



TOWARDS A HEALTHY DELTA

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THE HEALTHY DELTA

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TOWARDS A HEALTHY DELTA

AN EXPLORATION OF COMMUNITY
EMPOWERMENT AS A MEANS TO
SUPPORT THE DELTA'S ABILITY TO
PRODUCE ECOSYSTEM SERVICES

ABSTRACT

Currently, the Southwestern Delta is ill. The inability to produce its essential ecosystem services hinders the Delta from being healthy. Systems that make the Delta economy prosper are the main reasons for this obstruction. If current hazards like salinisation, soil depletion, and nitrogen pollution continue; the livelihood of the peri-urban Delta communities will be under threat. In contrast, the direct relation to the Delta makes them a potential stepping stone for change.

The main question: 'How can local peri-urban communities be the base of the just transition towards a healthy Delta, which restores the production of ecosystem services and improves the climate resilience of the Delta?' forms the foundation of this research. This research aims to explore the potential of communities as the missing link in the just transition towards a healthy Delta.

By creating a vision and designing its strategy, the Delta area will be able to produce its ecosystem services from 2050 on. The combination of

environmental assessments, mapping and spatial analysis, stakeholder engagement, a SWOT matrix, the development of action perspectives through scenario planning, and a policy review provides the base for a vision towards a healthy Delta. This vision is translated into a strategy where a design catalogue, community engagement approach, and a knowledge network bring everything together in the spatialisation of three zoom-in areas: Schouwen-Duiveland, Oesterdijk, and Haringvliet.

Through education and recognition, the awareness of the Delta communities will rise which will motivate them to be part of the urgent transition towards a healthy Delta. Field labs and knowledge centres stimulate cooperation and sharing of knowledge. The ecosystem can be restored through the collaboration of the communities with other stakeholders. The combination of ecosystem-based adaptation, knowledge networks, and the borderless approach creates a regenerative and resilient Delta that serves as an example to other estuaries in the world.

*Ecosystem adaptation
Delta restoration
Community based
Agroecological zoning
Borderless
Decentralisation*

PREFACE

The Delta landscape of The Netherlands has proven its worth throughout history. The water structure blessed the country with a strong geographical position to grow out to be one of the richest countries in global history. The economic situation of the country attracted communities and industries that settled along the Delta. Economic activities have been depleting the Delta for a long time. The health status of the Deltaic landscape is under pressure.

The communities that live in the Delta are dependent on the healthiness of the estuary. All upstream pollution flows along the river to the Delta. Delta communities have to deal with transboundary, upstream pollution which threatens the ability of the river to generate benefits for humans and environmental stability, like clean water and air. Peri-urban agricultural communities and industries pollute the soil and water in the Delta. In combination with climate change, there is a dire need for a change to be able to let communities

sustain themselves in the Southwestern Delta.

In the past, communities reclaimed the land by building artificial structures that constrain the Delta landscape. In this day and age, the global push for environmental resilience demands a new way of regional design. By giving room for the Delta, to regenerate itself, the potential of an agroecological approach is significant. The Southwestern Delta can be considered an ecological, economic, and cultural hub, where communities thrive in co-existence with nature.

This research and design project aims to create a vision and design an appropriate strategy to start a transition that transforms the current unhealthy Delta into a healthy one. In this project, communities take centre stage in the exploration of community involvement. They are the key players to resolve the missing link in the current governance where they are left out.

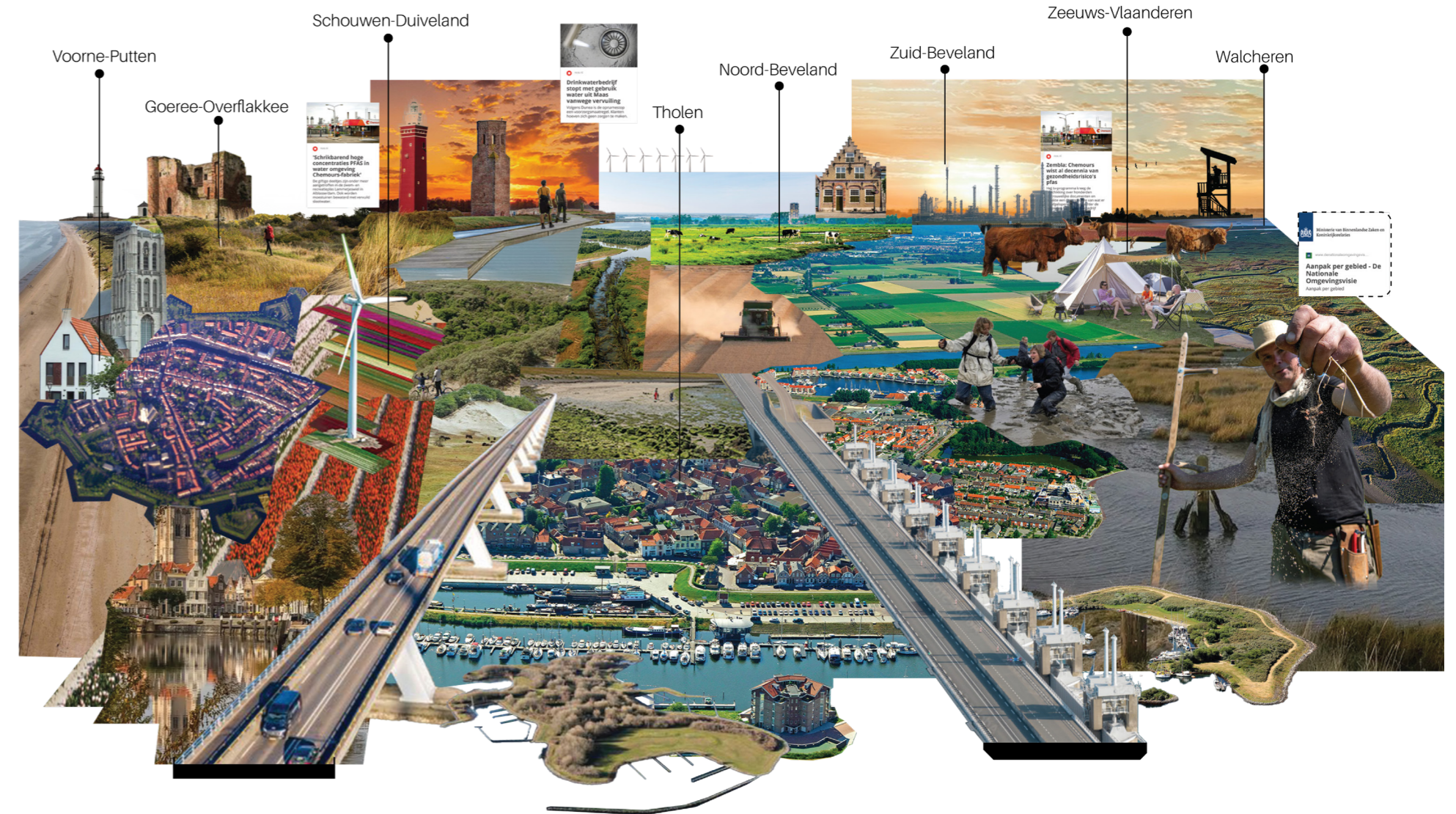


Figure 0.1 - Collage Southwestern Delta

1. DIVING INTO THE DELTA

This chapter gives an introduction to the Southwestern Delta area in The Netherlands. The historical analysis, combined with the explanation of essential ecosystem services provides a frame of reference for this project. From there, a pollution analysis gives insight into the problematic trends that put the Delta at risk.



1.1 DELTA HISTORY

SITUATION 1580

The South Western Delta is one of the most engineered Deltas in the world. For most of its existence, this ecosystem has been shaped by currents and climate. In the last 600 years, humans have acted as architects of this landscape. This Delta is a representation of the entrance into the Anthropocene period.

Since Roman times, the mouth of the Delta has been a strategic stop for sailors, including Vikings (Valli, 2018). As people took notice of the abundance of ecosystem services in the landscape, dikes were erected to utilise these characteristics for farming and trading.

The first dike constructions and land reclamation took place around 1300 (Meyer et al., 2015). This human activity of claiming land would steer the dynamic system of the Delta region for the coming 500 years. The landscape that arose was rich in fertile soil and had great access to fresh water. Families started individual farms and fisheries.

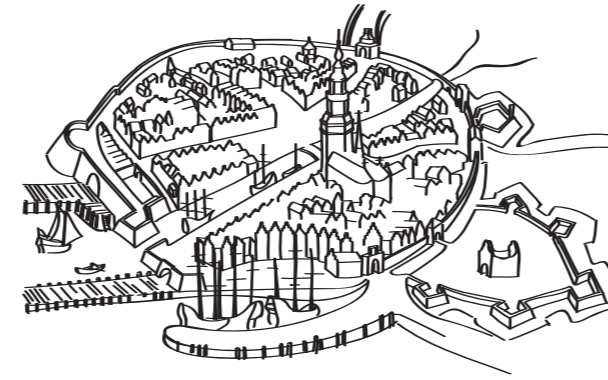


Figure 1.2 - Urbanised settlement 1580

Their choice of practices, livestock, and crops was greatly influenced by what the Delta provided them (Figure 1.3). As farm plots scattered around the Delta, so did the greater urban settlements. By 1500, the coast of the landscape became decorated by compact walled trading towns (Figure 1.2). The landscape steered the economy and life of the inhabitants (Meyer et al., 2015).

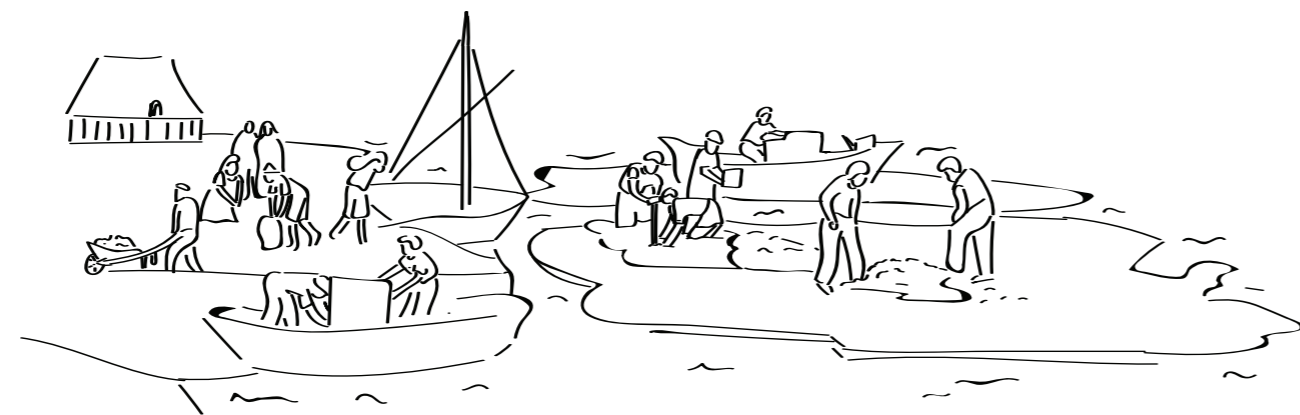


Figure 1.3 - Economy based on Delta landscape

- Urbanisation
- Port expansion 1950
- Port expansion 2010
- Agriculture vegetable
- Agriculture fruits
- Aquaculture
- Dikes
- Canal
- Water
- Wetlands
- Dunes

Figure 1.4 Historical map 1580



1.1 DELTA HISTORY

SITUATION 1850

In 1850, the land reclamation process started to slow down. However, the original tidal landscape of the Delta was barely recognisable anymore. Previously compact harbor towns, such as Rotterdam and Antwerp, started to expand beyond their walls.

The ports needed to expand to make room for steamships and industrial processes, which were newly introduced from overseas (Meyer et al., 2015). Original family farmers began to modernize and annex neighboring plots to become larger businesses.

The agricultural practices of this area are strongly characterised by production on demand. If there was a demand for something, they would produce it, even if it was a foreign crop or animal (Zeeuwse Ankers, 2022).

The fishers and shellfish farmers claimed a greater area of the OosterScheldt. Straight canals were built to provide infrastructure for the greater engine-powered fleets of ships (Meyer et al., 2015).

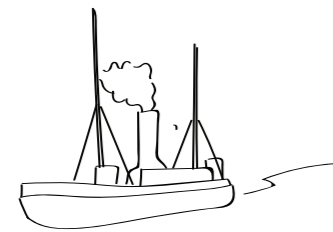


Figure 1.6 - Delta industrialisation



Figure 1.5 - Rise of harbour towns in the Delta region

The natural tidal systems of the landscape were stripped from the Delta to become a powerhouse production landscape.

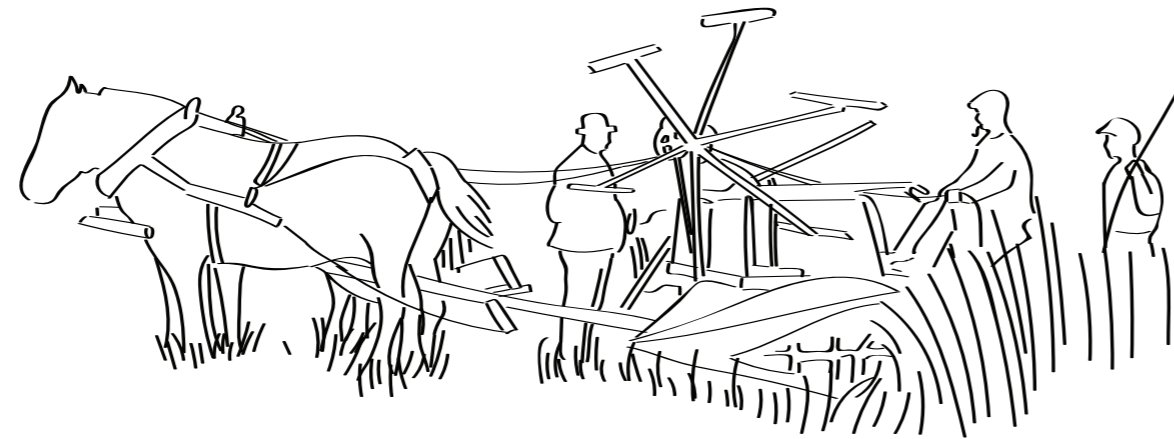


Figure 1.7 - Agricultural practices in the Delta region shift to the demand of the produce

- Urbanisation
- Port expansion 1950
- Port expansion 2010
- Agriculture vegetable
- Agriculture fruits
- Aquaculture
- Dikes
- Canal
- Water
- Wetlands
- Dunes

Figure 1.8 Historical map 1850



1.1 DELTA HISTORY

SITUATION 2010

The growth came to a halt when the Second World War strangled the Dutch Economy. The Port of Rotterdam was bombed in 1940, which also limited trading abilities (Stadsarchief Rotterdam, 2015).

After the war, the Delta faced another disaster. In 1953, high water levels and extreme winds caused the sea to rise above the dikes. The North Sea Flooding took place and ravaged most of the islands of the Delta (Hall, 2020). As a reaction to this disaster, the government introduced the Delta Works, a collection of great dams to close off most of the South Western Delta from the sea to prevent future floods (Figure 1.10). The river mouths of the Meuse and the WesterScheldt were left open as trading connections for the Port of Rotterdam and Antwerp to the North Sea. These ports extended away from the cities and further into the river mouth to become greater international gates of trade and industrial regions (Figure 1.9) (Meyer et al., 2015).

During this development, the Common Agricultural Policy was introduced in 1962. Farmers were subsidised to increase their production through modernization, which introduced heavy machinery, pesticides, and fertilisers. To enhance efficiency

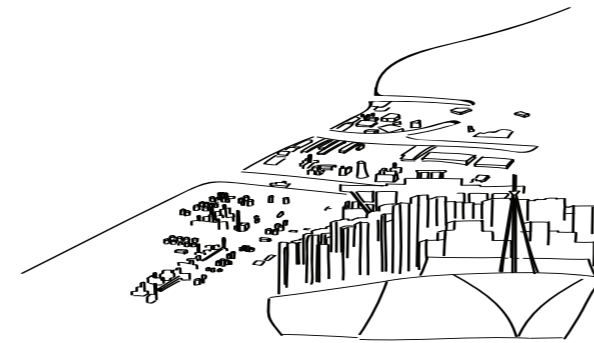


Figure 1.9 - Industrialisation of the port

even further, land consolidation practices started to reconstruct the polder landscape to be suited for new tractors and machinery (Van Den Noort, 1987). The organically formed plots became a grid of rectangular parcels. Traditional farming faded from the landscape, leaving only the large historic barns behind (Zeeuwse Ankers, 2022).

The South Western Delta, which evolved from being a dynamic and diverse estuary ruled by currents and climate, has now become a monocultural and fully controlled production landscape suited to human needs and wishes.

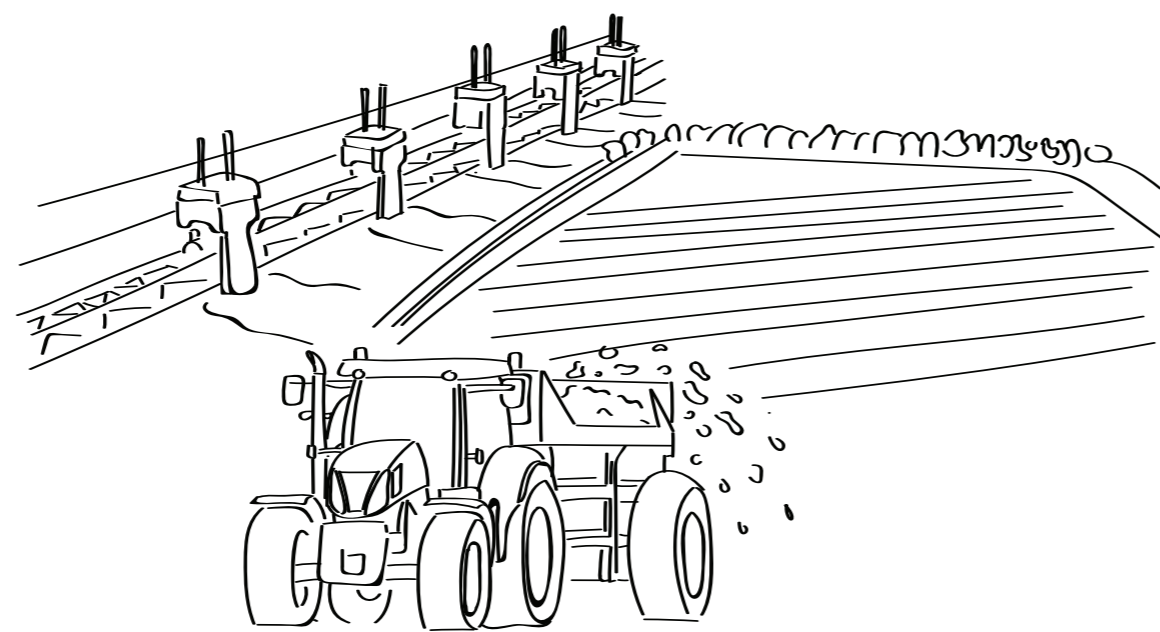


Figure 1.10 - Industrialisation of the Delta region and agricultural practices

- Urbanisation
- Port expansion 1950
- Port expansion 2010
- Agriculture vegetable
- Agriculture fruits
- Aquaculture
- Dikes
- Canal
- Water
- Wetlands
- Dunes

Figure 1.11 Historical map 2010



1.2 ECOSYSTEM SERVICES

Ecosystem services emerge when “an ecological structure (e.g., wood fiber) or function (e.g., the filtering function of vegetation and soils) contributes directly or indirectly toward meeting a human need or want.” (Daniel et al., 2012). Miyanaga and Shimada (2018) define ecosystem services comparably as “the direct and indirect contributions of ecosystems to human well-being”. The ecosystem services are classified according to their characteristics and benefits (Bennett et al., 2009; Daniel et al., 2012): **provisioning services** (e.g. food, fresh water, clean air), **regulating services** (e.g. climate regulation, purification of water and air), **cultural services** (e.g. belief systems, recreational experiences) and **supporting services** (e.g. nutrient cycle, soil formation).

The Delta is considered healthy when the Delta itself can provide its (natural) ecosystem services again. For this project, the ecosystem services are divided into 4 categories: provisioning, supporting, regulating, and cultural, as seen in the triangle below. Some services are the base of the Delta; water and soil. Other services occur when the natural function of the river is restored, such as the nutrient cycle or connecting habitats. The ecosystem services are a means to our project and at the same time a type of measurement. When projects are being implemented in the right way in the Rhine-Meuse-Scheldt Delta, ecosystem services emerge.

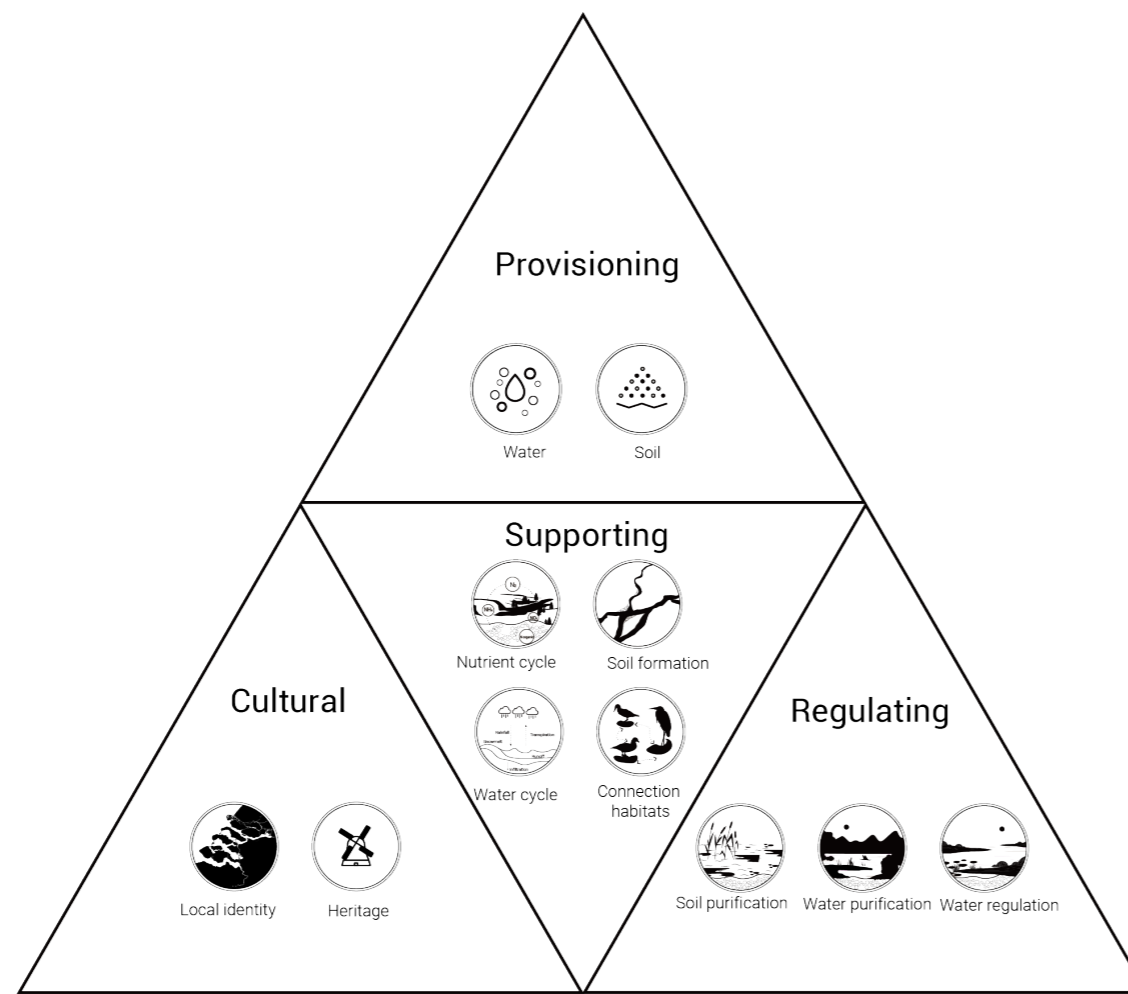
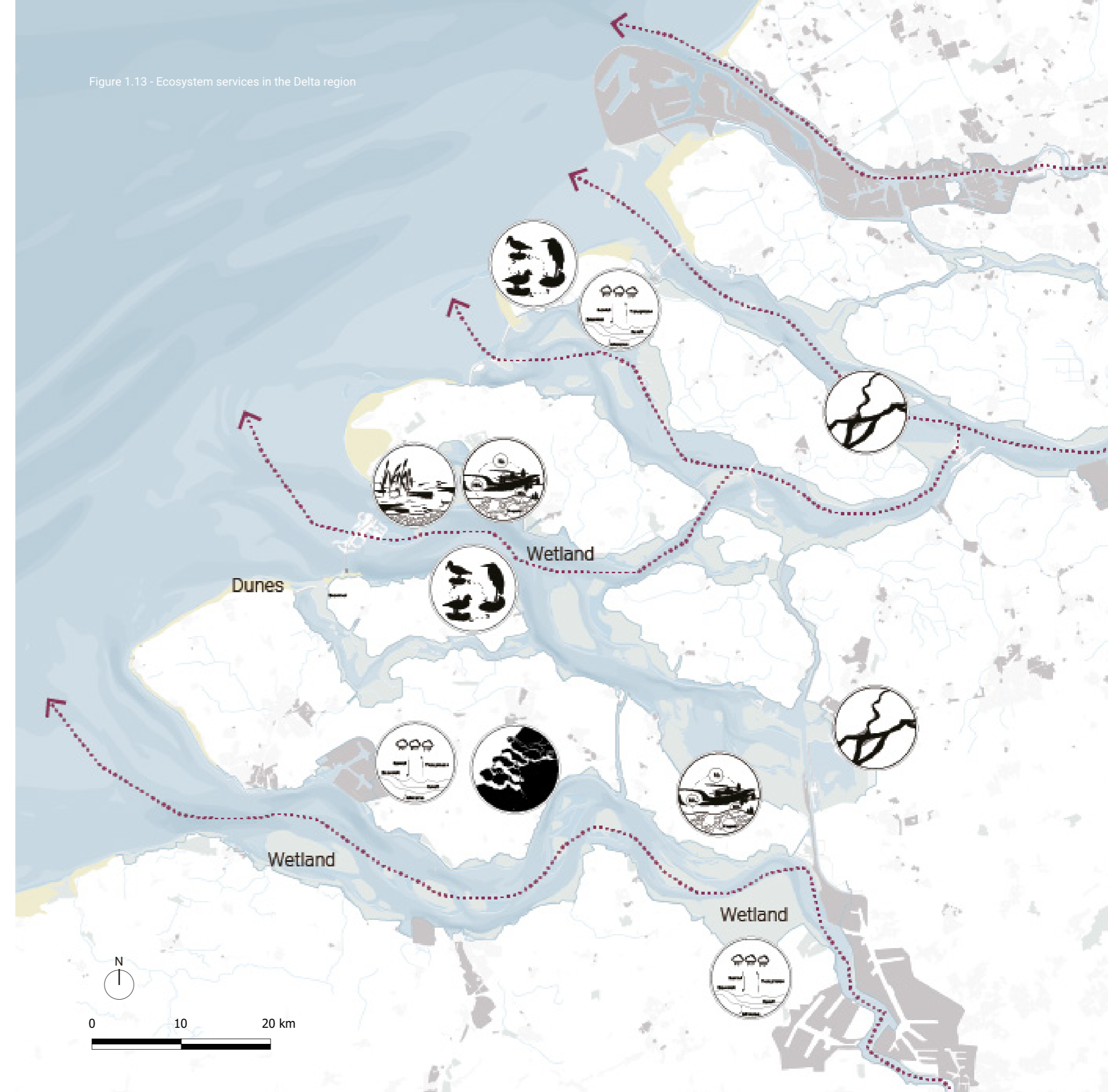


Figure 1.12 - Triangular overview of the ecosystem services

- Urban Fabric
- Ports and industries
- Dunes
- Water Bodies
- Wetlands
- Dike
- Water Flow

Figure 1.13 - Ecosystem services in the Delta region



1.3 THE ILL DELTA

NITROGEN POLLUTION

The Rhine-Meuse-Scheldt Delta has numerous industries linked to its river basin. These industries vary in sectors, from petrochemical industries to farming. However, they all pollute the Delta by discharging wastewater into the river, which often contains nitrogen.

Polluters

The main polluters around the mouth of the Delta region are the manufacturers of petroleum products, glass, and fertilisers (Figure 1.14). The cattle farmers also contribute to this, because the faeces of cows and pigs produce a significant amount of ammonia and nitrogen. However, most nitrogen comes from upstream pollution, often caused by (manufacturing) industries. This pollution results in the communities of the peri-urban areas in Zeeland needing to adapt to new nitrogen policies to improve nitrogen sinkage into

the soil. These rules are specifically high around Natura-2000 areas.

Emission

Nitrogen emissions are harmful when nitrogen comes in contact with water or air. This reaction process results in ammonia and nitrogen oxides, which are harmful to the environment. This exposure results in a loss of biodiversity and depletes the soil of nutrients that are necessary for agriculture. The Government has set reduction goals for nitrogen emissions to protect vulnerable natural areas. In 2030, 74% of the vulnerable Natura-2000 areas should not exceed the upper nitrogen limit (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2023). These effects of the nitrogen system, combined with the existing policies force farmers to change.

- Water
- Dunes
- Wetlands
- Ports and industries
- Urban areas
- Nitrogen release
- Ammonia release
- Pollution in the river
- Run off nitrogen cropfarming
- Source of pollution

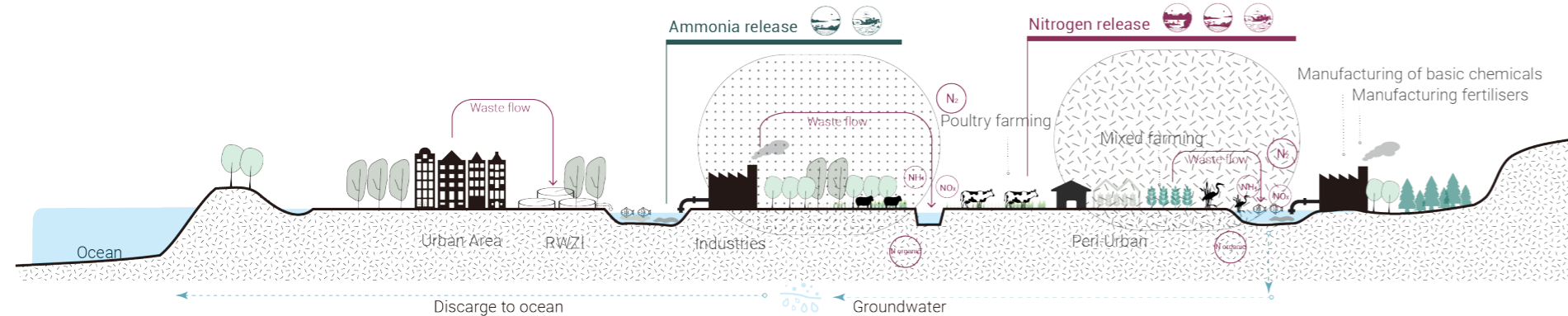


Figure 1.14 - Section of the Delta with the visualisation of the nitrogen pollution

Figure 1.15 - Nitrogen pollution in the Delta region



1.3 THE ILL DELTA

CLIMATE CHANGE

Another threat to the Delta is climate change. Climate change is a broad topic, but the problems that peri-urban areas face most are the water level rise (flooding), salinisation of the water, and experiencing problems in times of drought (Klimaateffectatlas, 2023).

Flood risk

All islands in the Delta region are protected by the Delta Works and other (smaller) dikes. However, due to the rising sea level and the precipitation being more extreme, the water levels in the Delta will also rise. Some dikes are not capable of protecting the peri-urban areas and communities (LIWO, 2022). These risk areas need a new way of engineering to protect the people who are living behind these waterworks from the water.

Salinisation

Salinisation is the process that leads to an excessive increase of water-soluble salts in the soil (ESDAC - European Commission, n.d.). This is

a natural occurrence but due to the rising sea level, the border of the salt-, brackish- and sweetwater moves more land inwards (Klimaateffectatlas, 2023). The salinisation of soil has a severe impact on arable farming because not all crops can grow on the (now) salty soil. This means that the production of crops needs to shift to a limited type of crops or that some farmers are forced to quit cultivating crops in the region that become too saline.

Drought

The soil is vulnerable to drought because the aeration of the ground changes, which translates to the soil not being capable of crop cultivation anymore (Qu et al., 2023). The peri-urban areas must be protected from the (salt) water, but at the same time areas for sweet water retention need to be created to protect the arable farmers, the nature areas, and the other peri-urban communities.

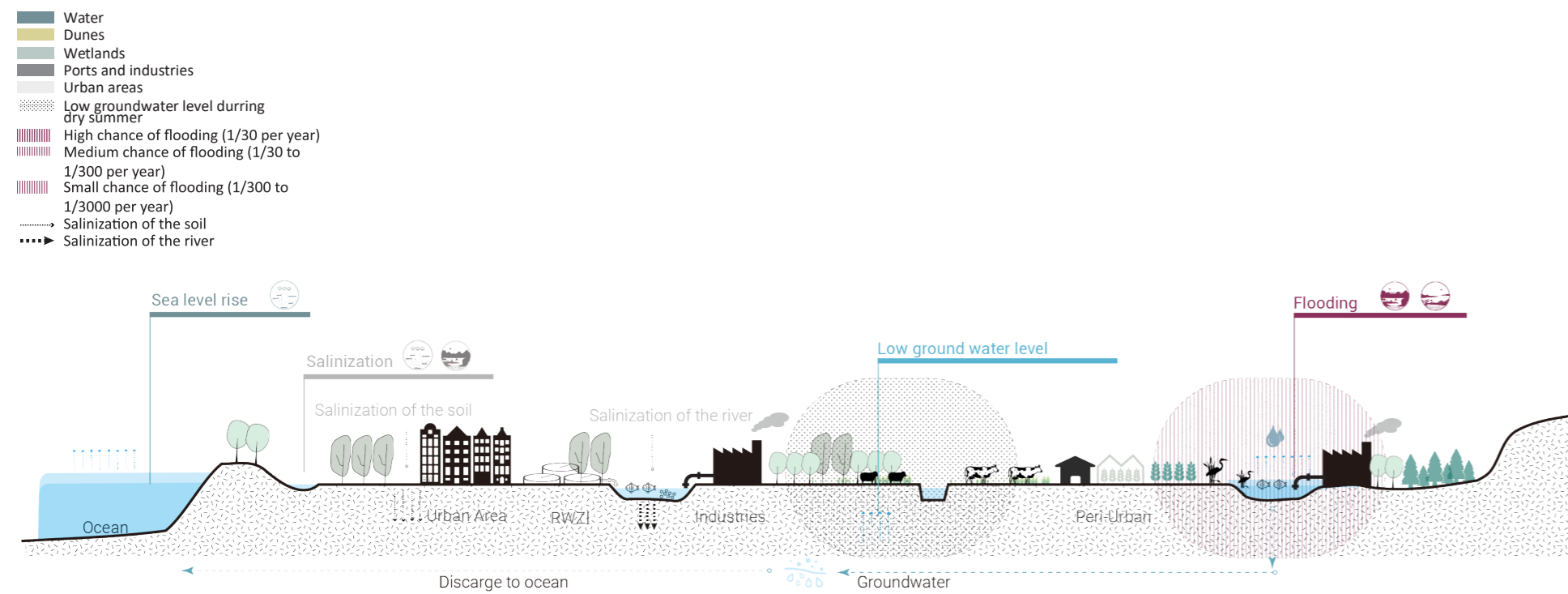
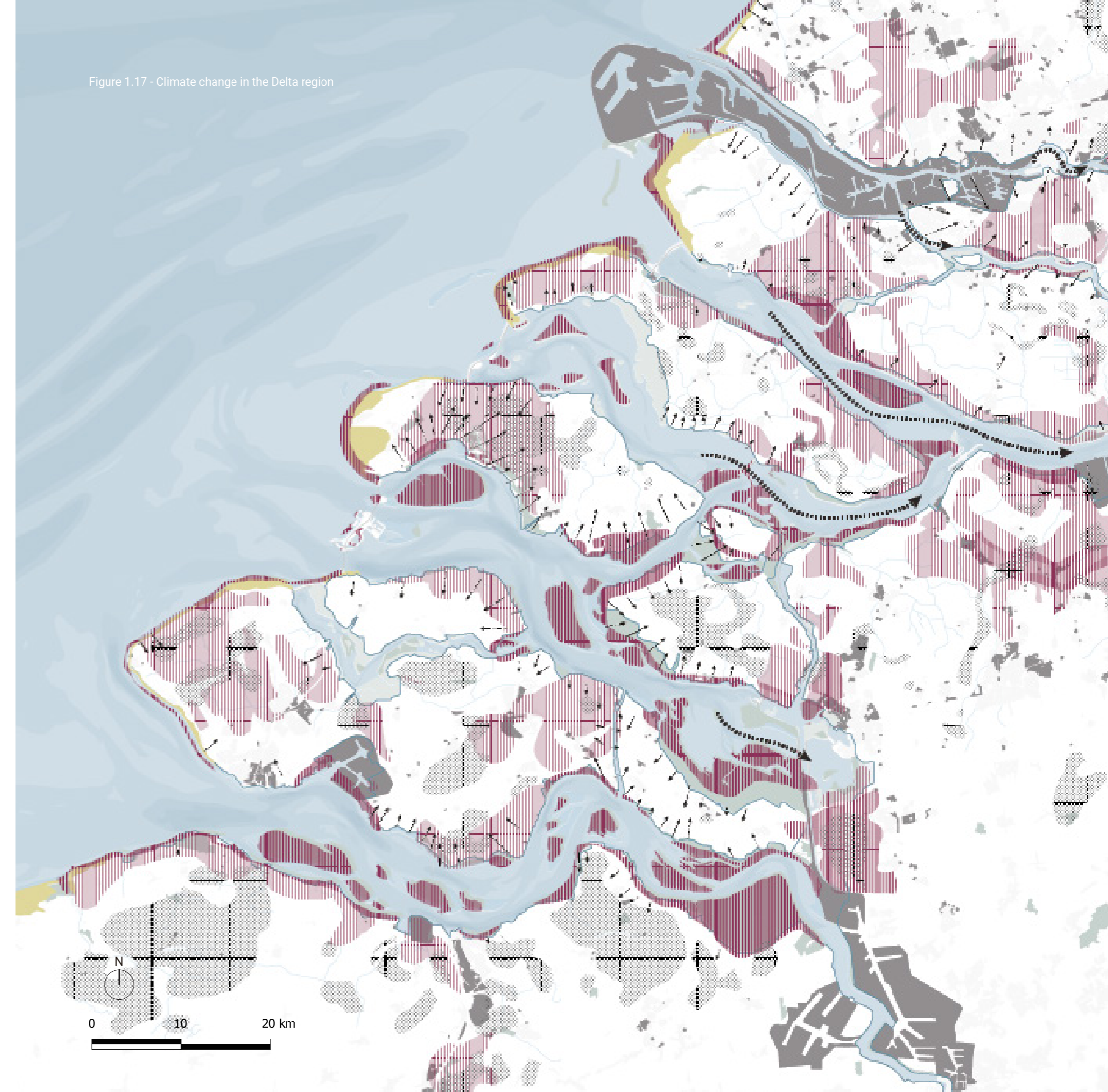


Figure 1.16 - Section of the Delta with the visualisation of climate change

Figure 1.17 - Climate change in the Delta region



1.3 THE ILL DELTA

TRIPLE BURDEN

The communities of the Delta region are in a difficult situation. Presently, they are stuck with three different problems that intensify each other. The triple burden of climate change, (upstream) nitrogen pollution, and strict policies constrain the Delta communities which are not fully responsible for all problems in the area.

Climate change

First, climate change is putting pressure on the communities. The extreme water scenarios for the future pose a threat to the water safety of the Delta region. On top of that, further salinisation of the area endangers the arable farming industries and forces a change in crop types.

(Nitrogen) pollution

Next, upstream pollution of big industries ensures the presence of nitrogen in water and soil in the Delta. This creates a biodiversity loss and endangers the Natura 2000 areas in the Delta. Farmer communities also contribute to nitrogen pollution in the Delta.

Policy

Finally, the combination of these two problems is the cause of strict policies regarding the reduction of nitrogen emissions. Since the Delta region has a significant amount of Natura 2000 areas in proximity, agricultural communities are forced to change their farming practices.

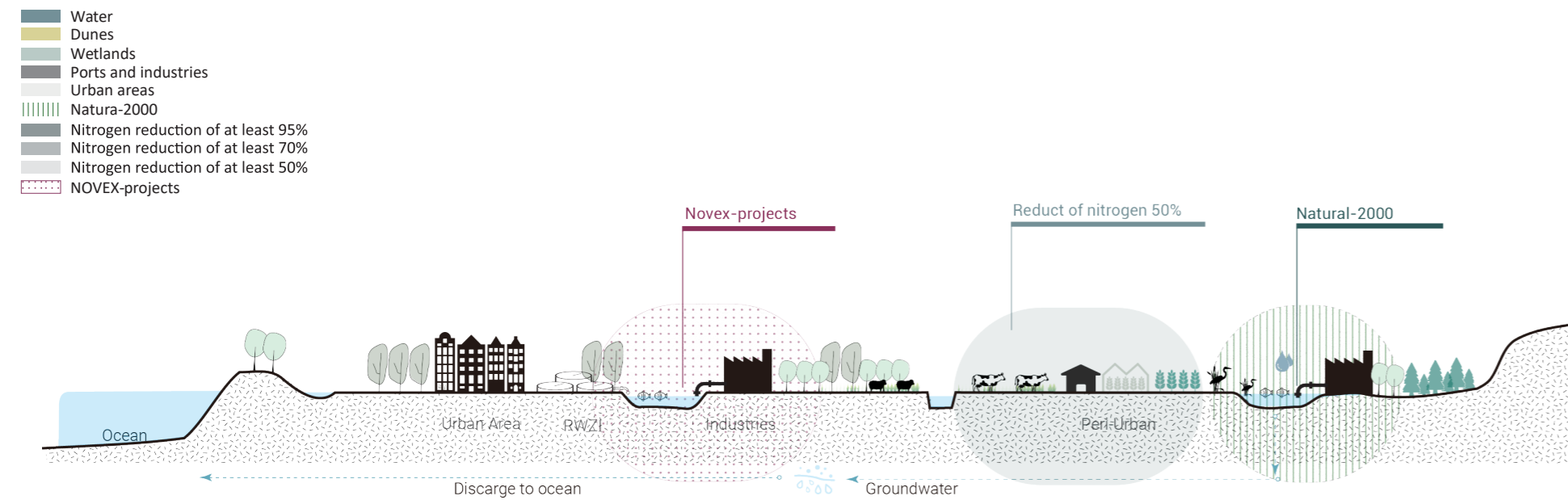


Figure 1.18 - Section of the Delta with the visualisation of the policies in the region

Figure 1.19 - Triple burden in the Delta region (policy based)



1.3 THE ILL DELTA

AGROCOMMUNITIES PROTEST

The Delta is getting ill from different kinds of pollution and climate change. This will hit numerous communities in the peri-urban areas, but the one that gets hit the hardest is the farmer community.

Policy

Policies are made to regulate the environment. The nitrogen policies are made to protect the natural environment from being polluted, while other policies make sure that no one gets left behind. Most of the climate change and nitrogen policies however affect the farmers a lot because they are the industries that are pointed out to make their practice more sustainable and emit less nitrogen into the water systems. While this sounds fair to others, the farmer community feels that they are already dealing with a lot of problems in the

current economic climate and therefore do not feel represented by the governmental institutions.

Protests

Because the farmer community feels left behind, organisations have been set up to gather farmers from all over the country to protest against the policies made by the government. These protests gather attention because the organisations block highways or other important infrastructures to create awareness.

What to do?

The best way to deal with the farmer protest is to listen to the farmer communities. To get to a healthy Delta together, the farmer communities should be involved in the decision-making by sharing their knowledge about farming practices and with policy writing for future generations.

- Dunes
- Wetlands
- Water Bodies
- Salinization
- Nitrogen reduction of at least 95%
- Nitrogen reduction of at least 70%
- Low groundwater levels
- Nitrogen pollution
- High flood risk
- Medium flood risk

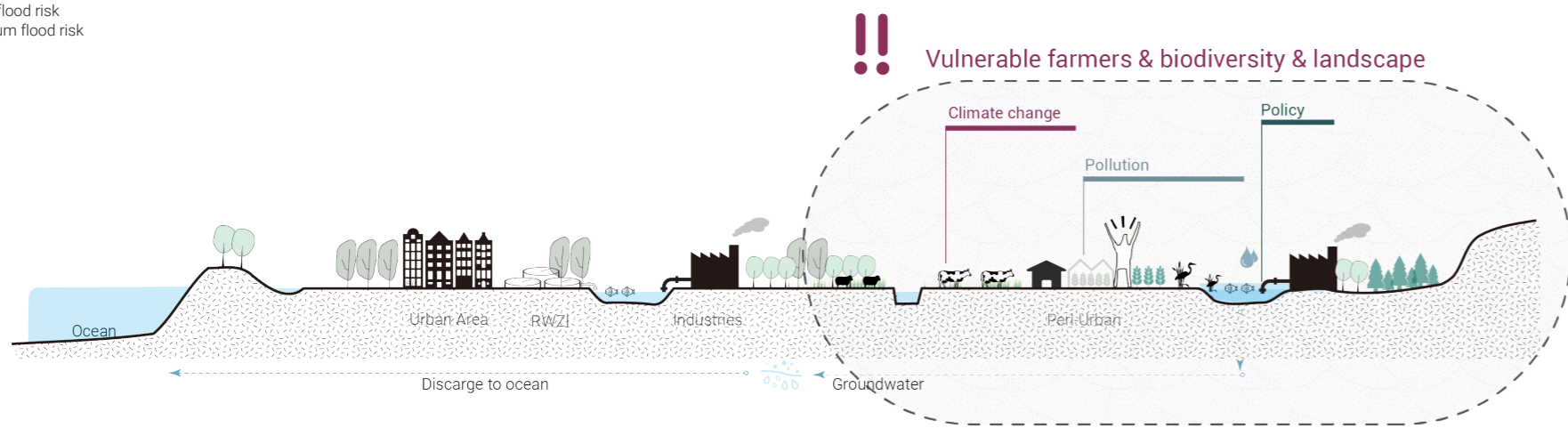
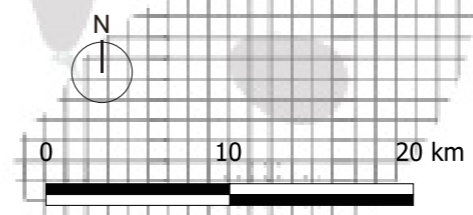
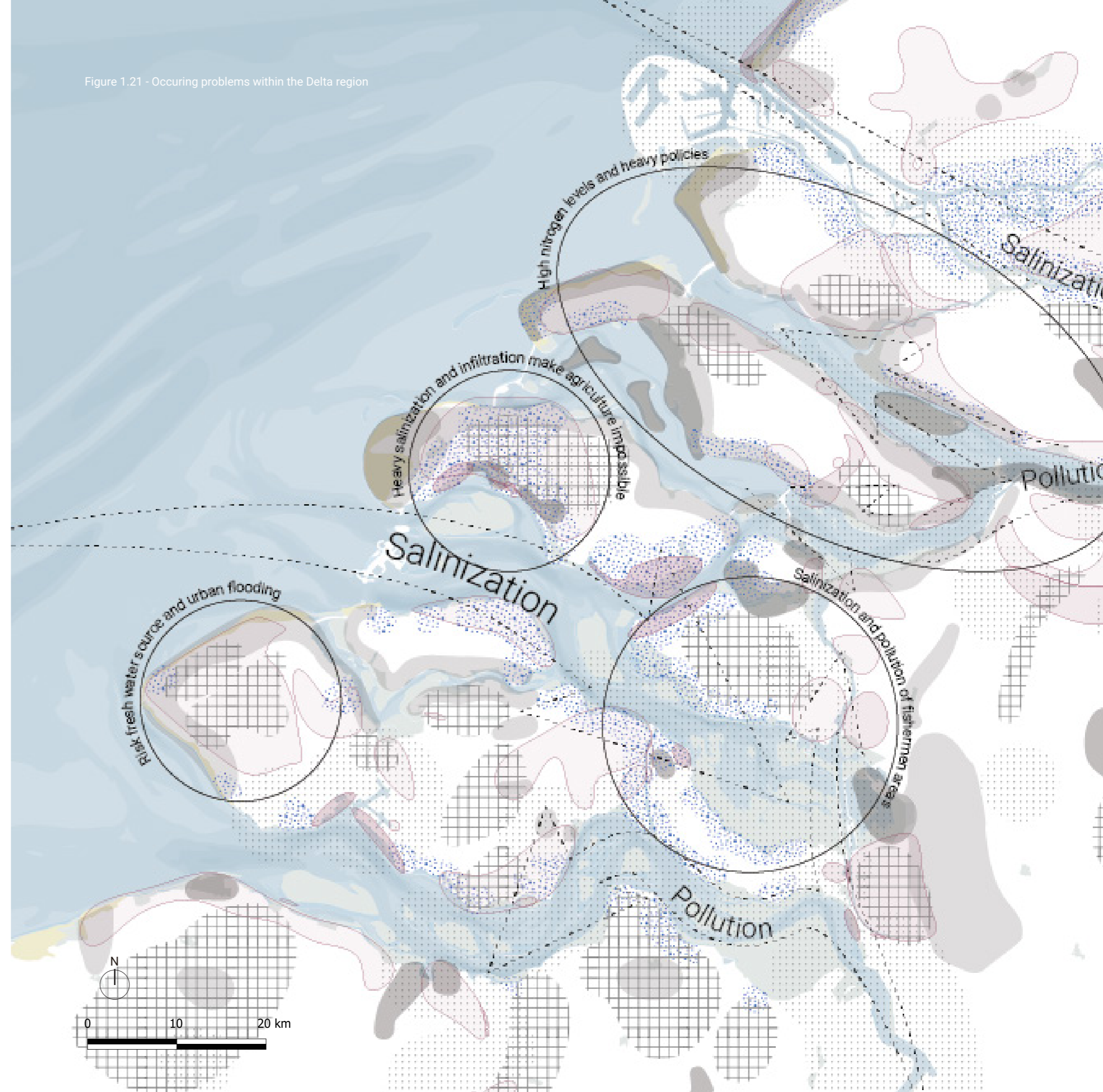


Figure 1.20 - Section of the Delta with the problems of the agro-communities

Figure 1.21 - Ocurring problems within the Delta region



2. THE UNHEALTHY DELTA

The problems that occur in the Delta region make the Delta unhealthy. To make the transition to a healthy Delta, a problem statement has been formulated. Together with a research question the scope of the project has been determined, which is summarized in the conceptual framework. The framework identifies and connects all related themes and concepts to the healthy Delta. How all of the analysis and research transforms into a plan to make the Delta healthy again is then summarised in the methodology overview.

Figure 2.1 - Sattelite image Noorder Krammer (Google Maps, n.d.)



2.1 PROBLEM STATEMENT

The biophysical qualities of the Rhine-Meuse-Scheldt Delta have endowed the region with rich ecosystem services, attracting habitation and economic activities (Peng et al., 2021). Today, the region is a European powerhouse, accommodating approximately 45 million people amidst high urbanisation, infrastructure, and prosperity (SURE EuroDelta, 2023).

However, **the prosperity of the Delta economy has placed increasing pressure on the Delta's ability to produce essential ecosystem services.** This is relevant because the continued degradation of the Delta will eventually render the region unsuitable for agricultural practices and habitation due to pollution, flood risk, and the inability to produce safe drinking water. These developments put **Delta-dependent peri-urban communities at risk. Although, the Delta and its peri-urban communities have the potential to break the destructive cycle.**



Figure 2.1 - Visualisation of the problem statement

2.2 RESEARCH QUESTIONS

Main question:

How can local **peri-urban communities** be the base of the just transition towards a **healthy Delta**, which restores the production of **ecosystem services** and improves **climate resilience** of the Delta?

Sub-questions:

1. *What are the current structures that make the Delta unhealthy?*
2. *How can local peri-urban communities be actively involved in restoring the production of ecosystem services within the Delta?*
3. *What specific strategies can be employed to enhance the climate resilience of peri-urban communities in Delta region as part of the transition process?*

2.3 CONCEPTUAL FRAMEWORK

The conceptual framework provides an overview of concepts creating the research perspective for the Healthy Delta. In this report, a Healthy Delta is defined by the ability to produce the ecosystem services of water and soil. To achieve this, the directly related actors—communities and the biophysical system—need infrastructure to support the ecosystems. Communities need access to participation and knowledge, and their position and culture must be recognised to participate in the transition. The ability to join the transition will enhance their spatial justice. This will be analysed through governmental documents, stakeholder analysis, historical, and spatial analysis.

Biophysical systems must have infrastructure for their self-regulating and self-organising properties. This infrastructure is made up of the natural landscape and the room for natural

cycles. This will be accessed by viewing internal and external influences on the cycles of the Delta. Internally, factors such as land use, soil, and water analysis will be considered, while externally, pollution sources will be examined. Restoring the presence of infrastructure for ecosystem services will increase their availability as well as their resilience in the face of climate change.

The synergy between communities and biophysical systems will be assessed by the presence of decentralised and agroecological practices. The level of centralisation will be examined through system analysis. The evaluation of crops and farming practices will indicate the level of agroecological practices. The results of all these analyses will represent the type of co-evolution and level of cohabitation within the Southwestern Delta.

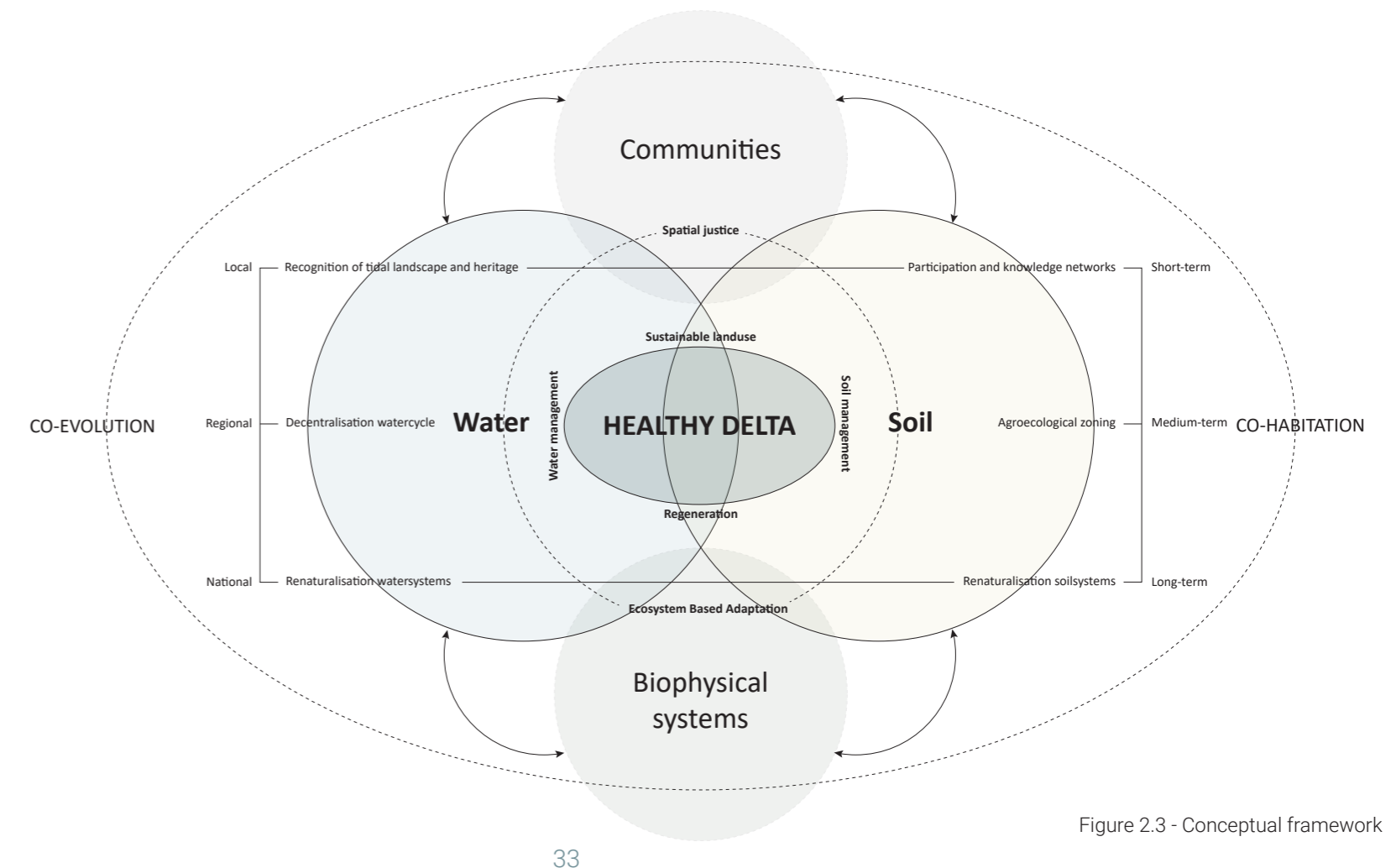


Figure 2.3 - Conceptual framework

2.3 CONCEPTUAL FRAMEWORK

LITERATURE REVIEW

This triple burden can be directly related to the mismanagement of ecosystems. To frame this narrative, it is necessary to enter the academic discourse about ecosystem management and the potential of ecosystem-based adaptation.

Ecosystem management

Ecosystems function as self-regulating adaptive systems, carrying self-organising properties that evolve through the interplay between populations and their environments. Ecosystems have functioned this way for most of human history. Human societies rely on these properties and ecosystem services for their livelihoods (Daniel et al., 2012; DeFries & Nagendra, 2017).

In the 21st century, humans have increasingly employed methods that substitute or enhance ecosystem functions, such as pesticides replacing the ecological role of natural pest predators and fertilizers boosting nutrient cycling, a crucial function of ecosystems. However, these methods don't mimic or fit into the self-regulating infrastructure of ecosystems. A mismatch arises, causing unintended consequences (Elmqvist et al., 2013; DeFries & Nagendra, 2017). In the Southwestern Delta, these consequences manifest as the runoff of nitrogen into waterways, resulting in nutrient excesses, and the reclamation of wetlands to arable land, which has led to the destruction of ecological networks regulating the nutrient balances of soil and water. Furthermore, the spatial separation of production and consumption, coupled with increasing inequality in access to ecosystem services, reveals the multi-scalar characteristic of ecosystem management (Unnikrishnan & Nagendra, 2015; DeFries & Nagendra, 2017).

Wicked problems

Contemporary studies recognise the inherent complexity of ecosystems and the unpredictability of the outcomes of interventions across various spatial, temporal, and administrative scales (DeFries & Nagendra, 2017). It is appropriate to view ecosystem management as a wicked problem without a clear or straightforward solution. To tackle these issues, strategies involve multisectoral decision-making, cross-boundary management institutions, adaptive techniques,

market systems valuing natural resources, and inclusive collaborations among stakeholders to address disparities (Head and Alford, 2013).

Ecosystem-based Adaptation as a Potential

There is an expanding acknowledgment of the role healthy ecosystems can play in spatial justice and climate resilience (Ecosystem-based Adaptation, 2009; Munang et al., 2013; Wamsler et al., 2016). The Dutch government has centralised water and soil ecosystems in their legislation (Rijksoverheid, 2022). The integration of facilitating biodiversity and ecosystem services in a comprehensive strategy to enhance social, environmental, and economic resilience is called Ecosystem-based Adaptation (EbA). In practice, ecosystem-based adaptation includes sustainable water management, disaster risk reduction, sustainable management of lands for pastoral livelihoods, diverse agricultural systems, strategic management of natural landscapes, creating and efficiently managing protected area systems to guarantee the ongoing provision of ecosystem services, thereby enhancing resilience to climate change (Ecosystem-based Adaptation, 2009)

Ecosystem-based Adaptation for Spatial Justice

By reintroducing and supporting natural self-regulating and organising mechanisms, the supply and access to services will increase. Additionally, ecosystems, as natural buffers, often have lower maintenance costs and are more effective than physically engineered structures. Thus, they offer a method of adaptation that is also available for poorer communities (Nottage & Robertson, 2005; Ecosystem-based Adaptation, 2009; Jones, Hole & Zavaleta, 2012). Munang et al. (2013) frame EbA as an approach for spatial justice: "Fundamentally, EbA is the use of natural capital by people to adapt to climate change impacts, which can also have multiple co-benefits for mitigation, protection of livelihoods, and poverty alleviation." The United Nations Environment Programme introduced an EbA program to support vulnerable communities adjusting to climate change. The primary components are (United Nations Environment Programme, 2022):

1. Assessments and knowledge support;

- a. Data gathering for decision-making.
2. Capacity building and demonstration;
 - a. Enable conditions to implement EbA such as policies and education.
 - b. Demonstrating through pilots to make community-based strategies.
3. Integration of EbA options into national adaptation plans;
 - a. Institutionalising structures to mobilise stakeholders to participate in the transition.

Munang, Andrews, et al. (2013) stress that the success of EbA greatly depends on the involvement of local communities in the planning and implementation processes. The inclusion of local knowledge at regional and national levels of planning makes community-based management of initiatives possible, and by celebrating local 'front-runners', awareness and enthusiasm can be raised within the community. However, EbA initiatives often require large areas of land to be transformed from productive to restorative landscapes. Without considering the political context, land use conflicts, and local needs, these transformations are impossible (Munang, Andrews, et al., 2013; DeFries & Nagendra, 2017). "Open communication, an inclusive approach, and respect for the traditional land rights of affected local communities are all essential for both the future resilience of the community and for achieving EbA goals." (Munang, Andrews, et al., 2013).

Land-use trade-offs and system thinking

Ecosystem management is closely linked with land-use management. Globally, land use significantly affects and alters the production of ecosystem services (Deng et al., 2016). Enhancing the production of one ecosystem service can harm others (Elmqvist et al., 2013), especially in peri-urban areas, the transitional zones between urban and rural areas, where much of the landscape is dedicated to resource production (Wandl et al., 2014). These landscapes support agricultural practices that utilise fertilisers to improve soil effectiveness but may damage natural purification processes, as well as industrial practices that deplete freshwater resources and contribute to chemical pollution. Despite progress in assessing ecosystem services and alternative land-use

theories, their practical application remains minimal (Daily et al., 2009). Ring et al. (2010) argue that prevailing research often focuses on one or a few services, leading to a disregard for the interdependence and relationships between ecosystem services and related socioeconomic and biophysical systems (Rodríguez et al., 2006).

