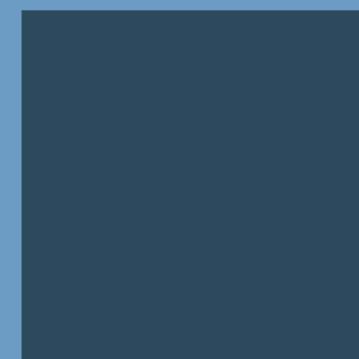
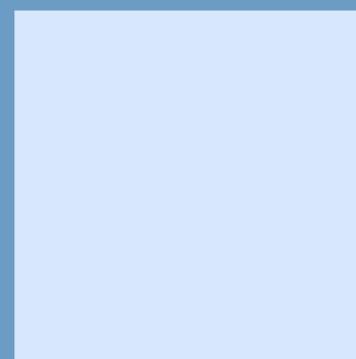


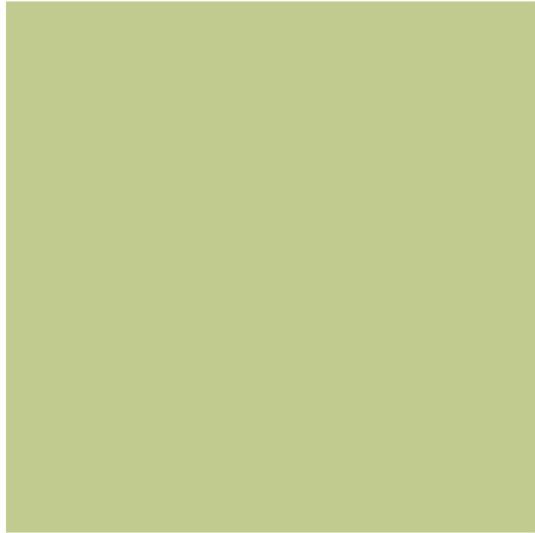
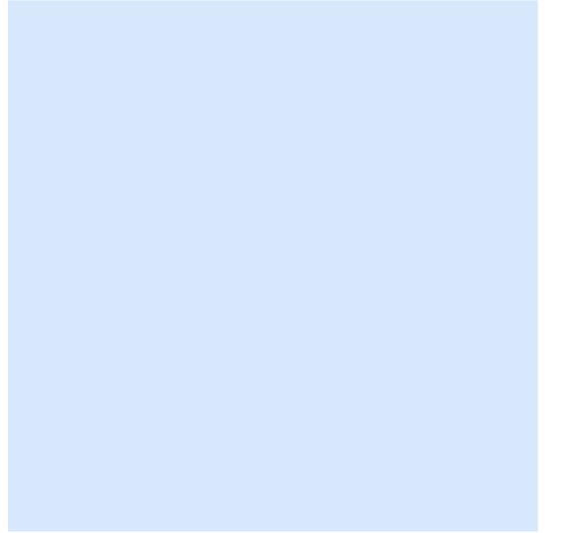
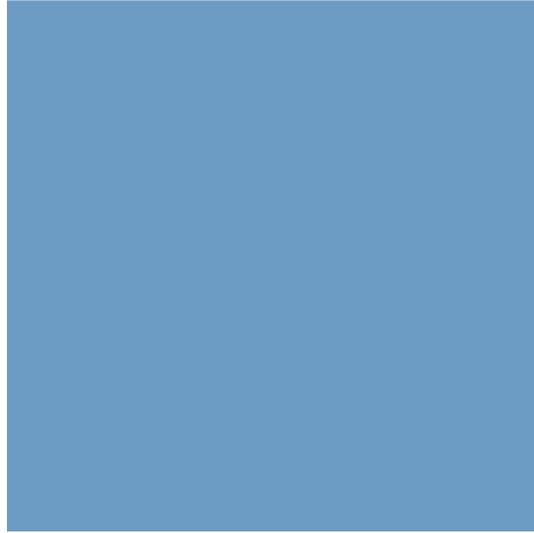
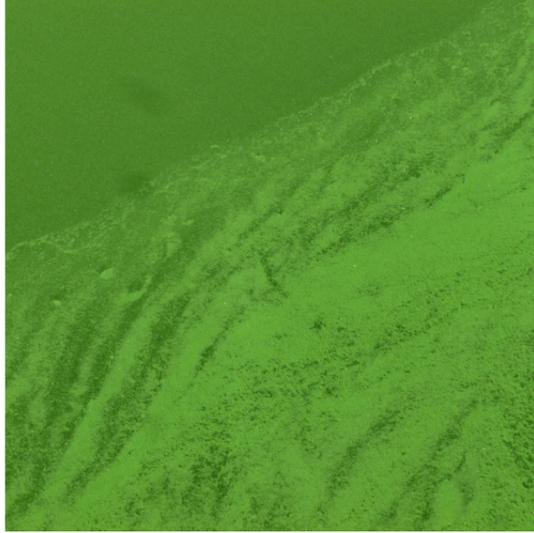
Saline flood



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Analysis and vision
MA+U Master of Architecture – Master of Urbanism
Tilburg
25 October 2015





The area bounded by the waters Volkerak, Krammer, Scheldt-Rhine Canal and the Zoommeer in the South West of the Netherlands forms Waterpoort. It used to have a dynamic delta, but after the construction of the Deltaworks became the coastline stable. Aside from the obtained control of the waterfront had the intervention some other consequences on the area. A few negative ones made the site spatially less attractive and usable. This development ensured government involvement. What translated in a government structural vision for the area. The structural vision describes drastic changes for the area and the transformation towards the new vision should be done by 2028. The biggest change will be that the Volkerak Zoommeer will change from fresh to salt water. This and the other changes will have (again) spatial consequences for Waterpoort. The urgency that comes with this development, serves as the basis of our graduation studio.

