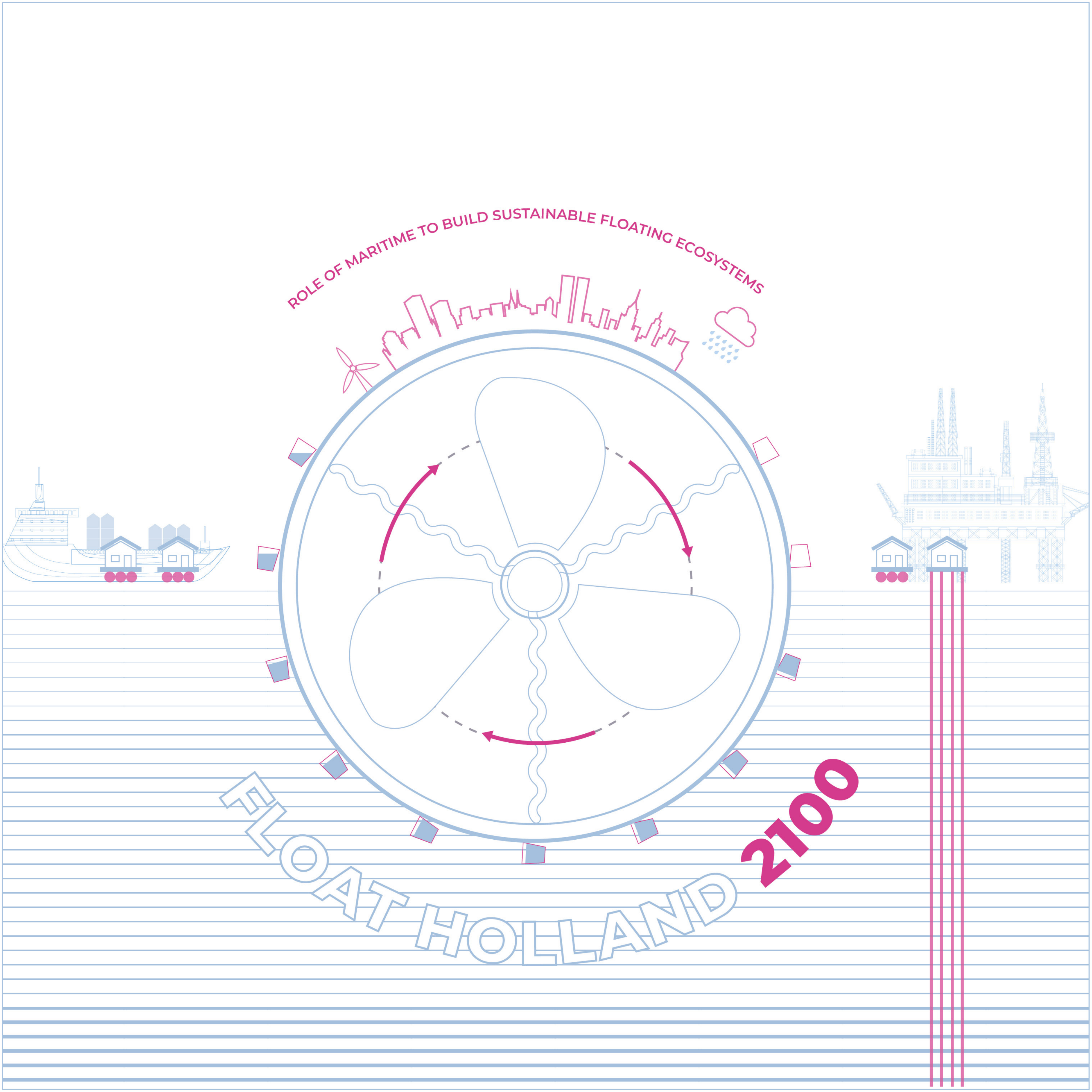

ROLE OF MARITIME TO BUILD SUSTAINABLE FLOATING ECOSYSTEMS
FLOAT HOLLAND 2100

Delft University of Technology
Faculty of Architecture and the Built Environment
Department of Urbanism

AR2U086 R&D Studio | Spatial Strategies for the Global Metropolis
AR2U088 Research and Design Methodology for Urbanism

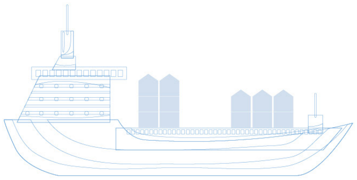
Authors: Akhilesh Shisodia 5490375 | Anyi Yan 5558220 | Froukje Ottema 4961156 | Pieter van Os 4644816

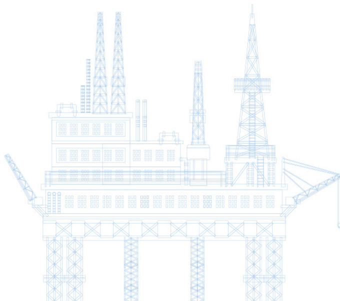
Tutors: Dr. Alexander Wandl | Dr. Caroline Newton

Methodological guidance: Dr. Roberto Rocco | Dr. Marcin Dabrowski

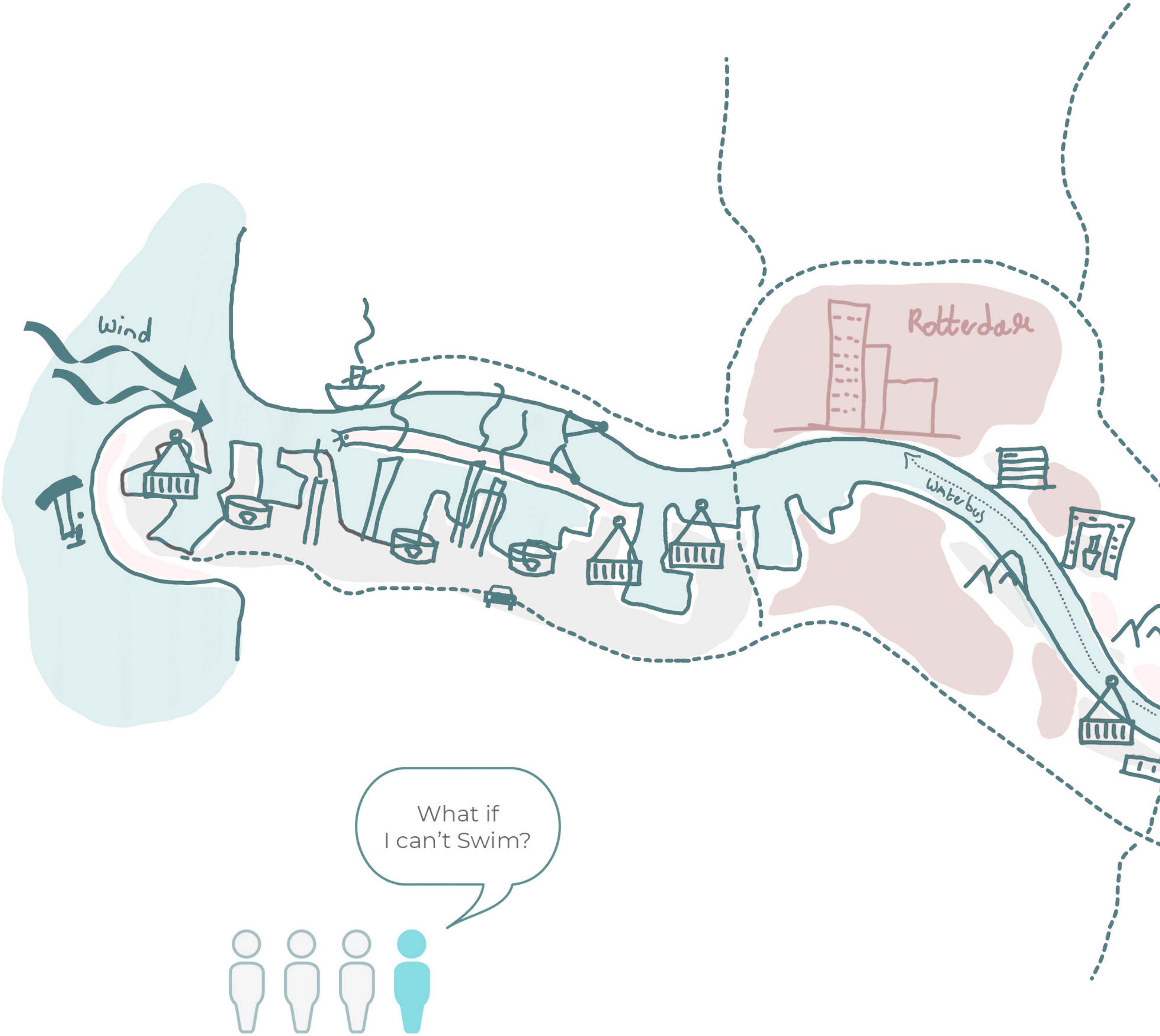
April 2022

RESTORING RELATION BETWEEN WATER AND PEOPLE





FLOAT HOLLAND 2100


Wind
Rotterdam
Waterbus
What if
I can't Swim?

Abstract

The Netherlands is inextricably linked to a network of water, polders, and dykes. Recent climatic and anthropogenic transitions pose several threats to destabilize this balance including the rise in sea level, extreme weather, and floods which could drastically change the landscape of South Holland as we know it by 2100. With this potentially unstable future in context, the demand for space and houses in the Netherlands rises consistently.
However, the combination of these issues presents an opportunity to restore the balance and linkages of Dutch ways with water. The future of the Maritime manufacturing industry can act as an adhesive to sustain these links by drawing on transitions around water at a global as well as local scale. Hence, the project intends to investigate the changes in the role of water systems in 2100 and how the Maritime manufacturing sector can steer it to address future spatial and climatic adversities.

In 2100, we envision the Maritime Manufacturing industry to expand its role to facilitate the adaptivity of the natural, social and technological landscape of South Holland, using water as the primary medium. We intend to introduce a radical transition by planning for diversified spaces on and for water, serving both an economic prospect as well as increasing consciousness of its role within society.
The vision addresses 3 major transitioning landscapes (wet peatlands, salt marshes, and water bodies) to develop systemic strategies and plan spaces by making optimum use of products by the Maritime industry. The vision opens up several areas of investigation around the 2100 'Portscape' including the scope of circularity in the shipbuilding/ship-recycling industry, rethinking material-flows, and transitions in socio-economic structure in context to new social environments.

Key words: Maritime Manufacturing, Adaptivity, Water networks, Flood-risk, Transitioning Landscape

Contents

1. Introduction
1.1 Context

South Holland: A river delta

The metropolitan region of South Holland, being favorably located in the delta of the rivers Maas, Rijn and Schelde, functions as the social and economic nucleus of the Netherlands. Its strategic position for trading in the delta near the sea has brought the region significant progress of economy and technology throughout history.

One of the largest contributors – providing approximately 385,000 jobs and contributing to around 6% to the Dutch GDP in 2021 – is the Port of Rotterdam. Europe's highest operating seaport extensively use South Holland's waterways which lead into Europe's hinterland.

This prosperity made the province through urbanization one of the densest and infrastructure-richest regions of the world with 3.7 million people living on roughly 3400 m2 (Quarter Guide Q3 2021-2022 MSc2 Urbanism, 2022). However, throughout history, a lot was needed to make this low-lying country inhabitable.

It is perhaps fitting to start with the melting of the ice caps and the consequential sea level rise – 5000 years ago. Figure 1 shows how during the geomorphological formation of the Netherlands the western part, including what is now South Holland, turned into a vast system of salt marshes, adaptive to the will of the sea. This shallow sea brought sedimentation of sand and marine clay, which was together with the growth of reeds the beginning of the peat and clay soil layers towards the east and south respectively, shown in figure 4.

Fast-forward to the Middle Ages, native Dutch people started to drain and dewater the peatland - which was back then still a few meters above sea level - by digging ditches for salt and fuel. This contributed significantly to the decrease of the peat surface level.

In the period between 1000 and 1200 AD, due to soil settling and oxidation, the peat surface lowered to the level of average high water on the Zuiderzee.

Diking of the peat land then became necessary. The subsidence continued behind the dikes and drainage became necessary to discharge the excess water. The subsidence that has occurred is the reason that the western part of the Netherlands is now several meters below sea level. (De eerste polders, n.d.)

However, trying to inhabit a delta dominated landscape resulted in a long history of floods. If a farmer wanted to construct a series of levees to protect his own home and farmland from flooding, all it would do is push the water away to their indignant neighbours. In the rivalries that ensued, the only way ensuring society's dry feet was a regional approach in land reclamation facilitated by the collaboration between farmers, nobles and townspeople, and became one of the first forms of civil society. Every inhabitant of what is nowadays the region of South Holland had to work together to build dikes, regardless of heritage or class, and the first Water boards were born.

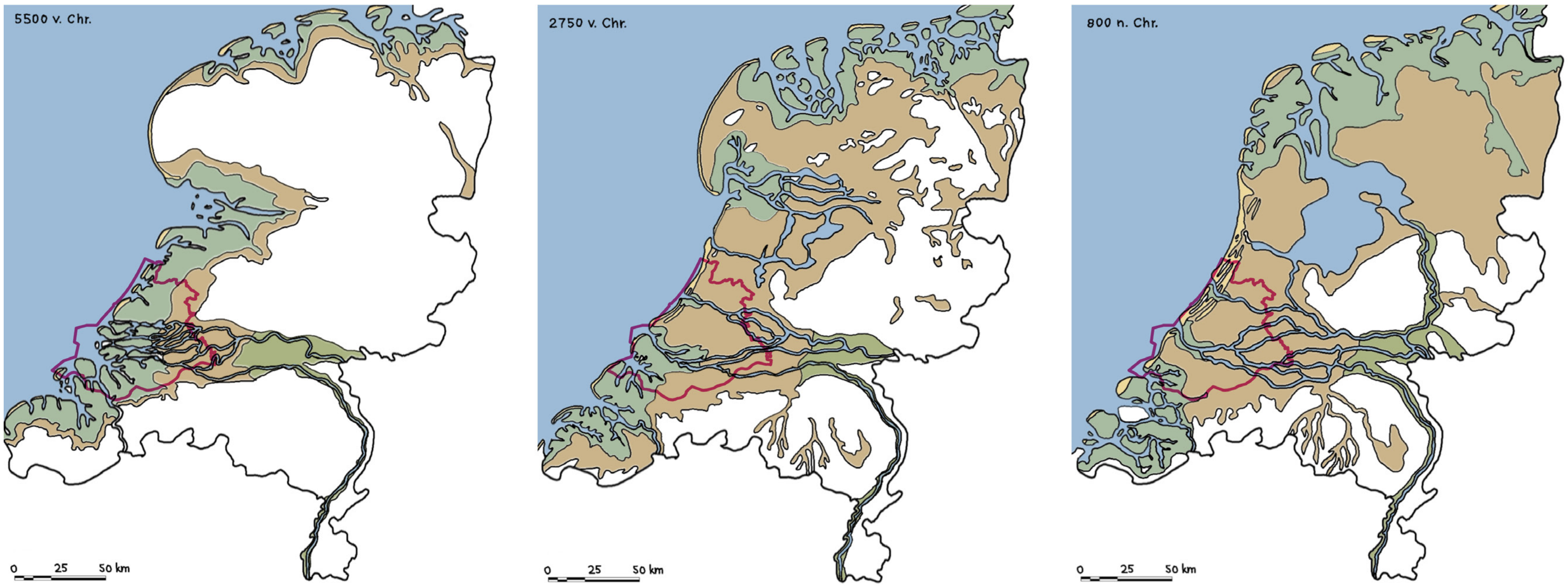


Figure 1: Geomorphologic formation of the Netherlands

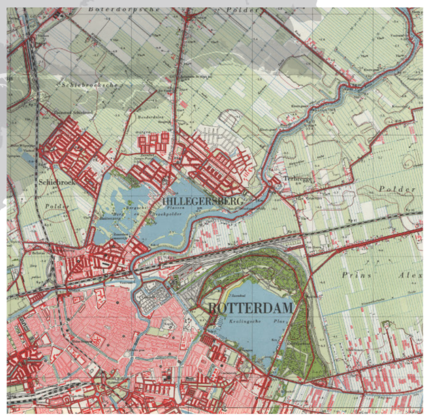
Water as connective tissue

Since the region of Holland consisted mostly of swampy peatlands with unpaved roads, water consequentially became the main connective tissue between its inhabitant. In the sixteenth and seventeenth centuries there were several ferry services with barges – departing from a fixed place and at fixed times – to inter alia Utrecht, Leiden, Amsterdam and Rotterdam. (De Trekschuit, 2018) The service between The Hague and Delft was one of the busiest in Holland. A barge departed every half hour: in the summer from 6.30 am to 7.00 pm. (Panman, n.d.) The Maritime sector was during the birth of Dutch culture and society vital for social and economic life by bringing people quite literally close to their shared water-dominated landscape.

Six centuries later in the 20th century, 18,000 km2 has been reclaimed from the sea, resulting in some 3,000 polders: about half of the total surface area of polders is northwest Europe. Meanwhile, the Dutch society's governance has become based on consensus-based economic and social policymaking, which in 1990 politician Ina Brouwer started calling 'The Polder Model': "a pragmatic recognition of pluriformity" and "cooperation despite differences", referencing with retroactivity to this way of cooperation in the Middle Ages. (Sanders, 2002)

1815

1857



1962

Figure 2 (left): Water as main medium for connecting social life in the 17th century. (Van Goyen)
Figure 3 (right): Development of polders near Rotterdam. Derived from Topotijdreis (2022)

Industrialization of the maritime sector

The second half of the 20th century was crucial for the current Dutch streetscape. For every household, more money was available to buy cars, and the government started to invest in hard infrastructure and petroleumscapes, which nowadays still dominate landuse in and between cities. (Filarski, n.d.) Due to industrialization and globalization, landuse around the Port of Rotterdam also started to shift, incorporating global businesses and upscaling industrial functions which separated port from city on a spatial level. This rapid industrial growth – especially oil refining and the introduction of containers – forced the port to develop beyond city confines. Changes in maritime technology induce growth of separate maritime industrial development areas between 1960 and 1980, which in consequence became more dependent on the port's petrochemical industries as well as scarce materials from global markets (Wiegmans & Louw, 2011). Due to these trends, the maritime sector became increasingly important on an international scale, while locally it partially lost its cultural value as connecting entity.

Shift in mindset

In parallel, the position of Dutch society towards water has slowly changed from accepting and living with it, to fighting it, leading to a cycle of heightening dikes and pumping out water. This shift in mindset is strongly related to the events of flooding, for instance the flood of 1953 which prompted a new approach to the design of dikes and other water-retaining structures, resulting in the infamous Delta Works (Ten Voorde, 2018).

Having put the Netherlands at the forefront of water-management, stories about the Delta works are constructed in such a way that they contribute to their national identity. (Salm, 2019) This technological victory over this great disaster gives the people the feeling they are now completely safe from the ever-present threat of water in South Holland, and that the government protects them. However, in her thesis, Ten Voorde (2018) rightly asks "Politicians often deal with topics that they can use to show in their next campaign. The longer term plans that are discussed often show a short-term threat. For how long will the government be able to say that they can protect the country from flooding?"

Rigid landscape

These interrelated events fostered a complex system of dykes, dams and canals in South Holland, which have been subjected to the notion of Path Dependency. Because their relative height in the landscape, they are often used for infrastructure. As shown in figure 4, they are an intrinsic part of the Dutch's water-management system and protect roughly 55% of the total land area in the Netherlands. (Planbureau voor de Leefomgeving, 2013) Currently, the vast landscape of the Netherlands which is dependent on these dykes is in a lock-in: they have become so prevalent for our way of inhabiting this land that, that imagining how to live without it has become a demanding problem. As Ten Voorde (2018) explains, the Dutch detrimentally altered its natural ecosystems in the past by blocking natural processes of sedimentation to create this now unsustainable, rigid system.

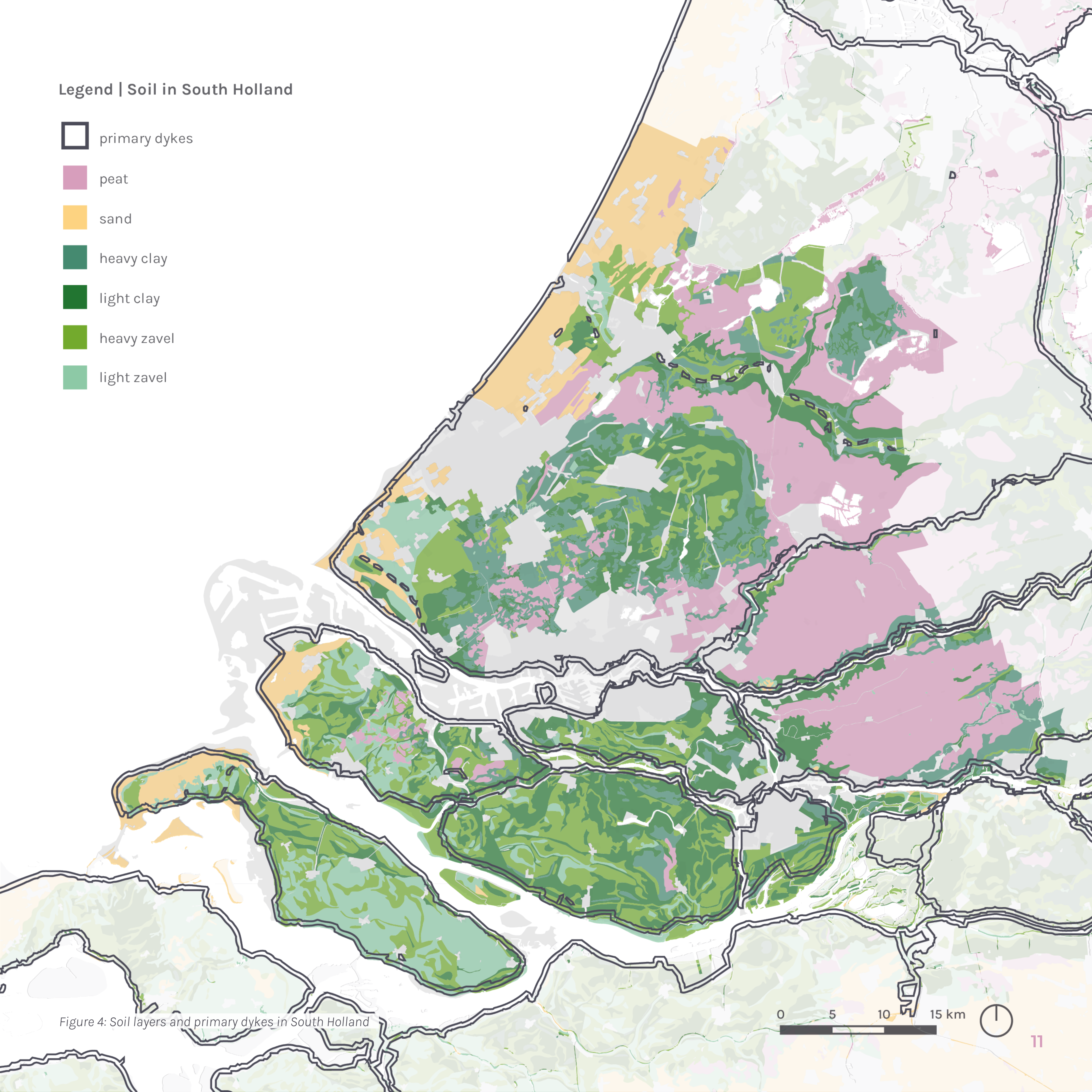


Figure 4: Soil layers and primary dykes in South Holland

1.2 Problem statement

An intergenerational threat

At this moment, the coastal province of South Holland is faced with a multitude of external as well as internal challenges. Externally, climate changes poses a threat to all of us – also those who do not have a voice: namely nature and future generations. Internally, the Netherland's dyke-system has become so rigid and unresilient that currently it does not yet have an answer to these environmental threats.

On a cultural level, shipping – once being the main connector of inhabitants of the region centuries ago – partially lost its cultural value of bringing society close to water. The now land-dominated modes of travel may have contributed to a lack of identification with South Holland's water-dominated landscape in society's mind itself while interestingly from an international standpoint, the relation with Dutch society and water is inseparable.

Climate change

Global human activity has become the core factor for climate change since the Industrial Revolution by burning fossil fuels. This produces carbon dioxide resulting in the Greenhouse Effect, which warms up the earth. This has several effects, including extreme meteorological phenomena and the rising of sea levels with the consequential relocation of whole coastal urban regions such as South Holland.

On behalf of the Deltacommissaris, an independent government institution for the national Delta Programme, Deltares, published a report in 2018 on the consequences of a possible additional accelerated sea level rise due to accelerated decomposition and melting from Antarctica (Haasnoot et al., 2018).

Since the technical life of the Delta works - the Dutch's main water defense system – partially depends on the number of closures, and the Delta works will have to close more often at a higher sea level, climate change tremendously shortens their lifespan, with dire consequences. Figure 5 shows a comparison between different sea level rise scenarios as well as the tipping point at the sea level rise of 1 meter, which is correlated with the Delta works having to close several times per year.

Awareness and risk perception

A survey conducted in 119 countries of Lee et al. (2015) about public awareness and risk perception of climate change showed that, despite high marks in awareness (95,6%), the Netherlands came at a distant 42nd for actual concern. As mentioned in society's relation towards water, this is partly because of our increasingly false sense of safety induced by the Delta works, combined with a difficulty to grasp the slow-moving and highly complex nature of climate change.

"Moreover, in the Netherlands people tend to want to maintain a positive view of the status quo since they may perhaps benefit from it, even if it is detrimental to their livelihood. Because of their wealth and position as world leaders in sustainability, logistics, agricultural science and resource management companies, the Netherlands as part of the Global North stand to handsomely profit from selling technology and services to governments and firms in the Global South where climatic chaos will wreak the most havoc." (Henriquez et al., 2017) .

Reviewing this in terms of global distributive justice, it is critical to disrupt and reimagine the status-quo, for which spatial planning is a possible solution.

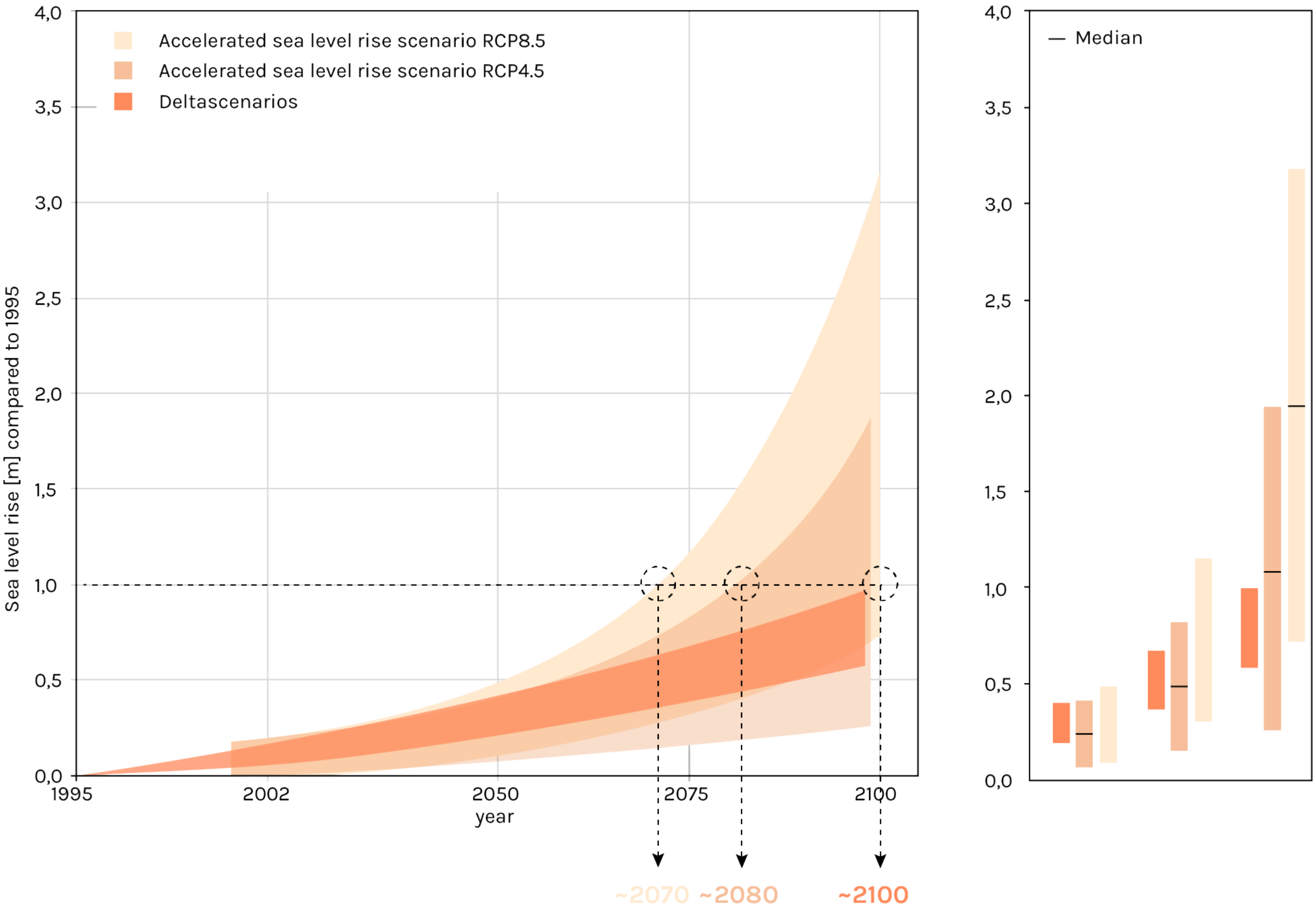


Figure 5: Accelerated sea level rise scenarios. Derived from Haasgenoot et al. (2018, p.5)

1.3 Goals

Having defined our context, five goals can be distinguished which form the core of our vision and strategy. These are based on challenges for South Holland's delta landscape and the transitioning role of the Maritime Manufacturing Industry and can be linked to numerous Sustainable Development Goals (SDGs), where these are allocated in order of significance to said goal. The United Nations (2015) established these SDGs as the new global sustainable development agenda for 2030. They are promoted as the global goals for sustainable development.

Figure 6: Goals for a future South Holland linked with SDGs. Based on United Nations (2015)

Relation with water

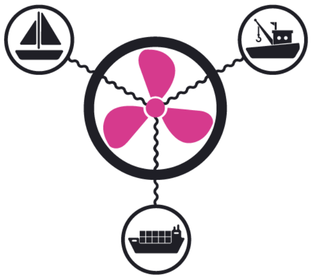
The first goal supporting the vision is society's relation with water. There is a mismatch between the water-rich landscape and the Delta works as a regional identity-generator. These Delta works – in the coming generations prognosed to be under severe pressure – seemingly contribute highly to society's identification with its water-management. This consequently nourishes unawareness about how water is an intrinsic element of a river delta such as South Holland, and should be given more space and attention. For the landscape to once again become more adaptive to climatic influence, climate action must be undertaken for which a paradigm shift has to occur in society's relation with water.

Water as connective tissue

To facilitate this awareness, Water Transit Oriented Development (WTOD) will be introduced to facilitate creating livable areas on and around water, which will be connected through the strengthening of innovative water infrastructure. The extensive system of water networks is currently underused, which forms a potential for the Maritime sector to once again facilitate connecting society. This potential builds upon how social life was connected via water during the inception of South Holland's culture centuries ago. The assumption is made that the nowadays car-dominated urban landscape serving mostly individuals will downscale to allow for more sustainable public modes of transport, including those on water.

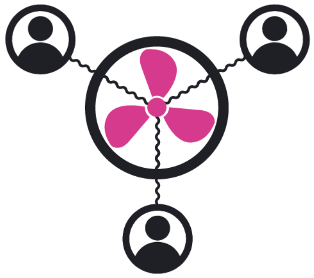
Local to global balance

The shift between local to global significance in the Maritime sector partially contributes to the underuse of waterways and water itself having become separated from the average person's sense of cultural identification. Due to globalisation, the shipping industry located mainly around the Port of Rotterdam and Dordrecht (Port of Rotterdam, n.d.) turned away from facilitating the social and environmental landscape it is partially responsible for, and is currently predominantly focused on contributing to the Dutch's GDP. To comply with its potential cultural value and adhere to changes in these different landscapes, a local to global balance needs to be restored in the maritime industry by creating strong partnerships and institutions between all levels of governances.



New specialized maritime industries

For the Maritime Industry to facilitate the aforementioned goals, new industries will have to emerge that serve these developments. Since our vision takes place in 2100, an adequate amount of time is reserved for these specialized industries to emerge. Since they will be centered about facilitating an adaptive social and environmental landscape, these can be for example centered around manufacturing modular autonomous boats, creating amphibious dwellings able to withstand floods and maintenance.



Diversified range of stakeholders

The current stakeholders served by the maritime industry is in majority occupied by private parties, having monopolies in influencing the industry's course. There is a division in governance between these private parties and civil society. These gaps in involvement of internal actors and citizens need to be addressed. The port economy presents an opportunity to be more inclusive in its governing playing field. Within 80 years the goal is to both intra- and intergenerationally diversify the stakeholders served by the maritime industry, including nature and future generations, to expand democracy and promote equitable development.

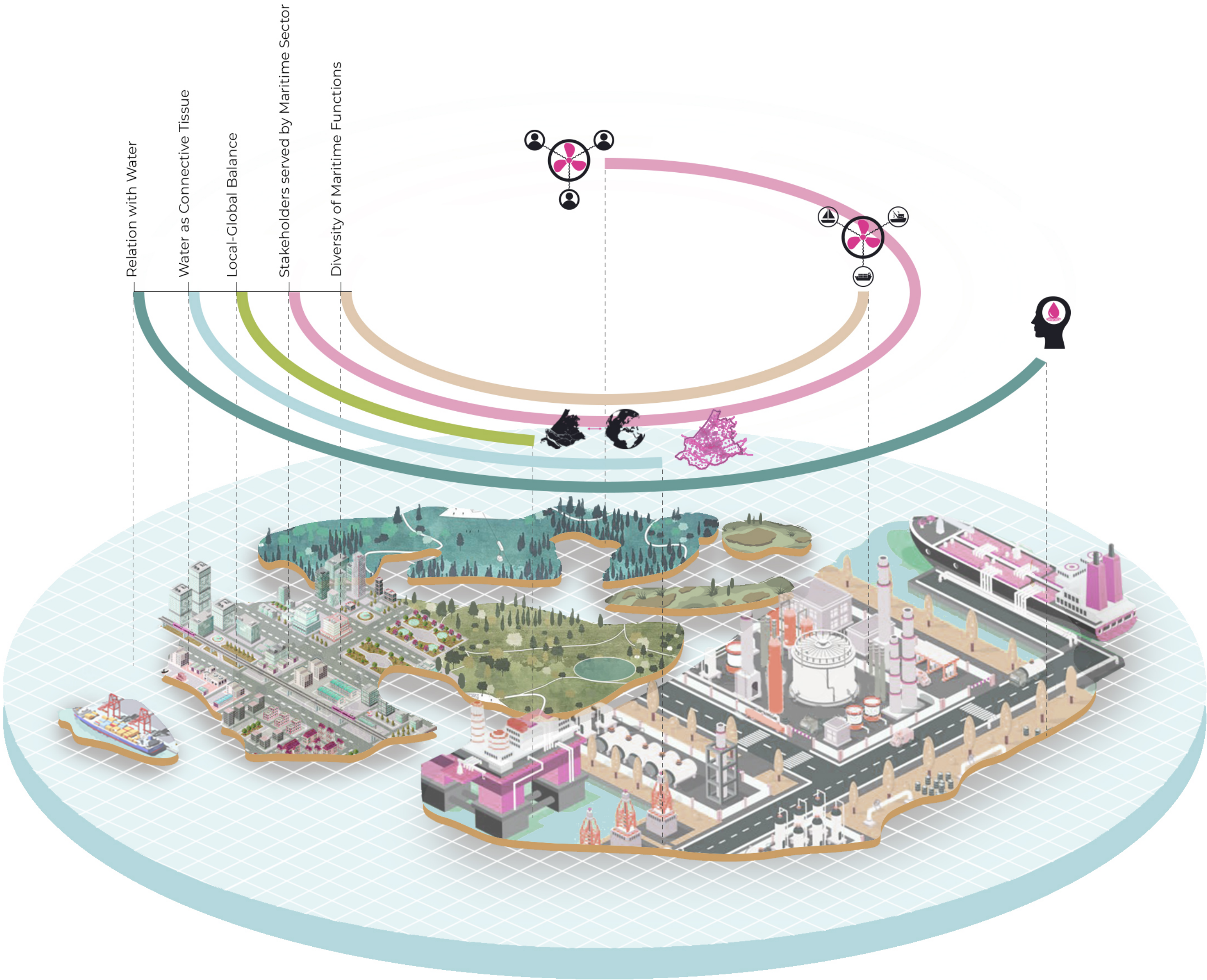
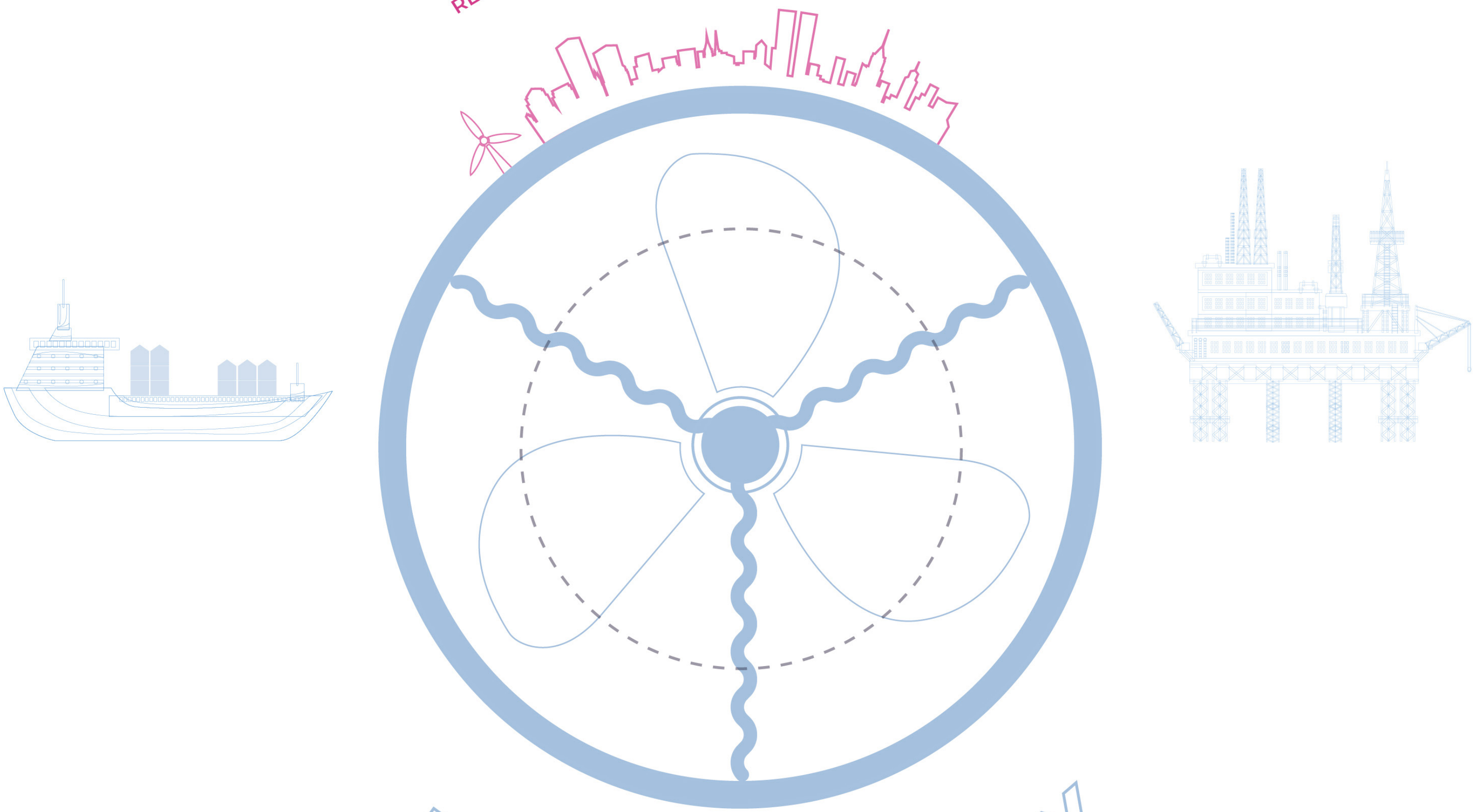


Figure 7: Assessment of goals in the current context

RESTORING RELATION BETWEEN WATER AND PEOPLE



METHODOLOGY

2. Methodology
2.1 Research question

This research is focused around the Maritime Manufacturing Industry and its role in the future of South Holland. Based on the problem statement and goals, the research question for this project acts as a focus-keeping device. To create structure, the sub-questions distinguish two topics: the Maritime Industry and the Adaptive Landscape, which are both theory - and design oriented. Together with the methodology and conceptual framework, it forms the foundation for designing the vision and strategy.

How can the **Maritime Manufacturing Industry** serve as a **catalyst** to establish an **adaptive South Holland?**

Adaptive Landscape
- How does climate change impact the landscape of South Holland?
- How do we foster awareness for water and its influence on South Holland?
- What does an adaptive landscape mean and how do we transition to it?
- How can the existing water infrastructure be improved to facilitate transportation?
- How will water-based developments affect both urban and rural regions?

Maritime Industry
- How does the shipbuilding industry function?
- What are the potential future transitions in the shipbuilding industry?
- What are technological and/or spatial trends that affect the maritime industry?
- What is the hierarchy of stakeholders within the maritime industry?
- How can the maritime industry serve a more diverse range of stakeholders?
- Which new industries can the maritime sector transition into, and how?

Conceptual framework
The conceptual framework shows the interrelation between water, the adaptive landscape and the maritime manufacturing industry.
Water is seen as the connective tissue in which the maritime industry acts as a catalyst to propel South Holland forward by promoting a symbiosis between society, environment, economy and technology. The objective is an adaptive landscape which adheres to a continuous process, taking into account uncertainties and external changes of the future.