Agroecological zoning

A method that connects land use to biophysical scales and systems is Agroecological Zoning (AEZ). Its presence in sustainable agriculture has greatly increased in the last twenty years. AEZ establishes a uniform structure for evaluating climate, soil, and terrain factors relevant to agricultural activities. Subsequently, AEZ matching techniques help pinpoint specific constraints for different crops based on existing climate, soil, and terrain conditions, considering assumed input and management levels. Lastly, AEZ functions as a foundational framework for diverse agricultural applications (Fischer et al., 2021).

Various agroecological practices have been documented in the literature, such as the implementation of cover crops, green manure, intercropping, agroforestry, biological control methods, as well as practices aimed at conserving resources, biodiversity, and integrating livestock (Wezel et al., 2013). Wezel et al. (2023) view agroecological practices as a method that prioritises food production by harnessing ecological processes and ecosystem services, rather than relying solely on conventional techniques like chemical fertilisers or genetic modification. They enhance agroecosystem sustainability by leveraging processes such as nutrient cycling, natural pest control, soil conservation, biodiversity preservation, and carbon sequestration. These properties give the framework the potential to support regional EbA land-use strategies by viewing the landscape as a system with local conditions and cross-scale relations.

Decentralisation and Participation

As mentioned before, EbA cannot be achieved without the involvement of local communities. In addition to land-use strategies, there needs to be

an understanding of local needs and wishes. The management of ecosystem services is greatly dependent on local culture and knowledge, making local communities themselves good candidates for decentralised management (Larson & Ribot, 2004). Falleth and Hovik (2009) found in their study in Norway that local councils can align local desires and interests by redefining national policy and management practices. However, they stress that municipalities must consider the socio-economic interests of their communities well. If they fail to do so, the attitude of the public sector may turn even more against the government. Larson and Ribot (2004) acknowledge participation as an important instrument for boosting the effectiveness of decentralisation and the inclusivity of democratic processes.

Co-evolution and Co-habitation

The introduction of the EbA approach in our societies gives a new perspective on a socio-ecological discourse that has existed since the beginning of mankind: coevolution, the synergy between nature and humans. Haraway (1997) describes dynamic processes in her work on 'natureculture' and criticises the current exploitative relationship between humans and nature. She proposes a renewed kinship system that upholds a solicitous and devoted bond to non-human entities. Embracing a coevolutionary perspective stimulates a complete rethinking of how resilience and development are modeled and applied across global to local scales (Haider et al., 2021). It demands a shift from humanism to posthumanism, accepting that humans are not the central figures but actors in an environment of cohabitation (Smith et al., 2017).

2.4 METHODOLOGY

The diagram on the right presents the systematic approach to transform the current, unhealthy Delta into a healthy Delta region. A step-by-step guideline provides structure and ensures the coherence of the individual acts throughout the project. It helps to break up the complex challenge of creating a healthy Delta into smaller, manageable actions.

Co-evolution, ecosystem services, Delta restoration, and a nature-based approach play a vital role in the transition towards a healthy Delta. The analysis forms the basis of the research, where the relation between ecosystem services, climate change, and (nitrogen) pollution is investigated. The interaction between the analysis and problem statement is iterative.

The problem statement and the conceptual framework result in an analytical synthesis, where a SWOT confrontation matrix, combined with action perspectives form the foundation for the spatialisation of the vision.

From there, the strategy defines and expands on the vision. The latter work together in an iterative process. Three strategic zoom-ins converge the systematic approach and are part of a multi-scalar approach. Finally, the diverging zoom-out to the Delta region concludes the vision and strategy, which is followed by an assessment and reflection to complete the project.

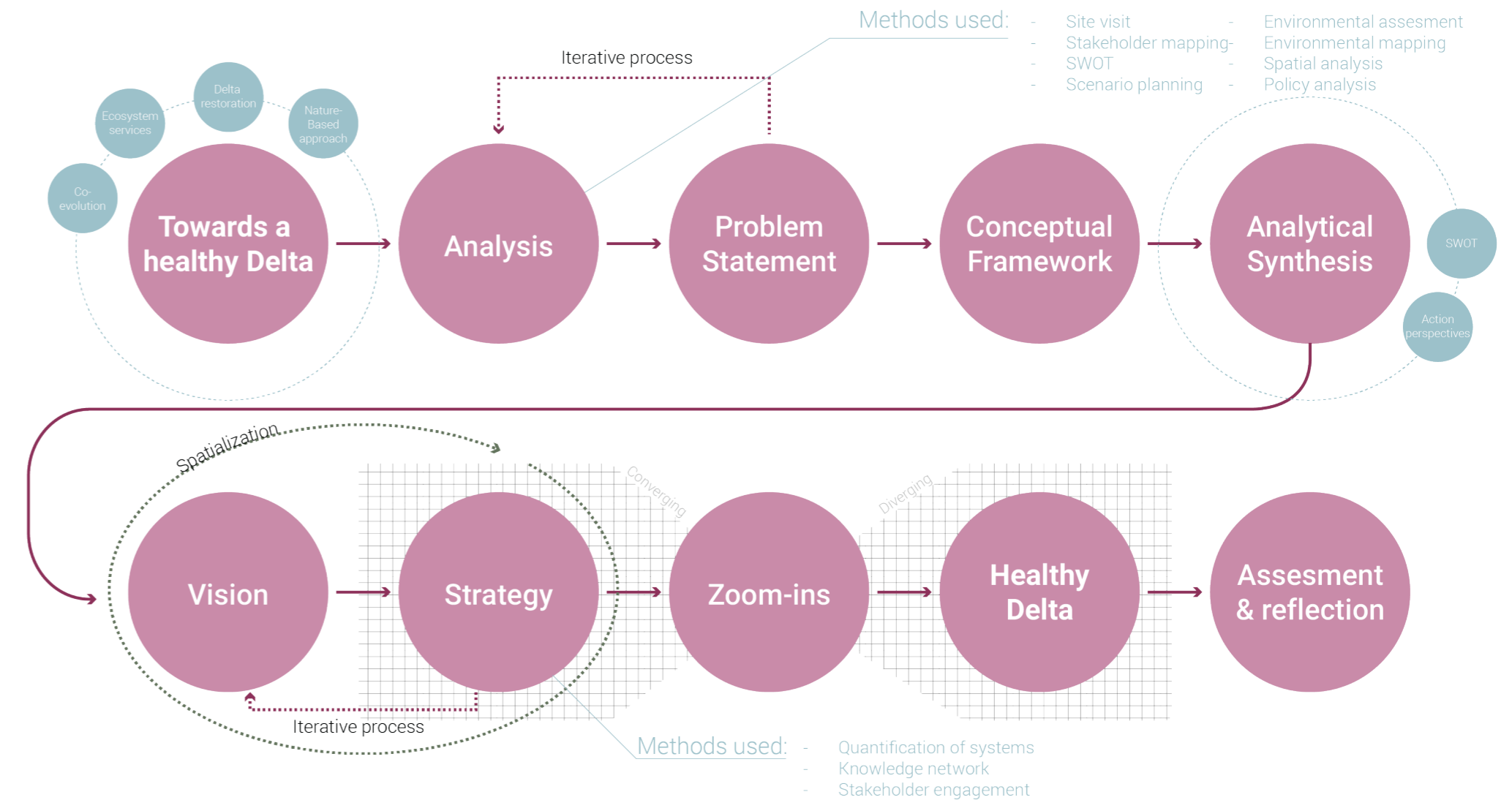


Figure 2.4 - Methodology framework

3. DELTA DWELLERS & FLOWS

This chapter introduces the concerned stakeholders and relates them to the existing systems. In the end, a stakeholder analysis shows the current power and interest ratios and their proposed shift.

Figure 3.1 - Sattelite Image Renesse (Google Maps, n.d.)



3.1 COMMUNITIES

PERSONA CARDS

To get a better grip on the communities that live in the Delta region, persona cards have been made. In these cards, a persona is highlighted as a spokesperson for the community.

A persona is made per island because of the different identities, but also because the main industries, land types, and populations differ in each of the islands. Looking into the statistics of the (main) municipality per island, assumptions are made of the occupation of each persona, but also on their political preference and values.

The persona cards are important to get insights into the different communities in the Delta region, especially when the project aims to restore a healthy Delta through community empowerment. Only when the different communities are recognised, different types of participation can be implemented to work together towards a Delta that provides ecosystem services.

The persona cards have been constructed with different elements, as can be seen on the right page.

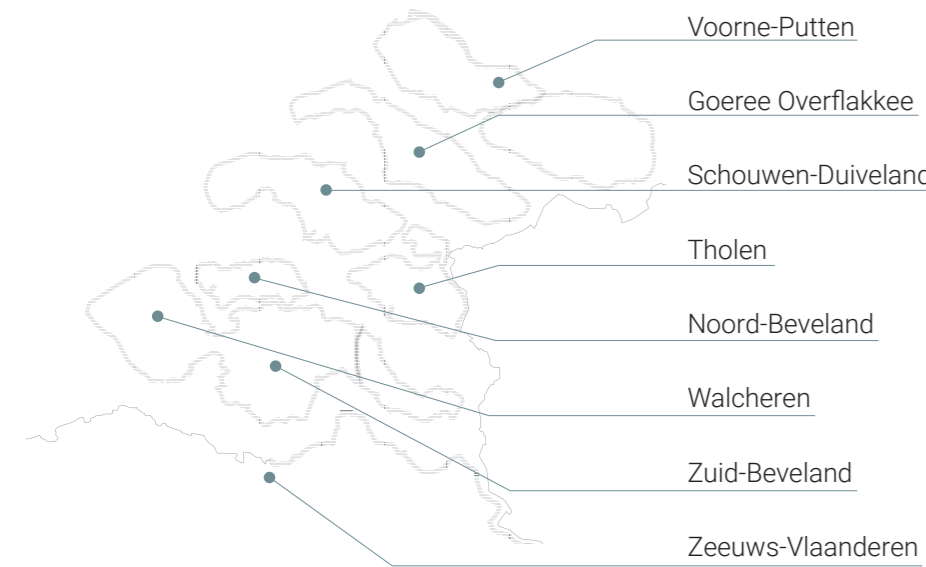


Figure 3.4 - Delta islands and their names

PERSONA CARD - 'BUILD-UP'

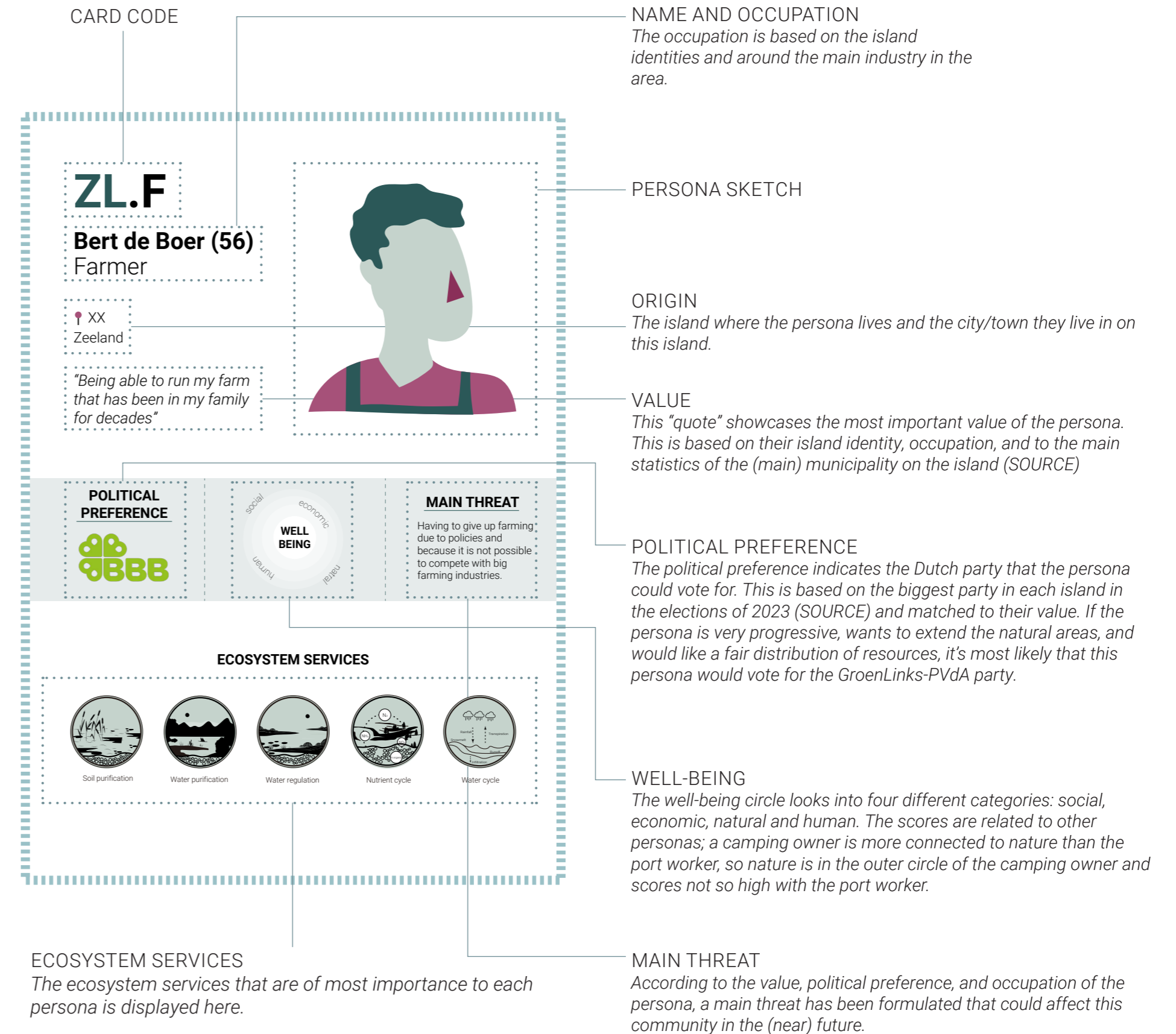


Figure 3.5 - Farmer persona card - explanation

3.1 COMMUNITIES

PERSONA CARDS

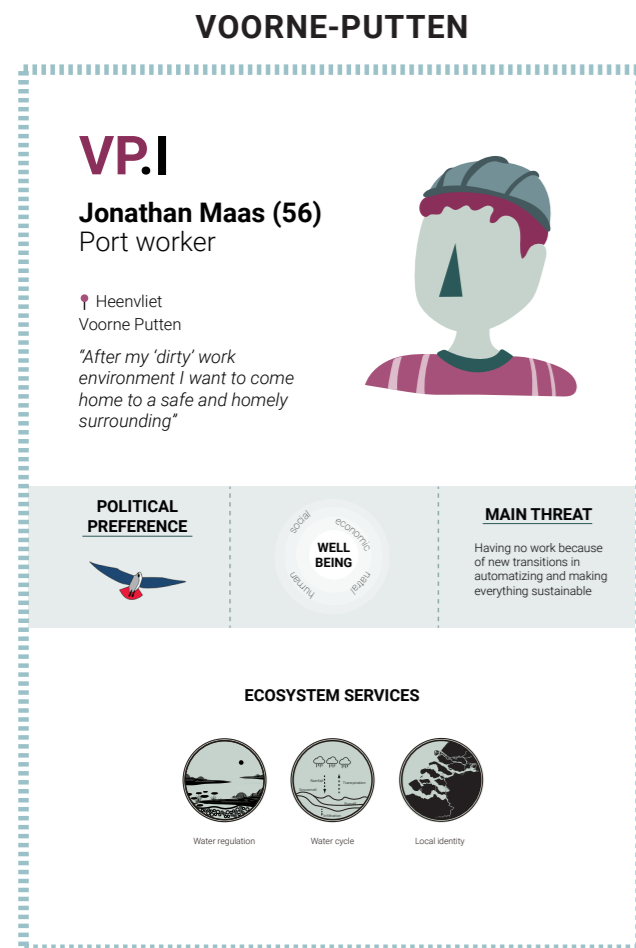


Figure 3.6 - Port worker persona card

Jonathan is the spokesperson for the port workers in the Delta region. He lives in Voorne-Putten, the island close to the harbour of Rotterdam. Because of the hard work in the port, he appreciates the surrounding area of his home, which is mainly a polder area mixed with a coastal environment.

His work is important to him but he is not certain of his future. The harbour industries are often badly portrayed in the media because of all the pollution. He wants to ensure his future, but he believes that the 'left-winged politics' are not validating the regular workers. Because of livelihood security, Jonathan votes for PVV - the right-winged, populist party. He does not want to spend a lot of time engaging with politics but hopes that the voice of the worker is heard in the new decision-making in the area.

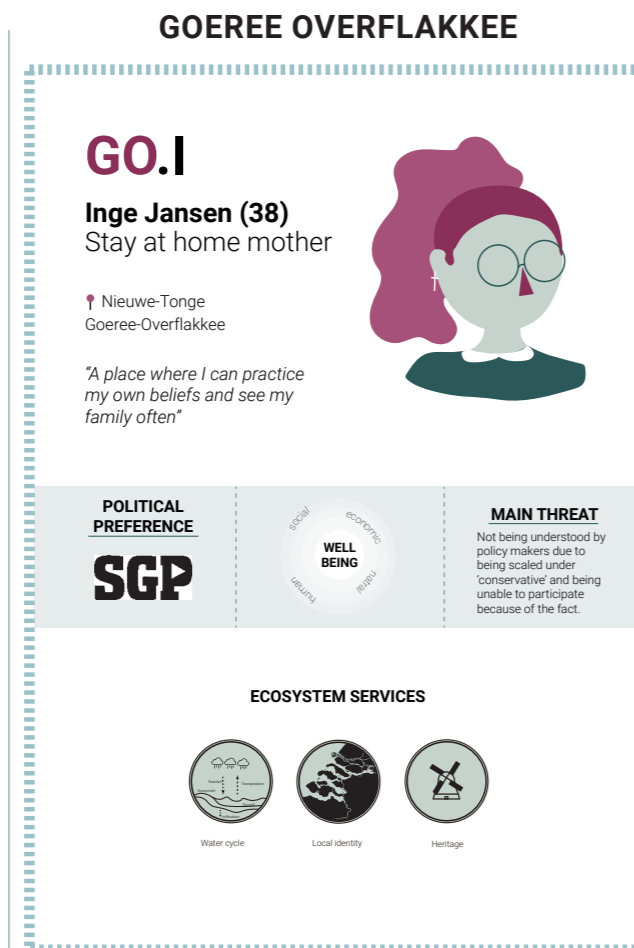


Figure 3.7 - stay at home mom persona card

As the representative of the people in Goeree-Overflakkee, Inge is a stay-at-home mom who is very active in her church community. Because her life mostly takes place around her living environment, she seeks much value in it.

People often generalise the church community of Inge as conservative. Their religious beliefs are a bit of a burden when it comes to connecting with the decision-makers in the area because they do not involve her community in it. To give a better voice to her religion in politics, she votes for the SGP.

Inge thinks that her community could be a great asset to creating a healthy Delta because by volunteering in projects her church community can do something good for her valuable living environment.



Figure 3.8 - Hospitality worker persona card

Franka lives and works on Schouwen-Duiveland, an island known for its natural areas and its famous among tourists. Therefore, Franka works in a bar in Renesse. Most of the time, a lot of elderly people visit the area. She hopes that the healthy Delta region makes Zeeland more attractive to young people.

In order to involve young people into politics, but refine the way that the government act now she votes for NSC.

It is important that Schouwen-Duiveland is capable of regenerating a lot of ecosystem services so the natural areas keep on existing. Franka knows that there are a lot of threats that endanger the livelihood on the island, but implementing new structures to revive the ecosystem services would help her living environment and workplace.

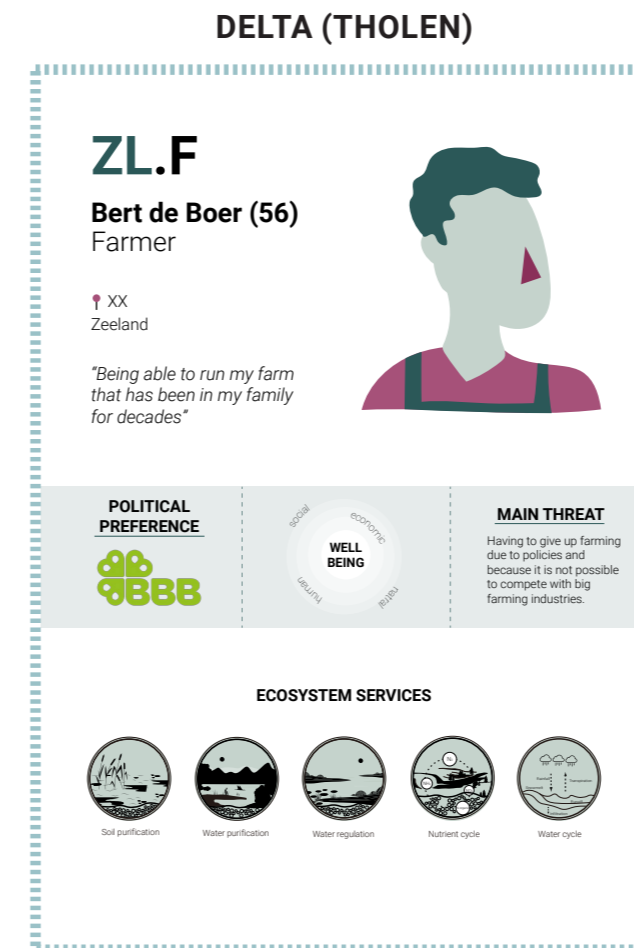


Figure 3.9 - Farmer persona card

One of the farmers in the Delta is Bert. He is an arable farmer who specialises in the cultivation of potatoes. His business is in the family for generations and he hopes that one day his daughter can take over his farm.

Being in the farming industry puts Bert in a fragile position. Most arable farmers cannot use specific types of fertilizer or other methods to enhance their soil because of nitrogen pollution.

In order to ensure his livelihood he votes for the BBB, the farmer-oriented political party. He does want to contribute to a more sustainable way of farming and protecting his island Tholen. Bert however thinks that this is not just the responsibility of the farmers, but also from other big polluters. The potatoe farm that he runs now should still be inherited by his daughter.



Figure 3.10 - Mussel farmer persona card

Mussels are the regional product of the province of Zeeland. As a mussel farmer, Ruben is proud to be a part of the tradition of his region.

He also knows that mussels and other shellfish are very fragile, so he hopes that the water is not being overused by cargo ships or that industries pollute the water even more.

Because Ruben wants to protect the water and his environment within the region, he votes for D66 because the political party centralises the people in their policies but also keep nature and climate change in mind.

The healthy Delta is vital for the ensurance of his livelihood and at the same time his occupation contributes a lot to the ecosystem services. Mussels and oysters are known water filters and Ruben likes to share his knowledge

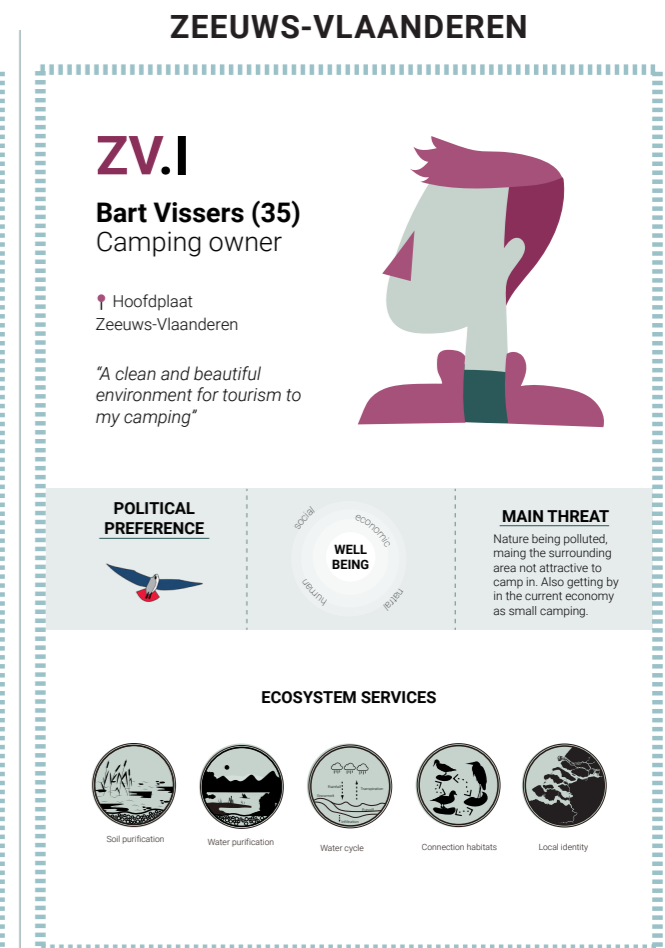


Figure 3.11 - Camping owner persona card

Bart has his own camping in Zuid-Vlaanderen. It is located in the midst of farmland and natural water structures. Because of the location, people from both the Netherlands and Belgium are guests in his camping.

For small camping owners, it is almost impossible to get around in the current economy. To strive for a more just economy for all businesses, Bart votes on the populist party PVV. Even though this party does not put the environment on the map, he still find it important that the area around his camping does not suffer from extensive pollution.

He is open for collaboration with farmers use the space more multifunctionally. The farmers can utilise the ground for the cultivation of crops, while visitors can camp next to this land and also have access to fresh produce.

3.2 DELTA SYSTEMS

SYSTEM FLOWS

This flow diagram, represents the flow of resources, raw materials, and stakeholders involved in this project. The components of the ecosystem are defined through their usage and the way they are being polluted. Water, land, and energy are the main categories involved in creating a healthy Delta. Humans (communities) interact with each category and influence how they function as a whole. Water is classified into saline water, brackish water, freshwater found on the surface, and groundwater.

The soil in the Delta predominantly is used as agricultural land. Even though energy transition is not the main theme, it cannot be neglected while discussing the transition towards a healthy Delta. The industries that pollute the Delta are energy-dependent. The transition to clean energy is crucial in this project. Farming is the major practice in this region and it emits a significant amount of nitrogen in the form of leaching and excess manures. The over-saturation of nitrogen in soil and water results in loss of biodiversity.

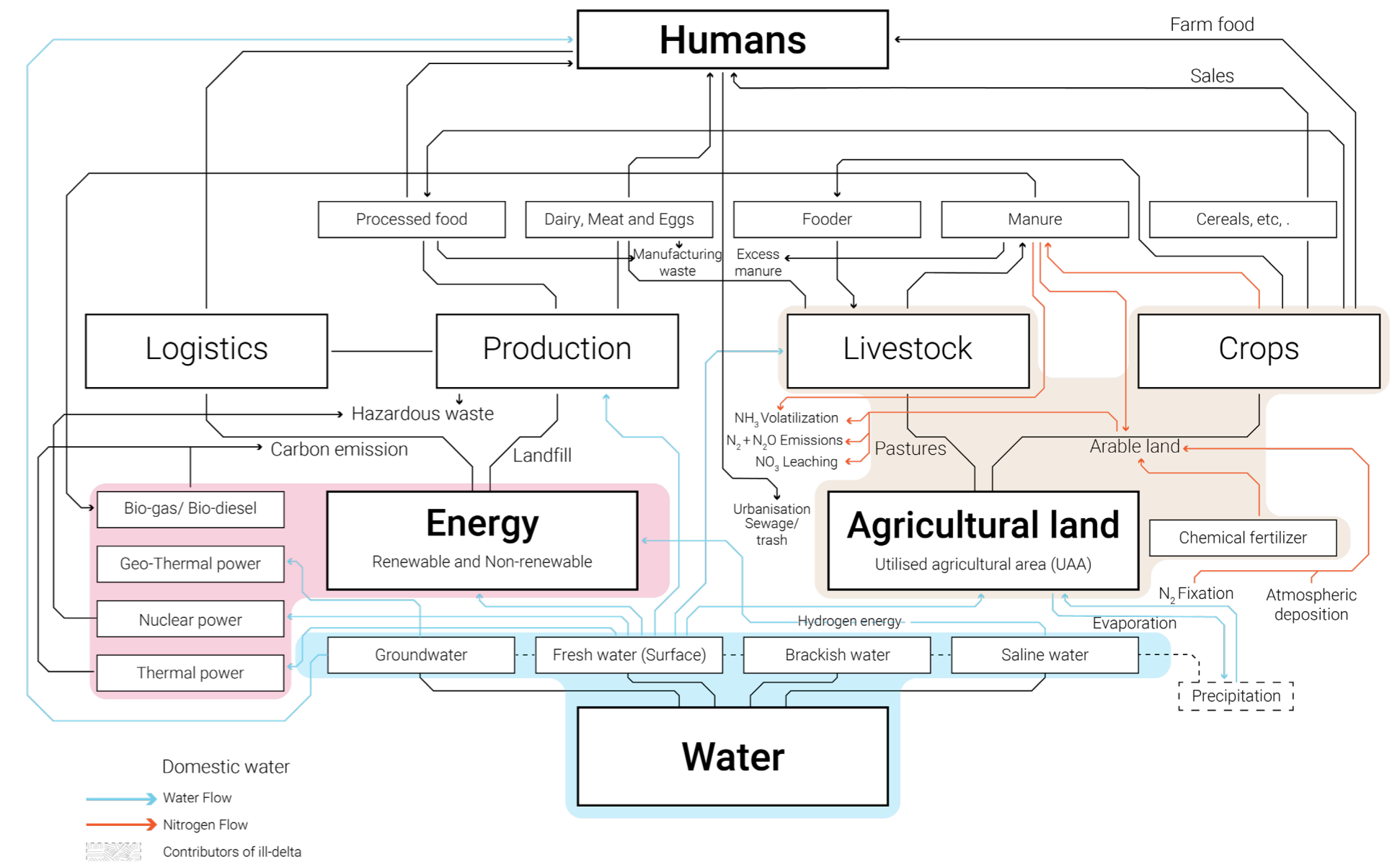


Figure 3.12 - Flowchart of systems in the Delta region

3.2 DELTA SYSTEMS

AGRICULTURAL LAND USE

The Delta region is filled with arable farming land. In the map on the right, the most present types of crops are shown. The rest of the land that has not been shown can be classified as grassfields. Crop types, such as corn, potatoes, onions, and fruits are mainly cultivated in the area (EuroCrops, n.d.). Tulips are only grown on Goeree-Overflakkee in the Delta. Potatoes are moderately sensitive to the salinisation of the soil. Fruits and onions are sensitive crop types (Van Dam et al., 2007).

The province of Zeeland is known for a relatively significant aquaculture with (shell)fish farming. The salinisation of the soil has negative effects on the current arable and aquafarming practices.

On top of that, current nitrogen pollution systems put pressure on farming practices in the area. Nitrogen and ammonia released from both industrial sectors as farms pollute the groundwater and soil.

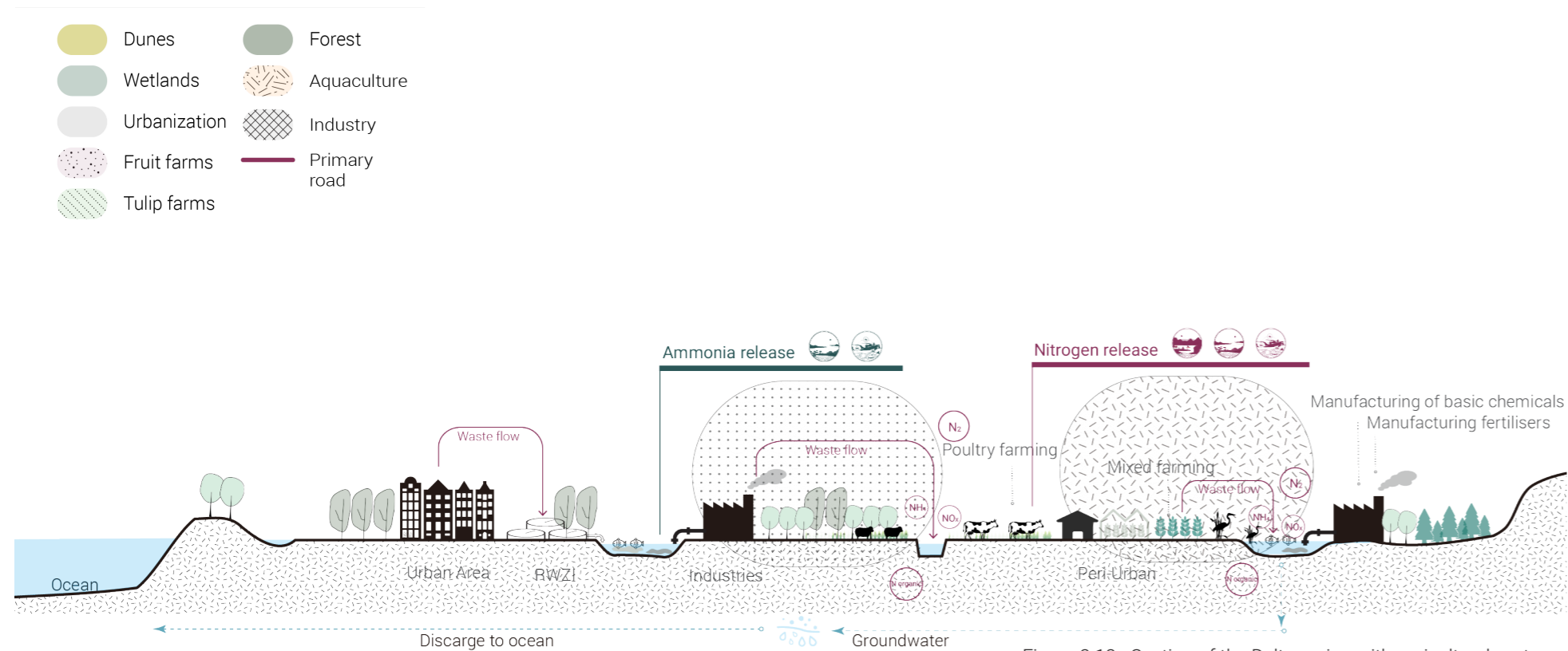


Figure 3.13 - Section of the Delta region with agricultural systems

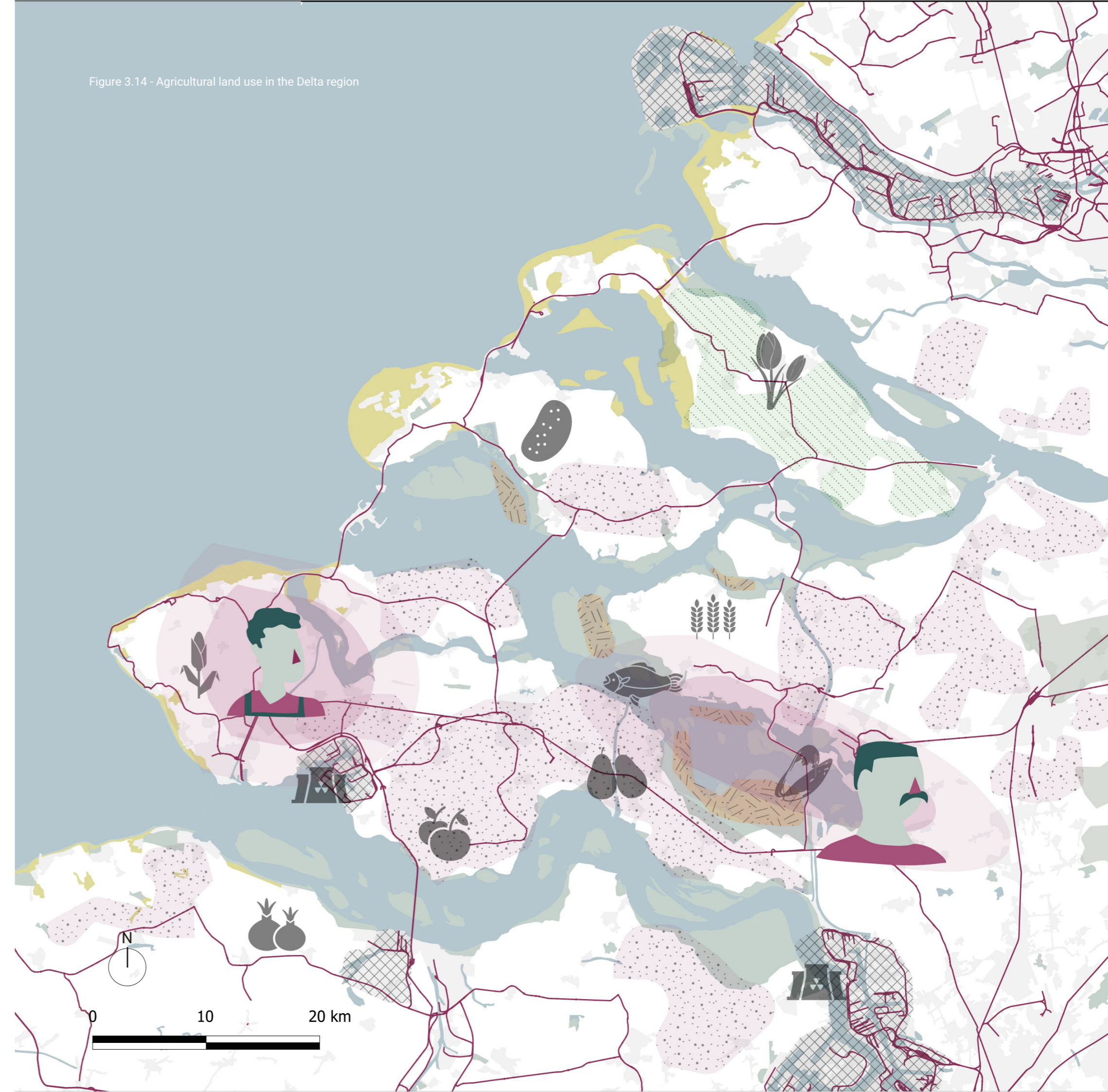


Figure 3.14 - Agricultural land use in the Delta region

3.2 DELTA SYSTEMS

WATER TYPES

The Delta area has differences in water types. The dynamics and the interaction between salt, sweet, and brackish water create a diverse marine (life) environment. According to Tangelder et al. (2020): "Due to activities such as land reclamation, dam construction and dredging works, the freshwater-saltwater transitions (estuaries) in the Dutch Delta have nearly if not entirely disappeared."

On top of that, the gradient of differences in water type is of ecological importance for fish and other sea life. The diverse habitats, food types, and

migration routes create a biodiverse marine life (Tangelder et al., 2020).

The map on the right shows the low tide, and high river discharge situation for the Delta. In the case of high tide, and low river discharge, saltwater dominates the water structure of the Delta. This happens in times of drought.

It is important to conserve the sweet water in the Delta to combat salinisation and to conserve diverse marine life.

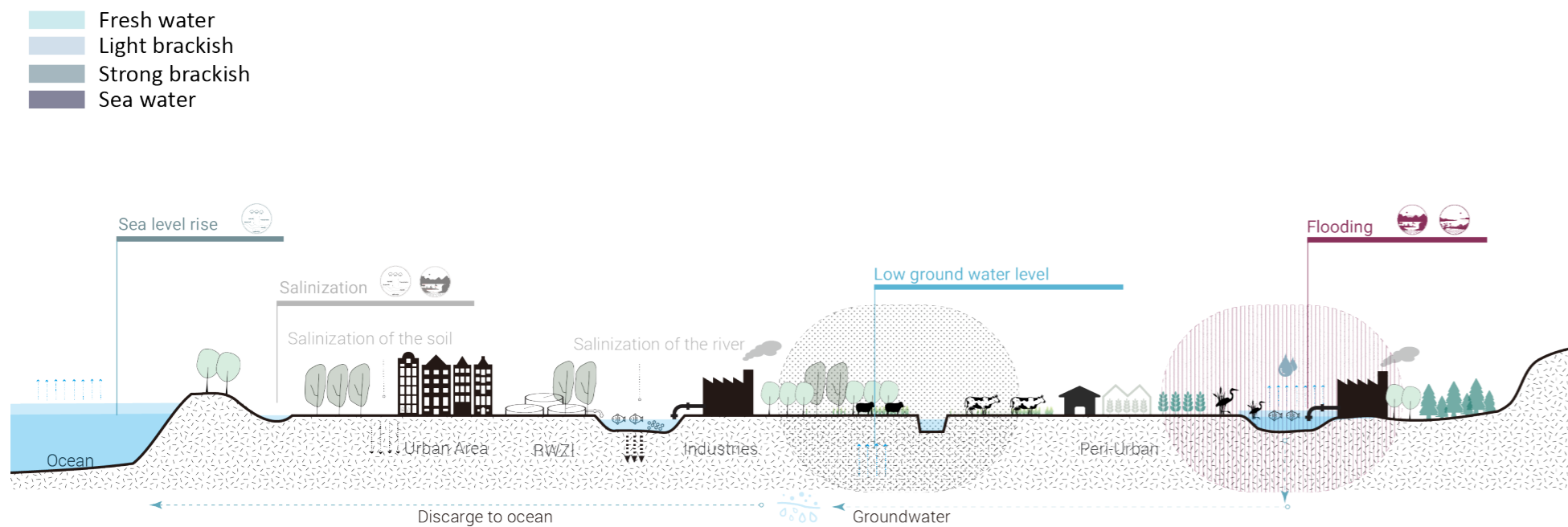


Figure 3.15 - Section of the Delta region with water systems

Figure 3.16- Water types in the Delta region



3.2 DELTA SYSTEMS

SOIL TYPES

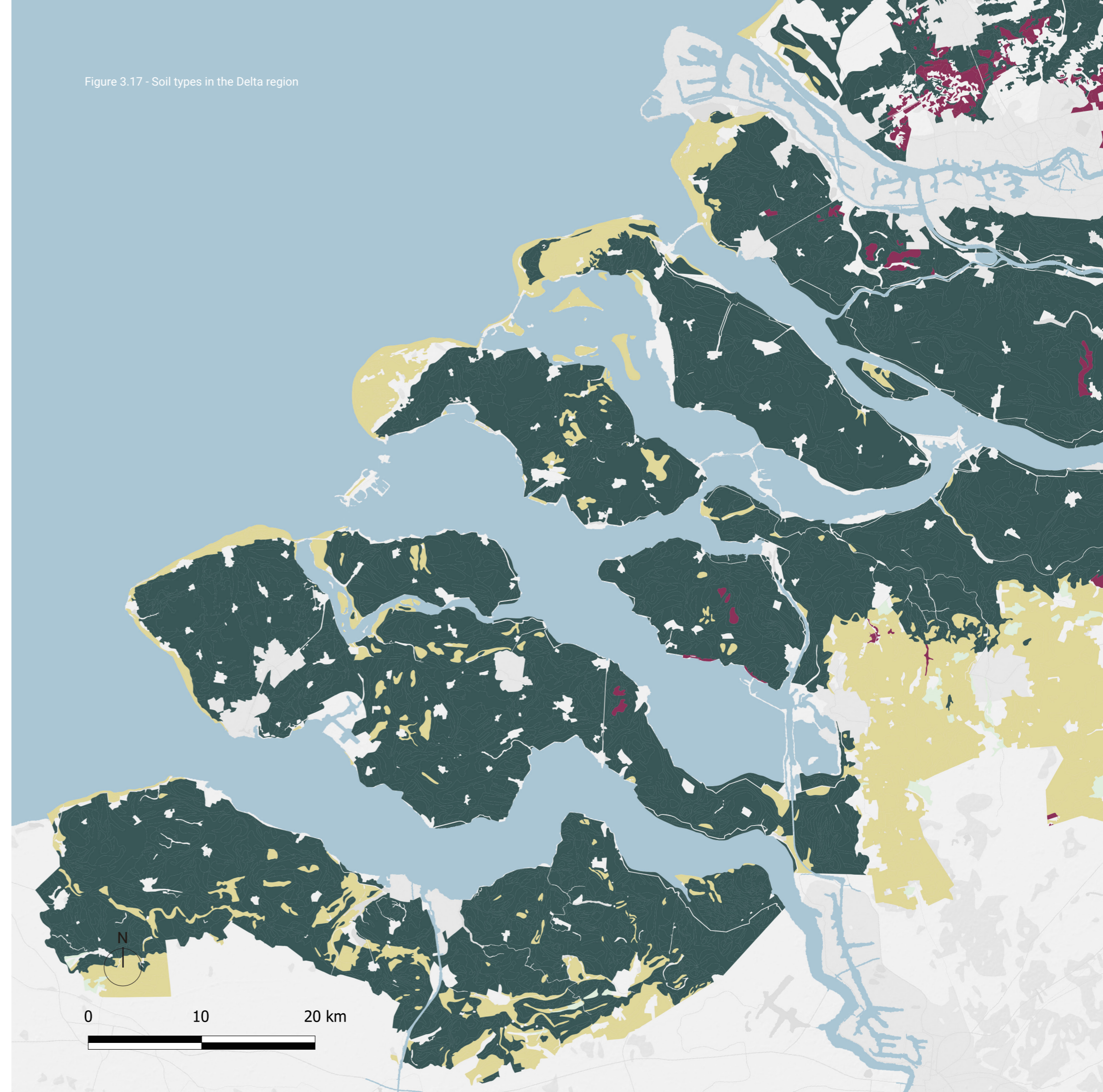
The Delta mainly has a clay subsoil, with sandy subsoil patches around the coastal areas and in the east. There are little patches of peat in the area (Heinen et al., 2020).

Clay is dense and has restricted water and airflow. This means that it can be wet for long periods. However, when exposed to drought, it can become hard (Bennett, n.d.). For agriculture, groundwater levels must be regulated.

Sand has relatively small particles and is not as dense as clay. There is more air and water flow in the soil (Bennett, n.d.). On top of that, sand can filtrate water. The sand particles absorb microbes that 'stick' to them through the formation of a slimy layer when water flows through the sand (Ministerie van de Vlaamse Gemeenschap Beleidsdomein Landbouw en Visserij, n.d.). The availability of sandy soil is used for water filtration already and has the potential to be expanded.

■ Peat
■ Sand
■ Clay

Figure 3.17 - Soil types in the Delta region



3.2 DELTA SYSTEMS

CURRENT ENERGY SYSTEM

The pie charts represent the energy demand of Zeeland (2020). The pie charts show that the energy system is mostly dependent on gas. The industrial sector is responsible for around 78% of the energy demand (CE Delft, 2020).

The main gas infrastructure is visible on the map on the right. Wind turbines are present on land. However, the Dutch Government has constructed numerous windmill parks, like the park Borssele, which is visible in the North Sea.

The WarmtelinQ network distributes heat through the Rotterdam Den Haag Metropole area, based on the residual heat of the Port of Rotterdam (Warmtelinq, 2024). This is an example of a good practice where the port provides energy to the urbanised areas in a circular way. Currently, this system is being expanded in South Holland. The ports and industries in the Delta area are not participating in good practices like this. However, there is significant potential for circular energy creation in the area.

- Water
- Dunes
- Wetlands
- Ports and industries
- Urban areas
- Existing windturbines
- Gas network
- Heat Link network
- Heat Link source
- Heat Link release

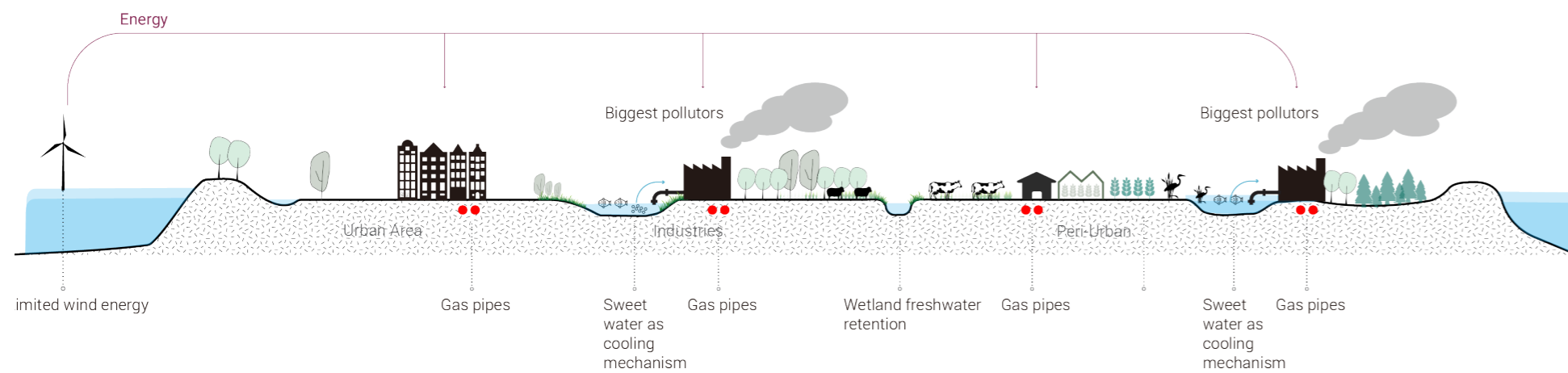


Figure 3.18 - Section of the Delta region with energy systems

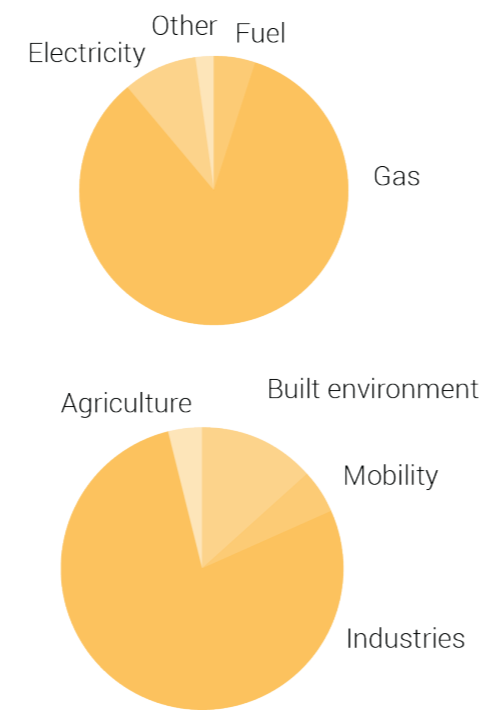
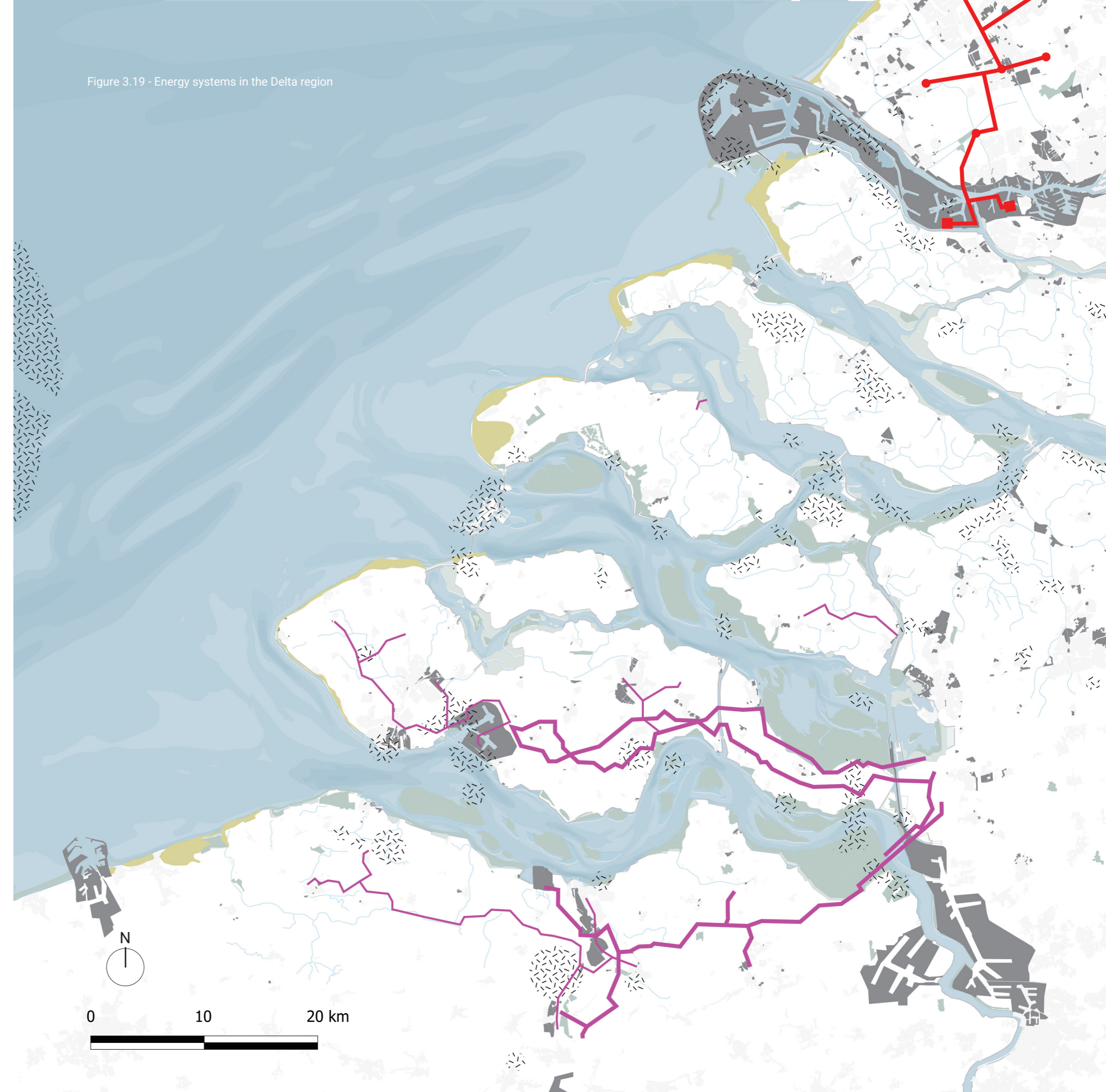


Figure 3.19 - Energy systems in the Delta region



3.3 POWER & INTEREST

STAKEHOLDER ANALYSIS

Many different stakeholders are connected with the Delta region. To establish the influential and important actors in the development of the healthy Delta, a stakeholder analysis has been made. Actors have been identified and displayed in multiple diagrams.

In this project, the actors can be categorised as a stakeholder in the *civil society*, *public sector* or *private sector*, as well as a direct or indirect stakeholder.

Power-Interest

The power-interest grid gives an insight in the role or position of the actor in the process of making a healthy Delta. Each quadrant has its 'function' according to the power and interest of the actor in the project;

Spectators

The actors with the least amount of power and interest are needed to *understand*. These parties can be engaged later on in the project, but they are not key players in making the Delta region healthy;

Interested parties

The actors that are interested need to be *informed*. Because these parties are not as powerful as other actors, they can be supportive of the project. However, they need to be enlightened with the progress of the project to keep them interested;

Influencers

The actors with a lot of power but little interest are needed to *keep satisfied*. The big (polluting) industries are placed here, because they often use the Delta to dump wastewater in. When creating a healthy Delta these industries need to change their workflows;

Key figures

The key figures are most important for the healthy Delta and need to *work together* to achieve this. Most of these parties are governmental institutions who are making the policies to achieve the healthy Delta system.



Figure 3.20 - Different actors in the Delta region

Power

Influencers

- Strong relation
- - - Moderate relation
- Weak relation

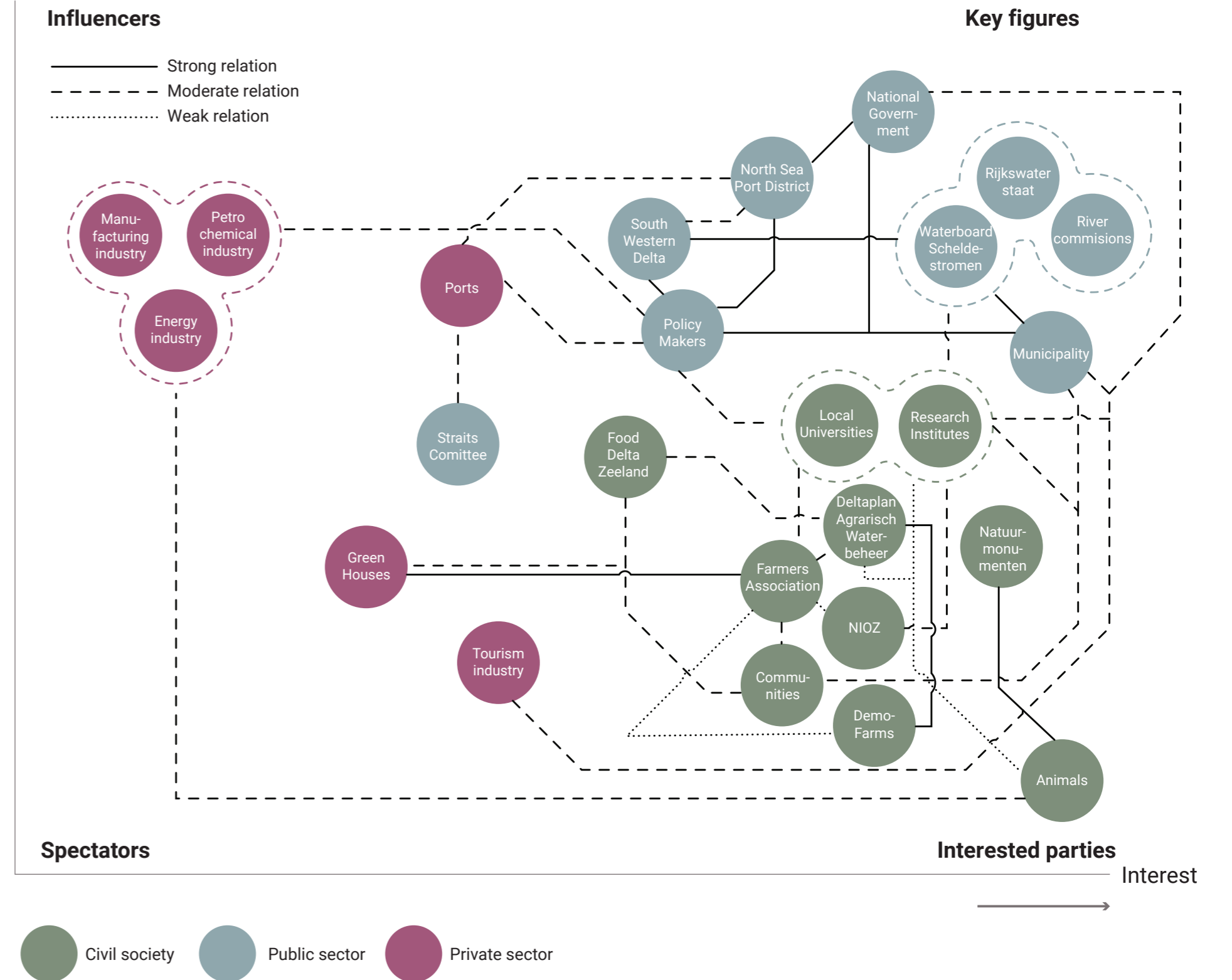


Figure 3.21 - Power-Interest relation of the stakeholders in the Delta region

3.3 POWER & INTEREST

EMPOWER AND PERSUADE

The arrangement of actors in the healthy Delta according to their power and interest gives an insight in their influence and importance to the project.

For some of these actors, it is important to make them more interested in the project or empower them. This shift in power and interest is visualised in figure X.

Industries

The influential industries that are identified actors for the project are now polluting the Delta, but are not very interested in making the Delta healthy. This often means a transition in their work-system. It is of importance to persuade these industries to strive towards a healthy Delta. This does not only benefit the ecosystem of the Delta but also everything around it; from communities that work in these industries to ensure the future of the environment of these industries.

Port

Two main ports are linked to the Delta region; the port of Rotterdam and the port of Antwerp. Both of these players have a say in the transition towards new energy systems and trade because of their influence on the economy. When their interest in the healthy Delta grows, the project has a firm base when it comes to supporters of the system transition.

Communities & tourism

Communities play a key part in making the

Delta healthy. This project is empowering the communities by providing multiple platforms to engage in the transition towards the healthy Delta. The identities and heritage of the communities are values in the project. Through giving them a platform and possibilities, they have a better say on the development of the region and also provide the base to a knowledge network of their own practices.

Farmers

Arable farmers are the communities that are affected the most in the healthy Delta transition. Because of the salinisation, new policies and re-zoning their land, it is important to empower them in order to keep them interested, informed and satisfied. The farmers are needed to create a new system for the arable farming industry and thus need to be both empowered and persuaded to get involved in creating a knowledge network to realise the healthy Delta.

Potential bridging organisation

In order to keep track of the progress of the healthy Delta project, a new bridging organisation is introduced. This organisation follows the principles and guidelines provided by this report and is the executive party for the vision and strategy. This organisation works closely together with the municipalities, farmers association and communities in the region to keep track of the progress and to steer them back on track if needed.

