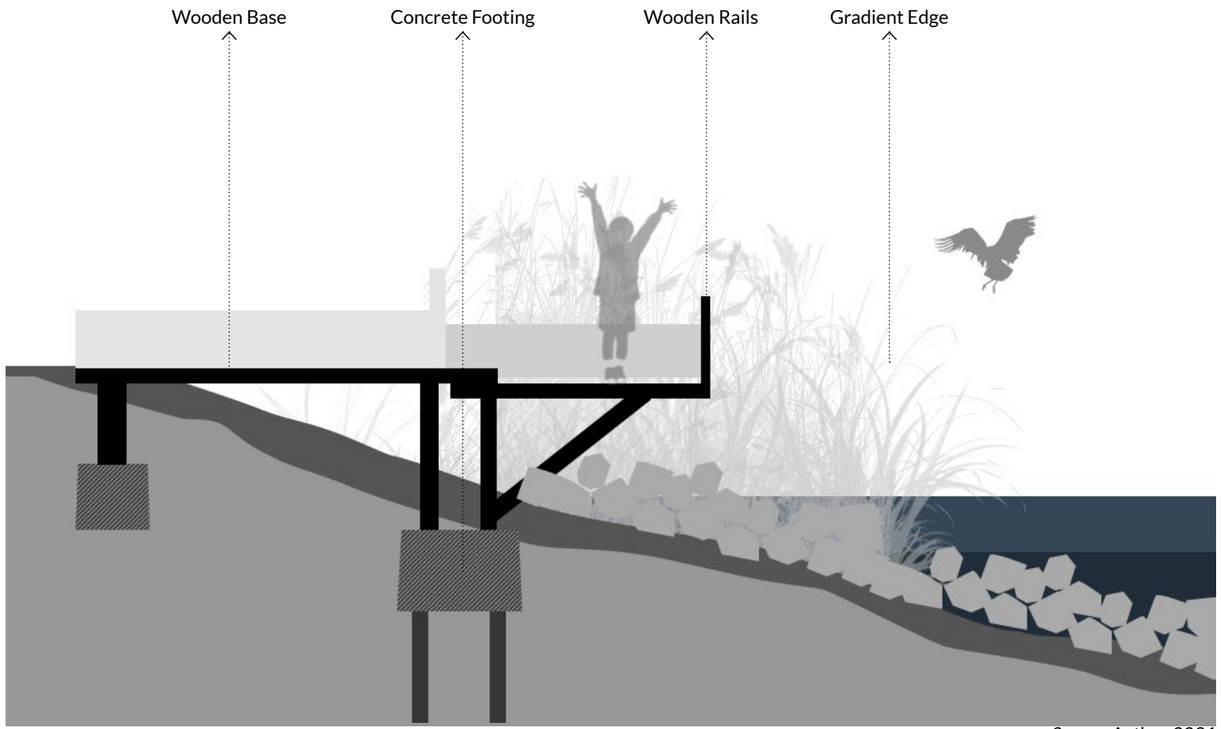
Maashaven Flooding Scenario

Source: Author, 2021

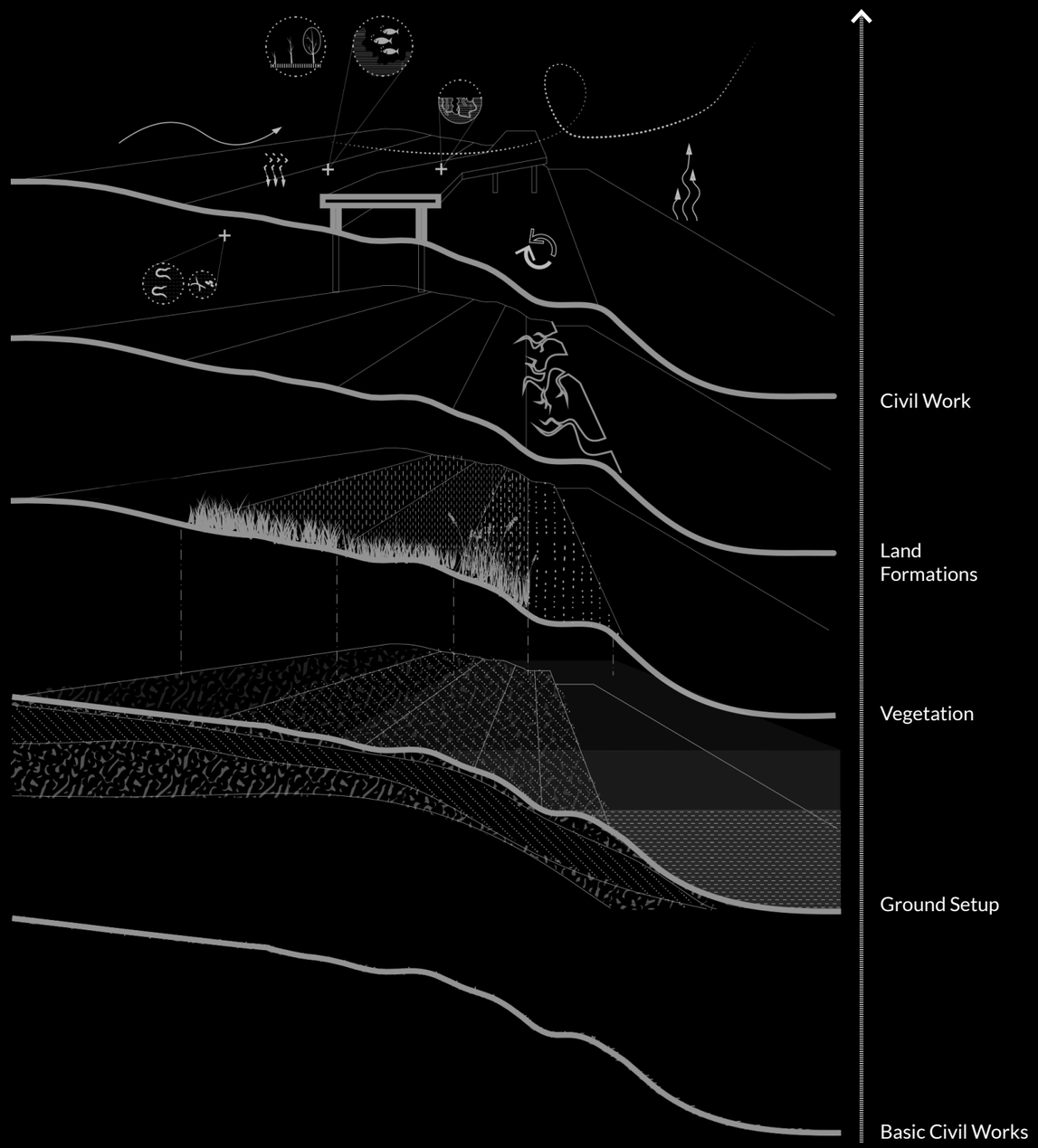




Source: Author, 2021



Source: Author, 2021



Civil Work

Land Formations

Vegetation

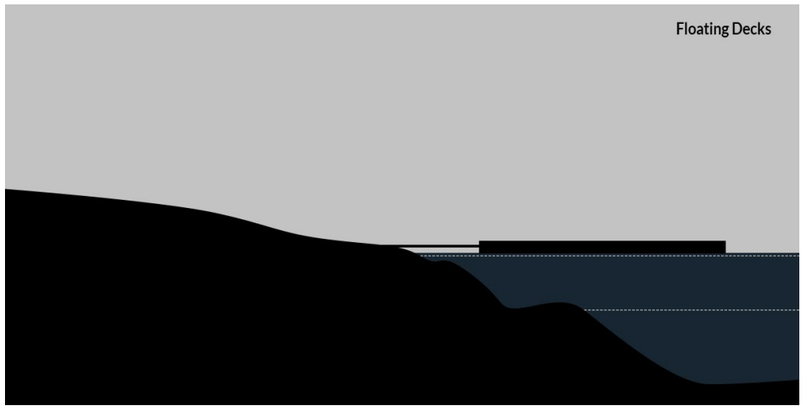