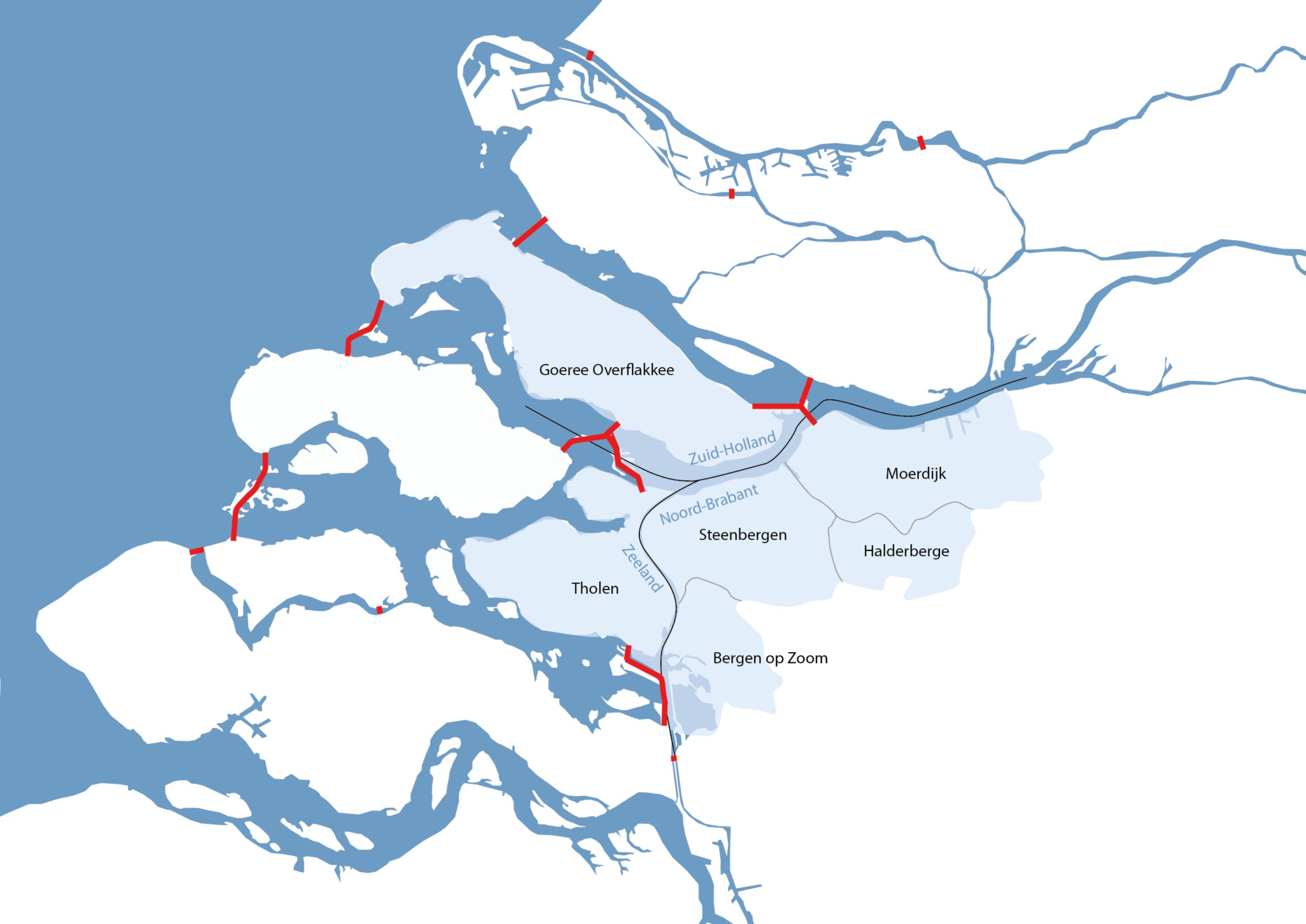
The Waterpoort site is reduced for a more specific geographical research. The new project location is formed during the process of the research itself. Bergen op Zoom, Scheldt-Rhine Canal, Volkerak, Dinteloord and Steenbergem make the new borders.

This publication describes our analysis of the historic development of the area, the plans described by the government structural vision, upcoming issues for the area and how the area is working now. All this information leads to a vision for the location. The publication ends with a first idea for the individual projects.

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Tilburg, 25 October 2015

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Goeree Overflakkee

Zuid-Holland

Moerdijk

Noord-Brabant

Steenbergen

Halderberge

Tholen

Zeeland

Bergen op Zoom



Waterpoort is an area who overlays three Dutch provinces: Noord-Brabant, Zuid-Holland and Zeeland. The region is one of the eight Brabantse areas in which the province is investing to create the spatial connection.

To achieve this is an organization created. The organization has as purpose to have overview on an area where are different interests and scales of spatial tasks. What makes a balanced, high-quality development possible. Waterpoort's work method is to bring entrepreneurs, governments and citizens with initiatives together to strengthen the quality and uniqueness of the region as a whole.