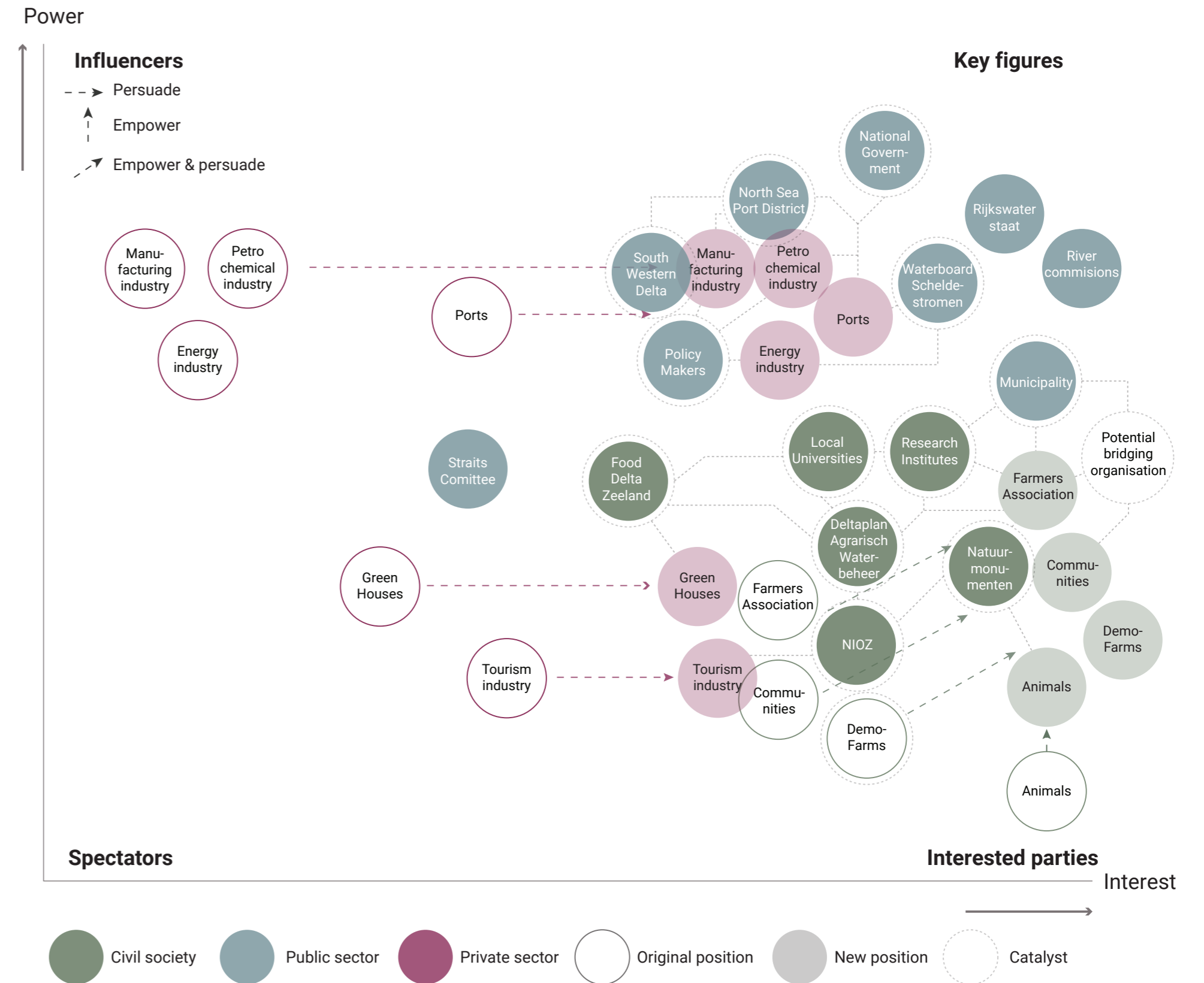
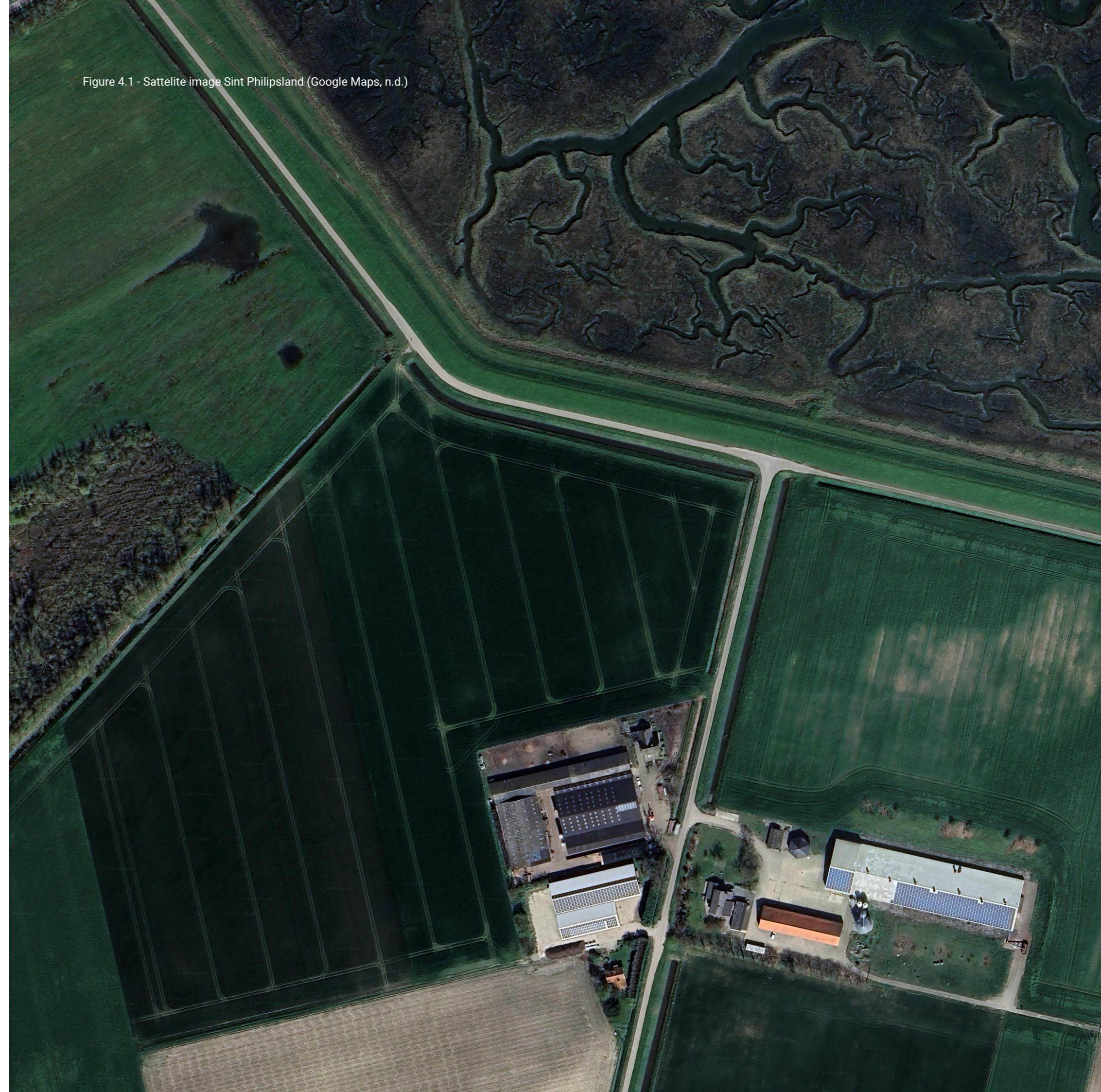


Figure 3.22 - Shift in power-Interest relation of the stakeholders in the Delta region

4. EXPLORING POTENTIALS

Exploring potentials connects the problem statement, analysis, and communities with the vision. The development of a SWOT confrontation matrix and multiple action perspectives forms the foundation for the vision-making process, combining analysis with Delta communities.

Figure 4.1 - Sattelite image Sint Philipsland (Google Maps, n.d.)



4.1 SWOT ANALYSIS

STRENGTH X OPPORTUNITY

This quadrant plots the strengths against the opportunities. By combining the existing strong properties of the area with the external opportunities, a strategy is formed that strengthens the project.

The energy transition can be embraced as an opportunity to extend and create new developments regarding the existing heat link network and connect them with NOVEX spatial projects. The 'Nationale Omgevingsvisie' (NOVI) is a collaboration between all governments concerning the spatial planning strategies in The Netherlands (NOVEX, n.d.). The Delta area is surrounded by the spatial projects of 'Stedelijk Brabant' and the 'Zuidelijke Randstad'.

The North Sea Port District is a spatial project that aims to connect Flanders area (Belgium) with Zeeland, thus crossing borders. The sea port, industrial sector, well-educated population are properties of the economic growth region that focuses on the sustainable development. Four goals are set up: An attractive and climate resilient connect between living areas and the natural landscape; sustainable energy creation; strengthening strong sea port position concerning trade and mobility; and improving governance to allow for a cross border cooperation between Flanders and The Netherlands (NOVEX, n.d.).

By decentralising, thus localising, water cycles; it serves as a first step towards the nitrogen reduction in the Delta area. The monitoring and regulation process of a localised water cycle is relatively easier and can be a catalyser for local mitigation strategies.





OPPORTUNITY

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- Steer **energy transition** by boosting NOVEX Spatial projects & Warmteling
- Use **localized water cycles and ecosystem services** to **regulate nitrogen cycle**

STRENGTHEN

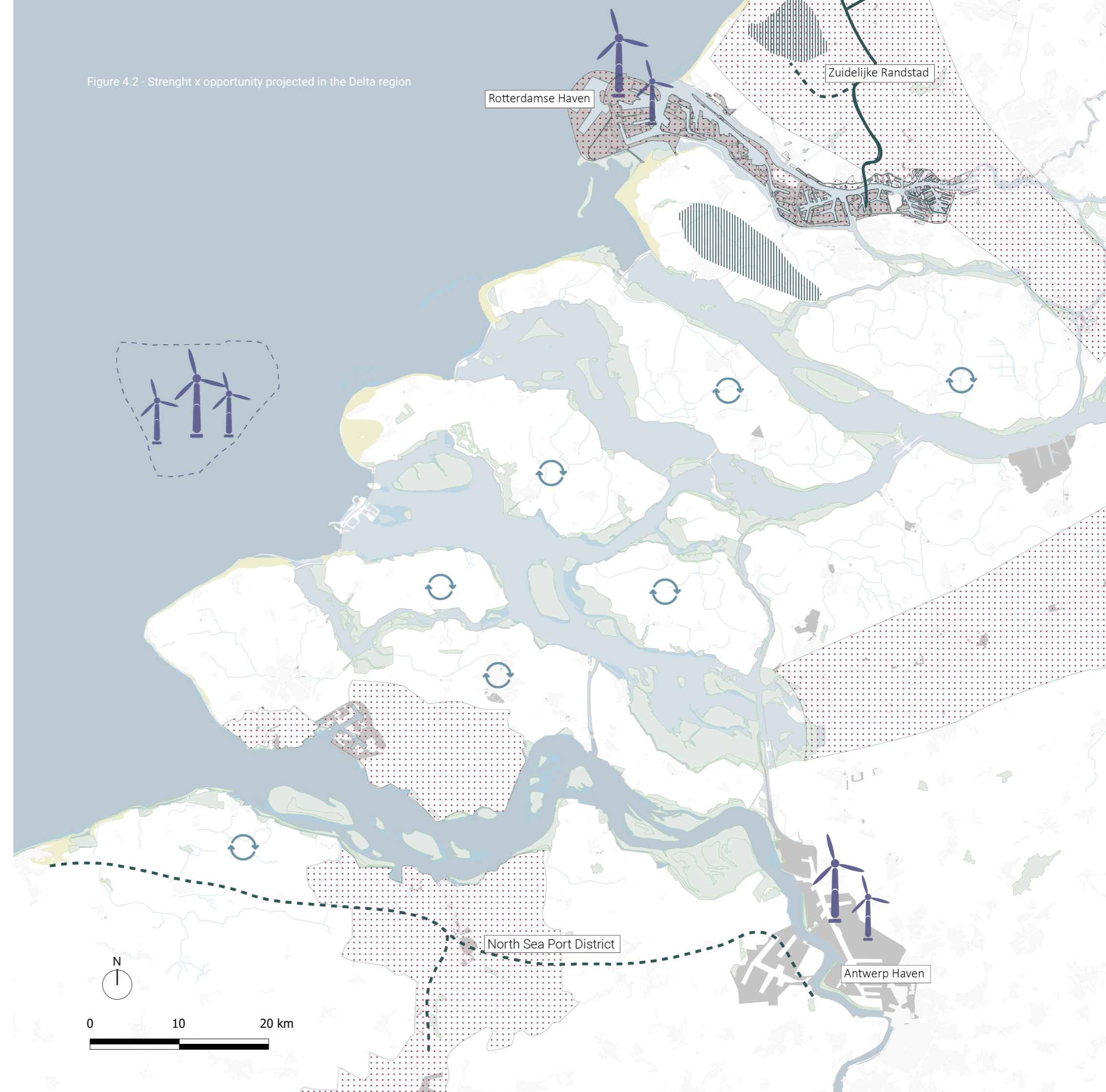
Strength

-  NOVEX-projects
-  Geothermal energy potential
-  Local water cycle
-  Warmteling

Opportunity

-  Energy

Figure 4.2 - Strenght x opportunity projected in the Delta region



4.1 SWOT ANALYSIS

STRENGTH X THREAT

Combining strengths and threats creates a strategy that resist opposing threats by utilising existing strengths. Wetlands can be used to combat salinisation, sink nitrogen, and are flood risk mitigators (Wolf et al., 2011) (Moomaw et al., 2018).

Another part of the resisting strategy is to steer away from the conservative ways of thinking of the local communities. The lack of trust and conservativeness are blocking new ideas and transitions to improve the healthiness of the Delta. By focusing on water heritage, local knowledge, and the acknowledgement of the communities; more trust might be developed.

THREAT

STRENGTH

- Use **wetlands** to desalinize, combat **eutrophication**, and mitigate **flood risk**
- Recognize **water heritage, local knowledge & sense of community** to steer away from **conservative thinking of local communities**

RESIST

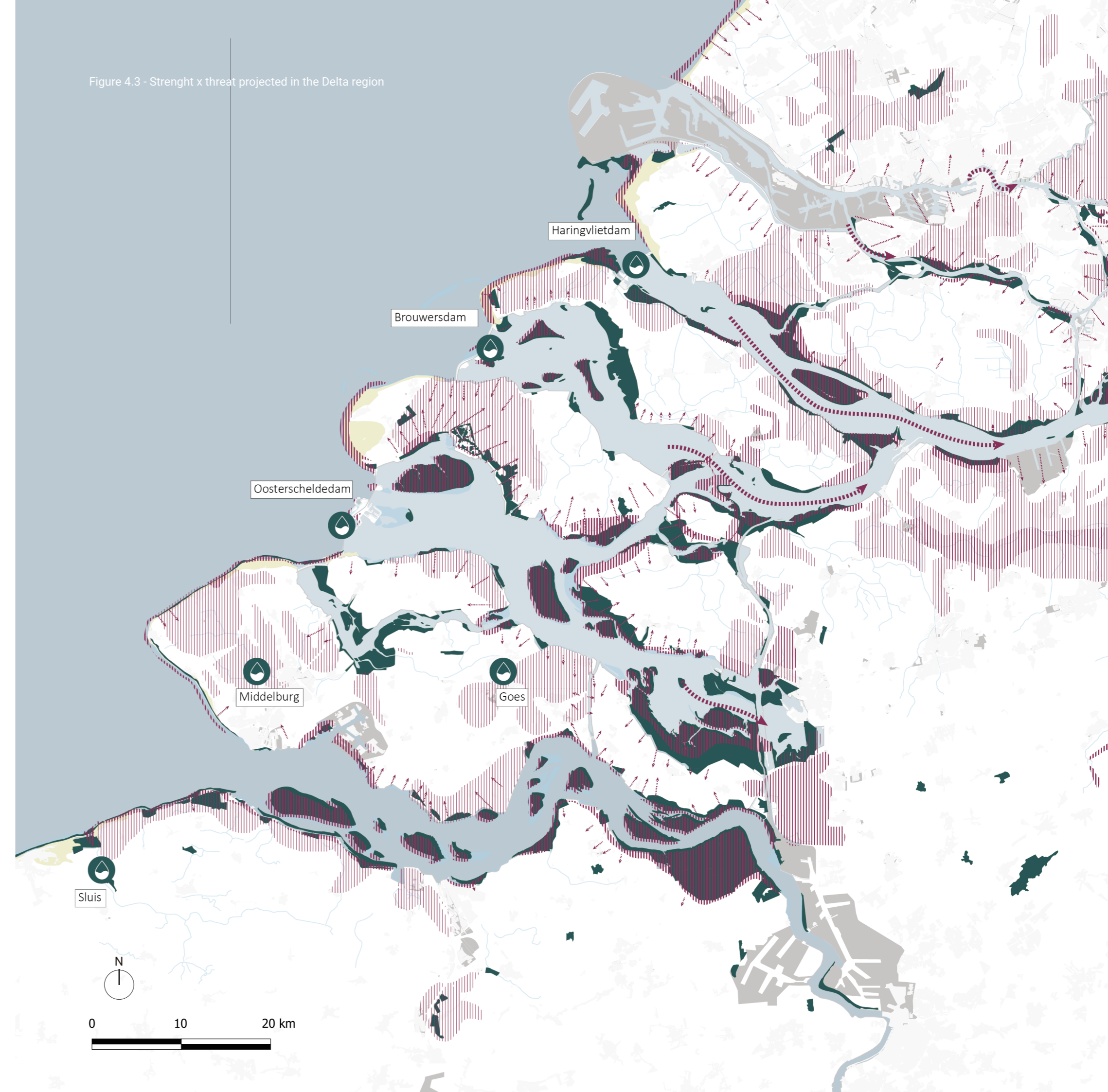
Strength

- Wetlands
- Water heritage

Threat

- High chance of flooding (1/30 per year)
- Medium chance of flooding (1/30 to 1/300 per year)
- Small chance of flooding (1/300 to 1/3000 per year)
- Salinization of the soil
- Salinization of the river

Figure 4.3 - Strength x threat projected in the Delta region



4.1 SWOT ANALYSIS

WEAKNESS X OPPORTUNITY

External opportunities can neutralise existing weaknesses within the Delta. The healthiness of the Delta is not bounded by administrative borders. The port of Antwerp has a central role in the pollution of the Delta. By adopting and catering to the North Sea Port District, Flanders and The Netherlands could cooperate and create an overarching governance that would be beneficial for the healthy Delta.

The drought and sweet water shortage of the area can be neutralised by introducing crop rotation and agroforestry to maintain groundwater levels and to reduce sweet water usage. On top of that, the transition towards salt water crop agriculture embraces the salinity and allows for farming in the Delta, whilst preserving the sweet water in the area.

OPPORTUNITY

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North Sea Port District could resolve **conflicting governance between BE & NL**

Introduce **diverse agriculture & sustainable land use** to steer away from **drought & sweet water shortage**

NEUTRALIZE

Opportunity

-  Diverse agriculture
-  Potatos
-  Onions
-  Sugar beas
-  Grain
-  Fruit
-  Cooperation between NL&BE
-  Border country

Weakness

-  Water shortage

Figure 4.4 - Weakness x opportunity projected in the Delta region



4.1 SWOT ANALYSIS

WEAKNESS X THREAT

The combination of existing weaknesses and possible threats creates a 'reverse negative spiral' strategy. The upstream pollution can be adjusted by policy makers. Polluters have polluting contracts which they can buy to 'pay off' their pollution. This does not contribute to the

transition towards a healthy Delta.

Policy makers and governments should nudge polluters to start in their transition towards a sustainable production process.

THREAT

W E A K N E S S

- Use policy-based solutions against **dependance on old economic structures** that causes **upstream pollution**

REVERSE NEGATIVE SPIRAL

Threat

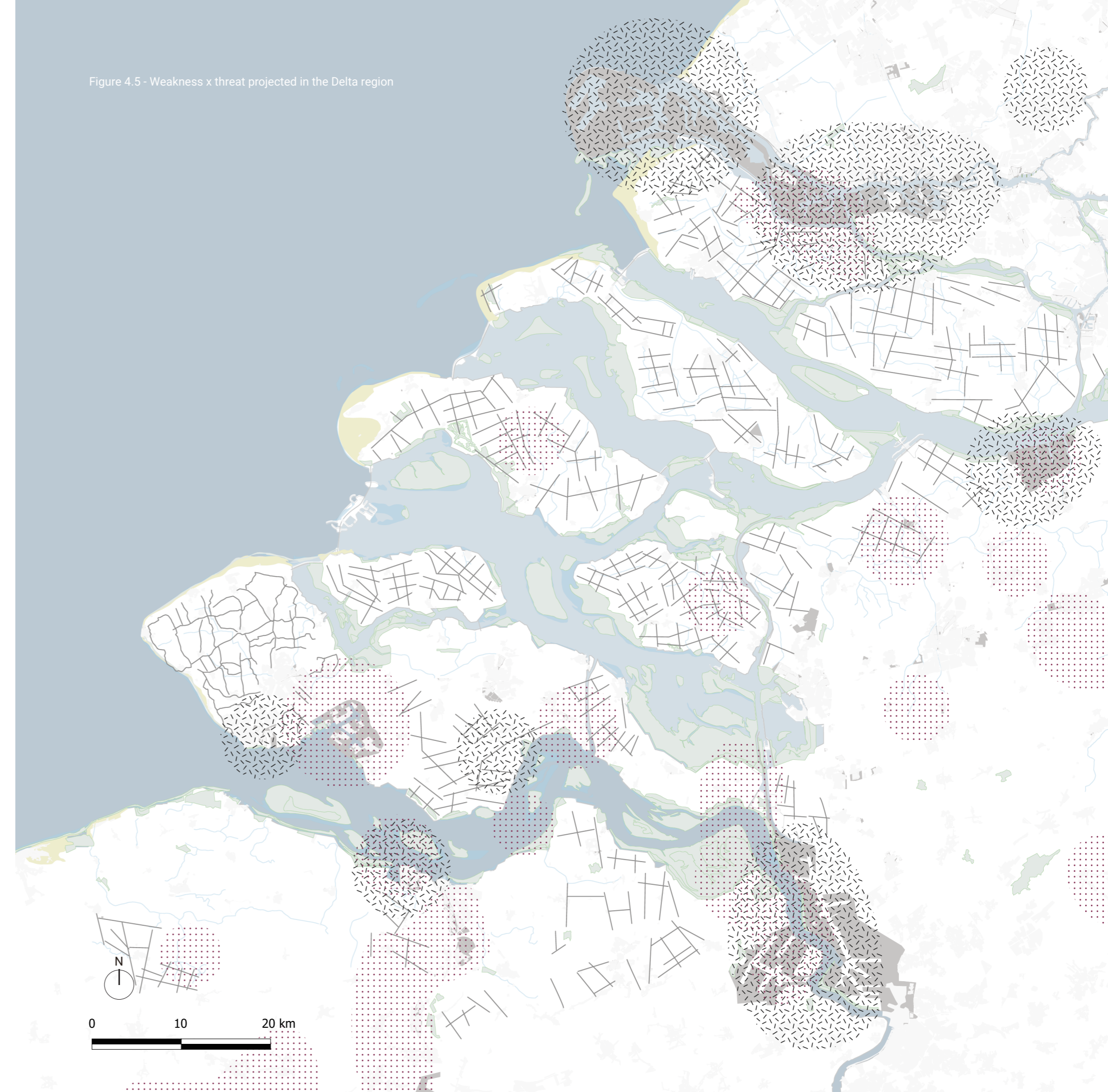
• Nitrogen pollution

• Ammonia pollution

Weakness

▨ Old economic structure

Figure 4.5 - Weakness x threat projected in the Delta region



4.2 ACTION PERSPECTIVES

The SWOT gave an insight into possibilities that could strengthen the region, but also showed aspects that are considered weaknesses to the Delta.

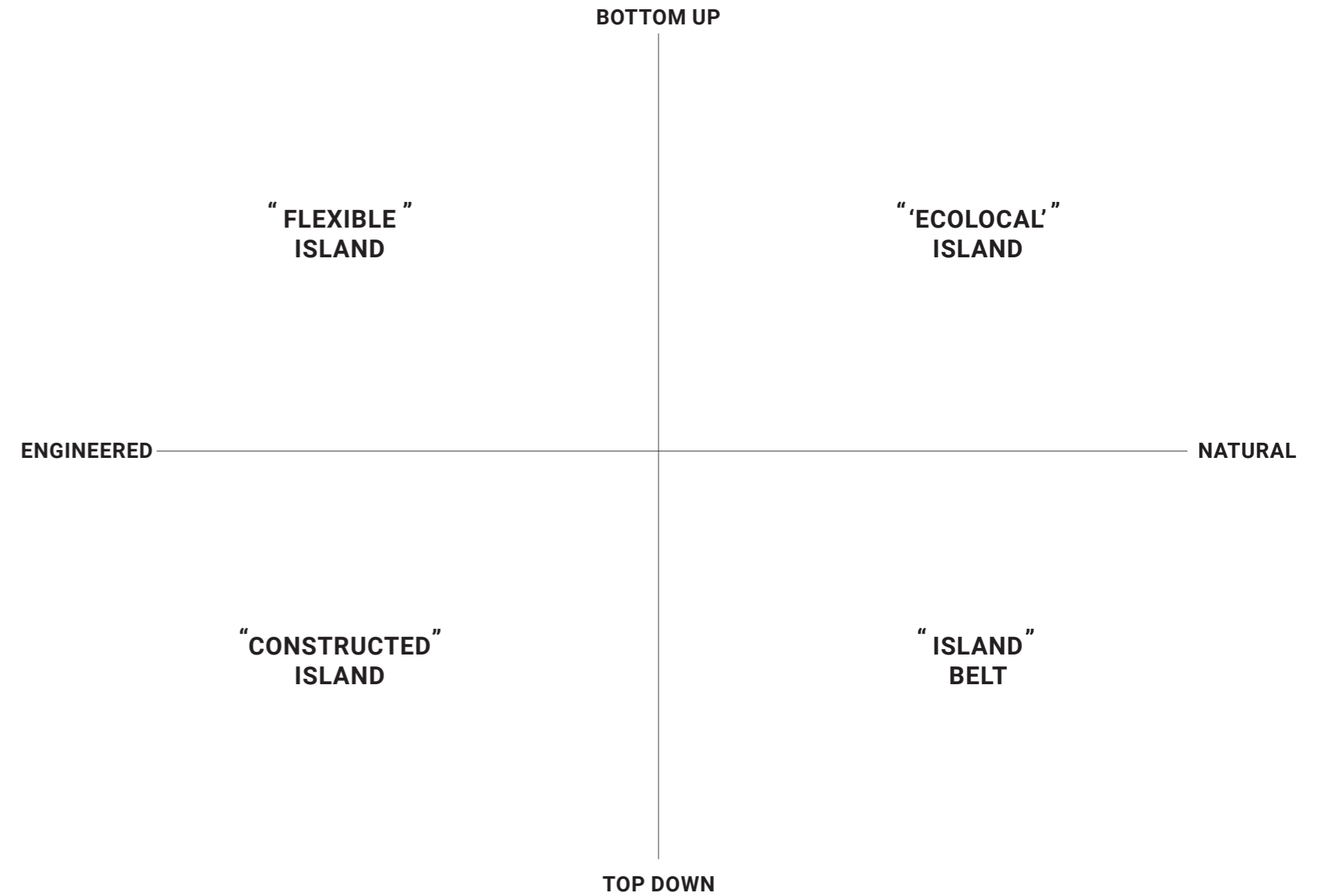
To go from a sum-up of a scale of possibilities and weaknesses to a strategy for a healthy Delta, possible futures need to be envisioned. By taking two important elements for the healthy Delta and plotting them against each other in an axis it is possible to get a better grip on those futures. In this project the method used is called 'action perspectives'.

Axis

To plot possible futures, the elements engineered versus natural are plotted against each other on the X-axis, while bottom-up and top-down (in the governmental sense) are plotted on the Y-axis.

Systems

The axis provides the basis and guidelines for a future envisionment. The systems of the healthy Delta (water, energy, nature, agriculture) are then plotted into the axis one by one (see appendix X). This resulted into a quote for each quadrant for each system. By combining all of these quotes, the names for each of the action perspectives were created; the 'flexible' island, the 'constructed' island, the 'eco-local' island and the island 'belt'.



4.2 ACTION PERSPECTIVES

FLEXIBLE ISLAND

The flexible island is part of the bottom-up/ engineered approach. It proposes a solution where engineered water management plays a key role, while the communities are being detached from larger systems.

Water

What if a double dike structure is used to preserve sweet water, create safety and allow for multi-land use? - The double dike system contains an area surrounded by two dike (Defacto Urbanism, n.d.). The dike linked to the river can be mechanically opened up, while the inner dike is used as the main water defense structure. This system creates a new area in between the dikes, which could be multifunctional.

Energy

What if every farm would have its own, local energy source? - By generating their energy,

farmers could become more independent. At the same time, their energy consumption becomes more sustainable by renouncing fossil energy generation.

Nature

What if we continue pumping excess water out of the polder? - The majority of the islands are made up of a polder landscape. In this approach, this is not being changed.

Agriculture

What if we focus on crop rotation? - Crop rotation is an agricultural practice where the planting of different types of crops is sequentially rotated to improve the health and the quality of the soil of the agricultural area (European Commission, 2023). This can be implemented on the local level by the farmers to make the soil that they are working with more healthy.

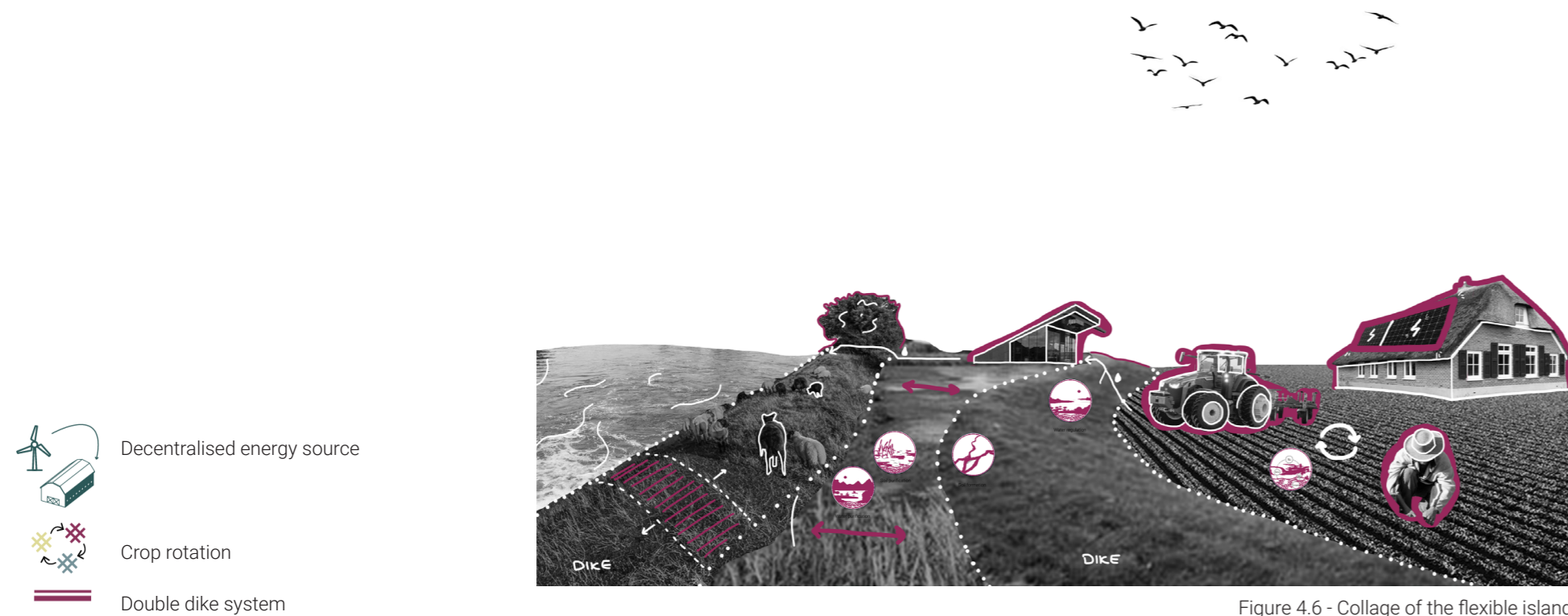
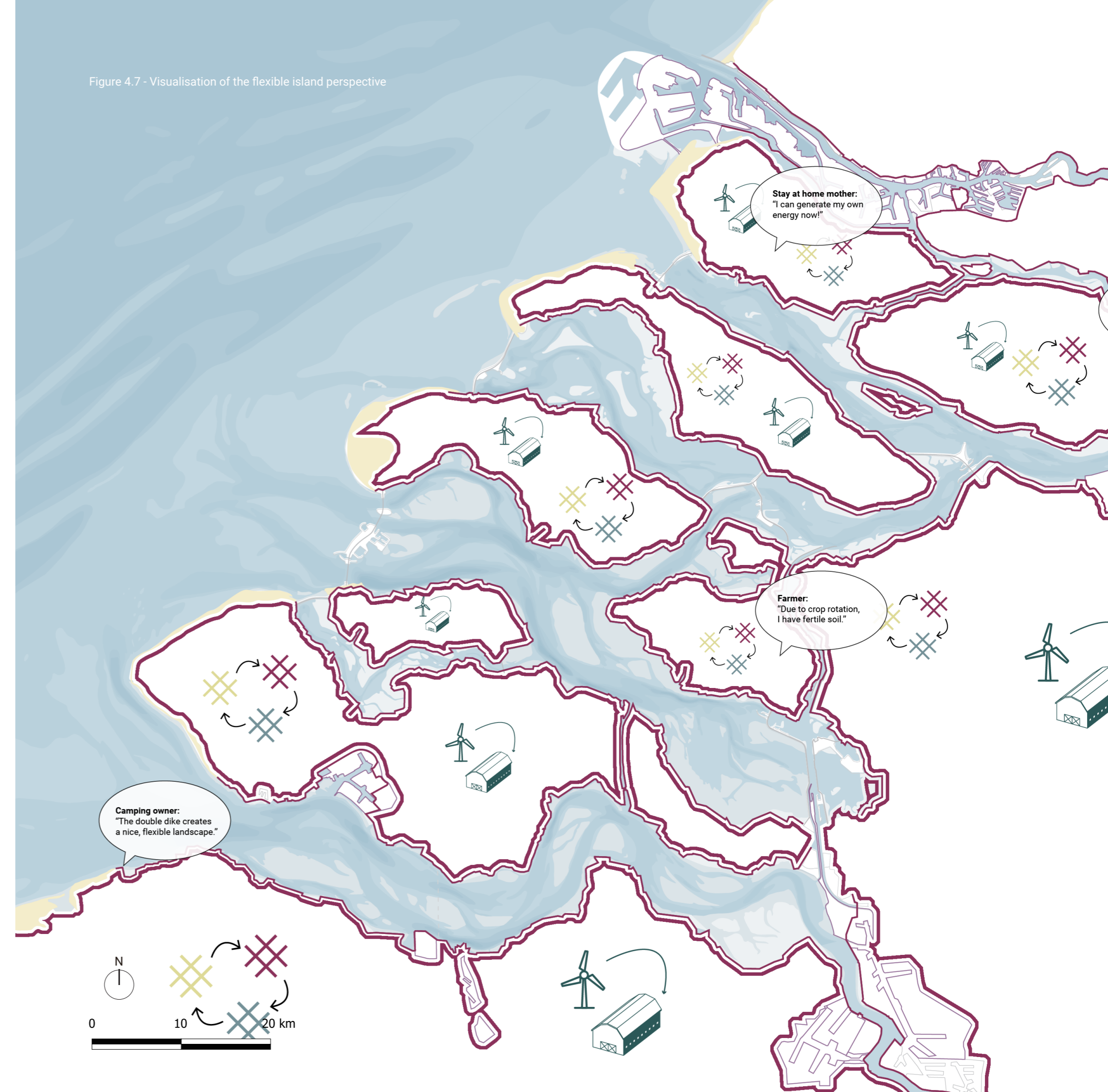


Figure 4.6 - Collage of the flexible island

Figure 4.7 - Visualisation of the flexible island perspective



4.2 ACTION PERSPECTIVES

CONSTRUCTED ISLAND

The constructed island is part of the top-down/engineered approach. It proposes a solution where engineered water management plays a key role, while the strategic planning of the region is implemented within a larger organisation.

Water

What if a dam would be constructed to preserve sweet water? - The land in the Delta region is prone to salinisation of the land. To preserve the sweet water in the region, this approach suggests to build a large dam. This could prevent further salinisation of the region and have accessibility to sweet water.

Energy

What if sustainable energy is generated by windmill parks? - To generate the desired energy needs, windmill parks will be realised. These parks are

built in the North Sea, no nuisance would concern the Delta communities.

Nature

What if we make a central, artificial nature reserve? - To sustain nature in the Delta region, a central, artificial nature reserve is created to sustain the biodiversity in the region. Within this central reserve, the animal habitats and fauna can be closely monitored.

Agriculture

What if verticals farms are being introduced in the peri-urban area? - To further extend the production of crops, verticle farms are introduced in the area. These 'greenhouse towers' cultivate more produce per surface area compared to the current way of crop cultivation.



Figure 4.8 - Collage of the constructed island






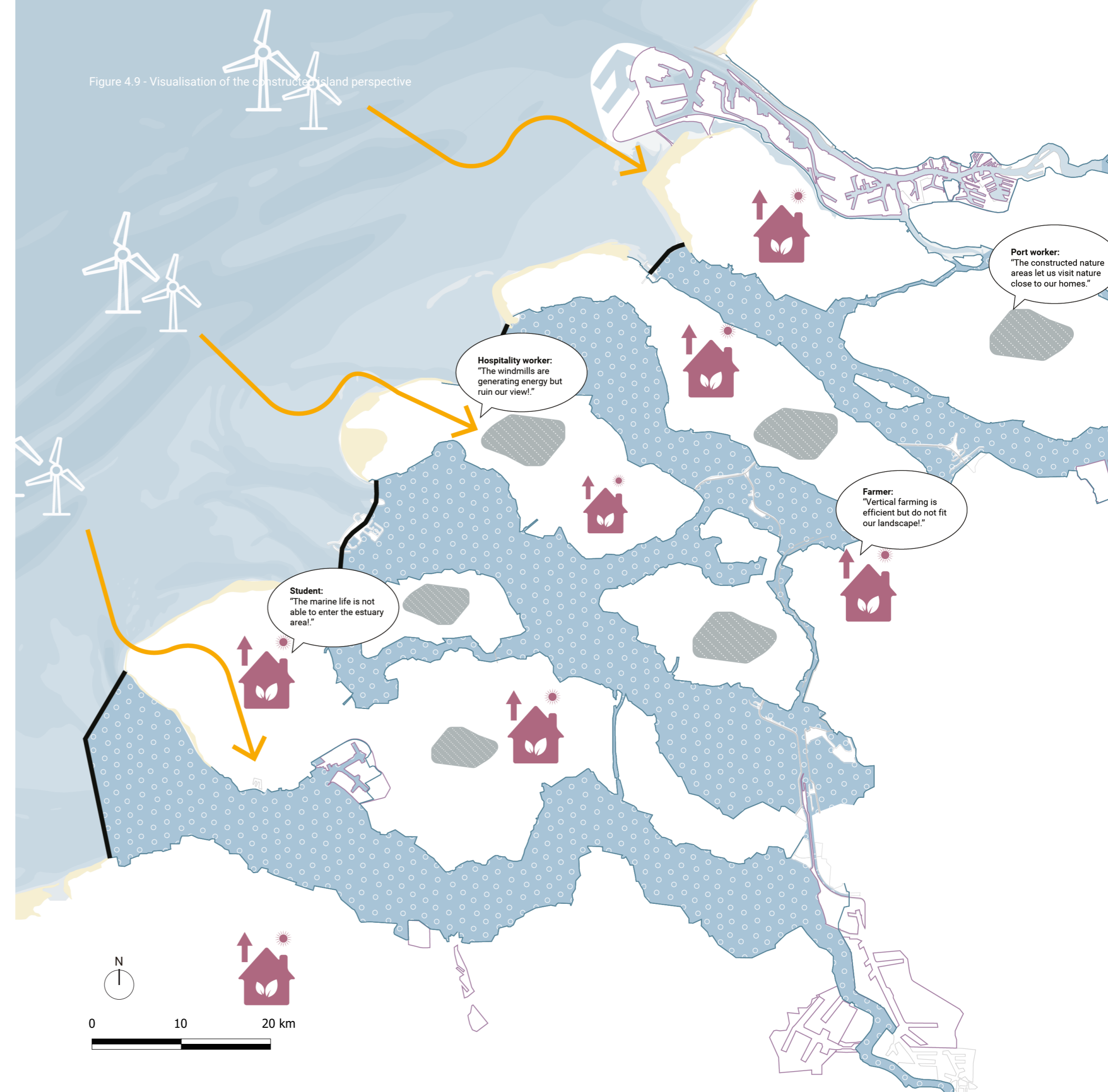
-  Verticle farms
-  Central, artificial nature reserve
-  Constructed dam
-  Windmill park at sea
-  Sweetwater - realised because of dam

Figure 4.9 - Visualisation of the constructed island perspective



4.2 ACTION PERSPECTIVES

'ECOLOGICAL' ISLAND

The 'ecolocal' island is part of the bottom-up/nature approach. It proposes a solution where the natural structures are key, while the communities are detached from the larger systems.

Water

What if every island would have its own water cycle? - The monitoring and regulation process of a localized water cycle is relatively easier than having to monitor a larger water structure. Therefore this perspective proposes a regulation of the water cycle per island so that communities can work together to mitigate their water cycle properly.

Energy

What if biomass is used as the main energy source? - By using natural products to generate energy for each community, people are less reliant on

the main energy network. Communities can also grow biomass used for their energy consumption and keep the cycle close to home.

Nature

What if we create a spider web structure of wetlands? - A wetland is an area that is flooded or can be filled with (excess) water within its ecosystem. These wetlands can be pointed out as nature areas and could become protected areas to preserve the flora and fauna.

Agriculture

What if agroforestry is used to regain biodiversity in the region? - By implementing agroforestry, trees are grown in or around the farming area. This results in more healthy soil within the crop cultivation fields. The trees can be used as a source of energy generated by biomass.





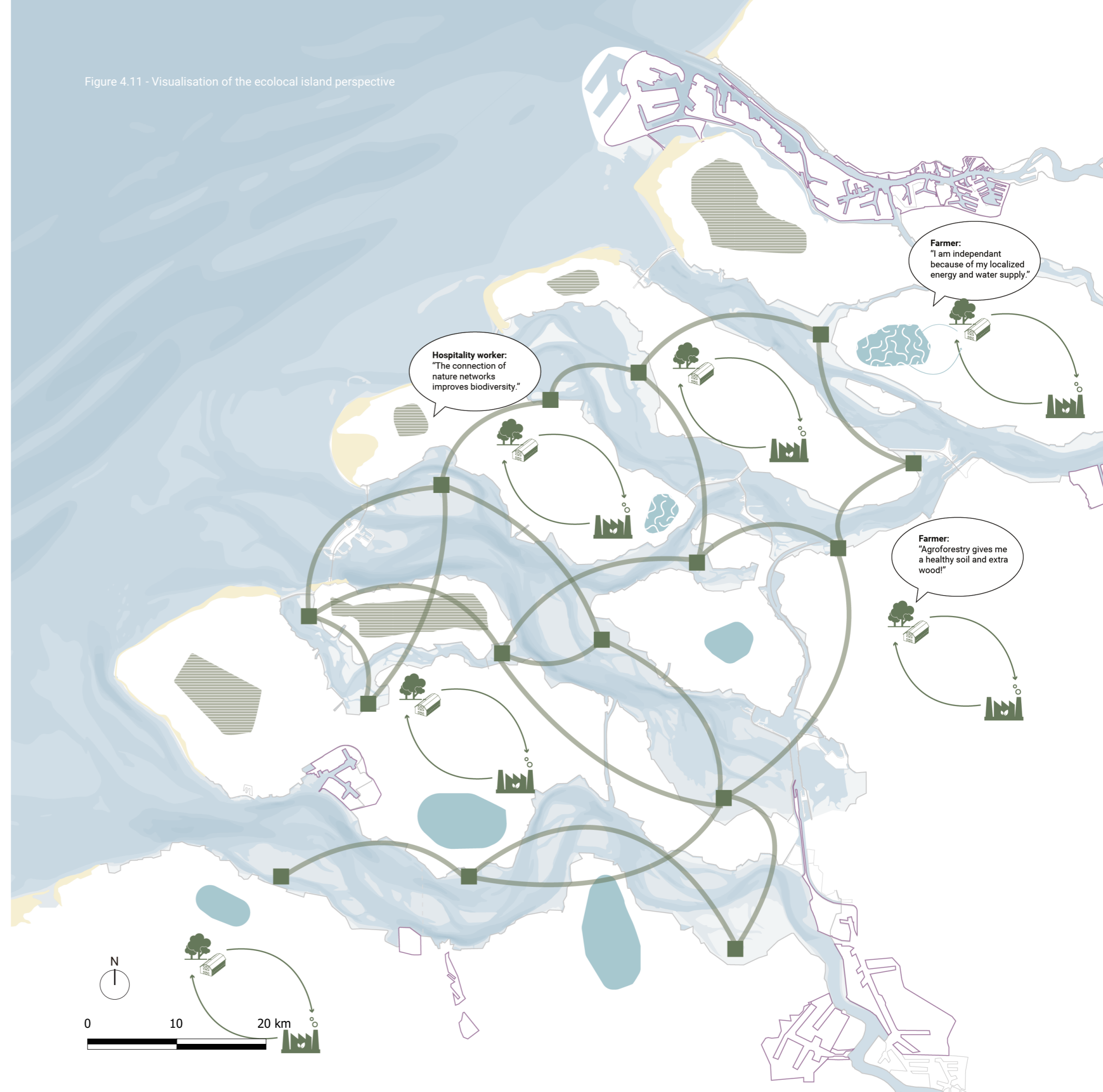
-  Agroforestry
-  Water cycle per island
-  Biomass as main energy source
-  Spiderweb of wetlands



Figure 4.10 - Collage of the ecolocal island

Figure 4.11 - Visualisation of the ecolocal island perspective



4.2 ACTION PERSPECTIVES

ISLAND BELT

The island belt is part of the top-down/nature approach. It proposes a solution where the natural structures are a key element, while the strategic planning of the region is implemented within a larger organisation.

Water

What if wetlands are used as a purification centre? - Because of the various natural elements within the wetlands, these areas can be used as a purification centre. Wetlands can filter out nitrogen to a certain extent. When connected to agricultural areas, these structures can work together to create a clean water system.

Energy

What if geothermal energy becomes the main provider of the region? - In the Delta region there is the potential to extract geothermal energy. This

can be used within the islands for heating urban areas.

Nature

What if we create an outer ring of wetlands per island? - A wetland is an area that is flooded or can be filled with (excess) water within its ecosystem. These wetlands can be connected at the edges of the island to create a 'ring' of wetlands that serves as a nature area.

Agriculture

What if zoning creates a central agricultural area? - When the island belt of wetlands is being enforced, the arable farmland at the border of the islands needs to move. A zoning structure is created to provide the farmers with land to cultivate crops on. This zoning ensures that every farmer can proceed with their business, while there is more room for the wetlands.



Figure 4.12 - Collage of the island belt



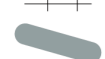
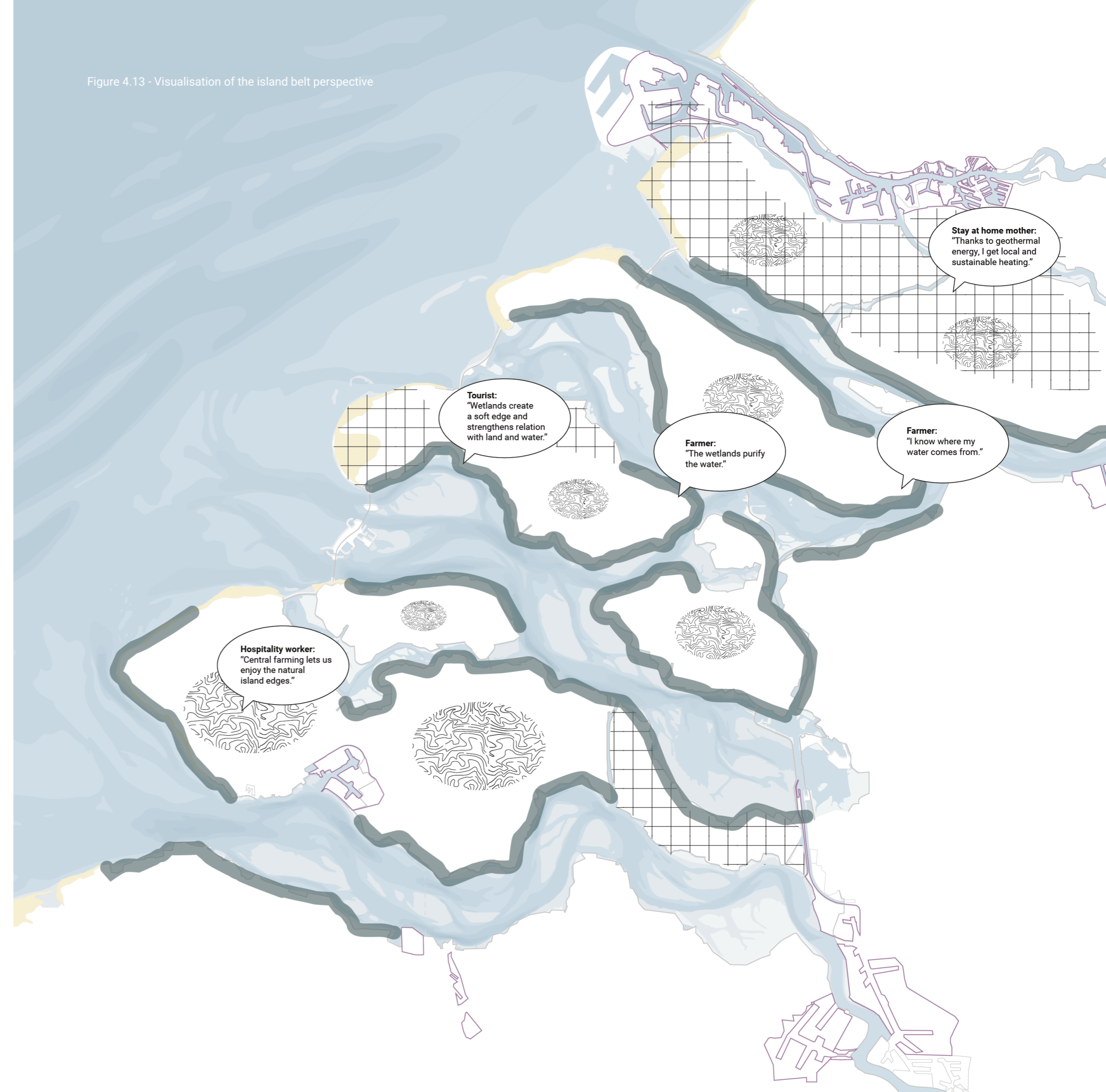
-  Agricultural zoning
-  Geothermal energy
-  Wetlands - ring & purifying system

Figure 4.13 - Visualisation of the island belt perspective



5. TOWARDS A HEALTHY DELTA

The groundwork for a healthy Delta region is being laid today. Towards a healthy Delta envisions how and where the transitions are taking place in the region to restore the Delta's ability to produce essential ecosystem services, water, and soil.

The Delta landscapes, together with the communities within the landscapes, provide the base for the transition. The decentralisation of production cycles of (fresh)water and crops results in the regeneration of ecosystem services. After connecting a sustainable energy network and new land uses to the region, a knowledge network through the area makes sure that the Delta is becoming healthy again.

Figure 5.1 - Sattelite image Tholen (Google Maps, n.d.)



5.1 VISION

DELTA LANDSCAPES

The groundwork for a healthy Delta region is being laid today. Over the next 25 years, the Rhine-Meuse-Scheldt Delta region will undergo a transition that will restore the Delta's ability to produce essential ecosystem services, water, and soil. This process will be realised through Ecosystem-based Adaptation. The communities of the Delta will shepherd this process to secure spatial justice and enable local management. The landscape, as well as the communities, will become self-regulating and resilient through co-evolution.

The unique identities of the Delta landscape and its islands will be acknowledged as the foundations for the transition, empowering the communities and embracing local qualities in the region. Five distinct landscapes are recognized:

1. **The Dune Front:** A coastal defence area that features nature-rich dune landscapes. The landscape supports a community that harbours a strong tourism industry.

2. **Fresh Water Reservoir:** Together with the Biesbosch, this area stores precious freshwater reserves and habitats. The produce of the area includes freshwater vegetables and tulips.

3. **Saltwater Enclave:** By accepting salinization, this core will transition to a saltwater-based economy. Production will focus on saltwater crops and shellfish. Historic practices will revive the local economy.

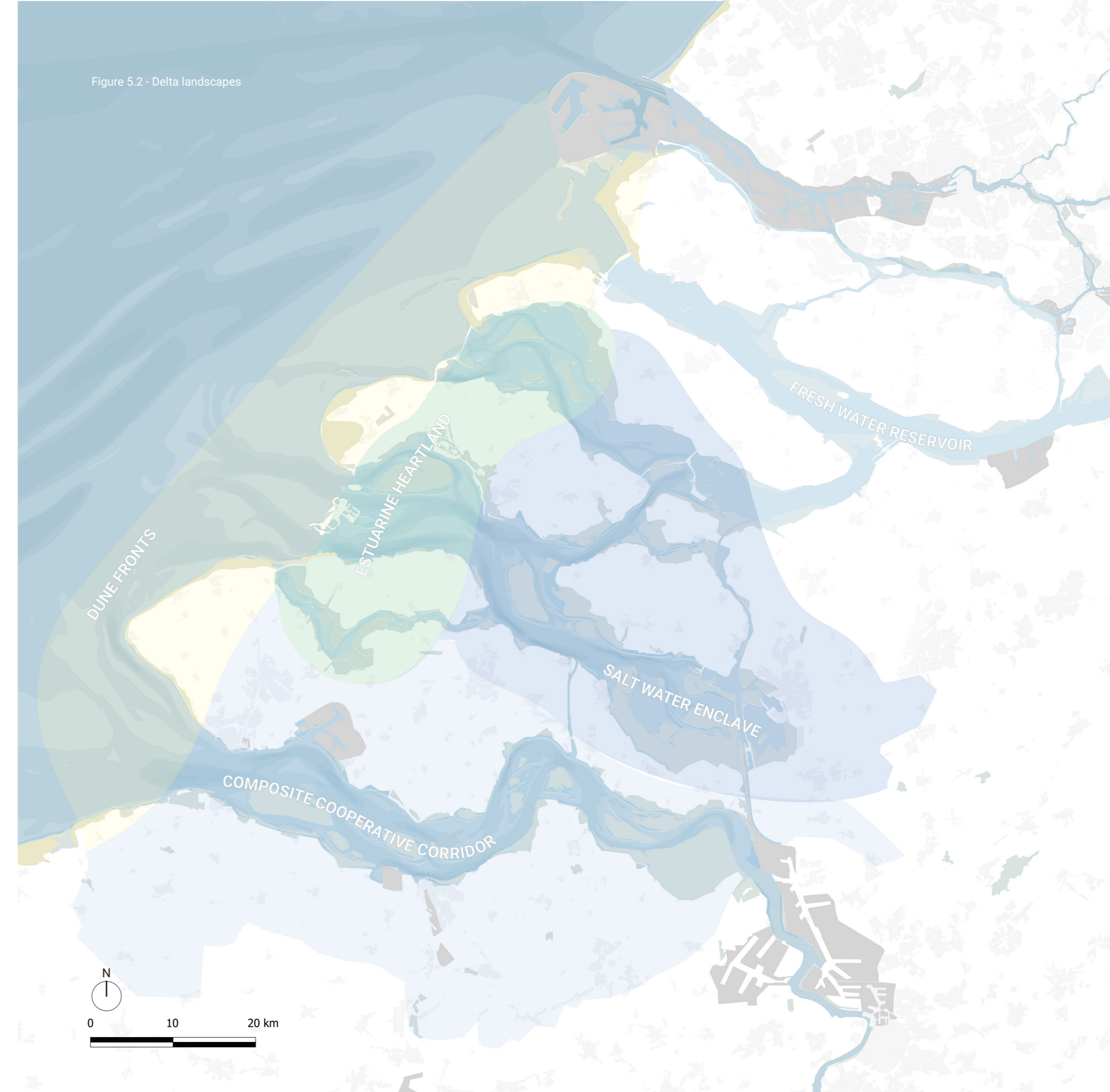
4. **Estuarine Heartland:** Renaturalization will return the landscape to its original salty marshland. This central plain will accommodate ecosystem infrastructure as well as habitats. It will also serve as a natural water buffer and destination for nature tourism.

5. **Composite Cooperative Corridor:** Instead of a border, this area and its waterway will be a connecting element between Belgium and the Netherlands. It will be a transitional area where salt- and freshwater will mix, along with people and knowledge.

Vision The Healthy Delta 2050

- Salt water
 - Fresh water
 - Wetlands
 - Dunes
 - Urbanisation
- Delta landscape typology
- Fresh water Reservoir
 - Estuarine Heartland
 - Dune Fronts
 - Salt Water Enclave
 - Composite Cooperative Corridor
 - Names Delta Landscape type

Figure 5.2 - Delta landscapes



5.2 GROUNDWORK FOR CO-EVOLUTION

COMMUNITIES IN THE DELTA LANDSCAPES

The distinct landscapes have each different types of communities and economic sectors based around it. Because the communities are the base of the transformation to a healthy Delta, it is important to localise them in the vision:

Tourism

Tourism based communities are mainly active in the Dune Fronts and the Estuarine Heartland. This gives them the potential to become the protectors of these nature-reserves while having unique landscapes for nature-tourism. The health of the landscape will be connected to their livelihood, thus creating an insurance for the protection of it.



Fishery

Around the saltwater enclave, the fisher economy thrives in oyster, mussel, and shrimp farming. These communities become care-takers of the oysters, seals and aqua heritage. By educating them in how biodiversity and purification of the water will support their work, the fishers can reassess their current practices to make them more sustainable.



Port

Port communities will be the bridge between agriculture and industrial regions. These communities are often mixed with arable land communities. Sharing experiences will help find a common ground.



Farmers

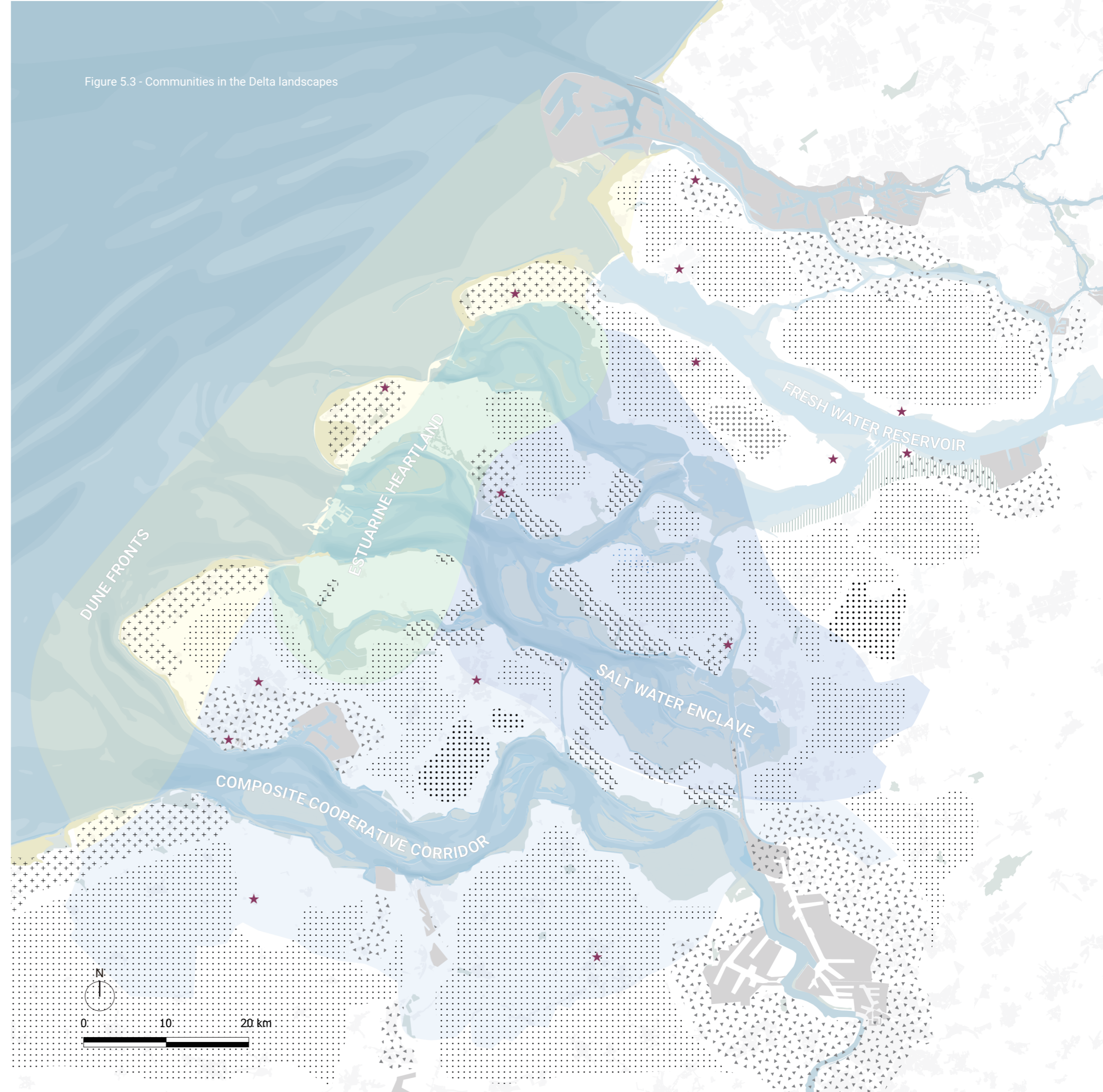
Arable farmer communities cover most of the land and their area touches all of the other communities. They are the ecosystem managers of the greater region. By mixing agriculture with nature or giving space away to greater parcels of wetlands, they manage the infrastructure for ecosystem services. They connect the local communities to the transition by selling their produce and showcasing their experiments.



Vision The Healthy Delta 2050

- Salt water
 - Fresh water
 - Wetlands
 - Dunes
 - Urbanisation
- Recognition of landscape and communities
- Port communities
 - Fruit communities
 - Arable land communities
 - Fisher and shellfish communities
 - Tourism communities
 - Tulip communities
- Delta landscape typology
- Fresh water Reservoir
 - Estuarine Heartland
 - Dune Fronts
 - Salt Water Enclave
 - Composite Cooperative Corridor
 - Names Delta Landscape type

Figure 5.3 - Communities in the Delta landscapes



5.2 GROUNDWORK FOR CO-EVOLUTION

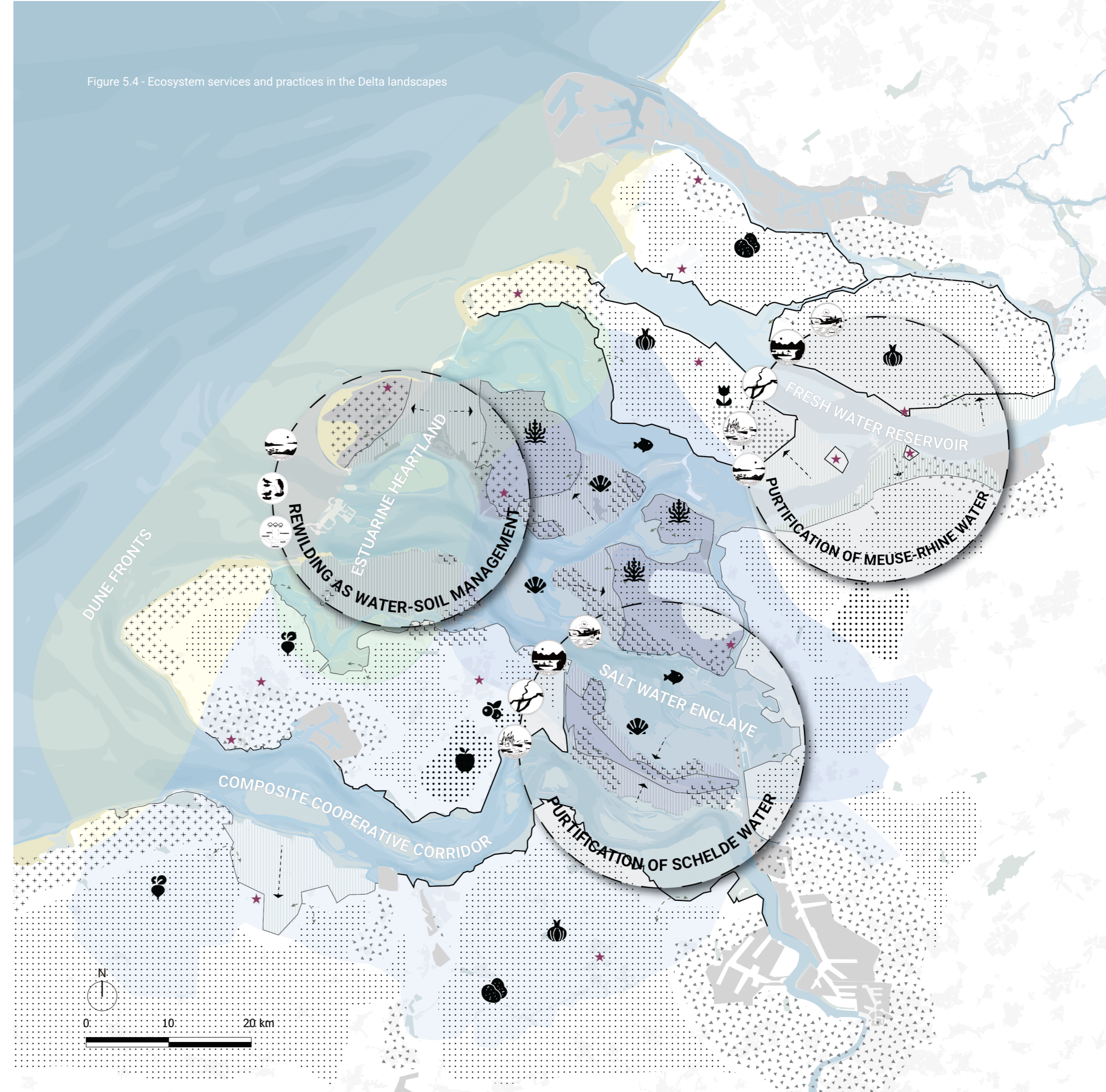
DECENTRALISATION & ECOSYSTEM SERVICES

The management of ecosystems will be localised through agroecological zoning and decentralisation of the water cycle, reconnecting agriculture and industrial practices to the biophysical system of the Delta. This makes production cycles part of the regeneration of the ecosystem infrastructure instead of contributing to its destruction.