2.2 Conceptual framework

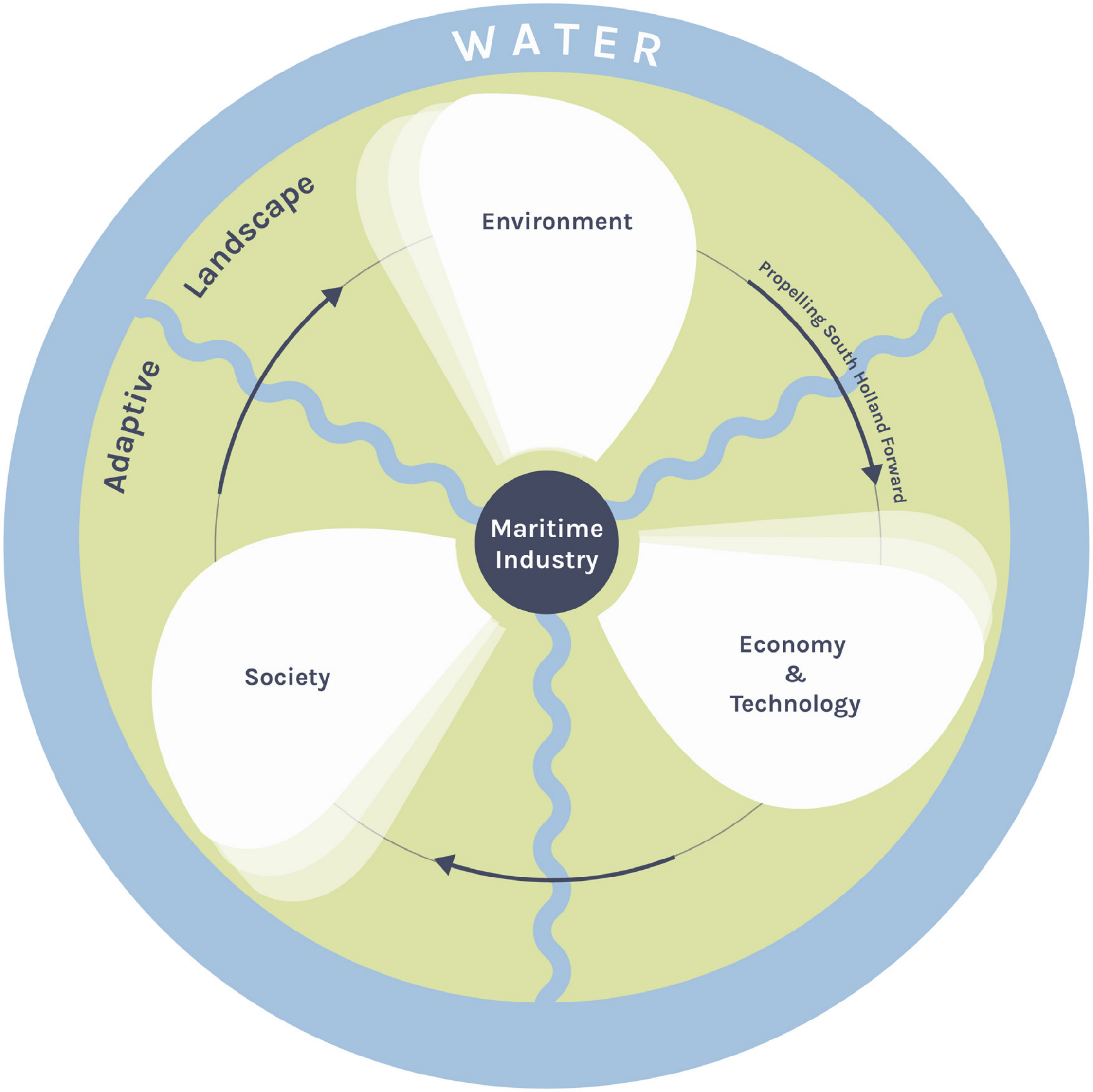


Figure 8: Conceptual framework

2.3 Methodology

Preliminary Research

Site visit

- Direct observation
- Mind map
- Photo documentation
- Sketching

Literature research

- SDS
- Capita Selecta
- Complementary literature

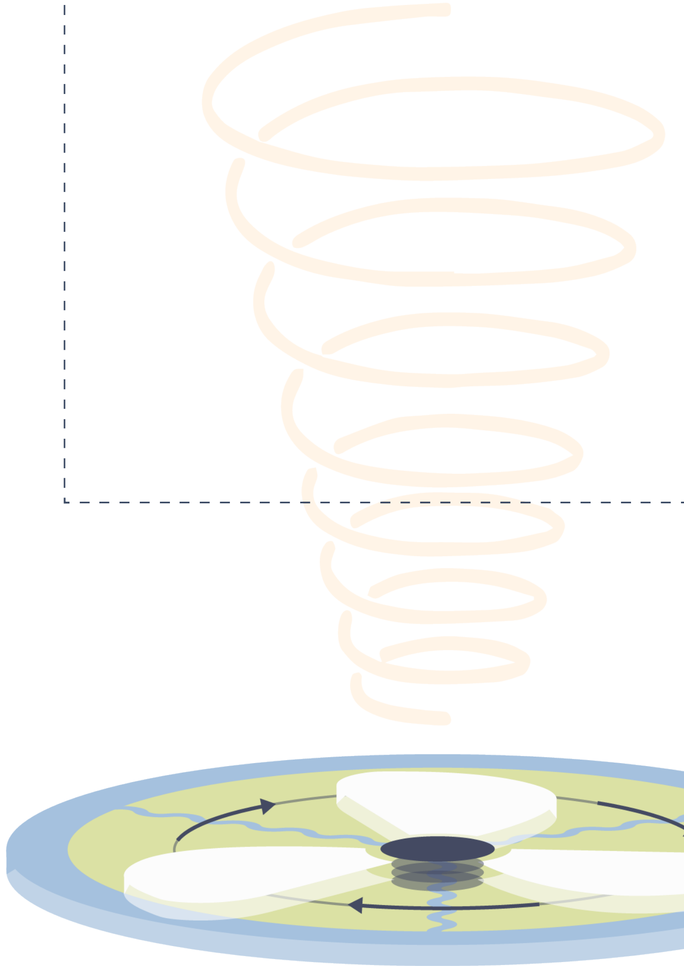
Problem Statement

- Mind map
- Motivation
- Scientific relevance
- Social relevance

Research Question

Conceptual Framework

- Water as connective tissue
- Maritime Manufacturing as main catalyst
- Adaptive landscape as objective



leads to

reassesses

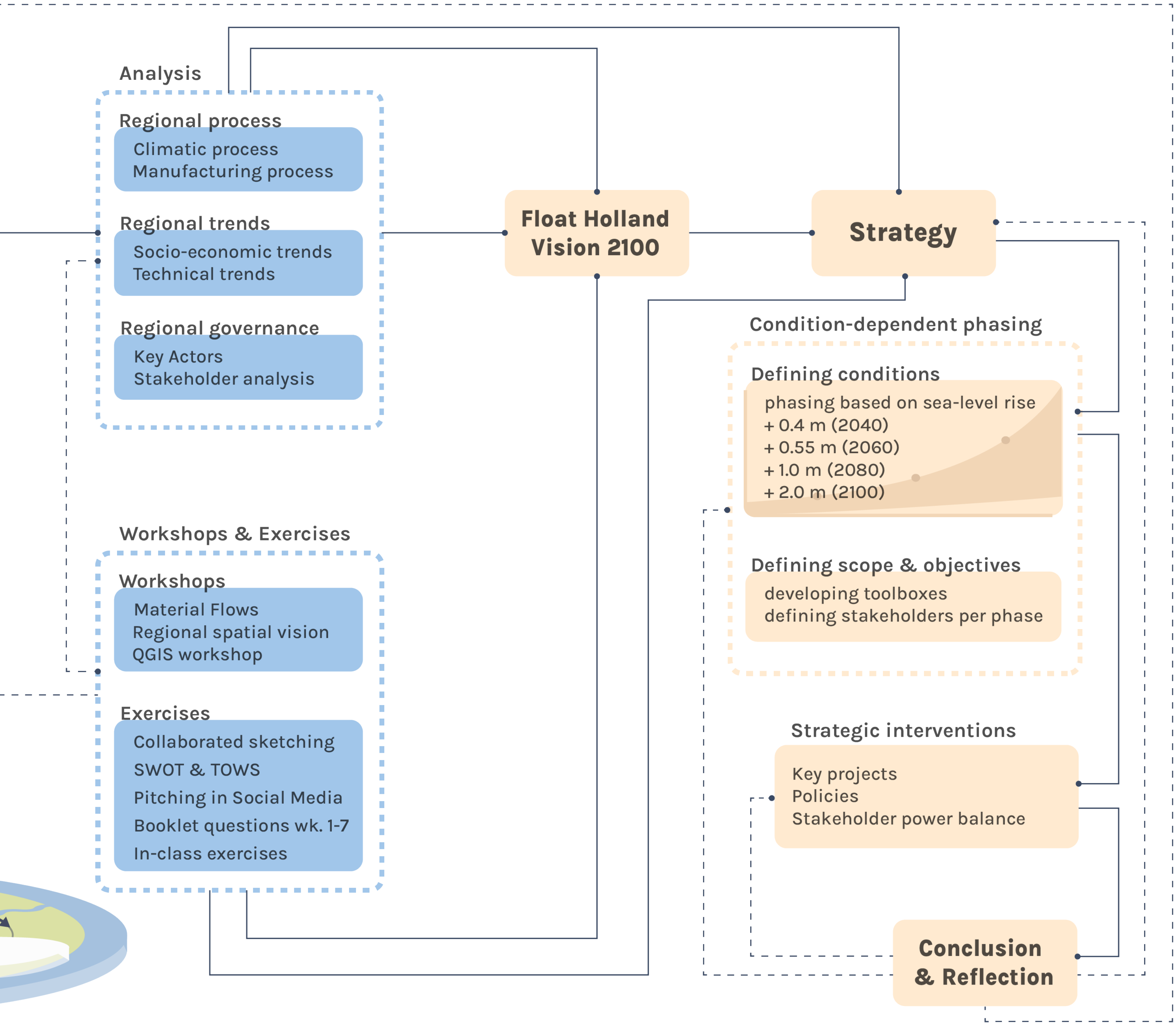


Figure 9: Methodology

STUDYING NETWORKS, RISKS AND STRENGTHS OF SOUTH HOLLAND

ANALYSIS

3. Analysis

In order to design for South Holland's future conditions and its prerequisite transition towards circularity, the climatic and maritime processes have to be identified. First, an assessment is made on the overall environmental threats the region is facing. Secondly, the processes and levels of circularity of the maritime manufacturing industry are explored. Thirdly, trends which impact the region are outlined. Concludingly, relevant stakeholders in the discussed maritime processes to are positioned.

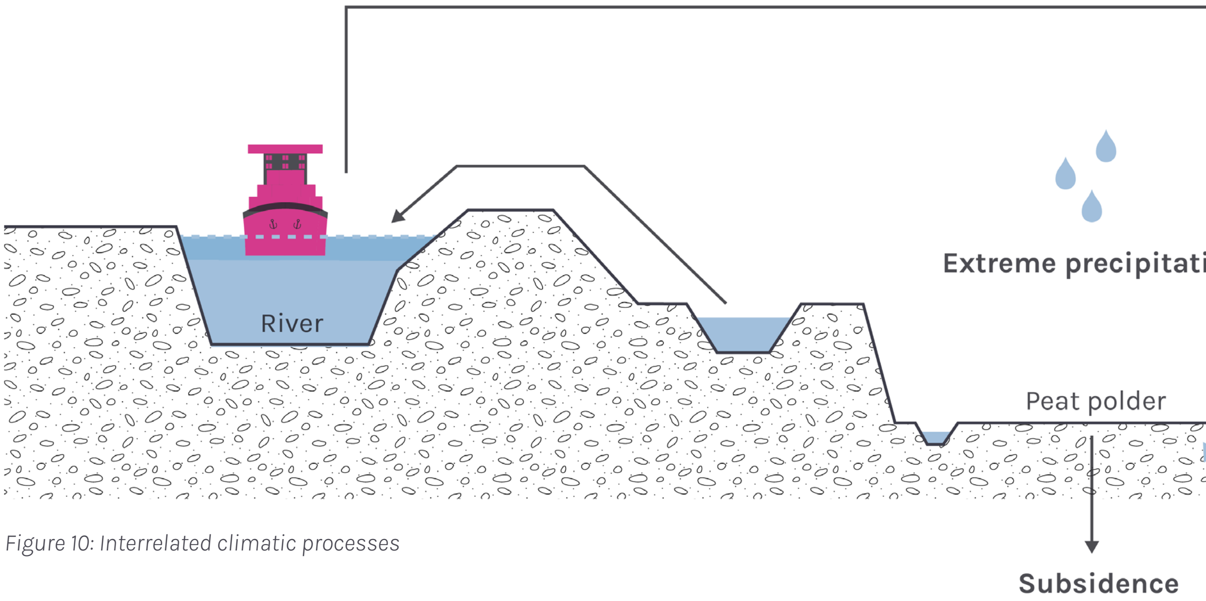


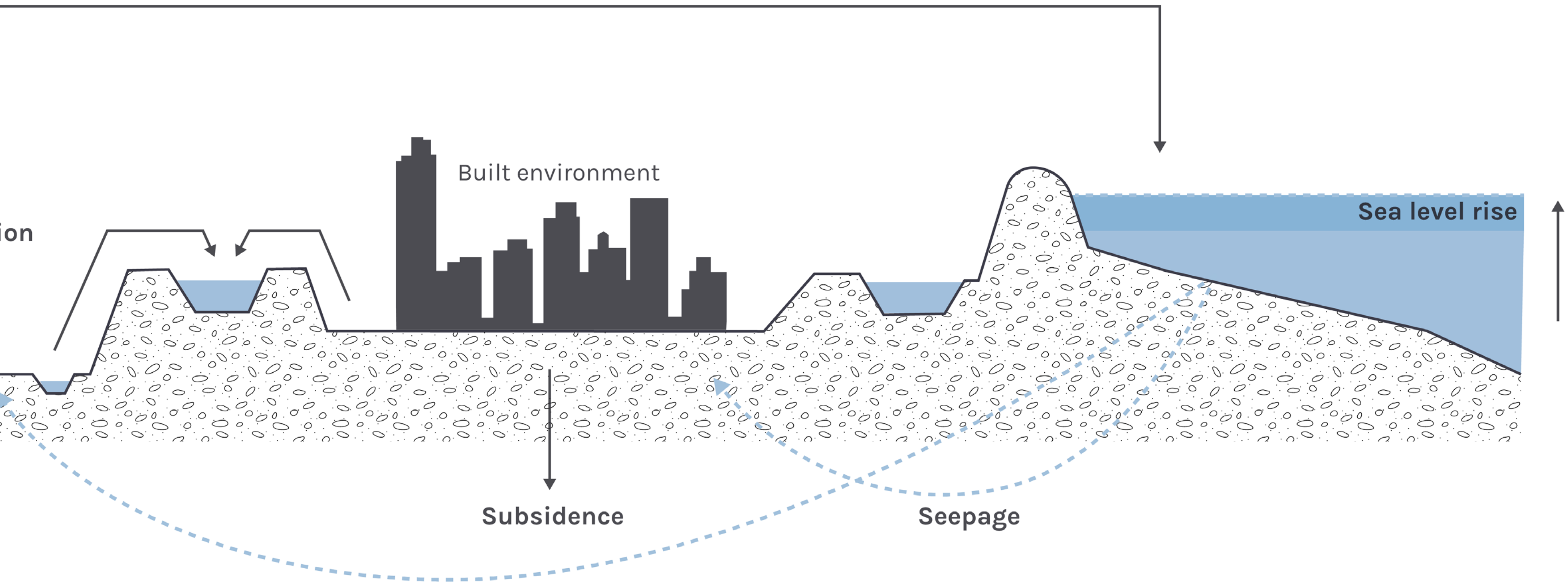
Figure 10: Interrelated climatic processes

3.1 Climate impact

The climate is changing faster than we previously thought. Also in the Netherlands, we are dealing more often with heat and extreme precipitation and less often with frost. The climate panel of the United Nations, the IPCC, has determined that global warming is man-made. In the Paris climate agreement of 2015, 193 parties agreed to limit the global temperature increase to 2 °C, and preferably to 1.5 °C.
However, with current emissions, the atmosphere will contain so much greenhouse gases in 10 years' time that the 1.5 °C limit will probably be permanently exceeded. (KNMI Klimaatsignaal '21, 2021). In short, this results in mean sea level rise, an increase of flood risk in all coastal regions and more extreme meteorological events. In the region of South Holland, this is aggravated by subsidence and subsequently seepage. Figure 10 shows how these environmental threats relate to and enhance each other.

3.1.1 Sea level rise

Regardless of if the temperature stops rising or even decreases after 2100, sea levels will inevitably continue to rise in the coming centuries. The reasons for this are the slow response of thermal expansion of the (deep) oceans and mass loss due to ice sheets. These processes operate on very long time scales, which means that once a change has been initiated, it cannot simply be stopped (KNMI, 2020).
The current scenarios for the Delta Programme assume a sea level rise for the Netherlands between 0.35 meters and 1 meter in 2100 (relative to of reference year 1995) (Haasnoot et al., 2018). However, new projections of the KNMI point out that this rise could accelerate in the coming century.



In the calculation of this accelerated sea level rise on the Dutch coast, many factors were taken into account, including the expanding of the oceans due to warming, the changes in salinity, and the loss in weight of glaciers and ice sheets on Greenland and Antarctica (KNMI Klimaatsignaal '21, 2021).
Depending on the extent of the sea level rise (with the current closing regime) the Delta Works will have to be closed more often and eventually even permanently.
At approximately +1 meter, the Oosterscheldekering and Maeslantkering close several times a year, at +1.5 meters sea level rise the Oosterscheldekering and Maeslantkering remain permanently closed (Haasnoot et al., 2018).

This moreover has dire effects on the ability of the Port of Rotterdam and the Maritime Industry to function. Therefor this condition of +1 meter rise is used as a tipping point later in our strategy, which was already shown in figure 5. Here it is also shown that the sea level could rise as much as 2 meters in 2100 with 2°C of warming. With the RCP8.5 scenario describing a warming of 4°C in 2100, the sea level can even rise up to 3 meters relative to 1995. Regardless of if we mitigate climate change, the sea level will continue to rise after 2100, in an extreme scenario up to 5-8 meters in 2200.
This means that transitioning into an adaptive landscape that can react to and move with the rise of the sea is an inevitability, and should be designed and planned proactively to account for the uncertainties in the coming century. To illustrate: According to the upper value of the Delta scenarios, the tipping point at 1 m will occur around 2100, but will occur at the earliest 20 to 30 years earlier if the sea level rises are extra accelerated. A tipping point at 2 m occurs in the Delta Scenarios well after 2100, but will already occur in this century (around 2090 at the earliest if the sea level rise is extra accelerated) (Haasnoot et al., 2018). And because of the long-term nature of spatial planning – especially in the Netherlands having its democracy rooted in its tradition of the Polder model – a sufficient amount of time for preparations should be taken into account.

3.1.2 Subsidence

The process of subsidence in South Holland started in the Middle Ages when natives were beginning to drain and dewater peatland. Today, we find that in many places the ground is sinking which is enhanced by climate change, shown in figure 11 and 12. Looking back at figure 4 the correlation with peat soils and subsidence becomes clear. Subsidence has various consequences, such as a greater risk of flooding with damage to building foundations, roads, bridges, sewers, cables and pipes. This damage is mainly caused by the fact that the ground does not subside at the same rate everywhere.

The decomposition of organic matter in the peat landscape not only leads to subsidence, but also to the emission of greenhouse gases, such as CO2. In the Netherlands, dewatering the peat meadow area results in annual emissions of 5.6 Mton CO2-equivalent (KEV, 2019), which is approximately 3% of total Dutch greenhouse gas emissions. In addition to CO2 emissions, there are also emissions of CH4 (methane) and N2O (nitrous) in the peat meadow area. These emissions result in a negative feedback loop which contributes to the warming up of the earth and therefor to an even faster rate of subsidence. (Kennisportaal Klimaatadaptatie, n.d.)

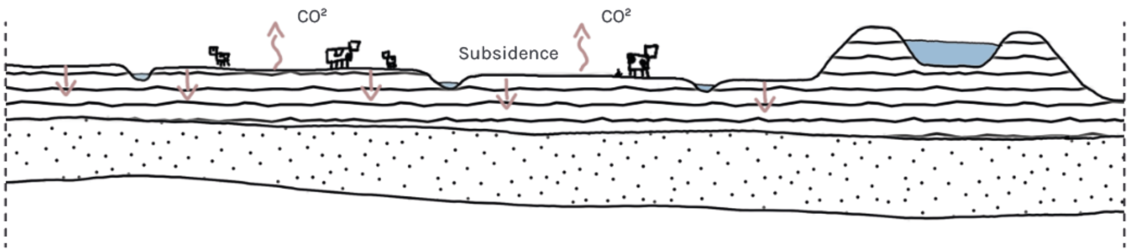


Figure 11: Section of subsiding soil

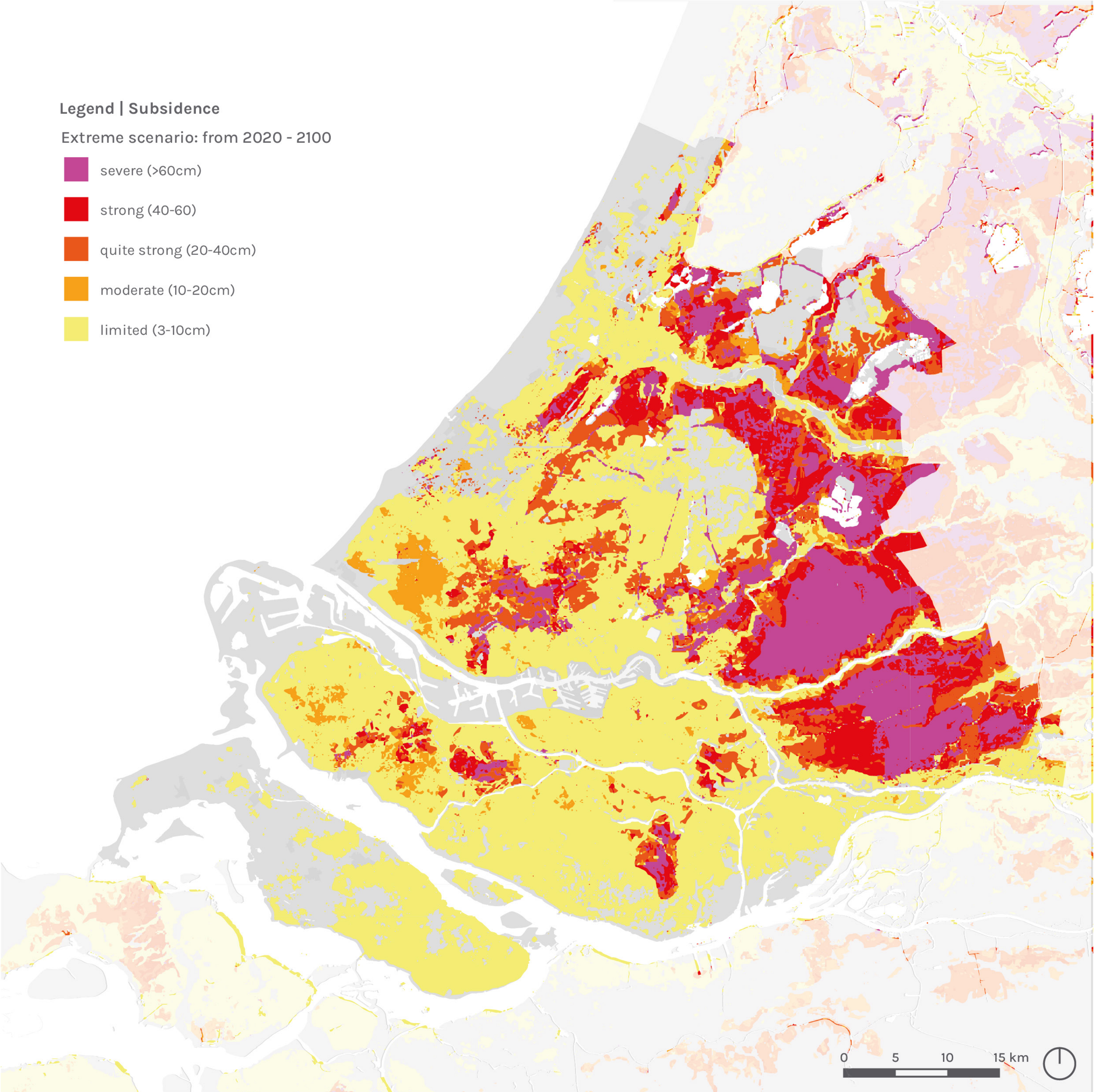


Figure 12: Amount of subsidence between 2020 to 2100

3.1.3. Seepage

Seepage is the movement of water through soils which is caused by an increase in groundwater pressure, visible in figure 13. This in turn is caused by the subsidence in combination with the increasing sea level rise. This seepage water is partly saline which leads to higher salt concentrations water system of the western Netherlands' polders. To control the consequences of this salinisation, the polder water system is flushed, which requires a lot of freshwater. (Haasnoot et al., 2018) Salinisation is disastrous for agriculture and horticulture and for natural ecology in general. Figure 14 shows the change in seepage, as well as the bordered area that is vulnerable for the shift of the fresh- salt water interface towards the east. Concludingly, in the near future South Holland will have to adapt to more saline forms of agriculture and horticulture.

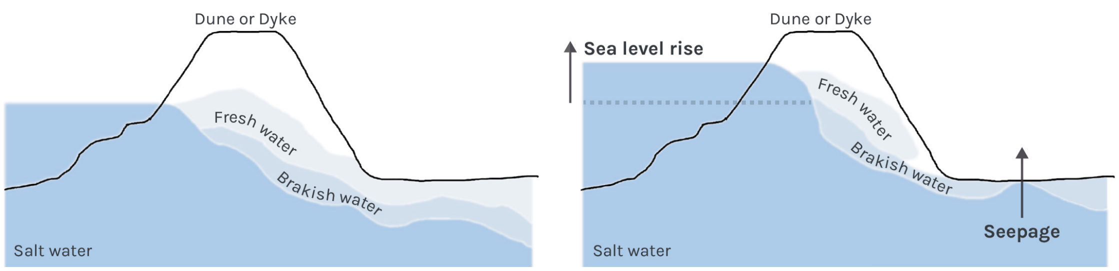


Figure 13: Section of seepage related to sea level rise

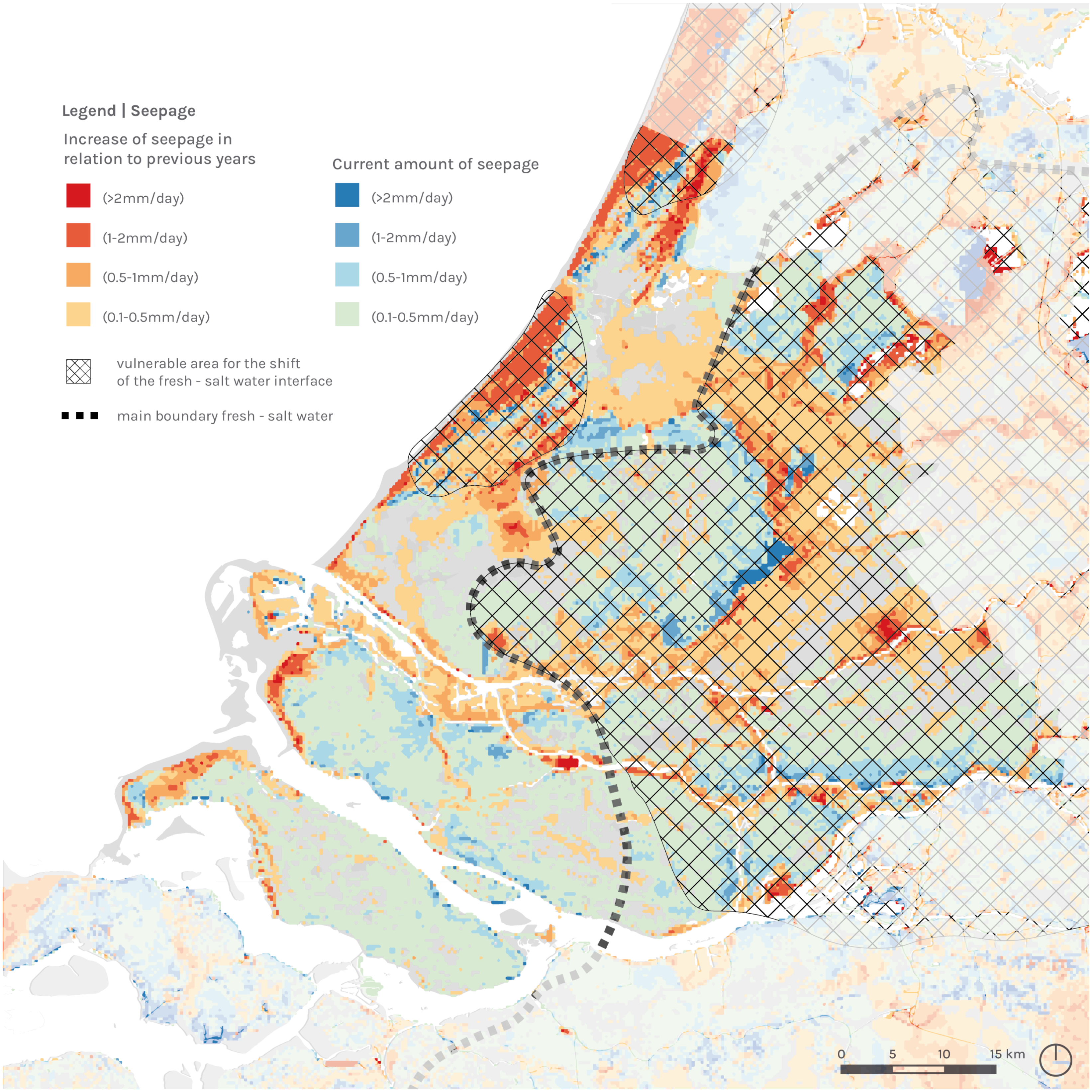


Figure 14: Seepage and the associated area vulnerable for the shift of the fresh - salt water interface

3.1.4 Extreme precipitation

Since the air in a prospective warmer climate contains more moisture, more extreme rainfall will occur. The heaviest showers can also create more gusts, which can be dangerous and cause a lot of damage (KNMI Klimaatsignaal '21, 2021). In the event heavy precipitation over a short period, the streams, ditches or canals will no longer be able to drain the water in time and the land will be flooded. As seen in figure 16, showing an indication of maximum water depth after such an event, mainly urbanized low-lying paved areas such as streets and squares are sensitive to flooding. The most damage occurs when water flows into buildings.

There are also health risks if polluted water remains on the street: in mixed sewers, rainwater can mix with non-treated water. (Kennisportaal Klimaatadaptatie, n.d.-c) In flood management, it is therefore imperative to look at streetscapes in the metropolitan area of South Holland, and how they can be redesigned to strengthen drainage systems and ecological infrastructure.

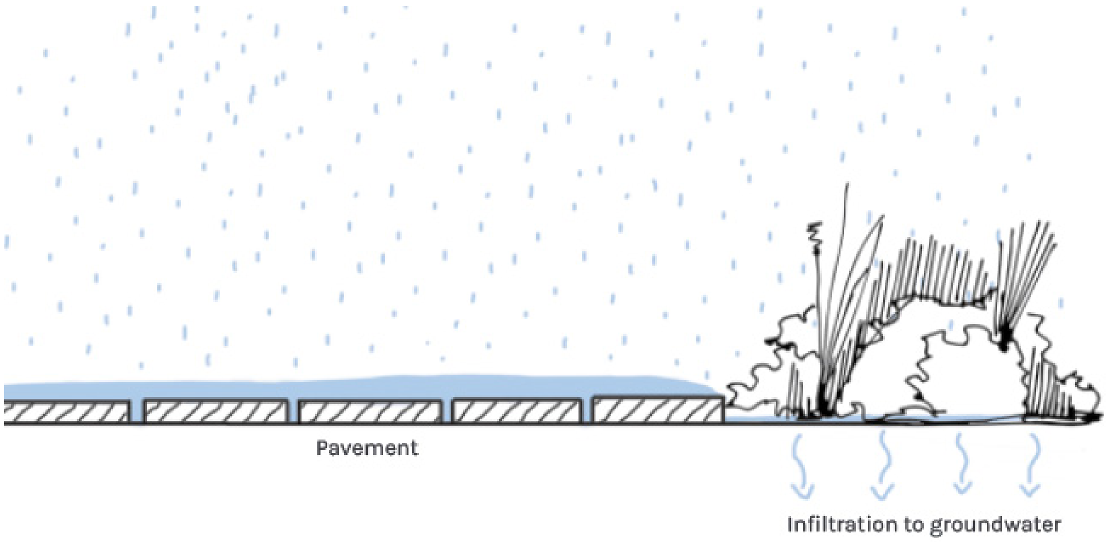


Figure 15: Infiltration capacity of different surface materials

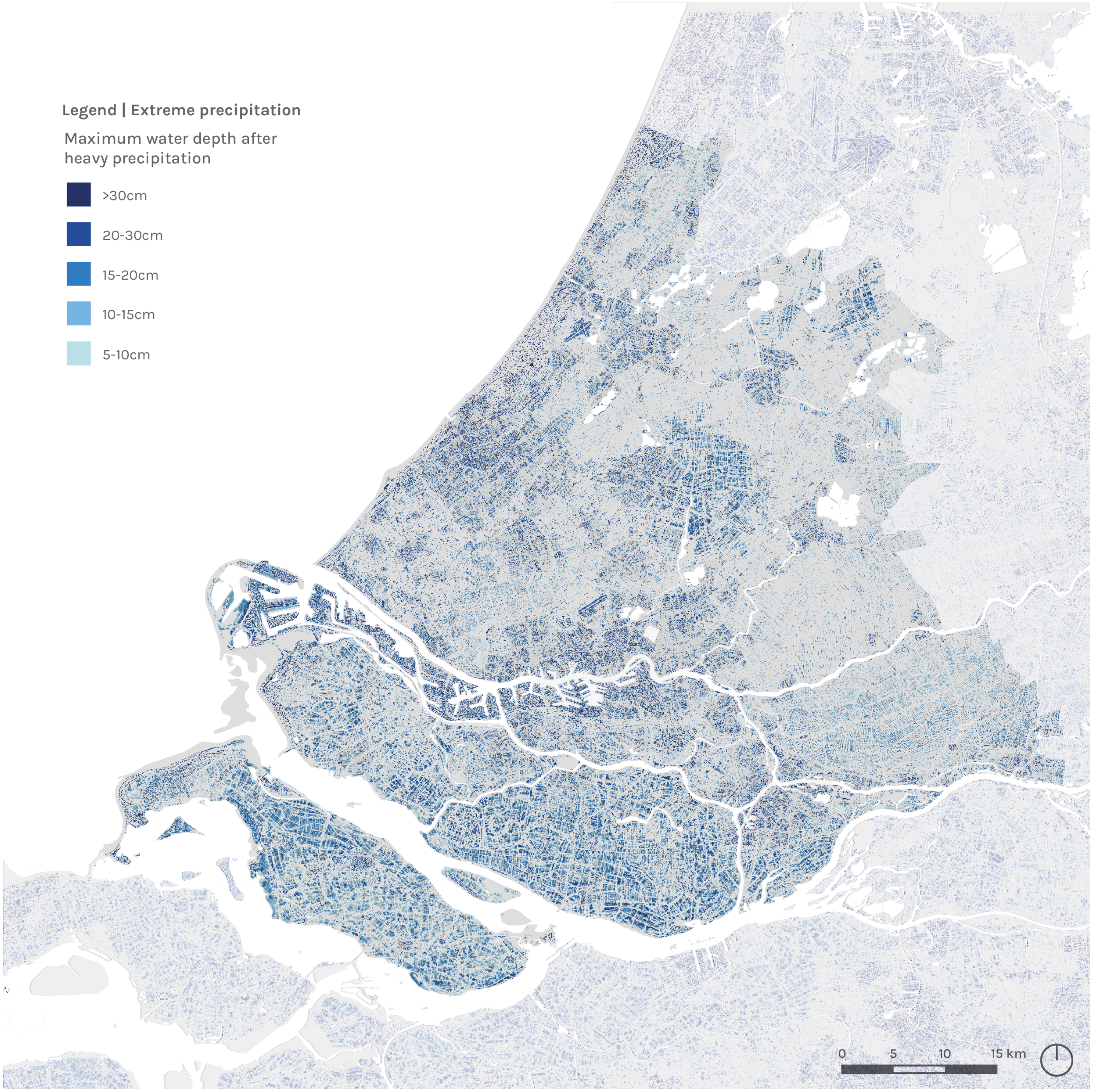


Figure 16: Maximum water depth after short period of extreme precipitation

3.1.5 Flood risk

Within the region there are great differences in the probability of a flood coming from the sea, river or due to extreme precipitation – as discussed previously. Shown in figure 17, the area with the highest probability of being flooded are logically mainly situated outside the dyke rings. It is noticeable that the highest risk of flooding is in-land: this is because the areas bordering the dune coastline are still sufficiently protected. (Kennisportaal Klimaatadaptatie, n.d.-b)

The amount of flooding ranges from 0.5 meter to >5 meter and are structured according to high, medium, small and very small probability. This in turn correlates with the probability that an area will be flooded every 10, 100, 1,000 and 100,000 years, respectively. According to IPCC however, the sea level rise throughout the 21st century contributes to more frequent and severe coastal flooding in low-lying areas and coastal erosion. (KNMI, 2020) states that just a small rise in mean sea level can significantly increase the number and strength of floods. In scenario RCP8.5, extreme sea level events that previously occurred once in 100 years could happen every year by the end of this century. It could therefore be argued the previously stated flood risk expressed in amount of floods per [x] amount of years will increase with a factor of 100, as shown in figure 17.

These kinds of events are increasingly less rare, as in Limburg, July of 2021, streams and rivers overflowed their banks, causing the center of Valkenburg, among other things, to be flooded. The damage was estimated at 1.8 billion euros in August. According to the province, about 1.2 billion euros is needed to prevent flooding in the future (NOS, 2021).

Less than a month before, the center of the Netherlands, including South Holland, was hit by severe thunderstorms on June 18, 2021, which caused severe storm damage and flooding. Many people saw the intrusive images of uninhabitable houses and gas leaks in Leersum, broken transmission towers in Oldebroek and the completely flooded streets in The Hague (KNMI Klimaatsignaal '21, 2021) .

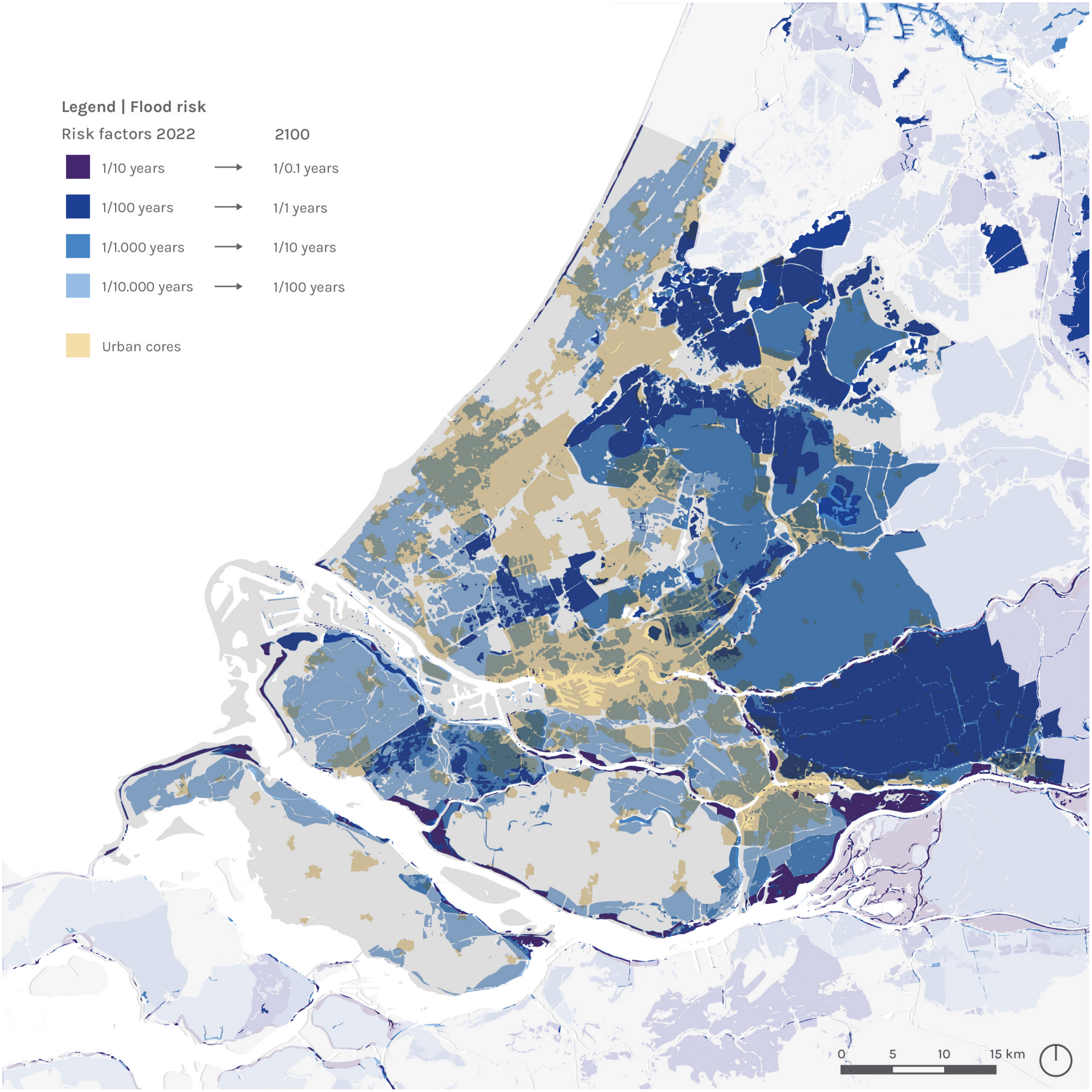


Figure 17: An increase of factor 100 in flood risk

3.2 Maritime processes

3.2.1 Manufacturing processes

The shipbuilding process, seen in figure 18 starts from order to delivery can be divided into the design stage and the manufacturing stage. The design stage can be further divided into contract design performed for the negotiation with the ship owner, basic design to meet the requirements of ship owner, and detailed design performed in a functional aspect.
On the other hand, the manufacturing process includes pre-processing, fabrication, assembly, precedence outfitting, painting, precedence block erection, block erection, out-fitting, et cetera, and these processes occur in a very complex pattern over a long period of time.

The life cycle of ships, shown in figure 19, includes rational use of construction and outfitting materials, energy consumption in all stages of ship design, manufacturing, operation, maintenance & repair, and finally in ship dismantling.
Manufacturing in Netherlands mainly includes the assembly of steel parts that are imported worldwide. When ships are out of service they are mostly moved back again to the developing countries for the disassembly and recycling. There is only one ship disassembly company in South-Holland which is in 's Gravendeel.