Province Noord-Brabant works together with different parties on the area development of Waterpoort around the Volkerak-Zoommeer both in and outside the provincial borders. A cooperation agreement between the parties was signed on 27 June of 2013 in Benedensas. This cooperation agreement describes the six municipalities around the Volkerak and Zoommeer, supported by the three provinces, Waterschap, land managers, ZLTO, business world and education to work on a robust, vital and self-conscious region.

Waterpoort

Municipalities:

Bergen op Zoom, Halderberge, Moerdijk, Goeree-Overflakkee, Steenbergen en Tholen

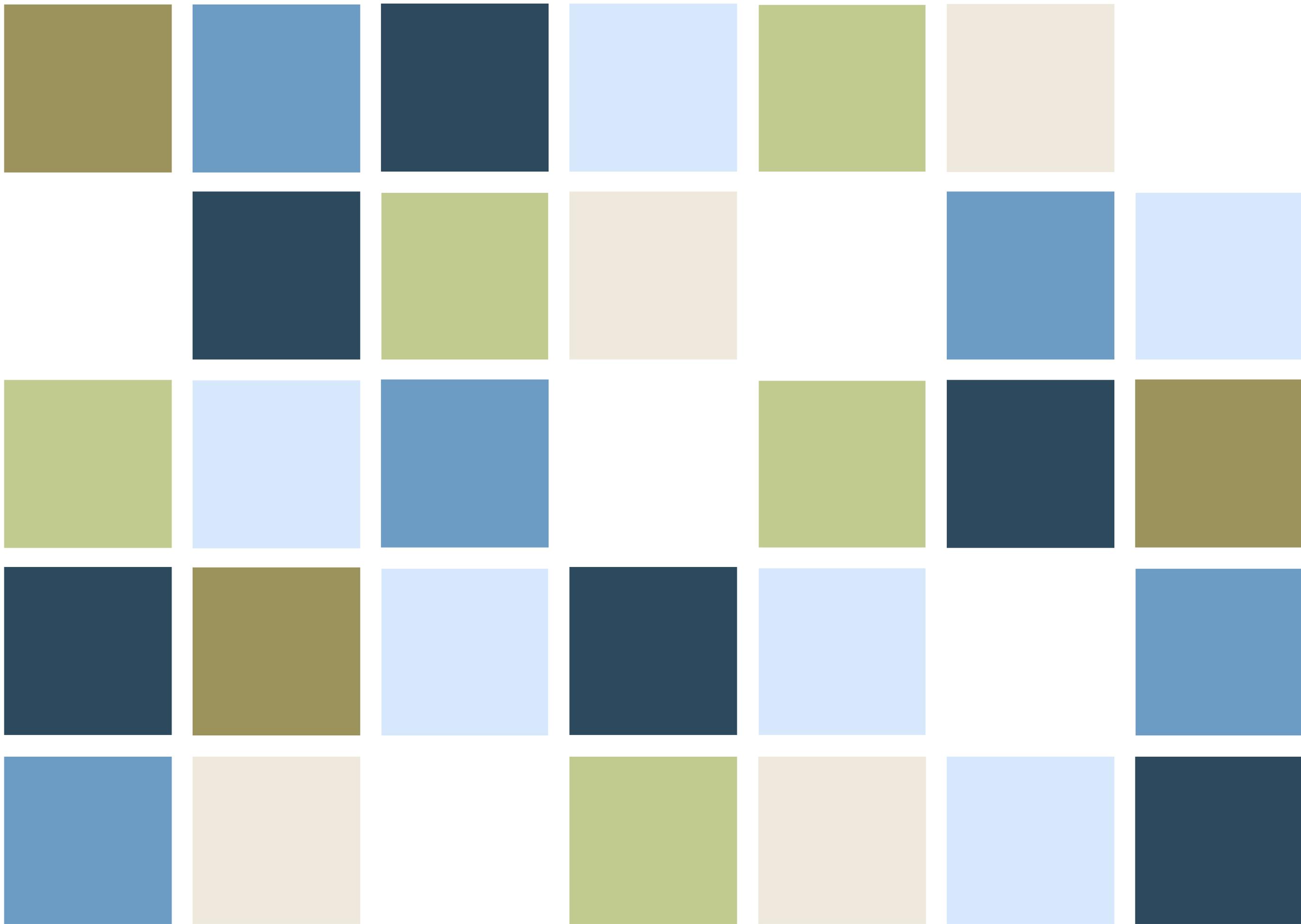
The waters:

Krammer, Mark, Dintel and Vlietboezem, Rhine-Scheldt canal, Volkerak and Zoommeer

Verder werken mee:

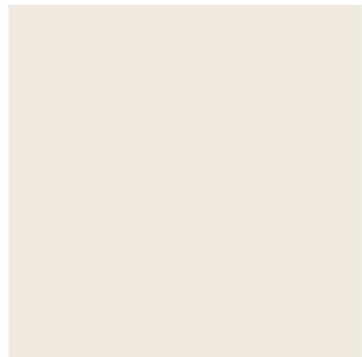
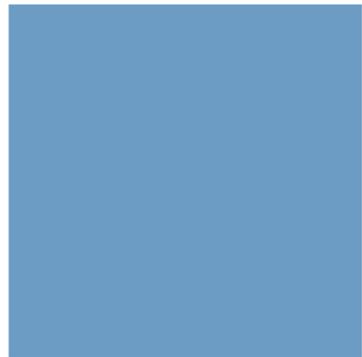
Province Noord-Brabant, province Zuid-Holland, province Zeeland, the region West-Brabant, Waterschap de Brabantse Delta, Brabants landscape, the Forestry and Natural Monuments.