The Delta will gain a niche salt-based economy, referencing the history of the region, and supporting a sustainable and unique production chain of salt products, such as salt crops and shellfish. Additionally, a saltwater hydrogen energy network will produce energy using locally provided wind, sun, and geothermal energy.

- Vision The Healthy Delta 2050**
- Salt water
 - Fresh water
 - Wetlands
 - Dunes
 - Urbanisation
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 - Fruit communities
 - Arable land communities
 - Fisher and shellfish communities
 - Tourism communities
 - Tulip communities
- Delta landscape typology**
- Fresh water Reservoir
 - Estuarine Heartland
 - Dune Fronts
 - Salt Water Enclave
 - Composite Cooperative Corridor
 - Names Delta Landscape type
- Regenerative land-use**
- Agroecological zoning
- Sugar beet (fresh water crop)
 - Black berry (Fresh water fruit)
 - Apple (Fresh water fruit)
 - Potato (Brakish water crop)
 - Dunes (Brakish water crop)
 - Shell fish farming (Salt water product)
 - Samphire (Salt water product)
 - Fishery (Salt and fresh water product)
- Ecosystem Adaptive Capacity**
- Strategic intervention location
- WATER Strategic intervention function**
- Soil purification
 - Water purification
 - Water regulation
 - Nutrient cycle
 - Soil formation
 - Water cycle
 - Connection habitats
- Decentralisation of cycles**
- Local watercycles
- Salt based production
 - Saltwater industries
 - Hydrogen based industries
 - Freshwater system
 - Freshwater production
 - Freshwater supply point
 - Freshwater surface storage
 - Freshwater surface storage
 - Reintroduce wetlands
 - Traditional dyke
 - Strengthened dyke system
 - Pushing back the dyke
 - Nutrient exchange

Figure 5.4 - Ecosystem services and practices in the Delta landscapes



5.2 GROUNDWORK FOR CO-EVOLUTION

RENEWABLE CYCLES

The Delta region will be a frontrunner in sustainable land-use and energy production, thriving as a knowledge hub. Field labs will emerge from the landscape, introducing new farming and landscaping methods to locals and visitors.

Each island will facilitate knowledge sharing and collaboration between farmers, governmental, nature, tourism, and industrial organisations. Furthermore, the Delta will be borderless on an inter-scalar level. Knowledge gathered in the region will be shared beyond borders through a centralised joint research centre in Goes, trading information with the rest of the Netherlands and Belgium.

The ports encircling the Southwestern Delta will catalyse a clean port transition throughout the Scheldt-Rhine-Meuse Delta. Additionally, relational borders will be rethought. Ecosystem-based Adaptation will foster kinship between man and nature, such as water defences that don't fight the river, but utilise sediment and riffles as natural buffers.

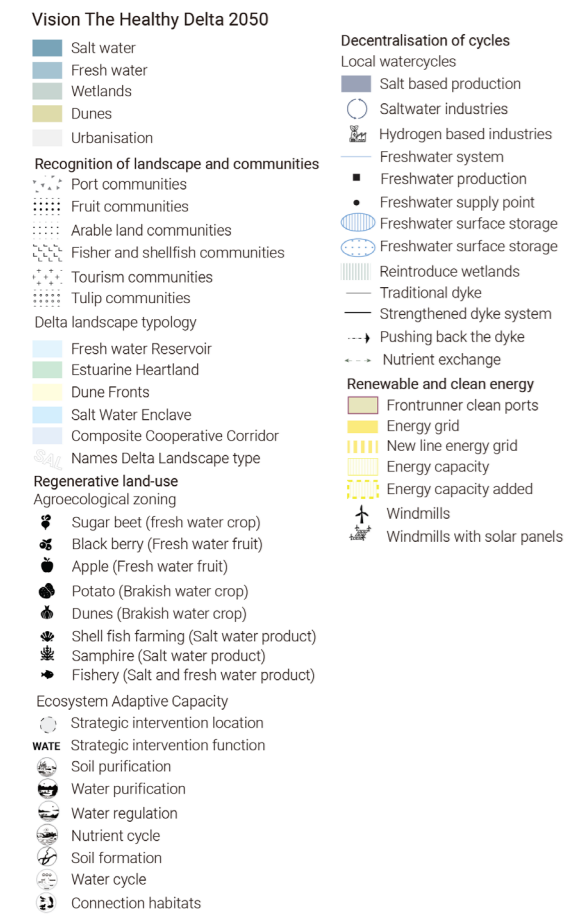
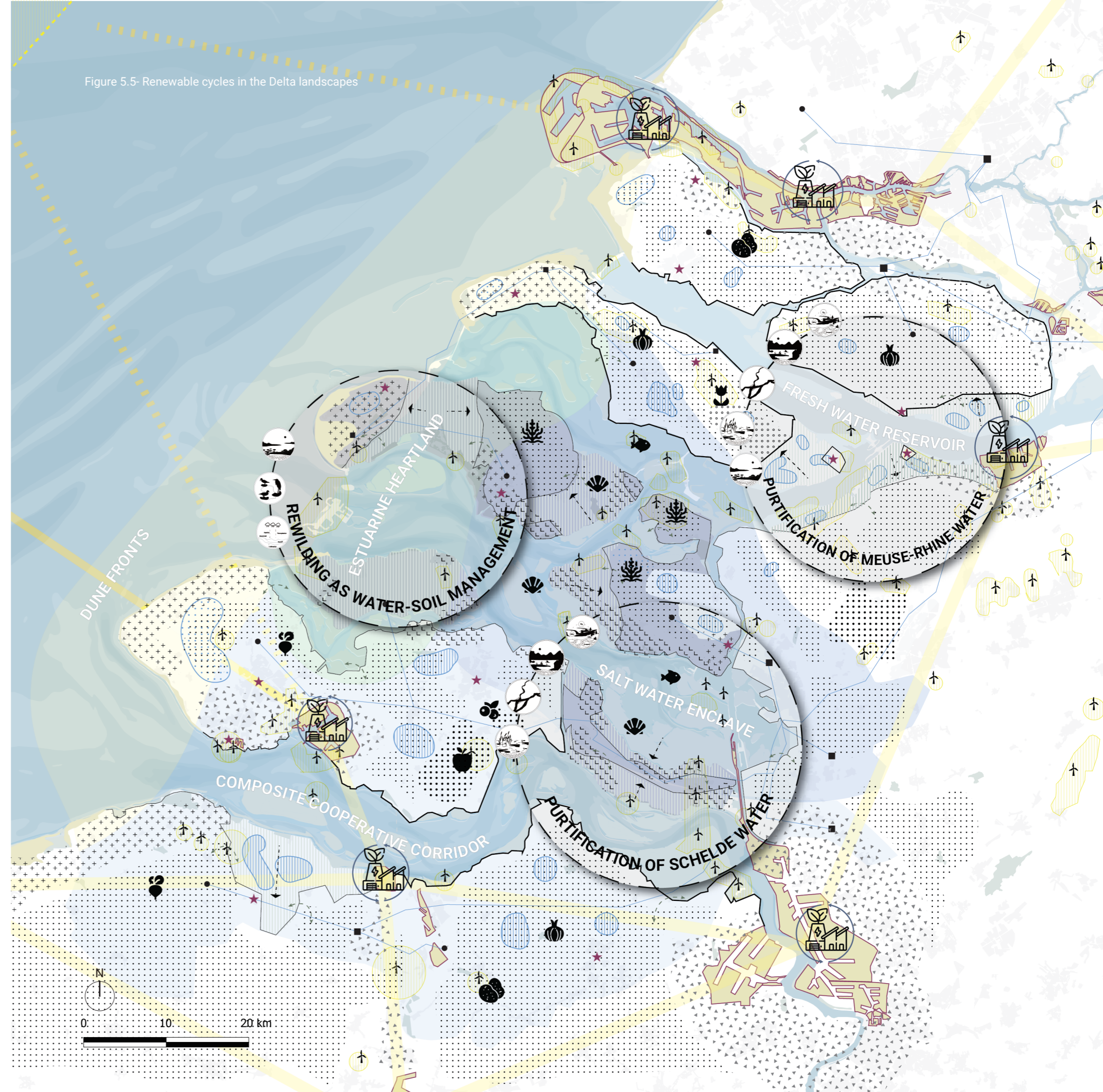


Figure 5.5- Renewable cycles in the Delta landscapes



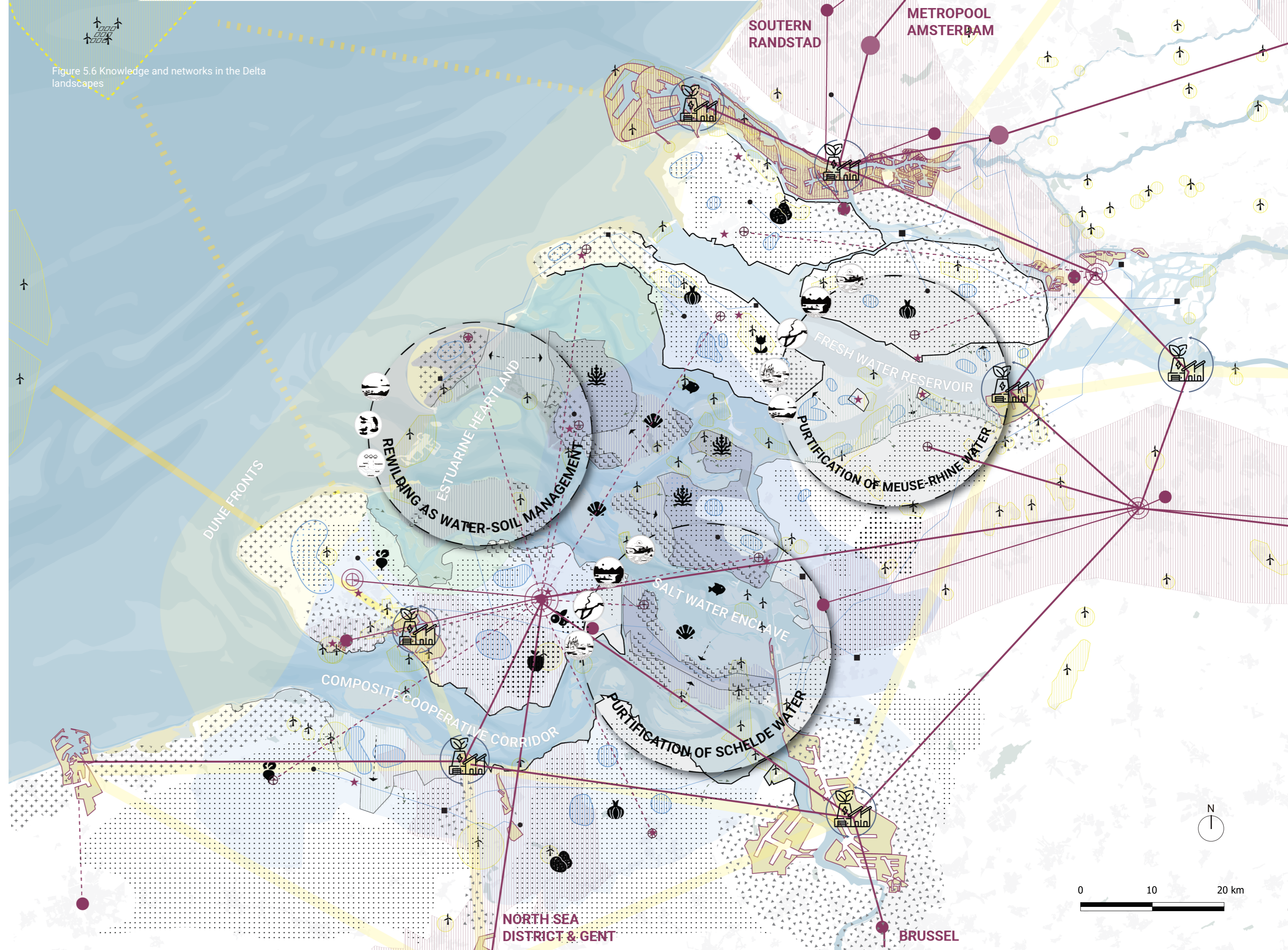
5.2 GROUNDWORK FOR CO-EVOLUTION

KNOWLEDGE & NETWORKS

By 2050, the healthy Delta region can be seen as a flagship project for the regenerative and resilient transition of urbanised Delta regions. The inter-scalar and cross-sector collaboration will uphold spatial justice as well as introduce an responsive and adaptive management of the region.

- Vision The Healthy Delta 2050**
- Salt water
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- Strategic intervention location
 - Strategic intervention function
- WATER**
- Soil purification
 - Water purification
 - Water regulation
 - Nutrient cycle
 - Soil formation
 - Water cycle
 - Connection habitats
- Decentralisation of cycles**
- Local watercycles
 - Salt based production
 - Saltwater industries
 - Hydrogen based industries
 - Freshwater system
 - Freshwater production
 - Freshwater supply point
 - Freshwater surface storage
 - Freshwater surface storage
- Renewable and clean energy**
- Frontrunner clean ports
 - Energy grid
 - New line energy grid
 - Energy capacity
 - Energy capacity added
 - Windmills
 - Windmills with solar panels
- Platform for knowledge networks**
- Heritage
 - Energy grid
 - Energy capacity
 - Research node
 - New joint research node
 - Local research and collaboration centre
 - NOVEX

Figure 5.6 Knowledge and networks in the Delta landscapes



5.3 VISION GOALS

OBJECTIVES

Each principle in the vision can be dissected into multiple objectives. These objectives are based on the previous literature review and are key elements to realise the vision principles:

Ecosystem-based Approach

- Agroecological zoning
- Renaturalisation for self-regulation
- Decentralisation of production cycles
- Local management of ecosystem services
- Adaptive water defence strategies

Appreciation of Island and Identity

- Protection of cultural heritage and identity
- Foster native natural structures
- Preservation of public services and infrastructure

Borderless Delta

- Infrastructure for cross-border and inter-scalar collaboration
- Joint research programmes
- Meaningful participation of communities and stakeholders
- Community engagement through education and events

Foundation of Innovation

- Platforms for sharing experiences and resources
- Delta landscape as stage for pilot programmes
- Celebration and appreciation of frontrunners

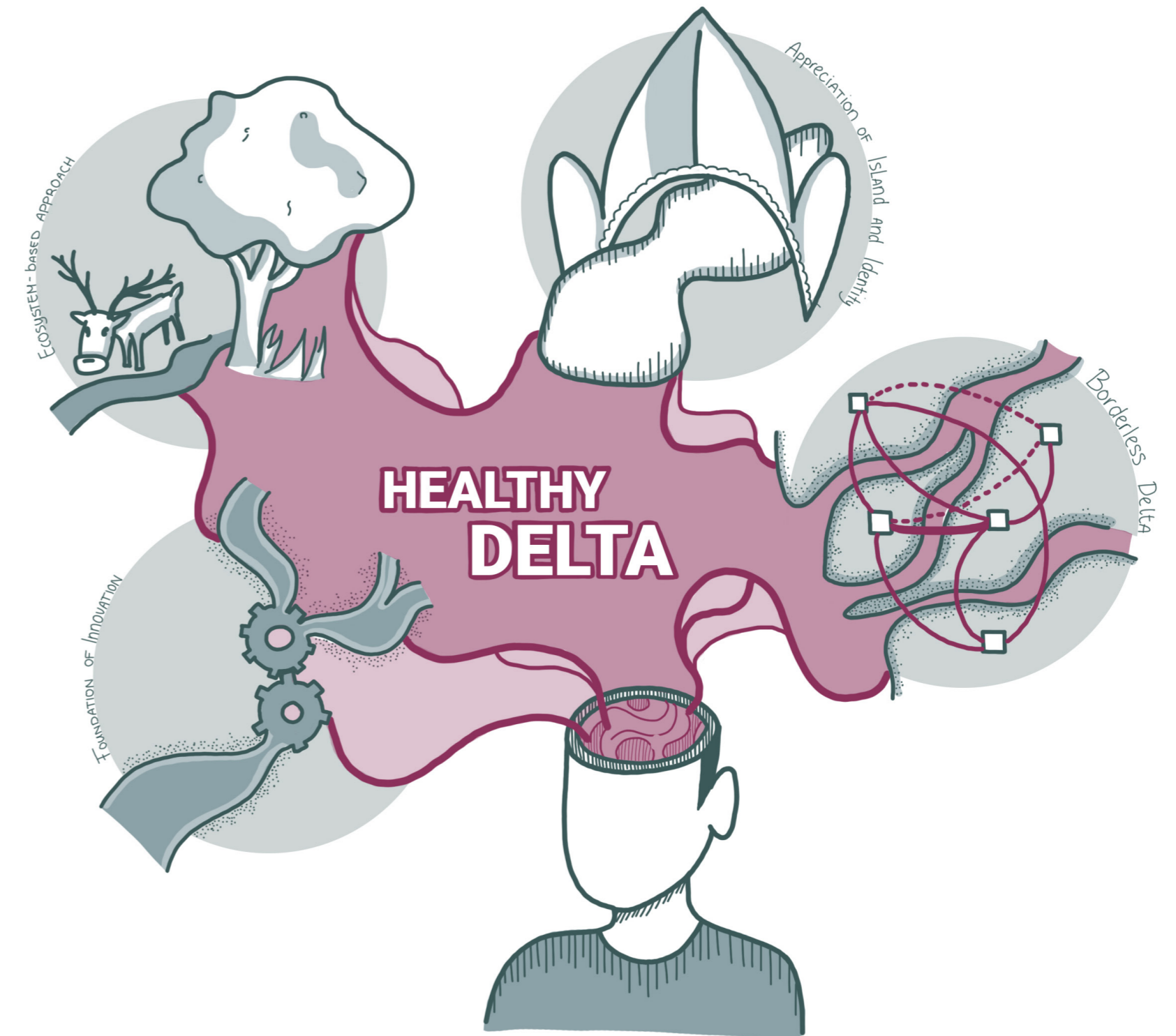


Figure 5.7 - Visualisation of the vision objectives to member of the peri-urban Delta areas

5.3 VISION GOALS

SDGS

The Sustainable Development Goals embody seventeen objectives embraced by United Nations Member States. They serve as a collective roadmap for fostering peace and prosperity for both humanity and the planet, both in the present and for generations to come (United Nations, 2015). These goals constitute the global blueprint for equitable development, making them particularly relevant to our project. The overview underneath presents how the vision contributes to various Sustainable Development Goals.



Figure 5.8 - SDG 6

Goal 6. Ensure availability and sustainable management of water and sanitation for all

- The regenerative agricultural practices, space for natural purification processes and stimulation of cleaner industrial processes support the preservation of water and its natural infrastructure.
- Decentralisation of water cycles creates awareness for the sensitivity of water systems and stimulates sustainable water-management, which focuses on reduce and reuse of water.
- The acknowledgment of the natural systems in policy and strategy will protect the water resources and quality.



Figure 5.9 - SDG 7

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

- Decentralising the energy production through the use of local elements: wind, sunlight and hydrogen based on salt water. The diversity in sources ensures resilience and the nearness could also reduce the costs of energy.

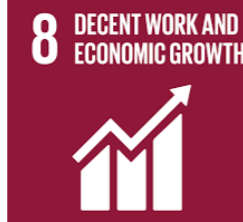


Figure 5.10 - SDG 8

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work

- Subsidising sustainable entrepreneurship. Field labs and demo-farms (local farms which test new practices on their field and let others visit) are the necessary front runners to support a sustainable and just transition.
- Lower taxes for organisations who use less nitrogen and freshwater will nudge them to rethink their practices and see opportunities in sustainable production chains.
- Marketplaces to sell local food without an in between facilitator (such as a supermarket) will create local employment and economic opportunities for grass root organisations.



Figure 5.11 - SDG 9

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation

- Adding a rail connection between Gent (Belgium) and Goes (Netherlands) which is connected to the Dutch train network will make it possible for more sustainable movement between Belgium and the Netherlands. The international movement will stimulate meetings between people which increases the potential of innovative collaboration.
- Spaces for research and knowledge sharing will build a cross-border knowledge network on sustainable land-use and hydrogen technologies. The public platforms will lower the threshold for locals to get introduced into the developments and research.
- Existing port structures together with the knowledge networks can create a cross-border port strategy for hydrogen production and trading.



Figure 5.12 - SDG 10

Goal 10. Reduce inequality within and among countries

- Recognition and fostering local knowledge through platforms for knowledge sharing and collaboration.
- Meaningful involvement of communities and local practices in policy and strategy making by introducing annual inter-scalar table discussion.



Figure 5.13 - SDG 11

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

- The interventions are based on local natural and cultural systems and values, such as shellfish farming and wetlands as natural water defence.
- Preserving access and availability of public services and resources, especially during the transitioning period.



Figure 5.14 - SDG 12

Goal 12. Ensure sustainable consumption and production patterns

- Introducing regenerative land use and practices support sustainable ecosystem management.
- The acknowledgment of the natural systems in policy and strategy will protect the local water and soil ecosystem.
- Decentralisation of water and energy create awareness and the feeling of ownership of the landscape and its ecosystem services.
- Awareness of personal influence on the environment will be fostered through participation and knowledge events.



Figure 5.15 - SDG 13

Goal 13. Take urgent action to combat climate change and its impacts

- Settlements will be protected from sea level rise and flood by making room for wetland flood plains and strengthening the dikes.
- By motivating the reduction of freshwater extraction and increasing storage of water in the Dunes, salinisation of the ground will be slowed down.



Figure 5.16 - SDG 14

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

- Reducing water pollution through cleaner industrial processes and regenerative practices reduces the pollution entering the water bodies.
- Room for purification of water and soil formation through wetlands and oysters, which also supports marine life.
- Ecosystem based planning supports the protection of marine life.
- Educating shellfish farmers and fishers on the risks of overfishing and unsustainable practices will help them become shepherds of the Delta.



Figure 5.17 - SDG 15

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

- Regenerative farming practices will be stimulated through incentives and access to knowledge and collaboration.
- Expanding wetlands and interconnecting nature networks will give the ecosystem its ability to self-regulate back.
- Expanding and protecting oyster riffs will support the sinking of pollution and accommodate fish habitats.
- Creating awareness through education will promote sustainable activities in communities and local industries.
- Agroecological zoning will connect landuse to the ecosystem through water and soil based planning.



Figure 5.18 - SDG 16

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

- Increase accessibility of landscape through the extension of bicycle paths and introduction of interactive and multifunctional land use will lower the segregation of public and private land.
- Enhancing access to education by introducing a new institution, adding waterbus-lines between islands and creating digital and physical platforms for knowledge sharing.
- Stimulating and facilitation participation through events, table discussions and digital platforms.



Figure 5.19 - SDG 17

Goal 17. Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

- Rail connection between Gent and Goes to connect to the Dutch train network will make collaboration easier between Belgium and the Netherlands.
- The creation of a cross-border network for knowledge sharing, collaborative research around sustainable land-use and hydrogen will be the infrastructure for international alliances for sustainable development.

6. ALL HANDS ON DECK

The vision of the transition towards a healthy Delta requires a strategy. This chapter elaborates on the strategic approaches that are necessary to reach the goals stated in the vision. The quantification of the systems shows how effective the proposed measures are. From there, the design measures are categorised in a catalogue that shows the relation to the stakeholders, ecosystem services, and the Brede Welvaart. Together with an explanation of community engagement and the knowledge network, the project zooms in to three key projects: *Schouwen-Duiveland*, *Oesterdam*, and *Haringvliet*. Finally, the phasing shows how all measures are prioritised over time and the vision beyond 2050 will conclude this chapter.

Figure 6.1 - Sattelite image Saefthinghe (Google Maps, n.d.)



6.1 QUANTIFICATION OF SYSTEMS

NITROGEN

Soil & Air

Nitrogen pollution can spread through water, soil, and air. Through soil and air, there are around 149 kilotonnes of elementary Nitrogen in the air in The Netherlands (Compendium voor de Leefomgeving, 2024). In the Delta area, a relatively small part of the nitrogen pollution is transported through the soil and air. Around 6.85 kilotonnes of nitrogen are internal, and 3.53 kilotonnes are transboundary. These two combined are responsible for 5.6% of the total amount of nitrogen pollution in the Delta area (Milieucentraal, 2023) (RIVM, 2018).

Water

Through water, 253 kilotonnes per year end up in the North Sea out of all rivers in The Netherlands. The Delta area deals with 196.08 kilotonnes per year. This is around 77% of all nitrogen pollution through water that ends up in the North Sea. Out of this number, around 176.59 kilotonnes stay in the Delta area (Deltares, 2022).

The Delta area has to deal with a significant amount of transboundary pollution. Most of this is transported through the Rhine (63%) and the rest through the Meuse (8%) and Scheldt (6%). In total, that adds up to 86% of all nitrogen pollution through water. The other part of nitrogen pollution is caused by agriculture (11%) and industries (3%) (internal sources) (CBS, 2022).

Solutions

The existing nitrogen pollution can be captured by wetlands (Jordan et al., 2010), agroforestry (Rosenstock et al., 2014), and oyster reefs (Van de Wouw & Holwerda, 2024). Wetlands can sink 0.01 kilotonnes of nitrogen per hectare per year (Jordan et al., 2010). This is based on a 100% functioning wetland. In reality, it would sink about half of this number. To sink all nitrogen in the Delta area, an area that is twice the size of Voorne-Putte is needed. Currently, the wetlands in the area sink around 14.675 kilotonnes of nitrogen.

According to Rosenstock et al. (2014), agroforestry could contribute, opposite to monoculture, fixate nitrogen. However, the combined area of Voorne-Putten, Goeree-Overflakkee, and Veere covers the nitrogen emissions from local agriculture.

Lastly, research in Zeeland showed that "oysters could remove a total of 22.500 kg nitrogen and 1.200 kg phosphorus in a year" (Van de Wouw & Holwerda, 2024). This means that oysters can sink 2.25 kilotonnes of nitrogen per hectare per year. An oyster field that is the size of half the TU Delft Campus would solve the nitrogen problem. Again, the oyster reefs can sink less in reality, since they live in very sensitive habitats. For the calculations, around half of the sinkage potential is taken.

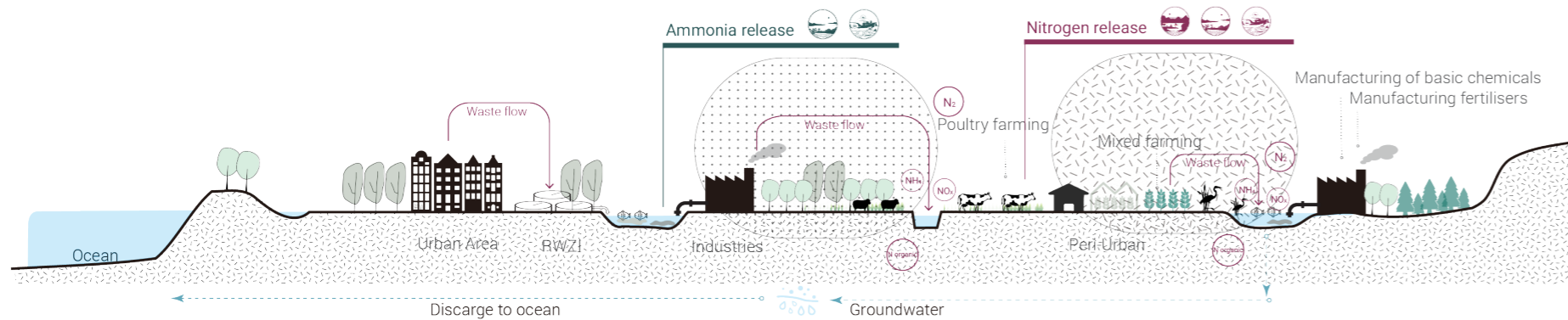


Figure 6.2 - The current nitrogen cycle within the Delta region

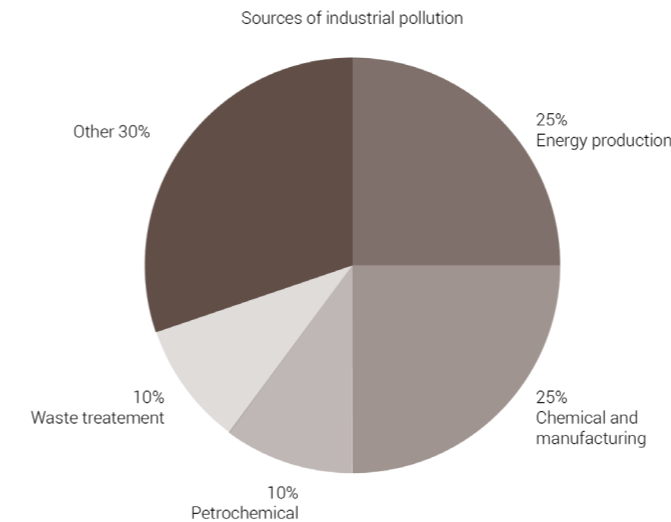
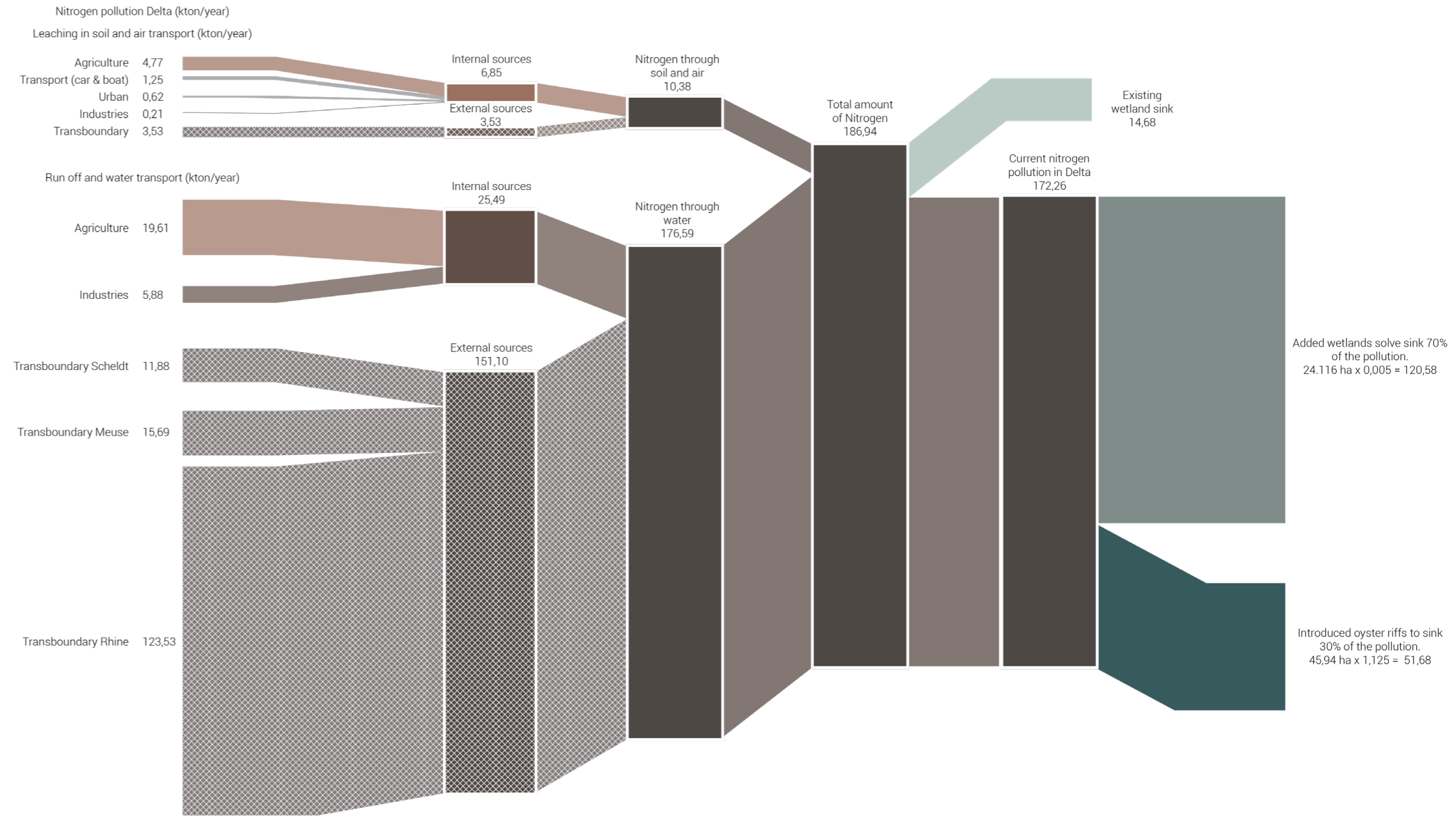


Figure 6.3 - Sankey diagram of nitrogen quantification

6.1 QUANTIFICATION OF SYSTEMS

NITROGEN

The map on the right shows the pollution sources, nitrogen, and ammonia release in the area. The transboundary pollution comes through the rivers.

The addition of wetlands and oyster reefs can sink the nitrogen in the area. On top of that, they are useful in keeping the soil healthy by balancing nutrients. Agricultural areas can be connected with wetlands and oyster reefs.

This will increase crop yield. Field labs in wetland conservation, crop rotation, and agroforestry support education on the nutrient cycle, and can reduce the use of fertilisers in the future.

The oyster reefs boost a new form of aquaculture, sink nitrogen, and create a new product for the urban area.

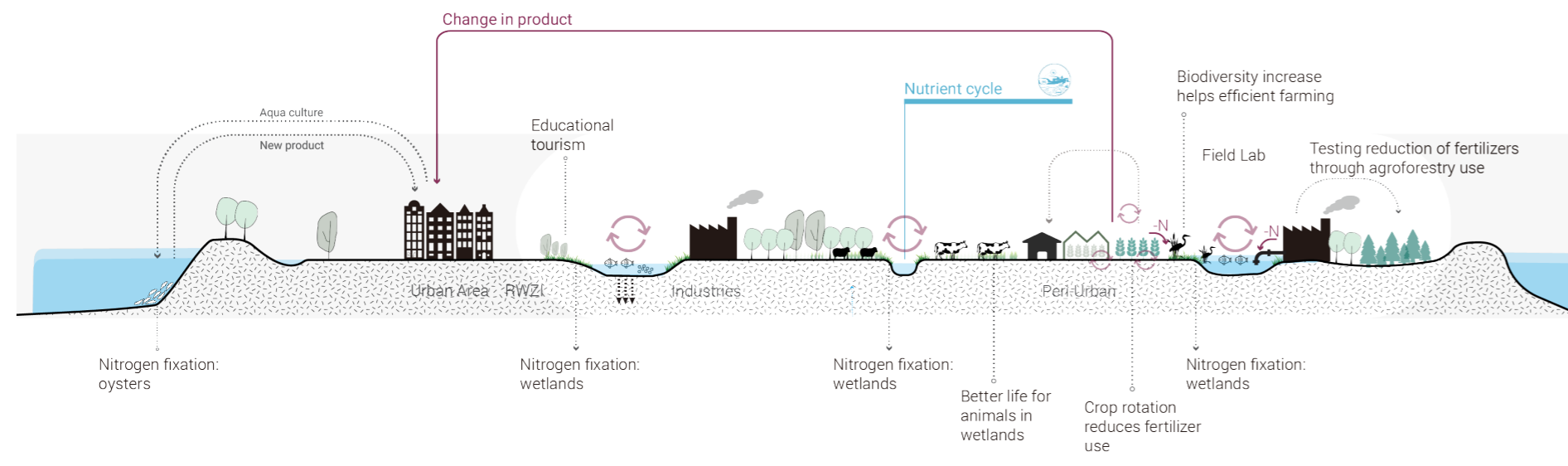
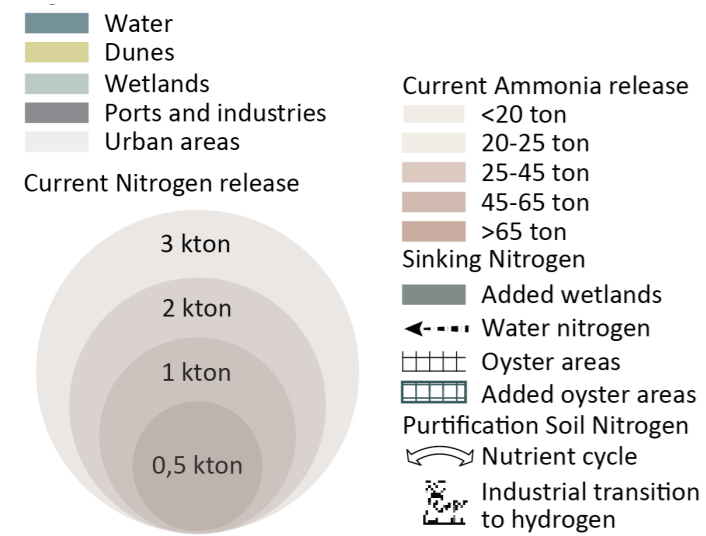
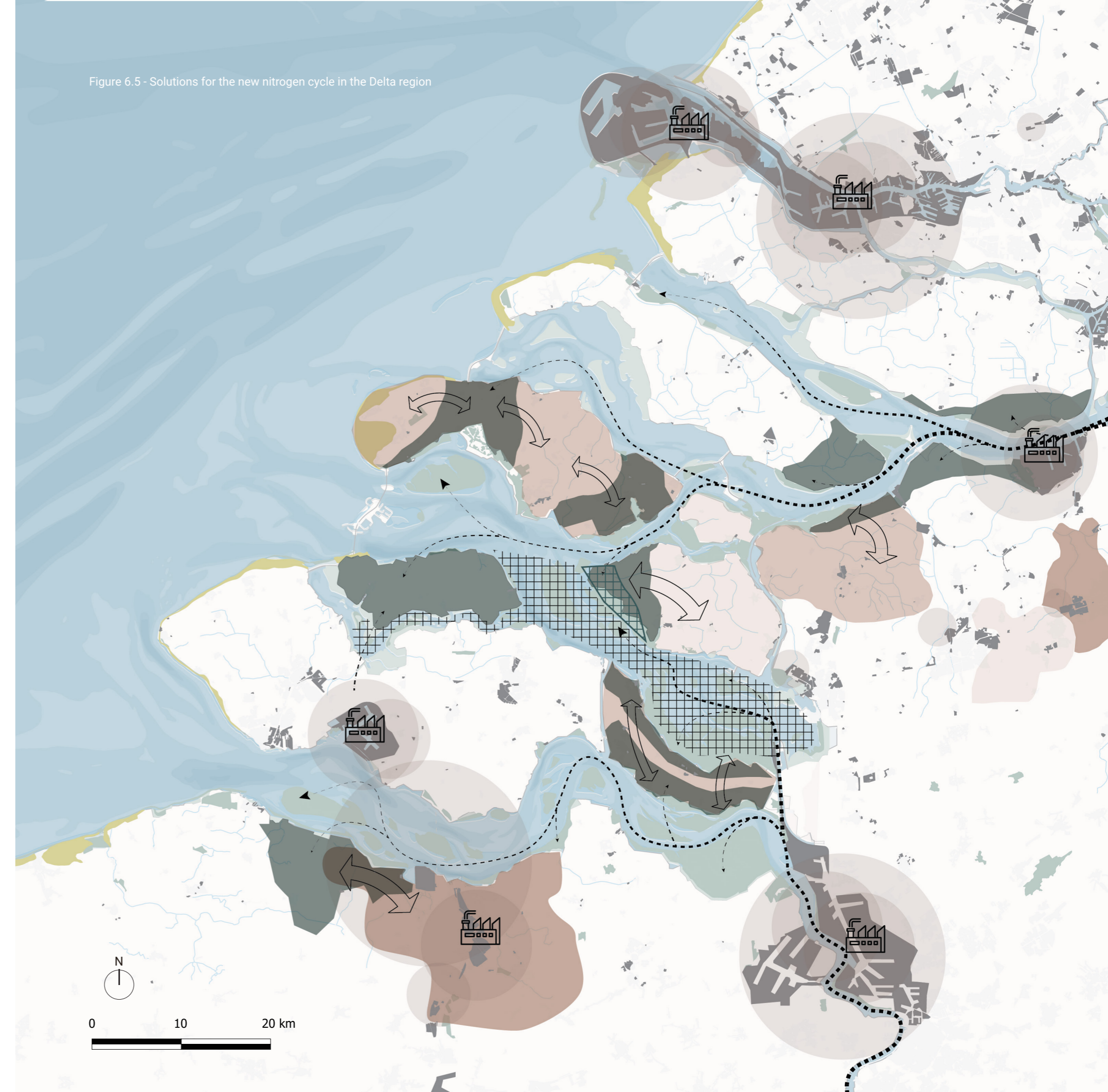


Figure 6.4 - The renewed nitrogen cycle within the Delta region

Figure 6.5 - Solutions for the new nitrogen cycle in the Delta region



6.1 QUANTIFICATION OF SYSTEMS

WATER

Freshwater provider Evides gets its freshwater from the Biesbosch and transports this to Zeeland. This shows that freshwater is scarce (Provincie Zeeland, 2021).

The total water demand of the Southwestern Delta can be subdivided into three categories: Agricultural water demand, Industrial water demand, and Household water demand. A share of the total water demand gets recycled. However, a bigger part can be categorised as single-use. This section shows how to reduce the single-use of the available freshwater supply.

Water demand

The agricultural water demand represents around 11% of the total water demand (Van der Meer, 2020). The industrial water demand is bigger, representing 46%. Lastly, the household water demand covers the other 43% (Zuidwestelijke Delta, 2009) (Industrielinqs, 2022) (CBS, 2020). The recycled water stream mainly comes from the industrial sector (TU Delft, 2023).

However, 65% of the water demand is single-use. To reduce water demand, agricultural innovation is needed. According to Burrows (2023), "Vertical farming offers a sustainable solution that uses 98% less water than traditional agriculture and can help support food security."

Solutions

Agroforestry could help reduce water use (FasterCapital, 2024). By implementing a smart irrigation system, the farm reduced water usage by 30% while maintaining a high crop yield (Aziz et al., 2021).

Around 95% of the utilised freshwater is cooling water in the energy production sector (CBS, 2020). Saltwater could also be used for this process. In the period between 2012 and 2018, an increase of 45% in the usage of saltwater for these cooling processes has been recorded by CBS (2020). The usage of saltwater in industrial processes is essential in the transition towards a healthy Delta.

The transition towards saline crop farming embraces the salinity. This would allow farmers to sustain themselves and lower their freshwater demand.

On top of that, the water use of households is increasing (CBS, 2020). By motivating households to reduce water usage, the water use can be lowered. This can be done through fieldlabs, or monetary benefits to new governmental programs.

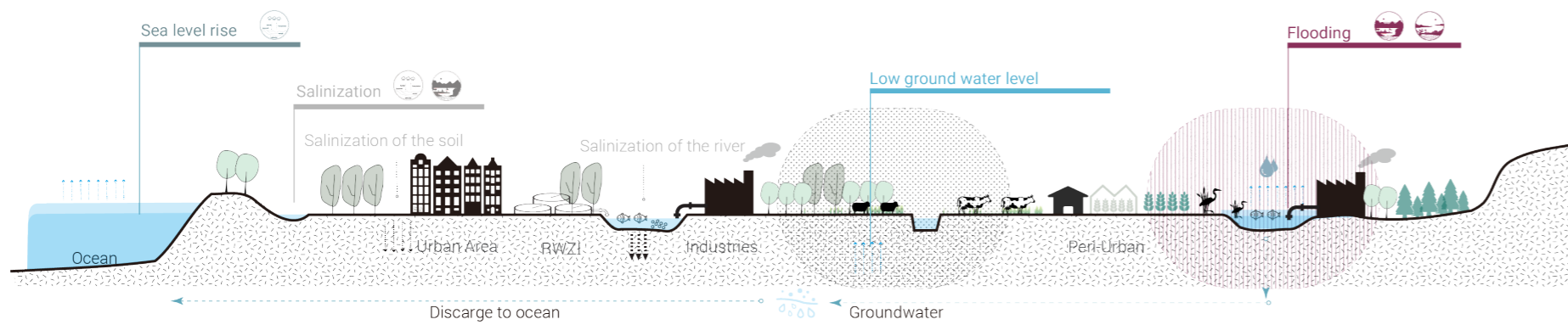


Figure 6.6 - The current water cycle within the Delta region

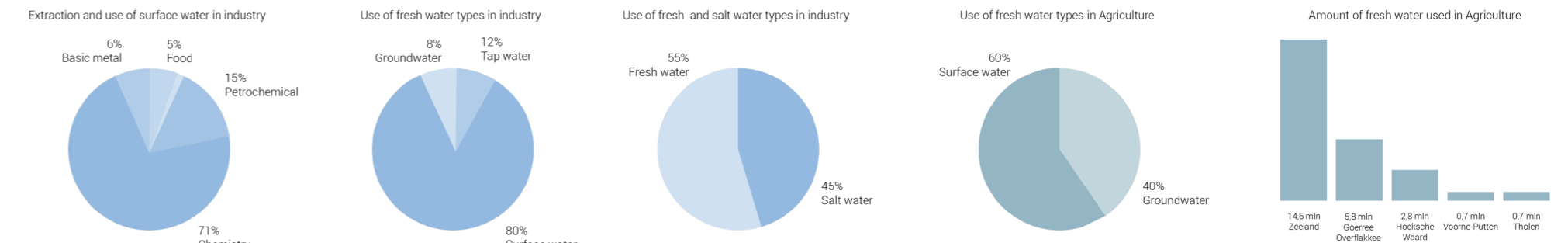
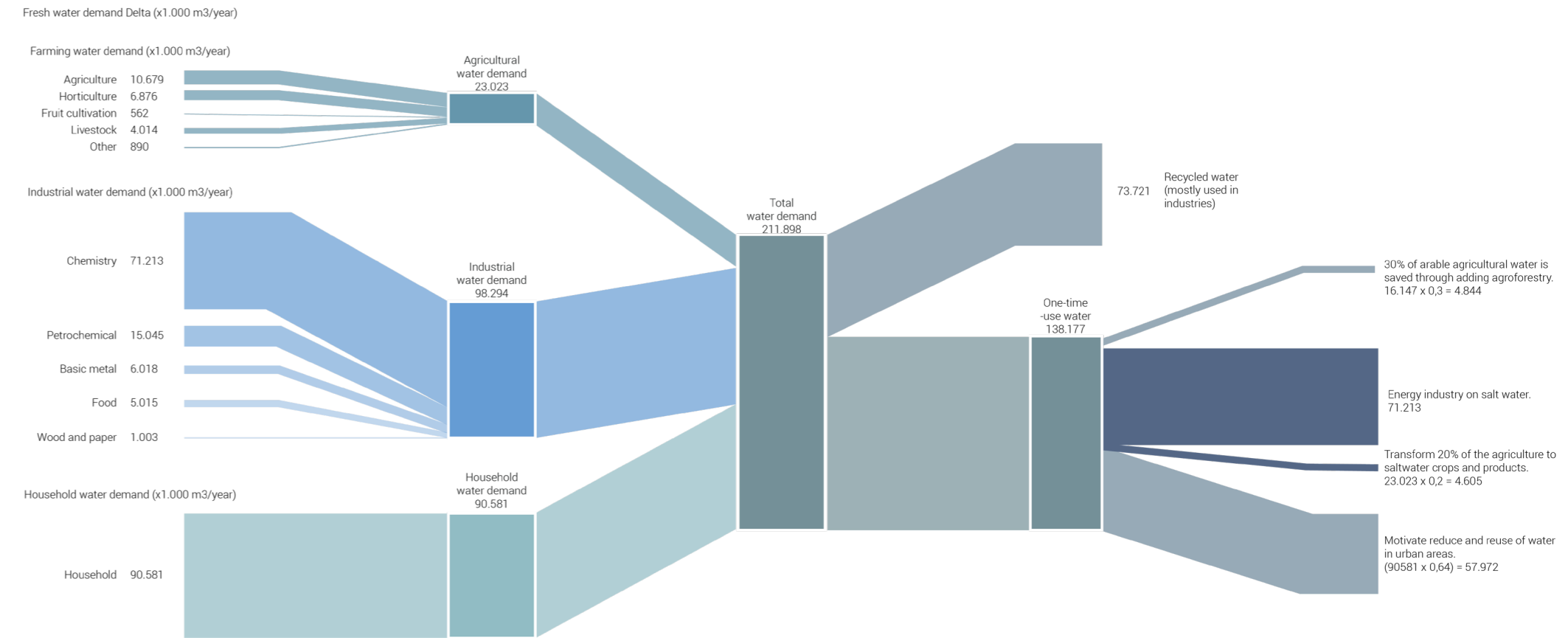


Figure 6.7 - Sankey diagram of water quantification

6.1 QUANTIFICATION OF SYSTEMS

WATER

The map shows the water extraction points and how the infrastructure distributes the freshwater in the Delta area. The decentralised watersystem can be a bottom up approach to foster the reuse of water on a local scale.

The saltwater aqua- and agriculture reduce the freshwater demand, just like the saltwater that can be used for energy generation. The introduction of crop rotation and agroforestry reduce the need for fertilisers and freshwater.

A collaboration of farmers introduces a market and knowledge centre for agricultural innovation.

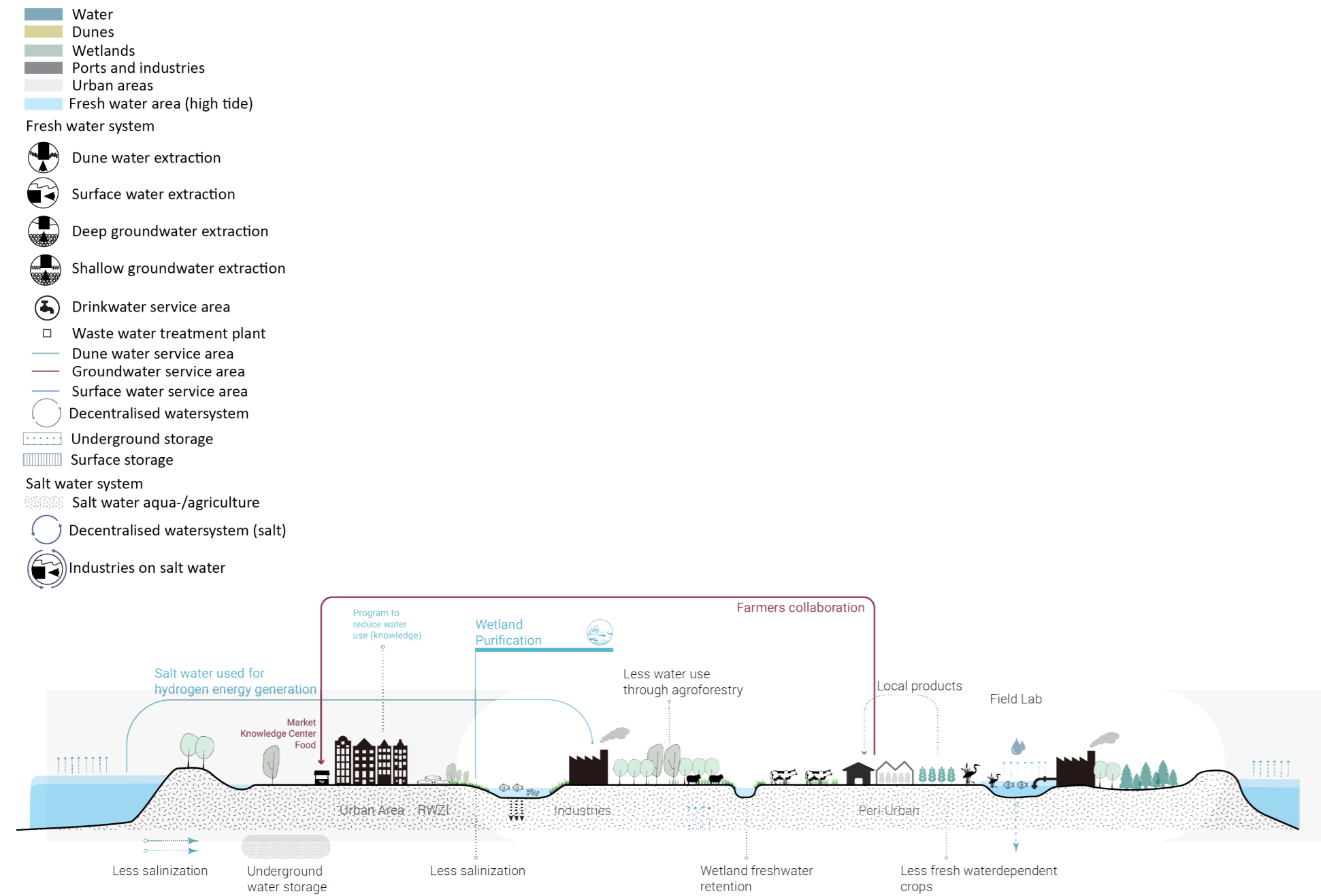
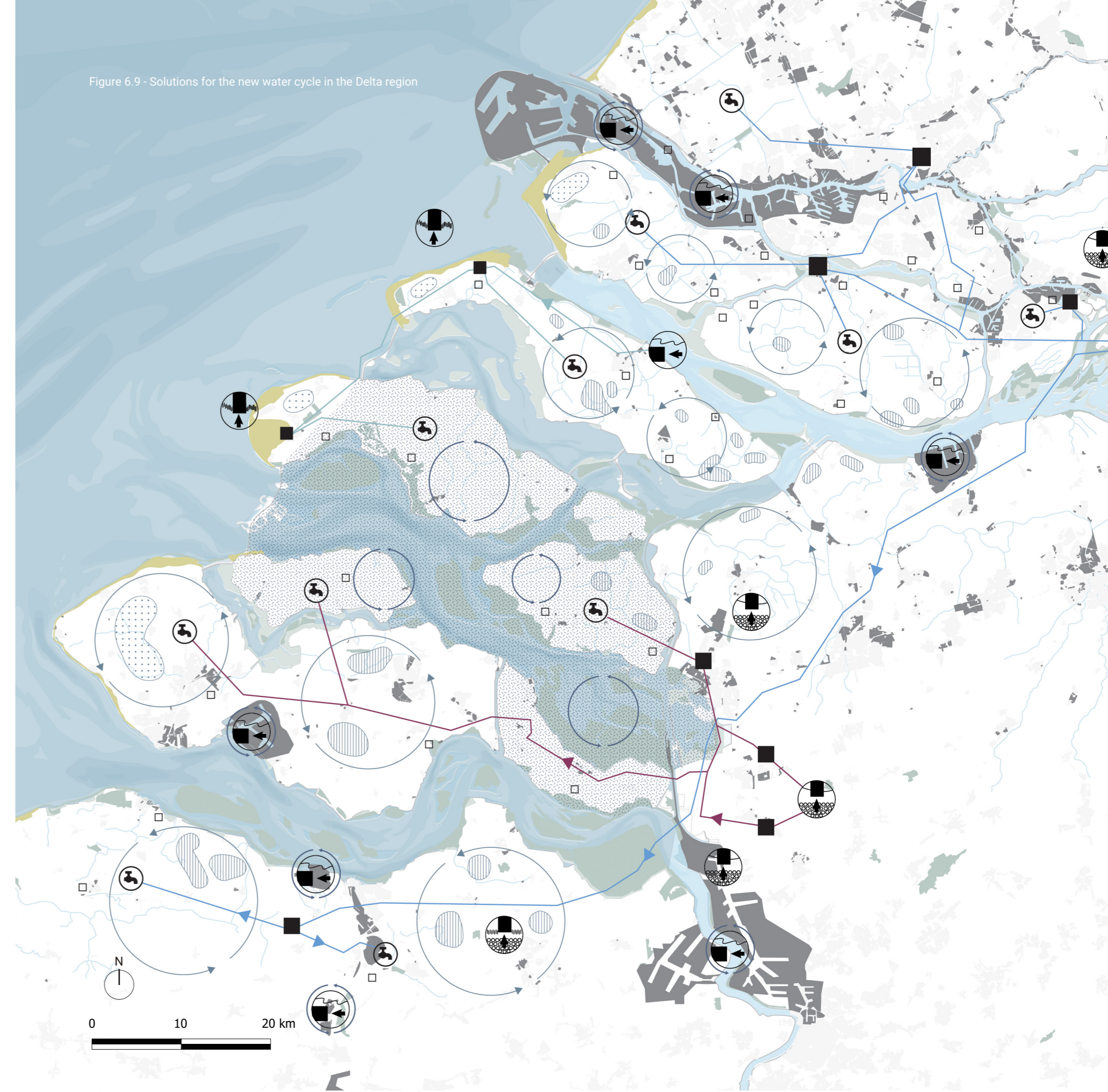


Figure 6.8 - The renewed water cycle within the Delta region

Figure 6.9 - Solutions for the new water cycle in the Delta region



6.1 QUANTIFICATION OF SYSTEMS

ENERGY

The pie charts represent the energy demand of Zeeland (2020) (CE Delft, 2020). The total of 135 PJ in one year, which can be converted to **4280 MW**. The industrial sector is responsible for around 78% of the energy demand. The existing renewable energy share fulfills a total of **1727 MW** (CE Delft, 2020).

Energy demand - Renewables = GAP
GAP = 4280 - 1727 = 2553 MW

What are the potentials for renewable resources to fill the GAP?

Wind farms

The windmills at sea in Park Borssele can produce 8 to 9.5 MW per year (Rijksoverheid, n.d.). If 8 MW is adopted for the new windmill park close to Zeeland, around 320 windmills can fill the GAP.

Solar farms on sea

The average yield is 150 kWh per square metre PV Panel oriented southwards in The Netherlands per year (VoltaSolar, n.d.). This can be converted into 0.0000172 MW per square metre. To fill the GAP; around 148,430,233 square metres are needed. This needs to be done in the North Sea, since solar farms on land are prohibited, due to scarcity of land (Rijksoverheid, 2023).

Solar farms are complementary to windmill parks. According to Oceans of Energy (n.d.), a solar field between 4 wind turbines can produce a peak capacity of 180 MW.

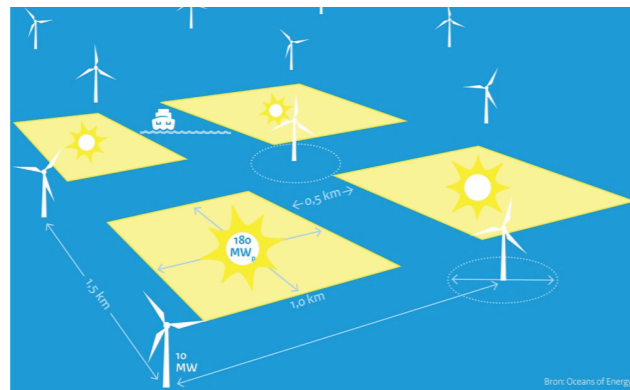


Figure 6.10 - Comparison of solar field with windmill parks (Oceans of Energy, n.d.)

A solar field (as Figure 6.10) has an area of 1 million square metres. Therefore can produce around 17 MW per year.

Geothermal energy

The geothermal potential of Zeeland is around 2500 TJ per year (PANterra, 2011), which can be converted to 285 MW. This fills around 11% of the GAP.

Biomass

According to Van Hasselt & WUR (2011), The use of 1.8 kg of wooden pellets is equal to the energy capacity of 1 cubic metre of gas. One cubic metre of gas has an energy capacity of around 35 MJ (Energieconsultant, n.d.). This can be converted into 0.00000401 MW in a year.

To fill the GAP, 636,658,355 cubic metres of gas are needed. This translated into 1,145,985,038 kg of wood pellets to fill the GAP.

Based on the agroforestry potential and the land availability, this is not achievable. On top of that, the unsustainable emission products of the combustion process are acknowledged. Biomass could be useful in the early stages of the energy transition..

Heat Link

The existing power capacity of the Heat Link network is 250 MW (WarmtelinQ, n.d.). If a new Heat Link network is introduced that is connected with the existing nuclear power plants, and the industrial areas of Gent & Antwerp; an extra 250 MW could be generated. This fills around 10% of the GAP.

Hydrogen

One kg of Hydrogen has an energy value of around 33.3 kWh (Goodall, 2021). Per year, this can be converted into 0.0038 MW. To fill the GAP, around 671.842 kilogrammes of Hydrogen are needed.

However, hydrogen is produced through the use of gas or electricity. Since gas is not sustainable, electricity needs to be generated to produce hydrogen. Currently, with efficiency rates being taken into account, it takes around 50 kWh to produce 1 kg of hydrogen (Goodall, 2021). This means that 33,592,100 kWh of electricity is needed for the production of hydrogen in Zeeland. This elevates the GAP to 3.8 MW. This could be supported by the addition of 2 extra windmills yearly.