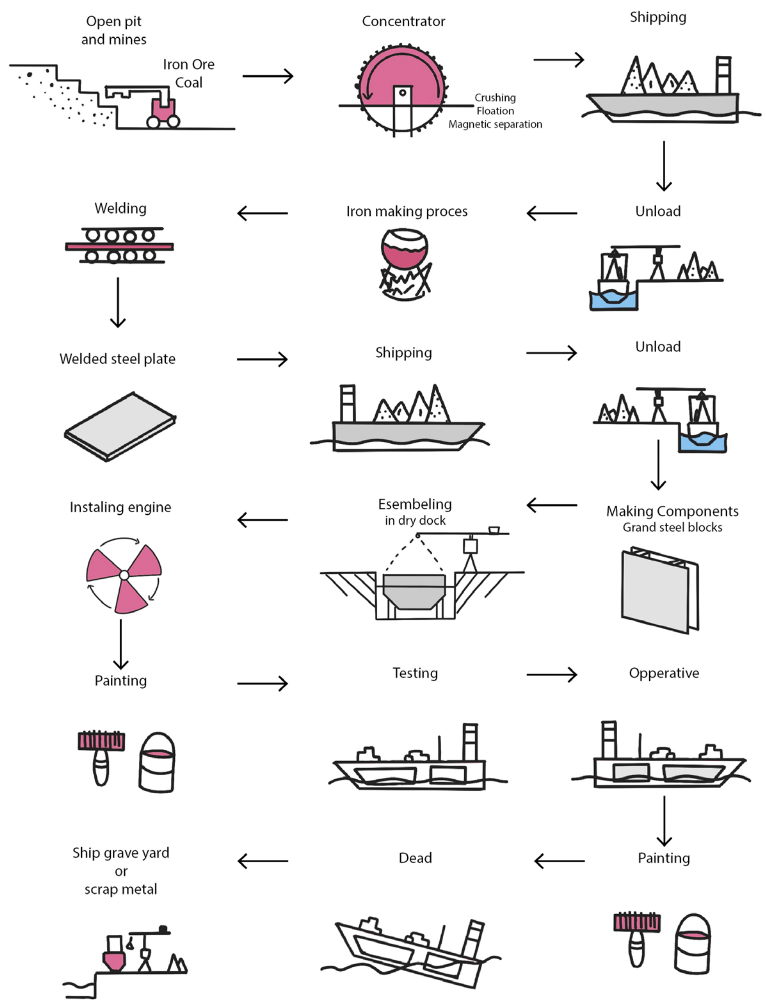


Figure 18: Ship making processes

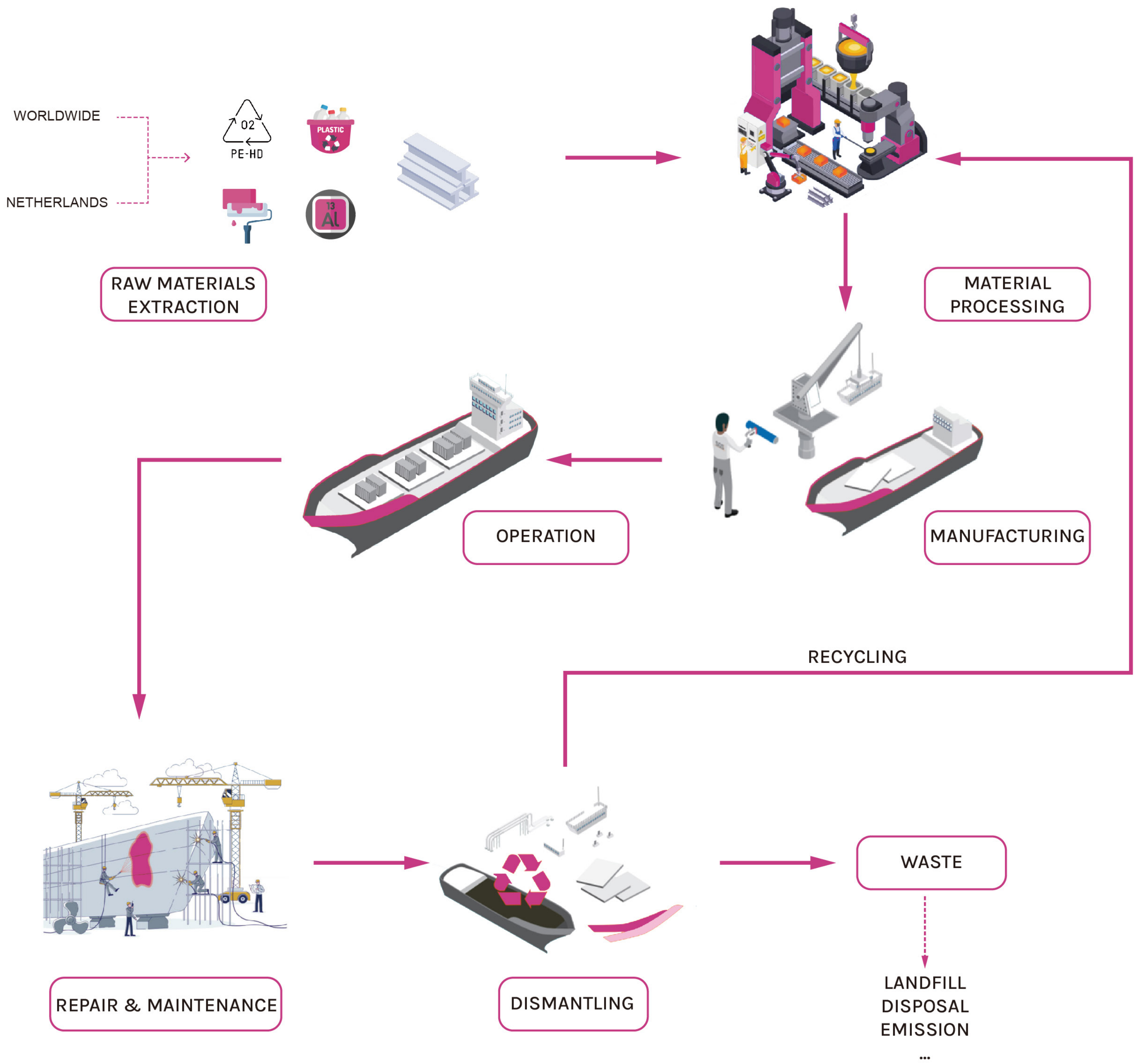


Figure 19: The life-cycle of ships

3.2.2 Raw materials

The four principle materials utilized for building vessels are steel, aluminum, fiber-fortified plastic (FRP), and polyethylene. The most widely used material in ship building - around 90% - remains steel; especially plain carbon- or mild steel. These materials are mostly imported.

In South Holland, the material processing industry are mainly located along with the canal where products can be shipped more conveniently. Figure 20 shows clusters in the Port of Rotterdam and the Drecht cities of processed materials such as metal, rubber and plastic. These materials are moreover based on fossil fuels.

When a ship reaches the end of its life, a shipowner sells it for recycling, in which case the shipowner is paid by a ship recycling facility or intermediary, who will recover and sell the steel and other components for recycling, refurbishing and reuse. Ship recycling facilities are an important source of scrap steel used in other sectors, such as construction and electronics.

South Asia (primarily Bangladesh, India, and Pakistan) has the largest global share of recycled tonnage, accounting for over 80% in 2020. The fourth main recycling country is Turkey. These four countries provide the vast majority of global ship recycling capacity (Sustainable Shipping Initiative & 2BHonest, 2021).

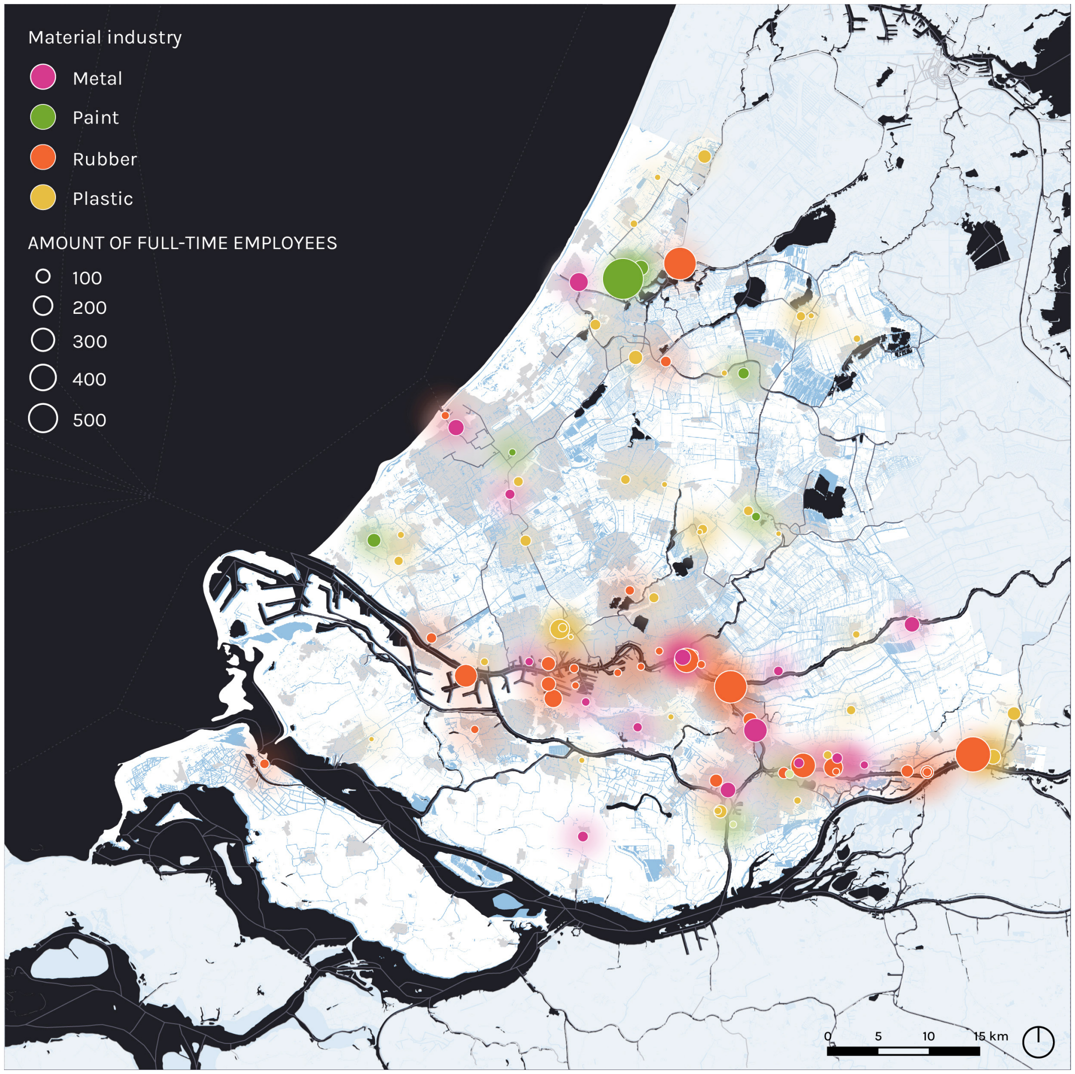


Figure 20: Material clusters needed for manufacturing ships

3.2.3 Maritime clusters

The Dutch maritime cluster is composed of various market segments. More specifically, it encompasses ports, offshore, maritime suppliers, shipbuilding, maritime shipping, dredging, maritime services (including maritime education and knowledge institutes), inland shipping, watersports, the fishing industry and the Royal Netherlands Navy.

Dutch shipyards have been producing a variety of vessel types over the last ten years, including dry cargo ships and tankers, dredgers, offshore service vessels, tugs, work/repair vessels, tankers, gas carriers, cruise/passenger ferries, fully cellular containers (FCC), bulk carriers and roll-on/roll-off (ro-ro) vessels.

There are two clusters with differentiated landscapes and specializations in Zuid-Holland. The manufacturing and repair of ships is done in a cluster in the port of Rotterdam and the Drecht cities. The other cluster of yacht building is in the north. Most businesses are related to a structure of canals.

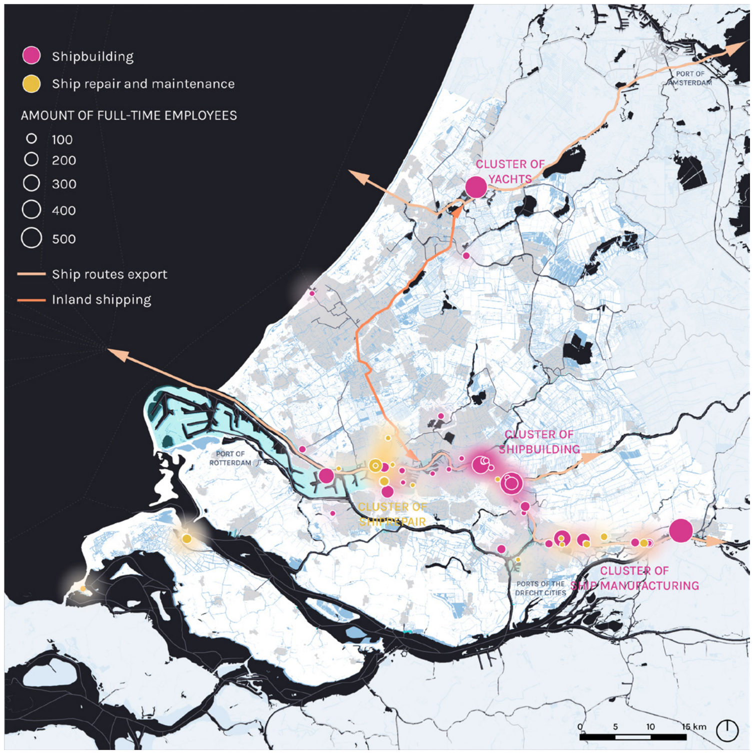


Figure 21: Clusters of maritime manufacturers

3.2.4 Systemic section

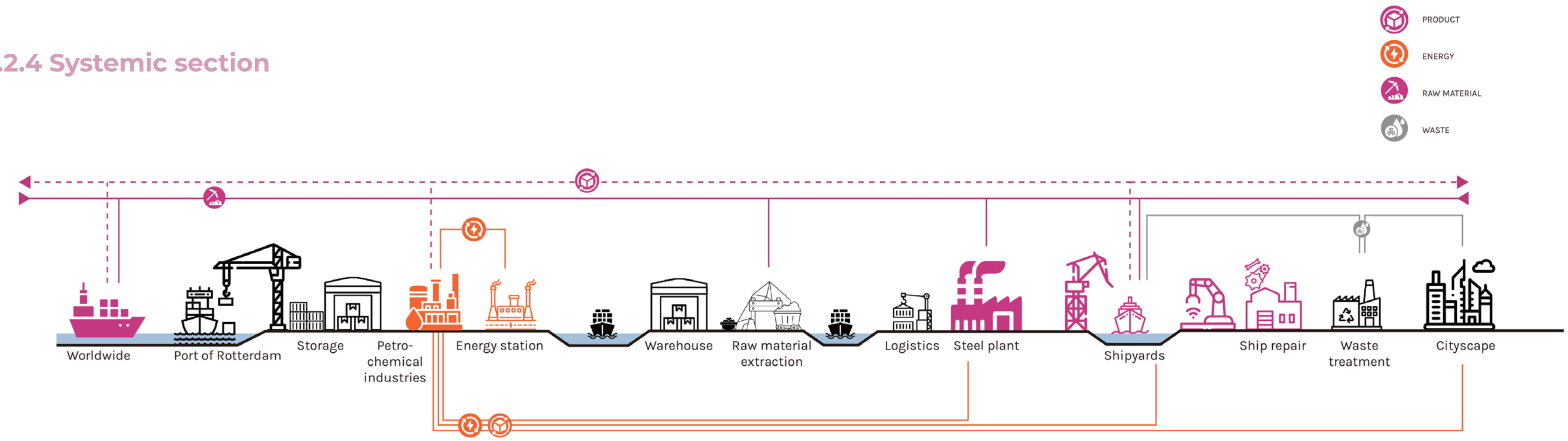


Figure 22: Systemic section of maritime manufacturing processes

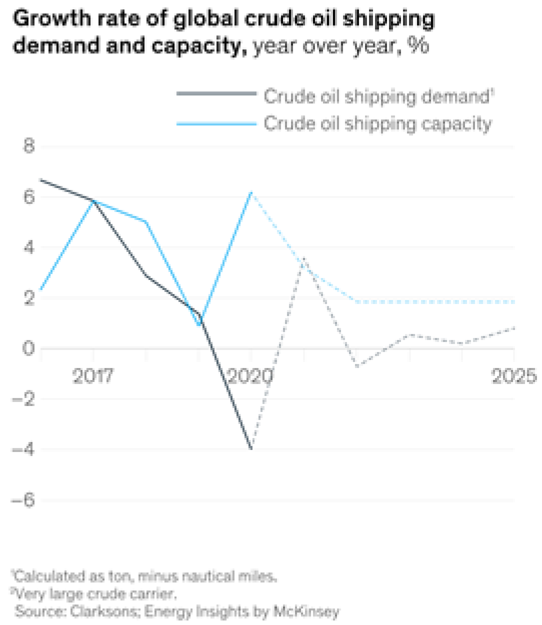
3.2.5 Oil tankers

Tankers have been one of the oldest types of merchant ships. The most common types of tankers operating at sea are oil tankers, which cost 9 to 15 months to manufacture. The economic lifespan of an oil tanker has historically been 25 years, although more recently this has dropped closer to 20 years.
The slowdown in global economic growth due to Covid-19 has decelerated demand for oil tankers, leading to a sustained oversupply of shipping capacity. With the growing numbers of shipbuilding orders, crude tanker oversupply will intensify in the next few years, which is shown in figure 23.

The oil tankers have the highest scrap value mainly because of the weight of steel, especially the super-tankers which can be anything up to half a million tons. They produce the following materials expressed as a percentage of their dead weight:

- 86% ferrous metals
- 1% non-ferrous metals
- 2% furniture
- 3% machinery
- 8% waste

The number of large oil tankers being scrapped reached record levels in 2018, with more than 100 vessels being sent for demolition. The majority ended up on beaches in Bangladesh, India and Pakistan where they are taken apart by unskilled workers, often with little or no safety equipment.
The life expectancy of those doing this dangerous work at these enormous shipbreaking yards has been estimated to be 20 years lower than the general population in these countries and the industry has faced accusations of human rights abuses. Environmental campaigners have also raised concerns about the hazardous substances and pollutants that leach out from the ships as they are dismantled, which has led to calls for stricter environmental regulations around ship breaking.



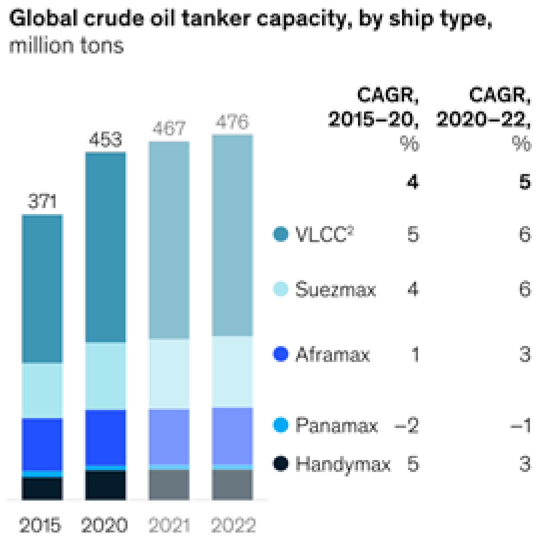


Figure 23: Oversupply of oil tankers

Rehabilitating old oil tankers

Figure 24 show three ways of how to rehabilitate old oil tankers:

- Use the vast hull of oil tankers to create floating power stations that can convert the ocean swell into electricity.
- Turn old supertankers into floating public villages that contain shopping malls, concert venues, museums, swimming pools and a public park on the top deck.
- Convert oil tankers into mobile waste water treatment plants. These offshore treatment plants could then be sent to cities around the world that are struggling with water shortages.

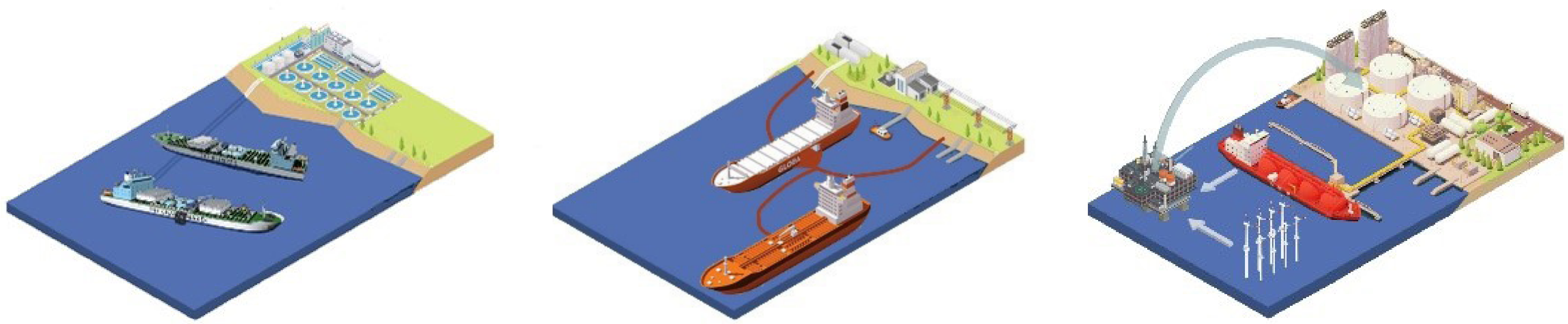


Figure 24: Possible rehabilitation for oil tankers

3.3 Trends

Population growth

South Holland is expanding. Therefore, exploring social-economic trends in more detail is important to raise the issue of potential risks and consequences that the previously stated climatic processes have. As seen in Figure 26, showing population growth from 2018 to 2050, population decline is regarded as occurring everywhere except in the Randstad. Especially the municipalities that are situated below sea level in the west show growth in population.

Economic growth

Especially for cities, our level of prosperity is of great influence on spatial growth – more so than demographic developments. The economic appeal of South Holland attracts inhabitants from the east, north and south of the Netherlands to an already highly dense metropolitan region. Because of this growth in population, the region is challenged by a housing crisis. Within the next 20 years, one 210,000 new homes need to be constructed to adhere to the growing demand (Provincie Zuid-Holland, 2021).

In constructing these homes, however, trends in the use of space also need to be taken into account. Hartman & de Roo (2011) state that, "while the Dutch population has tripled in the past 100 years, our use of space has increased by a factor of 25. In 1910 an average of five people lived in a house of some 60 m2. A hundred years on, a house of 120 m2 is just big enough for two people. The demands we made of our accommodation grew as our prosperity grew. If 1% or less of the Netherlands was urbanized at the start of the 20th century, this has now risen to 20% if you include greenhouse horticulture and docks."

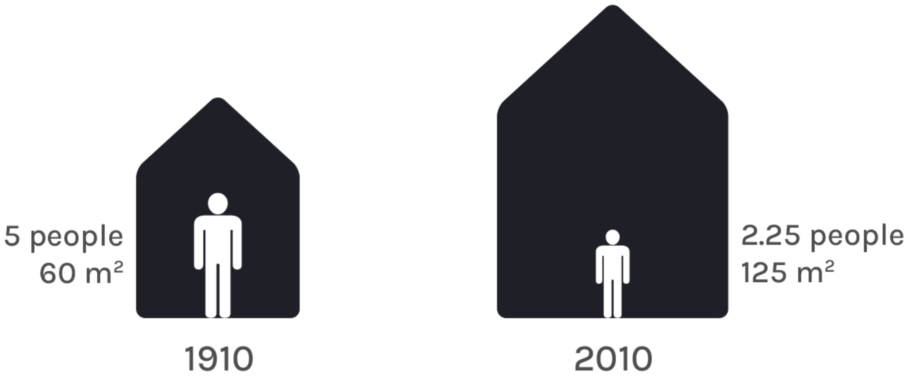


Figure 25: Increase of use of space. Derived from Hartman & de Roo (2011, p. 65)

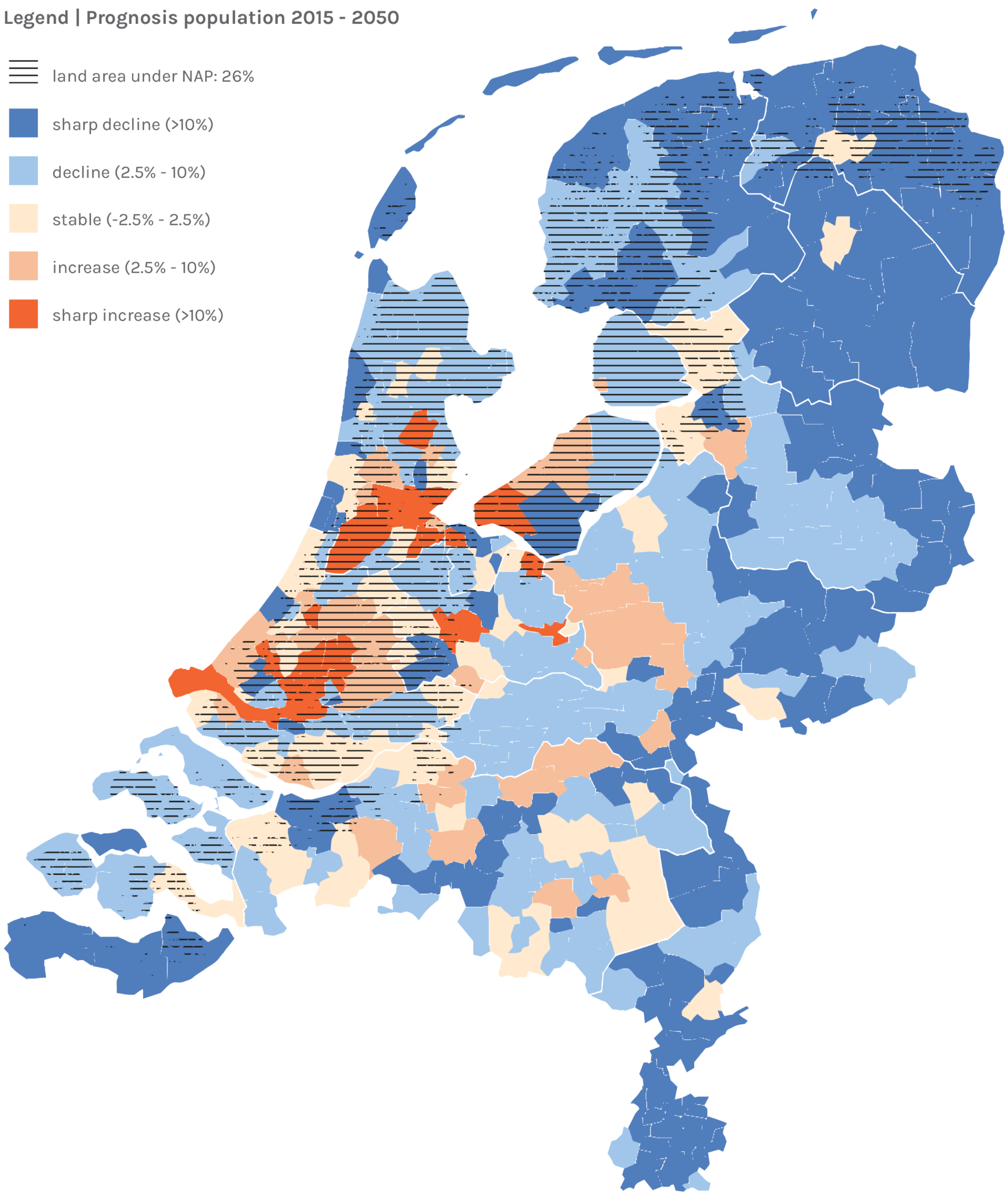


Figure 26: Prognosis of a population living beneath sea level. Based on PBL & CBS (2019)

Digitalization and automation

Technological trends outline how digitalization and automation create new opportunities for the maritime industry. In their report on the changing maritime ecosystem, van Dijk et al. (2019) state that "Change is a constant in the maritime industry. Sixty years ago, the introduction of the shipping container revolutionized trade and changed the way transportation, shipping, loading and unloading of goods is done even to this day. [...] Today, the maritime industry is once again at the cusp of a new era—one driven by increased digitalization and innovation, in particular, automated ships. This evolution has the potential to impact all aspects of operations and business in the industry."

The main shipping hubs and distribution centers around the world, like the Port of Rotterdam, are already investing to prepare for increased autonomy.

In a sense, smart ships can be seen as the evolutions of already existing subsystems of a traditional ship. The first fully autonomous ships, expected to arrive within 5 years, will be developed in environments that don't require much interaction with other infrastructure, like a windmill park at sea. Moreover, the potential for new applications in shipping is clear: concepts like automatic mooring and smaller autonomous ships could be seen upscaling within the coming decades. If this eventually becomes a reality, it might impact the current hub and spoke model in the maritime industry, where the Port of Rotterdam will play a central role in maritime logistics.

Figure 27: Representation of the connected maritime ecosystem. Based on van Dijk et al. (2019, p.3)

3.4 Stakeholders

Stakeholder network

The current Maritime sector is characterized by heavy industrialization and a vast infrastructural landscape. The nature of functions of this landscape is moderated and influenced by a comprehensive group of stakeholders with different goals and aspirations. The regional potential of the industry to adapt to upcoming transitions is held by a delicate balance of powers within these different groups. These are divided into 3 major themes based on their goals and roles:

1. The Maritime Sector (Port ecosystem and shipbuilding industry);
2. Citizens and Institutions (Knowledge hubs and community-based organizations);
3. City Agencies: Policymakers and executive government bodies.

A combination of hopes and fears produced by the inter and intra-links shared between these stakeholders helped us identify opportunities for improved network efficiency and hierarchy of roles. The citizen organizations, currently isolated in terms of decision-making within the Maritime sector, present a need to localize the nature of the industry itself for better inclusion. Similarly, the network also illustrates growing clusters of innovation hubs, material transporters, and producers, presenting possibilities of heading the key concepts of the vision for South Holland.

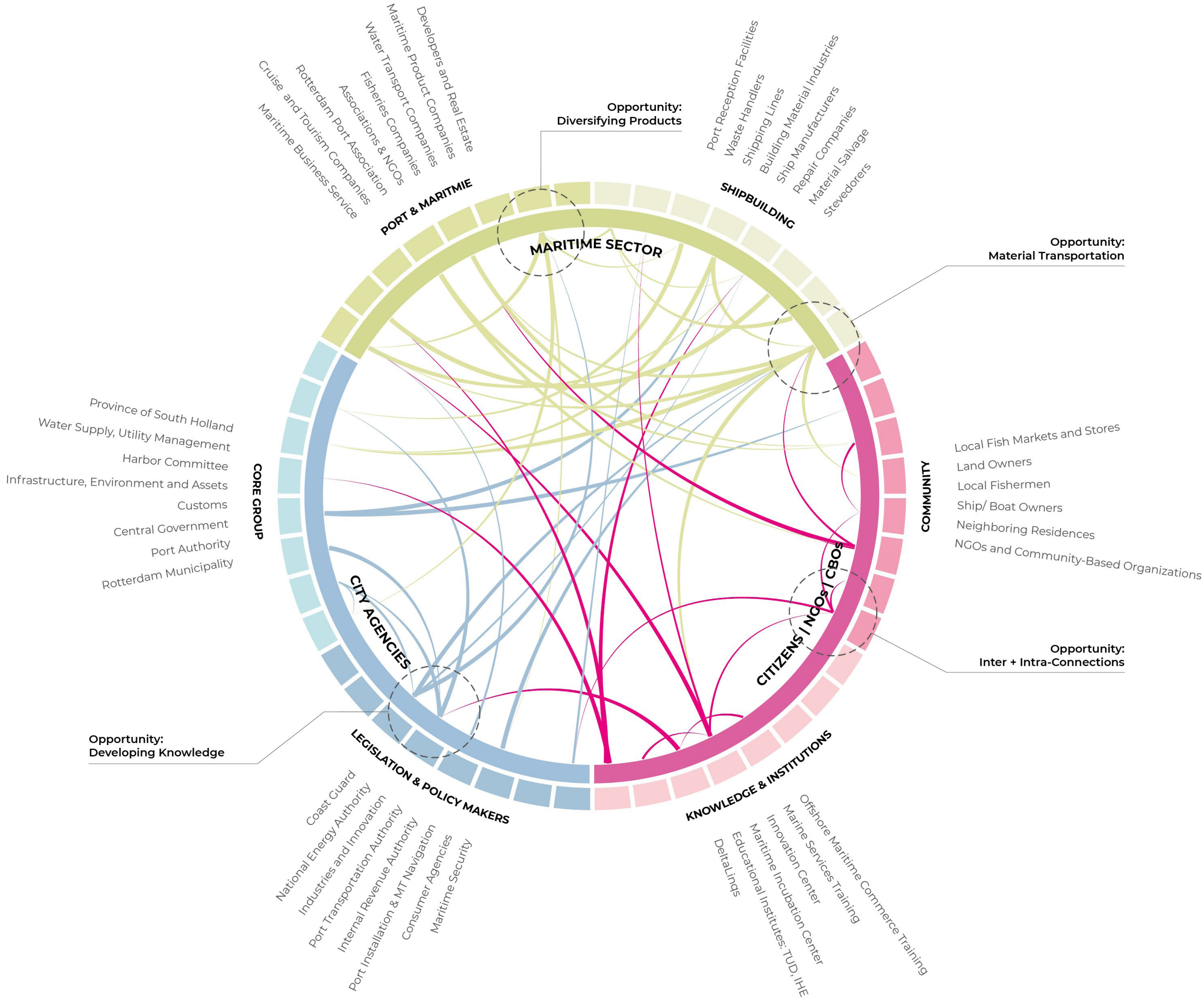
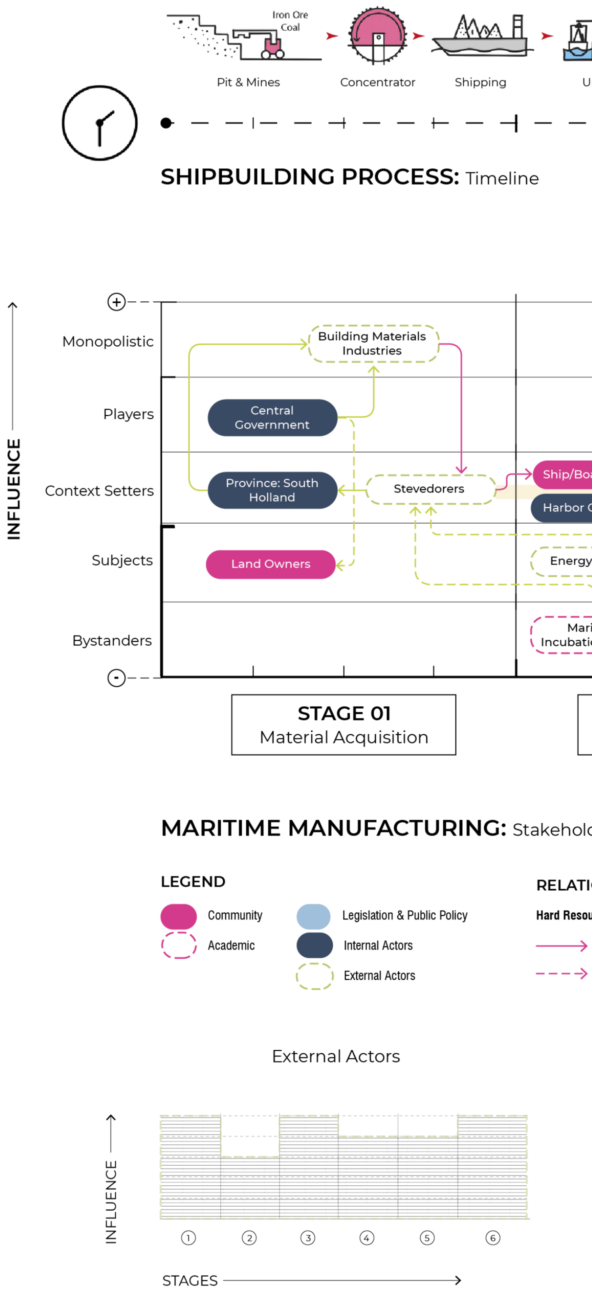


Figure 28: Maritime Manufacturing: Actor and Stakeholder Network

Power dynamics of stakeholders

The process of manufacturing maritime products involves different internal and external actors pitching in hard or soft resources such as capital, material, transportation and additional services. The balance of these transactions through different stages of manufacturing sets up the playing field for the stakeholders around the industry.
Figure 30 describes this power balance between the players. It is evident that with the port ecosystem in context, the majority region of the power matrix is dominated by private players as a result of their global reach. This deprives the community players of decision-making power in maritime processes, leaving them as bystanders. Additionally, the gaps in the involvement of internal actors and educational institutions indicate the need for a more equitable involvement of stakeholders while diversifying the spectrum of current players.

Taking into account the transitions in technological and knowledge fields, there is potential to add more local processes and diverse products from Maritime manufacturing to serve both scales. Since the transitions also take place around the concerns of climate change, the addition of natural landscapes as stakeholders is essential to sustain the matrix.



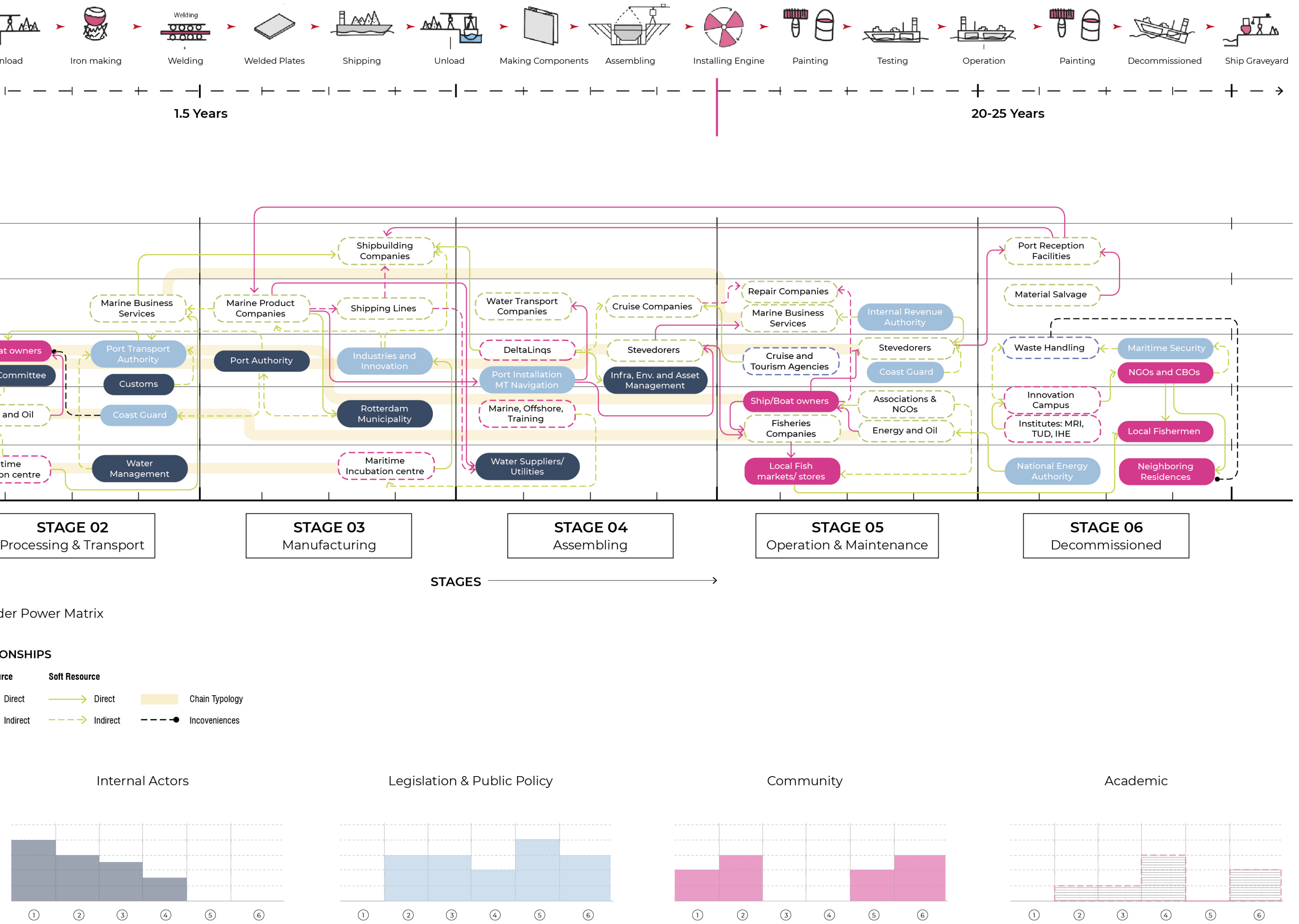


Figure 29: Power dynamics of Stakeholders based in and around Maritime Manufacturing

3.5 SWOT

Strengths

- The region encases a polycentric clustering, with well-defined flows of capital, knowledge and information systems.
- The individual administrative powers collaborate through a robust network of infrastructure. (rail, motorways, waterways but also electricity)
- Existing knowledge axis with individual focus and specializations in for of a growing innovation hub.
- Shared Dutch heritage as pioneers for water-based developments.

Weaknesses

- The eastern ends of the region are composed of low-laying land, resulting in a high risk of flooding
- There's a lack of connection between urban areas and water systems outside the port
- There's a high dependency of import materials
- The port is currently composed of high-emission industries on western edge as well as near Dordrecht.