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Hypothesis

HISTORY

The battle against the water is one of the things which The Dutch are famous for. The Dutch are trying to defend their land against the water for centuries. This battle was won by nature several times. The last time was in 1953. 1835 people lost their lives. One thing was for sure after that event: 'that cannot happen again'. The Dutch government decided to build the Delta Works which are world famous. The Delta Works secure safety at times of storms and high sea levels.

The Delta plan solved the flood problem of Zeeland, but created bigger problems in West-Brabant. For the safety west Brabant has paid a high price. The water of the Volkerak – Zoommeer transferred from salty to fresh water. That caused big natural and spatial changes in this area. In earlier days the cities had connection with water and they were oriented to the sea. Because of the Delta Works, cities lost their relation with the water which was the origin of their existence. The change of the water from salty to fresh caused the decrease in the water quality of the lake. The bad water is a treat to the nature as well as the human health. Nowadays the cities turned their back to the water. Now the water is a barrier.

It took 35 years for the nature to find a balance again, but still the situation is unsatisfying. The main problem that follow the water type change is the grow of cyanobacteria in the fresh water. Besides that there is another problem if we don't do anything the water will slowly become brackish. The soil also contains salt which causes twice as much salinization on the agricultural areas. Salinization is not only the problem of this area, but a problem which worldwide occurs. Sooner or later people have to do research about saline ground which we don't know much about it.

IDEA OF THE NATIONAL GOVERNMENT

We can avoid salinization by bringing more fresh water to the area which is expensive and unrealistic. We cannot spill any fresh water in this time of climate change. That is one of the reasons The National Government came up with a third solution. They want to make the Volkerak – Zoommeer salty again and the process is planned to be finished in 2028. This scenario would solve the water quality issues but on the other hand creates other problems on agriculture. To be able to maintain the recent agriculture, we still need to use lots of fresh water. To be able to do this they are planning to add ditches behind the dike to catch the salt seepage and let extra fresh water come into the area from the Hollands

Diep. That will cause limited accessibility which means less relation between people and the water side.

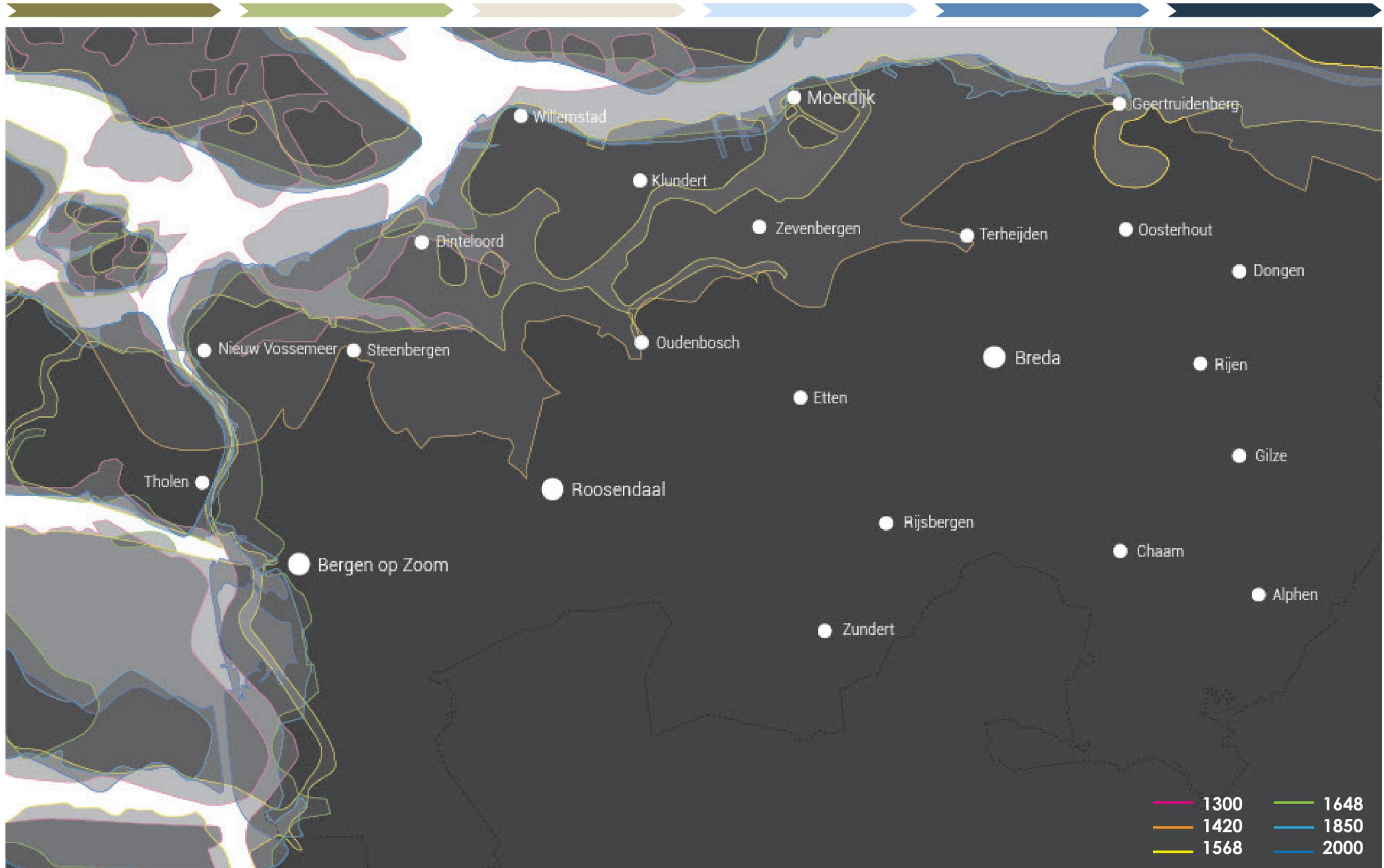
MAIN HYPOTHESIS

The Dutch way of water problem solving is to defend the land against the water. Times are changing, population is growing and fresh water is getting scarce. Now it is the time to change perspective. Why don't we just let the water run its course?