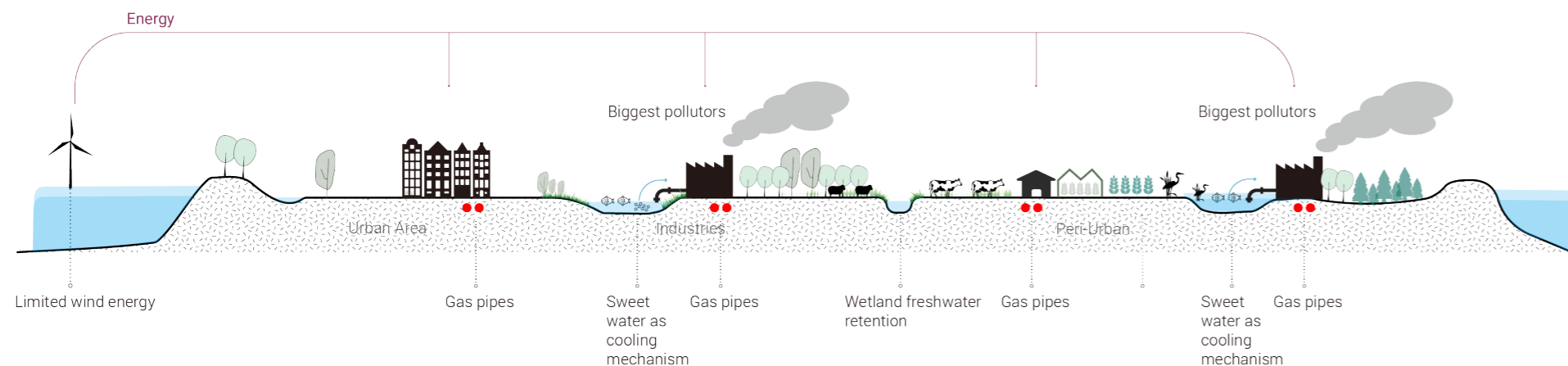


Figure 6.11 - The current energy cycle within the Delta region

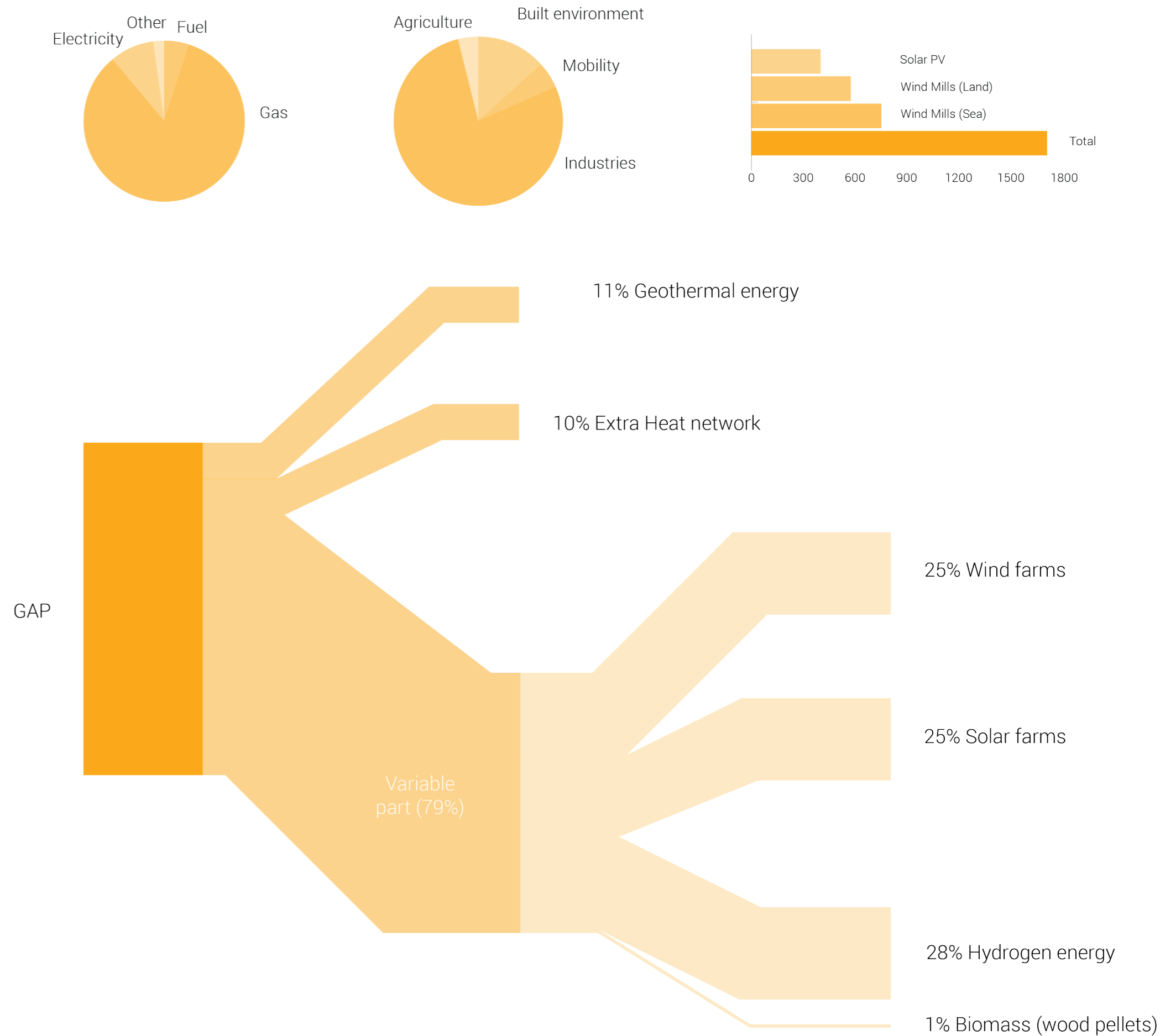


Figure 6.12 - Sankey diagram of energy quantification

6.1 QUANTIFICATION OF SYSTEMS

ENERGY

Variable part

The variable part has been divided according to the potentials that each of the individual energy resources have. If a new wind park is built, that is half the size of windpark Borssele, it is able to fill 25% of the GAP. There is a huge potential for the integration of solar farms with wind farms. If the new wind park were integrated with a solar farm, an additional 25% of the GAP could be filled.

Since biomass is not sustainable and requires an excessive amount of wood for the area, it fills 1% of the GAP. It could be used in the beginning of the transition or as a local energy source in case of an emergency.

The rest of the GAP can be filled with energy, derived from hydrogen. This technique also has a significant potential. Right now, it is still derived from unsustainable resources and requires a substantial amount of electricity. All of the variable energy resources have a considerable potential which could also provide for the rest of the Southwestern Delta that is not included in this calculation (Zeeland only).

Spatialisation

In the area, the island of Schouwen-Duiveland, together with Voorne-Putten has the potential for geothermal energy creation. Old gas pipes are transformed into a hydrogen network, which starts the hydrogen transition.

The new wind park, integrated with solar fields can be placed in The North Sea. The position of this field is dependent on existing ship traffic so that the new field does not interfere with water traffic.

Finally, a new heat link network is introduced in the Delta, which is connected to major industrial areas to spread heat through the area that supports businesses and housing. The diversification of energy sources lowers the risk in case of an emergency, where one of the sources is not usable.

Nuclear energy

The quantification of energy flows does not concern nuclear energy. In the transition towards a healthy Delta,

nuclear energy can play a role in the beginning but it is not desirable to become dependent on nuclear energy.

One kilo of uranium (U-235), that is used in the nuclear power plant, produces the same amount of energy as 2.7 million kilos of coal (The European Nuclear Society, 2019). However, uranium is a raw material and is not renewable. According to the U.S. Energy Information Administration, uranium ore is most used for nuclear energy generation. "Although uranium is about 100 times more common than silver, U-235 is relatively rare" (EIA, 2023).

Secondly, nuclear waste needs to be processed (International Atomic Energy Agency (IAEA), n.d.). Nuclear waste clashes with the regenerative approach of ecosystem services in the transition towards a healthy Delta. On top of that, the Government of the Netherlands (Ministerie van Algemene Zaken, 2017) is not planning to build more nuclear power plants.

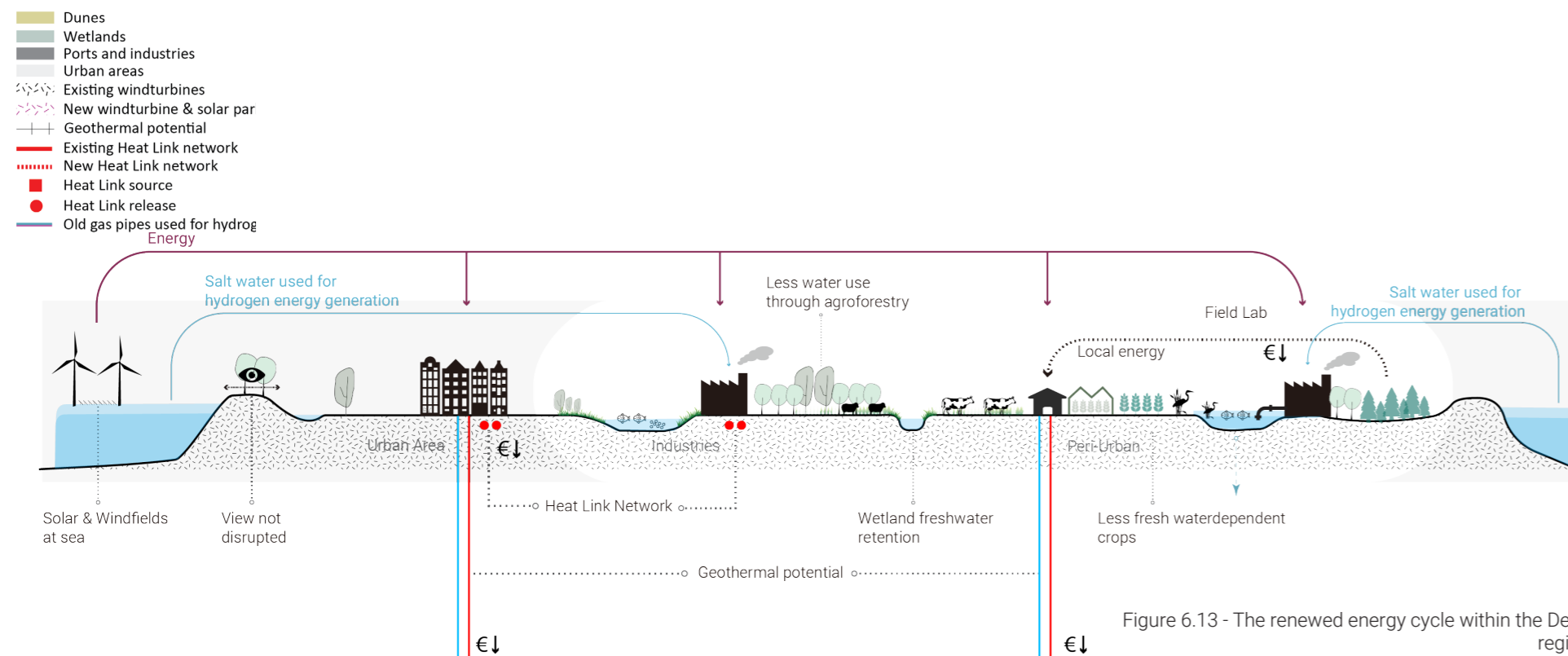
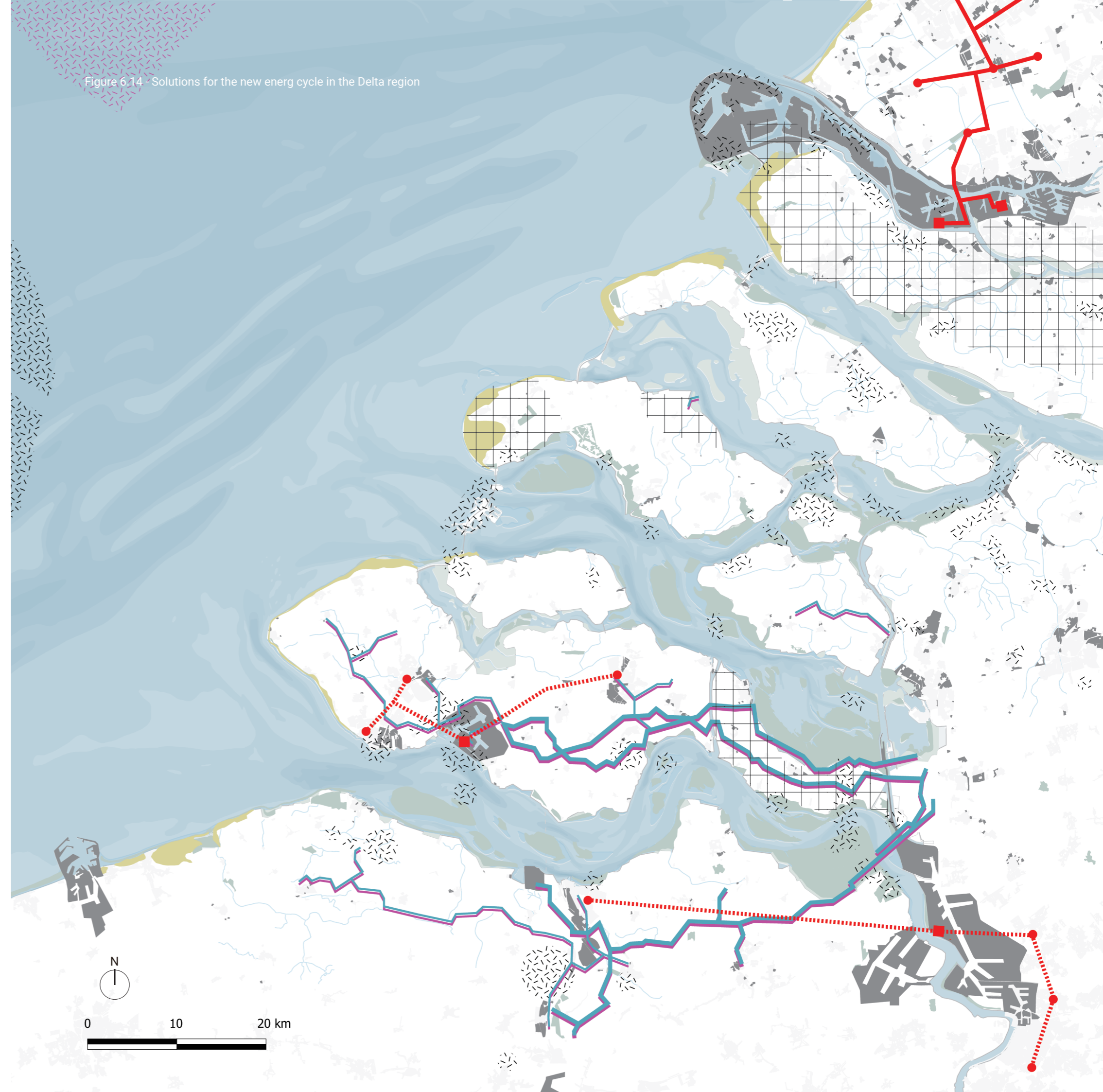


Figure 6.13 - The renewed energy cycle within the Delta region

Figure 6.14 - Solutions for the new energy cycle in the Delta region



6.2 DESIGN CATALOGUE

BREDE WELVAART

The 'brede welvaart' is a measuring tool for the wellbeing of people on a physical, social, and economic level (HZ Kenniscentrum Zeeuwse Samenleving, 2021). Each category consists of multiple elements that together give an insight into the aspects that should be improved in the area. To assess the different elements of the catalogue,

a variation on the 'brede welvaart' wheel has been used to assess the 'brede welvaart' in Zeeland. Elements have been adopted in the 'brede welvaart' wheel of the healthy Delta. Those elements are categorised into 4 elements; work & income, accessibility, environment, and wellbeing (see Figure on the right page).

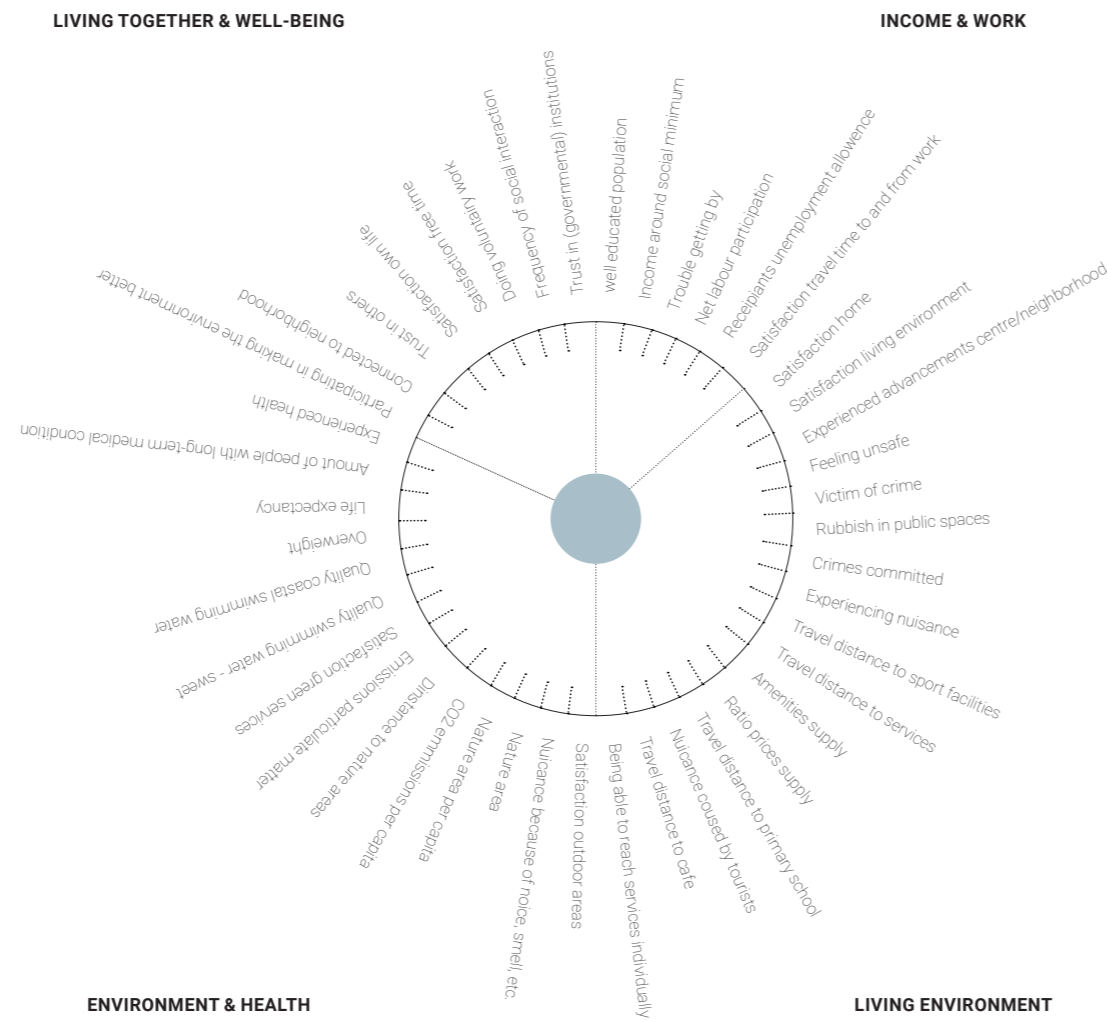


Figure 6.15 - Brede welvaart wheel (HZ Kenniscentrum Zeeuwse Samenleving, 2021)

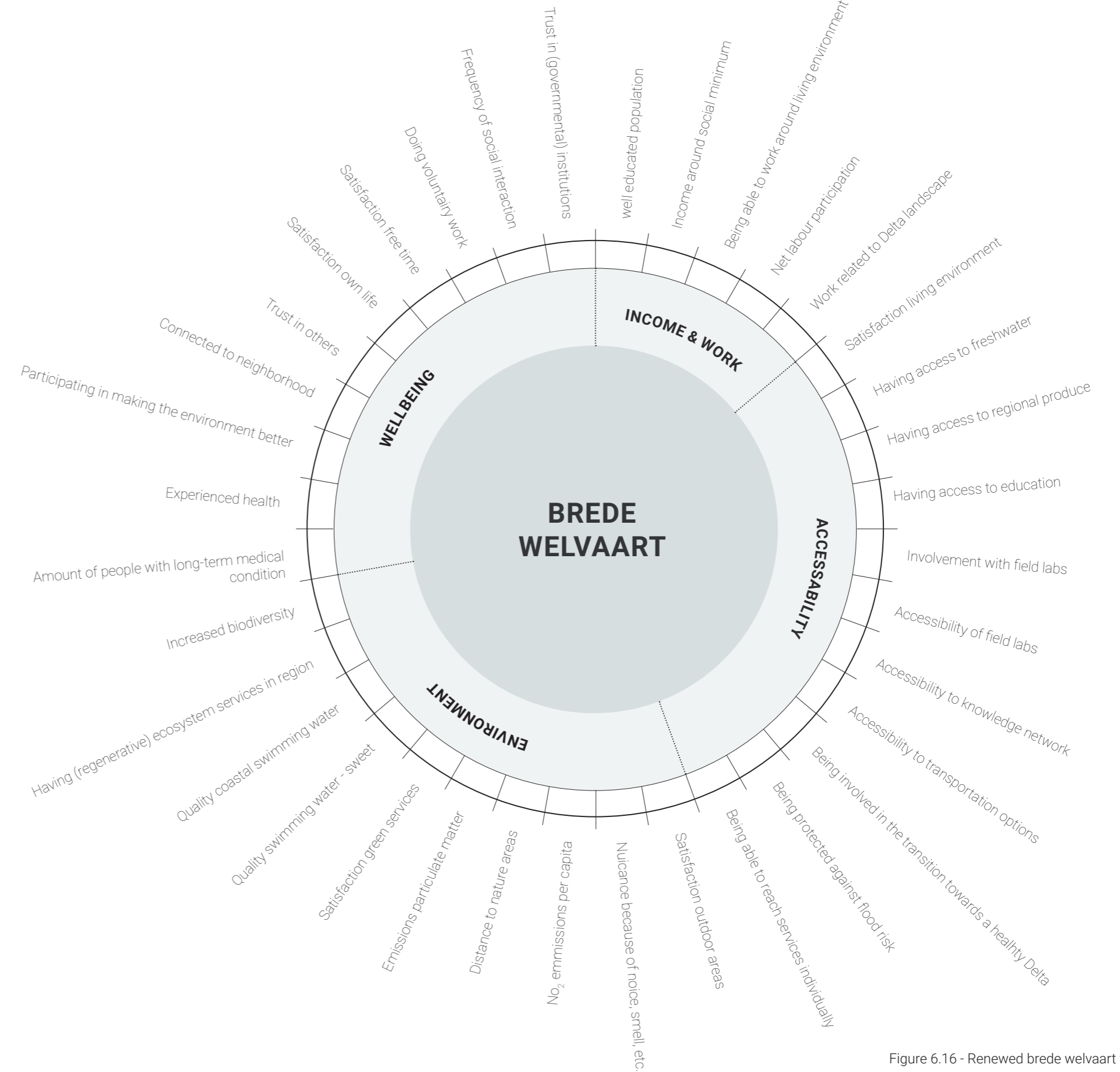


Figure 6.16 - Renewed brede welvaart wheel

6.2 DESIGN CATALOGUE

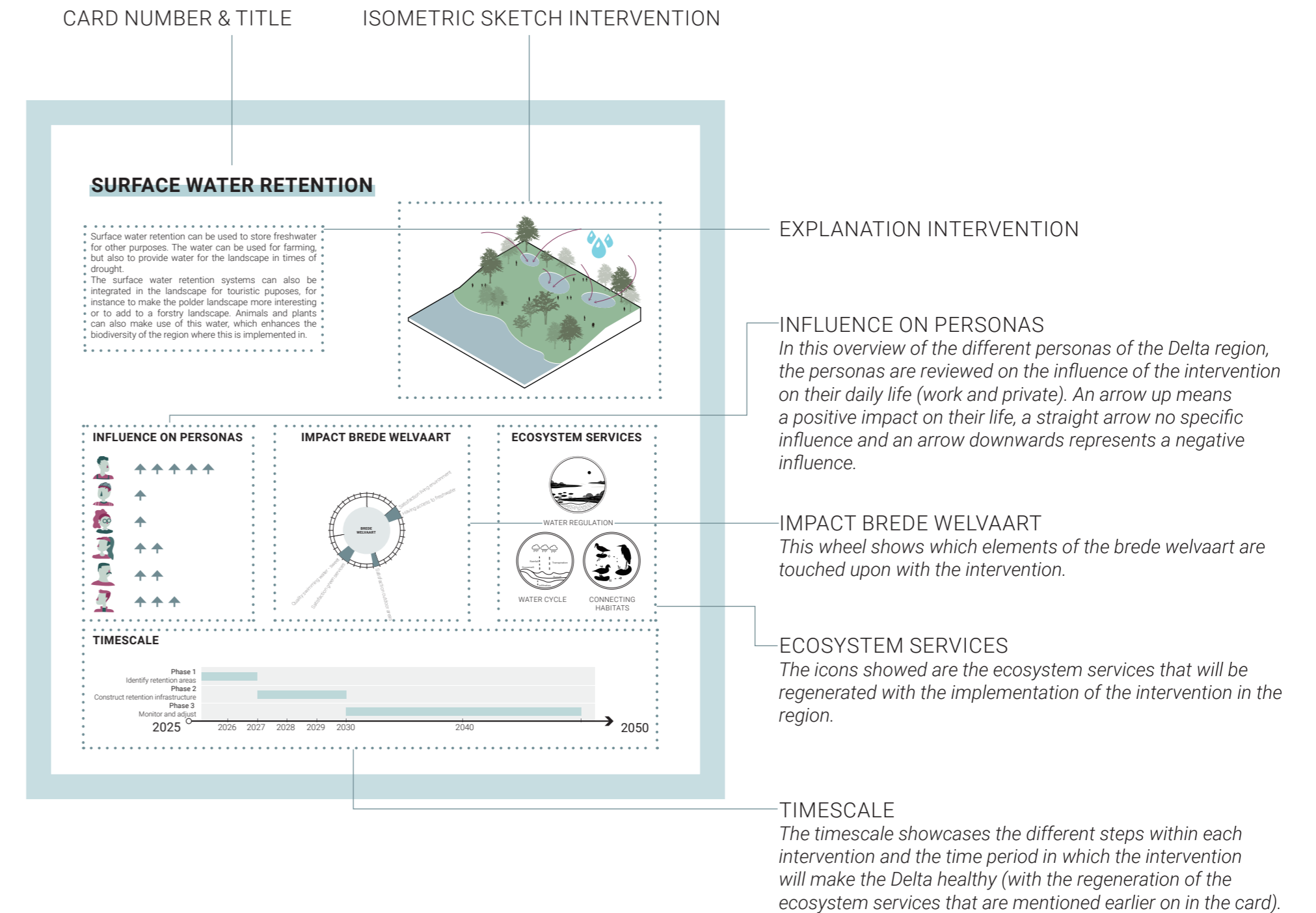
EXPLANATION CARDS

The catalogue is made up of different intervention cards within 3 categories: water, soil and communities. Together they provide an overview of proposals to make the Delta healthy.

Each card is put together with the same elements (see the right page). First, each element is introduced and explained through an isometric sketch of the intervention and text. The borders

showcase the category of each card; the blue border is for water, green for soil, and purple for communities. The impact of the different elements per category on the communities within the healthy Delta are visualised through the impact on stakeholders, the 'brede welvaart' wheel, the ecosystem services, and the timeline. How those elements are assessed can be seen in the build-up overview on the right page.

CATALOGUE CARD - 'BUILD-UP'



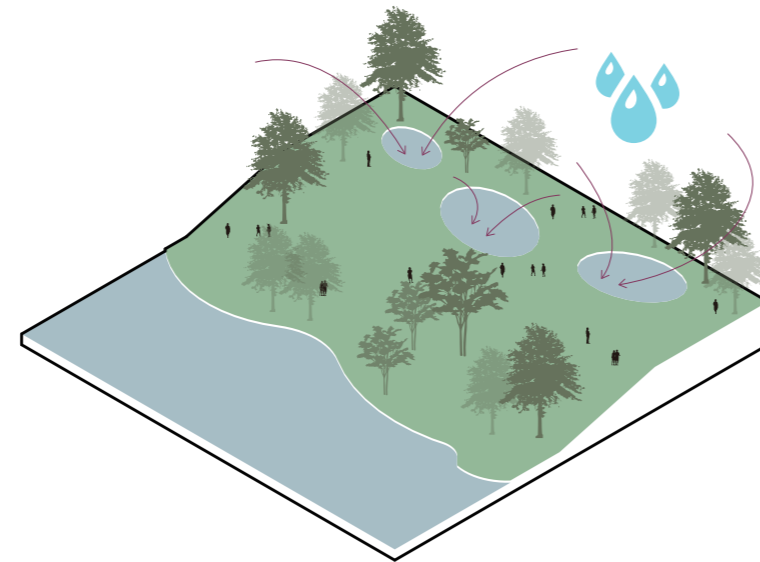
WATER

SOIL

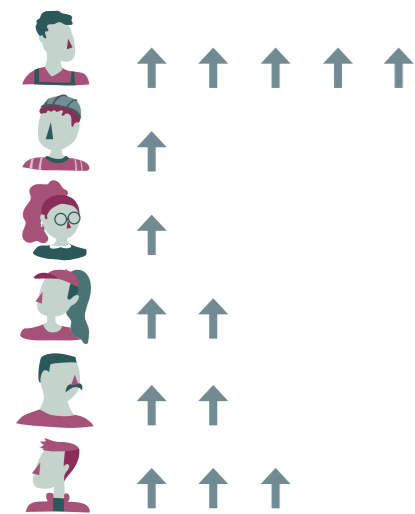
COMMUNITY

W.01 SURFACE WATER RETENTION

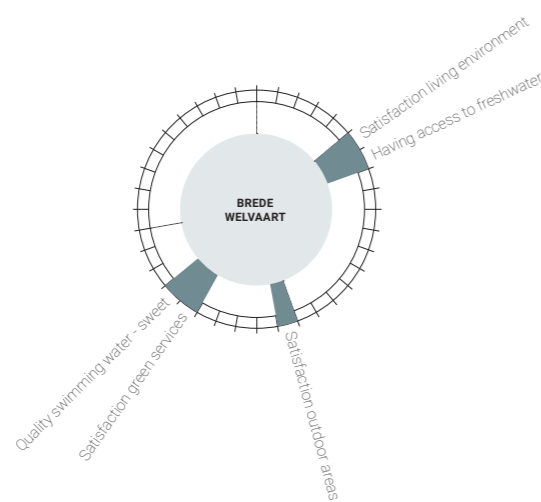
Surface water retention can be used to store freshwater for other purposes. The water can be used for farming, but also to provide water for the landscape in times of drought. The surface water retention systems can also be integrated into the landscape for touristic purposes, for instance, to make the polder landscape more interesting or to add to a forestry landscape. Animals and plants can also make use of this water, which enhances the biodiversity of the region where this is implemented.



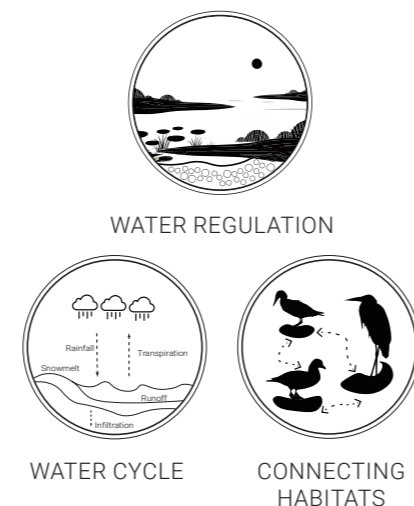
INFLUENCE ON PERSONAS



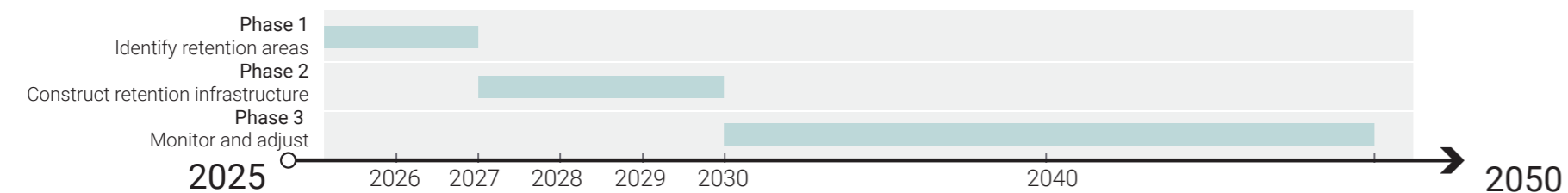
IMPACT BREDE WELVAART



ECOSYSTEM SERVICES

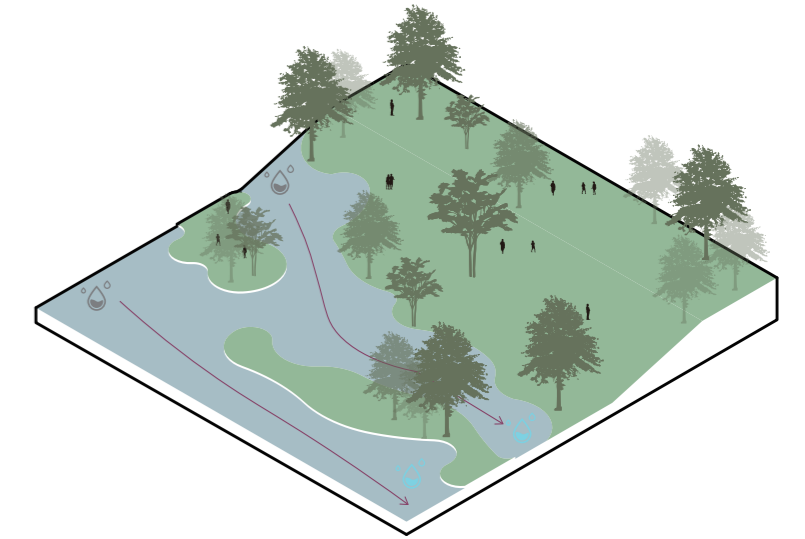


TIMESCALE

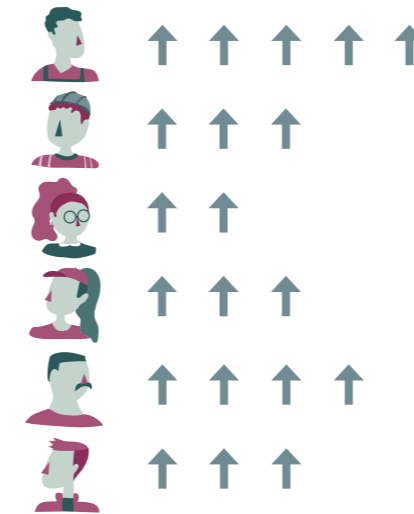


W.02 WETLAND (AS WATER PURIFIER)

Wetlands can be used for many things; as a water purifier or nitrogen sink but also for tourism and for increasing biodiversity. These all make the wetlands an interesting opponent in making the Delta healthy. In this project, a wetland is a term for an area that is flooded or can be filled with (excess) water within its ecosystem. The completion of these wetlands differs from the water system it connects to and the saline levels in the water system. A saltwater wetland for example has an ecosystem with different kinds of plants and animals than a freshwater wetland.



INFLUENCE ON PERSONAS



IMPACT BREDE WELVAART

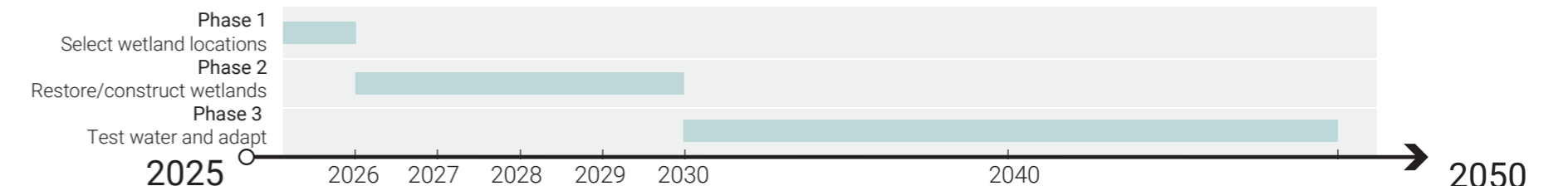


ECOSYSTEM SERVICES



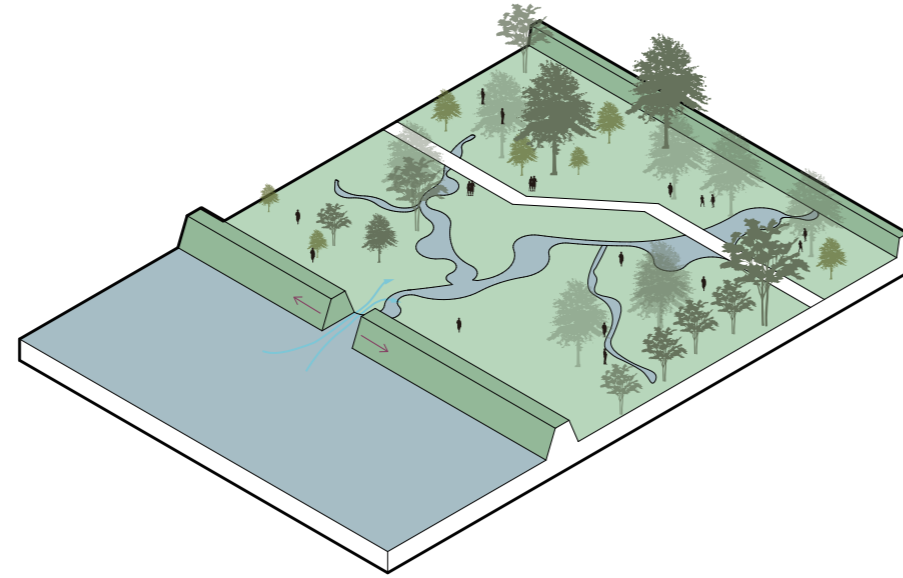
SOIL & WATER PURIFICATION, NUTRIENT & WATER CYCLE, WATER RETENTION, SOIL FORMATION, CONNECTING HABITATS, LOCAL IDENTITY & HERITAGE

TIMESCALE

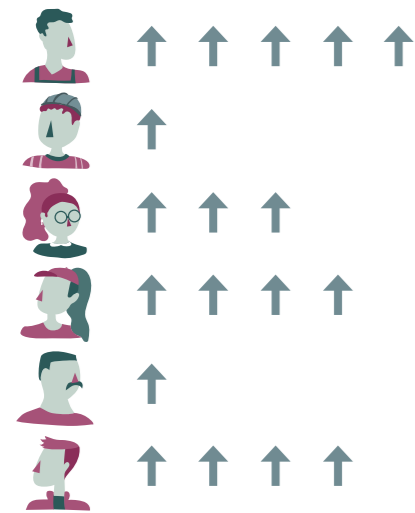


W.03 FLEXIBLE DIKE SYSTEM

The flexible dike system entails a system that exists out of an area surrounded by two dikes. One is linked to the bigger water structure - often a river - and the other is situated behind this dike, in the in-land. This creates a new area that can be referred to as the in-between area. The in-between area can have all sorts of functions, from a nature reserve to farmland. 'Flexible' in the flexible dike system touches upon the fact that the outer dike can be (mechanically) opened up and closed. In case of extreme situations, such as an overflow of water coming from the river, the dike can open up so that water can flow into the in-between area which serves then as a buffer. After a while, the dike can be closed off again. In other situations, the in-between area needs to be moisture again. Then the opening and closing of the dike can help to improve the water levels of the area.



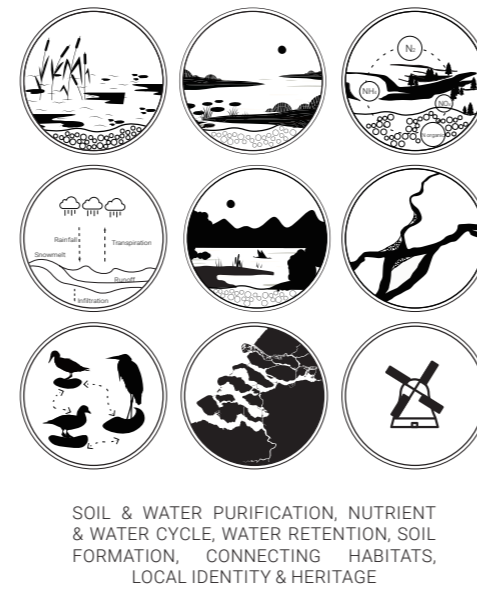
INFLUENCE ON PERSONAS



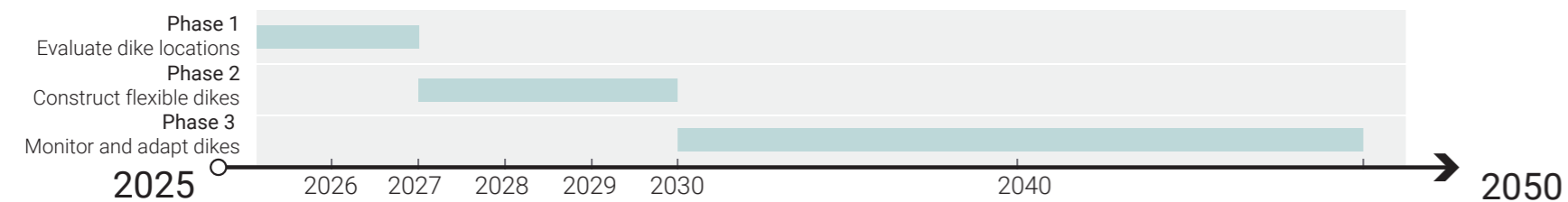
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ECOSYSTEM SERVICES

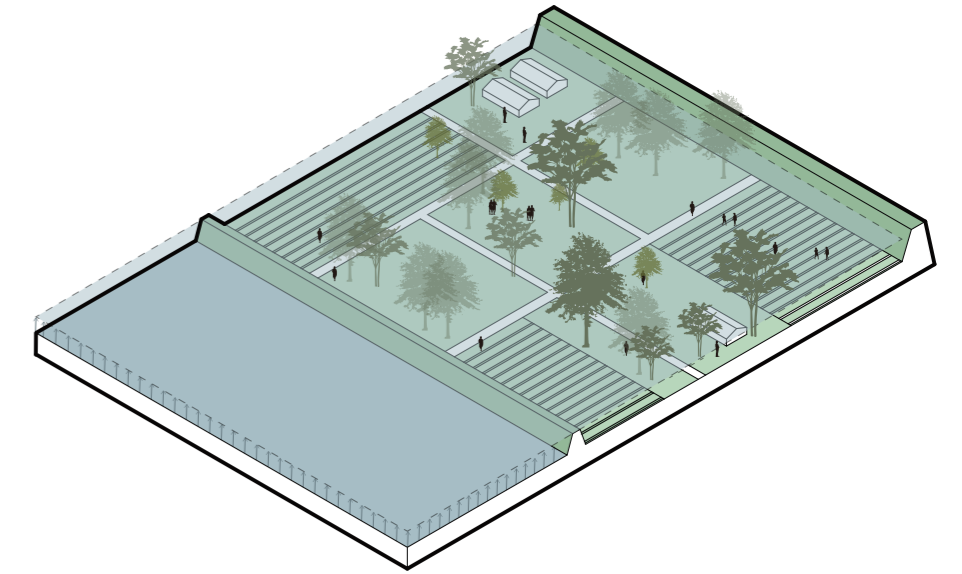


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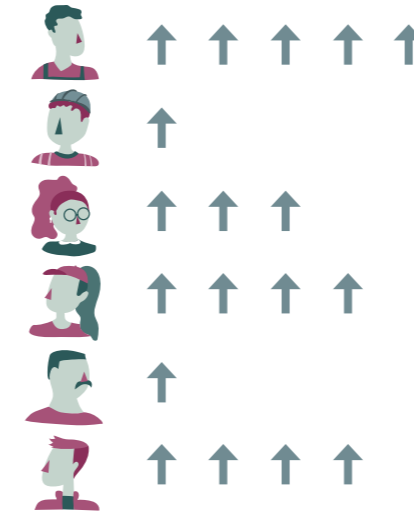


W.04 DOUBLE DIKE SYSTEM

The double dike system is based on the Dutch system of 'summer and winter dikes'. In this system, two dikes function together as a water defence system. The summer dike is the smallest dike of the two and is often situated next to the river. This dike is part of the embankment of the coast and protects the area behind it against the regular flow of water. The winter dike is the largest of the two and protects the hinterland when there is a bigger flow of water in the river. The hinterland can be flooded in this system, but this mostly depends on the (natural) water level of the river. Because this is less regulated than the flexible dike system, it is important to think about the functions that are in between these dikes.



INFLUENCE ON PERSONAS



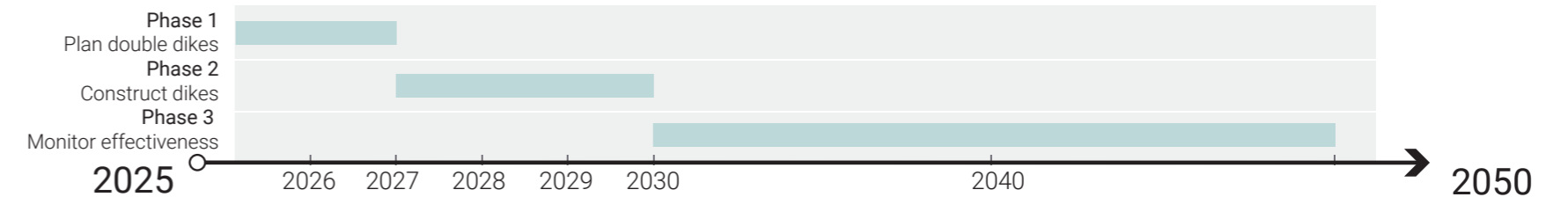
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ECOSYSTEM SERVICES

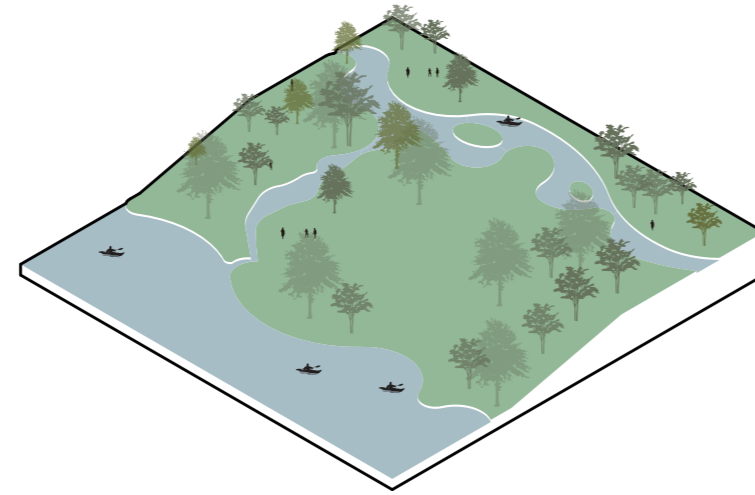


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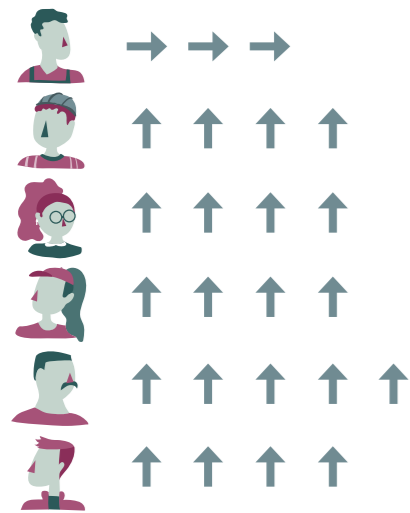


W.05 NATURAL BORDERS

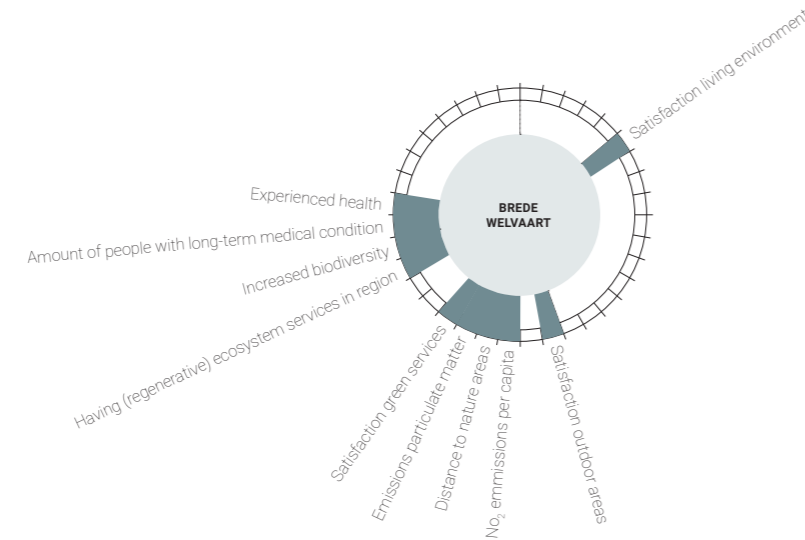
Naturefying river edges is a way to create space in-land for periods of the high tide of the river to store access water for a certain period. This can be done by broadening the river quay, by making an extra river canal, or by connecting the river to certain wetlands, which can be shut off. Room for the river projects are vital to protect the mainland in times of high tide. However, it does not always store water as the other tiles do. Therefore in times of drought, the room for the river project is not always as useful to provide the surrounding areas with water.



INFLUENCE ON PERSONAS



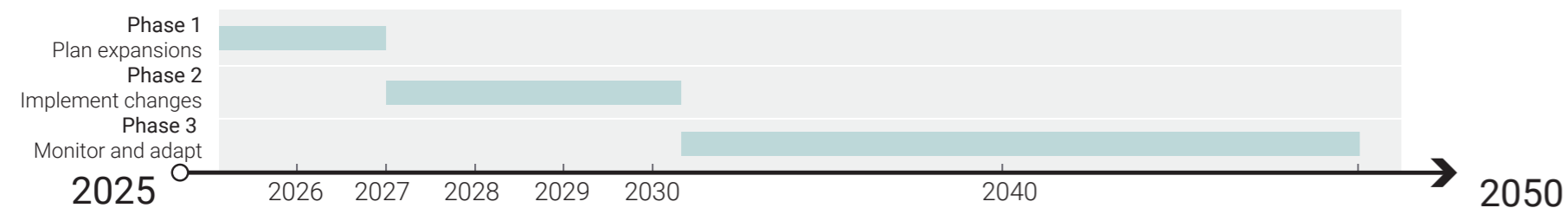
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ECOSYSTEM SERVICES

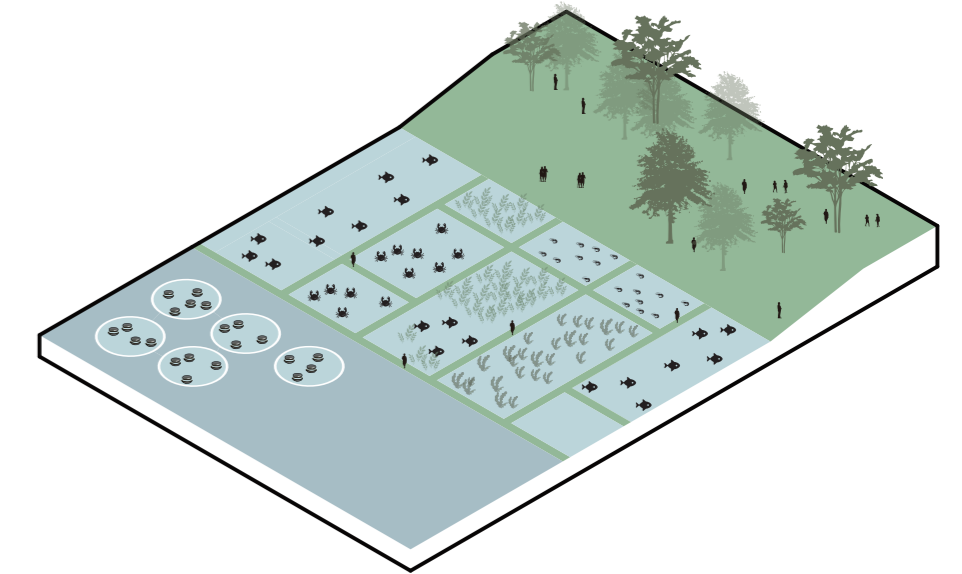


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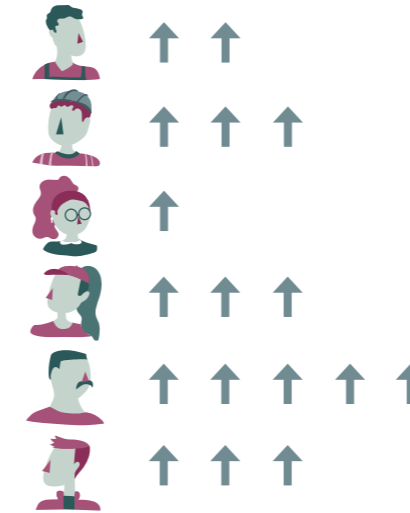


W.06 AQUACULTURE

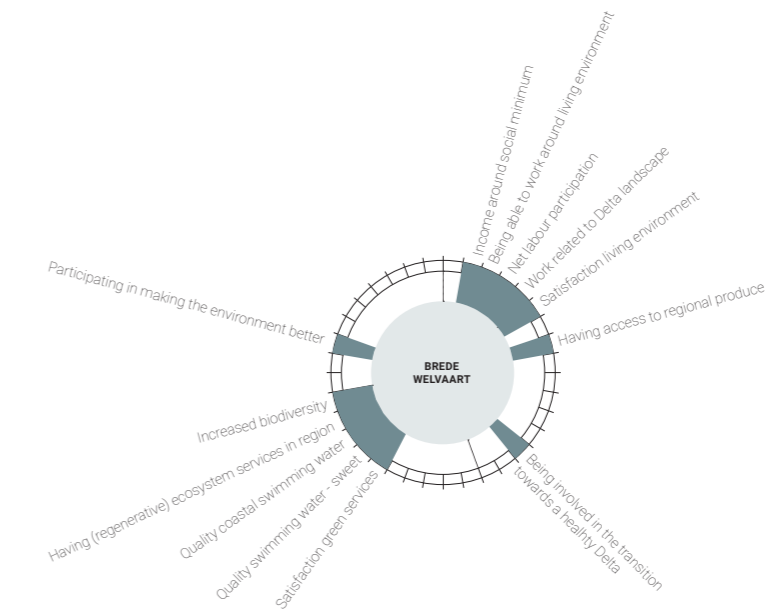
Aquaculture is the farming of (shell)fish in a controlled (and sustainable) way. Aquaculture is already a big sector in Zeeland for its mussels, shrimp, and oysters mainly for economic purposes. Shellfish however contribute a lot to making the river clean again. Oysters can extract nitrogen out of the water and release sediments, which can then be used in other areas in Zeeland for farming purposes or the wetlands. Next to this, the fishing industry could be expanded, which contribute to both the economy and the identity of Zeeland.



INFLUENCE ON PERSONAS



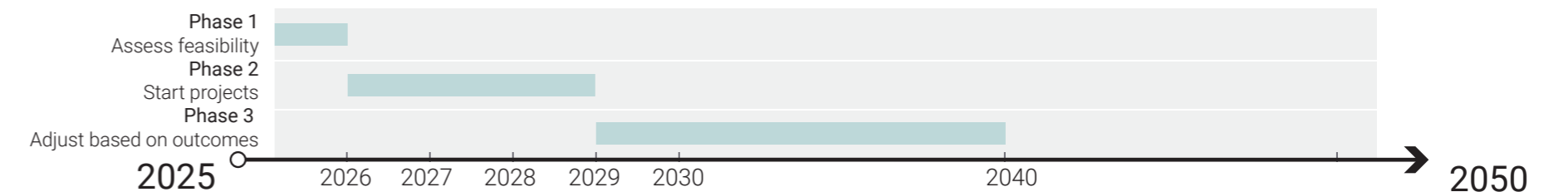
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ECOSYSTEM SERVICES

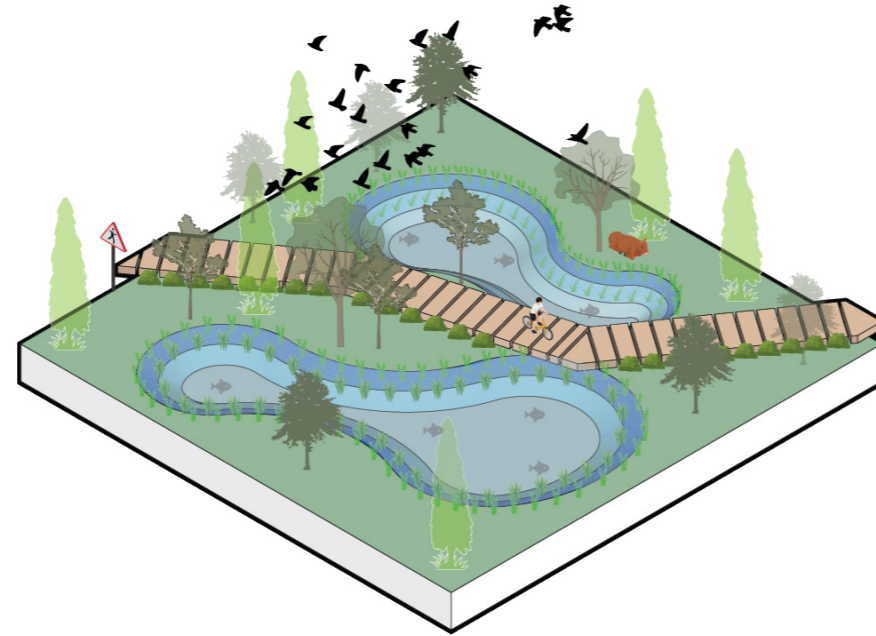


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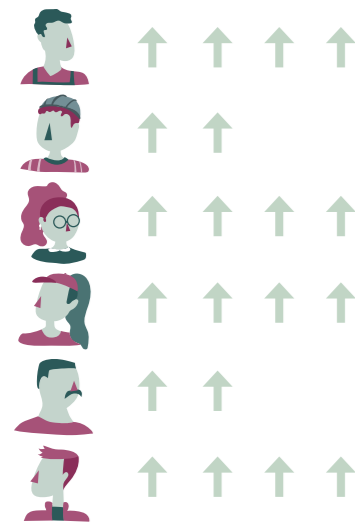


S.01 SPONGE PARCS

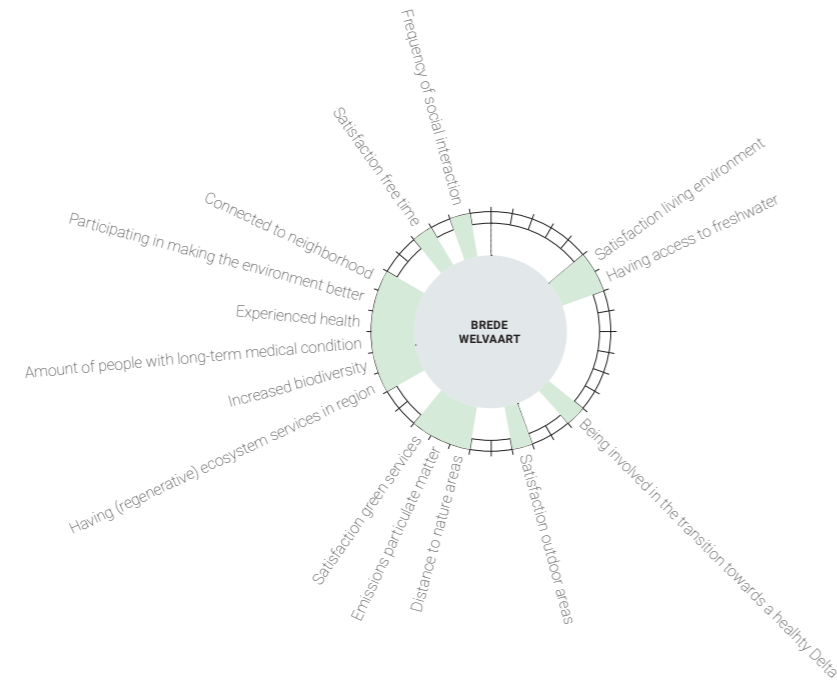
There is a need for areas that collect water, and sponge parks can be the solution for this. A sponge park is an area that contains natural elements that gather water in times of heavy precipitation. In times of drought, these elements still contain (a lot of) water, which can be used to moisture other areas of land that have a water shortage. Sponge parks also be used for tourist purposes, next to their ability to collect water.