Ground Setup

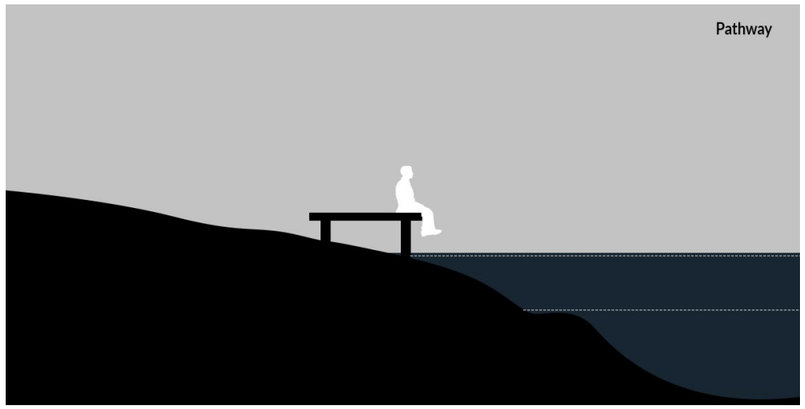
Basic Civil Works

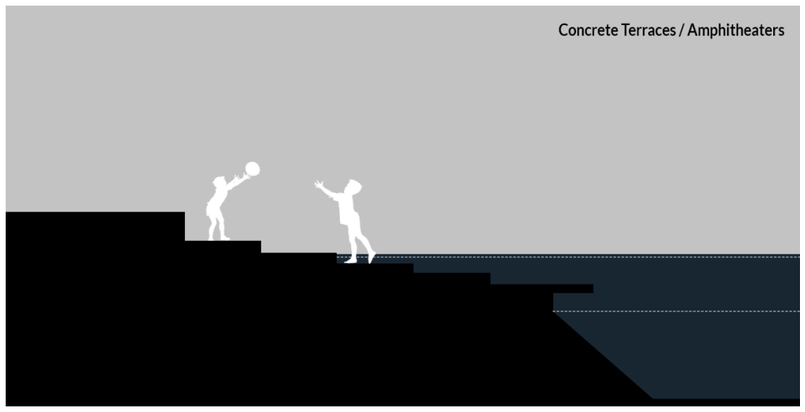
Source: Redrawn by Author from Design guidelines for tidal parks (Brink, L.V.D et al.)

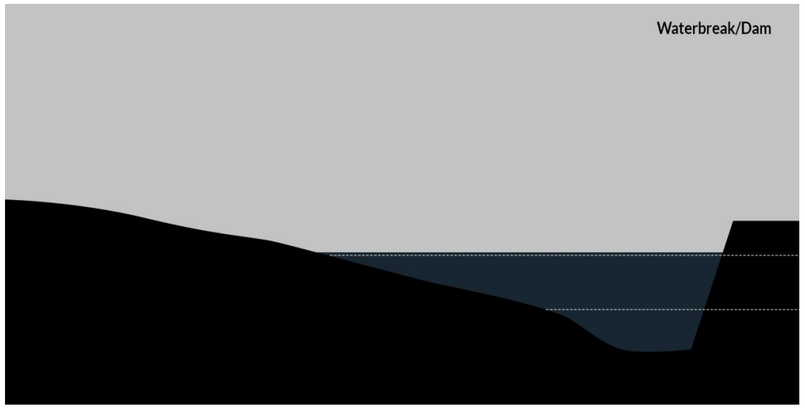
Ground Setup	Vegetation	Land Formation	Civil Works
No filling	Equal Distribution	Creek Formation	Deck
Filling Sand + Clay	Unequal Distribution	Creek Creation	Obstacle
Filling Rock Stablization			Path
Rock			Viewpoint
Concrete			Terraces
			Foreshore