No longer we should fight against salinization, but welcome it into the land. This change not only the conditions, but also the landscape. Giving space to nature to create its own fluent borders in the way to change the landscape to a unique brackish place. This is "the" way to make this area vital and attractive. Only then The Dutch can be an example to the world on water management another time.



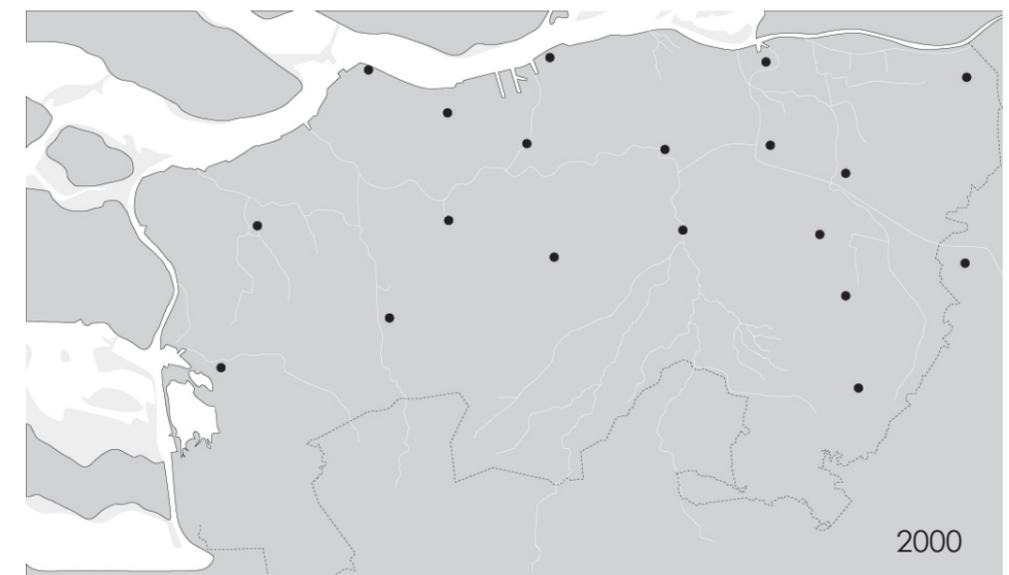
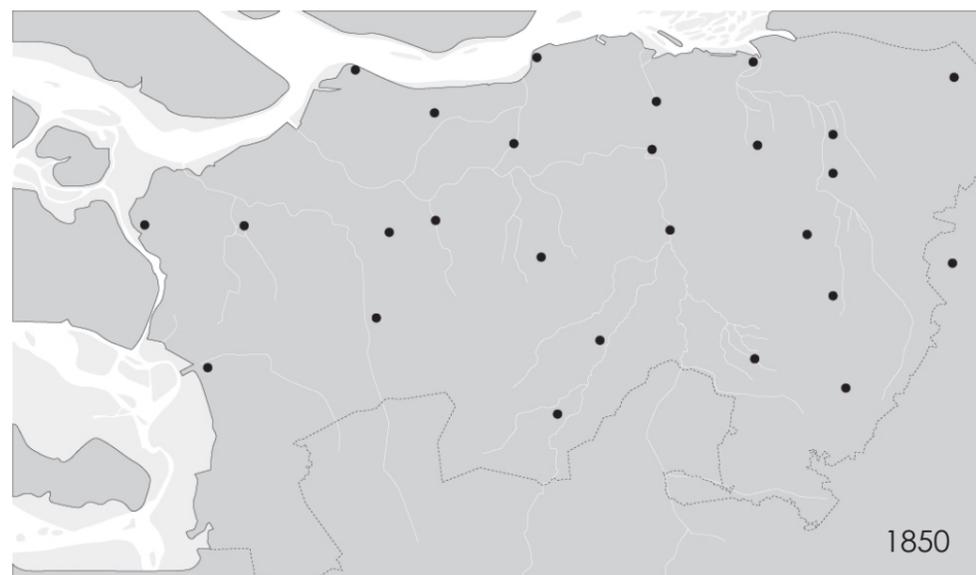
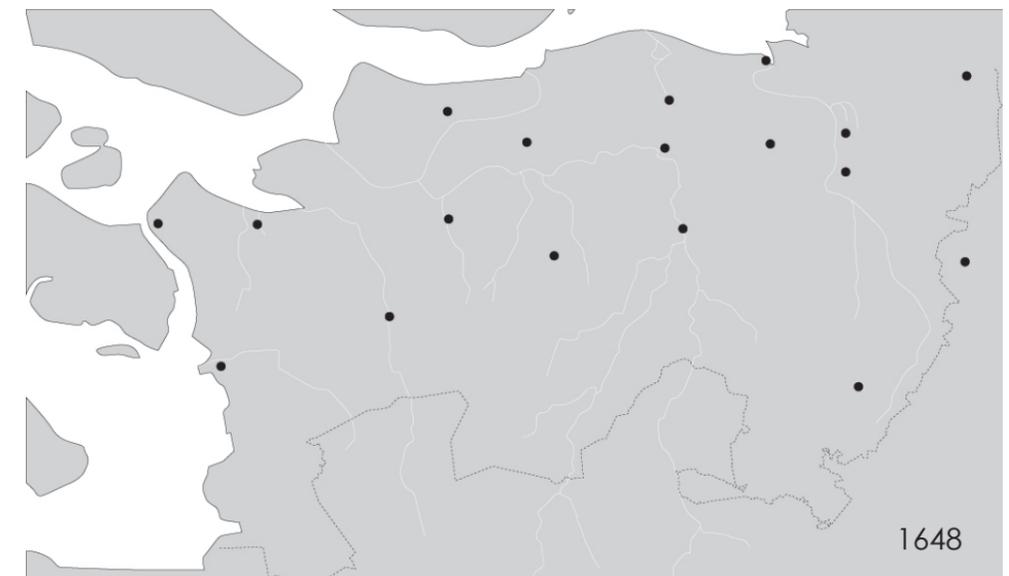
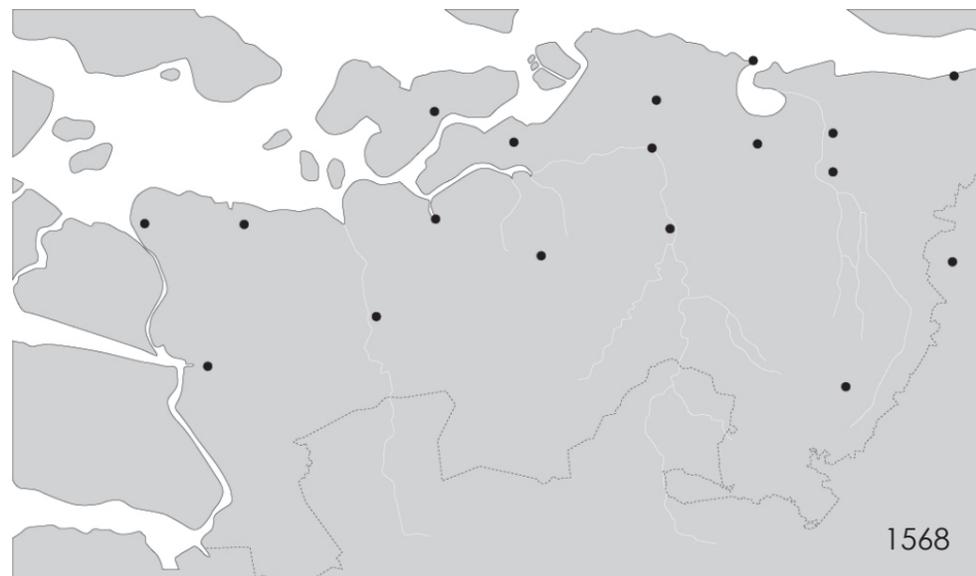
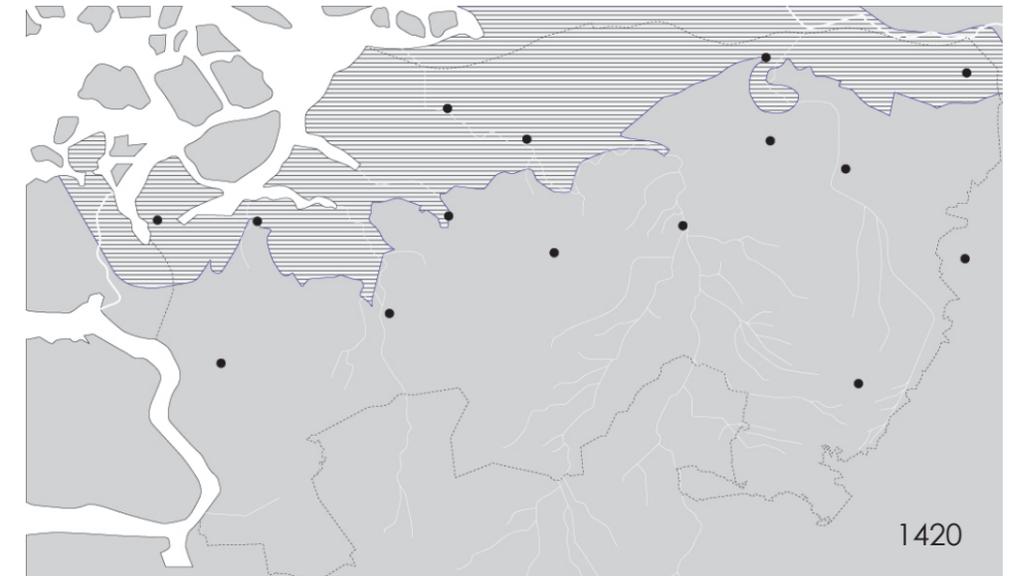
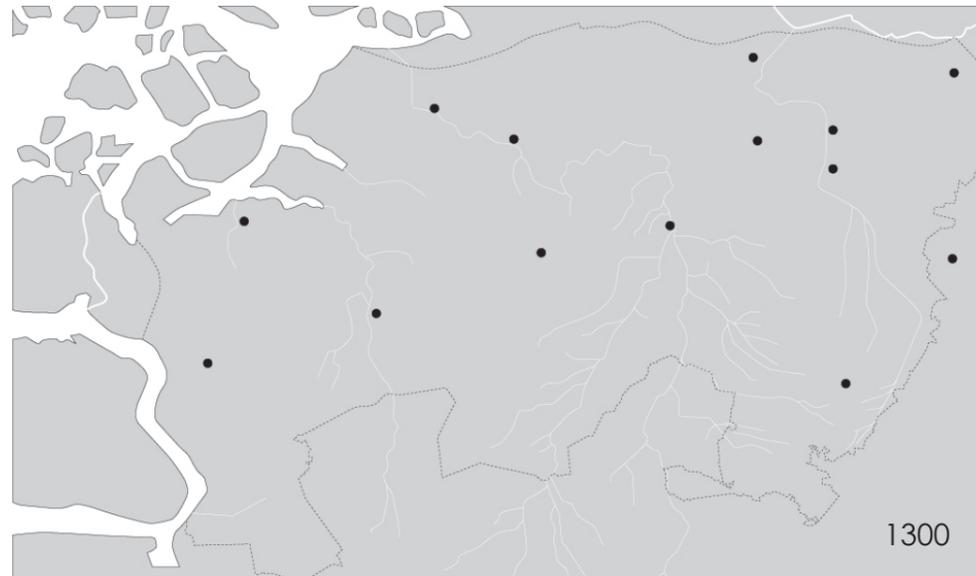
Landscape in transition