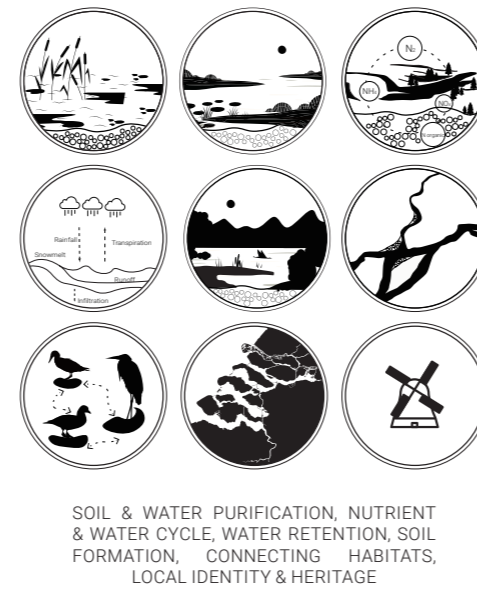
INFLUENCE ON PERSONAS



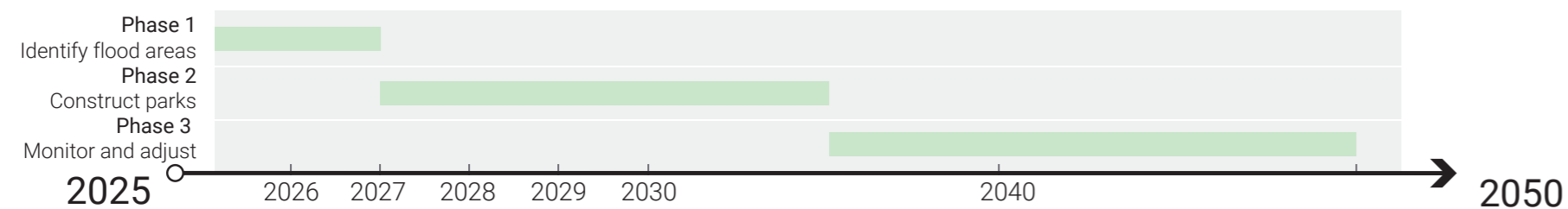
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ECOSYSTEM SERVICES

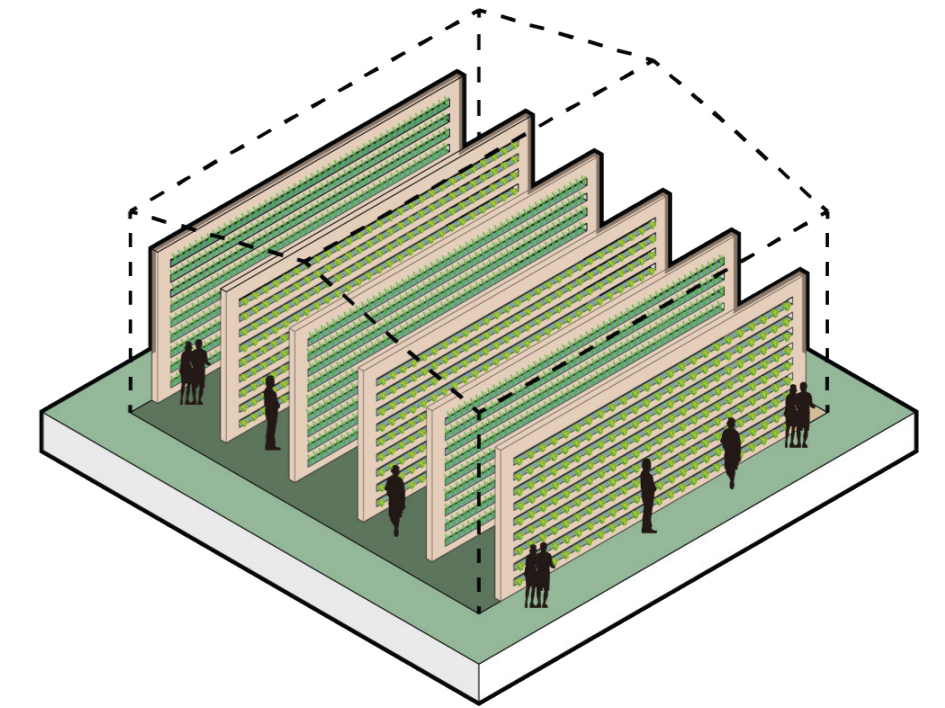


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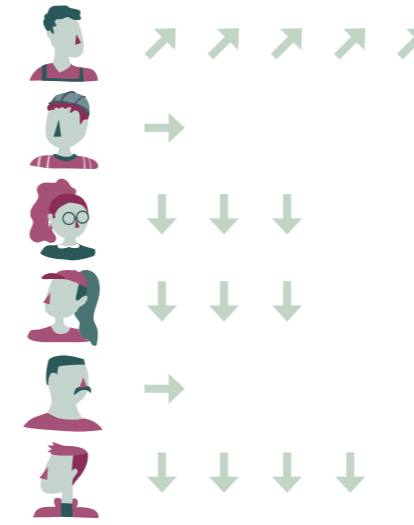


S.02 VERTICLE FARMING

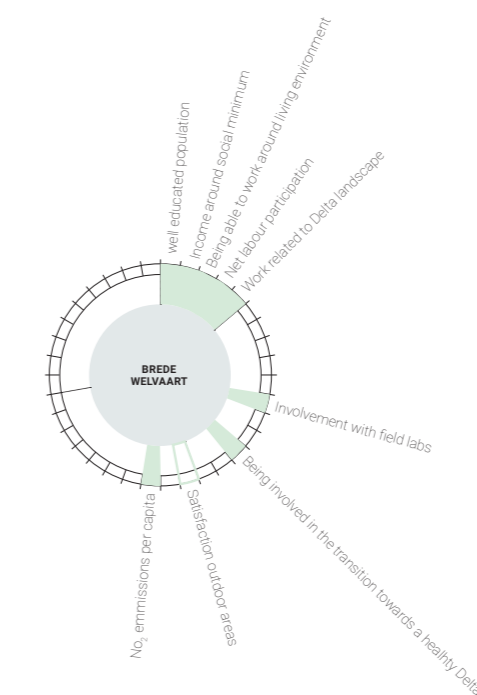
Verticle farming is a new way of greenhouse farming, where greenhouses are being used with multiple layers. Therefore space is used more efficiently because on the same surface, more plants can be reaped. Verticle farming poses however some difficulties. People who are used to the traditional Dutch farming landscape may not like the newly proposed greenhouse-towers that are used in the verticle farming industry. Next to that, the new infrastructure consumes a lot of energy. The greenhouses offer opportunities in saline areas. Because of salinisation, some farming areas cannot be used to cultivate the same produce anymore. Verticle farming can realise that the same produce will be cultivated with fewer areas to cultivate on.



INFLUENCE ON PERSONAS



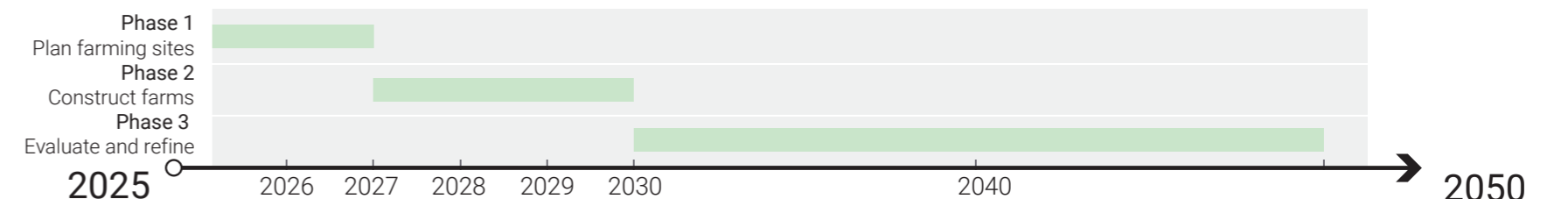
IMPACT BREDE WELVAART



ECOSYSTEM SERVICES

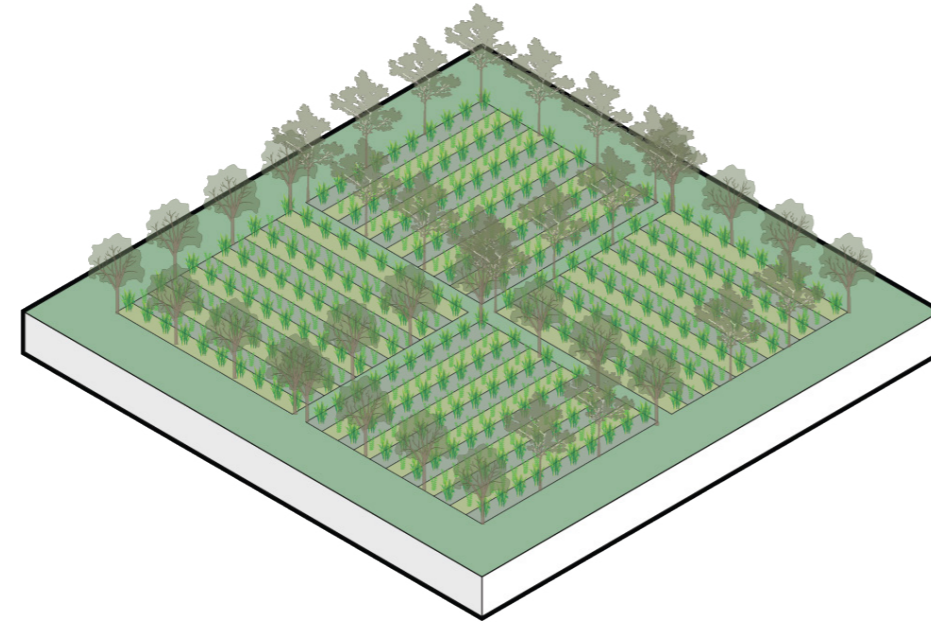


TIMESCALE

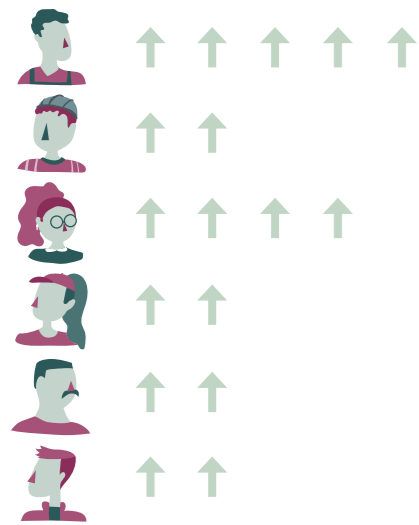


S.05 AGROFORESTRY

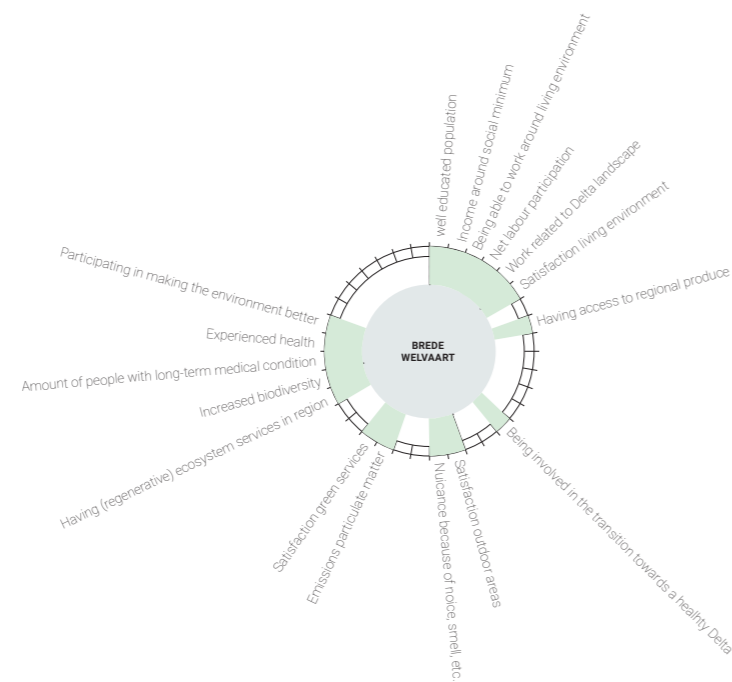
Agroforestry is a type of farming/land use management system where trees are being grown in or around the farming area. This creates a more profitable, healthy, and productive land use. The trees that are grown in the agroforestry system can also be used for the cultivation of wood for other practices. Because of the introduction of more trees in the often plain agricultural fields, biodiversity will also grow in the area. However, due to the salinisation of most areas in this project, only trees that can withstand this salinisation of the soil can be planted in the area.



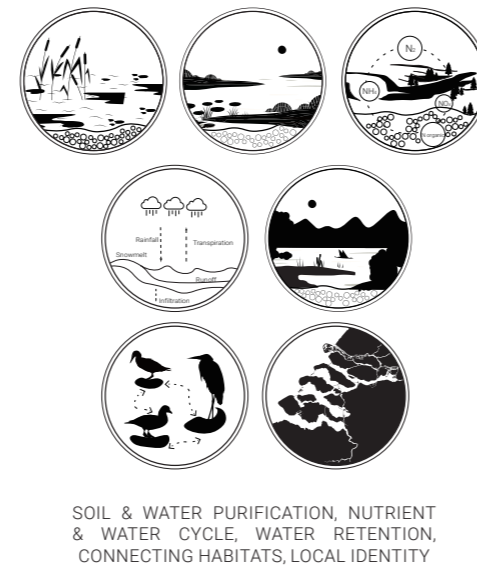
INFLUENCE ON PERSONAS



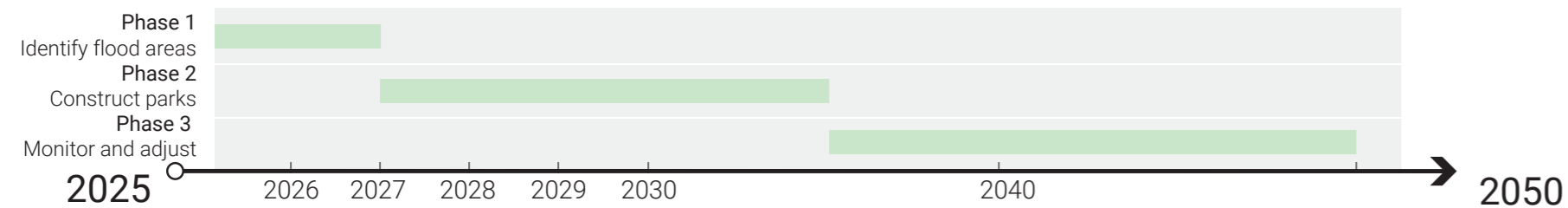
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ECOSYSTEM SERVICES

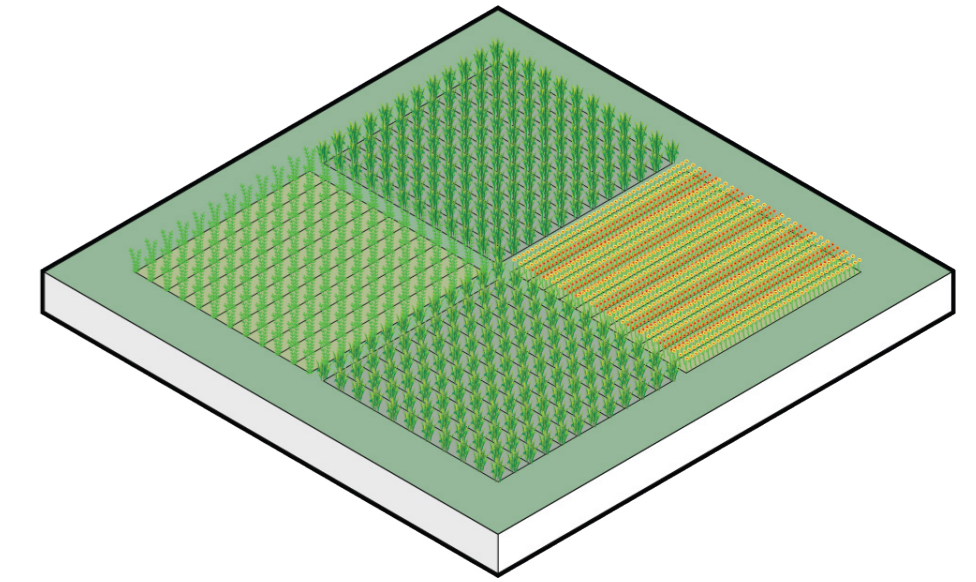


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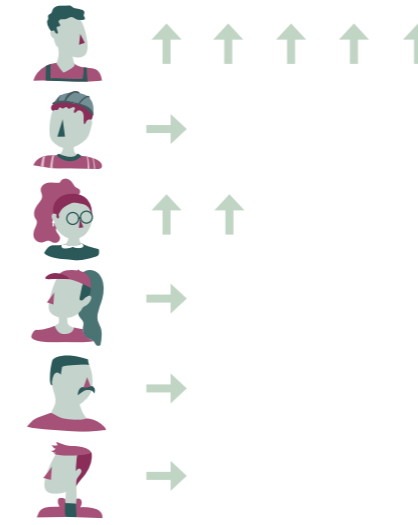


S.04 CROP ROTATION

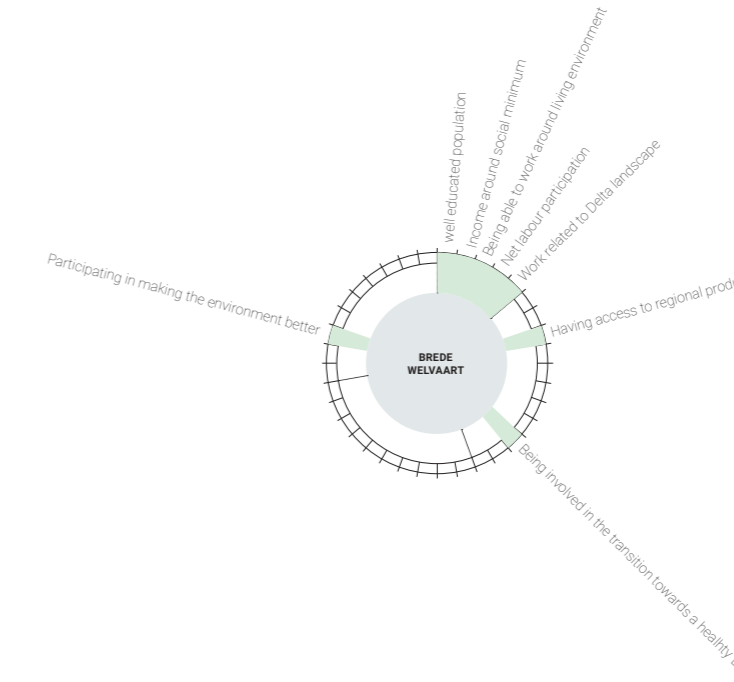
Crop rotation is an agricultural practice where the planting of different types of crops is sequentially rotated to improve the health and the quality of the soil of the agricultural area (European Commission, 2023). This practice is already very old, however, due to the high demand for certain produce, the variety of the crops can be decreased. By re-introducing crop rotation, farmers can work together to cultivate the same amount of produce that is demanded today, but in a more sustainable manner.



INFLUENCE ON PERSONAS



IMPACT BREDE WELVAART



ECOSYSTEM SERVICES

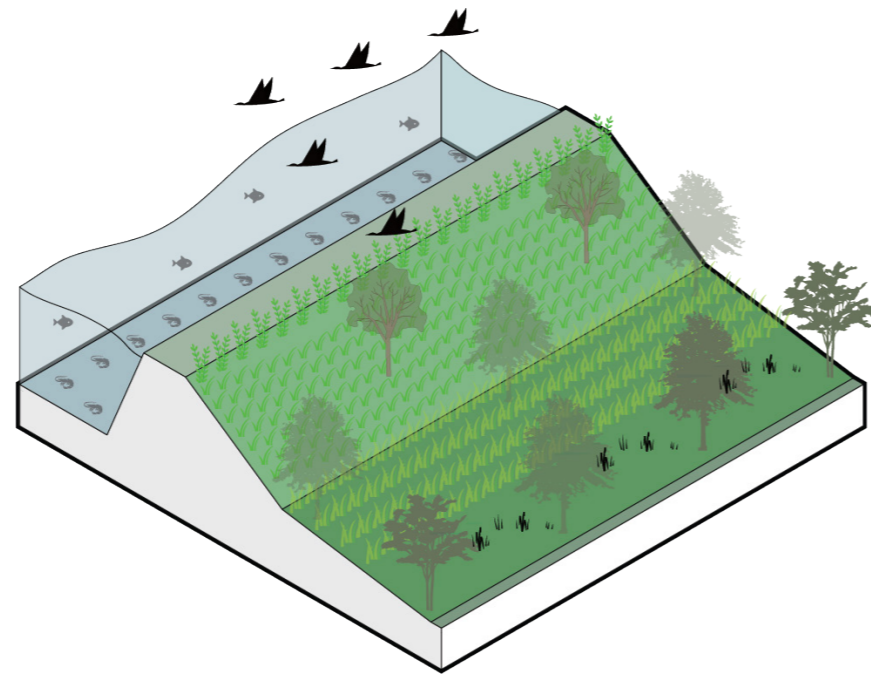


TIMESCALE

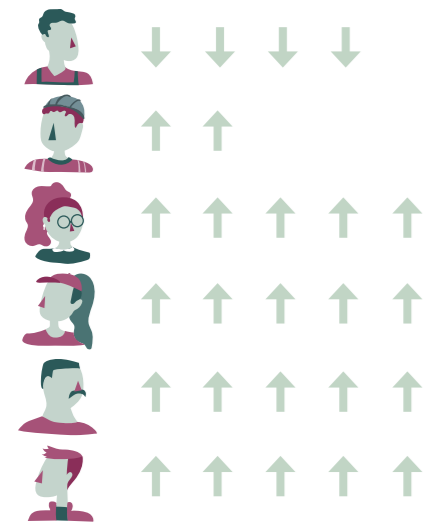


S.05 REWILDING OF POLDER LANDSCAPE

Naturefying the current landscape is needed to bring back biodiversity to certain systems and to make those systems healthy again. This is referred to as the 'rewilding of the polder landscape'. The common polder landscape consists often of grass, a few species of flowers, and some ditches. To enrich the soil, water, and air, there needs to be a better variety of species available in the area to ensure the healthiness of those systems. Certain polder areas can be pointed out to rewild to bring back biodiverse systems. This can also be used as a touristic attraction because nature areas can be extended in Zeeland.



INFLUENCE ON PERSONAS



IMPACT BREDE WELVAART

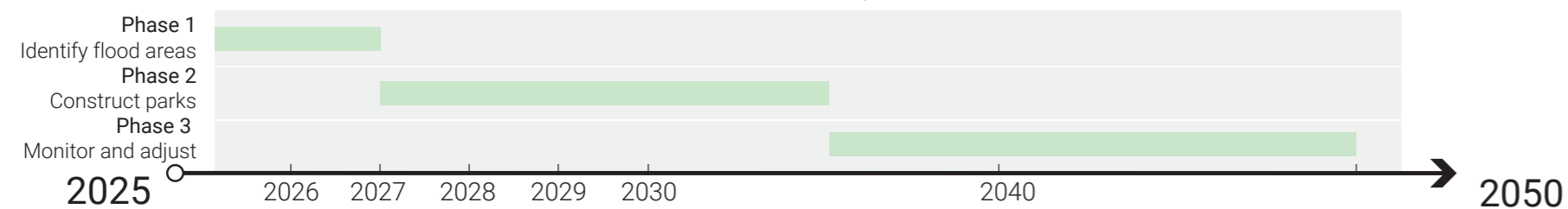


ECOSYSTEM SERVICES



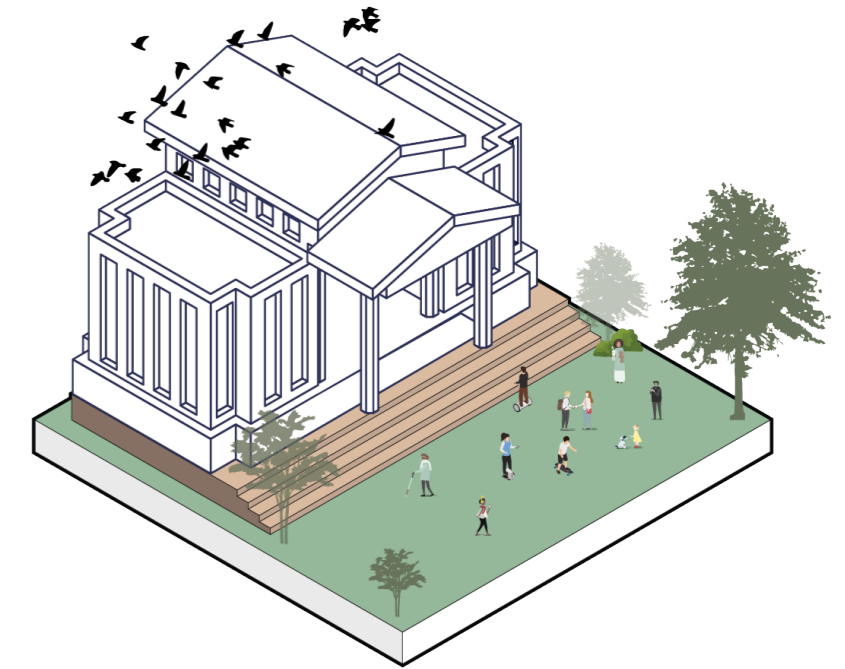
SOIL & WATER PURIFICATION, NUTRIENT & WATER CYCLE, WATER RETENTION, SOIL FORMATION, CONNECTING HABITATS, LOCAL IDENTITY & HERITAGE

TIMESCALE

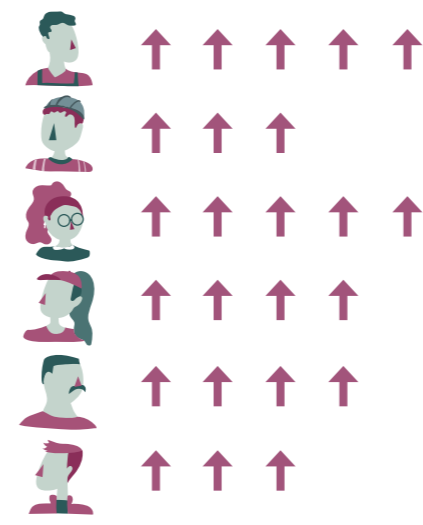


C.01 KNOWLEDGE CENTRE

A knowledge centre is a public place where people can go to learn about new practices and share knowledge about their ways of working towards a healthy Delta. A knowledge centre can be a school but also provides room for other people to visit the place and share their advice on certain aspects of the transition. The knowledge centres that are realised in Zeeland that strive towards a healthy Delta must be connected so that no information gets lost and that people can learn from each other. Next to this, it is important that all knowledge centres also have an online platform so that people who are troubled by visiting a centre at a certain time still can share their knowledge or learn from others.



INFLUENCE ON PERSONAS



IMPACT BREDE WELVAART

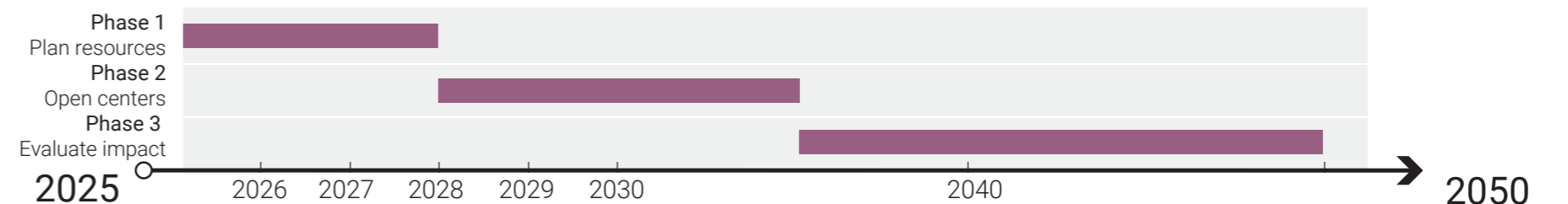


ECOSYSTEM SERVICES



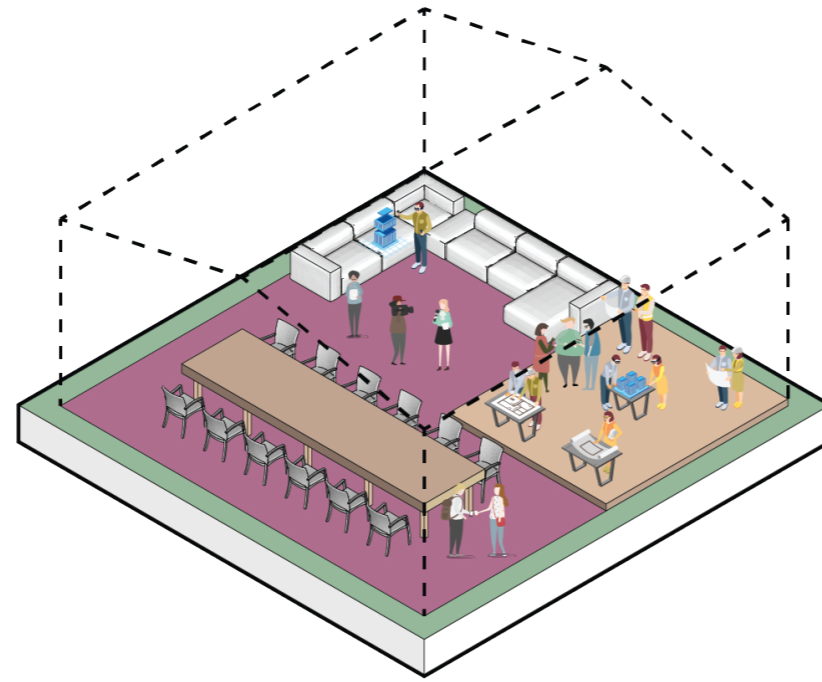
SOIL & WATER PURIFICATION, NUTRIENT & WATER CYCLE, WATER RETENTION, SOIL FORMATION, CONNECTING HABITATS, LOCAL IDENTITY & HERITAGE

TIMESCALE

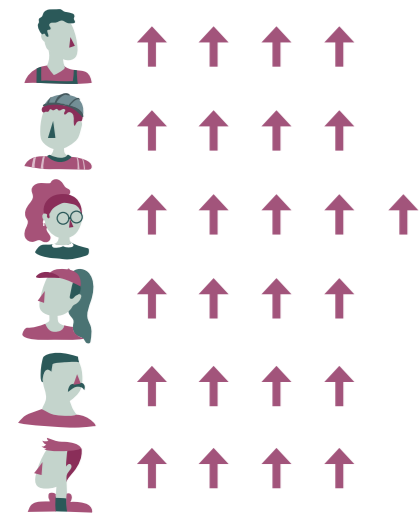


C.02 MEETING CENTRE

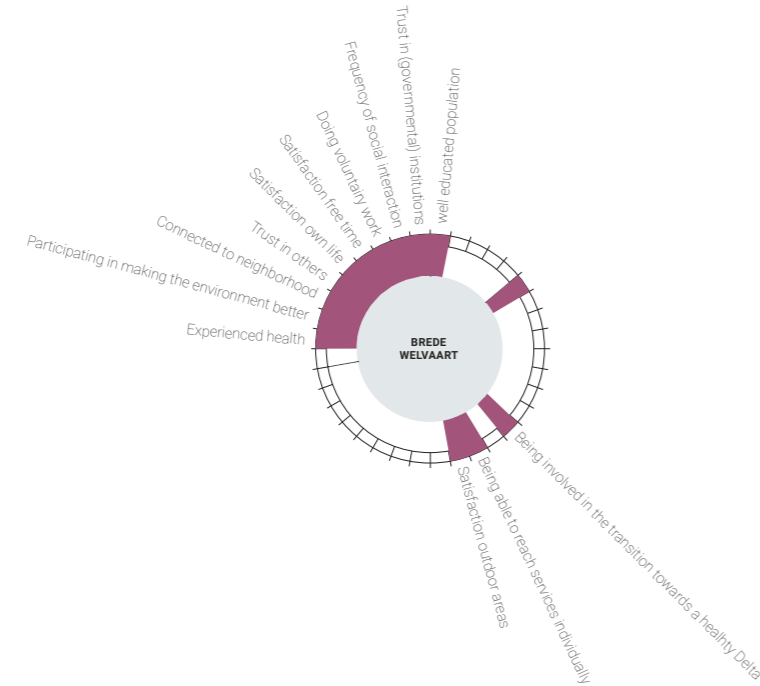
A meeting centre is a place where people can gather for social, educational, or political purposes. This place is accessible to the public, therefore everyone can make use of these centres. For a transformation towards a healthy Delta, the public needs to be on the same page as the decision-makers. The meeting centres can be used to strengthen the relationship between both parties. The centre can be used for casual meetings, but also workshops, markets, and input events. The meeting centres should be the heart of the participation of the communities in the healthy Delta project.



INFLUENCE ON PERSONAS



IMPACT BREDE WELVAART

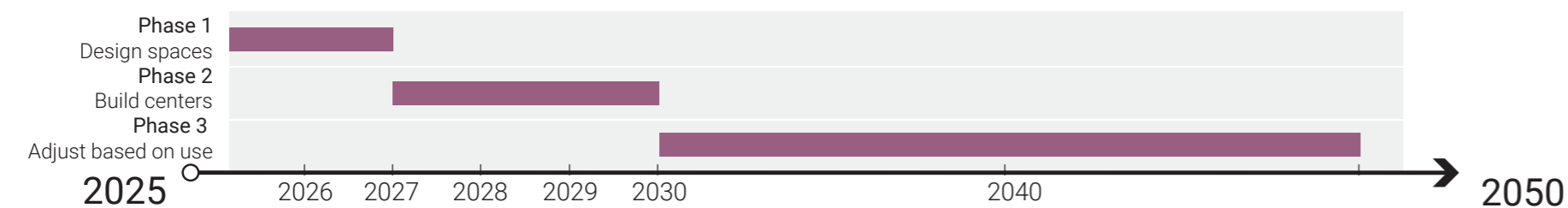


ECOSYSTEM SERVICES



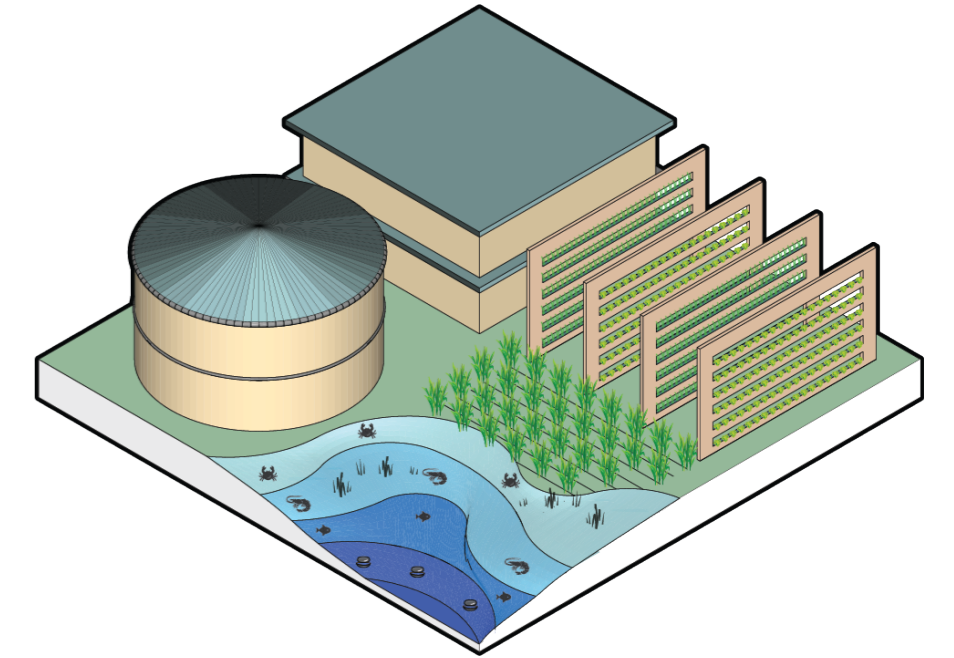
LOCAL IDENTITY & HERITAGE

TIMESCALE

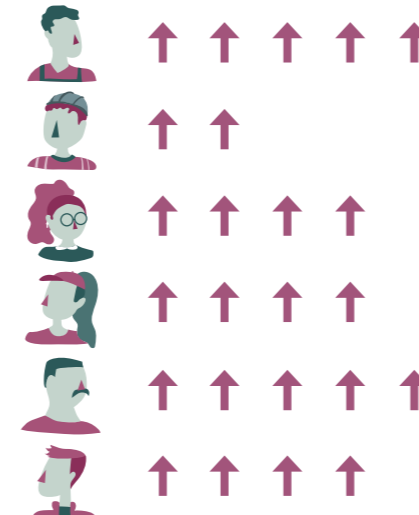


C.03 FIELD LABS

Field labs are centres where new technologies are being tested. They are (small) pilot projects that are used to test if a certain invention can be implemented on a bigger scale in the surrounding area. To create awareness of the innovations, people can visit these field labs to gather knowledge to implement themselves or to get acquainted with a new technology that could be implemented near their homes. The field labs can connect institutions to farmers, tourists, and inhabitants of/in the area.



INFLUENCE ON PERSONAS



IMPACT BREDE WELVAART

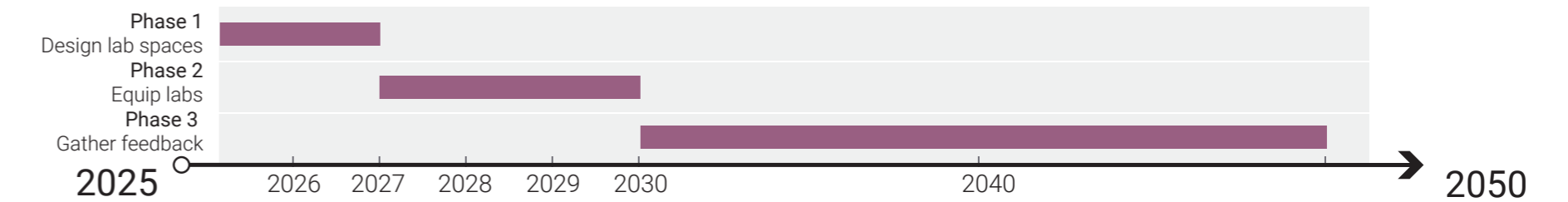


ECOSYSTEM SERVICES



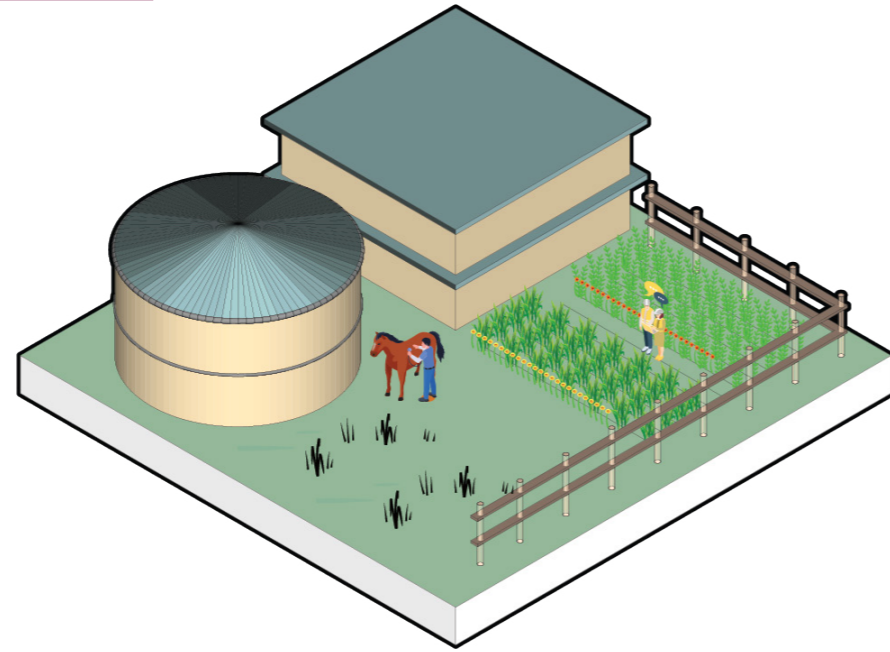
SOIL & WATER PURIFICATION, NUTRIENT & WATER CYCLE, WATER RETENTION, SOIL FORMATION, CONNECTING HABITATS, LOCAL IDENTITY & HERITAGE

TIMESCALE

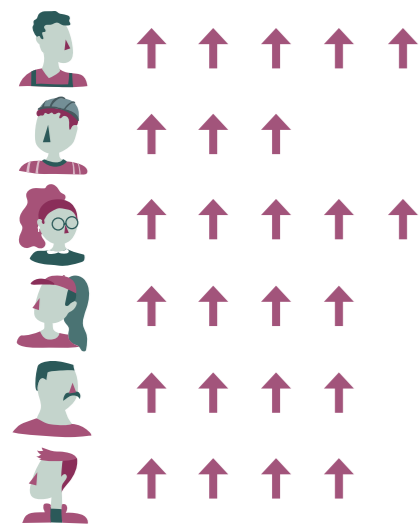


C.04 ENGAGEMENT IN FIELD LABS

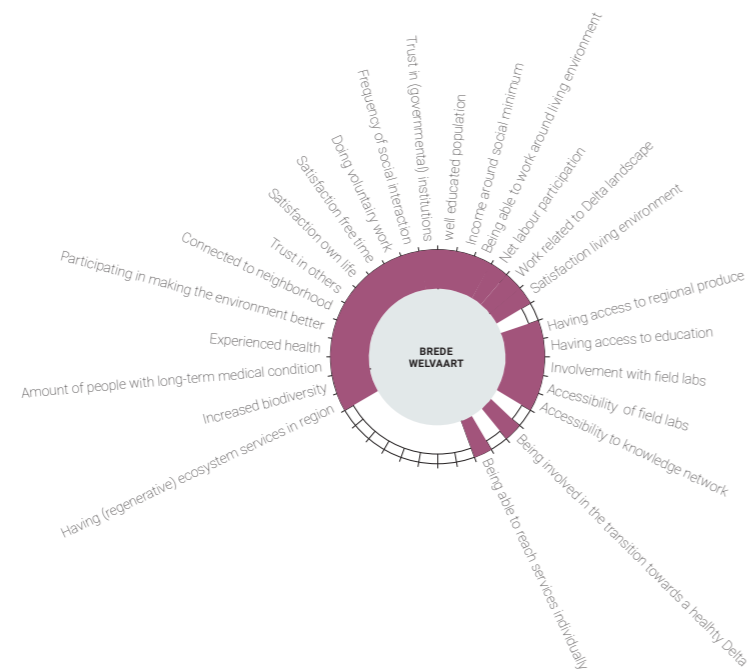
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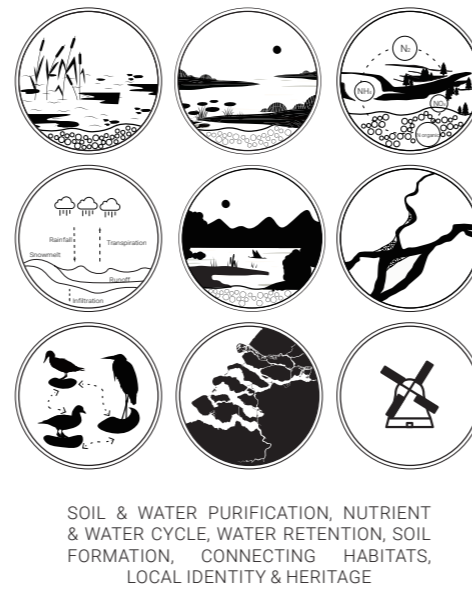
INFLUENCE ON PERSONAS



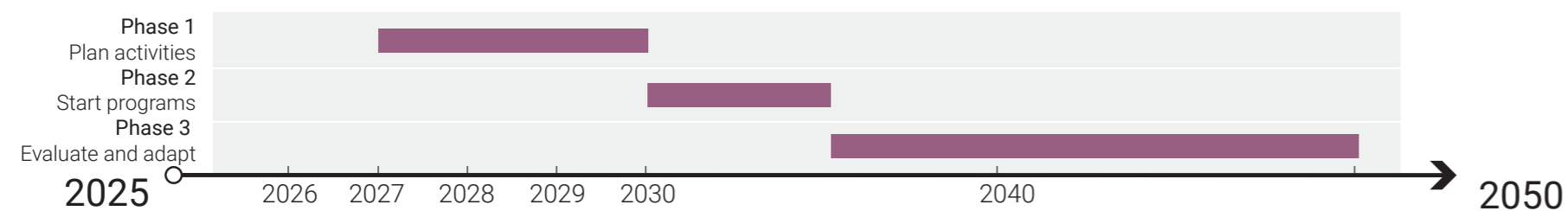
IMPACT BREDE WELVAART



ECOSYSTEM SERVICES

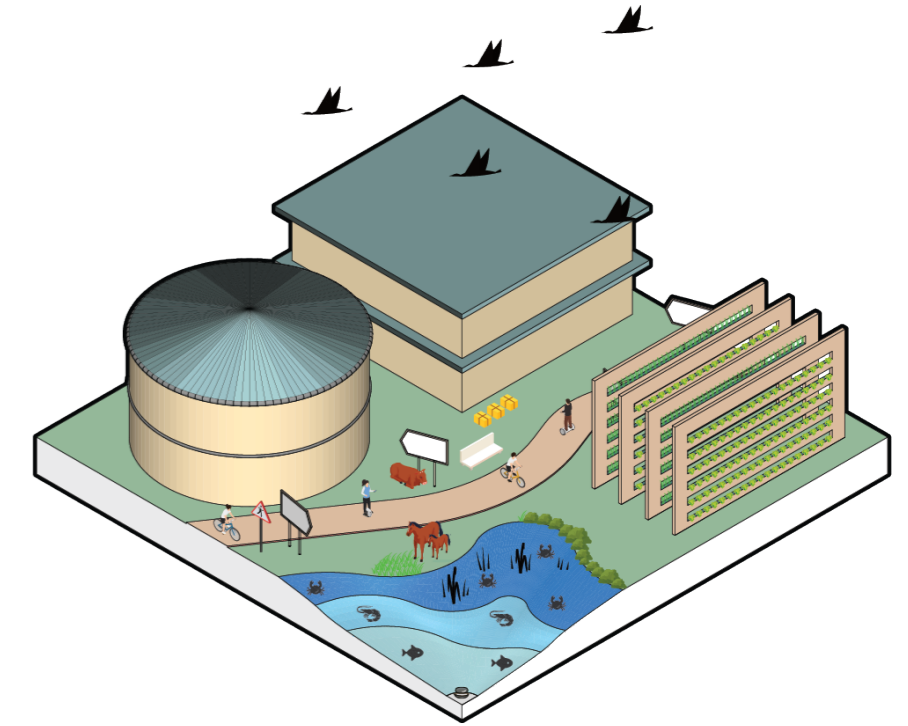


TIMESCALE

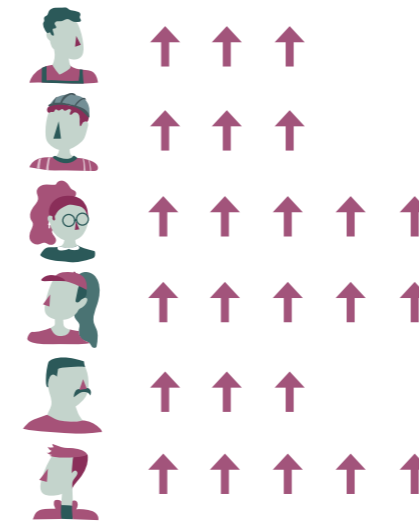


C.05 INTERACTIVE ROUTES

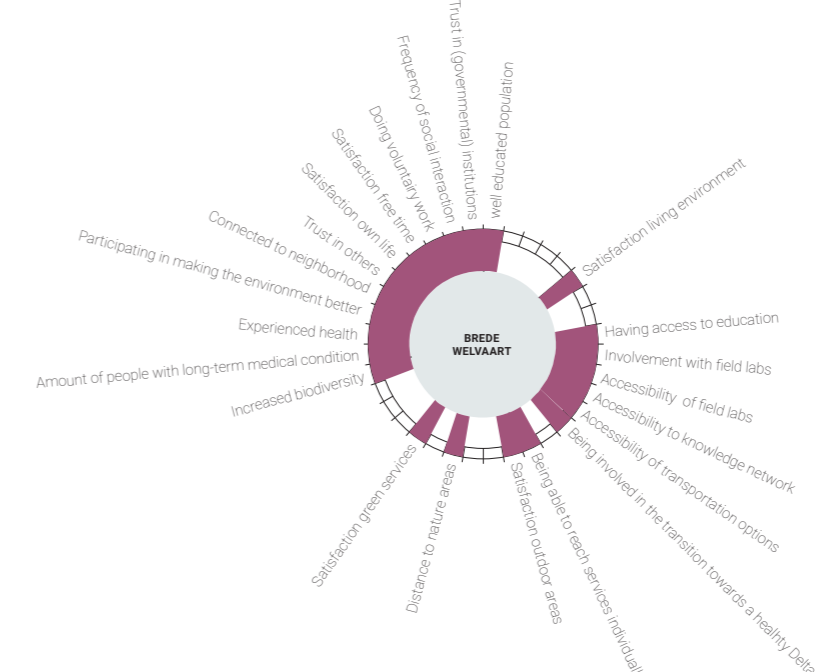
The interactive routes are connected to the field labs and marketplaces. The routes can be followed by bike or foot and engage people to gather knowledge on their environment and the plans for their surroundings that strive towards a healthy Delta. The routes are shared through the online environment that is created by the knowledge centres. Next to these routes, information is shared by boards and an online guide that is connected to the environment, knowledge centres, field labs, and current environment. These routes can be interesting for the general public who lives in the areas because they are getting familiar with the idea of the healthy Delta in their living environment. It can also be a tourist attraction because it gives a new depth to a 'regular' visit to the landscape.



INFLUENCE ON PERSONAS



IMPACT BREDE WELVAART

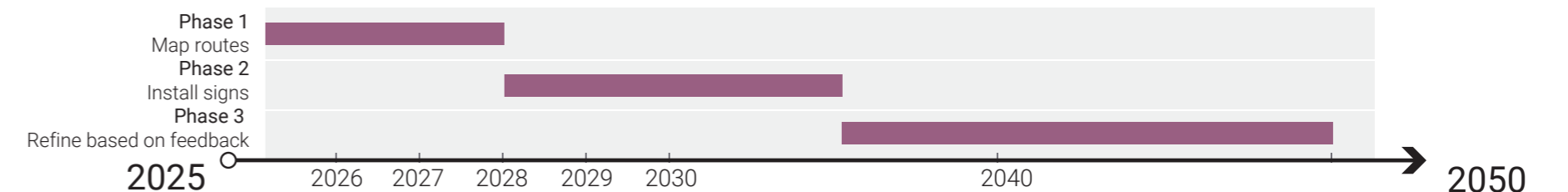


ECOSYSTEM SERVICES



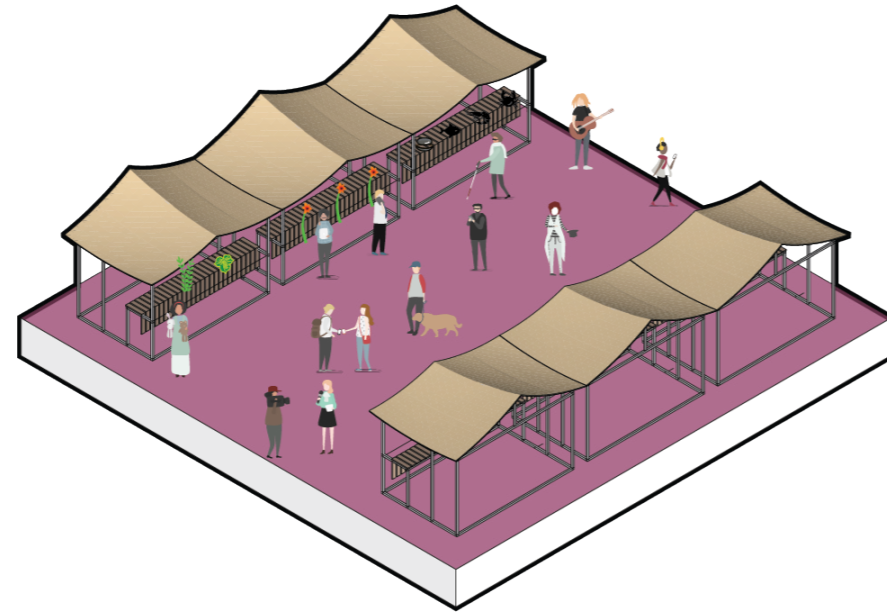
CONNECTING HABITATS, LOCAL IDENTITY & HERITAGE

TIMESCALE

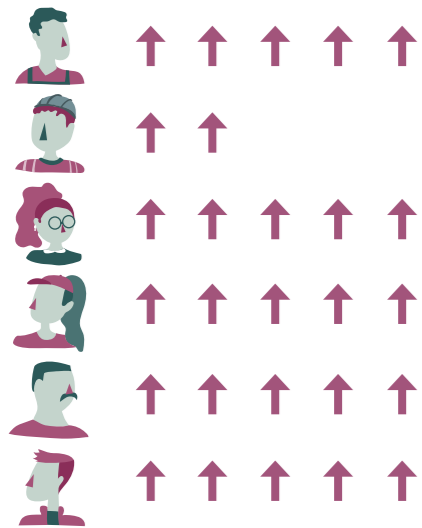


C.06 MARKETPLACES

It is important to embrace the products that are being made and/or cultivated in the area. Marketplaces are a good example of events that bring appreciation to the produce of their environment because stalls and pop-up restaurants can sell their goods to customers from around the area and tourists. To celebrate the 'product of their land', the marketplaces can be a big event that attracts a lot of people from all over the area. Because a lot of people will visit these events, this can also be used to create awareness for the transition towards a healthy Delta, but also to acquire input in participatory matters.



INFLUENCE ON PERSONAS



IMPACT BREDE WELVAART

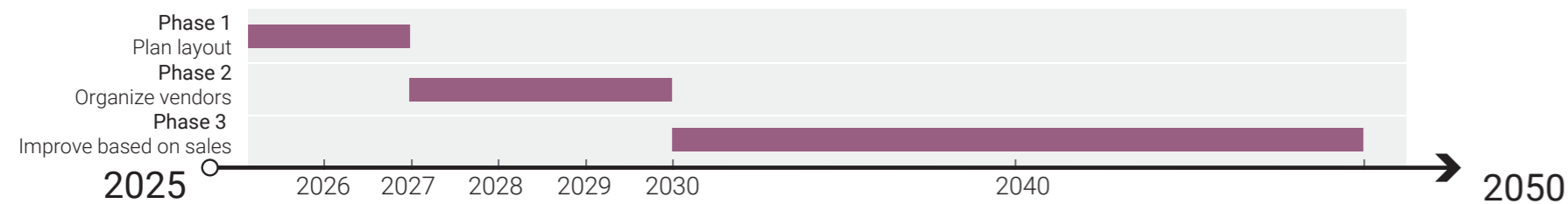


ECOSYSTEM SERVICES



LOCAL IDENTITY & HERITAGE

TIMESCALE



CATALOGUE CARD - OVERVIEW

- W.01 SURFACE WATER RETENTION**
- W.02 WETLAND (AS WATER PURIFIER)**
- W.03 FLEXIBLE DIKE SYSTEM**
- W.04 DOUBLE DIKE SYSTEM**
- W.05 NATURAL BORDERS**
- W.06 AQUACULTURE**
- S.01 SPONGE PARCS**
- S.02 VERTICLE FARMING**
- S.05 AGROFORESTRY**
- S.04 CROP ROTATION**
- S.05 REWILDING OF POLDER LANDSCAPE**
- C.01 KNOWLEDGE CENTRE**
- C.02 MEETING CENTRE**
- C.03 FIELD LABS**
- C.04 ENGAGEMENT IN FIELD LABS**
- C.05 INTERACTIVE ROUTES**
- C.06 MARKETPLACES**

6.2 DESIGN CATALOGUE

PATCHWORK

The catalogue is created to give an overview of interventions that can be implemented in the Delta region to make it healthy again. To give an indication where those interventions could be applied in the Delta, a map with patches is created. The combination of patches -each in the colour according to the theme of the card- showcases a

synergy between interventions to make the Delta healthy. In the key projects, the different catalogue items are used to hand a proposal to the executive party of the healthy Delta project. As the interventions are a recommendation, other interventions could also be used within the Delta region.















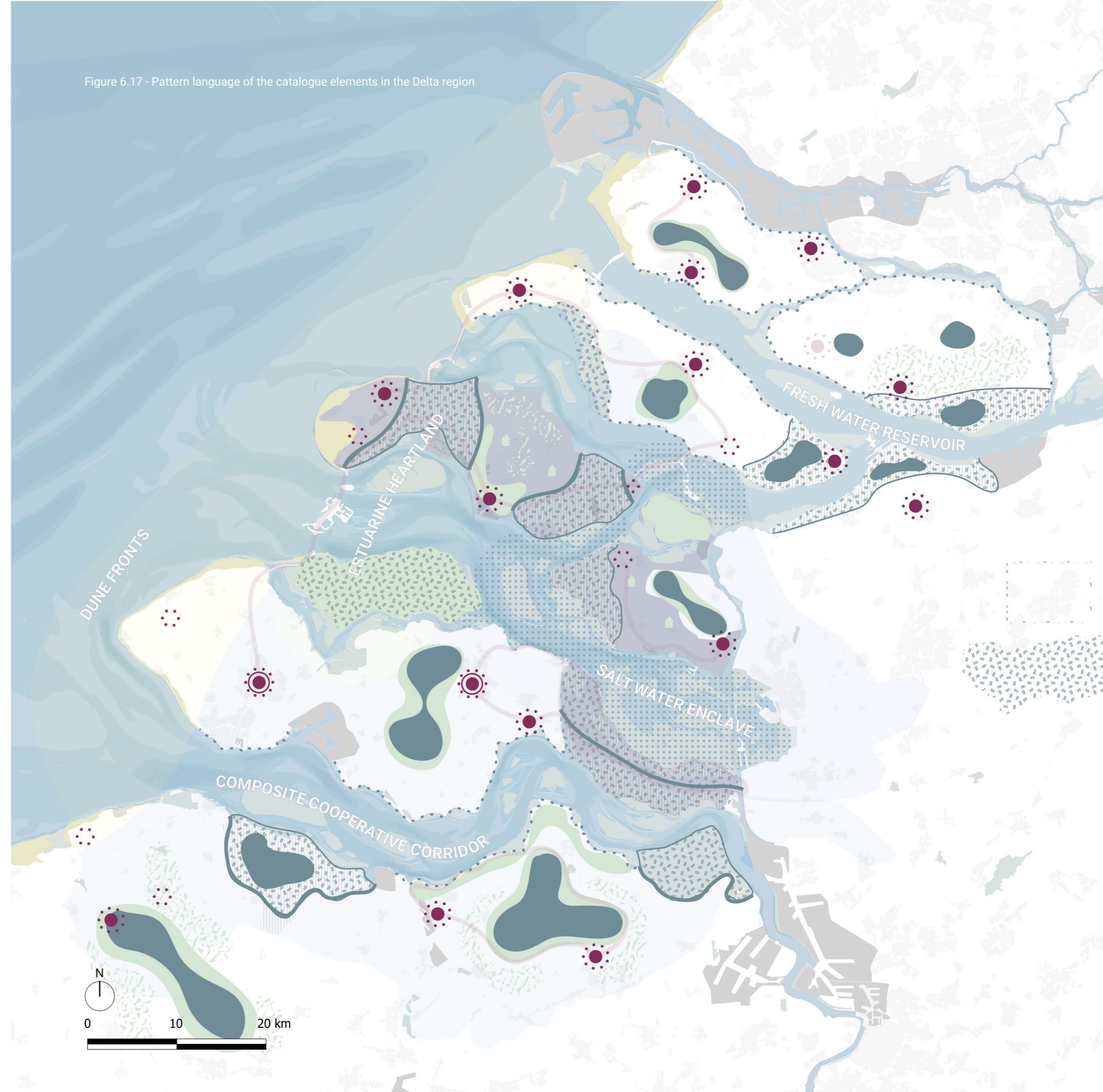
-  Natural border
-  Flexible dike
-  Double dike
-  Aquaculture
-  Wetlands
-  Surface water retention
-  Sponge parc around surface water retention
-  Rewilding of polder area
-  Verticle farming
-  Agroforestry
-  Interactive route
-  Marketplace
-  Knowledge hub
-  Meeting center

Figure 6.17 - Pattern language of the catalogue elements in the Delta region



6.3 COMMUNITY ENGAGEMENT

To enable an inclusive and just transition in systems, it is necessary to support and stimulate communities and industries to adapt. This distribution of resources and adaptation of policies will level and shift the power and interest dynamics in the region.

Currently, the biggest polluters - the energy companies and the ports - of the region are mostly against the transition to an ecosystem-based Delta. It will cost them large investments to transform their systems into sustainable ones. Although most of the companies have the money, they are not motivated to change. These companies need to be persuaded to adapt. This will be done by informing them of the economic potential of transitioning into upcoming markets, such as hydrogen. Nudging them with monetary benefits for good practice. International collaboration can also help because it can imply the sharing of costs in infrastructure changes. Next to the carrot, a stick can help press the time. An upfront announced heavy tax regulation on polluters will force the companies to reevaluate their current practices and their future validity.

Arable farmers are neutral to opponents of a transition in the Delta region. This has mostly to do with their lack of ability and resources to adapt. Just like the industries, the farmers need to be persuaded to take part in the transition. Through knowledge hubs and field labs or demo farms, the farmers can be aware of the potential of sustainable and landscape-based agricultural practices. They are also given space to transition and share their experiences and products

with others, without a middleman (such as a supermarket chain), through local marketplaces on each island. These marketplaces also serve as platforms for collaboration and celebration of frontrunners. They empower the farmers and recognise their position within the region and transition. Subsidising field labs and demo farms will enable and stimulate farmers to try new methods. If the nudging doesn't work, the earlier mentioned polluters' tax will force the farmers to think of their current manner of production. Lastly, giving them a seat at the table of governmental strategy-making will help them position and educate themselves as ecosystem managers.

The tourism industry is quite neutral in the proposed transition. The quality of the natural landscape is their capital. However, as most people and industries are, change is scary and the extension and changing of dike systems can limit the industries' practices for a while. The tourism industry has great potential to become caretakers of the natural landscape. Thus, they need to be persuaded to take the position. This can be done by reassuring them that the accessibility of their areas will not decrease or even will become better, through added water-bus lines and subsidised public services. The educational hub and increased accessibility to locally produced food can show them the potential of having an ecosystem-centred environment. The annual Healthy Delta events will also be an opportunity for income for the hospitality sector.