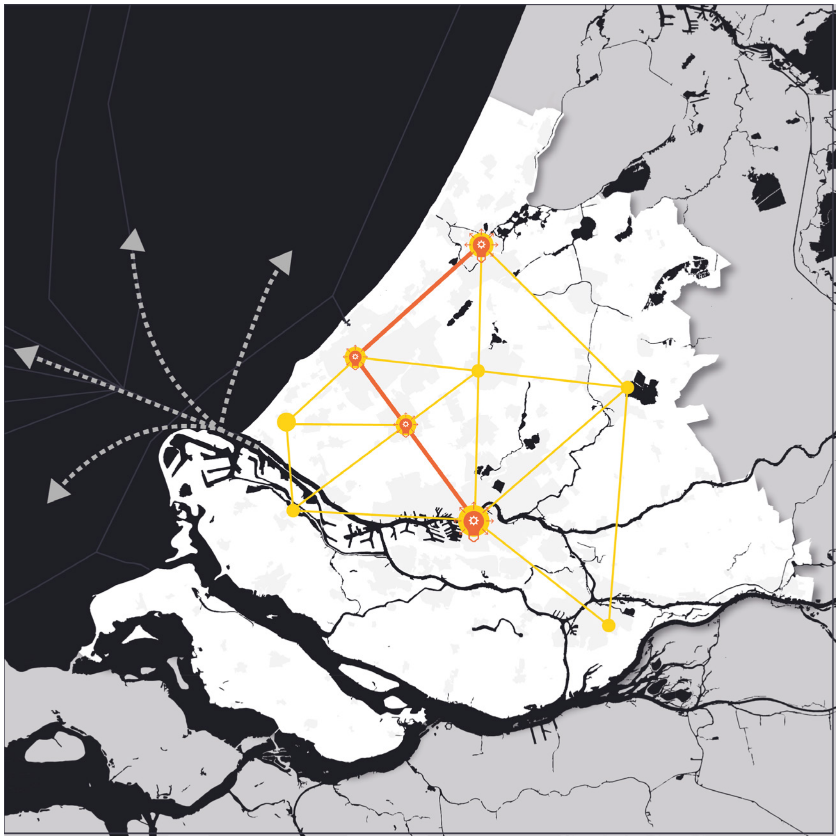


Figure 30: Strength map

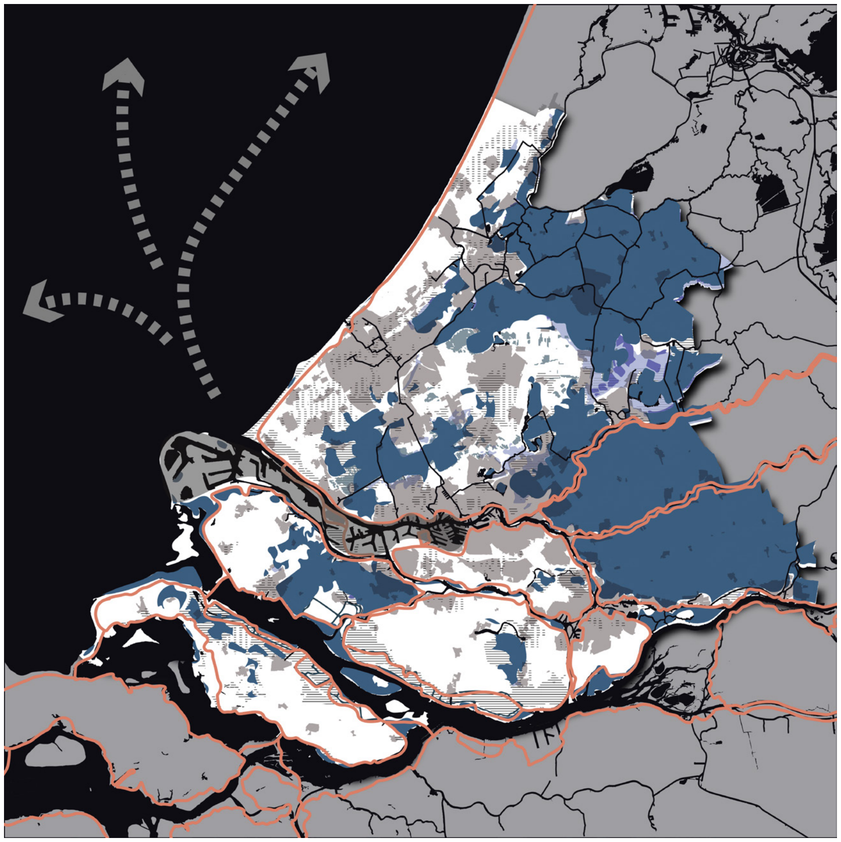
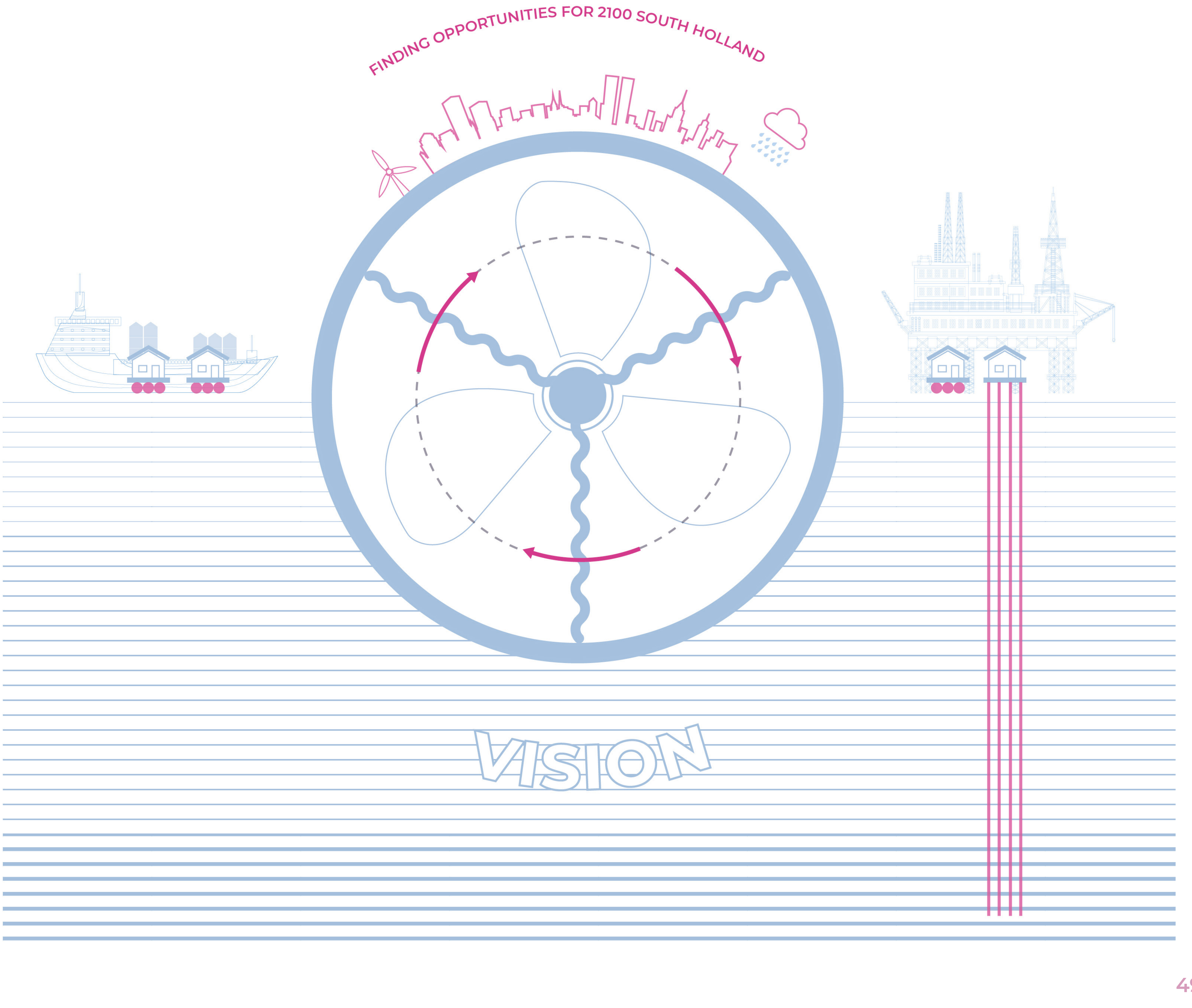


Figure 31: Weaknesses map


FINDING OPPORTUNITIES FOR 2100 SOUTH HOLLAND
VISION

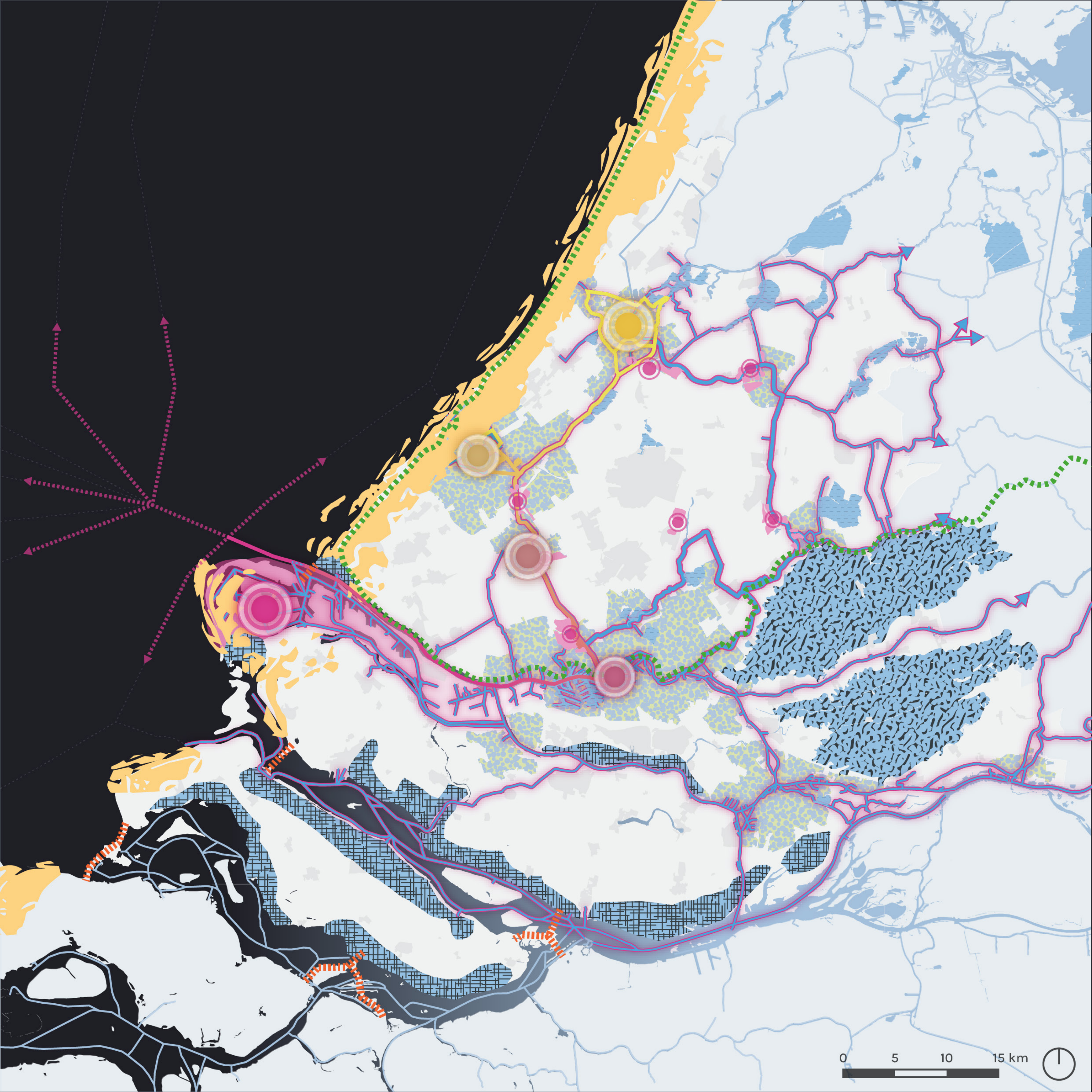
4. Vision

In 2100 we envision the Maritime Manufacturing Industry to expand its role into facilitating the adaptivity of the natural, social and technological landscape of South Holland, using water as primary medium.

We aim to introduce a radical transition by designing diversified spaces on and around water, serving both an economic prospect as well as increasing consciousness within society of potential environmental threats.

Legend

- maritime maker's industry
- waterways
- knowledge institutions
- knowledge axis
- global export
- port of Rotterdam
- salt marches
- flood plains
- waterbodies
- sponge cities
- dijkring 14
- opening Delta works
- reinforced coastal dunes


0
5
10
15 km

4.1 Landscape 2100

In the structural layer of the landscape, Dijkring 14 will be strengthened and the area within will be protected, since this is one of the most densely populated areas in the Netherlands, and holds a high economic value. Thus, the consequences of flooding would be severely high. The coastal dunes will also be strengthened by adding more sand, in which the maritime sector will play a vital role.
In the area outside of Dijkring 14, new distinct landscape types are created by strategically flooding both the peat landscape in the east, as well as the sandy landscape in the south. The Delta works are allowed to be opened again, which results in salt water infiltrating through the rivers. The province will have to accept to adapt to more saline forms of agriculture and horticulture.

In the current water management of the Netherlands system, groundwater is pumped out which results in subsidence and the emission of captured CO2 in the peat. Figure 30 shows that by partially flooding the peat, this process is stopped: the landscape can restore, and again capture CO2.
Because the salt marshes are located near the sea, the infiltrating water will have a tidal character, which brings the sedimentation of sand. The vegetation on these saltmarshes can hold these sand particles, eventually raising the landscape.

Legend | Landscape

- salt marches
- flood plains
- waterbodies
- sponge cities
- dijkring 14
- opening Delta works
- reinforced coastal dunes

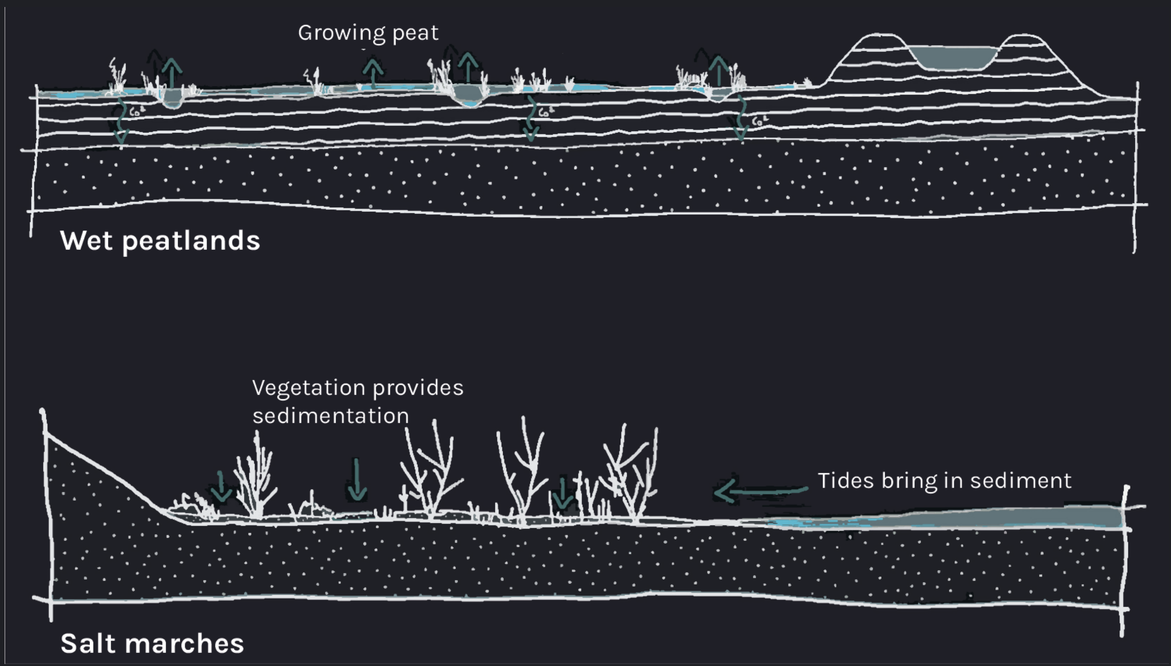
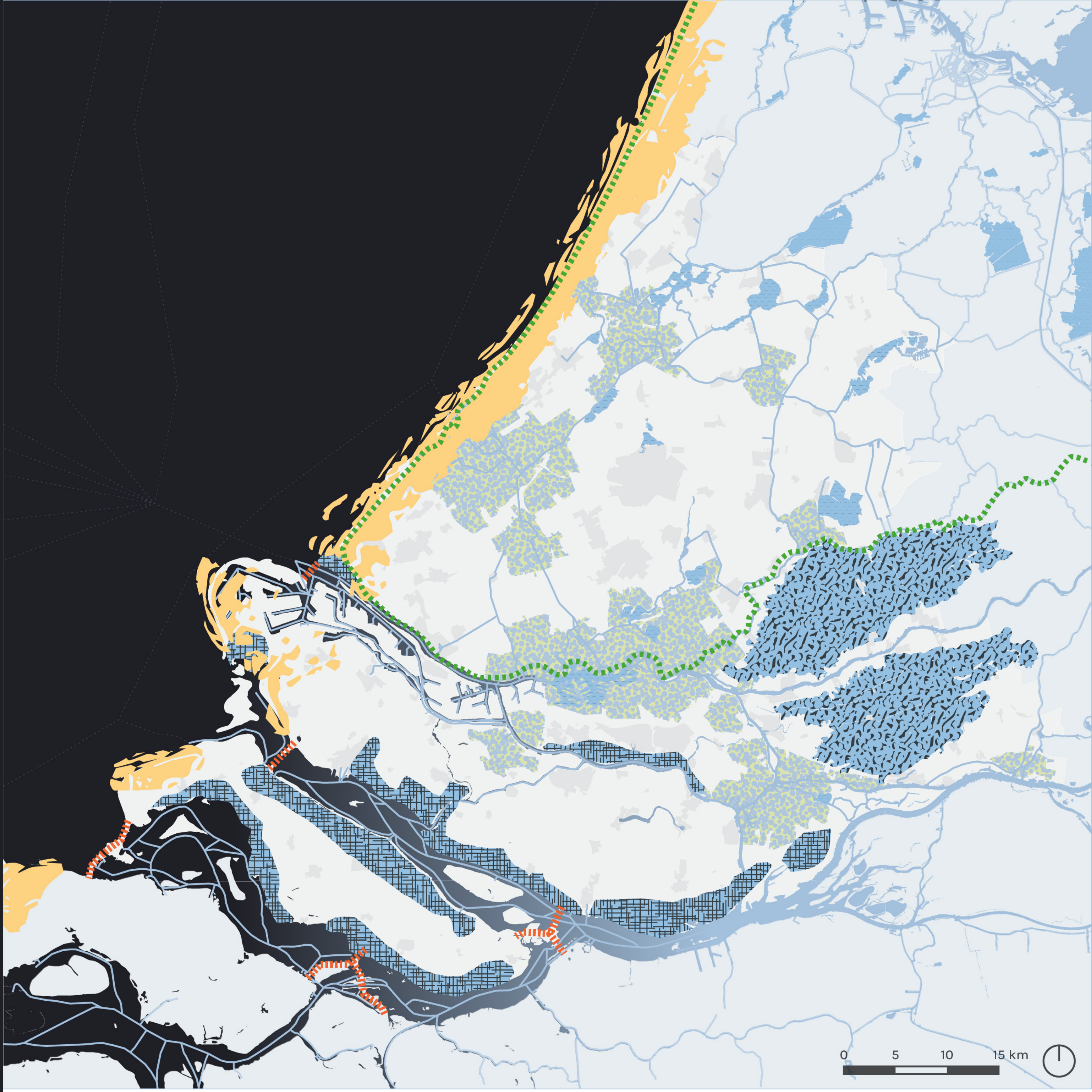


Figure 30: Schematic section of wet peatlands and salt marshes


0
5
10
15 km

4.2 Innovation 2100

Different expertises from around the region are clustered at the Port of Rotterdam, where testing grounds are established to be able to inhabit the previously defined peatlands and salt marshes, as well as redesigning 'dead' oil tankers.
In the cities surrounding the main waterway system, the concept of sponge cities is investigated. This makes the overall infiltration capacity of cities higher. Moreover, waterways within existing cities will be strengthened, facilitating a better connection over water. Solutions will be made for South Holland to once again be able to live in harmony with its, now adaptive, landscape. Eventually, this knowledge will be spread worldwide to other coastal regions with similar contexts who face similar threats.

Legend | Innovation

- knowledge institutions
- knowledge axis
- global export
- port of Rotterdam
- salt marches
- flood plains
- waterbodies
- sponge cities
- dijkring 14
- opening Delta works
- reinforced coastal dunes

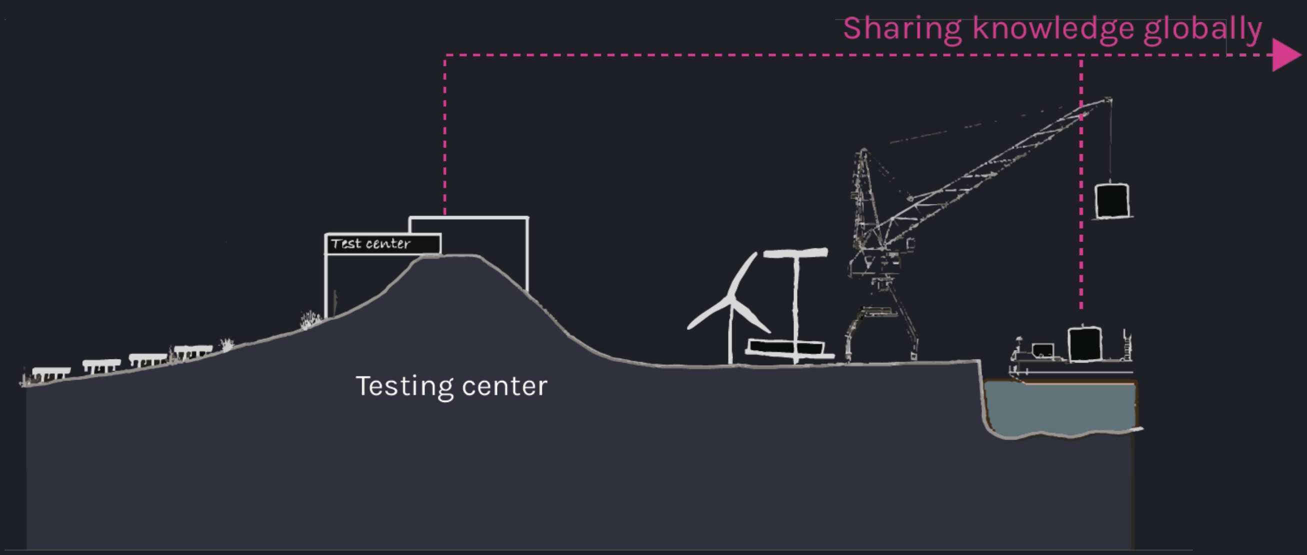
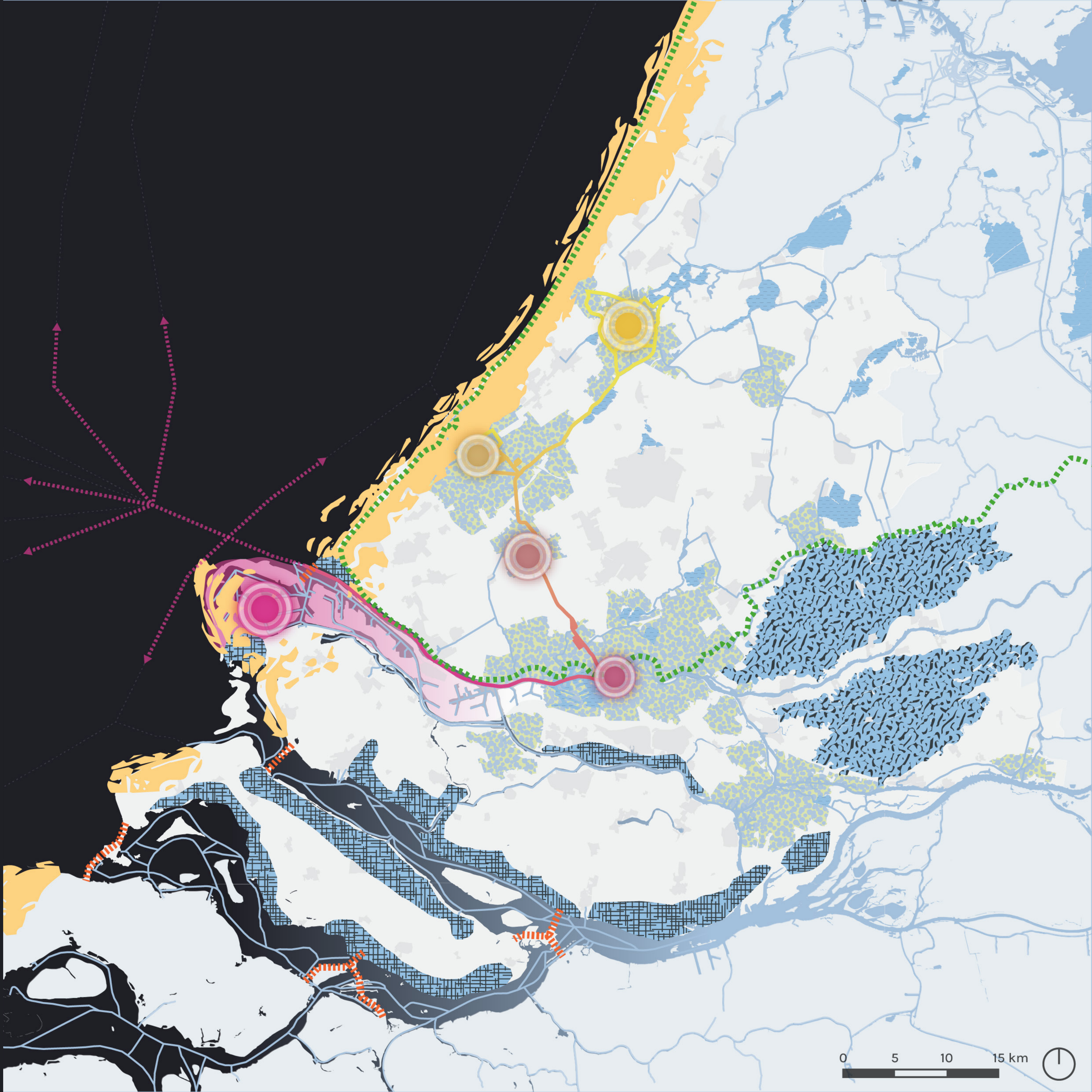


Figure 31: Schematic section of the innovation cluster in the Port of Rotterdam


0
5
10
15 km

4.3 Maritime Manufacturing 2100

Finally, in this story, the Maritime Manufacturing will once again be the main connector of the residents of South Holland, where specialized maker's industries are located on business parks in strategic locations throughout the whole region. It will bridge Dijkring 14 and connect all inhabitants through water-transit oriented development.

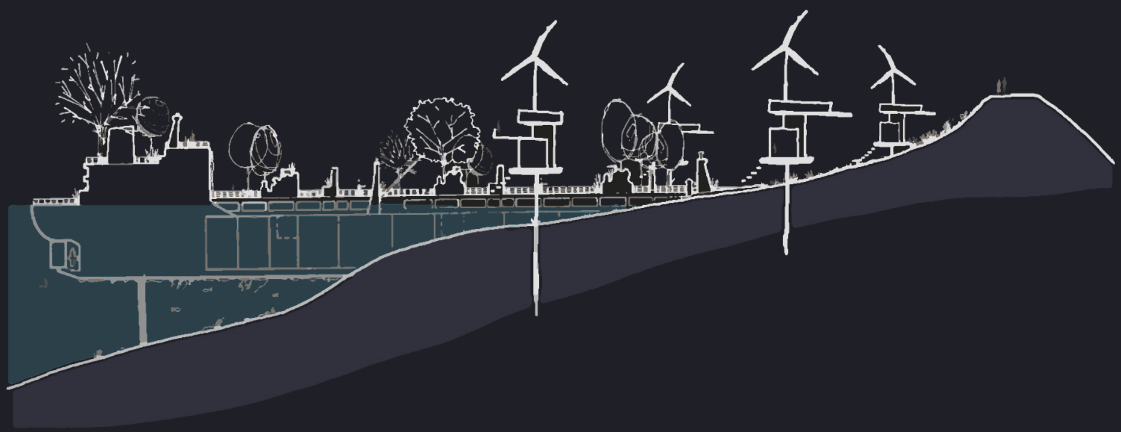
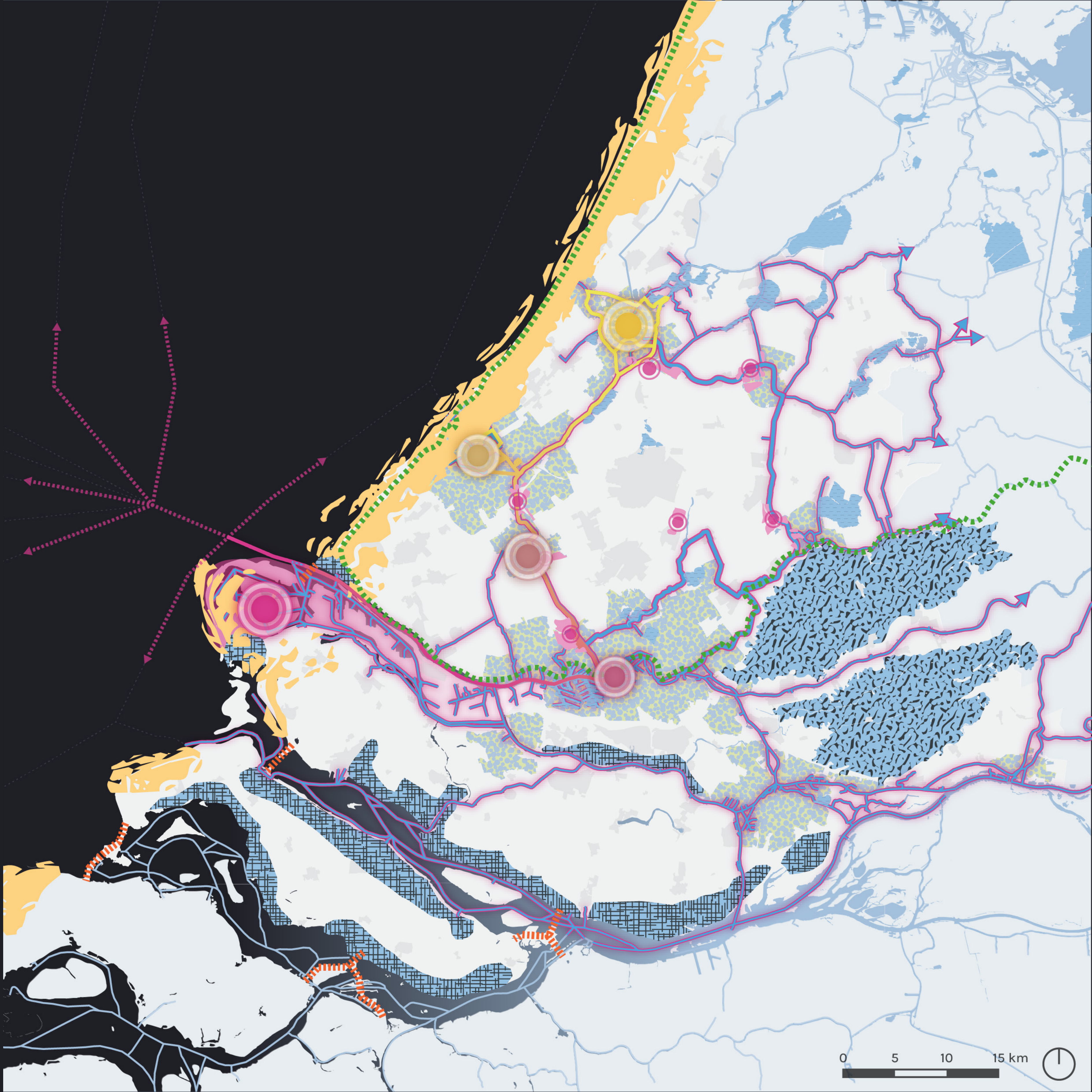
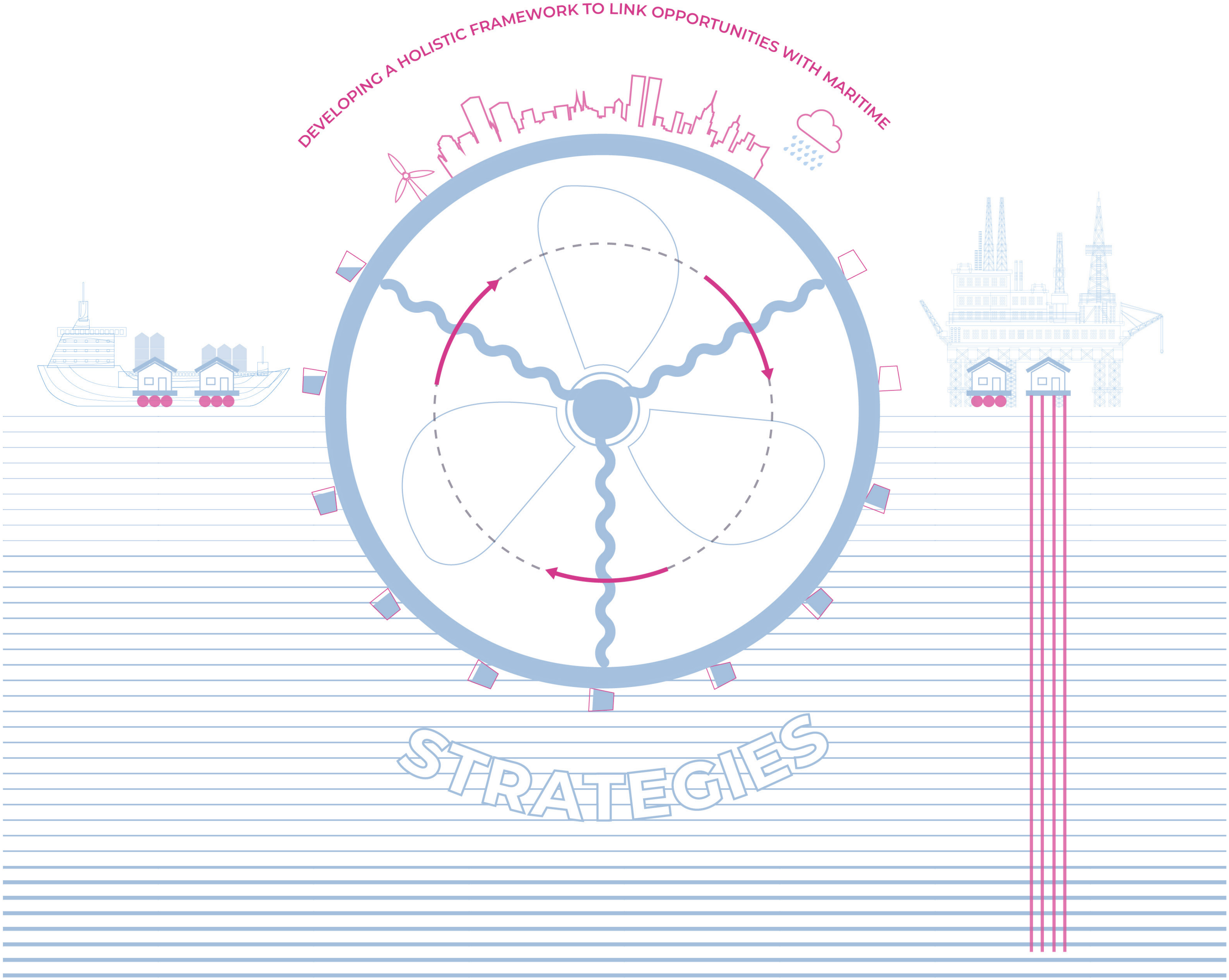


Figure 32: Schematic section of the Maritime Industry as facilitator for adaptivity

Legend | Maritime Manufacturing

- maritime maker's industry
- waterways
- knowledge institutions
- knowledge axis
- global export
- port of Rotterdam
- salt marches
- flood plains
- waterbodies
- sponge cities
- dijkring 14
- opening Delta works
- reinforced coastal dunes


0
5
10
15 km

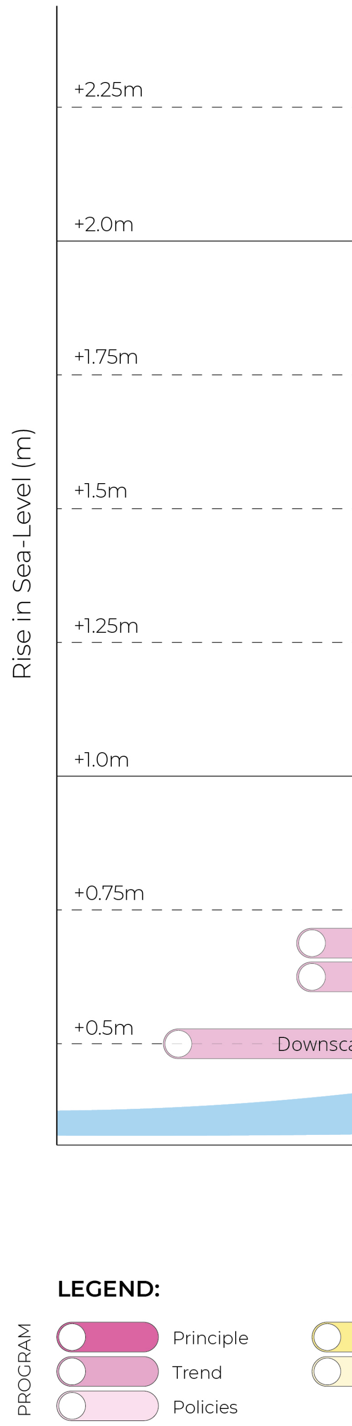

DEVELOPING A HOLISTIC FRAMEWORK TO LINK OPPORTUNITIES WITH MARITIME
STRATEGIES

5. Strategy
5.1 Condition dependent phasing

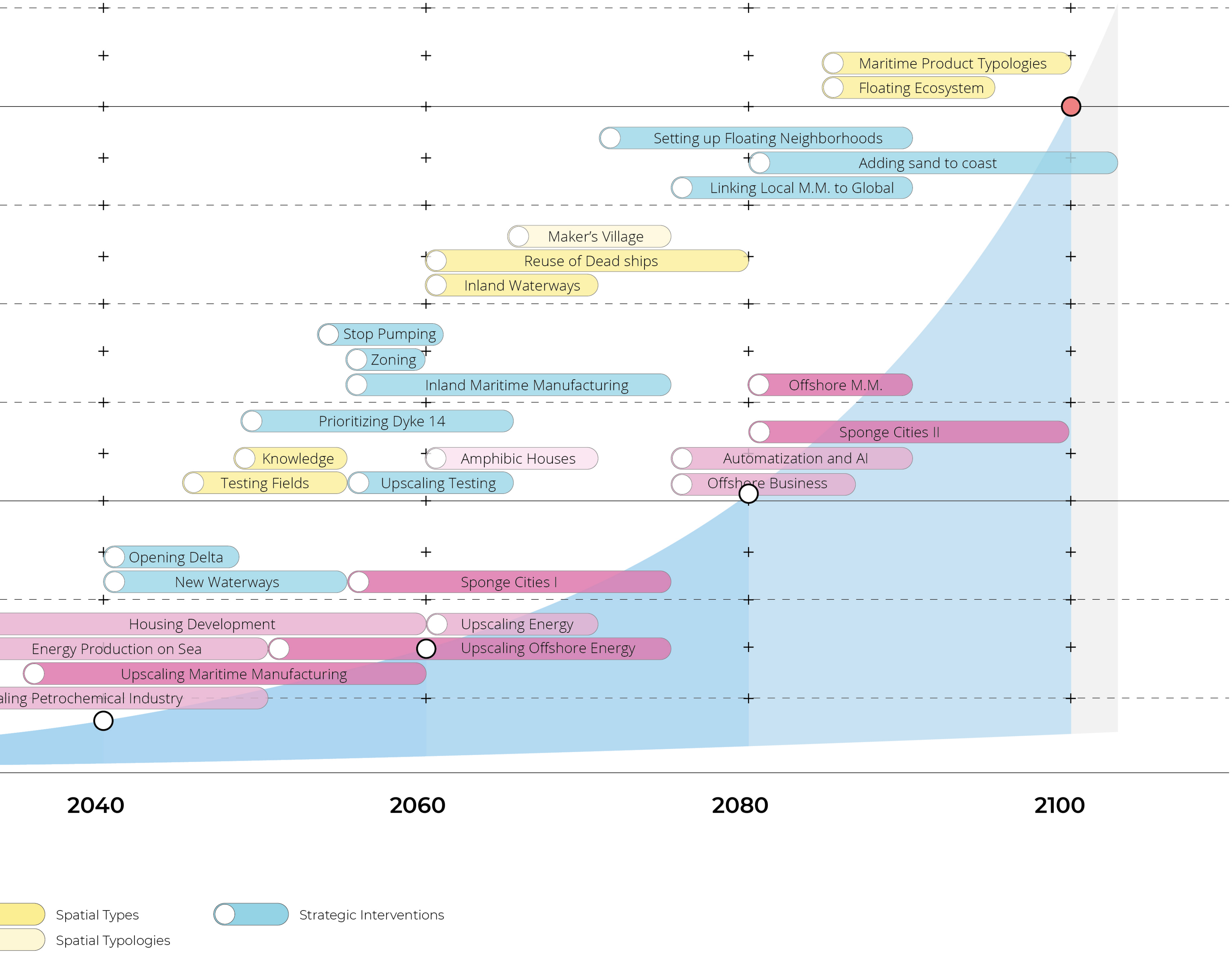
Since the rise in sea-level with each corresponding decade is a consistent but speculative scenario in terms of its degree, the vision strategy was framed along a timeline of 80 years in which each 20 years encase a shift in stage for developing floating ecosystems. The timeline takes a moderate scenario into account to list out a set of trends along with responsive strategic interventions to plan for them. This is done in 3 Action-based phases leading to an adaptive 2100 Landscape:

- Preparation: Restructuring existing infrastructure systems while introducing new ones. This stage also establishes institutions to develop knowledge which responds to the degree of trends with spatial typologies.
- Testing: Capacitation for tested programs and introducing pilot projects to evaluate changes in further spatial typologies to lay foundations for Amphibic settlements. This phase initiates sponge cities to develop protected and water-embracive urban areas.
- Occupation: The outcomes of testing facilities will lead to a range of spatial typologies of maritime products to upscale and link under new policy framework accounting for floating spaces.