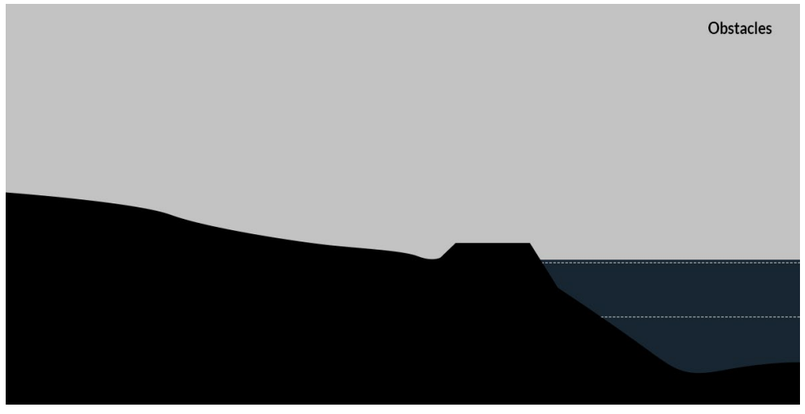
Composition Strategies











Edge Articulation

WILLOW TREE

SPINDOTTER

REEDS

OYSTER CATCHER

BARNACLE GOOSE

SANDWICH TERN

BLUE THROAT

BUMBLEBEES

MOTHS

LIZARDS

ARCTIC VOLE

OTTERS

BEAVERS

STURGEON

EUROPEAN EEL

ATLANTIC TWAITE SHAD

ATLANTIC SALMON

Ecology

Source: Redrawn by Author from Design guidelines for tidal parks (Brink, L.V.D et al.)

FAMILIARIZING

DELINEATING

APPROACHING

STRATEGIZING

DESIGNING

ENDING

FASCINATION

INITIAL ANALYSIS
OF ROTTERDAM REGION

DEFINING
THE PROBLEM & RESEARCH QUESTION

THEORETICAL FRAMEWORK + CASE STUDIES

SITE VISITS

ANALYZING
OPPORTUNITIES

IDENTIFYING SITES

SPATIAL DESIGN OBJECTIVES + PRINCIPLES

SPATIAL DESIGN

REFLECTING

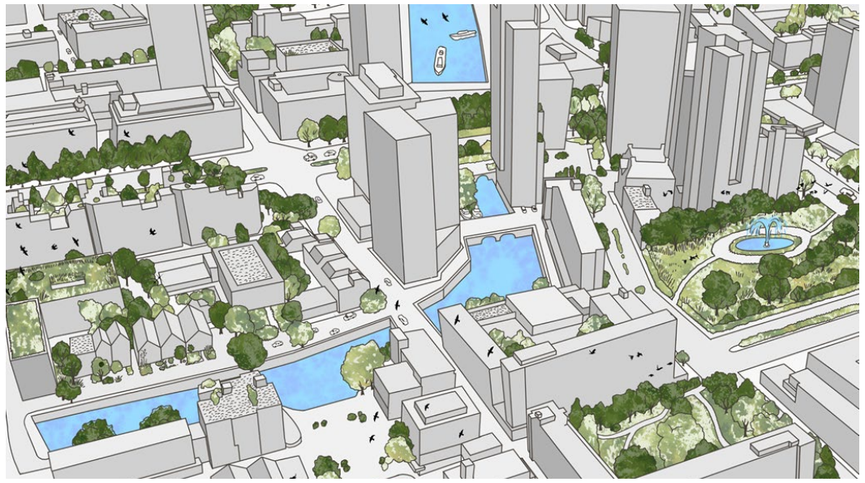
CONCEPTUAL FRAMEWORK
IN LINE WITH THE ORIGINAL VISION IDEAS BY ROTTERDAM MUNICIPALITY

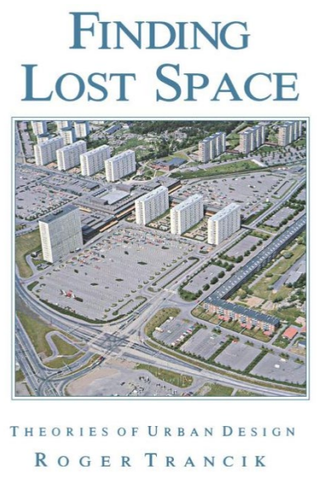
REGIONAL LANDSCAPE + URBAN FRAMEWORK
(ROTTERDAM URBAN AREA)