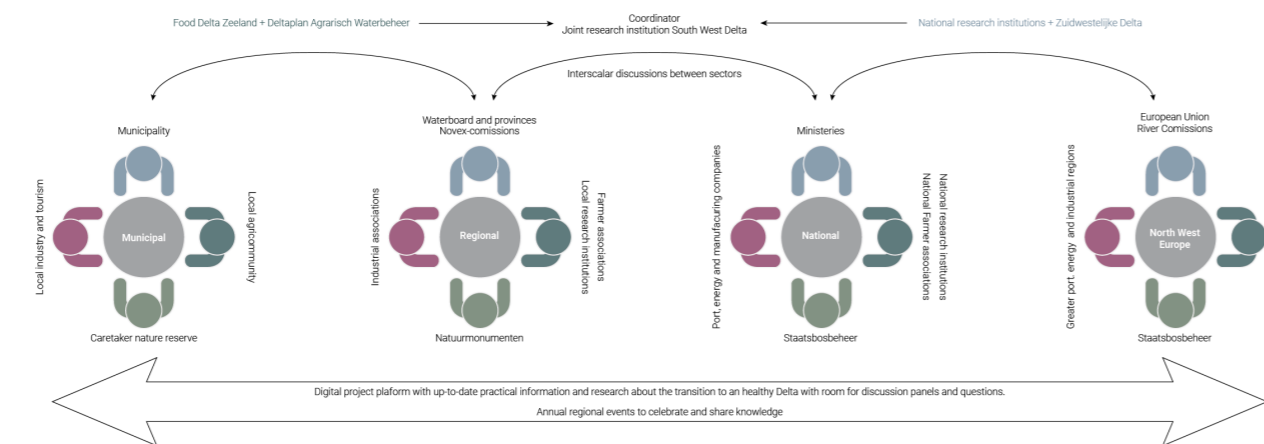
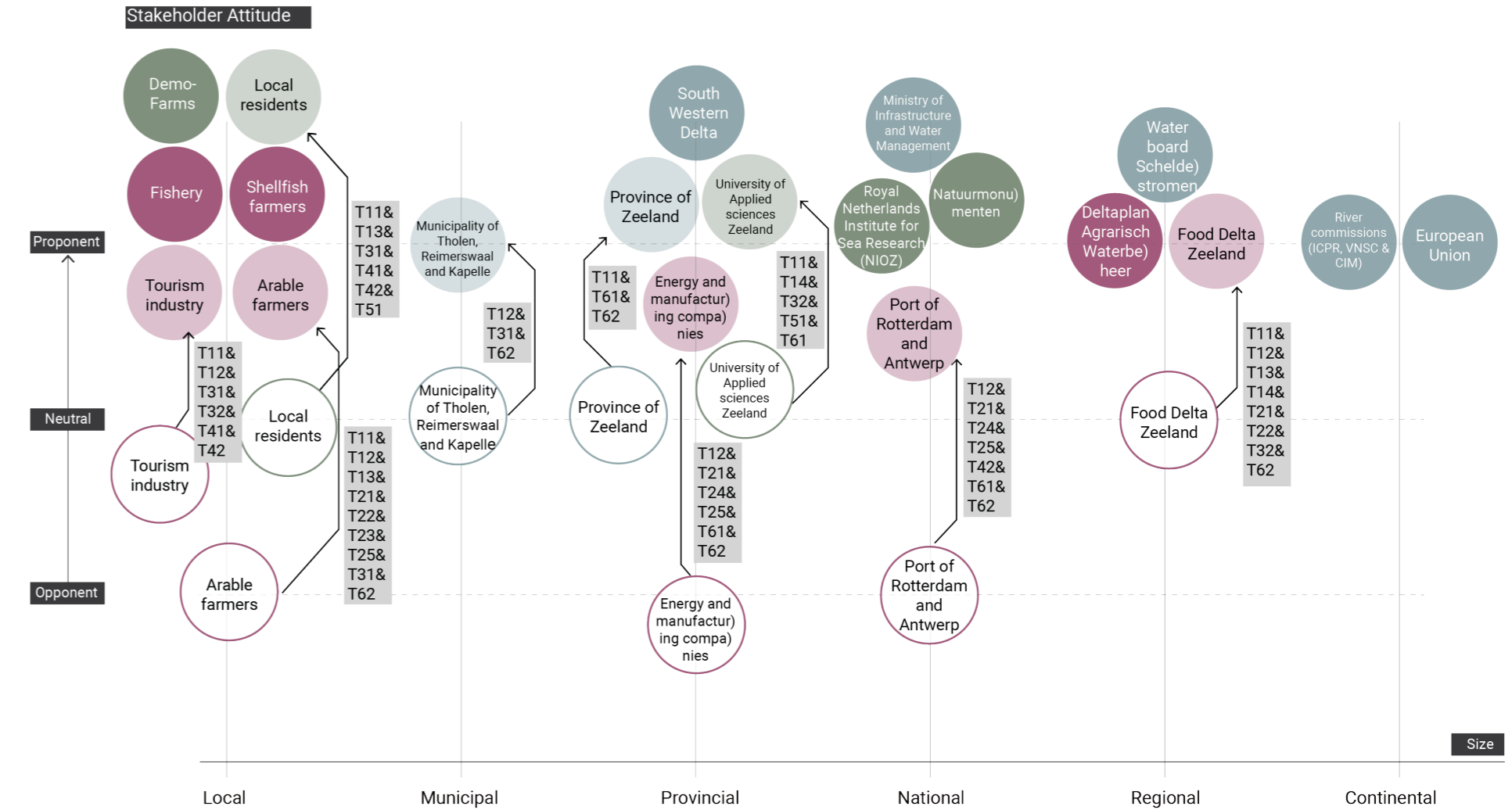


Figure 6.18 - Different stakeholders in table discussions on multiple scales



Tools for Attitude Change

T1: Community and Knowledge Exchange

T11: Platforms for sharing knowledge and meeting local organizations.
T12: Digital tool to share resources between farmers and updates of governmental activities in the region.
T13: Digital and physical newsletters to share their information and developments.
T14: Spaces to facilitate events.

T2: Environmental Incentives and Support

T21: Tax reduction for reduced use of fertilizers, pesticides, and freshwater.
T22: Subsidies for field lab tests and deformers to explore sustainable agricultural practices.
T23: Subsidies to help them initiate field labs.
T24: Connect to hydrogen transition.
T25: Polluters pay.

T3: Market and Economic Development

T31: Market place on each island to directly sell farmer products to local communities.
T32: Regional events celebrating local activities, industries and developments.

T4: Transportation and Infrastructure

T41: Added waterbus-line and subsidizing public transport.
T42: Added train connection between Goes and Gent.

T5: Research, Innovation, and Expertise

T51: Subsidizing research which connects to local expertise and academia.

T6: Policy and International Relations

T61: Legislation and organization to support cross-border corporation.
T62: Annual table discussions between governmental and non-governmental sectors.



Figure 6.19 - Stakeholder attitude change and projects that nudging them towards involvement in the healthy Delta

6.3 COMMUNITY ENGAGEMENT

Communities are also neutral to the vision. While proponents of a clean living environment, the large changes in water defences can be seen as frightening. The communities need to be well-informed and have a place to share their concerns and ideas. The knowledge and participation platforms will enable this and empower the inhabitants. Introducing a local market with cheaper regional products and the reassurance of public services will persuade them to accept the changes. The expansion of education and connecting education tracks to the local transition will also persuade and enable locals to completely immerse themselves in the transition.

Municipalities and Provinces are interested in the Healthy Delta transition. However, the attitude diverts to neutral due to the heavy costs of planning and adapting greater infrastructure. Especially, municipalities in low-density areas have little money to spare. The Dutch municipality's income is mostly taxes from their inhabitants and local companies. This makes it financially difficult for the Southwest Delta municipalities because most of them have great areas of land to maintain which are inhabited by very few people. The provinces have greater resources (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2017). By stimulating and making room for inter-scalar governmental collaboration and private investors, municipalities can gain a more positive attitude towards the adaptation of their landscape and infrastructure. The knowledge network will also expand their knowledge and communication abilities to support an effective transition. The collaboration potential will also help Provinces in planning, enabling their visions, and moving their resources.

Organisations built on farmer initiatives will be empowered by access to knowledge and collaboration spaces. Food Delta Zeeland (FDZ) and Deltaplan Agrarisch Waterbeheer (DAW) are incredibly suited to become mediators and translators between the public, private, and governmental sectors. Even though the interests of FDZ and DAW do not fully align, they bring discussion and varying perspectives to the table, one of financial security and the other of sustainable development.

DAW and FDZ, along with the governmental organisation Southwest Delta and the local research institutes, could organise regular table discussions involving all stakeholders. Due to the mix of private and governmental interests in the organisation of these discussions, the accessibility of these meetings is increased. This supports inclusive planning and collaboration opportunities.

The combination of cross-border and inter-scalar knowledge sharing and collaboration will empower and persuade stakeholders to rethink their interaction with the ecosystem. Subsidies will nudge the stakeholders towards the transition and give them time and tools to adjust. The future polluters' taxes will be a stick that presses for actions to take place. Participation in the transition is made accessible and enticing by giving a seat to non-governmental stakeholders and subsidies for experimenting with alternative production practices.



Figure 6.20 - Community engagement in the healthy Delta

6.4 KNOWLEDGE NETWORK

DELTA REGION

The realisation of an inter-scalar and cross-border network requires infrastructure and planning. Local knowledge and interests need to reach greater scales and powerful stakeholders. Simultaneously, spaces for discussion and connections for sharing need to be established in both digital, organisational and physical landscapes.

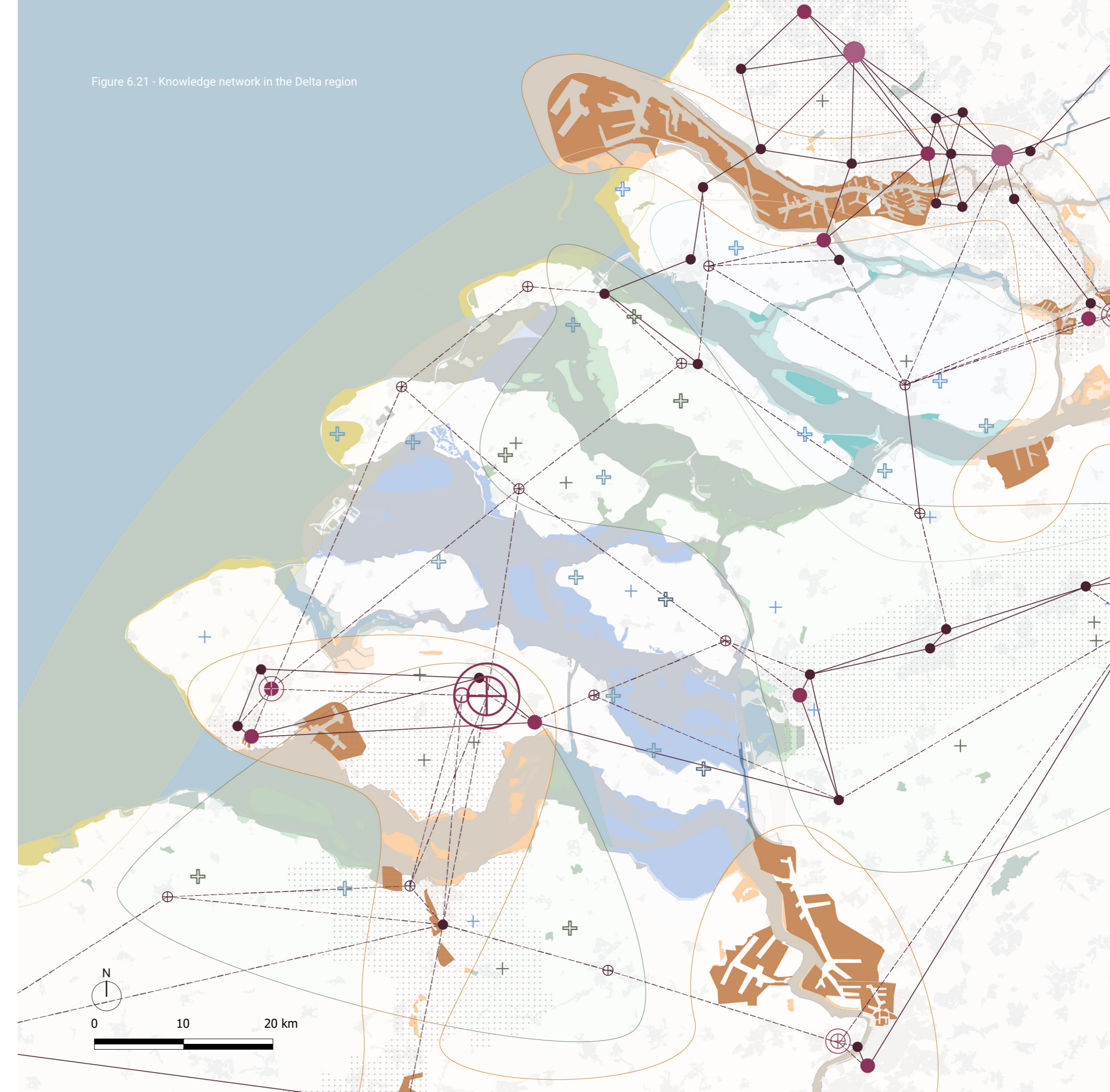
On all islands, local marketplaces that incorporate knowledge hubs will be introduced to support local collaboration and share experiences. On these platforms, farmers and communities will connect, along with farmers connecting to other farmers or industries. This lowers the threshold to start experimenting with field labs because

information is more easily obtainable. Farmers who have already tried certain practices can share their experiences with their neighbours and customers. The hub will showcase the results of experiments and appreciate the frontrunners, thus making field labs more common and accepted by the general public. The marketplace will be a breeding ground for celebrating local produce and practices.

The knowledge hubs will be connected to greater research and educational institutes. In specialised research centres, information is shared, and local grassroots organisations (such as DAW and FDZ), governmental, and research institutes build collaborations.

- Water
- Dunes
- Wetlands
- Ports and industries
- Urban areas
- Novex
- Knowledge network**
- University
- University of Applied sciences
- vocational education
- Joint research centre
- Added joint research centre
- Added local research centre combined with market
- Added University of Applied sciences
- Knowledge network
- New knowledge connections
- Delta as field lab**
- Field lab sustainable agriculture
- Field lab fresh watermanagement
- Added field lab regenerative agriculture
- Added field lab fresh watermanagement
- Added field lab salt water agriculture
- Added field renaturalisation
- Zoning focus research**
- Fresh water-management dunes
- Hydrogen and energy transition
- Fresh water-management river
- Acceptance of salt and renaturalisation
- Regenerative agriculture

Figure 6.21 - Knowledge network in the Delta region



6.4 KNOWLEDGE NETWORK

IMPACT ON THE EU

A regional joint research institution will be established in Goes. A new train connection between Goes and Gent will boost this initiative. The international train connection will support national as well as international collaboration among private, public, and governmental organisations. The regional institute will collect data on ecosystem-based adaptation in the Southwest Delta and share its knowledge with regions in comparable landscapes. Southwest Delta will become the pioneer of the Healthy Delta transition. In addition, the ports in the polycentric ARA-RSD region (Amsterdam-Rotterdam-Antwerp) (Van Den Berghe et al., 2022) will initiate collaboration toward clean and local industrial

processes. The synergy between the knowledge networks of ecosystem-based adaptation and clean industries will transition the region from a field of opportunities to a leader in ecosystem-based economies. This will be celebrated through an annual event (such as the stadsmakerscongres, Figure 6.22), inviting tourists, investors, and potential collaborators to the region.

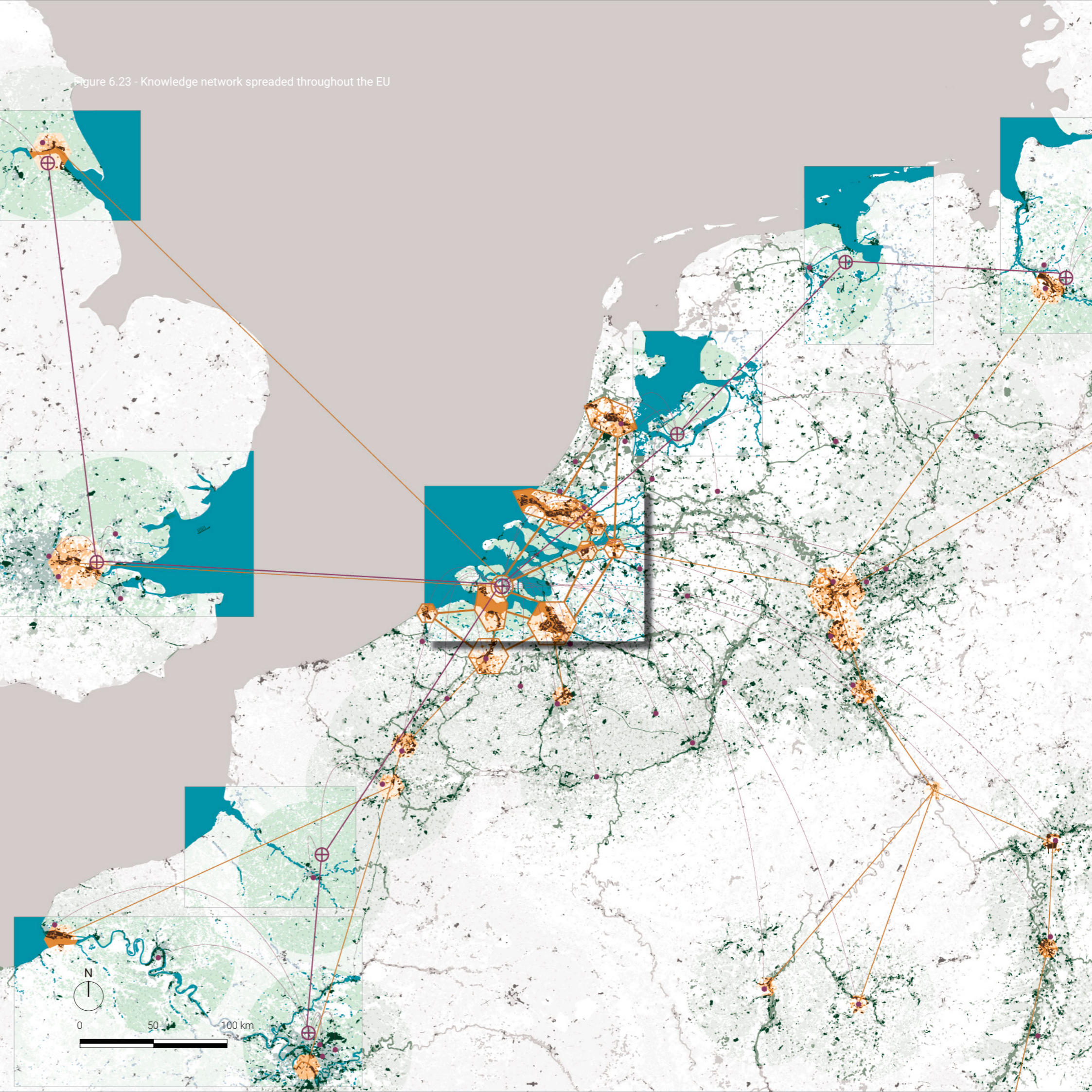
The Southwest Delta region will be the breeding ground for local pioneers by opening up its landscape for field labs and connections. Eventually, it will become a key player in ecosystem-based adaptation and clean production chains, while recognizing and empowering local

- Legend**
- Water
 - Crop land
 - Ports and industries
 - Urban areas
 - Critical coastal zones
 - South West Delta
 - Knowledge network ecosystem based transition**
 - ⊕ Joint research centre
 - Knowledge network
 - University
 - Research connection
 - Regenerative agri
 - Purification landscape
 - Renaturalisation delta
 - Knowledge network Clean port transition**
 - Key ports
 - ARA-RSD
 - Collaboration



Figure 6.22 - Stadsmakerscongres Rotterdam (Stadsmakerscongres, 2022)

Figure 6.23 - Knowledge network spreaded throughout the EU



6.5 KEY PROJECTS

FUNCTIONS

We have identified three key regions—Schouwen Duiveland, Haringvliet, and Oesterdam—as focal points for our initiative, demonstrating a comprehensive strategy for addressing environmental challenges.

Schouwen Duiveland is set to evolve into a wetland landscape, enhancing biodiversity and pioneering salt-tolerant agriculture, while also boosting local tourism and fostering community involvement.

Haringvliet is being transformed into a vital freshwater reservoir, employing sophisticated

dike systems and creating wetlands that serve both as water purification sites and as means for landscape conservation.

Oesterdam, strategically located near the port of Antwerp, is focusing on aquaculture, empowering traditional fishing communities to manage the ecosystem effectively, mitigate pollution, and nurture a burgeoning shellfish industry. Each selected area illustrates a distinct and innovative approach to achieving sustainability and community-empower in the face of ongoing environmental shifts.

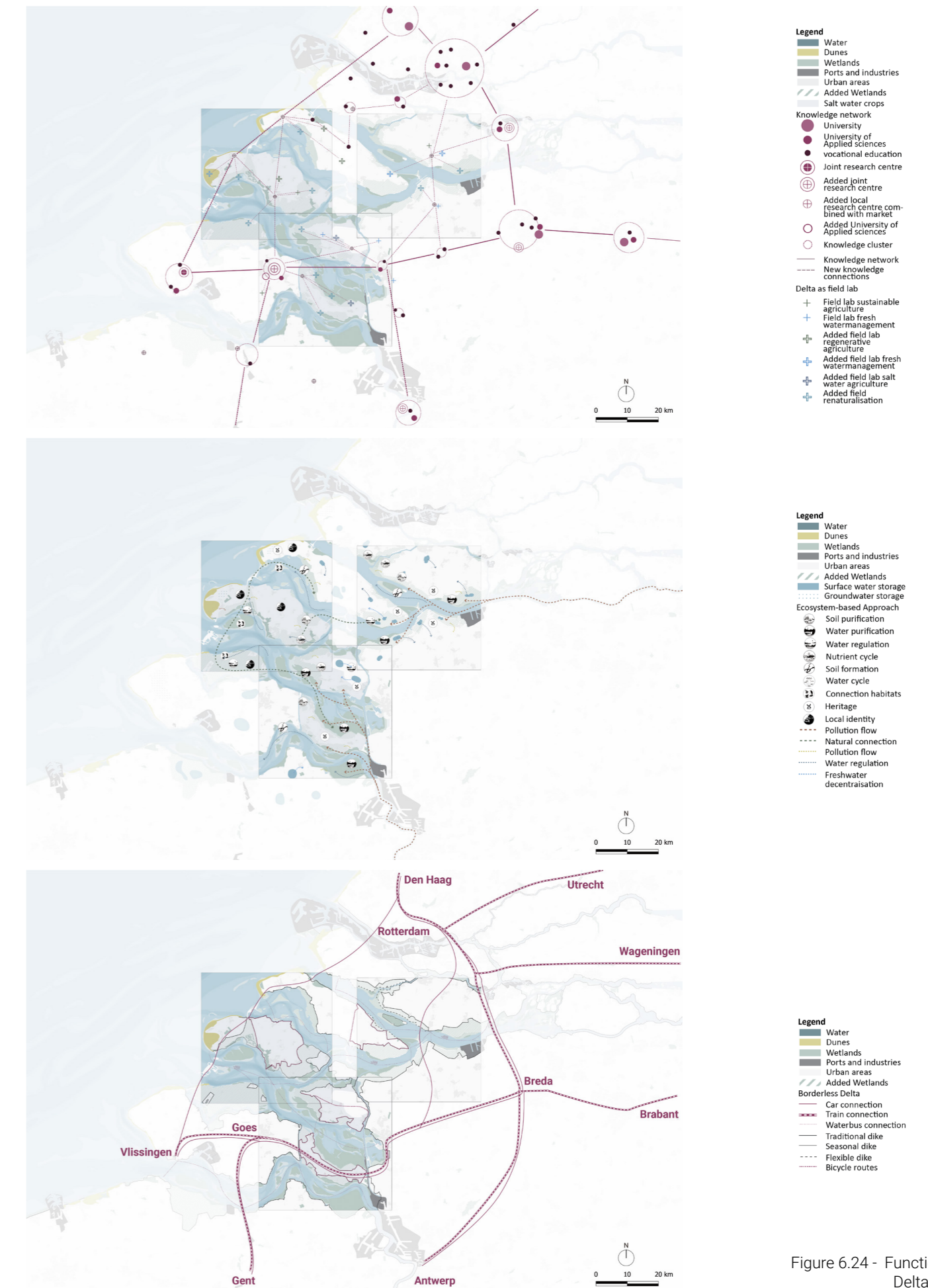


Figure 6.24 - Functions of the Delta zoom-ins

6.5 KEY PROJECTS

OESTERDAM

A regional joint research institution will be established in Goes. A new train connection between Goes and Gent will boost this initiative. The international train connection will support national as well as international collaboration among private, public, and governmental organisations. The regional institute will collect data on ecosystem-based adaptation in the Southwest Delta and share its knowledge with regions in comparable landscapes. Southwest Delta will become the pioneer of the Healthy Delta transition. In addition, the ports in the polycentric ARA-RSD region (Amsterdam-Rotterdam-Antwerp) (Van Den Berghe et al., 2022) will initiate collaboration toward clean and local industrial

processes. The synergy between the knowledge networks of ecosystem-based adaptation and clean industries will transition the region from a field of opportunities to a leader in ecosystem-based economies. This will be celebrated through an annual event, inviting tourists, investors, and potential collaborators to the region.

The Southwest Delta region will be the breeding ground for local pioneers by opening up its landscape for field labs and connections. Eventually, it will become a key player in ecosystem-based adaptation and clean production chains, while recognizing and empowering local communities in the transition.

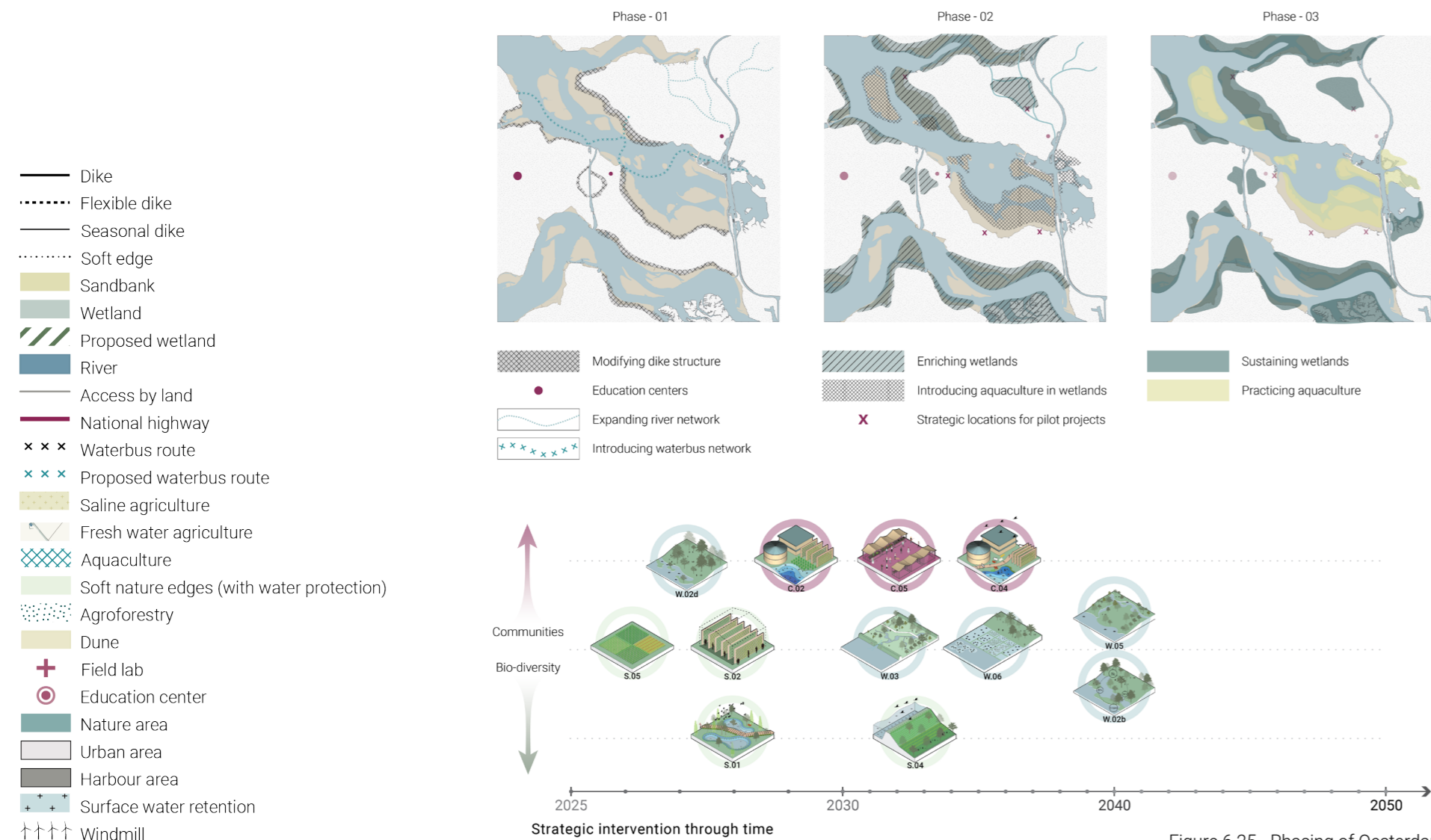


Figure 6.25 - Phasing of Oesterdam

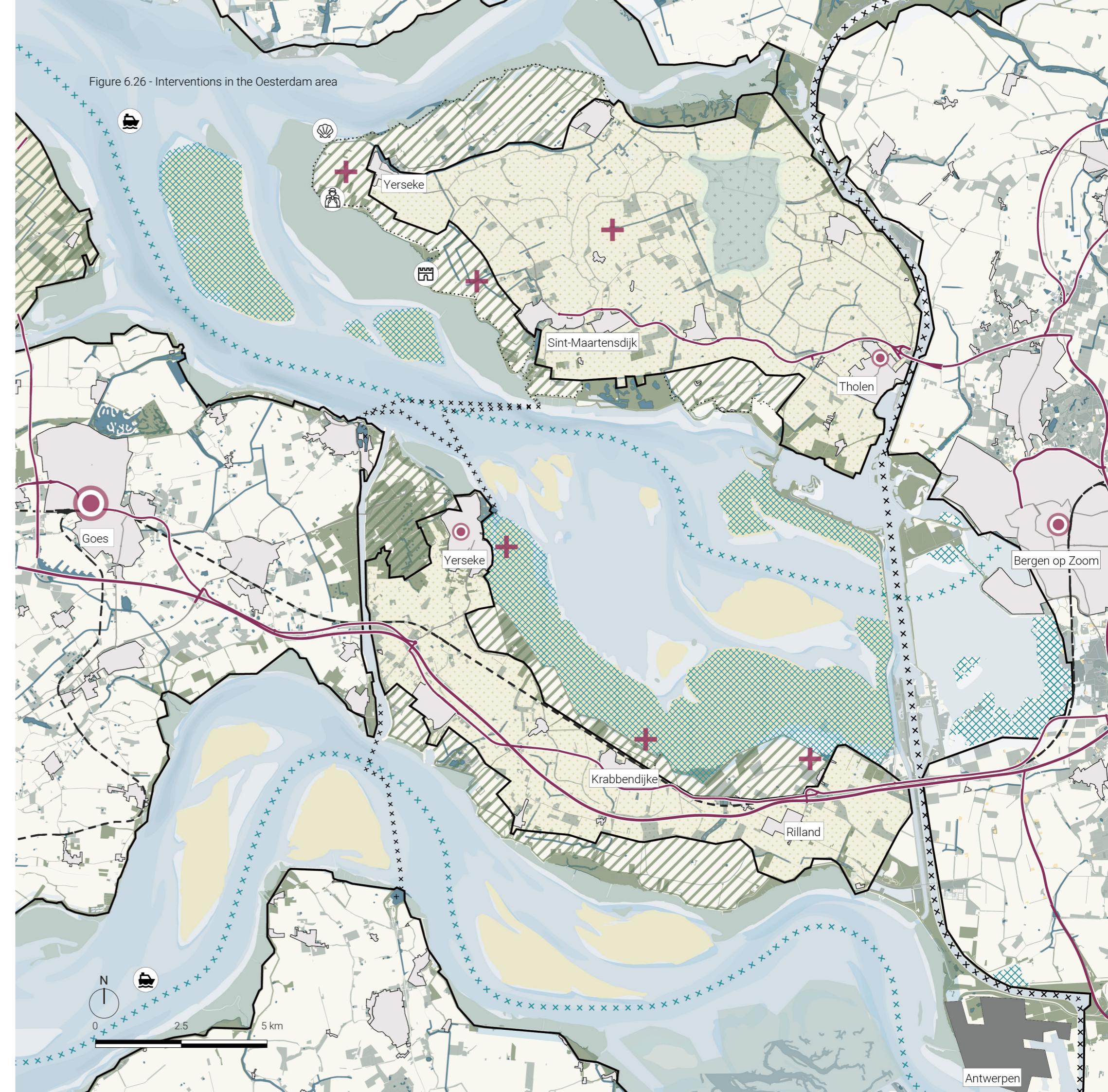


Figure 6.26 - Interventions in the Oesterdam area

6.5 KEY PROJECTS

OESTERDAM - POTENTIALS OF THE TRANSITION

The collages give an overview of the different possibilities of the interventions in areas in the region.

- In Yserke, the marine industry will be expanded, giving opportunities for fishery companies to grow.
- Stavernisse will become more touristic, with the heritage of the landscape being highlighted and different activities (such as diving) being promoted.
- The overall biodiversity in Tholen will grow, due to the expansion of the wetlands and the rewilding of the polder landscape in the island.



Figure 6.27 - Potentials in Yserke



Figure 6.28 - Potentials in Stavernisse



Figure 6.29 - Potentials in Tholen

6.5 KEY PROJECTS

SCHOUWEN-DUIVELAND

A regional joint research institution will be established in Goes. A new train connection between Goes and Gent will boost this initiative. The international train connection will support national as well as international collaboration among private, public, and governmental organisations. The regional institute will collect data on ecosystem-based adaptation in the Southwest Delta and share its knowledge with regions in comparable landscapes. Southwest Delta will become the pioneer of the Healthy Delta transition. In addition, the ports in the polycentric ARA-RSD region (Amsterdam-Rotterdam-Antwerp) (Van Den Berghe et al., 2022) will initiate collaboration toward clean and local industrial

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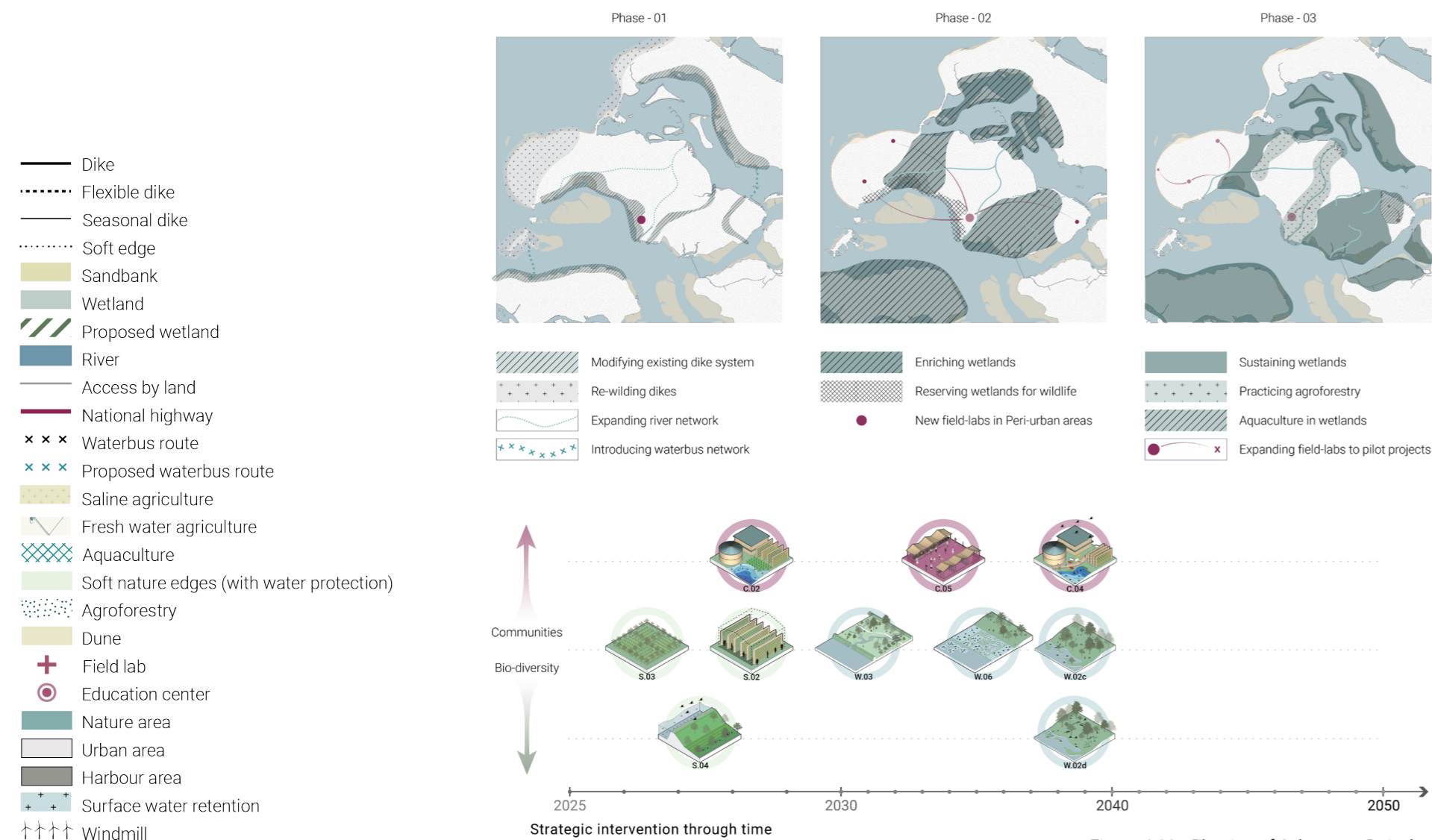


Figure 6.30 - Phasing of Schouwen-Duiveland

Figure 6.31 - Interventions in the Schouwen-Duiveland area



6.5 KEY PROJECTS

SCHOUWEN-DUIVELAND - POTENTIALS OF THE TRANSITION

The collages give an overview of the different possibilities of the interventions in areas in the region.

- For Schouwen-Duiveland this showcases the sealife of Bruinisse, which is connected to the communities through expanding the marine economy and waterbus-line.
- Renaturalising the area gives both room for biodiversity to expand, as create new areas for tourism to grow.
- The agroforestry provides new opportunities in both the farming industry as for the overall environment in the island.



Figure 6.32 - Potentials in Bruinisse



Figure 6.33 - Potentials in renaturalising the area



Figure 6.34 - Potentials in using agroforestry

6.5 KEY PROJECTS

HARINGVLIET

A regional joint research institution will be established in Goes. A new train connection between Goes and Gent will boost this initiative. The international train connection will support national as well as international collaboration among private, public, and governmental organisations. The regional institute will collect data on ecosystem-based adaptation in the Southwest Delta and share its knowledge with regions in comparable landscapes. Southwest Delta will become the pioneer of the Healthy Delta transition. In addition, the ports in the polycentric ARA-RSD region (Amsterdam-Rotterdam-Antwerp) (Van Den Berghe et al., 2022) will initiate collaboration toward clean and local industrial

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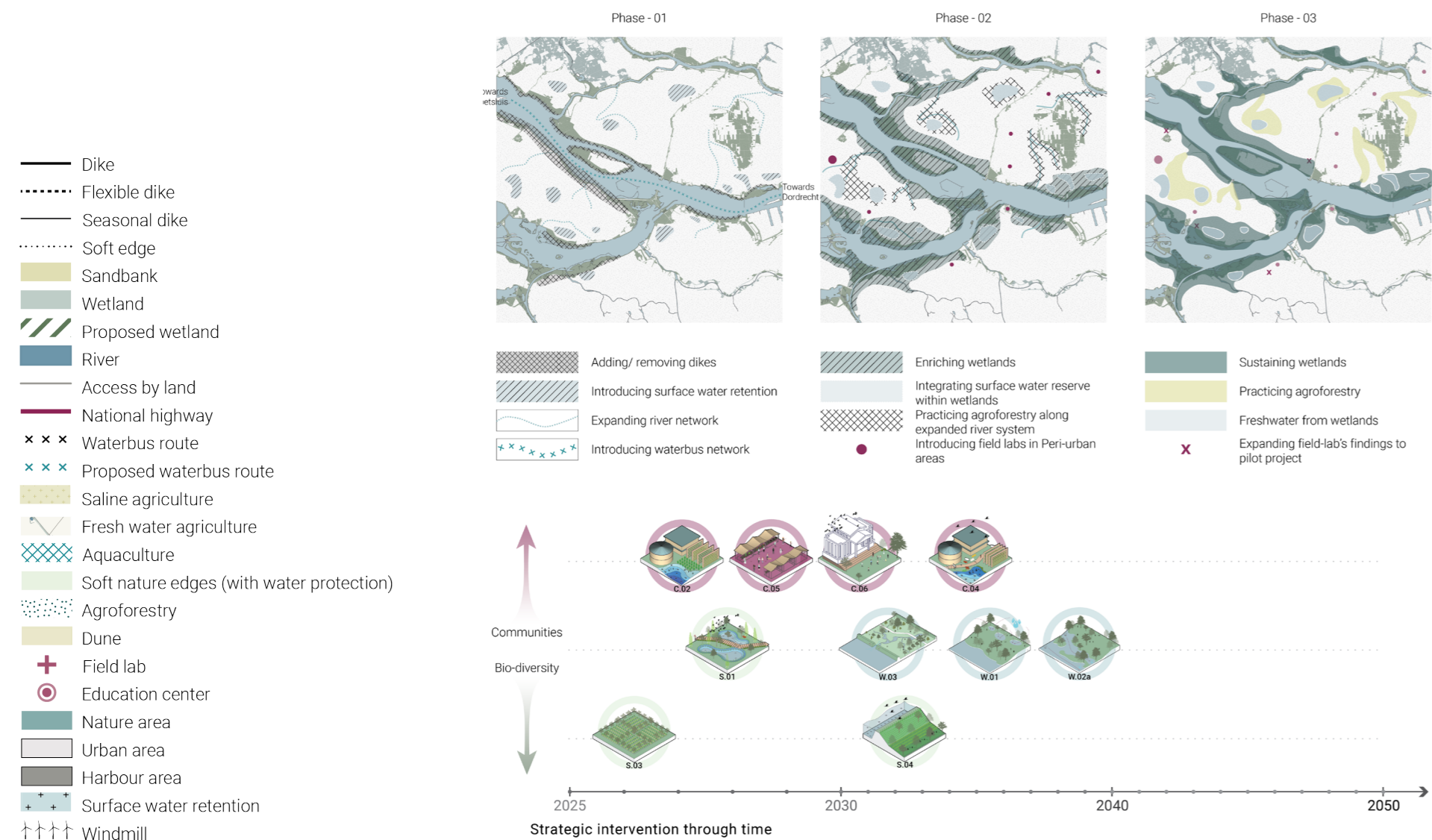
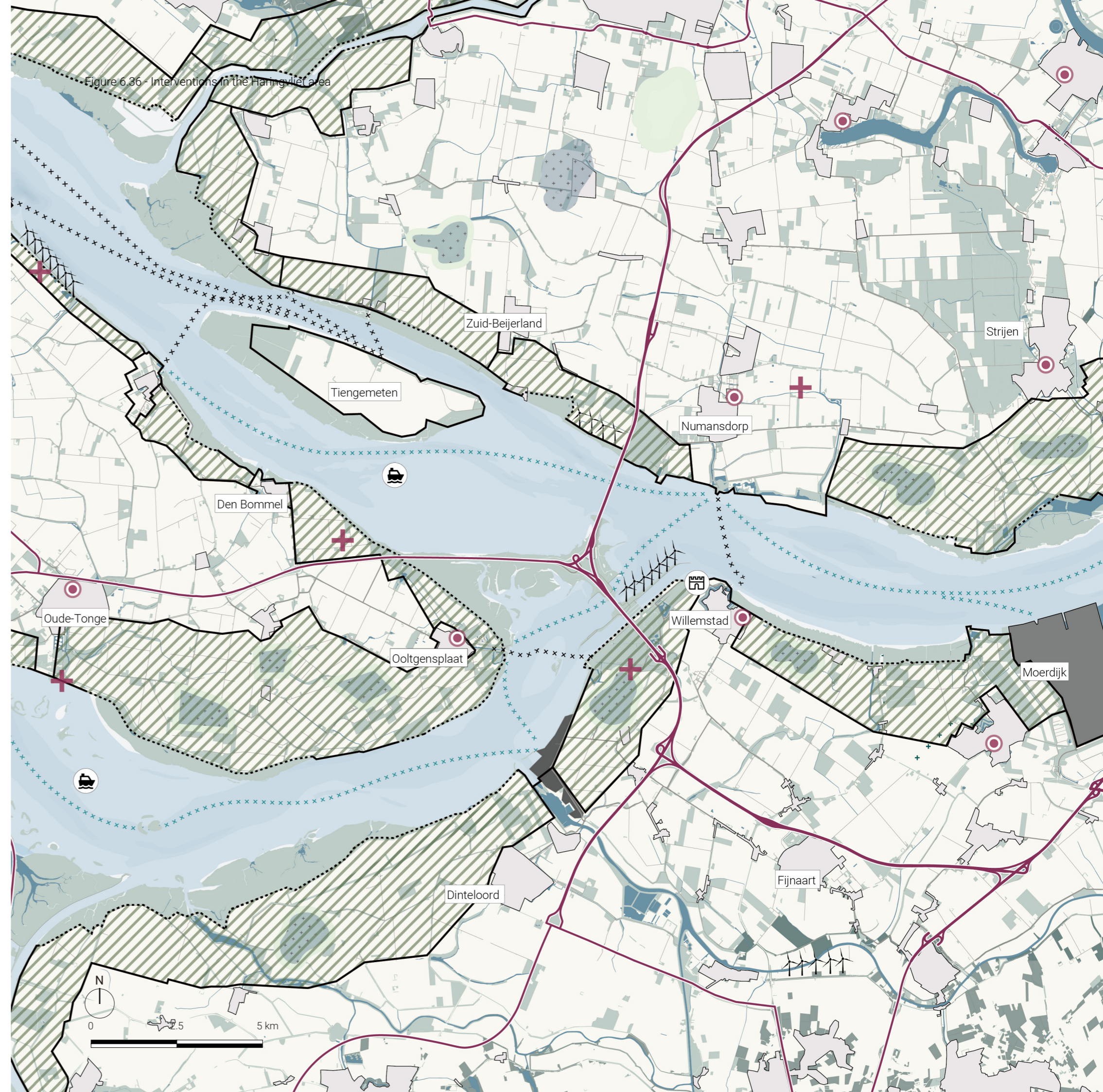


Figure 6.35 - Phasing of Haringvliet

Figure 6.36 - Interventions in the Haringvliet area



6.5 KEY PROJECTS

HARINGVLIET - POTENTIALS OF THE TRANSITION

The collages give an overview of the different possibilities of the interventions in areas in the region.

- The double dike system creates new landscapes for testing and developing the principles of the healthy Delta.
- Because the Haringvliet is closely connected to the Biesbosch, these nature areas are extended into the Delta region.
- The synergy between the port and the Delta region provides a healthy base for both environment and community.

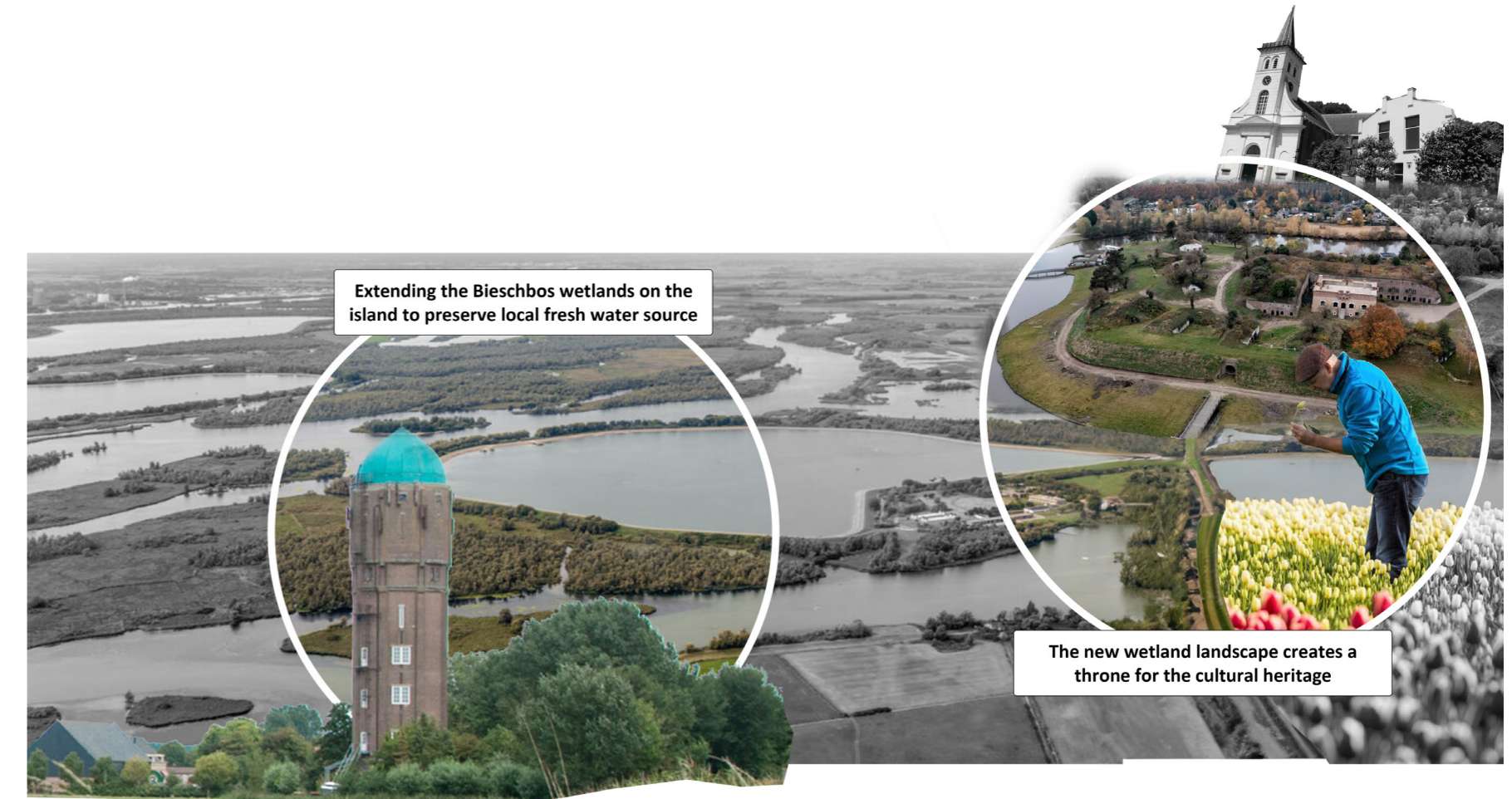


Figure 6.38 - Potentials in extending the Biesbosch nature

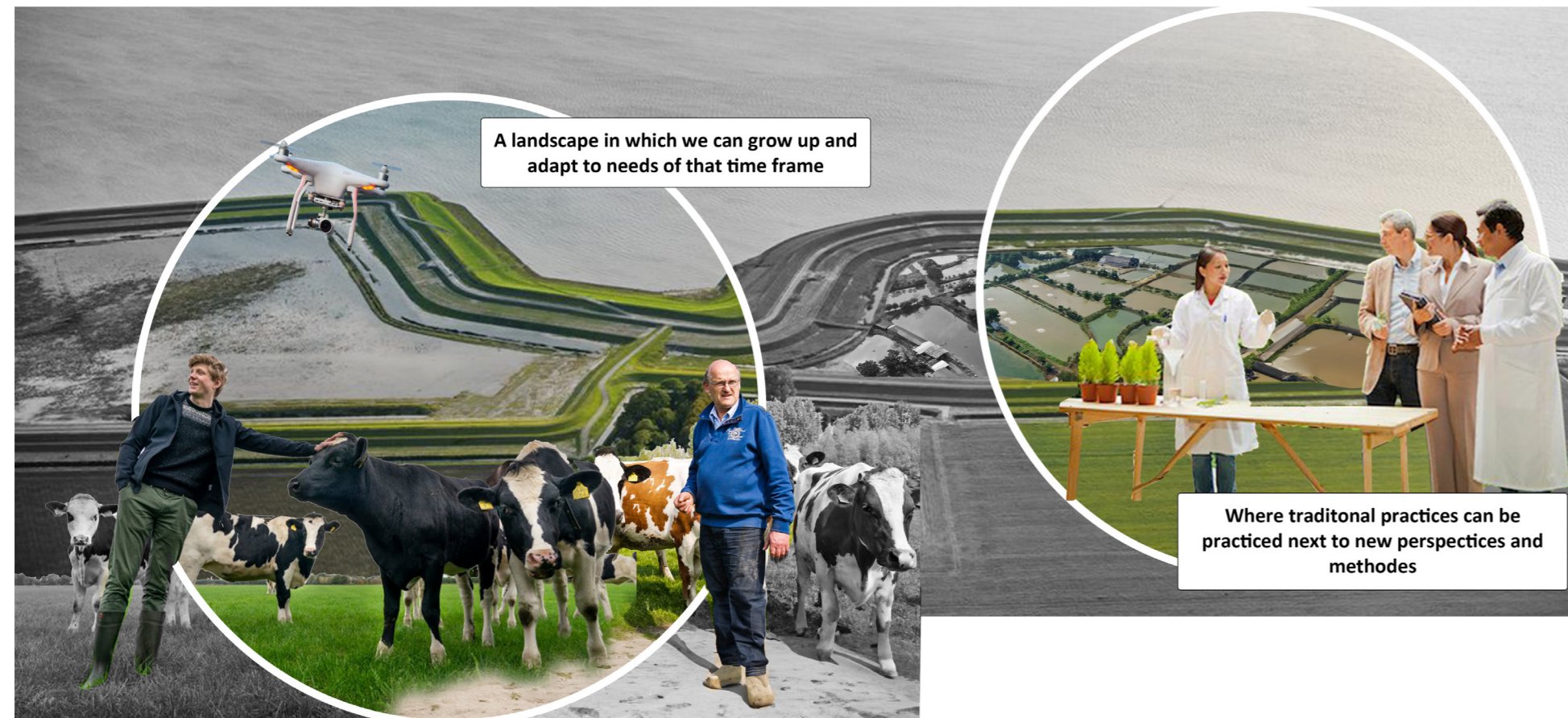


Figure 6.37 - Potentials in the double dike system



Figure 6.39 - Potentials in connecting the harbour to the Delta region

6.6 PHASING

The phasing represents the arrangement of spatial interventions over time to account for priorities, stages of growth, and change (Kraan et al., 2023). The phasing is done in a linear way instead of an x-curve as it represents the progress of this project in a more appropriate way. The project aims to reach a healthy Delta by the year 2050, so the interventions towards the vision are classified into 4 phases: *Identifying Delta*, *Transforming Delta*, *Sustaining Delta*, and *Producing Delta*. The phasing is also sub-classified into different categories by grouping systems such as knowledge network, ecosystem-based, borderless Delta, and policies/governance.

Knowledge network aims to spread and engage the findings from an academician to the communities. This involves creating a Virtual Platform for public

participation, and then making it physical to hold meetings and symposiums. Ecosystem-based adaptation aims to bring back nature in the Delta region. It is achieved by creating flexible dikes and double dykes and also looking into enhancing the aquaculture in the region. This process involves acquiring farmlands from farmers along the rivers to enrich the ecosystem as a whole. This process yields profits to the farmers in the long run. Borderless Delta aims to expand the system throughout the river and involve upstream polluters. This involvement focuses on reducing the amount of pollution from industries, encouraging them towards clean energy sources. Each intervention is related to stakeholder response and certain milestones are met at the end of each phase.

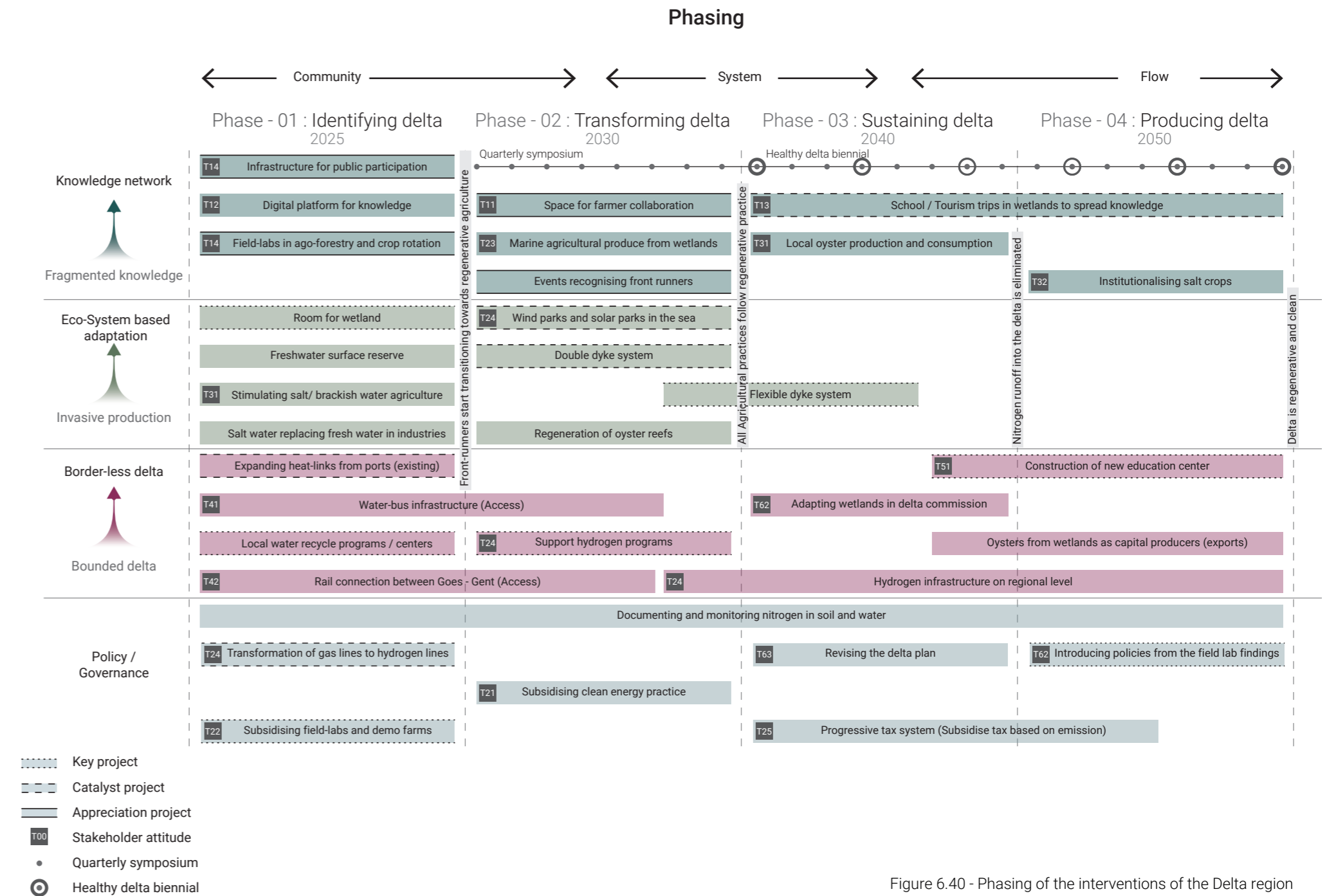


Figure 6.40 - Phasing of the interventions of the Delta region

6.7 VISION BEYOND 2050

The Southwest Delta has become the centre of innovation and inter-scalar governance. Communities serve as the shepherds of ecosystem services, while building their own unique locally-based economy and regenerative landscape. Together with the government and industrial regions, strategies are created to organise an inclusive growth of the region.

As a pioneer in renaturalising an estuary, the Southwest Delta region becomes a central piece in the North Sea Ecosystem Alliance. The edge of the North Sea is full of areas with comparable challenges as those experienced by the Southwest Delta. This collaboration begins with joint research programs, but as trust is built, greater cross-border projects are realised. The alliance strengthens the natural capital and defence of the region while cleansing the river water before it enters the North Sea.

The experiences of the agro-communities are collected in the greater joint research institute in Goes. Digital platforms, educational programs, and the annual celebration of projects in the Delta region serve as sources of knowledge for other European research and education institutes. The EU Joint Research Centre can use this information for suitable legislation and to create common ground with farmer associations. The regional

institutes can act as translators for their region. They gather new information, translate it to their local situation, and share it with their own agro-community. This creates polycentric knowledge, spreading knowledge to the European peri-urban areas and motivating further ecosystem-based adaptation across the continent.

The Scheldt-Rhine Delta ports frame themselves around the Southwest Delta, positioning them close to innovation development and possible alliances with governmental and non-governmental bodies through collaboration programs and events. Now that most of the infrastructure is in place for clean and renewable production chains, their profit will begin to grow, and expanding this system is the logical next step. The Schelde-Rhine Delta ports start collaborating with inland ports. Pollution will further decrease, and the natural landscape will begin to regenerate itself instead of purifying pollution.

The Northwest of Europe will enter its greater transition towards a Healthy Delta, and the Southwest Delta will be the gateway to the new post-humanistic era. Where knowledge is a common resource, together with the restored self-regulating ability of the Delta and its communities, the region will attain a high capacity for flexibility and resilience.

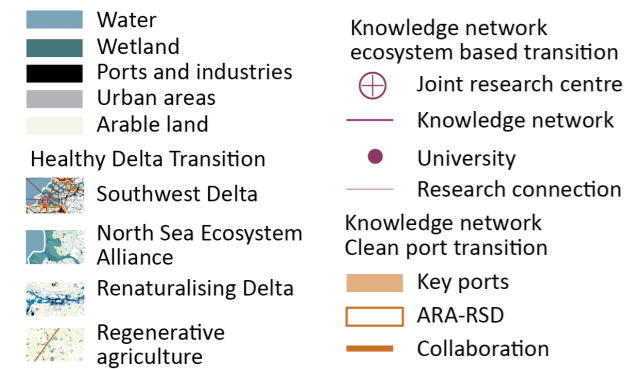


Figure 6.41 - The healthy Delta beyond 2050



7. CONCLUSION

This project is an exploration of community empowerment as a means to support the Delta's ability to produce ecosystem services. The main question: 'How can local peri-urban communities be the base of the just transition towards a healthy Delta, which restores the production of ecosystem services and improves climate resilience of the Delta?' is answered by the combination of environmental assessments, mapping and spatial analysis, stakeholder engagement, a SWOT-matrix, the development of action perspectives through scenario planning, and a policy review.

Currently, the Delta is considered unhealthy because of its inability to produce essential ecosystem services. The emergence of ecosystem services is hindered by systems such as climate change (salinisation and flood risk), pollution, and policies that put pressure on the vulnerable Delta communities. These policies are heavily top-down oriented. Thereby, the full potential of a healthy Delta is missed. This creates an unjust situation, where communities are lacking tools and a voice to represent themselves and be part of the transition. The analysis reveals that conditions such as invasive production, fragmented knowledge, and a bounded Delta create the context where this injustice takes place.

Local peri-urban communities can be actively involved in restoring the production of ecosystem services by gaining knowledge and recognition

from governmental institutions. However, knowledge and recognition are not enough. The local peri-urban Delta communities need to be aware of the urgency of the unhealthy Delta and therefore motivated to step up and be part of the transition.

Participation processes create community recognition. From there, the government can nudge agricultural communities into the agroecological transition. Monetary benefits and the celebration of good practices empower the communities. The instalment of knowledge hubs, field labs, and demo farms allows for sharing and spreading knowledge. This creates awareness and engagement between communities. This process can be accelerated by a cross-border and inter-scalar collaboration that involves knowledge sharing in the area. The synergy between recognition, knowledge, awareness, and motivation makes the communities rethink their relationship with the ecosystem. This allows the communities to become the Shepherds of the Delta: the missing link in the transformation of the top-down approach that currently is being governed.

Three strategies can be employed to enhance the climate resilience of peri-urban communities as part of the transition towards a healthy Delta. First, the ecosystem-based adaptation results in a self-regulating system. This strategy entails the decentralisation of cycles, agroecological zoning, and re-naturalisation. The second strategy refers to

the education and engagement of the communities through a knowledge network. It creates flexibility and resilience through knowledge. Hubs and platforms for experimentation, marketplaces, and digital platforms promote the spread of knowledge in the Delta. The final strategy puts the Southwestern Delta on the map by opening up the borders. The borderless Delta rethinks the relationship between man and nature. On top of that, this approach creates opportunities for its communities internationally. Table discussions and joint research centres form the base of cross-border cooperation and make the transition towards a healthy Delta a flagship project.