Timeline 2100 Visio



n:

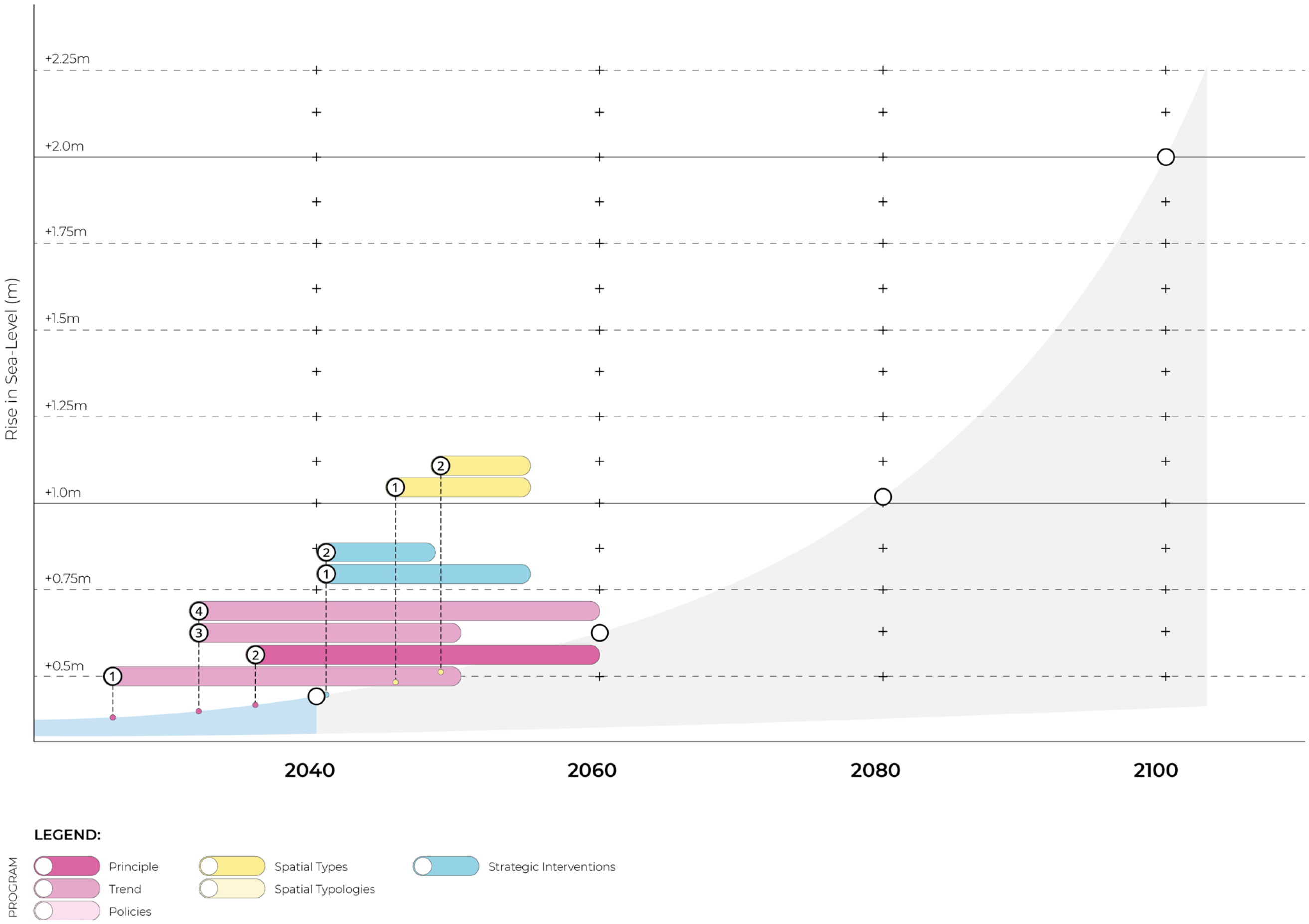


Maritime Product Typologies
Floating Ecosystem
Setting up Floating Neighborhoods
Adding sand to coast
Linking Local M.M. to Global
Maker's Village
Reuse of Dead ships
Inland Waterways
Stop Pumping
Zoning
Inland Maritime Manufacturing
Offshore M.M.
Prioritizing Dyke 14
Sponge Cities II
Knowledge
Amphibic Houses
Automatization and AI
Testing Fields
Upscaling Testing
Offshore Business
Opening Delta
New Waterways
Sponge Cities I
Housing Development
Upscaling Energy
Energy Production on Sea
Upscaling Offshore Energy
Upscaling Maritime Manufacturing
aling Petrochemical Industry
2040
2060
2080
2100
Spatial Types
Spatial Typologies
Strategic Interventions

5.1 +0.4 m sea level rise

5.1.1 Phasing | 2040

PREPARATION: LANDSCAPE & INFRASTRUCTURE



TRENDS:

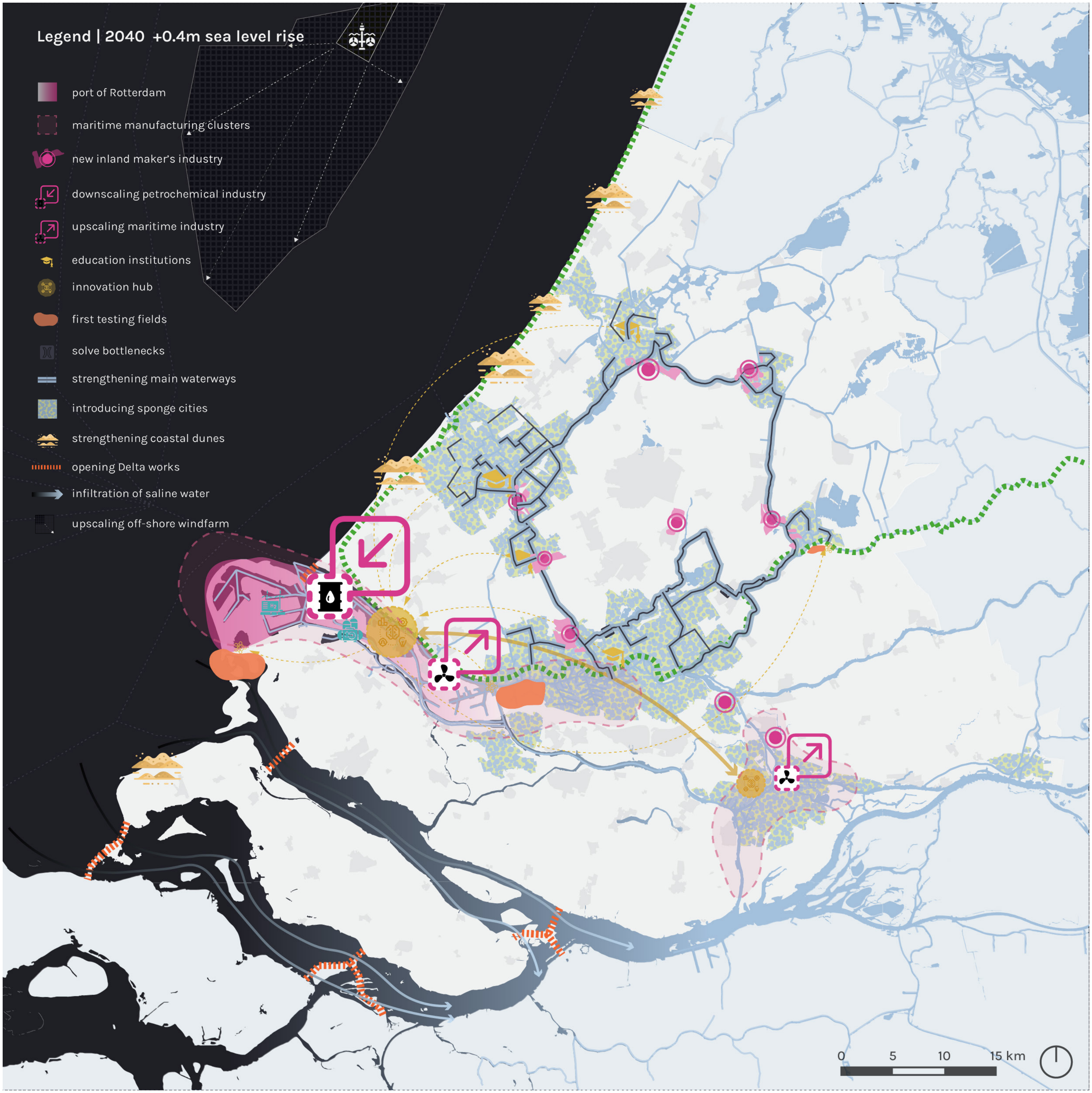
1. **Downscaling**: Petro-chemical industry, increasing availability of space.
3. **Energy**: Shifting energy production to the sea.
4. **Housing**: Development of Housing to cater rising housing demand.

PRINCIPLES:

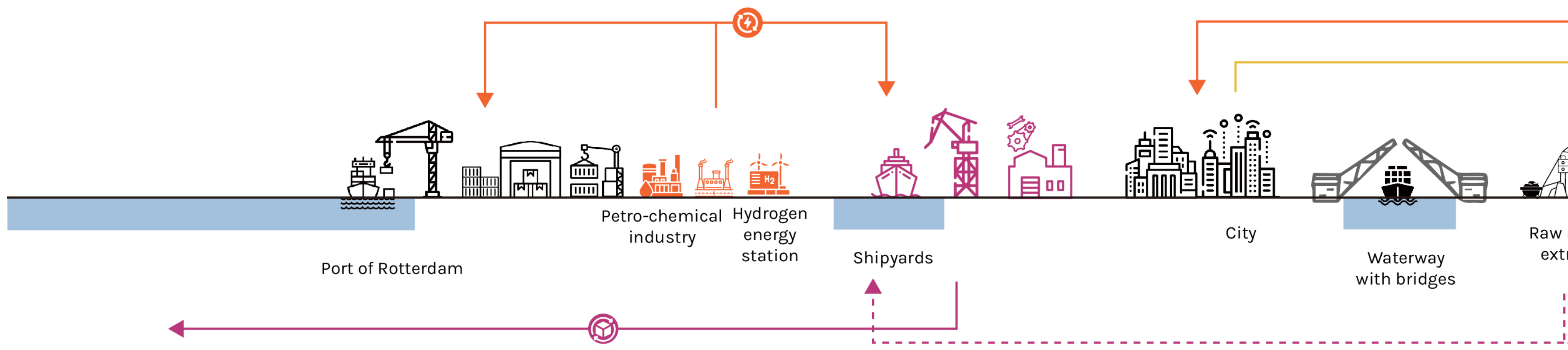
2. **Upscaling**: Maritime Manufacturing industry along augmented water networks.

1. Strengthening existing waterways and creating new water networks.
2. Opening the delta dams to let water in.

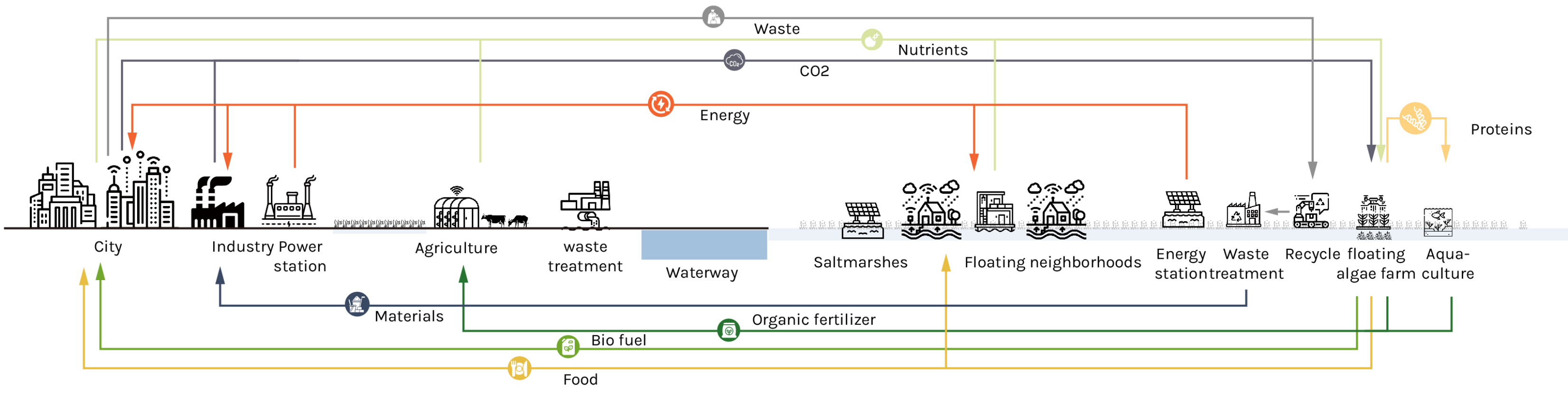
1. Identifying and Establishing Testing fields for Pilot projects and Floating units.
2. Setting up Knowledge centers around Testing fields.

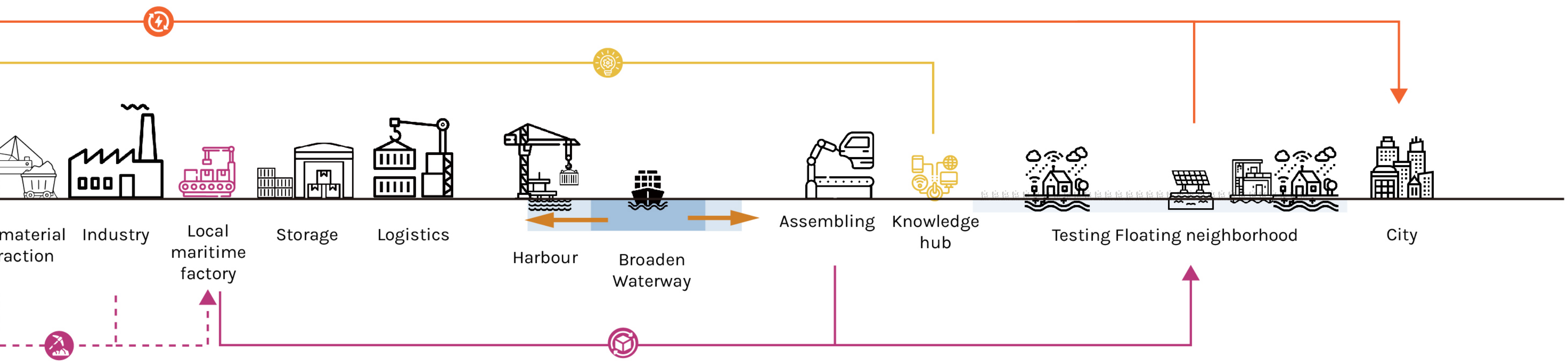

Legend | 2040 +0.4m sea level rise
port of Rotterdam
maritime manufacturing clusters
new inland maker's industry
downscaling petrochemical industry
upscaling maritime industry
education institutions
innovation hub
first testing fields
solve bottlenecks
strengthening main waterways
introducing sponge cities
strengthening coastal dunes
opening Delta works
infiltration of saline water
upscaling off-shore windfarm
0
5
10
15 km

Section | strengthing exting watereways



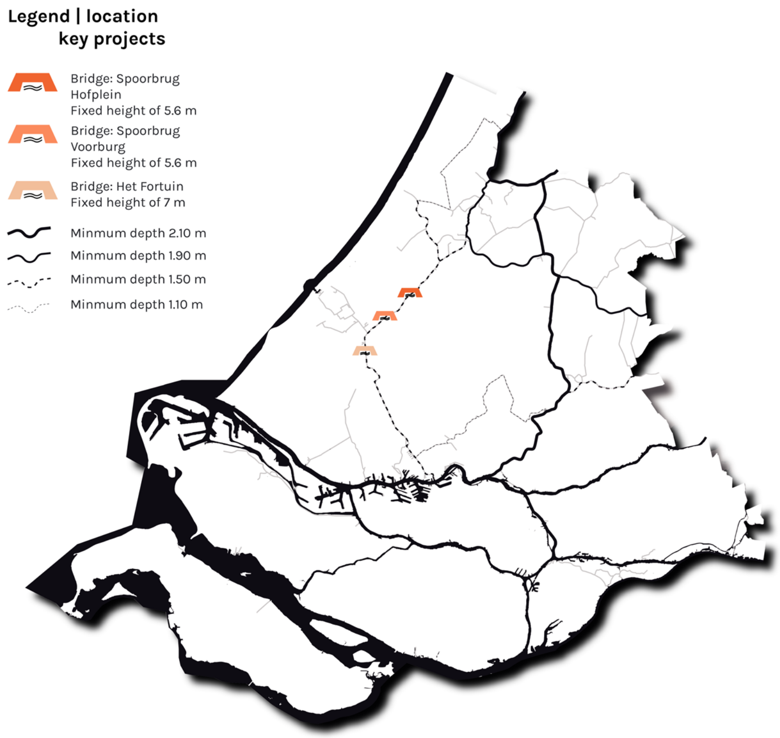
Section | connection citties and floating neigherhoods



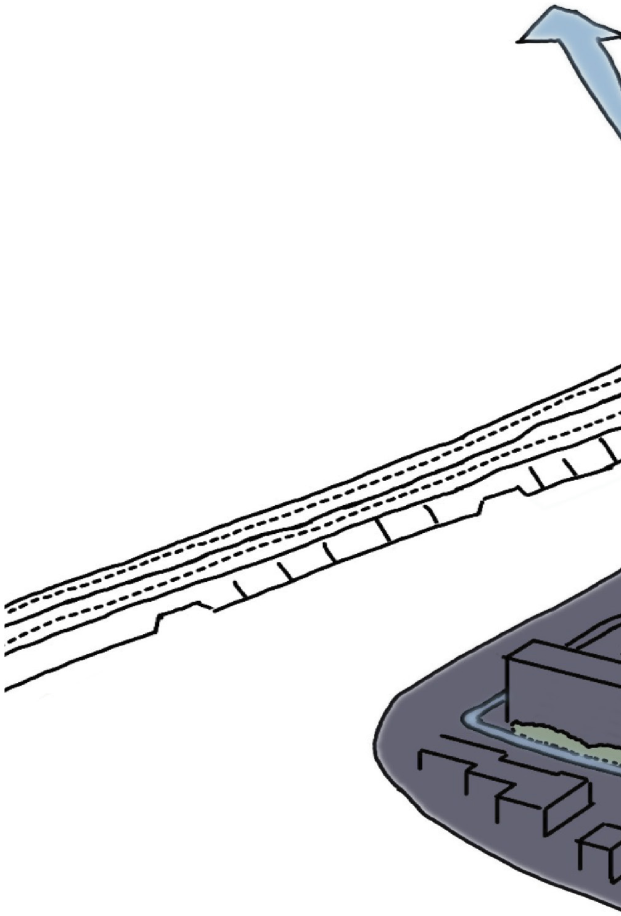


5.1.2 Expanding waterways

This keyproject is located along the schie. The schie is in the network of waterways the one that needs the most attention, by getting rid of bottlenecks here they waterway network can function better as a whole. The bottleneck we address in this keyproject is de Fortuin bridge in the hague. This bridge is part of the A4 highway. Also in this keyproject we show how the specialist maritime industry is located along the waternetwork and the sponge city concept.



Legend | key projects
The Hague
waterways
business area
sponge city
maritime manufactoring
highway A4
movable bridge
Schie
Highway A4
Highway A4

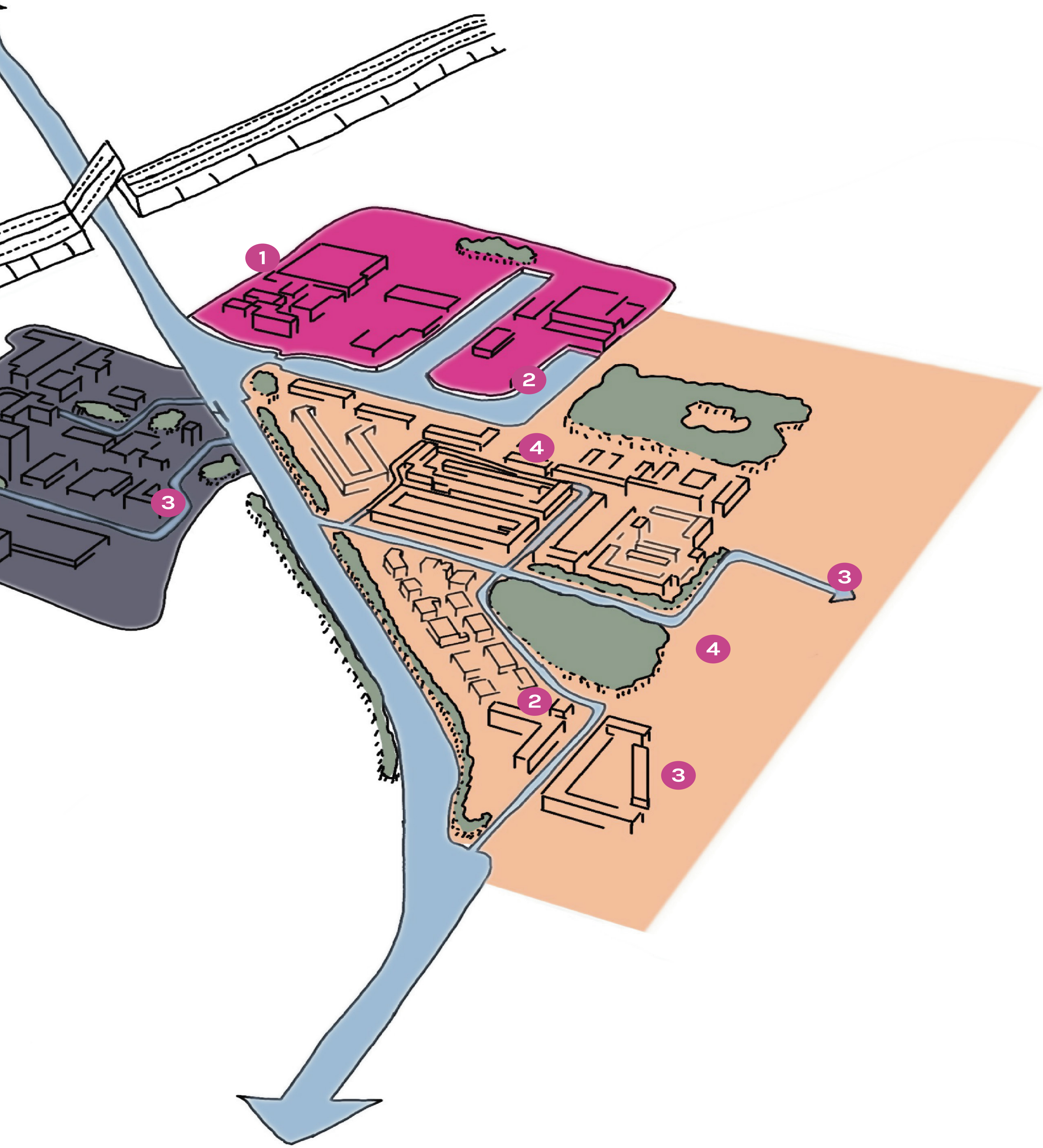


1. Strengthen the waterways

2. Autonomous boat

3. Wadi

4. Water retention park


1
2
4
3
3
4
2
3

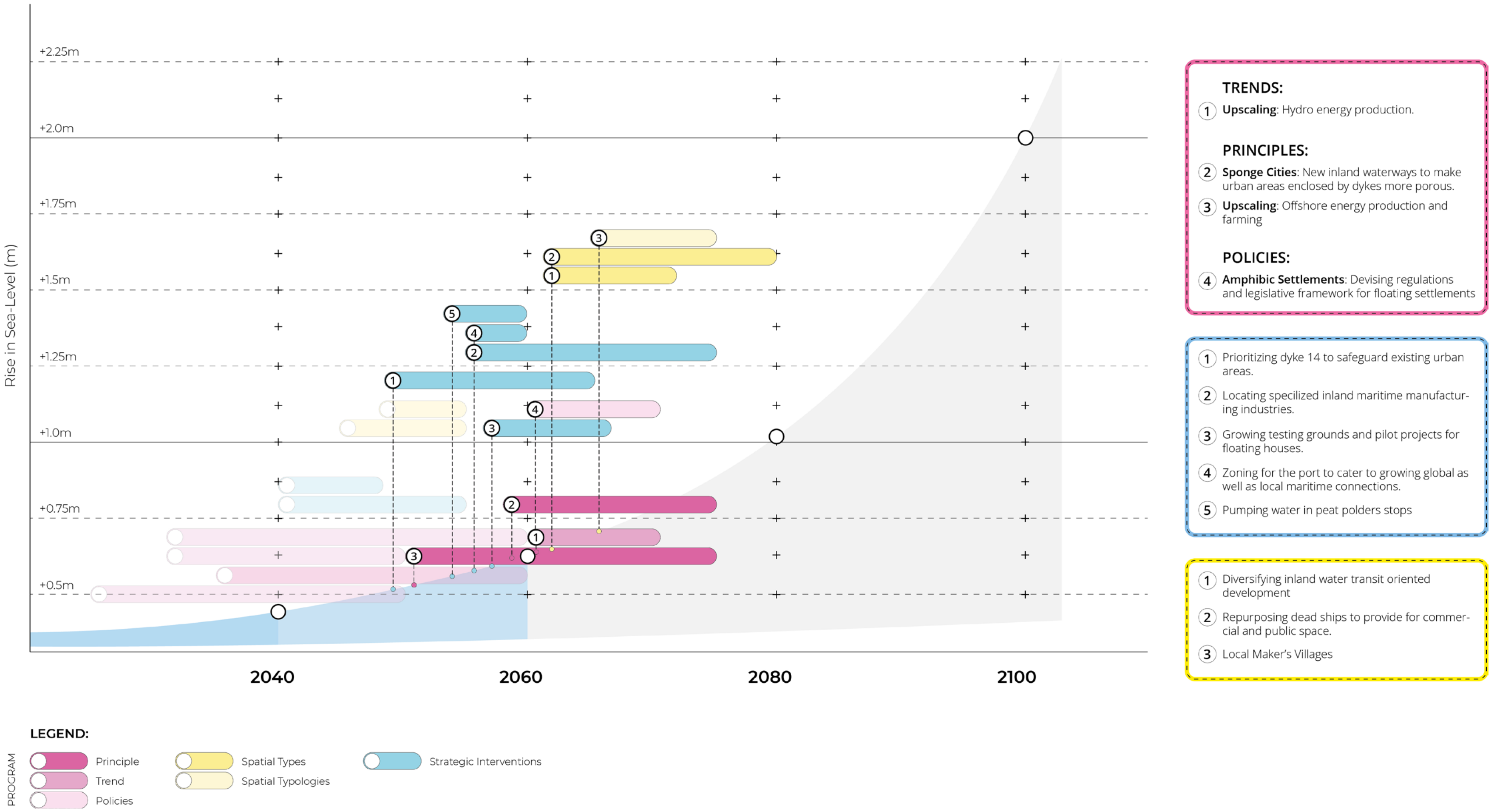

COTTON ON
COTTON ON

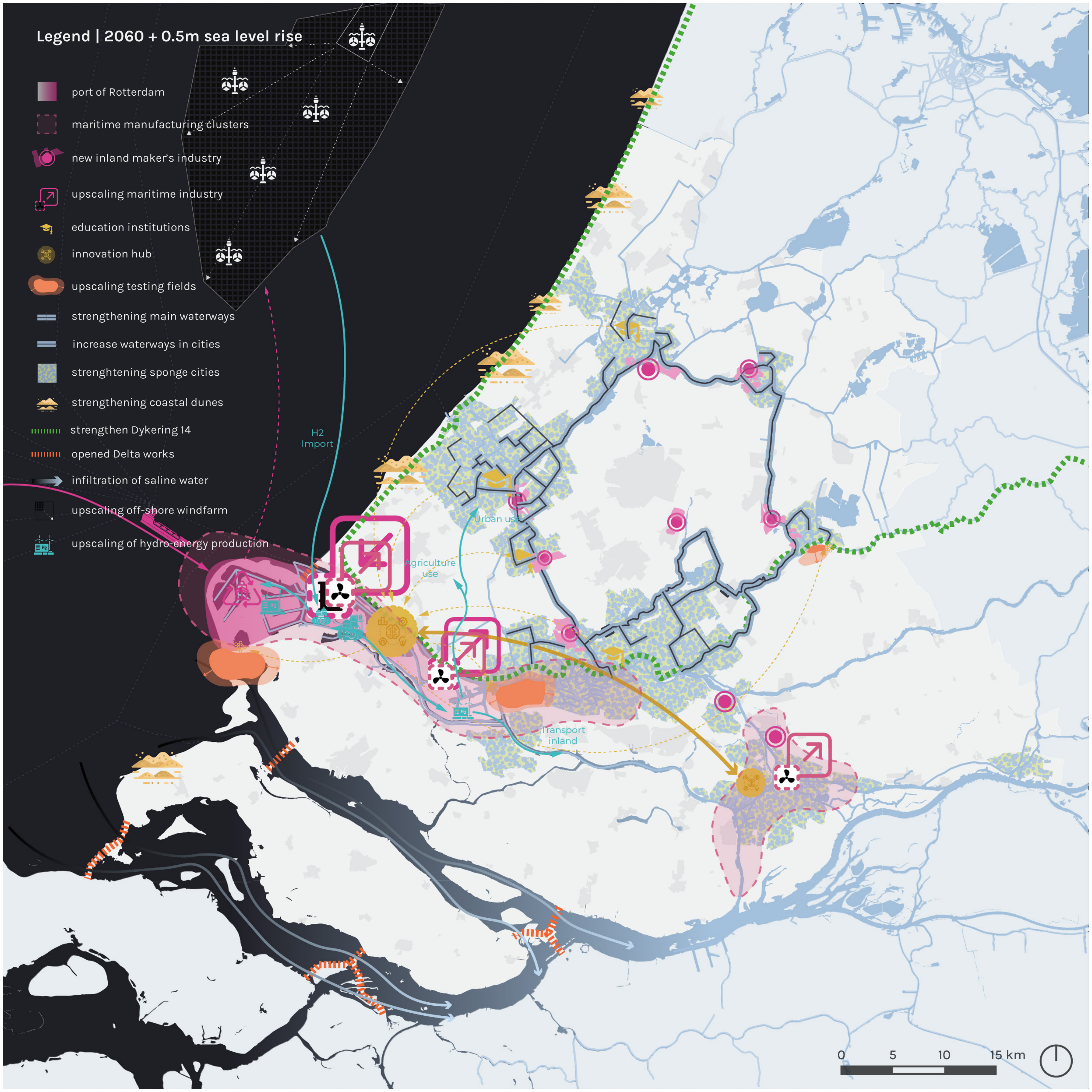

Patentlaan
RIJSWIJK

5.2 +0.55 m sea level rise

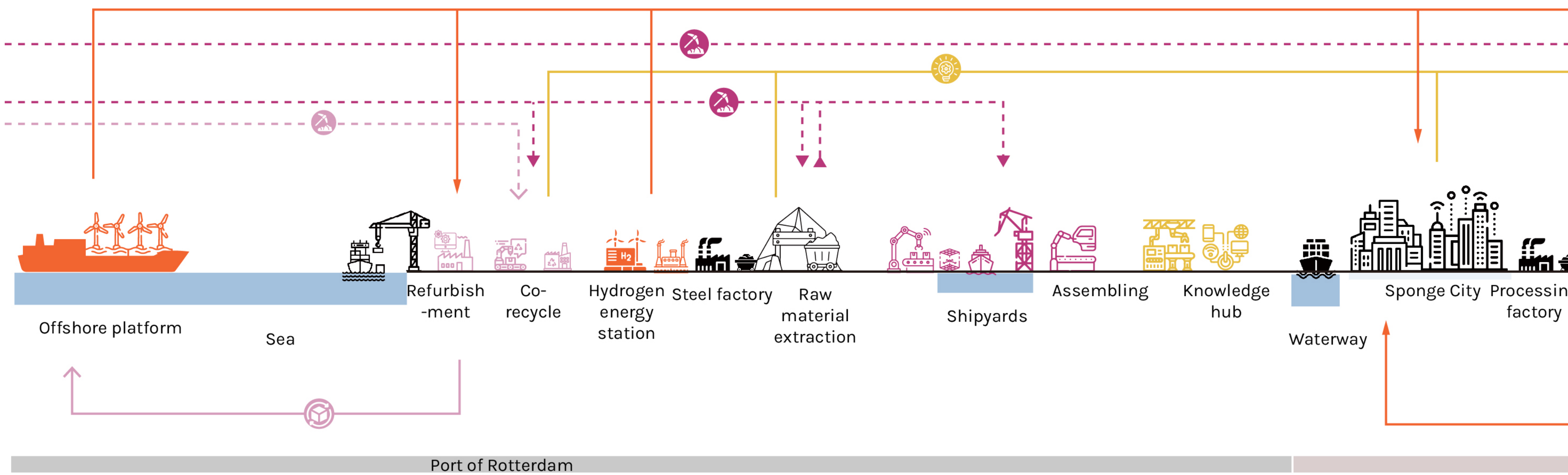
5.2.1 Phasing | 2060

TESTING: CAPACITY & PILOT PROGRAMS

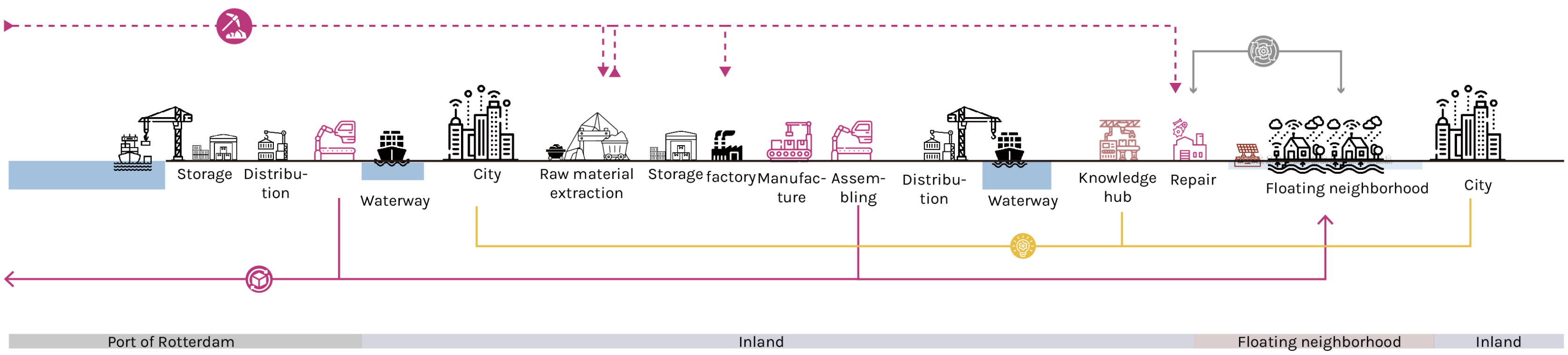


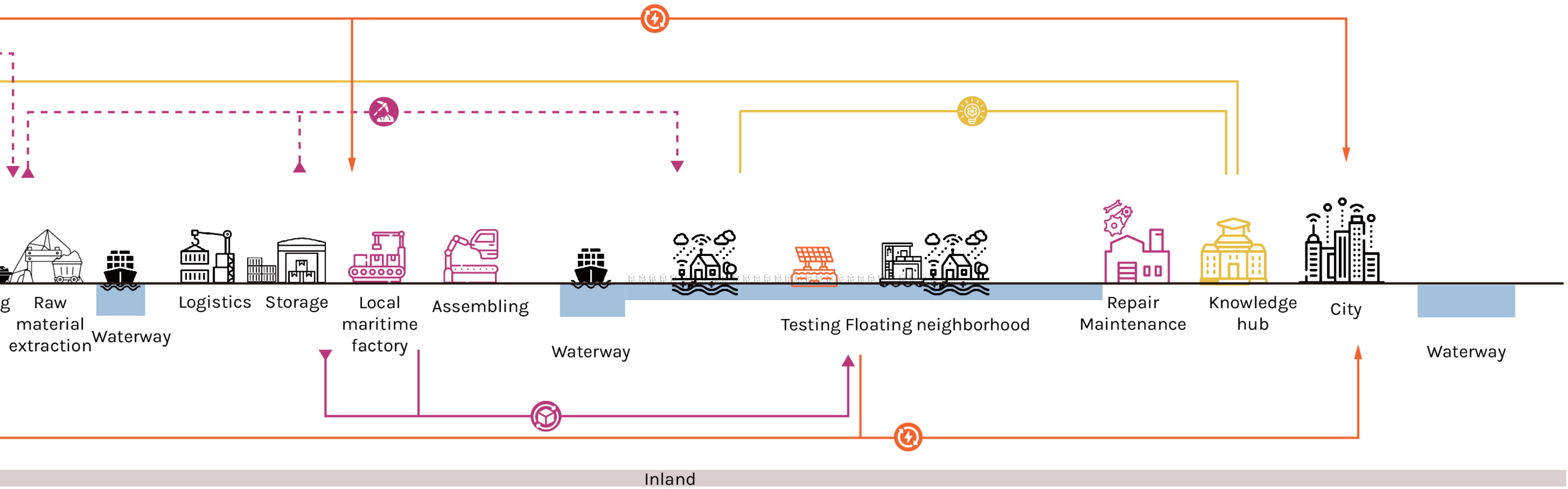

Legend | 2060 + 0.5m sea level rise
port of Rotterdam
maritime manufacturing clusters
new inland maker's industry
upscaling maritime industry
education institutions
innovation hub
upscaling testing fields
strengthening main waterways
increase waterways in cities
strenghtening sponge cities
strengthening coastal dunes
strengthen Dykering 14
opened Delta works
infiltration of saline water
upscaling off-shore windfarm
upscaling of hydro-energy production
H2
Import
Urban use
Agriculture
use
Transport
inland
0
5
10
15 km

Section | locating local martime industry



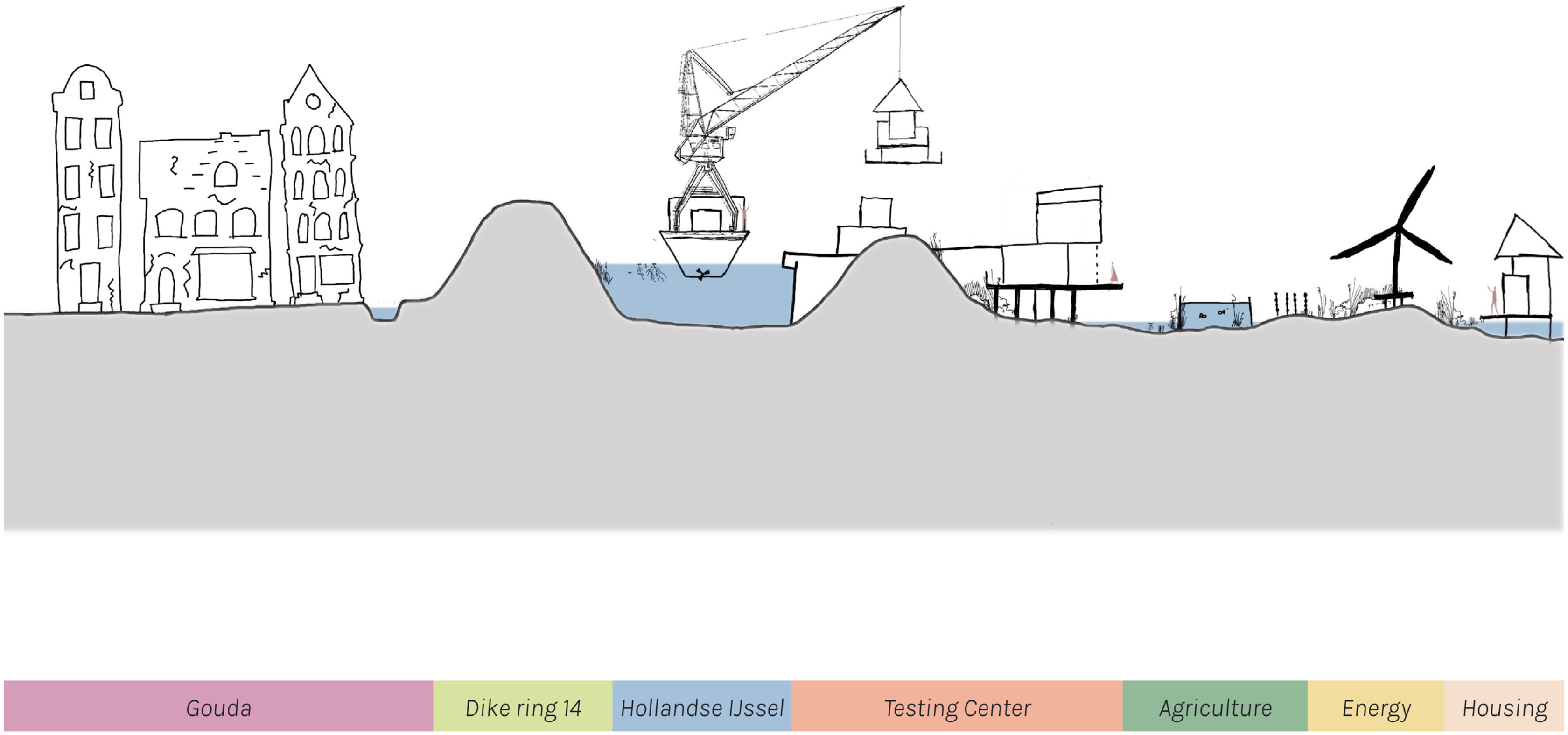
Section | specilized maritime industries





5.2.2 Wet peatlands: testing location

This key project is located on the southern part of gouda. On this location the peat soil reaches till the river the Hollandse IJssel and an already existing harbor is located here. which allows the maritime manufacturing to reach this area.