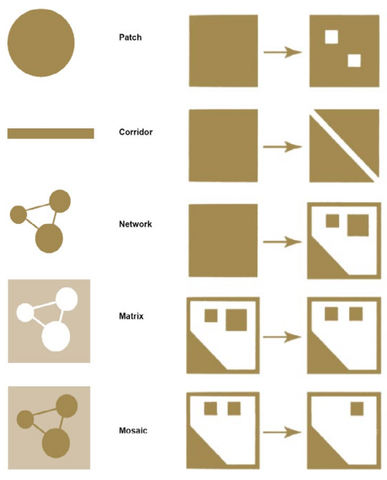
PRODUCTS

PROJECT REFLECTION

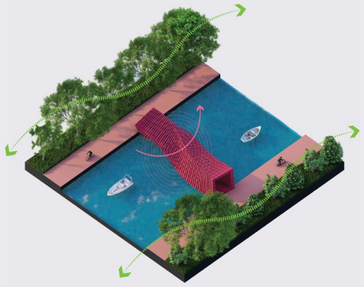
UNDERSTANDING THE UNDERLYING LANDSCAPE



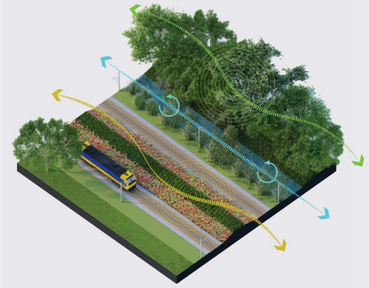




THEORIES ON RELEVANT THEMES

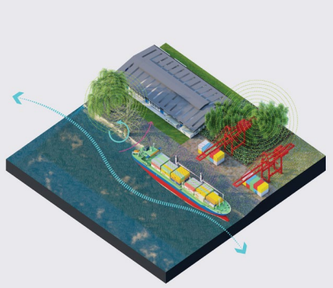


Slits on bridges for bats.

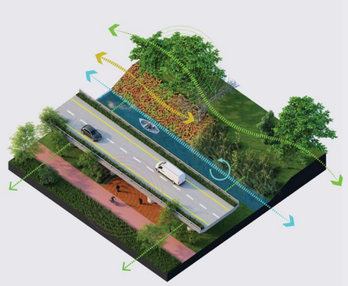


Greening Tram/Train lines.

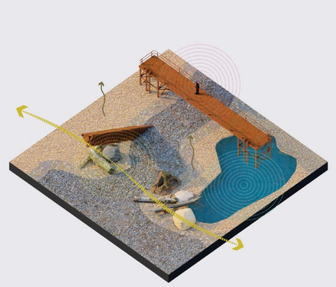
Tall structures for birds.



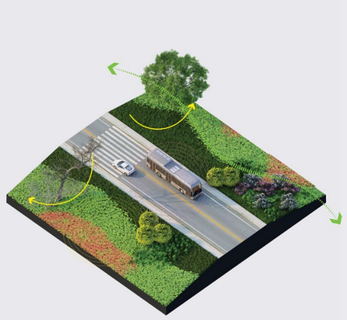
Using gradient water edges.



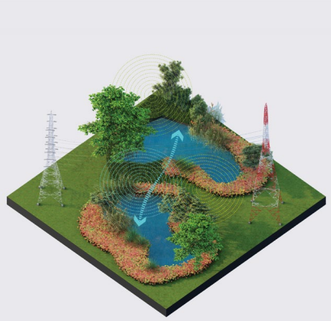
Using the Flyover bottoms.



Dry Sand for insects.



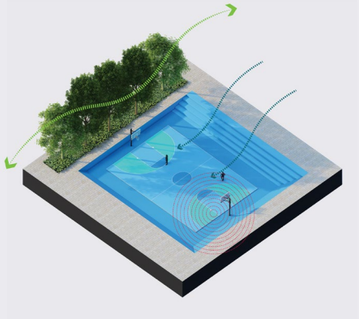
Gradients along roads.



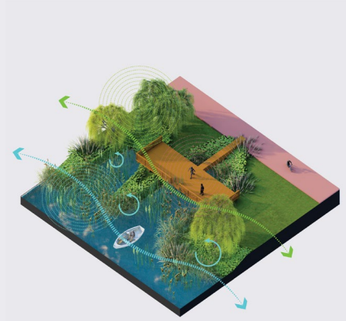
Power line green corridors.

Small ponds for frogs/toads.