Dynamic landscape

The area where Zeeland and Brabant meet each other haven't had always the current form. Before the Delta Works the area was very dynamic. It was an open delta where the water chooses its own way. Sediment was deposit and floods came to take the land back. After the floods in the 13th and begin of the 14th century, villages that now lay land inwards, were for a short time directly connected with the open sea. But mankind slowly claimed land in a more permanent way. They started building dikes and taking it permanently in use.

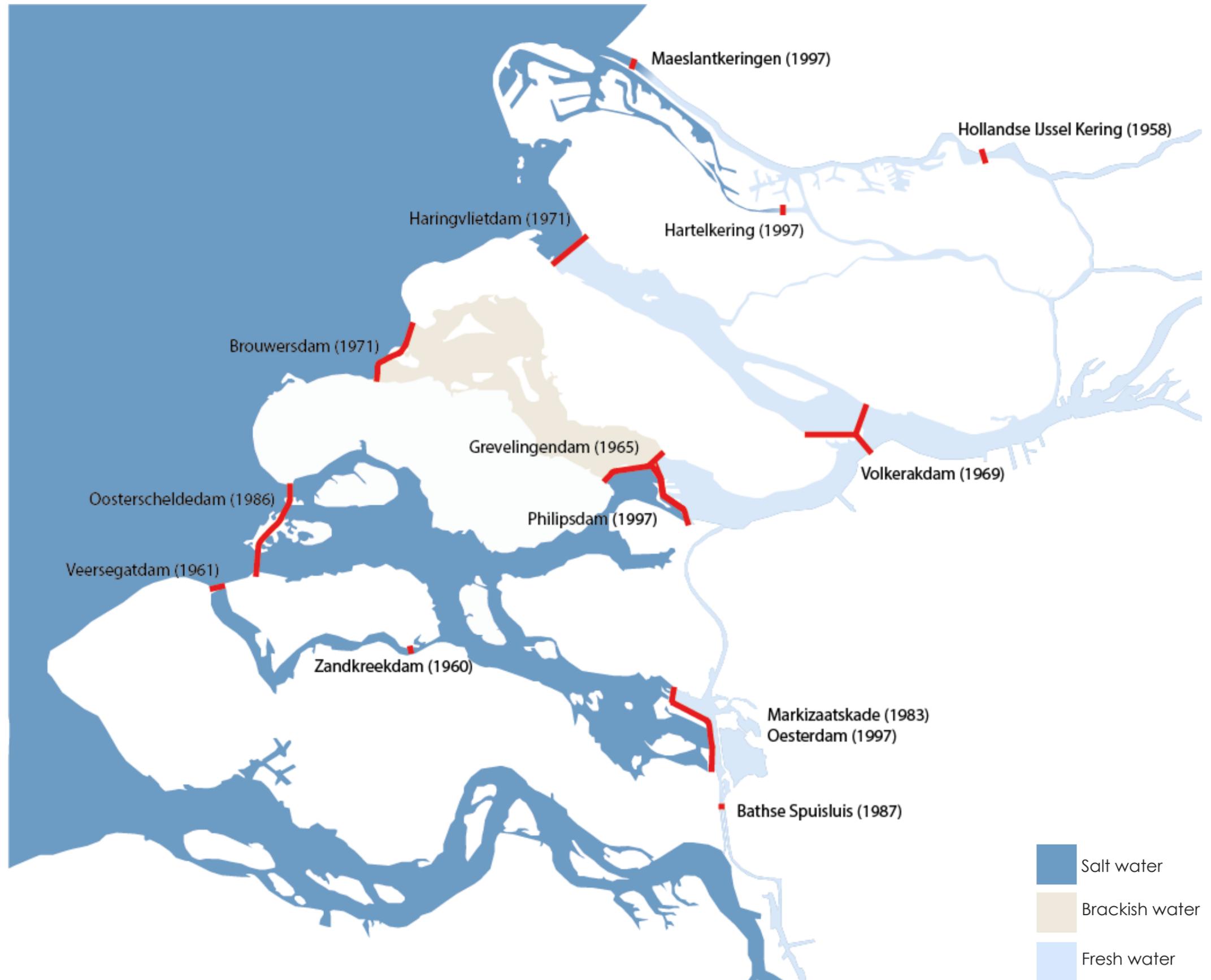
When you lay the multiple time areas on top of each other, you get to see how much the land has changed. But most of the current villages lie on places where the land was stable and higher as its environment so they could keep develop themselves.