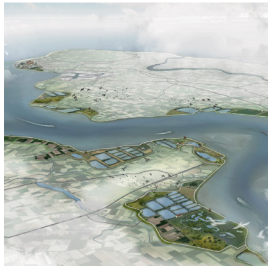

Legend | key projects
Gouda
water
housing
agriculture
maritime industry
mobility
test center
waste and water treatment
energy
recreation
strengthing dike ring 14
250
500 m

1. Windturbine

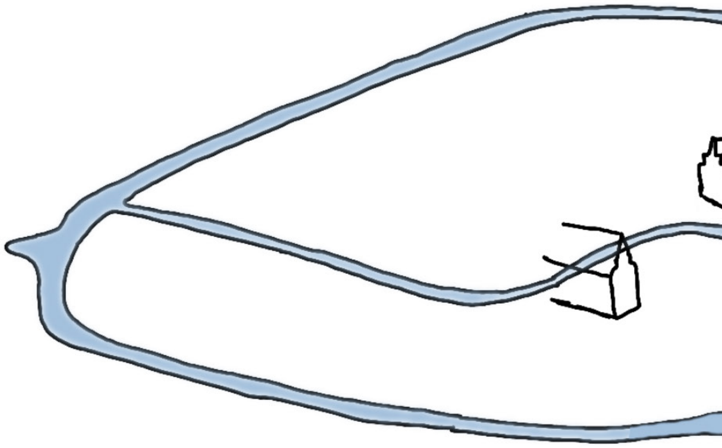
2. Aquaponics and aeroponics

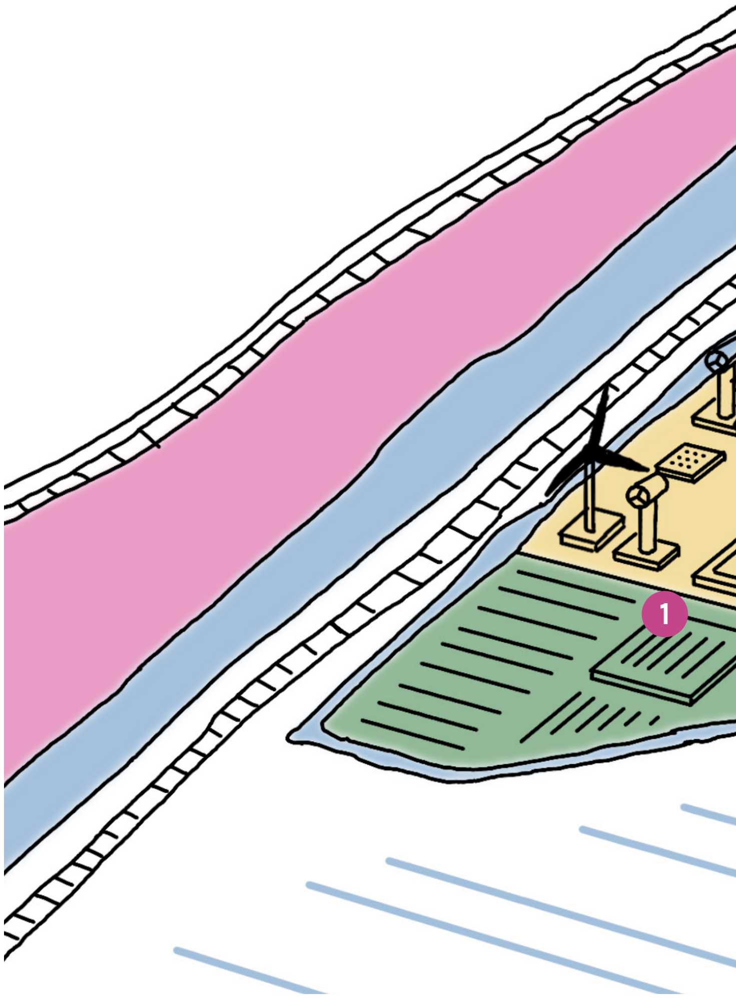
3. Floating farm

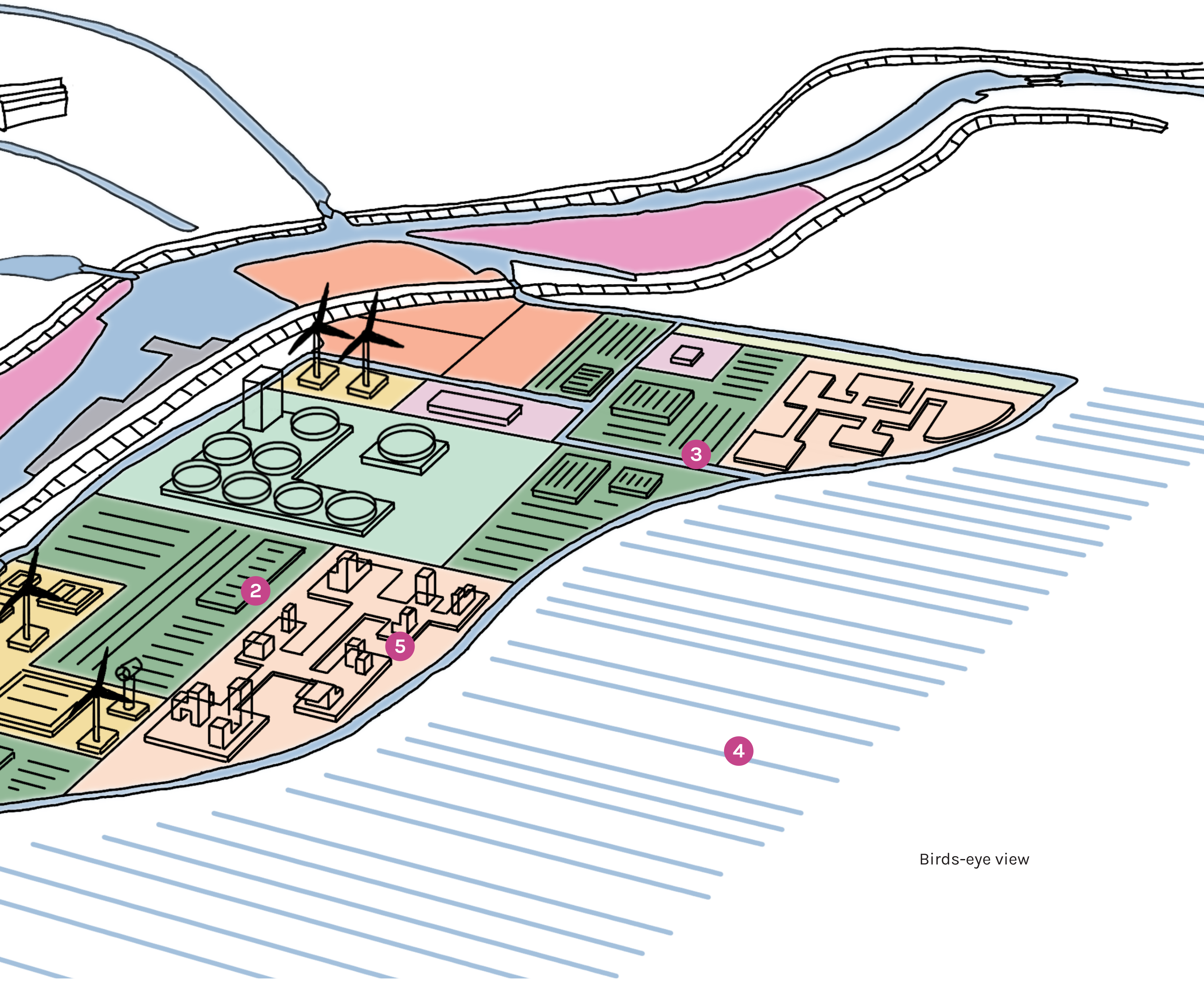
4. Wisselpolder



5. Suspended Pavilion





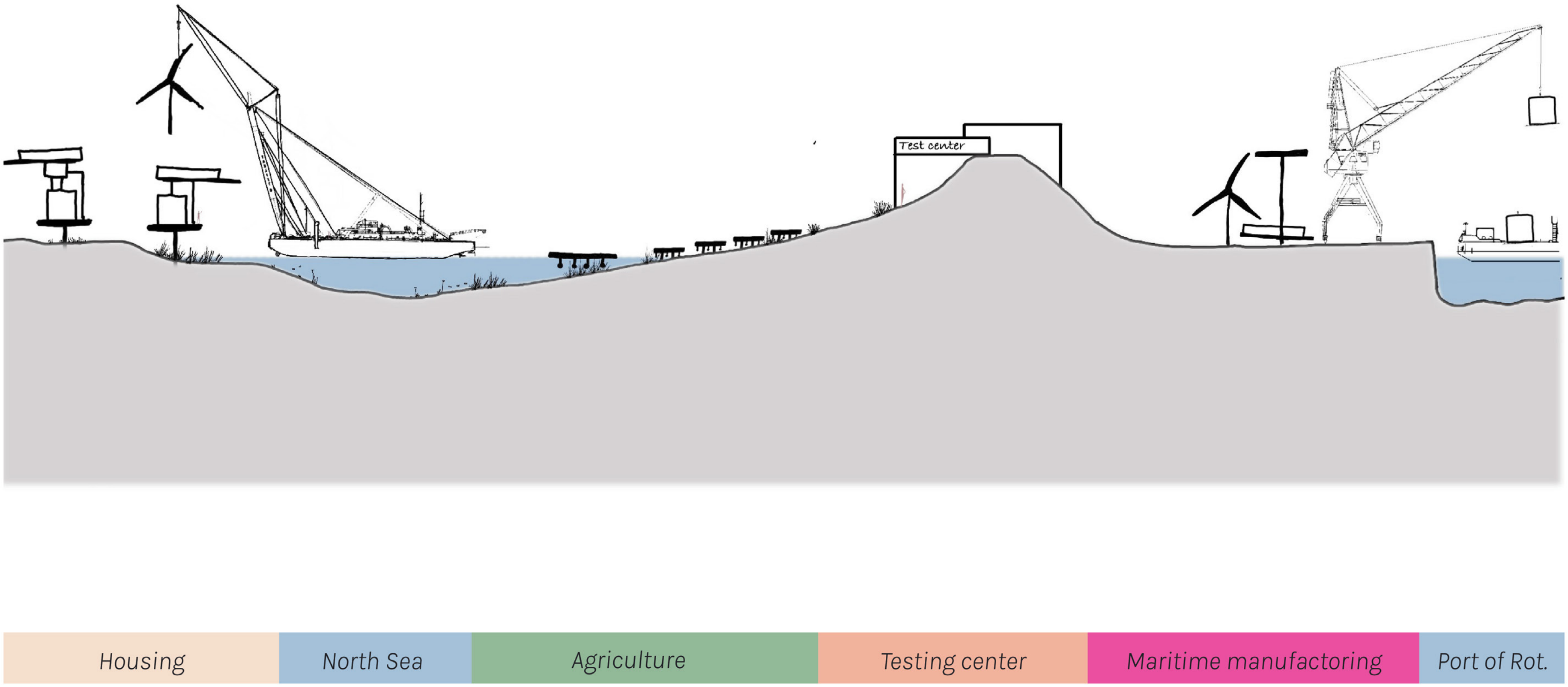


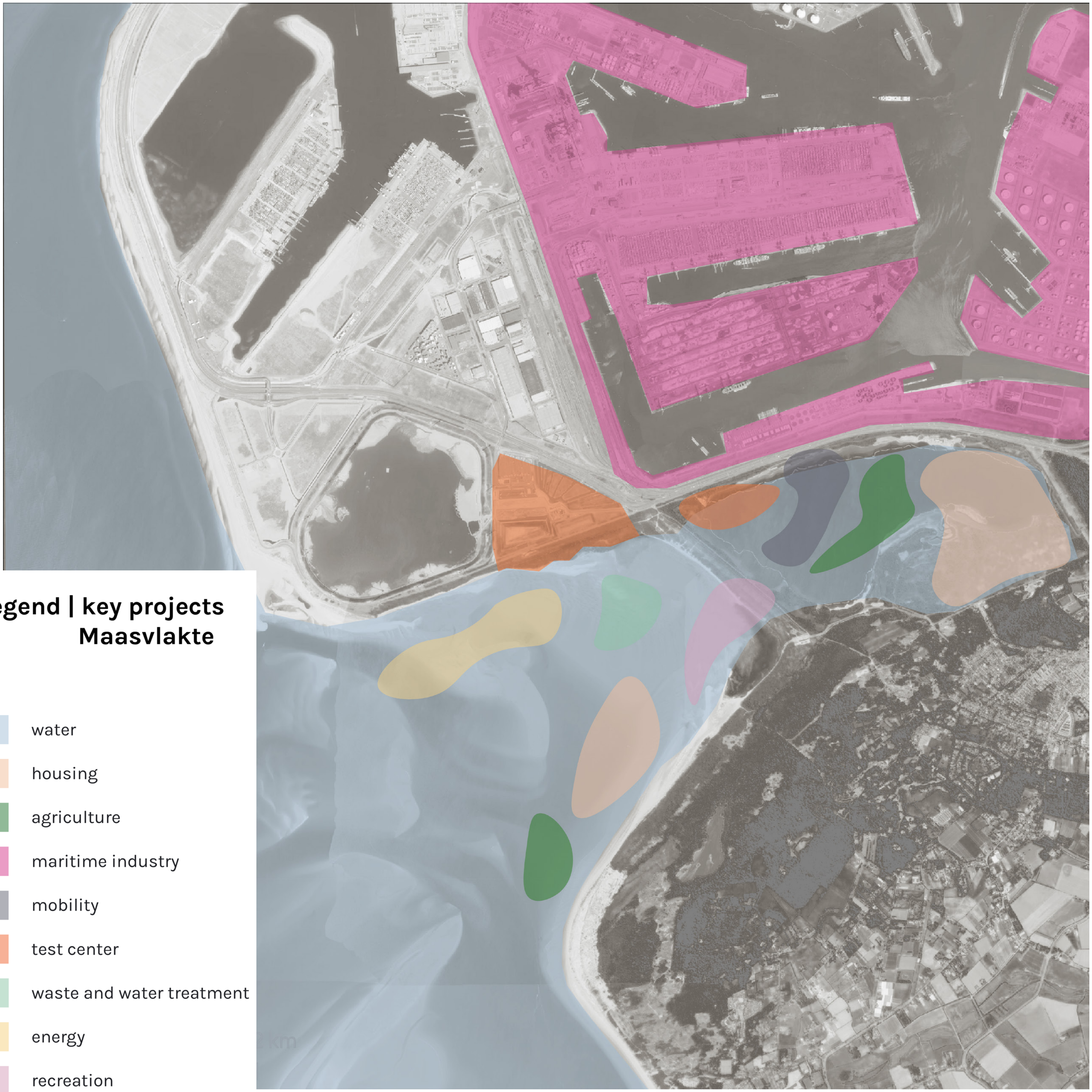
Birds-eye view

5.2.3 Saltmarshes: testing location

The location of this testing field is located at Maasvlakte 2. This location is wise because of the already existing knowledge there and the spacial characteristics of the land here allows the saltmarshes to develop.

The testing field is meant as a place where knowledge is applied to practice. here different innovative ideas can be tested in full scale. The testing field located at the maasvlakte 2 is intended for testing the saltmarshes. Here there can be tested if and how long it takes to establish a salt marshes and how it developes over time. On the saltmarsh different occupation can be developed and tested. Like tidal energy statation, floating farms, water treatment oil tankers etc.



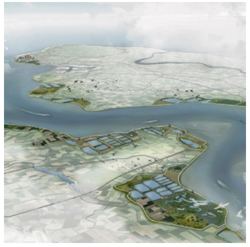


Legend | key projects Maasvlakte

- water
- housing
- agriculture
- maritime industry
- mobility
- test center
- waste and water treatment
- energy
- recreation

1. Aquaponics and aeroponics

2. Wisselpolder



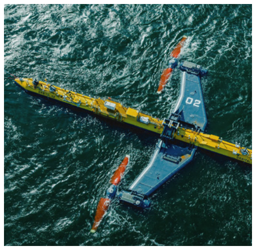
3. Floating farm

4. Autonomous boat

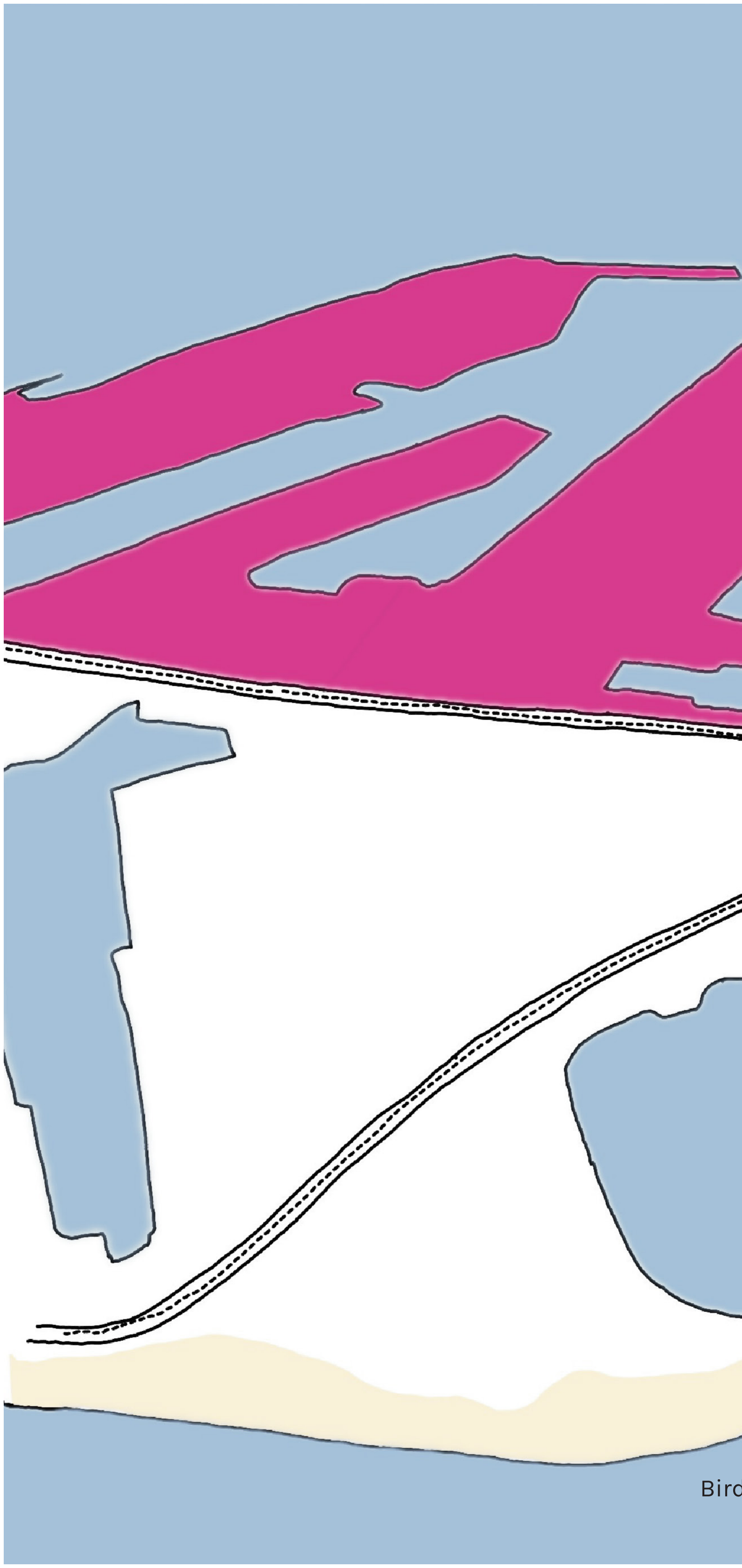
5. Windturbine

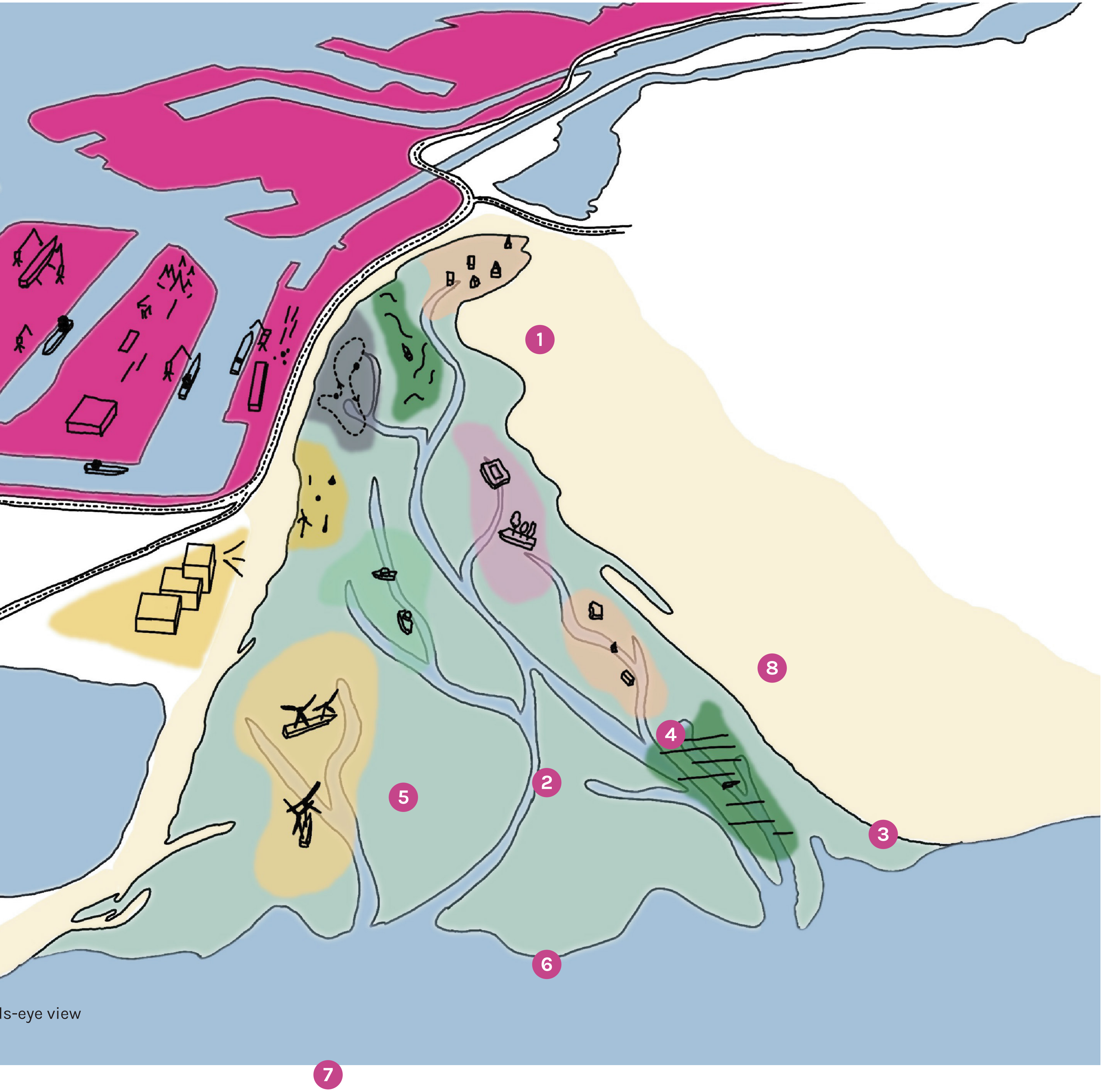
6. Wave energy

7. Tidal turbine



8. Suspended Pavilion





ls-eye view

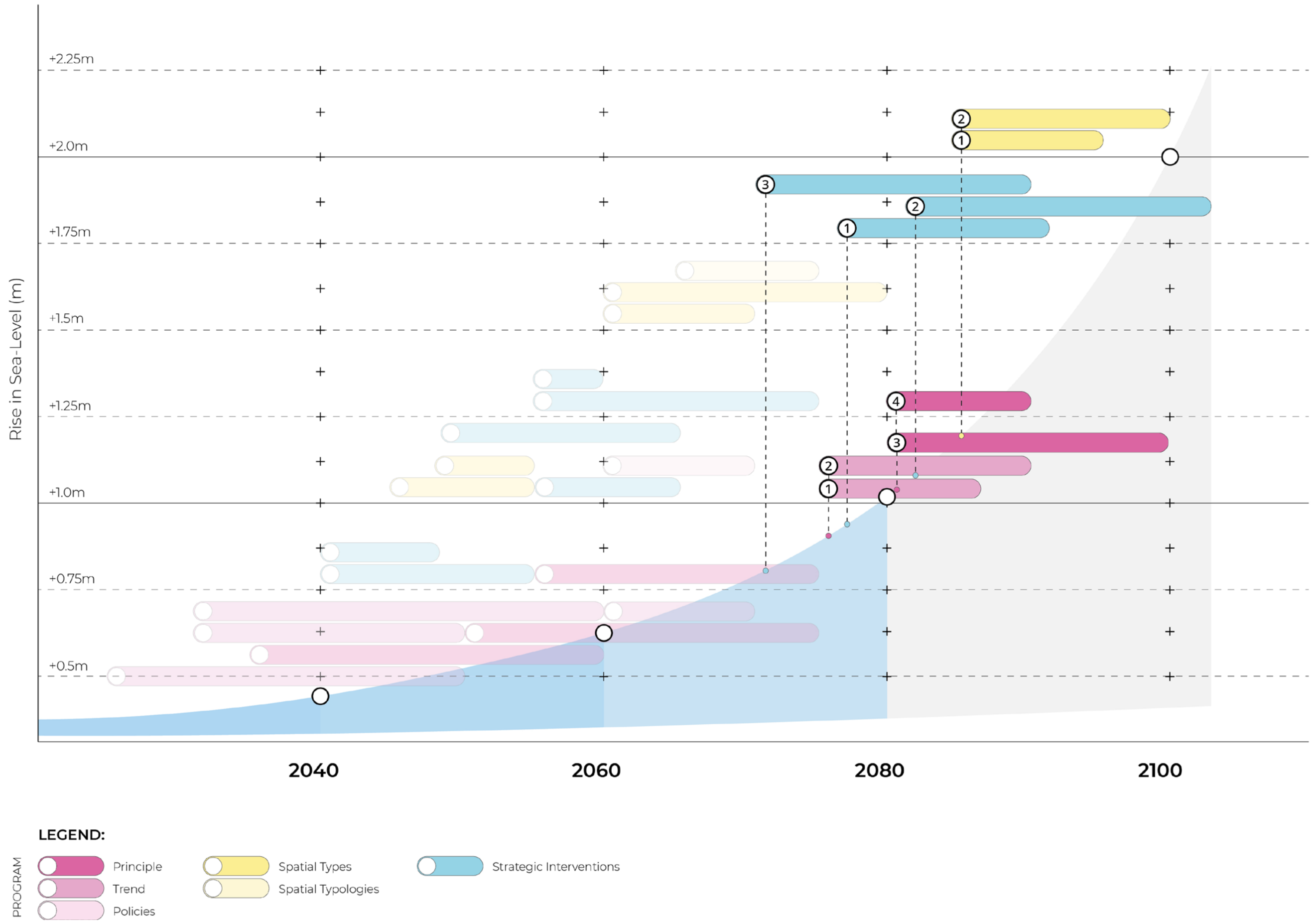

MARK
Italian


MAASVLAKTE

5.3 +1 m sea level rise

5.3.1 Phasing | 2080

OCCUPATION: UPSCALING & LINKING



TRENDS:

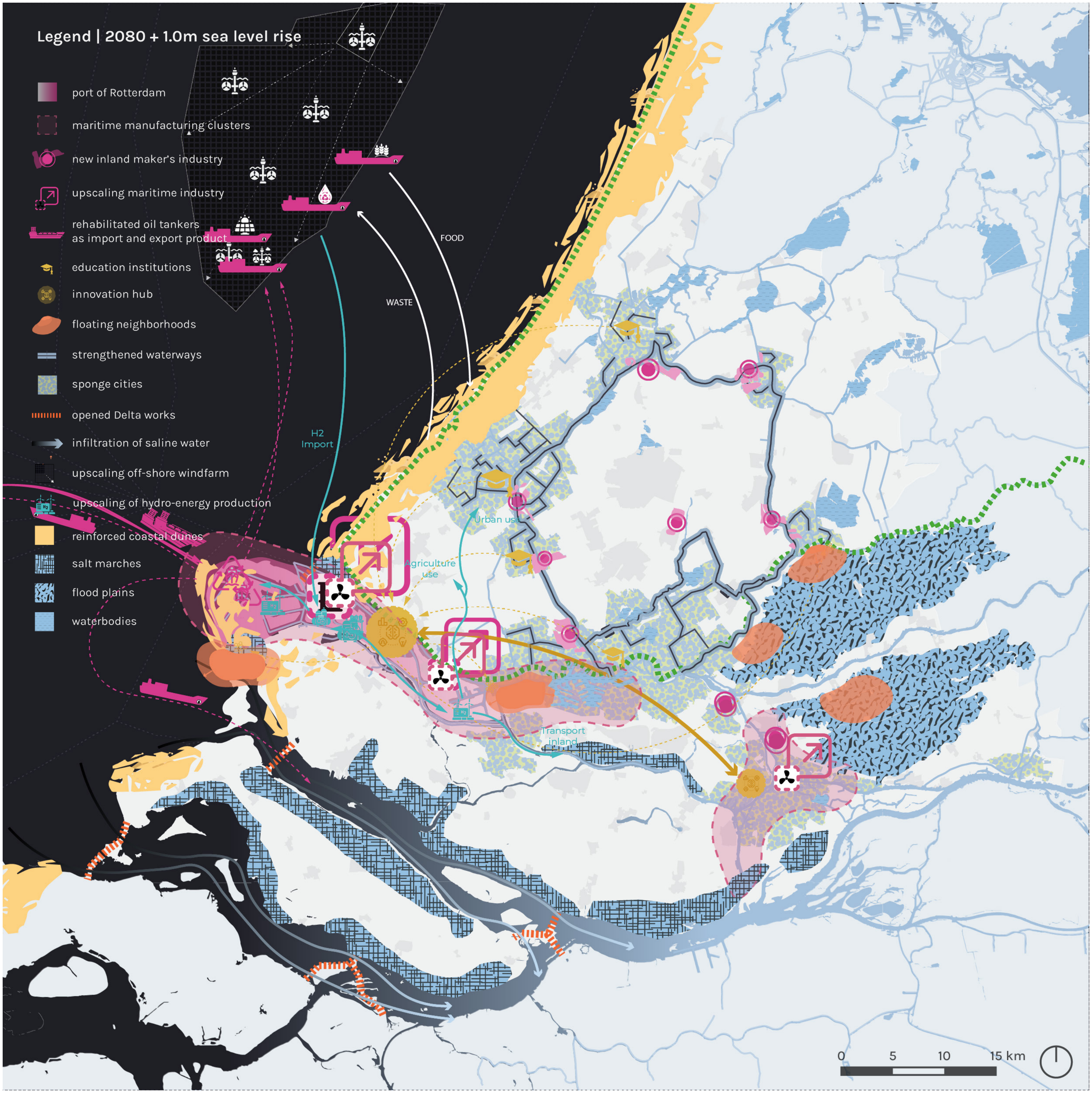
1. **Upscaling**: Offshore business and trade.
2. **Automatization:** Application of AI for port logistics.

PRINCIPLES:

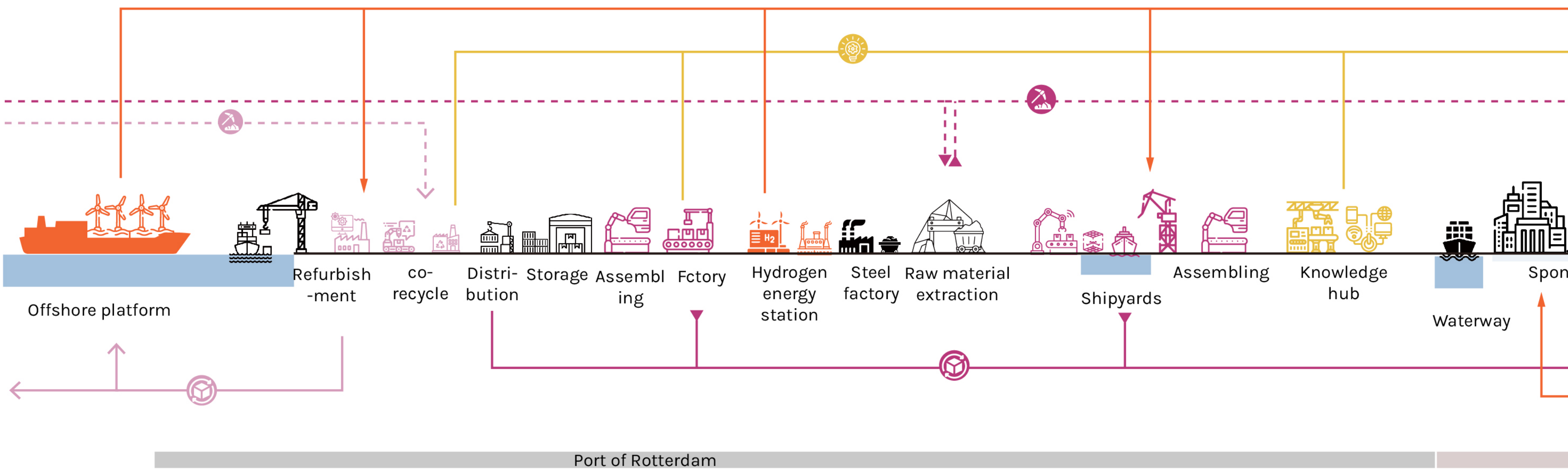
3. **Sponge Cities**: Further increasing networks of inland waterways.
4. **Upscaling**: Offshore maritime manufacturing to cater increased trade opportunities.

1. Linking specialized Maritime Manufacturing industries to port's industries.
2. Adding sand to coast and Port.
3. New floating neighborhoods set-up in transformed Landscapes.

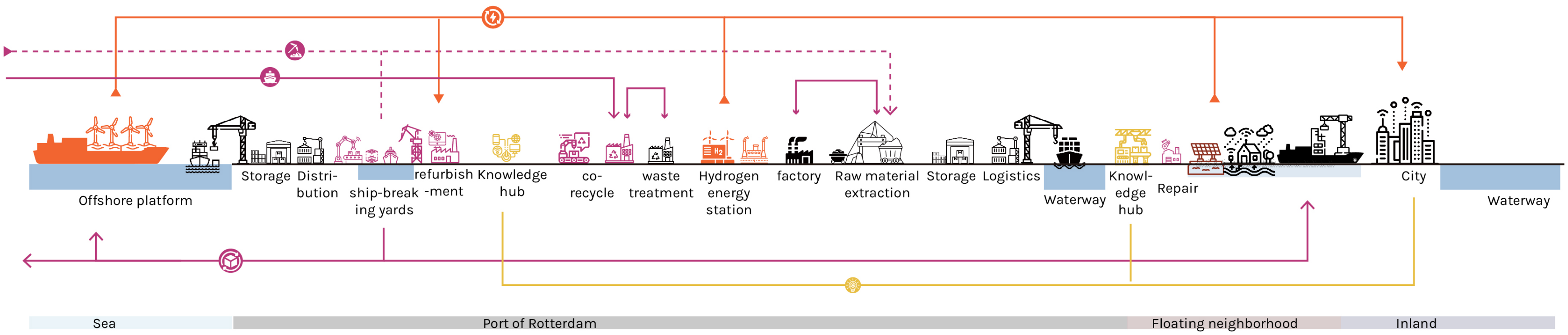
1. Floating/Amphibic ecosystems are established within neighborhoods.
2. Neighborhoods are assisted by maritime product typologies in following themes:
-Energy Production
-Food Production
-Recreation around water
-Transportation

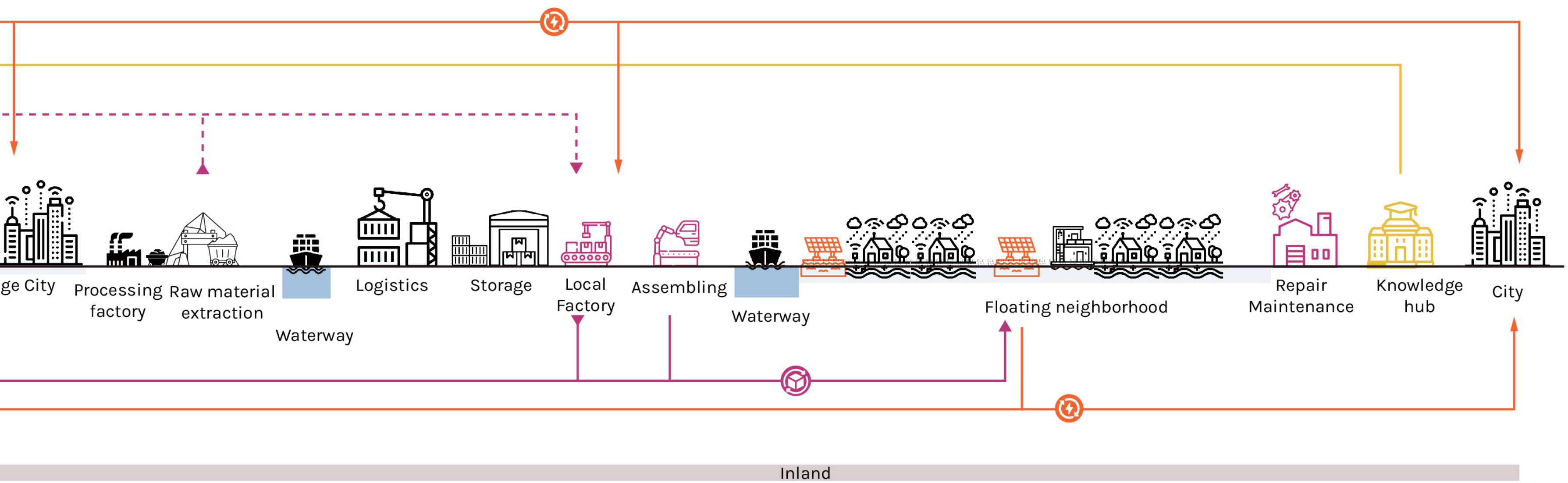

Legend | 2080 + 1.0m sea level rise
port of Rotterdam
maritime manufacturing clusters
new inland maker's industry
upscaling maritime industry
rehabilitated oil tankers as import and export product
education institutions
innovation hub
floating neighborhoods
strengthened waterways
sponge cities
opened Delta works
infiltration of saline water
upscaling off-shore windfarm
upscaling of hydro-energy production
reinforced coastal dunes
salt marches
flood plains
waterbodies
FOOD
WASTE
H2 Import
Urban use
Agriculture use
Transport inland
0
5
10
15 km

Section | linking local martime manufactoring to the port clustur



Section | oil tanker reuse

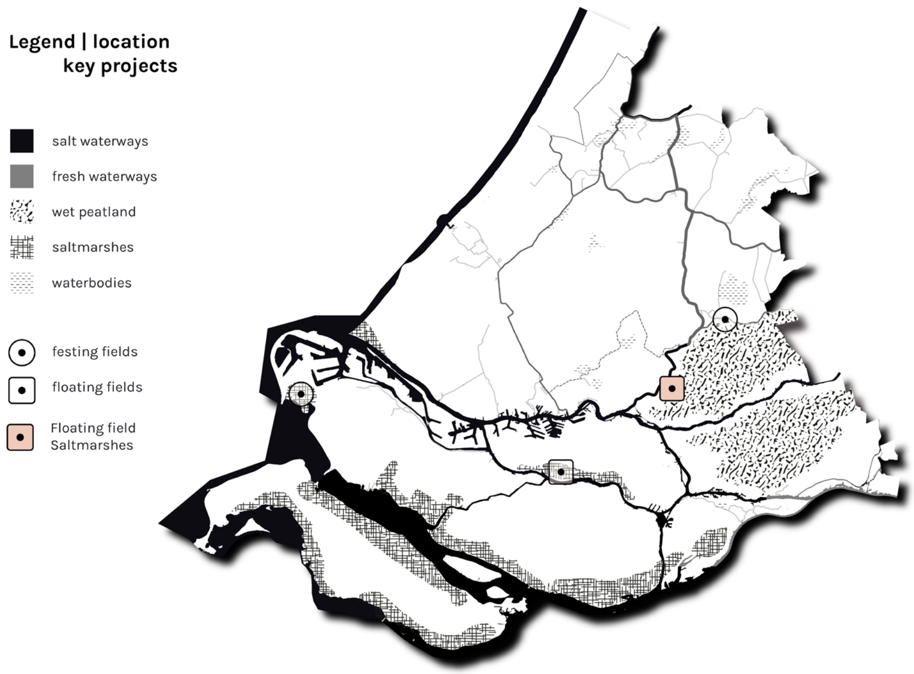




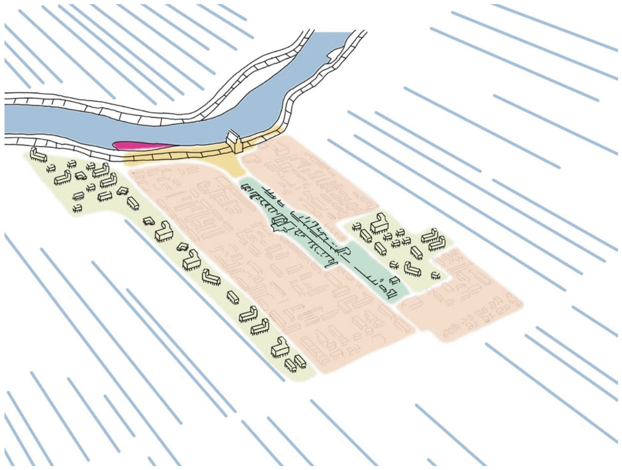
5.3.2 Wet peatlands: neighborhood

The location of this key project is in the peatland area around the village Ouderkerk aan den IJssel. This location is chosen because of the subsidence due to the peat, the village has to deal with. If the village want to keep exciting in the future, changes have to be made. We propose a strategy for this in this key project.

the strategy for the village ouderkerk aan den IJssel is split up in 4 phases. In phase 1 new adaptive buildings are made on agriculture land, a football field and a business area. In phase 2 the former buildings are demolished. The higher located old village is preserved and the road with houses along it leading into the landscape is is renovated so they can withstand the higher groundwater level. In phase 3 the groundwater level is raised and the peat meadow are becoming swampy. In phase 4 on the places of the former buildings new floating houses can be build