Rooftop Gardens

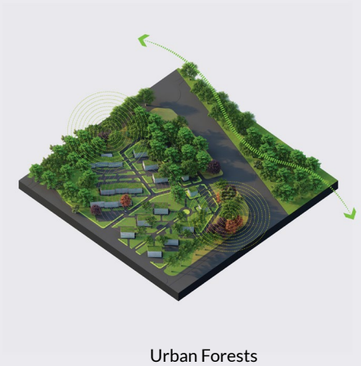


Water squares



Riparian zones.

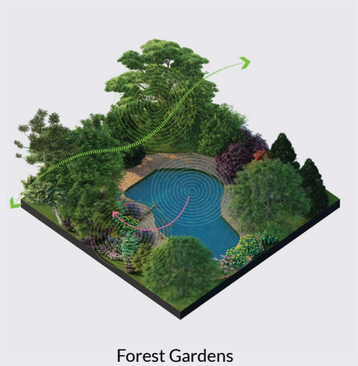
Community Orchards



Urban Forests

Truss/Metal structure for green.

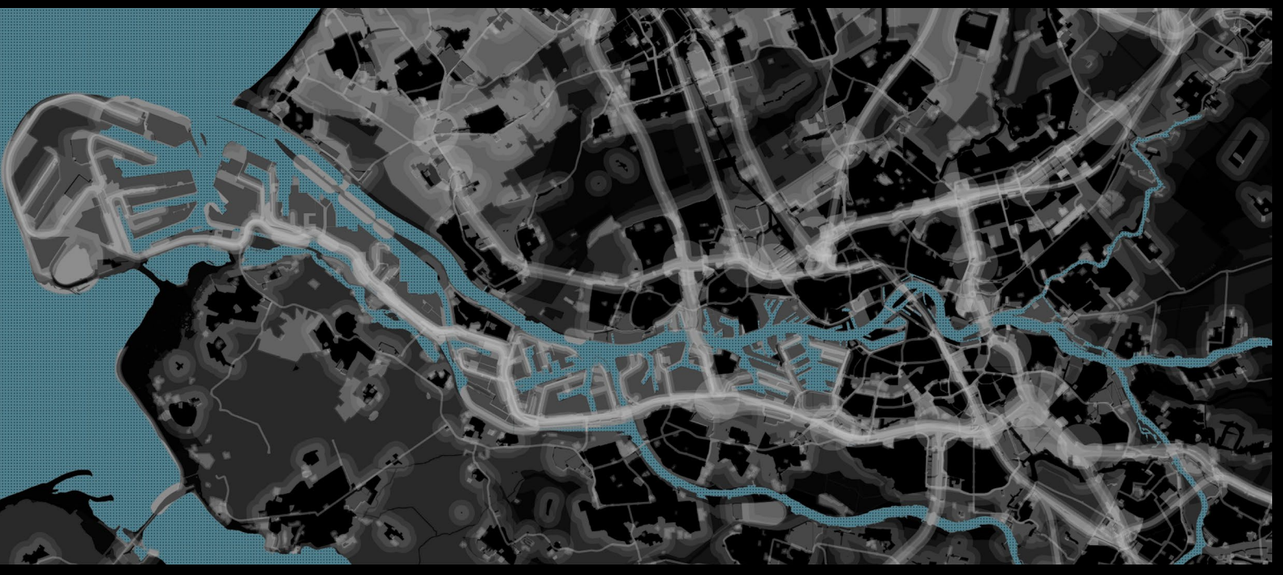
Eco Cathedrals

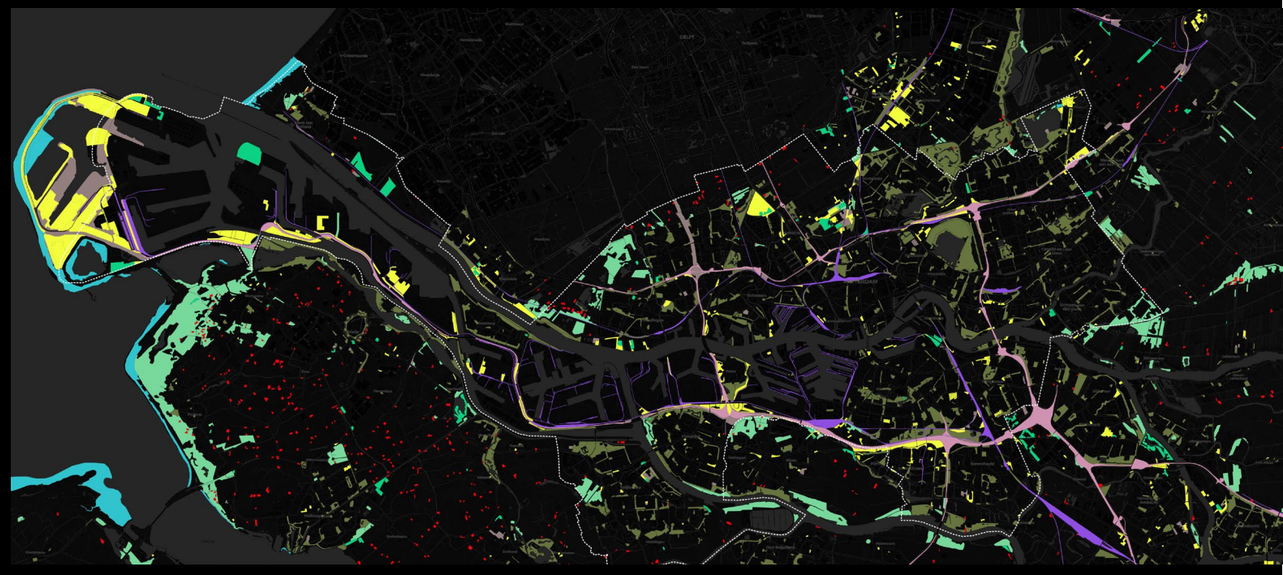


Forest Gardens

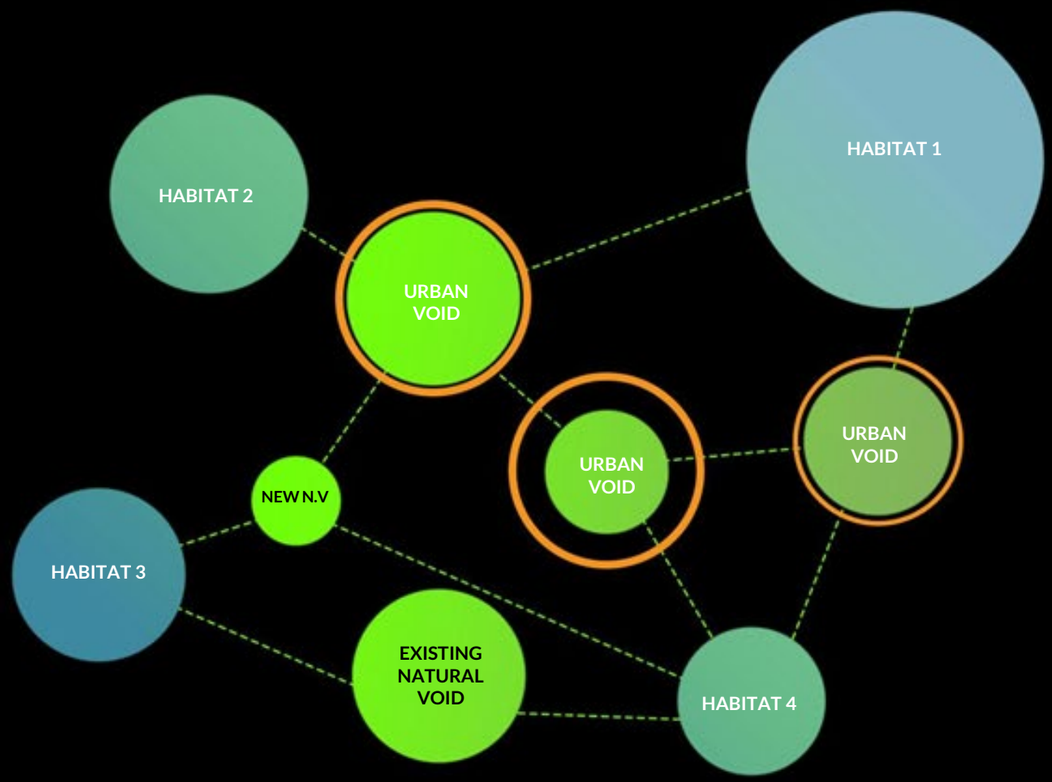
Pioneer Species surprises