Local peri-urban communities can take up the role of Delta Shepherds under the condition that recognition, by governmental policies, and education will raise awareness and motivation to adopt the role in this urgent transition. The Shepherd's ways of participation through field labs and other ways, give them a guiding role in transforming the Delta from a top-down oriented approach to a justful approach. Together with concerned stakeholders, the Shepherds can restore the ecosystem services in the Delta. The combination of ecosystem-based adaptation, a knowledge network, and the borderless approach will create a foundation for a regenerative, resilient, and inclusive Southwestern Delta that serves as an example for other estuaries in the world.

Figure 7.1 - The healthy Delta beyond 2050 - conclusion



8. REFLECTION

GROUP

This project explored the potential of communities as the foundation for a healthy Delta transition. Based on our research, a pathway was visualised which included knowledge networks, participation platforms, agroecological zoning, decentralisation of ecosystem management and inter-scalar collaboration. Our project revealed that communities can be the Shepherds of ecosystem-based transition within the Southwest Delta if given the tools and are meaningfully involved.

This direction we explored is one of many, but the compactness of the course demanded quick decision-making. Through literature review and experimenting with methods, we choose an approach which combined empowered and persuade communities through participation and knowledge to become ecosystem managers. We aimed to make a general and low threshold participation system for the communities. Although, we faced the fact that communities don't exist on paper. Each community has different values and interests which frames the participation system that suits them. Time prevented us from meeting the communities, but we created personas and communities based on local policy documents, news articles, historic analysis and the experiences of our groupmate who grew up in the Southwestern Delta. The conceptualisation of these people and their desires helped us explore the limits and potentials of the strategic interventions. It also helped searching for the winners and losers of the system change. For example, farmers who produced invasive crops must introduce native crops into their practices, which costs time and money. Through subsidies and open source knowledge we tried to help even the most resource limited farmers.

In our strategy we also propose collaboration networks and participation platforms to make the transition accessible and an (financially) enticing endeavour. Literature and numbers of individual projects (Ecosystem-based Adaptation, 2009; United Nations Environment Programme, 2022) have shown that these methods are key in the transition. However, these methods come with a large number of uncertainties. We are unsure if the communities will participate, collaborate or that the educational platforms will be used. By nudging the communities through incentives and celebration of frontrunners, we increase the interest in joining the transition. Eventually even forcing the ones who are too stubborn, with progressive taxes. As mentioned before, a community suited strategy is necessary to integrate a knowledge system well.

Just as communities are an uncertain spectrum, climate change as well as innovation and political changes are difficult to programme to. We can mostly programme to the near future. That is why our vision is split in two timeframes. The first one aims to create a foundation for regeneration, participation, inter-scalar collaboration and clean energy. This structure makes room for adaptation through meaningful involvement of all stakeholder and recognition for water and soil in future plans. The second proposes a future which can expand on the first one but also can be altered if necessary (for example, instead of a North Sea Ecosystem Alliance, a River or Delta-farmer Alliance).

To conclude, this project challenged us to think from a local as well as a governmental body and industrial company. While facing, as a group of students, our strengths and weaknesses during this course. The project made us get to know each other professionally as well as personally. We grow individually as well as a group over the time of the course.

9. INDIVIDUAL REFLECTION

GIJS TEN BOSCH

How do vision and strategy intertwine in the transition towards a healthy Delta?

The vision-making process, which is more research-oriented, provides a foundation for the strategy. I learned that setting boundaries for the scope of the project is essential. Our interpretation of a healthy Delta acted as a guiding theme throughout the vision. The exploration of the role of the communities is necessary to achieve a holistic outcome of this transitional project.

The environmental analysis, mapping, and involvement of the peri-urban Delta communities made me realise how a regional research and design project has an impact on an extensive amount of stakeholders. In my view, this project represents current societal challenges and requires identifying, comprehending, and interlinking all individual systems that are present in the Southwestern Delta.

The research-focused vision-making process requires a strategy. Without a strategic approach, it is impossible to specify and spatialise design interventions in the area. Besides that, I realised that the process of vision to strategy is iterative. By strategising, you are forced to adjust the vision to align it with the strategy again.

In the middle of the process, I discovered that the local scale is just as important as the regional scale. Working through the scales is a requirement for a

successful project. In the vision-making process, I was tempted to draw lines with arrowheads to present the design interventions on a regional scale. Soon enough, I realised how these lines have a significant difference in appearance on a local level and how an evidence-based attitude is required to shape the design interventions through the scales. The strategy allowed us to expand on the vision and shape it in a detailed way.

I tried to support the group process by adopting a goal-oriented attitude and a supporting role that would help the group with the connection of research in the creation of the vision and strategy. My teammates helped me with improving my visuals. I experienced a pleasant working environment and collaboration with my team. The workshops helped me understand how to spatialise data in QGIS and how this can be used in vision and strategy creation.

In this personal reflection, I expand on the way how the vision and strategy in our project intertwine and require an inter-scalar and holistic approach. I elaborate on my role in the group process and the lessons I have learned. When I look back, I started the project as a regional design novice. The transition towards a healthy Delta gave me extensive experience in the development of a regional design. The regional scale requires an evidence-based approach in a project where research and design cross.

9. INDIVIDUAL REFLECTION

JING TIAN

Reflecting on this project has been an eye-opening journey, showing the complex details of ecosystem management within the Southwest Delta. The project not only broadened my knowledge of the Netherlands' famous water management skills but also showed how vulnerable the delta's ecosystem is. Realizing that the usual top-down ways of managing water might not get the best out of a healthy delta was a key moment. This understanding pushed us to look into strategies led by the community to build a strong ecosystem, highlighting the important role local communities play in taking care of the environment.

The choice to go with a community-led approach came after a lot of reading and trying different methods, leading us to a plan that not only gives power to communities but also gets them actively involved in managing the ecosystem. We wanted to make a system of participation that was easy for everyone to access and take part in. This meant we had to recognize that communities are different—they have their values and interests, and we needed to adjust our approach to meet their specific needs. This part of the project showed how important it is in urban design and planning to adjust strategies to meet the specific needs of different communities.

Personally, this project greatly improved my ability to communicate and work well with a team. In the beginning, I didn't contribute much because of language barriers and not knowing much about the topic. But getting constructive feedback made me more active, share my strengths, and really get into the team spirit. This change in how we interacted had a big impact on the outcome of the project, showing how important it is to talk openly, give feedback to each other, and bring together different ideas. This experience was very different from past projects where we hardly worked together, and it has changed how I view the importance of teamwork in urban design.

Overall, this project has helped me grow both professionally and personally. It has strengthened my belief in the effectiveness of community-led approaches to challenges in urban design, especially when it comes to managing ecosystems. What I've learned from this project will definitely affect my future work, pushing me towards a more inclusive, participatory way of creating strong urban ecosystems. The experience also highlighted how essential good teamwork and communication are in the complicated field of urban design and planning. I would like to express my gratitude to the tutors and my wonderful teammates who provided unwavering support throughout this journey.

9. INDIVIDUAL REFLECTION

GANESH UMASANKAR

Spatial strategies in global metropolis is a course which I was looking forward to as it deals in a regional scale and is new to me. The systems involved in a regional scale functions as a complex entity which works across scales, levels, and disciplines. As someone who is not familiar with the Netherlands, it was difficult to grasp, it was quite challenging to address the communities too. There were cultural differences which I was learning along the course.

The SDS and Capita Selecta lectures at the beginning of the quarter help me understand the quantity we are dealing with. The workshops did help me gain skills required for a regional scale planning but the main drawback was that it was difficult to trace back if something goes wrong or I didn't have much time to experiment on the findings and learn more by myself.

Understanding the region through document research was helpful, having people from the region helped (as a group) gain insights and better understanding of the stakeholder involved. As we progressed through the quarter, after each discussion with the tutors, my understanding of our vision became stronger. I also liked how our group discussion would start with looking back at what our vision is and agreeing/ discussing our individual vision (understanding of the vision).

The difference in perspective also helped back my arguments with case studies. Even though they are from different geological locations, they added different perspectives to the project.

Being new to the field of strategic planning, settling on a vision statement at the beginning brought in a sense of narration, which helped me as the project progressed. Going through vision in the first half of the quarter gave space to ideate what I wanted, while the ideas such as Circular economy, Sustainable land use, De-centralisation and Social justice looks idea on paper, making use of them in a regional scale added value and justification of why I needed to do that. These ideas were also helpful in strategizing our vision. To summarise overall takeaway from this course in a single paragraph would be quite difficult. This course developed my regional understanding, working across borders, identifying the borders, engaging the communities, addressing the communities, developing a holistic vision, tailoring the vision to strategic locations, formulating intervention through phasing to achieve a vision, making sure the communities are addressed in each scale, balance/adapt the vision as the project progressed. I wanted to thank the tutors and my lovely team mates who were supportive throughout this journey, starting from field trip till finalising the report.

9. INDIVIDUAL REFLECTION

CHRISTEL VONCKEN

How did we translate conceptual solution directions, such as knowledge networks, to physical interventions?

A key element of our vision is the knowledge network that supports participation, field labs, and collaboration across scales. Our challenge was to create an infrastructure that supports the production and sharing of intangible resources among extremely diverse stakeholders. The translation of our solution was mostly done by me and it made me realise how important it is to have a talk with the user of your plan.

To build a knowledge network, I thought it was most logical to build further on existing networks and collaborations. This made educational and research centers the foundation of the networks. Additionally, industrial regions have great collaborations for research and knowledge sharing, which brought the clean port transition collaboration to life. But how do we intertwine these interests? While educational sectors focus on knowledge gathering, companies wish to find ways to increase or sustain their market position. To attract the attention of companies, we came up with a regional event. From experience, I know that events such as 'Stadmakerscongress' connect investors to research and vice versa. This event can also attract the interest of communities to the transitions in their region.

This brought us to the next step: participation. How do we motivate people and local companies

to join the transition? Before we could answer that, we had to find out what prevented them from joining. From documents as well as experiences from my acquaintances (I come from the region), I know that there are multiple barriers preventing participation: financing, ability to apply the practice, and willingness to join. Subsidies and education can help with financing and ability, but willingness is another story. Facing heavy policies and seeing strategies that do not connect or even threaten their livelihood, people will feel unrecognized and pushed aside. I remember when I was working for the municipality, people wanted nothing more than to have someone to talk to on common ground. That's why we came up with platforms for collaboration and knowledge sharing. Here, people can look up information at their own pace, see local application experiments, and discuss it with their peers and maybe local civil servants. Of course, these places need to stay interesting and active to avoid becoming a project that will wither over time. By combining the platform with a local food market, people can see and experience their local food production transitioning.

To transform a concept from conceptual to physical, I really had to think of the intervention as a user. 'How would I use it if I were a farmer? As a port worker? As an official or researcher?' It made me realize how important it is to really talk to the people you are designing for. Conceptually, everything is possible, but it needs to be suited to the system in which it exists as well as to the users you are designing it for.

9. INDIVIDUAL REFLECTION

LEONIE ZWIENINK

How can communities be portrayed and involved in a regional design project?

Making a regional design requires a more abstract way of working, while taking many social problems into account. The regional design however still affects people, even if they are not directly involved in the process on this scale. Therefore I found it interesting to find out how to involve people and their communities in the making of a regional design.

Creating personas

When the region was established, we had a clear overview on the locations and ecological qualities of the Delta region. The communities missed in this story. In order to visualise the different communities persona cards were made according to the identities of the different islands in the region. This was difficult to do, as there was not enough time to talk to people within these communities. I had to make assumptions based on statistics on their work, age, and political preference.

Spatialising communities

The personas were now created to be a 'spokesperson' for the different communities in the Delta region. To integrate the different communities into the vision for a healthy Delta we had to spatialise them into the maps of the Delta region. This was difficult for me, because a lot of information missed about the exact living environment of the Delta communities. When I

started diving more into the policies of the islands and identities provided by the municipalities in Zeeland, I got a better grip on the different people and their heritage of their islands. Most of all, the people were proud on their islands' heritage and feel connected to the water surrounding their living environment.

Participation

As the communities were established, we still needed to give them a platform to empower them. When making the catalogue, we came up with different elements to engage the communities. By involving the 'brede welvaart' and personas in this process, I was able to use the information for the different interventions and their influence on the different communities in the Delta region. The key projects created possibilities to work out the involvement of the communities in the region in more detail. It made it possible to pinpoint locations for field labs and routes to engage the communities. This interaction between regional and a more localised scale made it possible to understand interventions better and helped me in the process to finetune the personas and understanding of the communities.

Objectives

Future projects may differ in scale – working in a regional or on street level – but it is important to involve the people that I am designing for. A design is always made for and by humans, therefore it is vital for a good design to put the people in the centre of attention when making one.

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All icons except for the ecosystem services are retrieved from The Noun Project.com.

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10. APPENDIX

ANIMAL HABITAT MAP OF THE NETHERLANDS

Legend

Littoral biogenic habitat

- 0 - 0
- 0 - 1
- 1 - 5
- 5 - 10
- 10 - 156

Coastal habitats

- 0 - 0
- 0 - 1
- 1 - 5
- 5 - 10
- 10 - 113

Grassland

- 0 - 0
- 0 - 1
- 1 - 5
- 5 - 10
- 10 - 160

Heath and tundra land

- 0 - 0
- 0 - 1
- 1 - 5
- 5 - 10
- 10 - 85

Forest land

- 0 - 0
- 0 - 1
- 1 - 5
- 5 - 10
- 10 - 44

Vegetated man-made habitats

- 0 - 0
- 0 - 1
- 1 - 10
- 10 - 7
- 7 - 98

Natura2000

CLC2018

- Urbanisation
- Dune
- Wetland

basin Rhine and Seine

- Rhine
- Seine
- Water

0 10 20 km



Source: CLCC 2018 Dataset



10. APPENDIX

INFRASTRUCTURE AROUND THE DELTA

Legend

Railway

— rail

— Motorway

— primary roads — Primary roads

— Secondary roads — secondary road

Protected Green structure NNN

CLC2018

■ Urbanisation

■ Port, rail and road associated land

■ Water

Source: CLCC 2018 Dataset

0 10 20 km



10. APPENDIX

DELTA AS A PRODUCTION LANDSCAPE

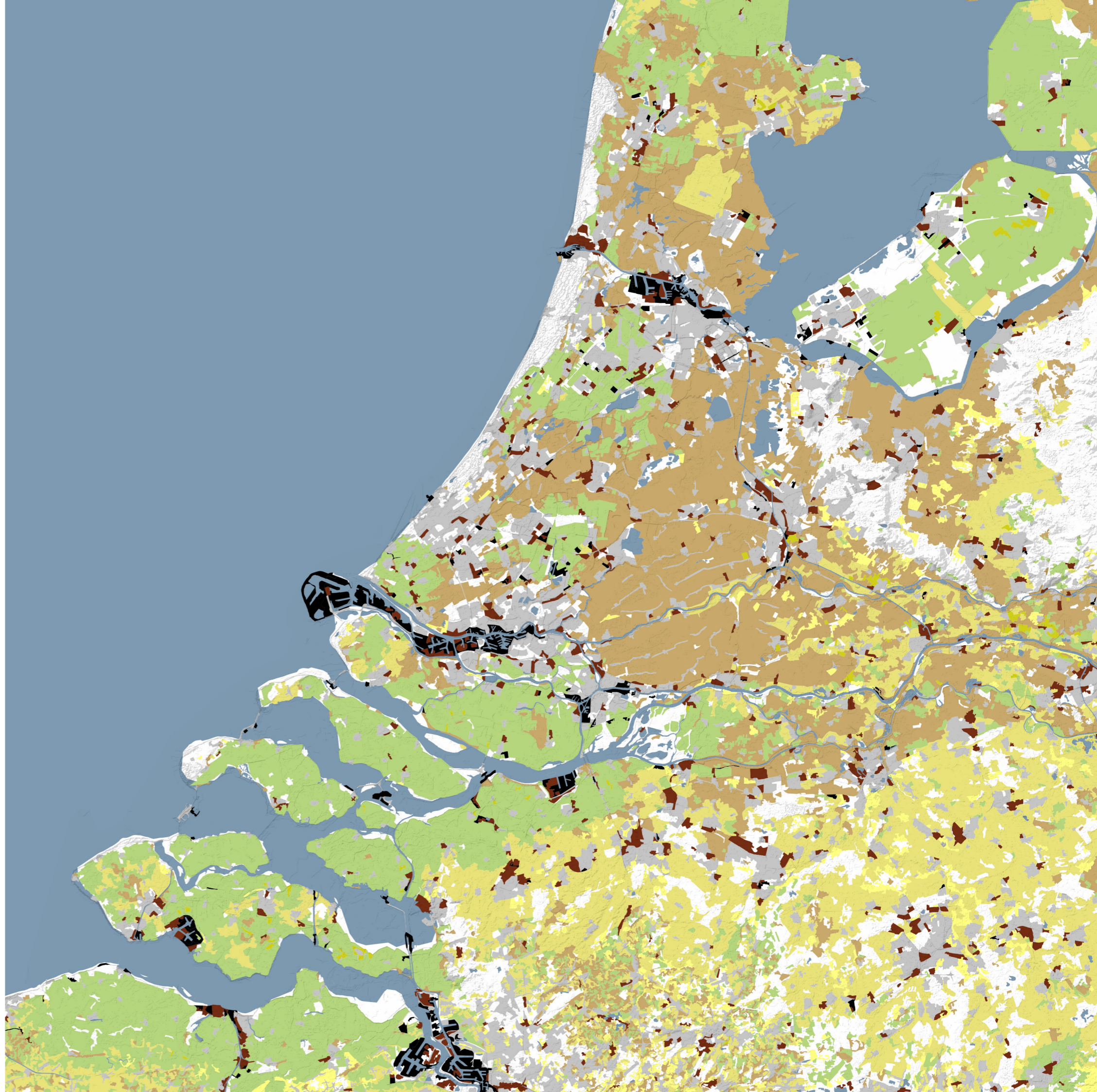

Legend

Landuse

- Urbanisation
- Industrial and commercial practices
- Port
- Non-irrigated arable land
- Vineyards
- Fruit trees and berry plantations
- Pastures
- Complex cultivation patterns
- Land principally occupied by agriculture, with significant areas of natural vegetation
- Agro-forestry areas
- Water

Source: CLCC 2018 Dataset

0 10 20 km



10. APPENDIX

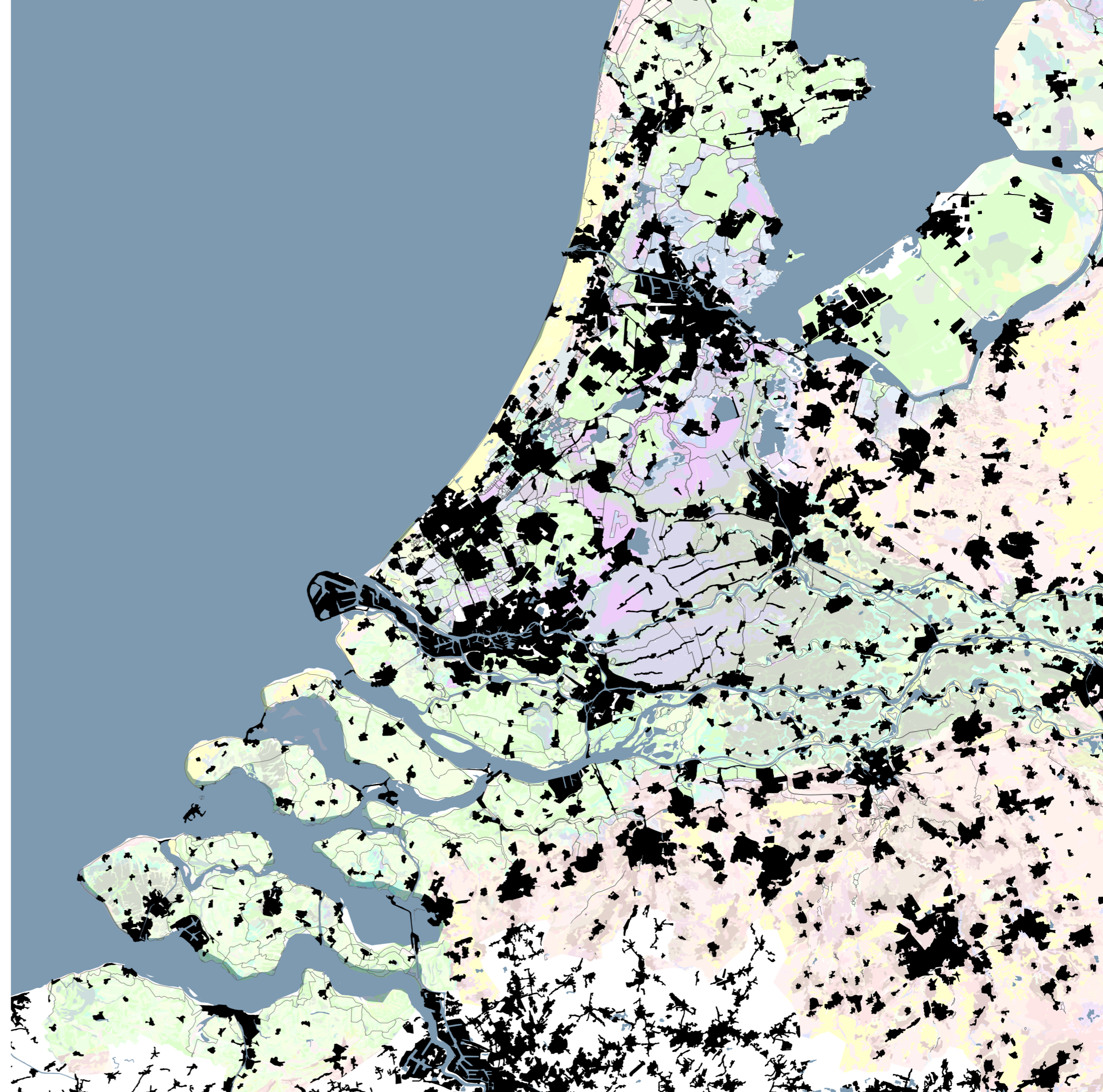
SOIL TYPE MAP OF THE NETHERLANDS

Legend

- 1001 Dikke veengronden: kleig moerige bovengrond op bos-/zeggeveen
- 1002 Dunne veengronden: moerige bovengrond op veen op zand zonder podzol
- 1003 Dunne veengronden: moerige bovengrond op veen op klei
- 1004 Dunne veengronden: kleig moerige bovengrond op veen op klei
- 1005 Dunne veengronden: zandige bovengrond op veen op zand zonder podzol
- 1006 Dikke veengronden: (kleig) moerige bovengrond op veenmosveen
- 1007 Dikke veengronden: zandige bovengrond op zeggeveen
- 1008 Dunne veengronden: kleibovengrond op veen op zand I
- 1009 Veenafbraakgebied (alleen in NOP)
- 1010 Dikke veengronden: moerige bovengrond op zeggeveen
- 1011 Dunne veengronden: veenkoloniaal dek op veen op zand met podzol
- 1012 Dikke veengronden: kleibovengrond op bos-/zeggeveen
- 1013 Dunne veengronden: moerige bovengrond op veen op zand met podzol
- 1014 Dunne veengronden: zandbovengrond op veen op zand met podzol
- 1015 Dikke veengronden: klei(ig) dek op veenmosveen
- 1016 Dunne veengronden: kleibovengrond op veen op zand II
- 1017 Dunne veengronden: kleigige bovengrond op veen op zand
- 1018 Dikke veengronden: kleidek op bos-/zeggeveen of klei
- 2001 Moerige gronden met zanddek
- 2002 Moerige gronden met veenkoloniaal dek
- 2003 Moerige gronden met kleiondergrond
- 2004 Moerige gronden met kleidek en zandondergrond (Flevoland)
- 2005 Moerige gronden met kleidek en zandondergrond
- 2006 Moerige gronden met moerige bovengrond I
- 2007 Moerige gronden met moerige bovengrond II
- 3001 Zandgronden (kalkrijk) met veenondergrond
- 3002 Sterk lemige zandgronden met kleidek (eerdgronden en vaaggronden in zeezand)
- 3003 Grofzandige zandgronden I
- 3004 Sterk lemige zandgronden I
- 3005 Sterk lemige enkeerdgronden
- 3006 Grofzandige zandgronden II
- 3007 Zwak lemige zandgronden met cultuurdek
- 3008 Zwak lemige zandgronden met oude-kleiondergrond
- 3009 Zwak lemige zandgronden I
- 3010 Grofzandige zandgronden met kleidek
- 3011 Zwak lemige zandgronden met kleidek (vaaggronden)
- 3012 Zwak lemige enkeerdgronden
- 3013 Zwak lemige enkeerdgronden of cultuurdek (kustregio)
- 3014 Zwak lemige zandgronden II
- 3015 Zwak lemige zandgronden III
- 3016 Sterk lemige zandgronden II
- 3017 Grofzandige zandgronden met kleiondergrond
- 3018 Sterk lemige enkeerdgronden met oude-kleiondergrond
- 3019 Zwak lemige zandgronden IV
- 3020 Sterk lemige zandgronden met oude-kleiondergrond
- 3021 Sterk lemige zandgronden III
- 3022 Sterk lemige zandgronden met kleidek (vaaggronden in dekzand)
- 3023 Zwak lemige zandgronden met kleidek (podzol- en eerdgronden)
- 4001 Knipkleigronden (zavel en lichte klei)
- 4002 Kleigronden (klei) op veen
- 4003 Kleigronden (klei) op homogene ondergrond (soms met veen) I
- 4004 Kleigronden (lichte zavel) op homogene ondergrond I
- 4005 Kleigronden (klei) met veentussenlaag of veenondergrond
- 4006 Kleigronden (zavel) op veenondergrond
- 4007 Kleigronden (zware klei) homogeen of op zware klei tussenlaag of op veen
- 4008 Kleigronden (klei) op zandondergrond I
- 4009 Kleigronden (zavel) op zandondergrond I
- 4010 Kleigronden (zware klei) op zware kleitussenlaag of zware kleiondergrond
- 4011 Kleigronden (zware zavel) op homogene ondergrond (soms met veen) I
- 4012 Kleigronden (klei) op zandondergrond II
- 4013 Oude kleigronden (zware zavel en klei)
- 4014 Kleigronden (klei) op homogene ondergrond (soms met veen) II
- 4015 Kleigronden (zware klei) op veen
- 4016 Kleigronden (zavel en lichte klei) op homogene ondergrond
- 4017 Oude kleigronden (lichte zavel op grof zand)
- 4018 Kleigronden (zware zavel) op homogene ondergrond (soms met veen) II
- 4019 Kleigronden (lichte zavel) op homogene ondergrond II
- 4020 Kleigronden (zware zavel) op homogene ondergrond (soms met zand)
- 4021 Knipkleigronden (zware klei) en kleigronden met katteklei
- 4022 Kleigronden (zavel) op zandondergrond II
- 4023 Kleigronden (lichte zavel) op homogene ondergrond III
- 4024 Kleigronden (zavel) op zandondergrond III
- 5001 Keileemgronden
- 5002 Kalksteenverweringsgronden
- 5003 Tertiaire kleigronden
- 5004 Leemgronden: zandige leem zonder briklaag
- 5005 Leemgronden: zandige leem met briklaag
- 5006 Leemgronden: met esdek
- 5007 Leemgronden: siltige leem
- Water

Source: CLCC 2018 Dataset






0 10 20 km



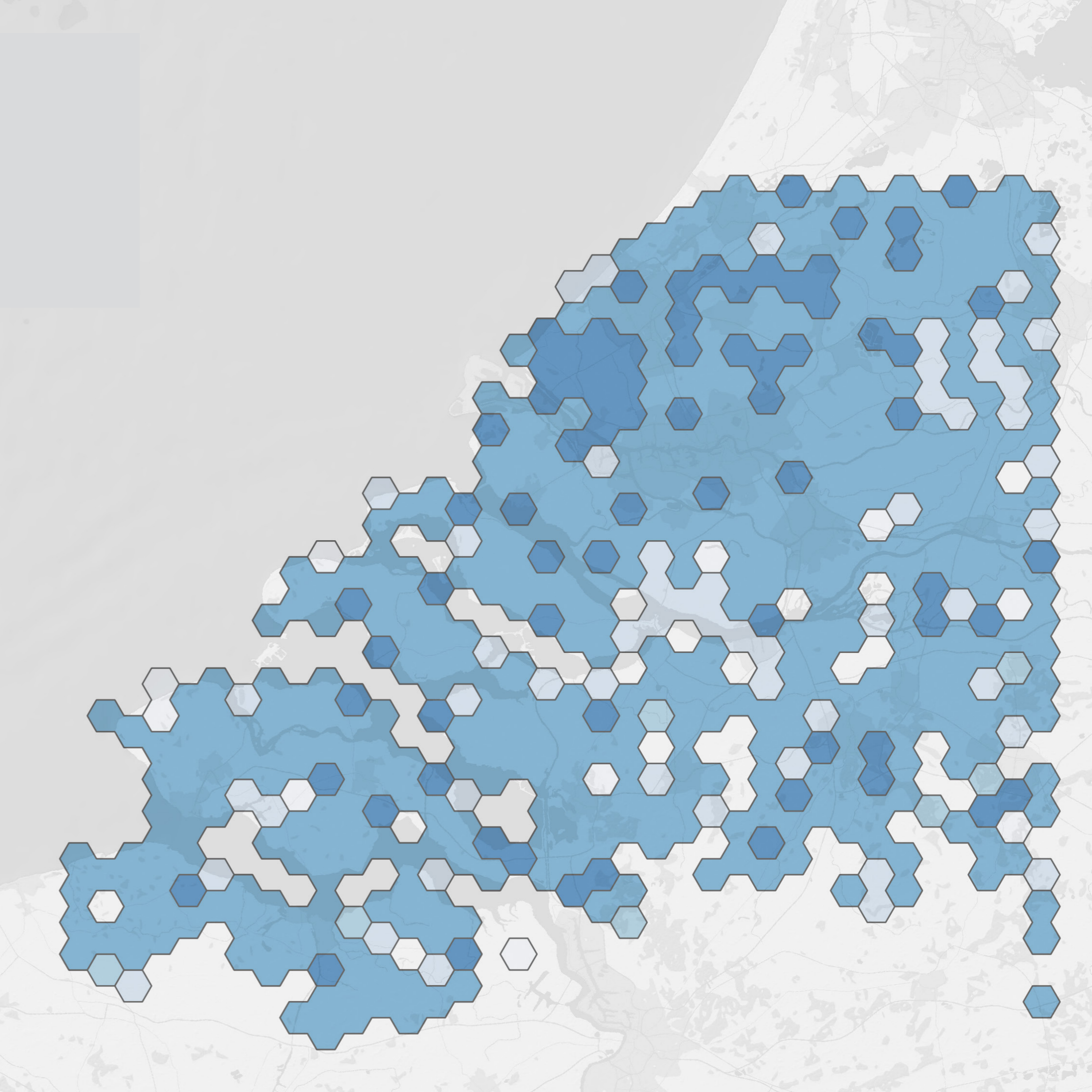
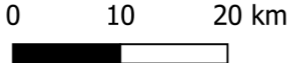
10. APPENDIX

WATER QUALITY MAP OF THE DELTA REGION

Legend

-  No Toxicity
-  Low Toxicity
-  Moderate Toxicity
-  High Toxicity
-  Very High Toxicity

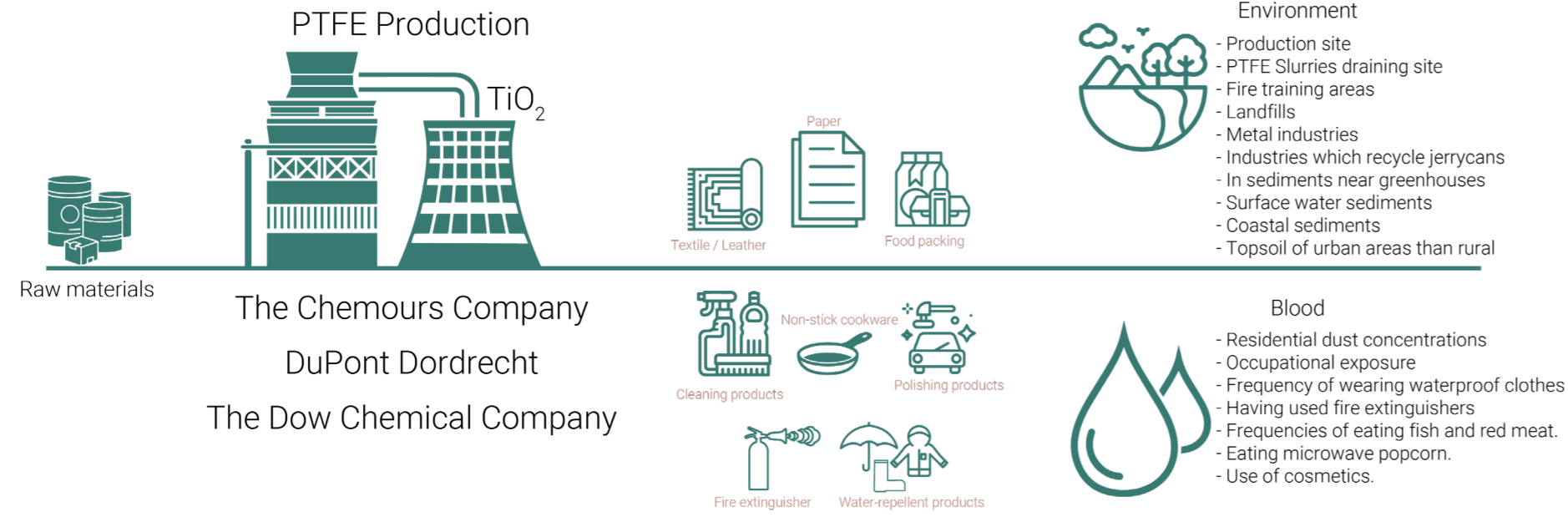
Source: CLCC 2018 Dataset



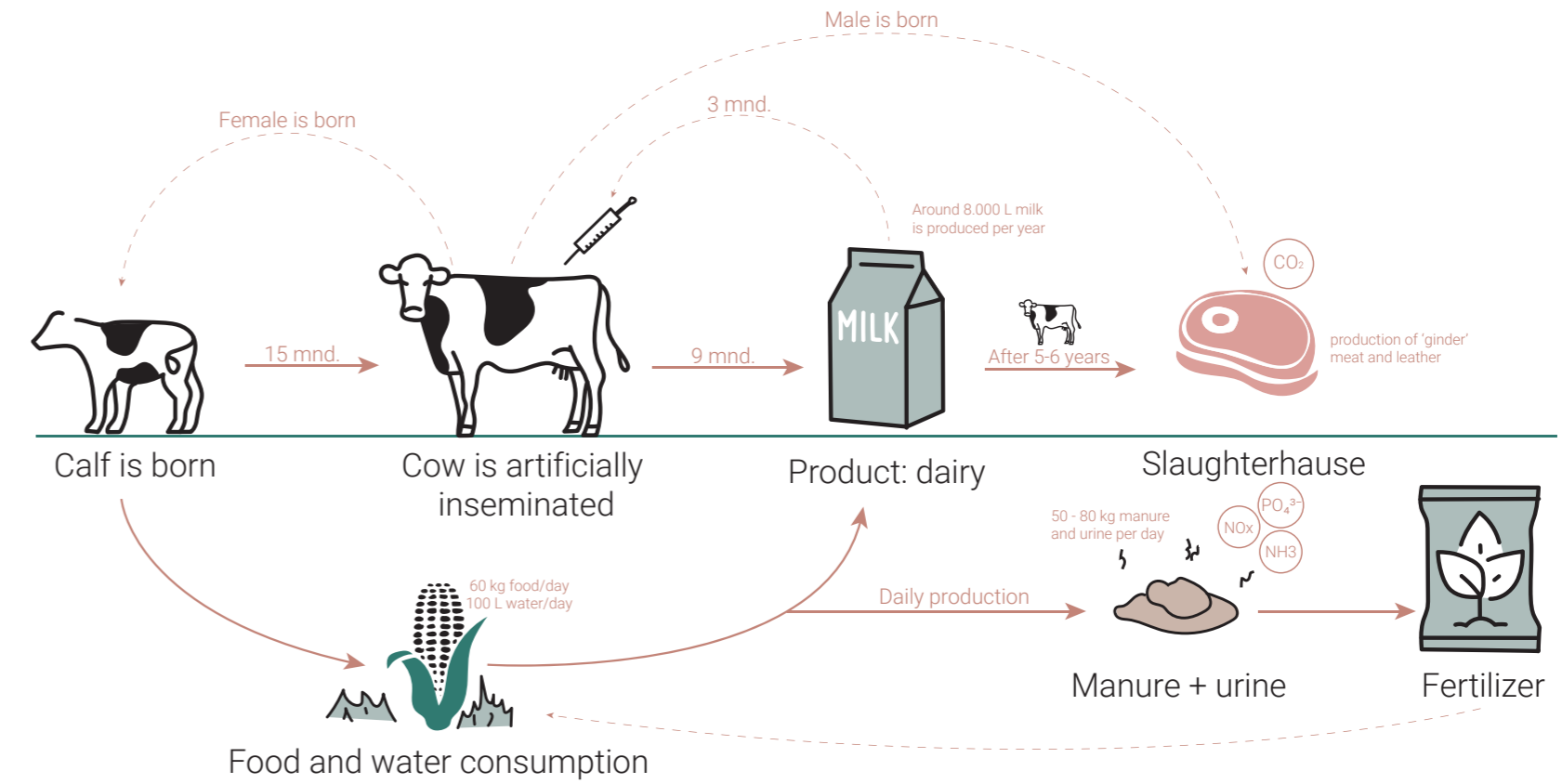
10. APPENDIX

PRODUCTION CYCLES AND PROCESSES

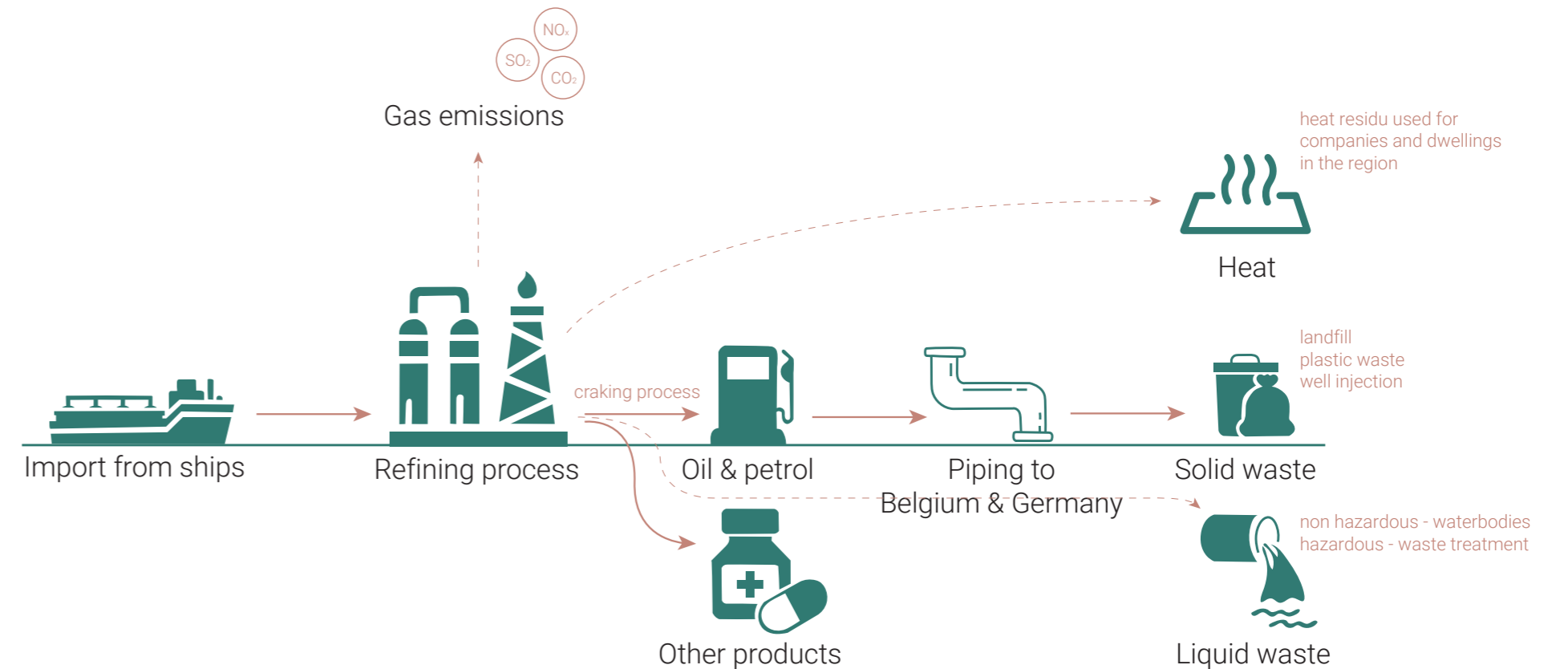
Manufacturing Industry (PFAS)



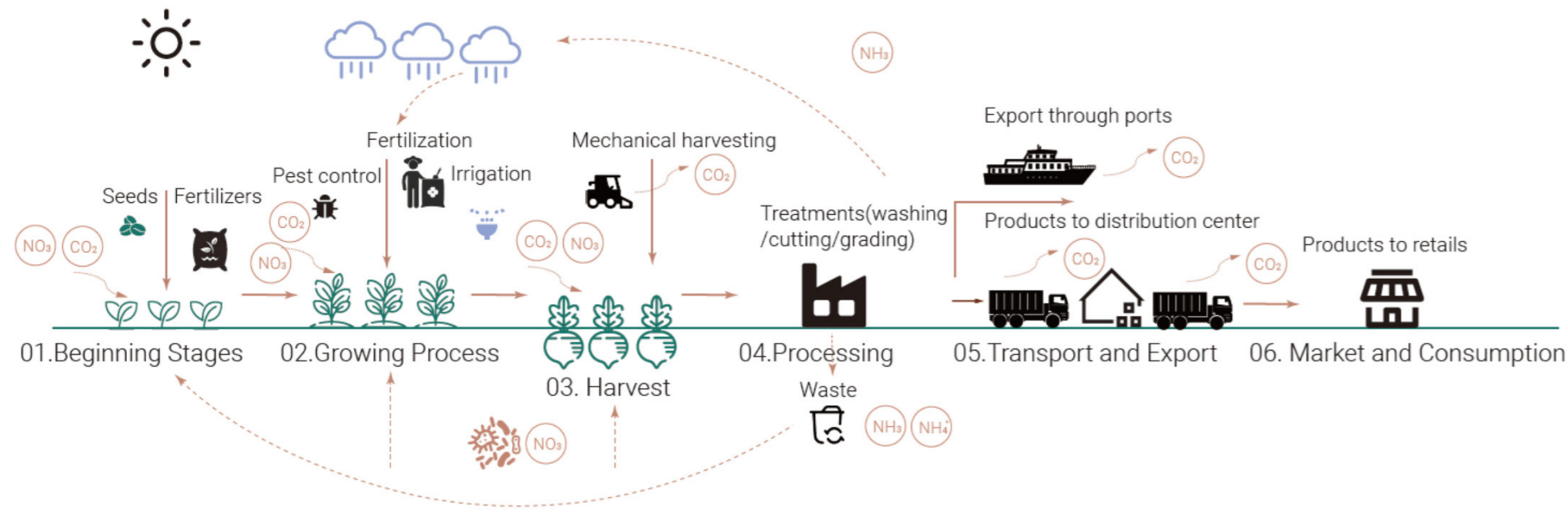
CYCLE OF DAIRY PRODUCTION



PETROLCHEMICAL INDUSTRY PROCESS

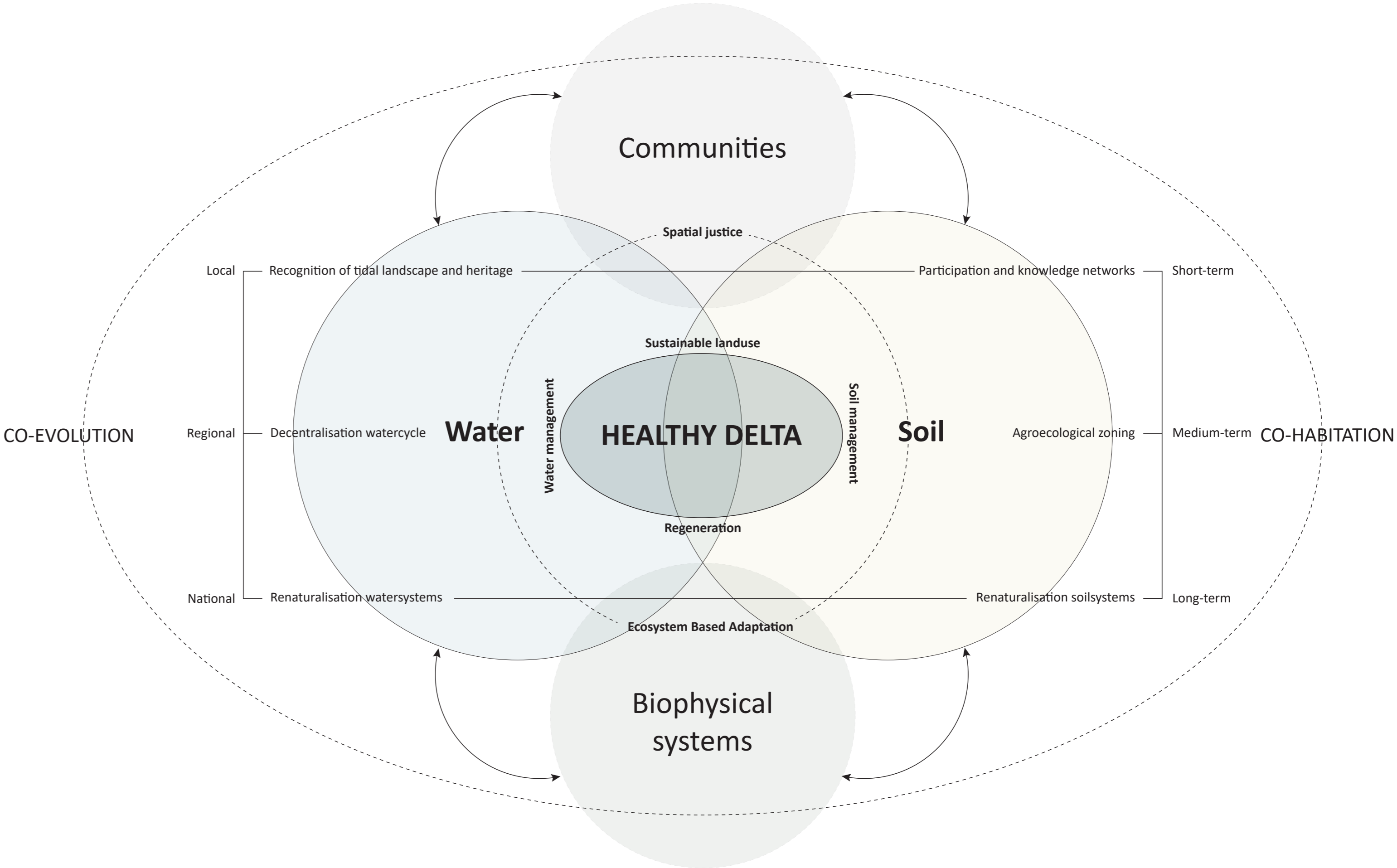


CYCLE OF CROP PRODUCTION



10. APPENDIX

CONCEPTUAL FRAMEWORK
(ZOOMED IN)



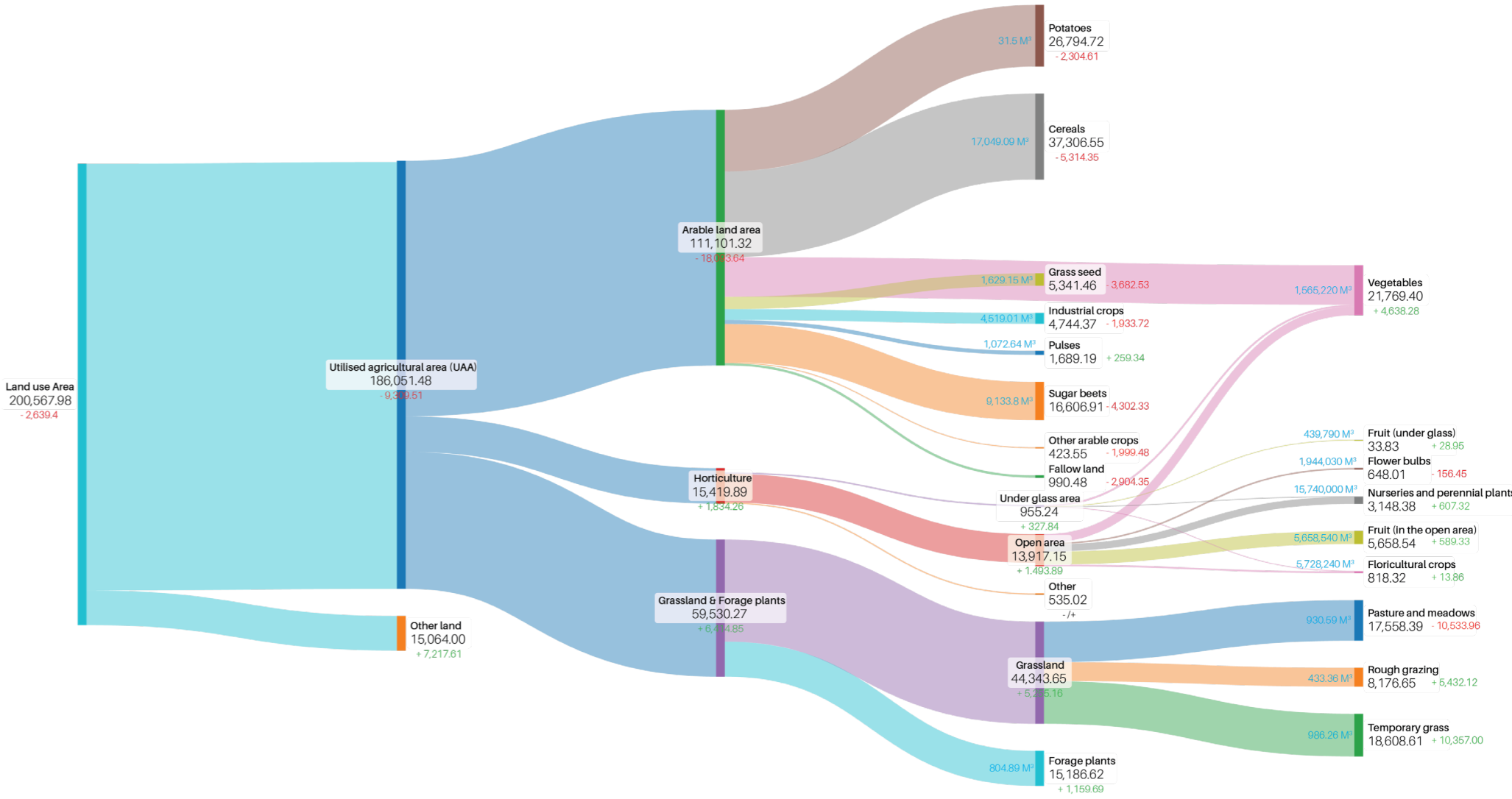
10. APPENDIX

EXTENDED STAKEHOLDER ANALYSIS

Actor	Size	Attitude	Reasons for support/resistance	Attitude we need	Catalyst for attitude change	Tools
Fishery	Local	Proponent	Support: Securing their practices in the area. Dependence on water quality and safety. Recognition of their work and products. Resistance: Used to consistency in their environment. Feeling of none recognition in the strategy making.	From dependence on the ecosystem, we need the fishermen to be come more interested in the health of the environment. We need them to want to take a shepherding role .	Sharing knowledge with the fishermen to make them understand their influence on their surrounding and how a healthy Delta can support their positions. Also giving them a voice in the designing and regulating of the waterscapes. Recognising their relation between them and the Delta. Incentives to transition towards more nature-based practices.	<ul style="list-style-type: none"> Platforms for sharing knowledge and meeting other farmers and organizations Seasonal table discussions between farmers associations, DAW, FDZ, water board and municipality Digital tool to share resources between farmers and updates of governmental activities in the region Tax reduction for reduced use of fertilizers, pesticides and freshwater. Subsidies for field labs and demofarmers to explore sustainable agricultural practices. Market place on each island to directly sell farmer products to local communities.
Shellfish farmers	Local	Proponent	Support: Securing their practices in the area. Dependence on water quality and safety. Recognition of their work and products. Resistance: Used to consistency in their environment. Feeling of none recognition in the strategy making.	From dependence on the ecosystem, we need the shellfish farmers to be come more interested in the health of the environment. We need them to want to take a shepherding role .	Sharing knowledge with the shellfish farmers to make them understand their influence on their surrounding and how a healthy Delta can support their positions. Also giving them a voice in the designing and regulating of the waterscapes. Recognising their relation between them and the Delta. Incentives to transition towards more nature-based practices.	<ul style="list-style-type: none"> Market place on each island to directly sell farmer products to local communities. (digital) Platforms for sharing knowledge. Added waterbus-line and subsidising public transport.
Arable farmers	Local	Opponent	Support: Securing their practices in the area. Dependence on soil quality, water quality, access and safety. Recognition of their work and products. Resistance: Used to consistency in their environment and work. Need of availability of arable land. Feeling of none recognition in the strategy making.	We need the farmers to get interested in the systems of their environment and accept the salinization of the area. Thus, adapting their work methods to the need of the Delta .	Sharing knowledge with the farmers to make them understand their influence and how a healthy Delta can support their positions. Also giving them a voice in the designing the landscape. Recognising their relation between them and the Delta. Incentives to transition towards more nature-based practices.	<ul style="list-style-type: none"> Spaces to facilitate their activities. Connection to the municipality and province. Digital tool to share their information and developments.
Food Delta Zeeland	Regional	Neutral	Support: Securing collaborative agricultural practices in the area. Dependence on soil quality, water quality, access and safety. Recognition of local work and products. Resistance: The quick transition in the food production methods can put heavy pressure on the farmers. Feeling of none recognition in the strategy making.	Food Delta Zeeland has the potential to become the connector between policymakers and the local farmers (associations). It needs to take a bridging position.	They need to be able to share their knowledge and have room to facilitate their activities as collaboration initiator. Recognition in the governmental space is necessary.	<ul style="list-style-type: none"> Digital tool to share their information and developments. Subsidies to help them initiate field labs.
Deltaplan Agrarisch Waterbeheer	Regional	Proponent	Support: Research into sustainable agricultural practices. Increasing policy and physical space for field labs and demo farmers. Resistance: Top-down strategies and zoning.	Deltaplan Agrarisch Waterbeheer already started as organizer of local research initiatives . This position needs to be preserved and their work needs to be appreciated.	To preserve their attitude and expand their practices, the organization needs to be funded and given space to share their results .	<ul style="list-style-type: none"> Market place on each island to directly sell farmer products to local communities. (digital) Platforms for sharing knowledge. Added waterbus-line and subsidising public transport.
Tourism industry	Local	Neutral	Support: Securing their practices in the area. Dependence on qualitative and healthy landscape. Access to local goods and resources. Resistance: Used to consistency in their environment. Potential to grow in size and (car-) infrastructure that is suited to it.	Campings can help promote the naturalisation of the area . We need to get them interested in this transition and accept the changes coming. Also as platform for local products and practices.	Sharing knowledge with the camping owners how a healthy Delta can support their practices and how they can help support the transition. Giving them access to local products and resources. Preserving and/or enhancing the quality and access of mobility .	<ul style="list-style-type: none"> Tax reduction for reduced nitrogen pollution and fresh water use. (digital) Platforms for sharing knowledge. Connect to hydrogen transition. Polluters pay.
Energy and manufacturing companies	Provincial	Neutral	Support: Need to clean energy for their future operations. Economic potential in hydrogen transition. Resistance: Lot of investment is necessary or change while the sustainable energy market is uncertain and unfamiliar.	The industries as front-runners of sustainable change . The need to explore the local potentials of the landscape and be interested in their influence on their environment.	Provide incentives for clean energy investments and highlight the long-term cost savings and market advantages of early adoption.	<ul style="list-style-type: none"> Tax reduction for reduced nitrogen pollution and fresh water use. (digital) Platforms for sharing knowledge. Connect to hydrogen transition. Polluters pay.
Port of Rotterdam and Antwerp	National	Neutral	Support: Good water management and protection of trading routes. Resistance: Lack of urgency because industry recognise activities for economy and employment as more important.	The ports need to be a catalyst towards sustainable port practices . This means it needs to be come more interested and involved in the energy transition and environmental needs of the river.	Demonstrate the economic risks of environmental neglect , and the benefits of sustainable trade routes to secure industry buy-in.	<ul style="list-style-type: none"> Market place on each island to directly sell farmer products to local communities. (digital) Platforms for sharing knowledge. Connect to hydrogen transition. Polluters pay.
Local residents	Local	Neutral	Support: Main users of drinking water, recreational services, infrastructure and flood protection. Resistance: Have strong connection to the landscape but feel left out in the transitions.	Residence join the farmers in this transition and help them by buying local, recreating locally and getting educated in local practices.	Sharing knowledge with the local residents how a healthy Delta can support their livelihood and educating them how they can help support the local transition. Giving them access to local products and resources. Preserving and/or enhancing the quality and access of mobility .	<ul style="list-style-type: none"> Subsidizing research which connects to local expertise and academia. Added waterbus-line and subsidising public transport.
University of Applied sciences Zeeland	Provincial	Neutral	Support: Expanding the knowledge on water safety and sustainability. Securing the ability to give education and supports regional academic growth. Resistance: Funding and professional researchers are needed.	The research institutions needs to be the connecting figure between top and bottem-stakeholders . Empowering the agri-communities to be meaningful involved in the transitions.	Campaign for increased funding by showcasing the societal and environmental impacts of research and its role in innovation, to local as well as provincial stakeholders. Enhance regional accessibility to the university.	<ul style="list-style-type: none"> Subsidizing research which connects to local expertise and academia. Added waterbus-line and subsidising public transport.
Royal Netherlands Institute for Sea Research (NIOZ)	National	Proponent	Support: Expanding the knowledge on aquaculture, aqua biodiversity, water safety and sustainability. Resistance: Funding and professional researchers are needed.	The research institutions needs to be the connecting figure between top and bottem-stakeholders . Empowering the agri-communities to be meaningful involved in the transitions.	Campaign for increased funding by showcasing the societal and environmental impacts of research and its role in innovation, to local as well as provincial stakeholders. Enhance regional accessibility to the research facilities.	<ul style="list-style-type: none"> Platforms for sharing knowledge and meeting local organizations A seat at seasonal table discussions between farmers and government. Subsidise joined field labs between Natuurmonumenten and farmers.
Natuurmonumenten	National	Proponent	Support: Protecting nature and heritage. Representing the voice of nature. Resistance: Quick and drastic changes in the environment can be harmful for the ecosystems.	Natuurmonumenten needs to stay the voice of nature and help connect locals, officials and companies understand the needs of their environment.	Advocate for measured and scientifically guided environmental actions that prioritize ecological stability and resilience. Give a seat to the NGO in the policy and strategy making.	<ul style="list-style-type: none"> Subsidising buy-out of farmers and informational events. Digital tool and physical newsletters to share their information and developments.
Municipality of Tholen, Reimerswaal and Kapelle	Municipal	Neutral	Support: Securing drinking water safety, flood protection and sustainable environment. Resistance: Balancing local economic development and environmental protection	The municipality needs to prioritize water pollution over economic growth to maintain water quality and safety. Advocate for ecosystem based adaptation and community based strategizing .	Municipalities need to incorporate ecosystem based adaptation in to their decision and strategy making. Their needs to be a collaboration with higher scale governance and lower scale organizations. They also need funds to buy-out or support farmers.	<ul style="list-style-type: none"> Digital tool and physical newsletters to share their information and developments. Platforms for sharing knowledge and meeting local organizations. A seat at seasonal table discussions between farmers and government.
Water board Scheldestromen	Regional	Proponent	Support: Securing water safety and quality for citizens and sees it as a core issue in sustainability and regional development. Resistance: Pollution from industry and abuse of pesticide.	The water commission Scheldestromen needs to encourage clean energy and agriculture activities and help rethink watermanagement within a natural tidal landscape.	Incorporating ecosystem based adaptation into their vision and strategies. Connecting with researchers and local industries to find the new perspective on the delta land use.	<ul style="list-style-type: none"> Digital tool to share their information and developments. Platforms for sharing knowledge and meeting local organizations. A seat at seasonal table discussions between farmers and government.
Province of Zeeland	Provincial	Neutral	Support: Secure water safety, tackle sustainability challenges, and promote regional development Resistance: Facing difficulties with uniform legislation and differing economic urgencies across province	The province of Zeeland needs to put more effort into legislation and research to secure the water safety and quality .	Foster regional economic development plans that align with water safety and sustainability efforts, demonstrating the long-term economic benefits of environmental investment.	<ul style="list-style-type: none"> Platforms for sharing knowledge and meeting local organizations. A seat at seasonal table discussions between farmers and government. Legalization and organsation to support cross-border corporation.
Ministry of Infrastructure and Water Management	National	Proponent	Support: Securing water quality and safe water management. Resistance: Balancing different regional urgencies and the economical impacts within the country	The Ministry need to be more interested in the health of the Delta . Thus also creating more legalization, laws and regulation to enforce more sustainable practices.	Implementing a water management framework that can be tailored to regional needs, showing that environmental strategies can be economically beneficial. Giving space for legislation that presses polluters.	<ul style="list-style-type: none"> Platforms for sharing knowledge and meeting local organizations. A seat at international discussions between farmers associations and government. Legislation and organization to support cross-border corporation. Polluters pay.
River commissions (ICPR, VNSC & CIM)	Continental	Proponent	Support: Securing water safety, quality and trade in the Schelde-Rhine-Meuse Delta. Challenging polluters and restraining harmful urban growth. Resistance: The need of funding and the possible changes in trading routes.	This commission needs to be the shepherd of the developments in the river basin . Enforcing polluters to transition towards more clean industrial or agricultural practices.	Lobby for strategic investments that highlight the benefits of water safety and quality, ensuring economic stability and public health. Giving space for legislation that presses polluters.	<ul style="list-style-type: none"> Digital tool to share their information and developments. A seat at international discussions between farmers associations and government. Legislation and organization to support cross-border corporation. Polluters pay.
European Union	Continental	Proponent	Support: Secure water safety for European citizens. Dealing with challenges in sustainability and regional development. Resistance: Difficulty to legislate actions of nations and economic activities.	The European Union needs to be more involved in the maintenance of the water quality and management. This can be done through legislation and research. Being a mediator between public and private sector. A means to support cross-border collaboration .	Facilitate EU-wide discussions to harmonize water management laws with economic strategies, ensuring legislation supports both environmental and economic health.	<ul style="list-style-type: none"> Digital tool to share their information and developments. A seat at international discussions between farmers associations and government. Legislation and organization to support cross-border corporation and ecosystem based adaptation. Polluters pay.

10. APPENDIX

SANKY DIAGRAM:
EXPLORING LAND
DISTRIBUTION IN THE
DELTA REGION (IN HA)



Source: CBS