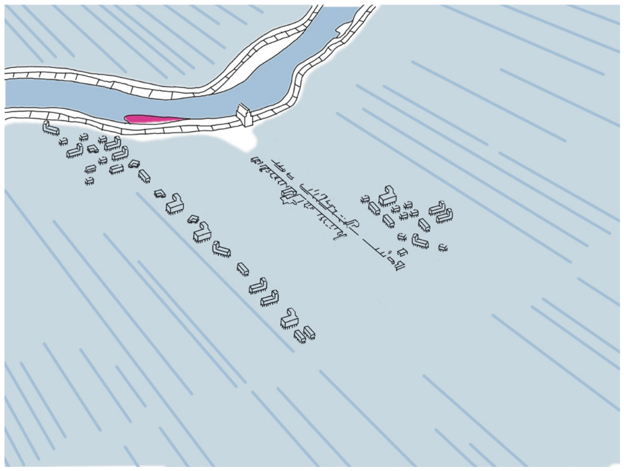


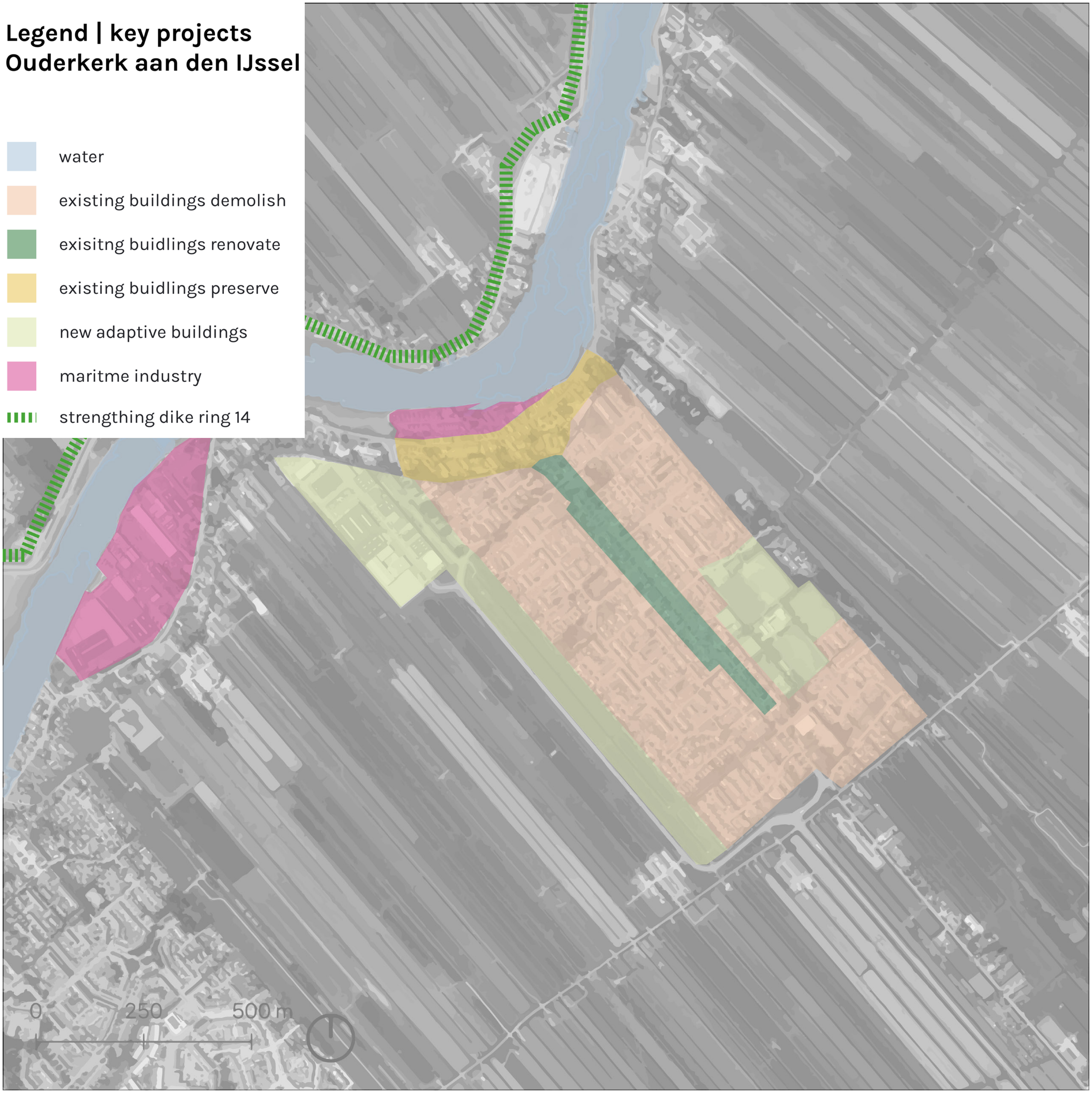
Phase 1



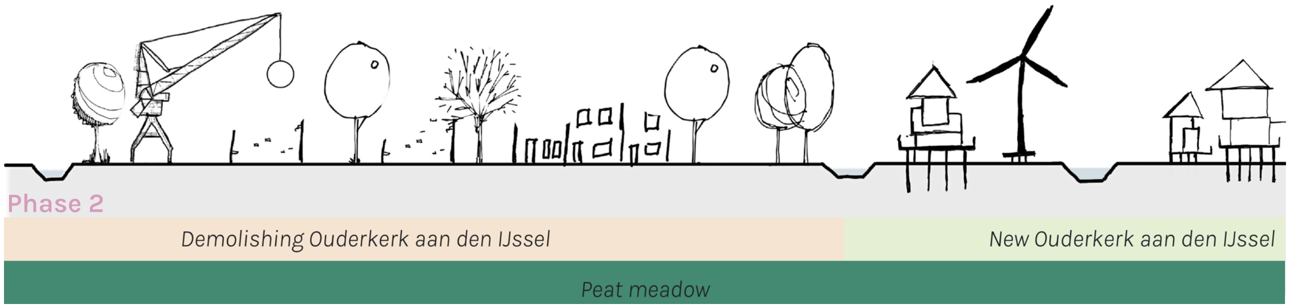
Phase 2

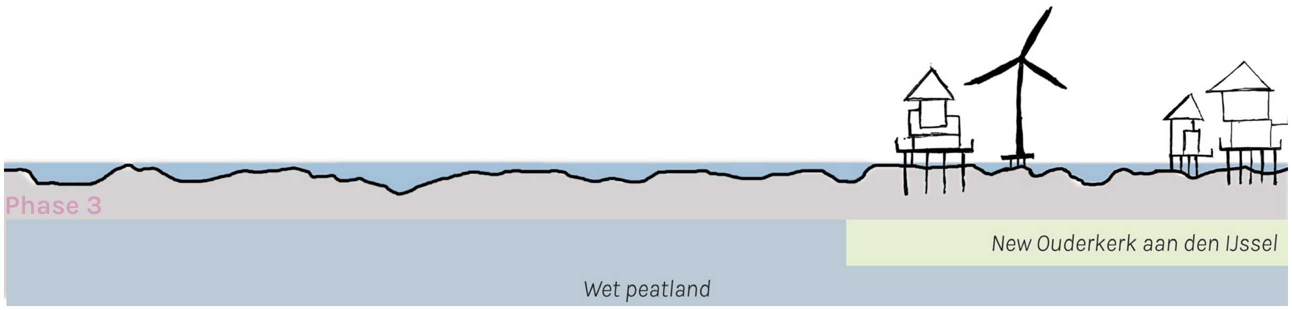
Phase 3

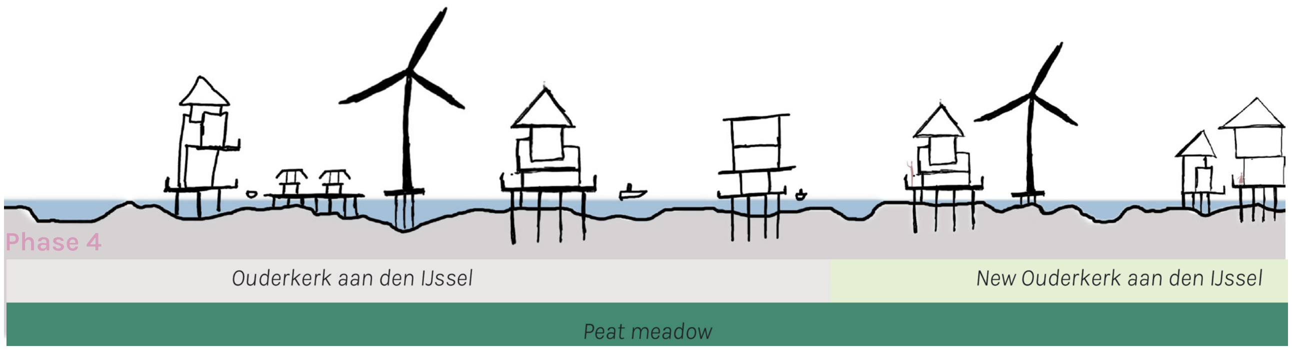


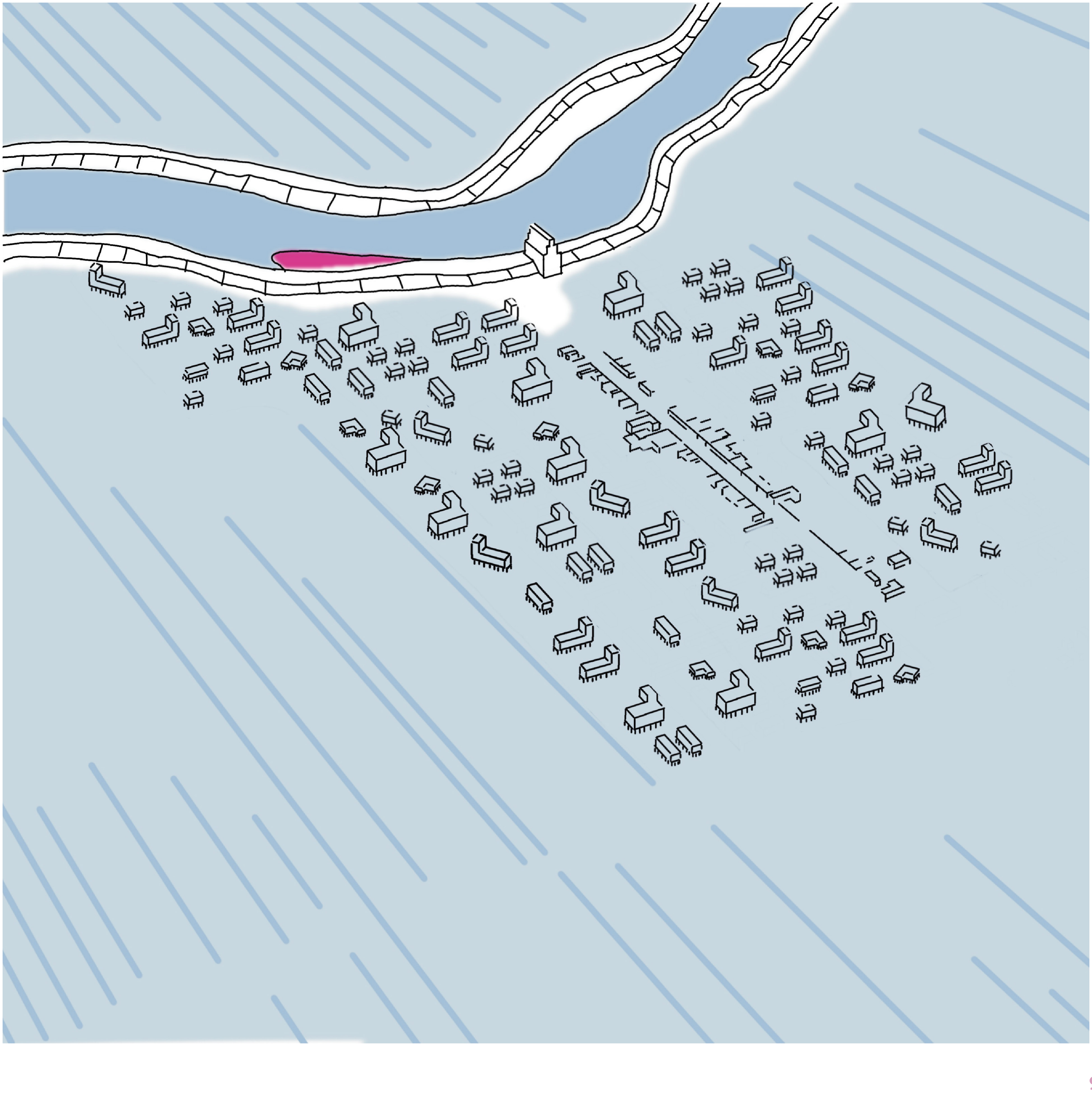

Legend | key projects
Ouderkerk aan den IJssel
water
existing buildings demolish
exisitng buidlings renovate
existing buidlings preserve
new adaptive buildings
maritme industry
strengthing dike ring 14
0
250
500 m


Phase 1
Ouderkerk aan den IJssel
New Ouderkerk aan den IJssel
Peat meadow


Phase 2
Demolishing Ouderkerk aan den IJssel
New Ouderkerk aan den IJssel
Peat meadow


Phase 3
New Ouderkerk aan den IJssel
Wet peatland

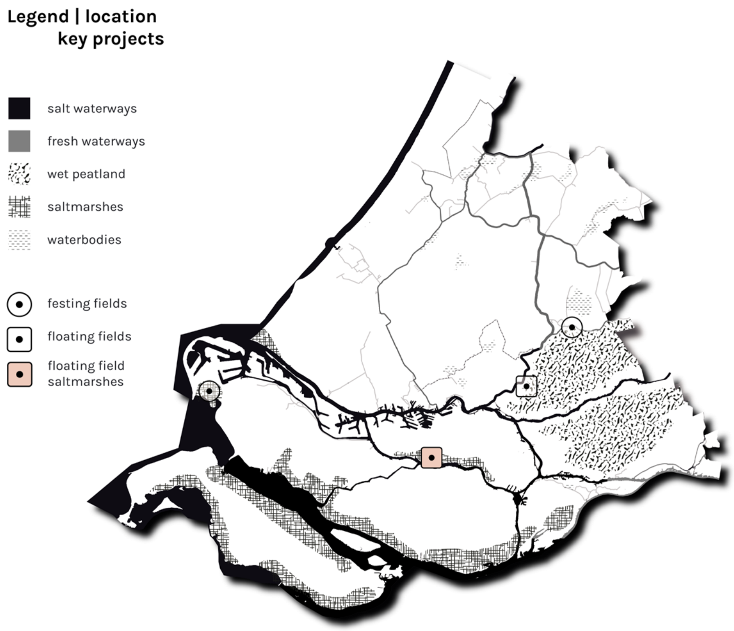

Phase 4
Ouderkerk aan den IJssel
New Ouderkerk aan den IJssel
Peat meadow

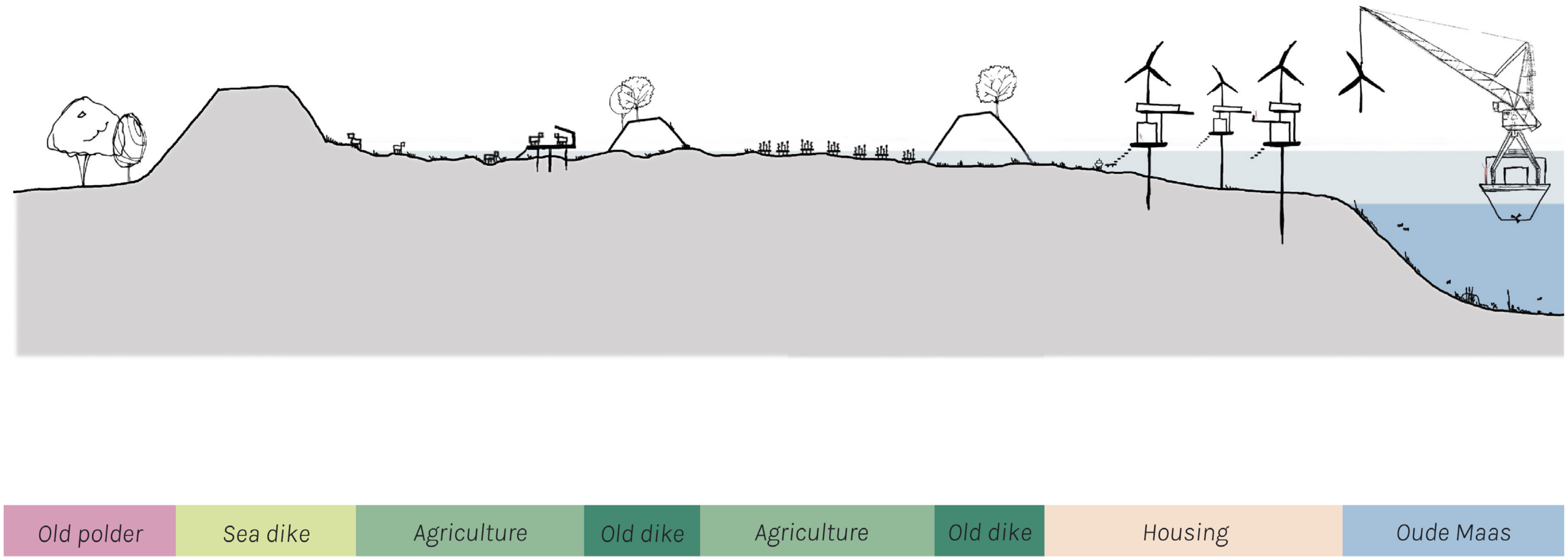


5.3.3 Salt marshes: wisselpolder

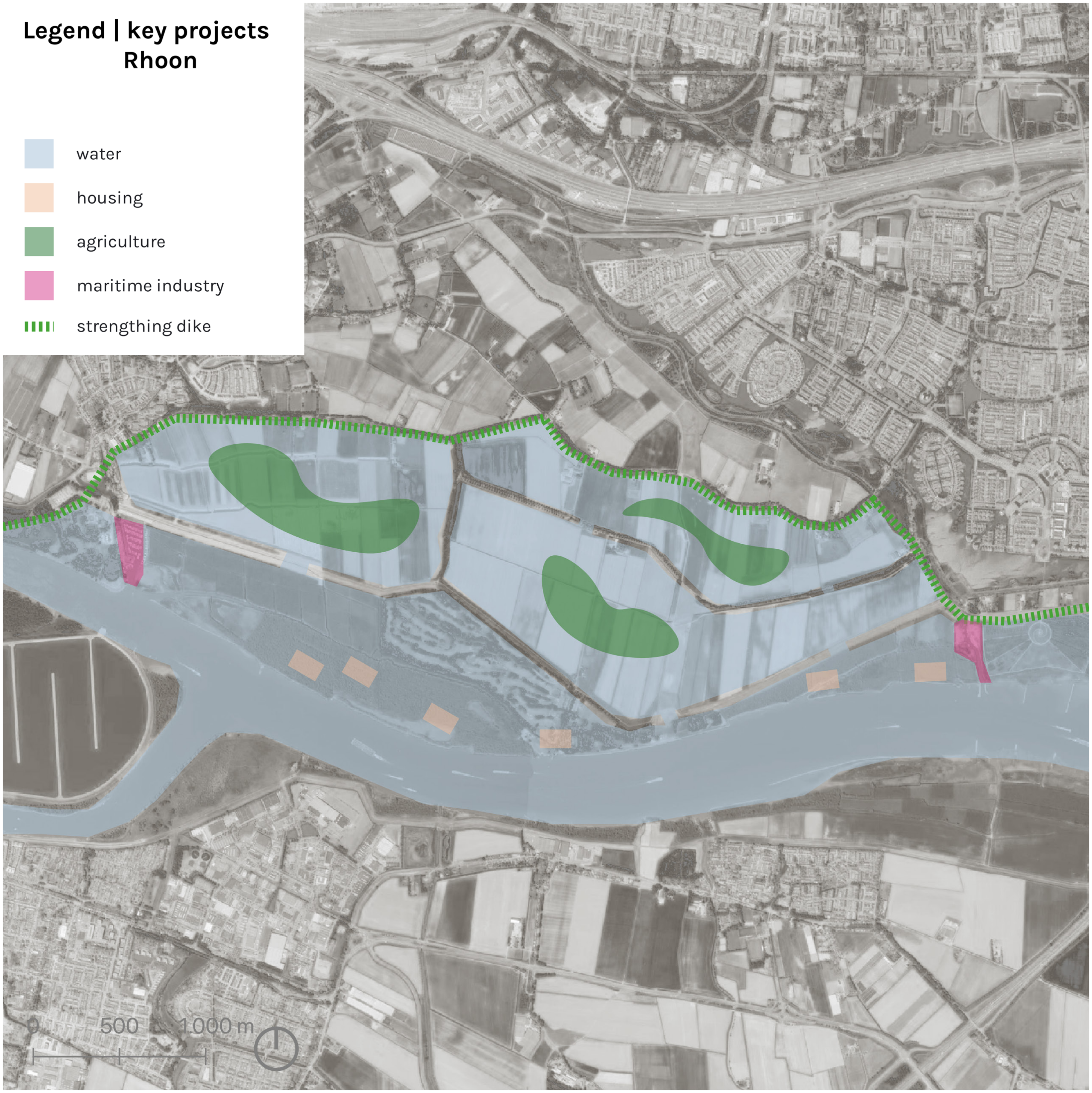
This location is chosen due to the spacial characteristic of the spot that makes introducing the saltmarshes possible. Also is this location close to the suburbs of Rotterdam South which gives a more urban characteristic to this spot.

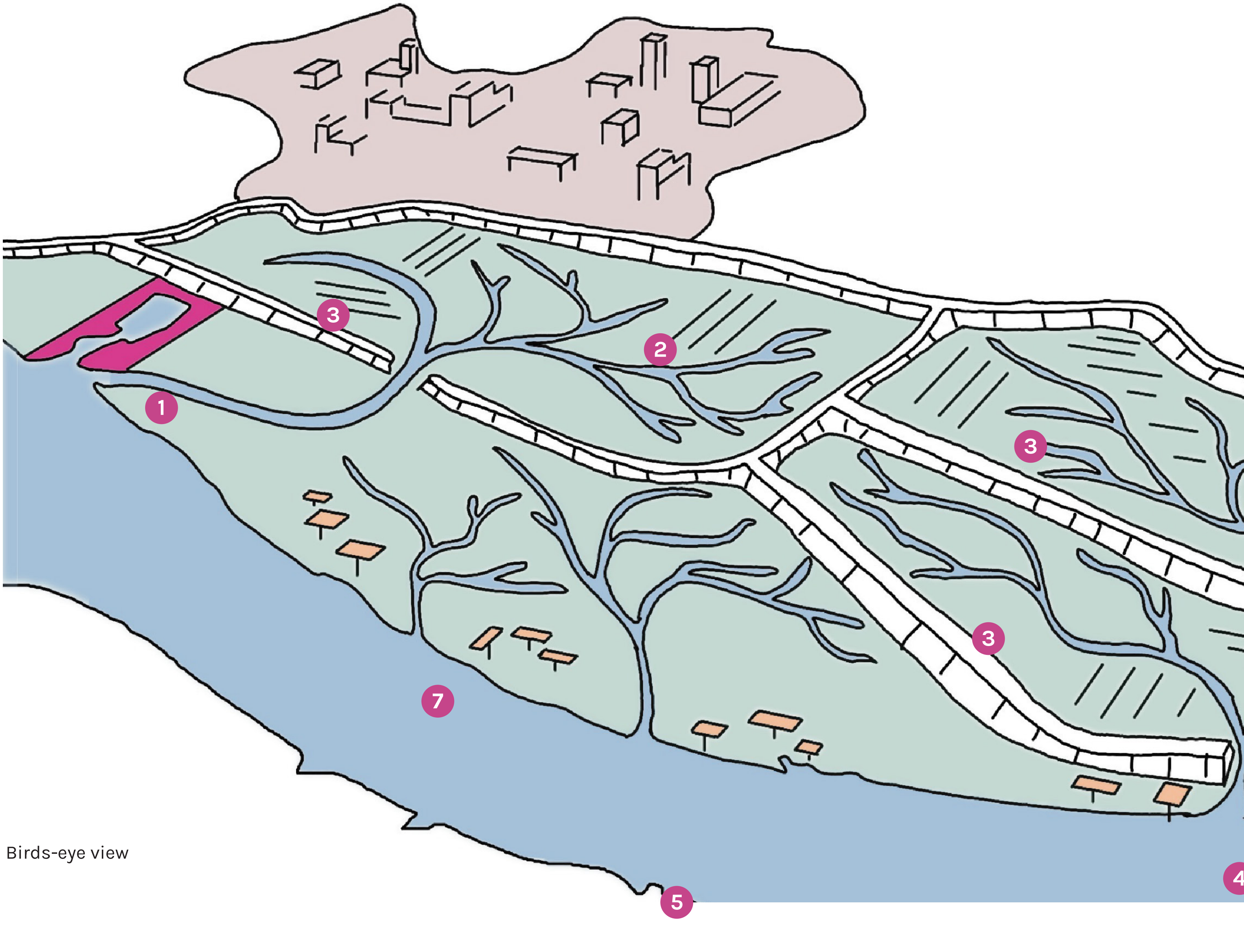
the saltmarshes in Rhoon are created by moving the main dike in land. In the old dikes holes are made, so with higher tide the water can flow in. The tidal landscape that is created can after this be occupied with housing and agriculture uses.





Legend | key projects Rhoon



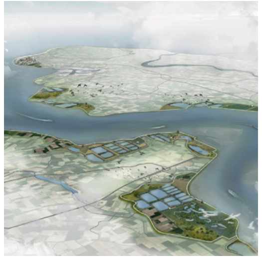


Birds-eye view

1. Windturbine

2. Aquaponics and aeroponics

3. Wisselpolder

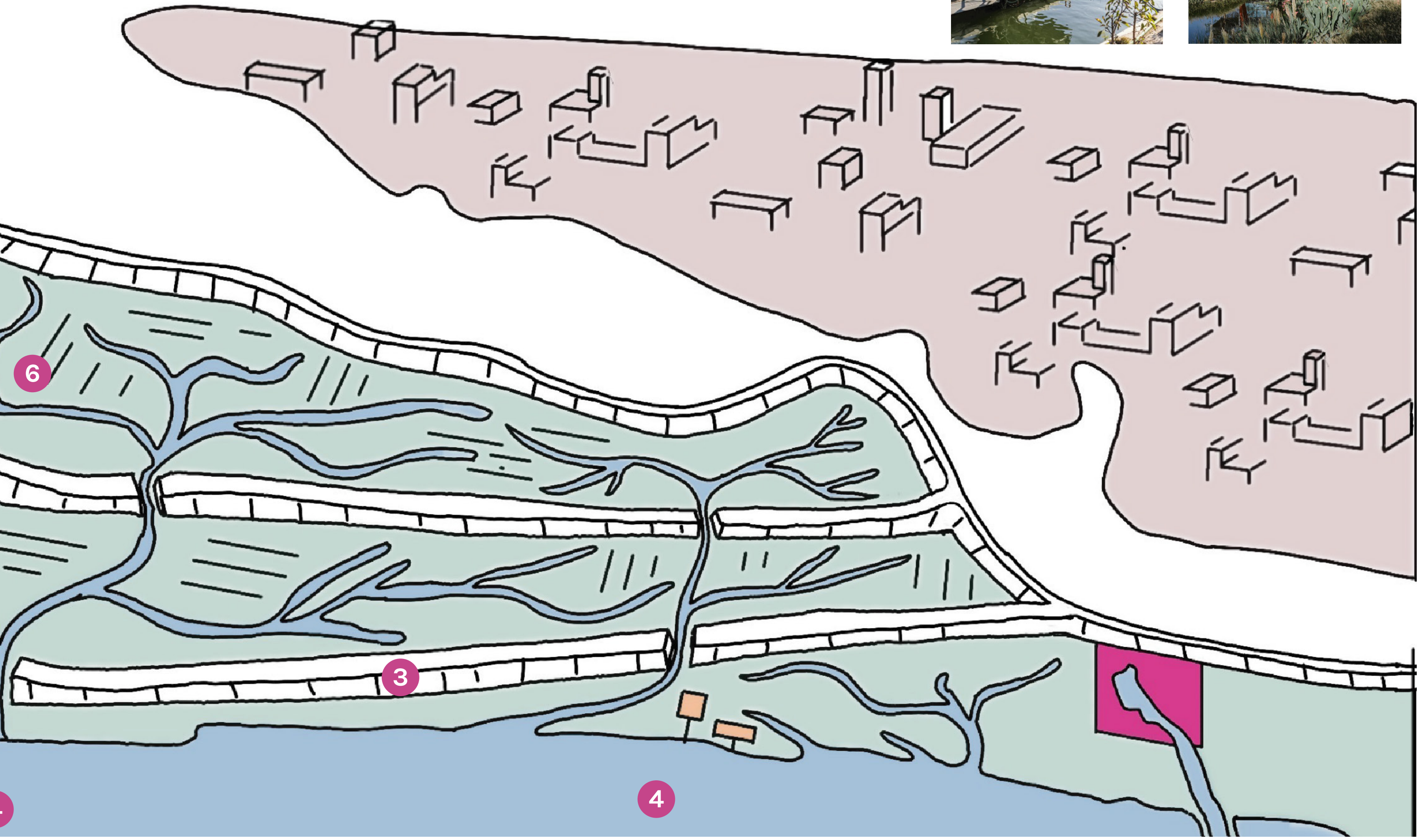


4. Tidal turbine

5. Autonomous boat

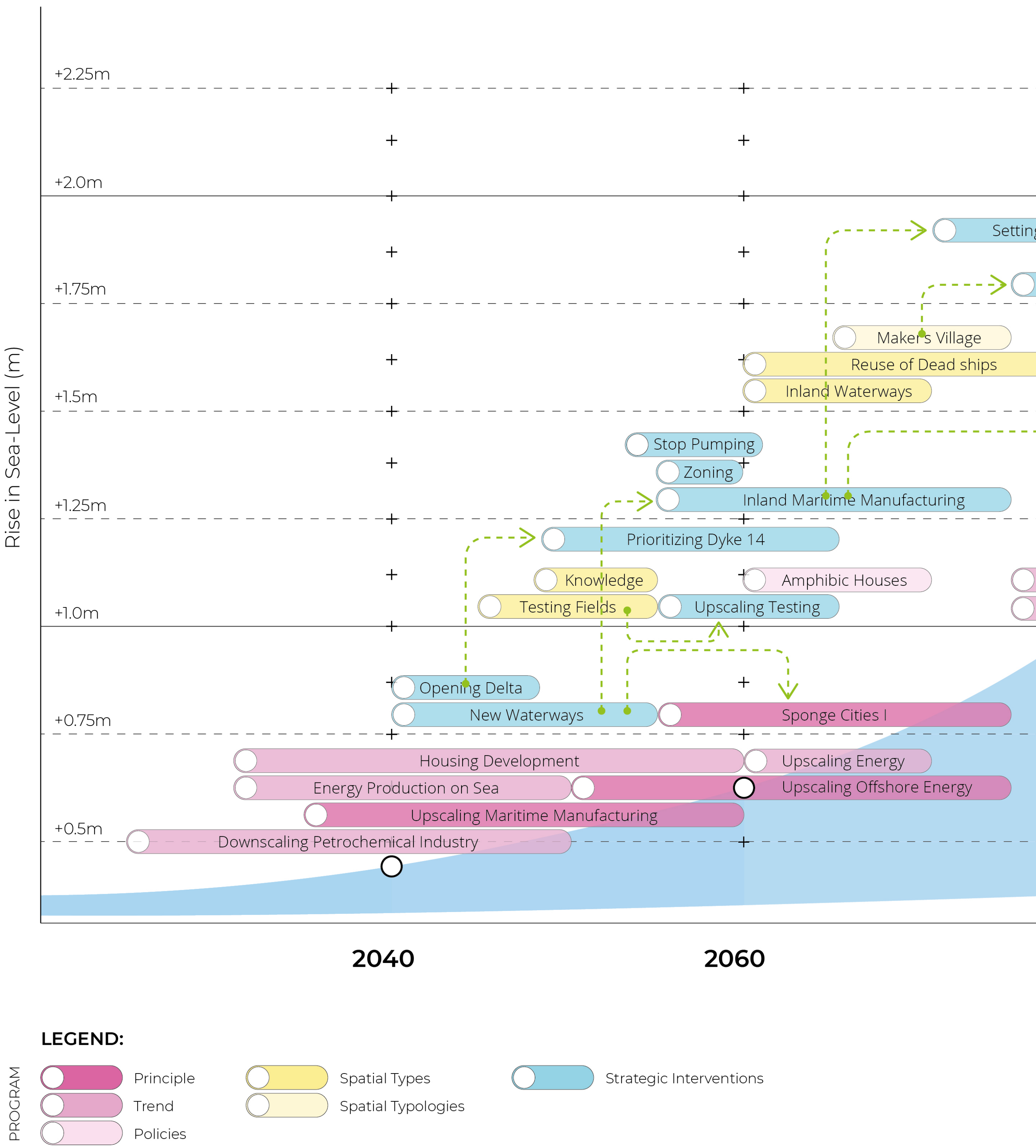
6. Floating farm

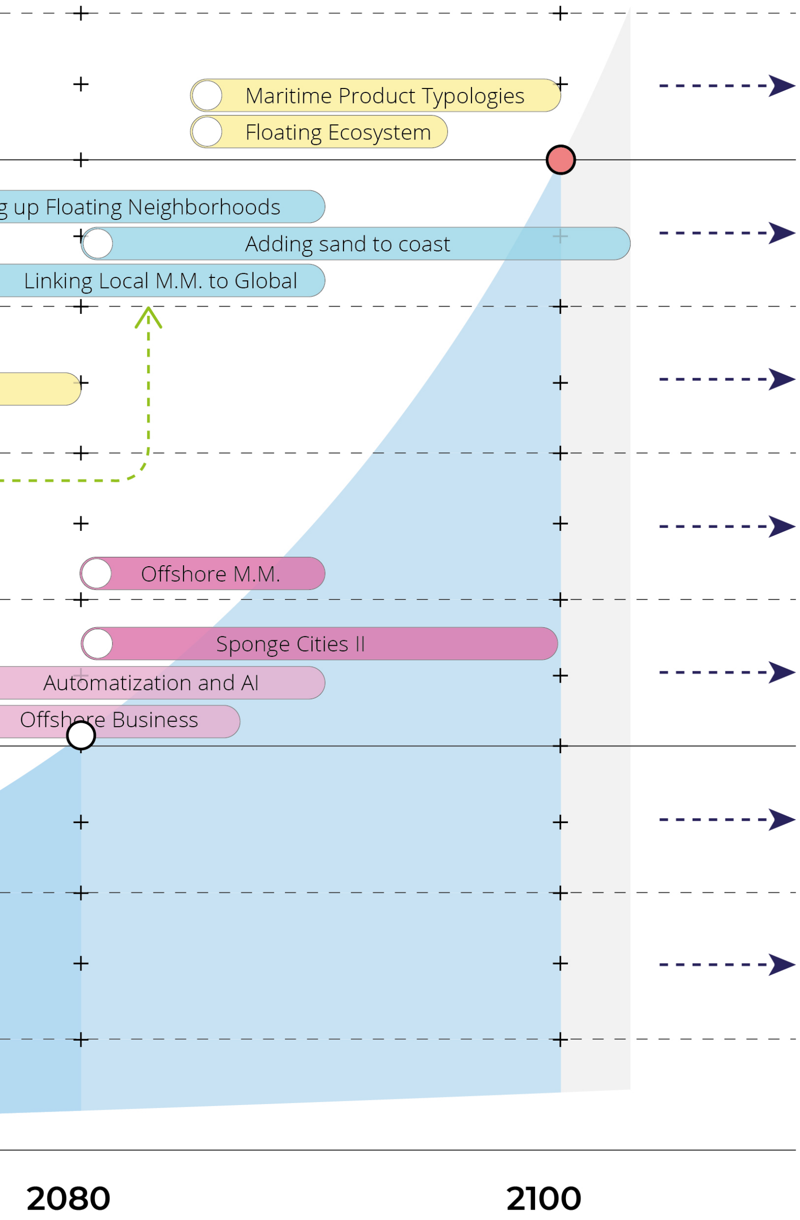
7. Suspended Pavilion




RHOON

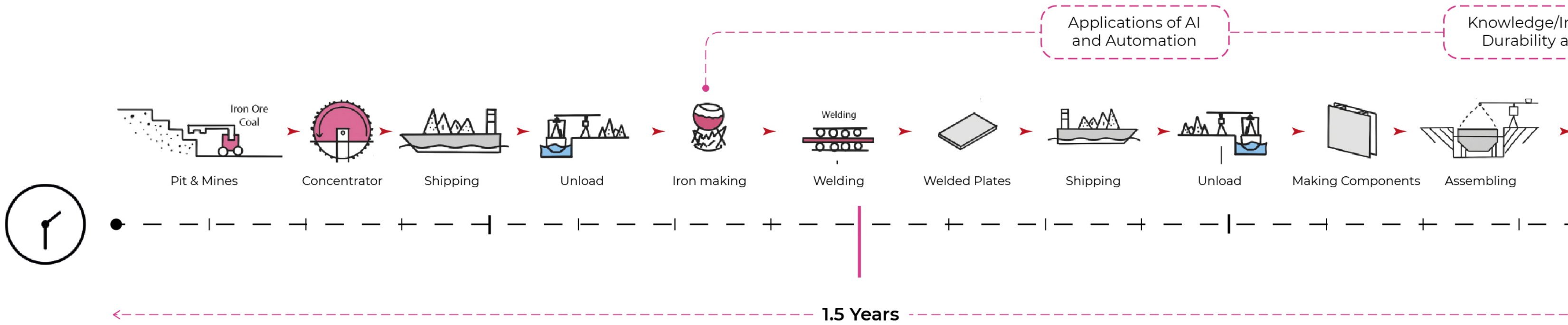
RESULTANT: FLOAT HOLLAND 2100



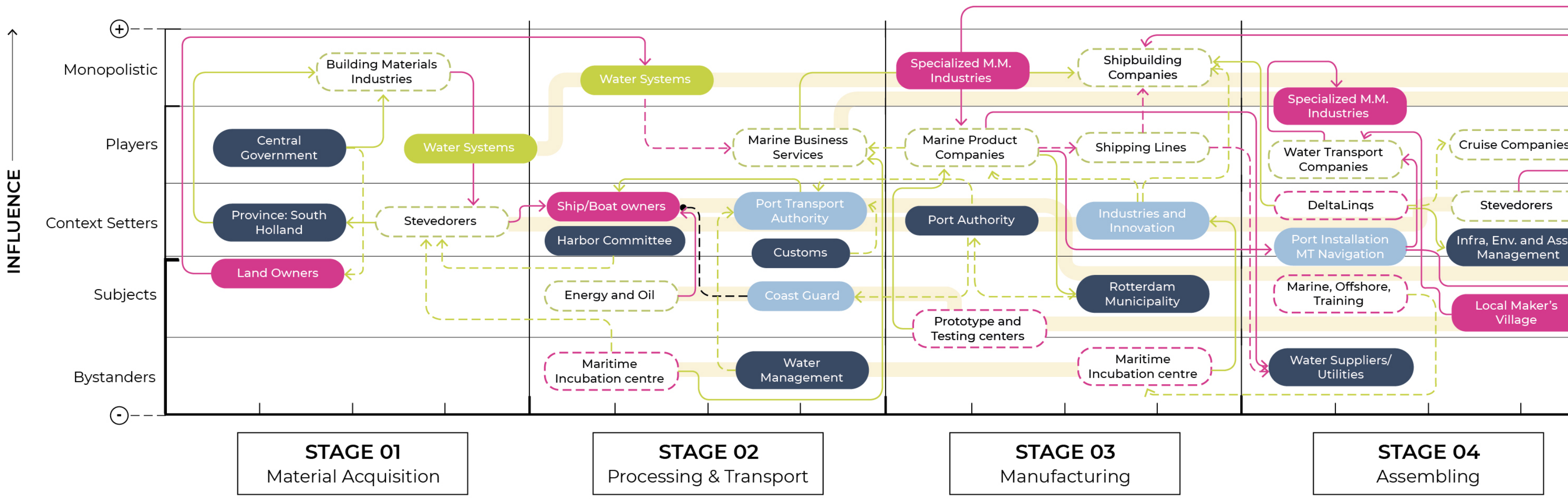


WAY FORWARD:

1. **Global Knowledge Resource**: Benchmarking applications of floating ecosystems.
2. **Floating systems & Sponge cities:** Connecting transformed landscapes to urban areas within dykes.
3. **Scaled-up Waterways:** Development regulations for Water-TOD.
4. **Integrated Transportation:** linking new water transit to existing land-based public transport



FLOATING PRODUCT INVENTORY: Timeline



MARITIME AND FLOATING LANDSCAPE: Stakeholder Power Matrix

LEGEND

Community
Academic
Nature
Legislation & Public Policy
Internal Actors
External Actors