DESIGN TOOLBOX OF LANDCAPE ARCHITECTURAL PRINCIPLES





URBAN VOID PATTERNS



NEW FRAMEWORK FOR ECOLOGY

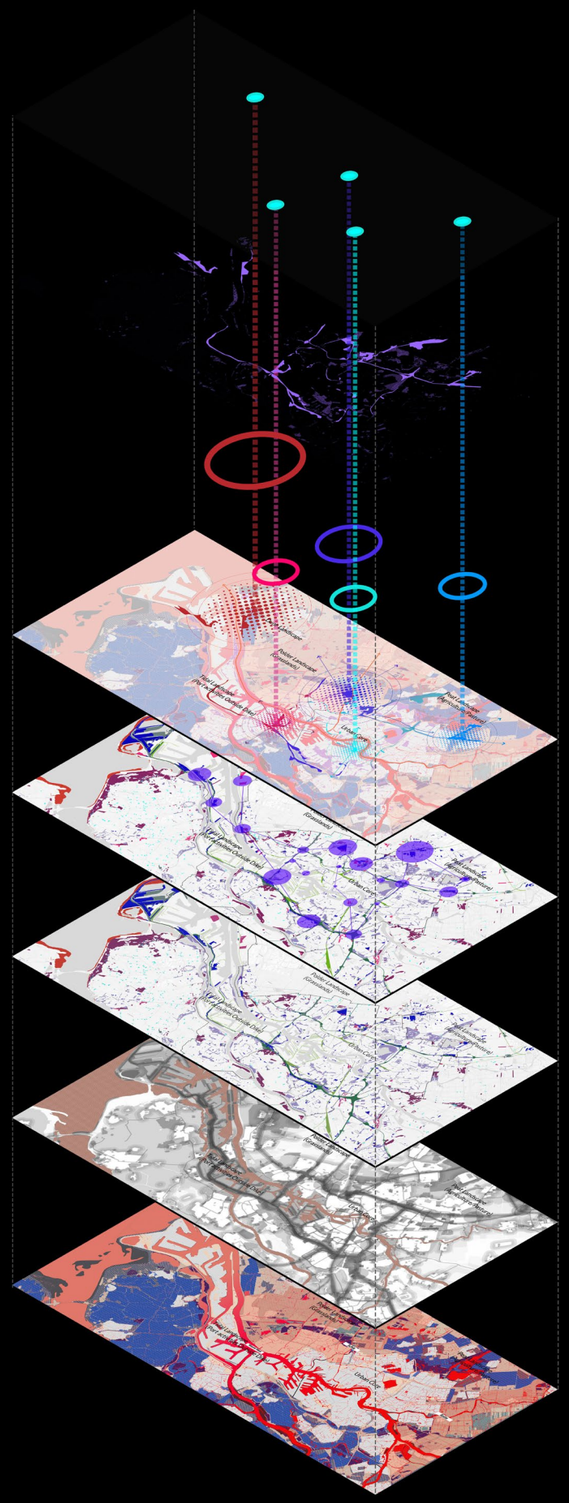
CONTEXT SPECIFIC ECOLOGY

APPLICATION OF PRINCIPLES ON SITE

APPLICABLE TO OTHER CITIES

Flooded Urban Housing areas in Kochi

Source: The Indian Express, 2018



LANDSCAPE ARCHITECTURE PERSPECTIVES

PERCEPTION

New identities for abandoned/over urbanized areas as nature-based catalysts for a new green network.

PALIMPSEST

Using the underlying natural and cultural landscape to create a new urban ecological gradient.

PROCESS

Letting nature take over as the sites undergo transformations, reflecting s fine-tuned ecological structure for the urban system.

SCALE CONTINUUM

Site-level patterns, along with multi-scalar design interventions help in creating a stronger ecological gradient for the region.