RELATIONSHIPS

Hard Resource
Direct
Indirect

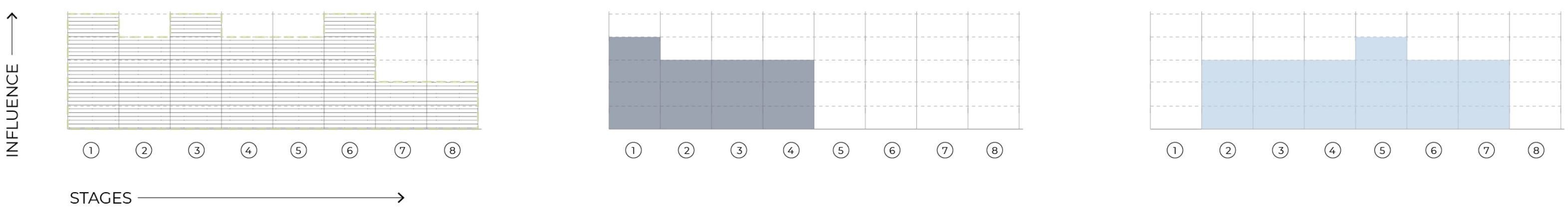
Soft Resource
Direct
Indirect

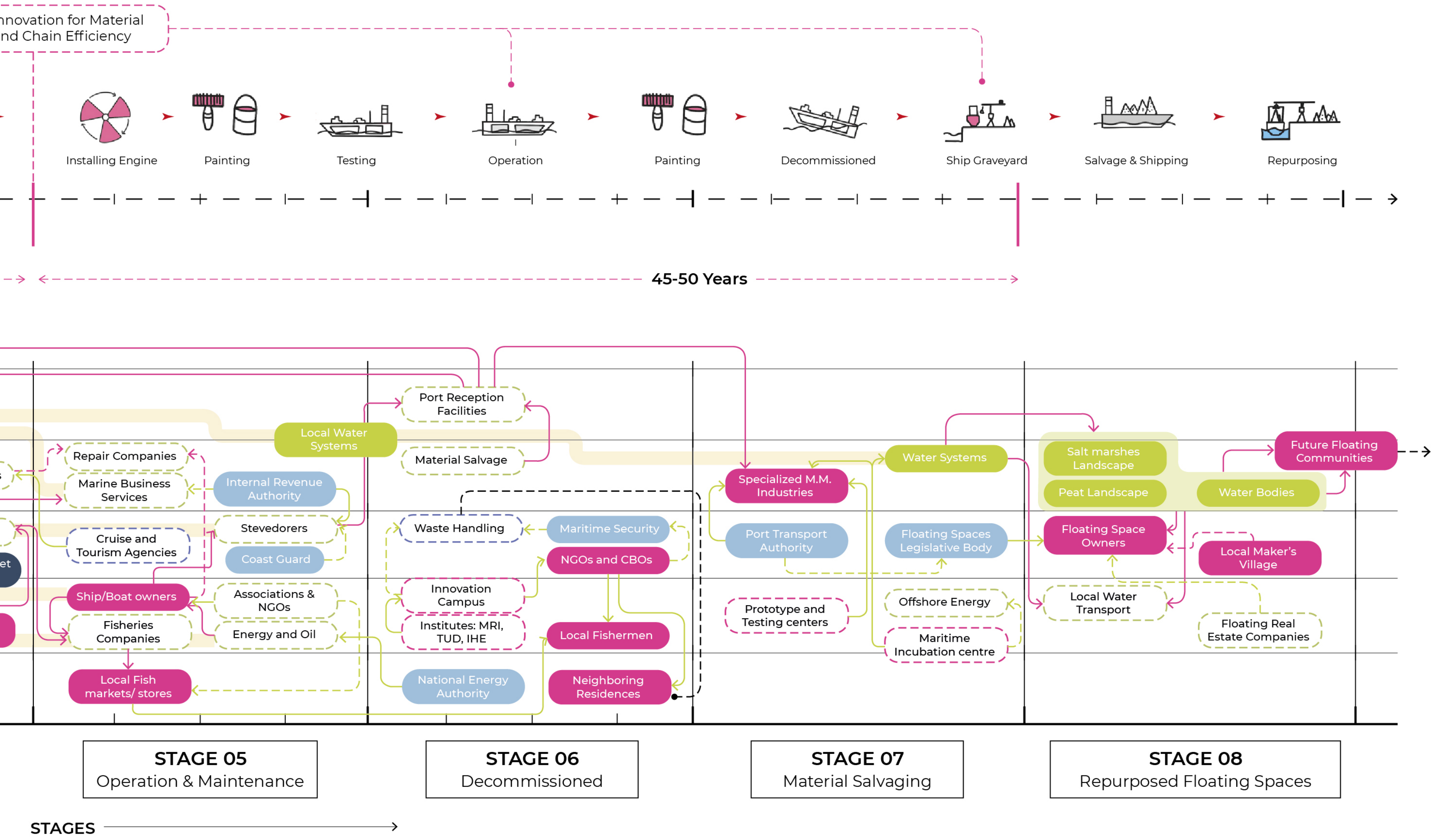
Chain Typology
Inconveniences

External Actors

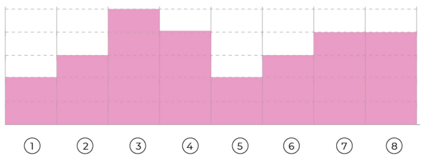
Internal Actors

Legislation & Public Policy

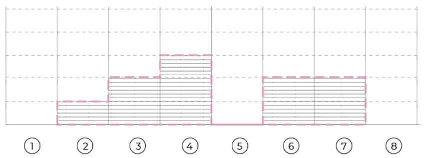




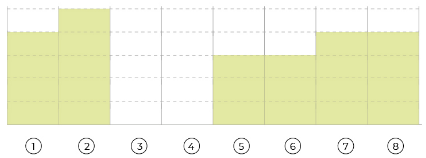
Community

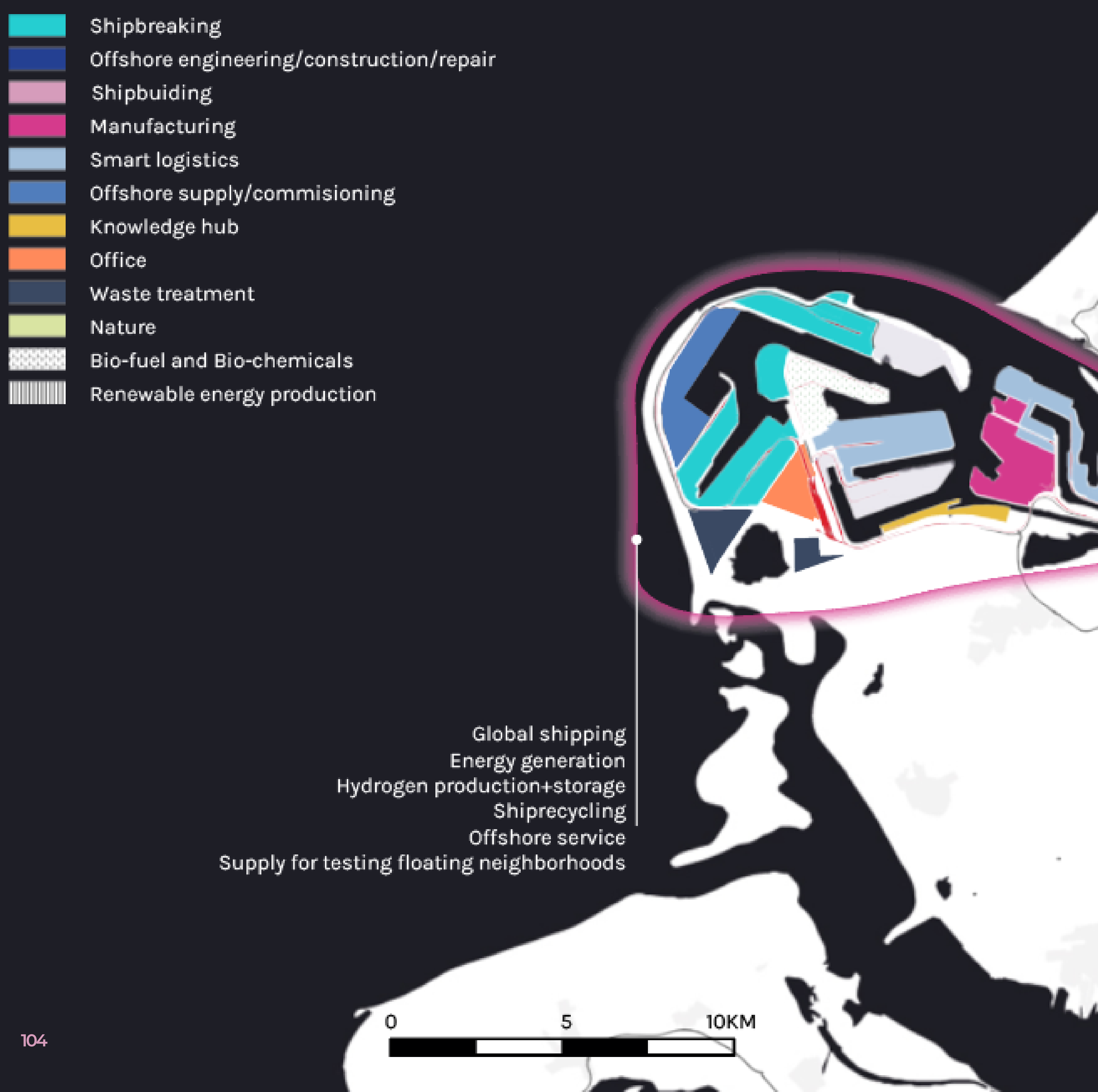


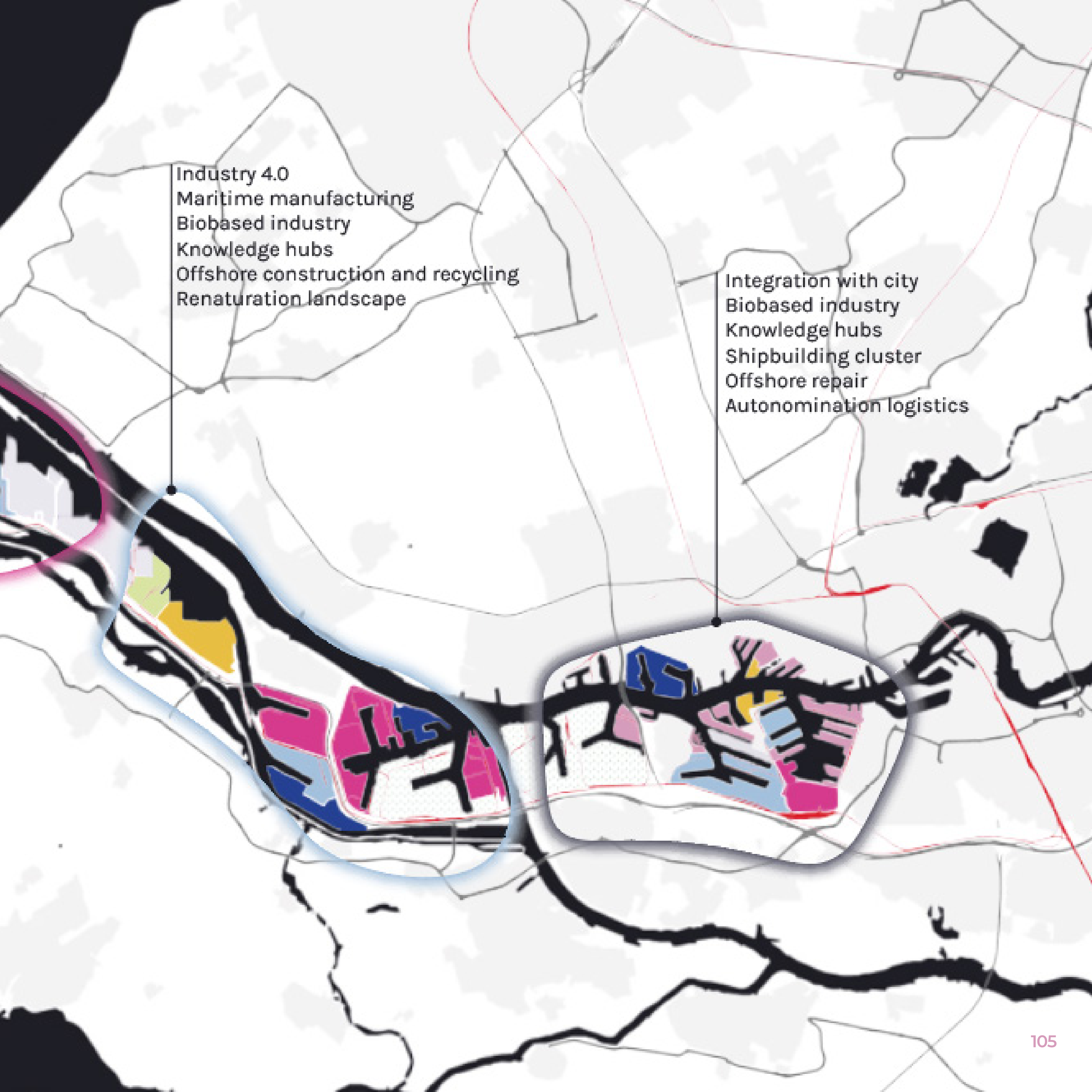
Academic

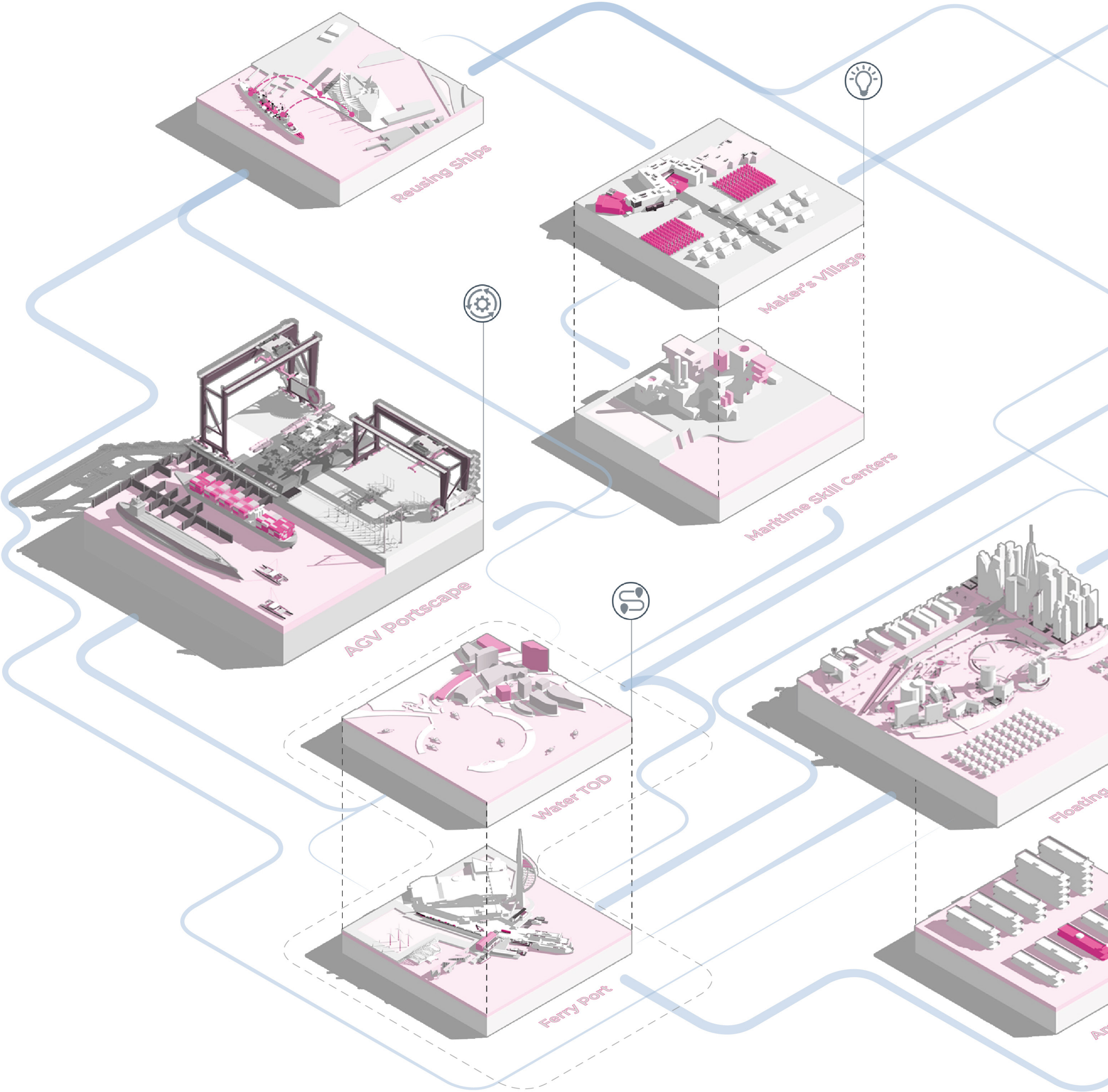


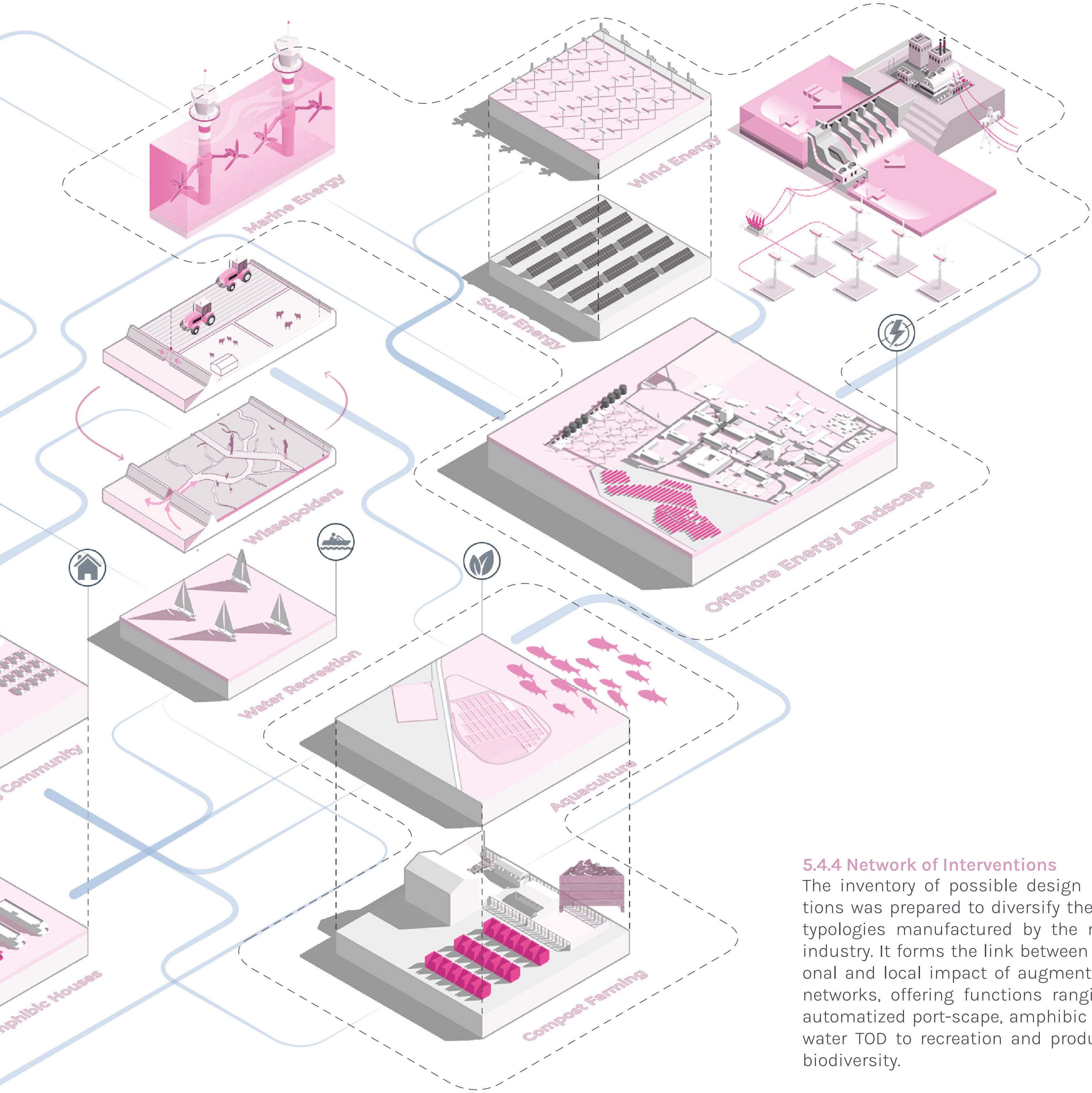
Natural Landscape




Shipbreaking
Offshore engineering/construction/repair
Shipbuiding
Manufacturing
Smart logistics
Offshore supply/commisioning
Knowledge hub
Office
Waste treatment
Nature
Bio-fuel and Bio-chemicals
Renewable energy production
Global shipping
Energy generation
Hydrogen production+storage
Shiprecycling
Offshore service
Supply for testing floating neighborhoods
0
5
10KM


Industry 4.0
Maritime manufacturing
Biobased industry
Knowledge hubs
Offshore construction and recycling
Renaturation landscape
Integration with city
Biobased industry
Knowledge hubs
Shipbuilding cluster
Offshore repair
Autonomination logistics


Reusing Ships
Maker's Village
Maritime Skill Centers
AGV Portscape
Water TOD
Ferry Port

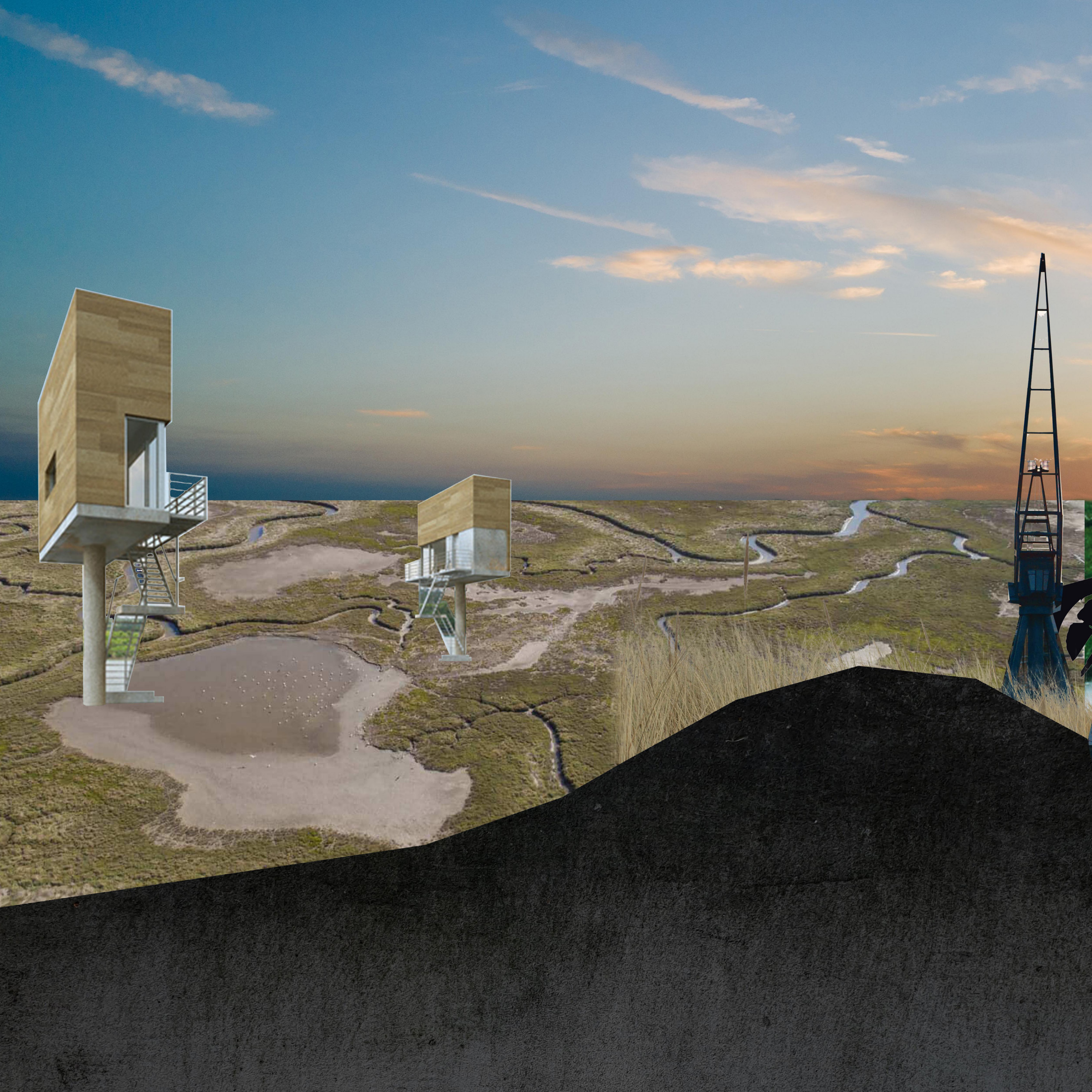


5.4.4 Network of Interventions

The inventory of possible design interventions was prepared to diversify the product typologies manufactured by the maritime industry. It forms the link between the regional and local impact of augmented water networks, offering functions ranging from automatized port-scape, amphibic housing, water TOD to recreation and production of biodiversity.


RAW MATERIALS
SHIPRECYCLING
LOGISTICS

Specialized
maritime manufacturing
SCHOOL
TU Delft
Erasmus University Rotterdam
Knowledge Center
KNOWLEDGE HUB
SHIPBUILDING
BIO-BASED
MANUFACTURING
N ENERGY
SHIPBUILDING+MANUFACTURING
Specialized
maritime manufacturing
Knowledge Center
KNOWLEDGE HUB
Knowledge Center



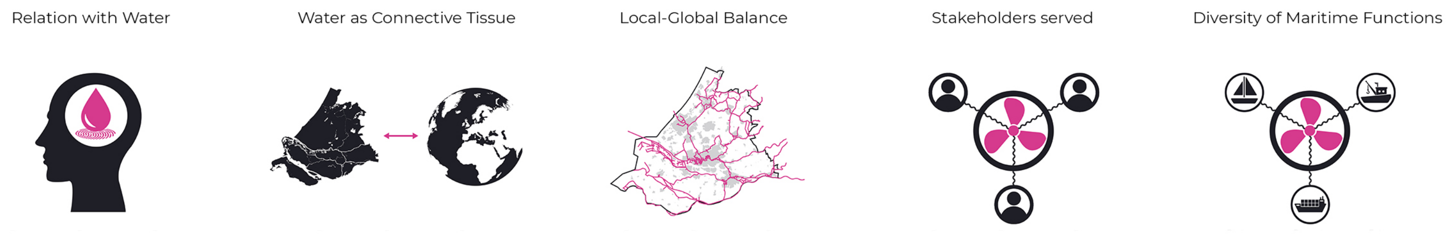
6. Conclusion
6.1 Backlinking to the issue

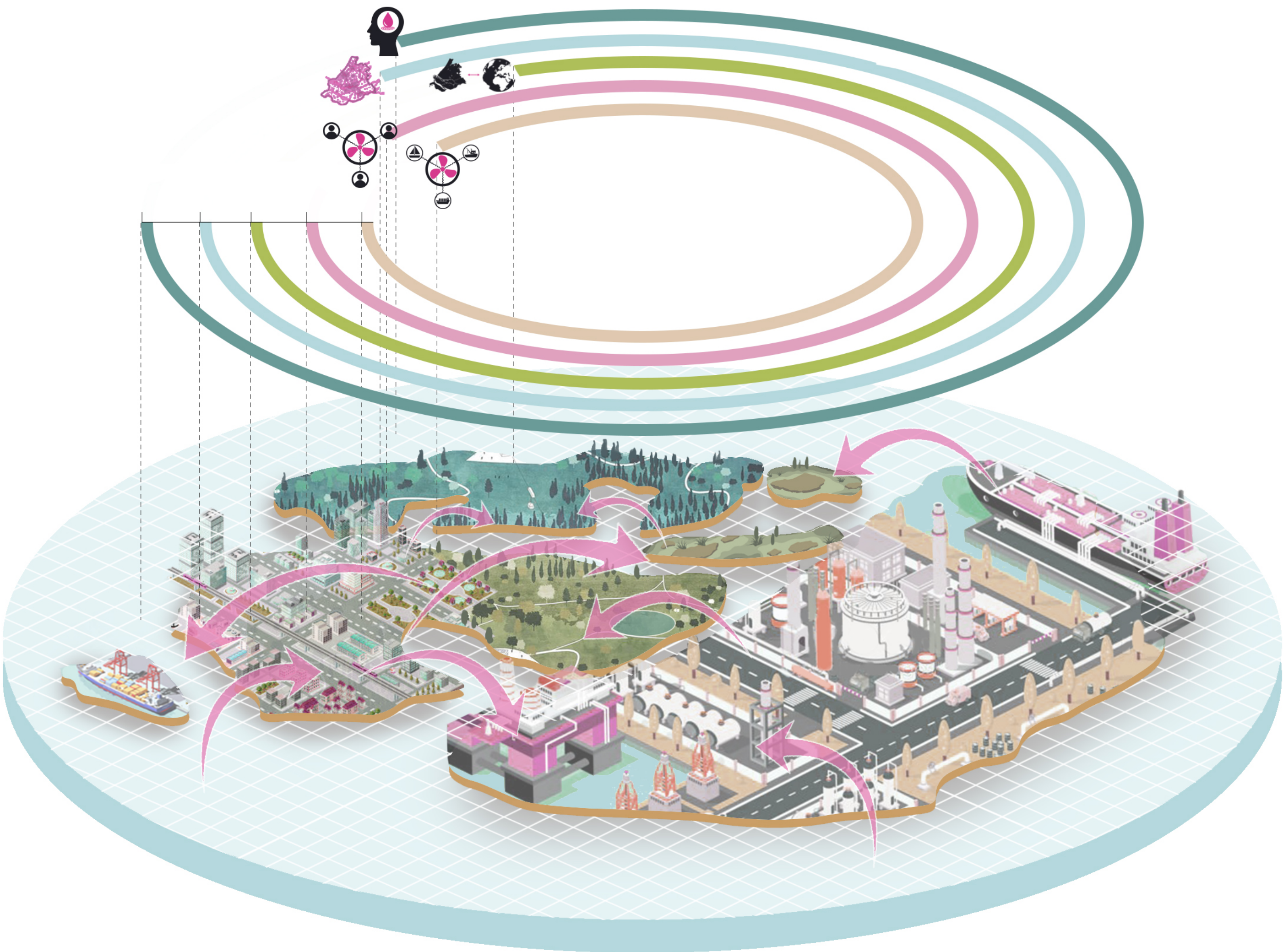
The relationship between the Dutch people and water systems is certainly dynamic in nature. Hence, to address the transitions to the future technological, infrastructural, and primarily the physical landscape (it is subject to potential climatic adversities), it was essential to address this role around an 'adaptive' and dynamic 2100 South Holland. Envisioning a future that is almost a century away, brings forth excessive speculation to choose the direction of development. Including nature-based actors and making room for innovation to cope with the transitions in question helps moderate the risk of looking far ahead.

How can the **Maritime Manufacturing Industry** serve as a **catalyst** to establish an **adaptive South Holland?**

The spatial vision and strategy help establish a mutually beneficial relationship between urban areas and water systems resulting inhabitable spaces on water. Maritime Manufacturing, in addition to serving as a catalyst to support this relationship, also transforms its role from being a medium to enable global thoroughfare, to diversifying the range of its products, eventually restoring links with the local scale. It can pave way for the possibility of having dynamic spaces on water be accounted as real estate, public spaces, and linkages to connect systems like energy and biodiversity.

Water and People: Testing and developing floating communities softens the boundaries of the isolated port ecosystem, providing citizens of Rotterdam with higher stakes to retain this ecosystem as a memory of the city by localizing the manufacturing industry.
Integrating divided landscapes: The vision progresses along a strategic path to develop separated landscapes (some embracing water and the others protected from it). This is done to provide urban areas and commercial centers with appropriate time to establish and strengthen an infrastructure landscape around water. This eventually leads to a 2100 vision where these landscapes can be integrated to form porous urban systems where citizens accept water as a feasible integration with day-to-day uses like transit.


Relation with Water
Water as Connective Tissue
Local-Global Balance
Stakeholders served
Diversity of Maritime Functions



6.3 Individual reflections

Akhilesh Shisodia

As the Regional Strategy studio comes to its conclusion, it is interesting to reflect upon the questions I got to ask myself, to add to my ongoing process of understanding the Dutch ways of tackling landscape. This studio was especially intriguing as it progressed in close connection to perhaps the most comprehensive infrastructural network in South Holland, i.e., water. Transitioning from a city-scale perspective of water systems to its regional complexity was tedious, but essential for the narrative. I got introduced to a range of roles water serves in the Netherlands in addition to day-to-day needs, which brought forth a peculiar observation: the abundance of this natural resource has eventually led to its impression to become that of a deterrent. While working on developing a vision for the future of South Holland 80 years from now, water still remained the prime frame of all the key interventions we came up with. However, it was interesting to see the possibility to transform its impression and restore it as connective tissue for the people of South Holland.

The process of vision development began with establishing the urgencies to be addressed, to conceive new realities (fictions). While trying to understand the network of layers around the port as an ecosystem, I had to chance to closely analyze the balance and types of stakeholders on the playing field around the Maritime industry. Working with such chains of actors and their respective power balance introduces you to the phenomenon of a global scale of exchange (Port of Rotterdam) and also it influences spatial trends and policies far beyond its geological limitations.

The port is not an enclosed market-oriented commercial and infrastructural entity, it also influences aspects like innovation systems, energy, research, spatial justice as well as the structure of the landscape itself. With this in perspective, the port ecosystem became a much more comprehensive and interesting system to tackle.

We defined our problem statement around deteriorating climatic conditions leading to a rise in sea level. It was a great choice to time the progress of our 2100 vision to correspond with the rise in water level, enabling us to make space for it instead of protecting against it. With interventions based on floating ecosystems and amphibious habitation, some interesting questions came up which demanded a new policy framework to govern the use of water-based spaces to address the housing crisis. Through the assisted lectures on Research and Methodology, I learned about the nature of addressing urban issues concerning market-based development. Hence, it wasn't a surprise that my primary research questions about the way forward to our vision centered around the possibility of water-based real estate and zone-based master planning for such spaces. I am looking forward to adding to this question through urban experimentation at different scales.

Anyi Yan

During this quarter, my team and I developed a regional design vision and strategy for the Province of Zuid-Holland in Maritime Manufacturing theme. We started from 'What if' questions, what if in the future most areas of South Holland are flooded. Then we moved to the maritime sector, what is the role of maritime sector, like shipbuilding. We also took the social justice into account. Since the very early ages of our analysis, we started collecting information to have an overall understanding of the current climate situation, the process and material flows in the shipbuilding. It seems not relevant between the flooding scenario and shipbuilding industry at the very beginning. As we continued the analysis, we got the logic and relation behind these two lines, the human and the Dutch identity.

As we all know, large parts of land in the Netherlands are below the sea level. And we cannot deny that the continuous climate change is inevitable. So, how can we face the more and more severe crisis? Before this quarter, I never think about this question. The government and authorities have been thinking about the solutions to fight against the sea level rise crisis, I just comply with the policies. During the research and analysis, this viewpoint has changed a lot. Why not just obey the natural rule and prepare to be adaptive to the future? Why not be reconciled with water? We cannot stop the changes among the world, but we can learn to adaptive to these changes.

In the next step, we think about the strengths of the current situation and opportunities for the future development. And we got the vision that we can expand the role of the maritime manufacturing to facilitate the adaptivity of the natural, social landscape in south holland on the basis of water. Then we jumped through different regional scales not only in landscape but also through the social environment and gradually get the strategies to get our vision.

Regional design needs a transdisciplinary approach. It is a combination of architecture, nature, politics, economy and more fields. It is not a fixed plan.

It's really difficult to step into the regional planning. Because it is quite different from what I learn from Chinese planning. Urban planning in China is currently characterized by a top-down approach, high density urban development and extensive urbanization, which also means 'traditional planner' mentioned in Methodology course to some extent. The government has the dominant power to organize the comprehensive planning. While in the same time, with the rapid development of economy, market also plays an essential role in planning. In this sense, the planning will not change a lot, but the overall direction of urban development. In my bachelor study, in the planning, we focused more on the structure of urban space, for example, the corridor, axis, cores, etc. We didn't really focus on the larger scale, and also the strategy and visions.

To conclude, it is super nice work experience in this quarter, not only the course, but also the teamwork and tutoring!

Froukje Ottema

"The living world is a unique and spectacular marvel. Yet the way we humans live on earth is sending it into a decline. Human beings have overrun the world. We're replacing the wild with tame. This film is my witness statement and my vision for the future. The story of how we came to make this our greatest mistake. And how if we act now, yet put it right. Our planet is headed for disaster. We need to learn, how to work with nature, rather than against it. And I'm going to tell you how." (David Attenborough: A Life on Our Planet | Official Trailer | Netflix, 2020)

This quote/speech is from David Edinburgh. This speech is written for the film that was launched by Netflix and it is called a life on our planet. What I like about this speech and why I refer to it in this reflection is because it reference to how I feel now after this project. The speech state the fact quit hard but it gives also hope. And that is how I want to put my self out there. Because without hope nothing will or can happen. Now I wil tell shortly what I learned through this project

My biggest learning point in this course was the moment a realized we are heading for disaster. I read on the site of the ipcc the following sentence: "Coastal areas will see continued sea level rise throughout the 21st century, contributing to more frequent and severe coastal flooding in low-lying areas and coastal erosion. Extreme sea level events that previously occurred once in 100 year could happen every year by the end of this century." (Climate Change Widespread, Rapid, and Intensifying Â Â, 2021) This triggered for me the realization that our dike system is ordered by risk of extreme sea level events. So dike rings that surround an area that has more value is more protected.

Dike ring 14 witch protects the randstad has the highest protection norm. Because the damage that a flooding will give is the highest. So I searched for the map of the Netherlands that shows the safety standard for each dike ring. So for example dike ring 14 witch is the strongest dike ring. Is now design with a safety norm of 1 in the 10.000 years. But if we implement the statement the Ipcc gives. This dike ring will have a safety norm of 1 in the 100 years. This is the strongest dike. A dike with a safety norm of 1 in the 4000 years like dike ring 17 where the southern part of the city of Rotterdam is situated can flood every 40 years. And I came to the shocking realization that if we don't act dramatically our water-system would fail before the end of the century.

This idea was quite overwhelming form me. Also because all the thing that are happing nowadays in the world. If felt like my future was maybe not can be as good as my past had been. The feeling of having this burden made me feel a bit down. I'm not used to feeling this way. The world is changing and I felt I couldn't do anything about it.

But time went by and this project for me helped to give me the feeling I was helping to make the future brighter. It was helpful to work on something that can maybe steer the future even if it's just a tiny bit. This project made me feel like a still had a bit control over the future.

Climate change widespread, rapid, and intensifying â â. (2021, August 9). IPCC. https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/

Overstromingsgevaar in Nederland. (n.d.). Floodsite. https://www.floodsite.net/juniorfloodsite/html/nl/student/thingstoknow/geography/nederland1.html

David Attenborough: A Life on Our Planet | Official Trailer | Netflix. (2020, September 23). [Video]. YouTube. https://www.youtube.com/watch?v=64R2MYUt394

Pieter van Os

In a workshop at the beginning of the course, one of our tutors (Dr. Alexander Wandl) posed a What-If question about what would happen if South Holland were to be flooded. This would eventually become the basis for our research question: “How can the Maritime Manufacturing Industry serve as a catalyst to establish an adaptive South Holland?” This resulted in two parallel storylines, being about the Maritime Manufacturing and South Holland as adaptive landscape. At first I felt that we struggled to find connections between the two, but having gone through the process I am confident in having produced an interesting mix, which could be built upon by future research and design.

Having been born and raised in South Holland, knowing that most of the province lived under sea level was nothing new under the sun. However, doing in-depth analysis has made me come to the realization that neither me nor most people in my environment are aware of the actual potential threat the province awaits in the coming decades. In the report, I would have liked to address this issue called: “The Banality of Figures” (Henriquez et al., 2019) which was in a book Dr. Caroline Newton gave me during our weekly studio sessions. It explains by how having been exposed to a certain way of communicating the climate impact, society at large might be suffering from ‘environmental melancholia’, which could be addressed by doing interdisciplinary research and design between spatial planning and psychology.

In general, it would have been interesting to have addressed the social aspect more. There was limited attention to for example what would happen to the current or potentially new labor forces in the maritime industries, which was due to trying to figure out the earlier described parallels in our narrative.

There are some notes here and there about how the Netherlands might actually profit from climate change while it wreaks havoc in the Global South, however possible solutions are not given, and at first I was afraid it would be a strategy grounded in market values.

What would moreover have given more theoretical depth to our report was an explanation about panarchic cycles, since one of our core themes is an adaptive landscape which is able to respond to change and uncertainties of the future. In this explanation, the melting of the ice caps 5,000 years ago would be the start of the panarchic cycle relevant to our project. The inevitable establishing of the rigid dyke-systems due to making the polders would be the exploitation phase, et cetera. Linking these historical processes and future interventions to this panarchic system would be an interesting way to substantiate our vision for South Holland in 2100 and beyond.

Overall, having made a vision on the regional scale was compelling since on the one hand allowed for freedom, and on the other hand made me face potential future scenarios that I probably would not have encountered in spatial planning, had we had worked on a smaller scale. I would like to thank my tutors for their support and insights throughout this project.

7. Bibliography

7.1 References

C40 Cities. (2021, November 12). Sea Level Rise and Coastal Flooding. Retrieved March 17, 2022, from https://www.c40.org/what-we-do/scaling-up-climate-action/adaptation-water/the-future-we-dont-want/sea-level-rise/

De eerste polders. (n.d.). Canon van Nederland. Retrieved on March 27, 2022, from https://www.canonvannederland.nl/nl/zuid-holland/rijnland/1330-de-eerste-polders

De trekschuit, het openbaar vervoer van de zeventiende eeuw. (2018, March 19). Www.Utrechtaltijd.Nl. Retrieved March 15, 2022, from https://www.utrechtaltijd.nl/verhalen/de-trekschuit-het-openbaar-vervoer-van-de-zeventiende-eeuw/

Defacto Stedenbouw. (2021, February). Versnelde zeespiegelstijging. http://d.efac.to/nl/stedenbouw/versnelde-zeespiegelstijging

Esri Nederland. (2021, May 5). Kwel en infiltratie - huidig. Arcgis.Com. Retrieved March 1, 2022, from https://www.arcgis.com/home/item.html?id=19393fceb49e40f486e7b6ebd3ae1f79

Filarski, R. (n.d.). NMGN - Aarzelende modernisering: Binnenvaart in de negentiende eeuw - Nieuwe Maritieme Geschiedenis van Nederland.

MaritiemPortal. Retrieved March 1, 2022, from https://beta.nmgn.huygens.knaw.nl/binnenvaart-negentiende-eeuw.html

Hartman, S., & de Roo, G. (2011). Regio's in verandering. Uitgeverij 010.

Henriquez, L., van Timmeren, A., & van Timmeren, A. (2017). Under Pressure (1st ed.). TU Delft & AMS Institute.

IPCC. (2021). Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou. (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press. In Press.

Henriquez, L., van Timmeren, A., & van Timmeren, A. (2017). Under Pressure (1st ed.). TU Delft & AMS Institute.

IPCC. (2021). Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou. (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press. In Press.

Kennisportaal Klimaatadaptatie. (n.d.). Bodemdalingsvoorspellings-kaarten - Klimaateffectatlas. Retrieved March 1, 2022, from https://www.klimaateffectatlas.nl/nl/bodemdalingsvoorspellings-kaarten

Kennisportaal Klimaatadaptatie. (n.d.-b). Overstromingsdiepte - Klimaateffectatlas. Retrieved March 1, 2022, from https://www.klimaateffectatlas.nl/nl/overstromingsdiepte

Kennisportaal Klimaatadaptatie. (n.d.-c). Waterdiepte bij kortdurende hevige neerslag - Klimaateffectatlas. Retrieved March 1, 2022, from https://www.klimaateffectatlas.nl/nl/waterdiepte-bij-kortdurende-hevige-neerslag

KNMI Klimaatsignaal '21. (2021, October). https://www.knmi.nl/kennis-en-datacentrum/achtergrond/knmi-klimaatsignaal-21

KNMI. (2020, February 6). Zeespiegelstijging nu en in de toekomst. KNMI specials. Retrieved April 1, 2022, from https://magazines.rijksoverheid.nl/knmi/knmispecials/2019/03/nu-en-in-de-toekomst

Lee, T.M., Markowitz, E. M., Howe, P. D., Ko, C.-Y., & Leiserowitz, A. A. (2015). Predictors of public climate change awareness and risk perception around the world. Nature climate change, 5(11), 1014-1020.

Lertzman, R. (2015). Environmental Melancholia: Psychoanalytic dimensions of engagement (Psychoanalytic Explorations) (1st ed.). Routledge.

M. Haasnoot, L. Bouwer, F. Diermanse, J. Kwadijk, A. van der Spek, G. Oude Essink, J. Delsman, O. Weiler, M. Mens, J. ter Maat, Y. Huismans, K. Sloff, E. Mosselman, 2018, Mogelijke gevolgen van versnelde zeespiegelstijging voor het Deltaprogramma. Een verkenning. Deltares rapport 11202230-005-0002.

NOS. (2021, December 27). Overstromingen in Limburg en buurlanden op één na duurste natuurramp van 2021. Retrieved April 1, 2022, from https://nos.nl/artikel/2411052-overstromingen-in-limburg-en-buurlanden-op-een-na-duurste-natuurramp-van-2021

Oppenheimer, M., B.C. Glavovic , J. Hinkel, R. van de Wal, A.K. Magnan, A. Abd-Elgawad, R. Cai, M. Cifuentes-Jara, R.M. DeConto, T. Ghosh, J. Hay, F. Isla, B. Marzeion, B. Meyssignac, and Z. Sebesvari, (2019). Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. Cambridge: Cambridge University Press, 321–445. https://doi.org/10.1017/9781009157964.006.

Panman, M. (n.d.). Met de trekschuit op reis vanuit Delft. Erfgoedhuis Zuid-Holland. Retrieved March 28, 2022, from https://geschiedenisvanzuidholland.nl/verhalen/verhalen/met-de-trekschuit-op-reis-vanuit-delft/

PBL & CBS. (2019). Regionale bevolkings- en huishoudensprognose. Themasites.Pbl. Retrieved March 28, 2022, from https://themasites.pbl.nl/o/regionale-bevolkingsprognose/

Planbureau voor de Leefomgeving. (2013, January 15). Correctie formulering over overstromingsrisico Nederland in. PBL Planbureau voor de Leefomgeving. Retrieved March 4, 2022, from https://www.pbl.nl/correctie-formulering-over-overstromingsrisico

Port of Rotterdam. (n.d.). All shipping routes via Port of Rotterdam | Navigate planner. Navigate Port of Rotterdam Shipping Routes - Get a Complete Overview of the Best Connections. Retrieved March 4, 2022, from https://rotterdam.navigate-connections.com/companies

Provincie Zuid-Holland. (2021, December 21). Verstedelijking. Retrieved April 1, 2022, from https://www.zuid-holland.nl/onderwerpen/ruimte/verstedelijking/

Quarter Guide Q3 2021–2022 MSc2 Urbanism. (2022, 27 January). [Presentatieslides]. Brightspace. https://brightspace.tudelft.nl/d2l/le/content/398764/viewContent/2589750/View

Rocco, R., Newton, C., d'Alençon, L. M. V., Watt, A. v. d., Babu, G., Caradonna, G., Di Gioia, L. Subendran, J., Tellez, N., Pessoa, I. T. (2021). A Manifesto for the Just City. Delft: Delft University of Technology.

Salm, H. (2019, January 31). Hoe geven rampen de Nederlandse identiteit vorm? Trouw. Retrieved March 15, 2022, from https://www.trouw.nl/nieuws/hoe-geven-rampen-de-nederlandse-identiteit-vorm~b-14f8469/?referrer=https%3A%2F%2Fwww.google.com%2F

Sanders, E. (2002, April 22). Poldermodel. NRC. Retrieved April 1, 2022, from https://www.nrc.nl/nieuws/2002/04/22/poldermodel-7586691-a456062

Sustainable Shipping Initiative & 2BHonest. (2021, June). Exploring shipping's transition to a circular industry. https://www.sustainableshipping.org/resources/shippings-transition-to-a-circular-industry/

Ten Voorde, J. (2018, January). Relocating Rotterdam (Master Thesis, Delft University of Technology). Retrieved from http://resolver.tudelft.nl/uuid:0a6be126-3fff-4ad2-9716-253bc8d99f73

Topotijdreis: 200 jaar topografische kaarten. (2022). Topotijdreis. Retrieved March 15, 2022, from https://www.topotijdreis.nl/kaart/1850

United Nations. (2015). THE 17 GOALS | Sustainable Development. Https://Sdgs.Un.Org/Goals. Retrieved March 20, 2022, from https://sdgs.un.org/goals

van Dijk, T., Moonen, H., van Dorsser, H., Negenborn, R., & van den Berg, R. (2019). Smart ships and the changing maritime ecosystem.

Van Goyen, Jan. Landschap met gezicht op de Vliet bij Voorschoten. (1642), Museum de Lakenhal, Leiden. https://www.lakenhal.nl/nl/collectie/b-1431

Wiegmans, B. W., & Louw, E. (2011). Changing port–city relations at Amsterdam: A new phase at the interface? Journal of Transport Geography, 19(4), 575–583. https://doi.org/10.1016/j.jtrangeo.2010.06.007

7.2 List of figures