Deltaworks

In 1937 performed Rijkswaterstaat studies on the safety of the Netherlands during high storms and high water levels. The studies concluded that the safety could not be insured. To strengthen the existing dikes or constructing new ones was expensive and difficult around the densely populated areas. The first plan was to “afdammen” of all river ends. The construction started in gradual stages in 1950, but came to an abrupt stop caused by the flood of 1953. The flood caused 1835 lives and over 150 000 ha was under water. The disaster ensured that the Deltaworks had more priority.

The closed and permeable dams of the Deltaworks ensures that the Dutch coastline is reduced by 700 km. An advantage of this design is that the dikes no longer need to be increased and strengthened. An disadvantage is that the Deltaworks have a negative effect on the local nature. After the construction a part of saltwater area became freshwater. This change had consequences on the water quality as well as local plants.

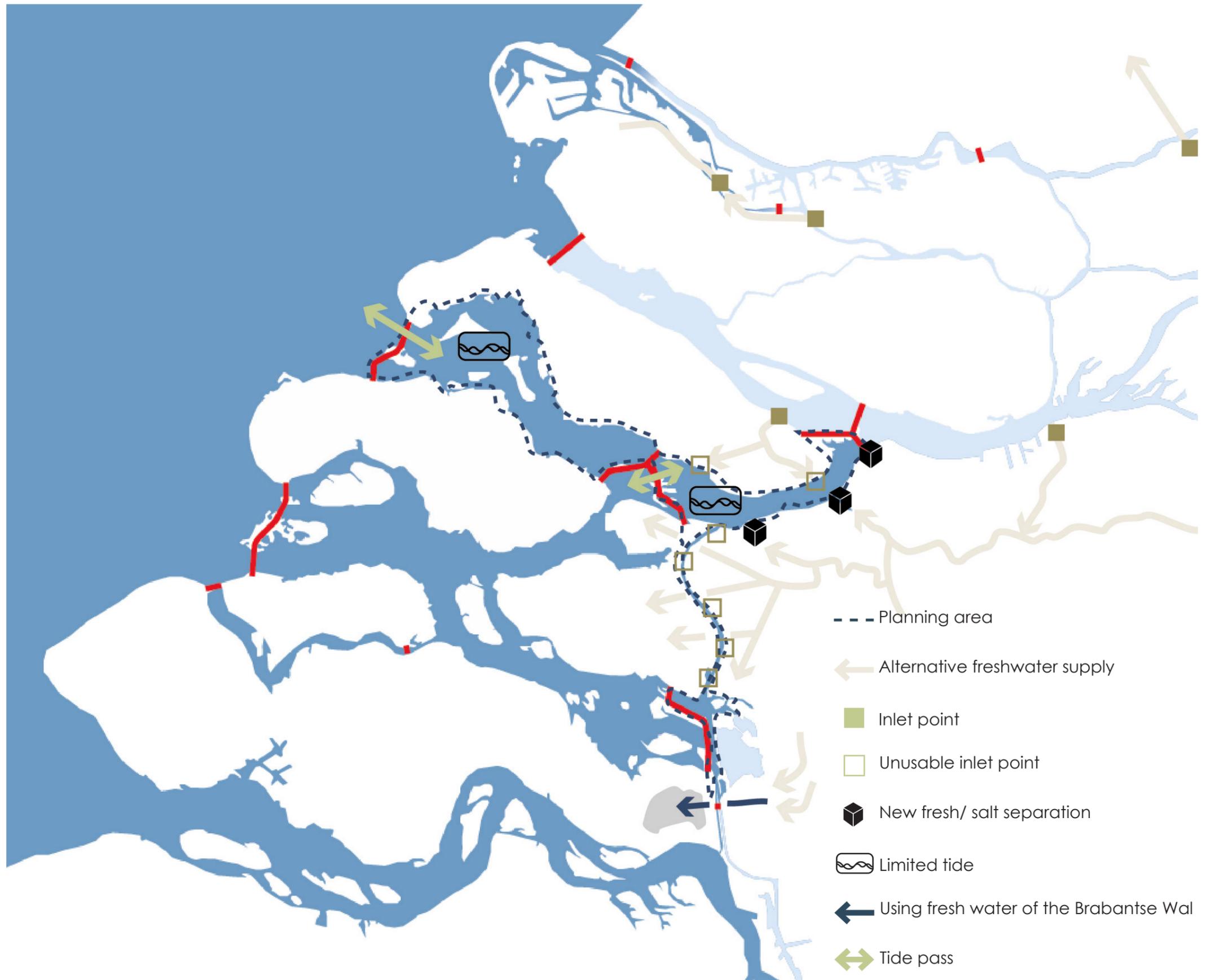


Development perspective government

The advents of the delta works have caused unforeseen consequences. The transformation from salt to fresh water has caused problems with the water quality. The creeks that supply the Volkerak Zoommeer with fresh water have high nutrient levels. This resulted that the cyanobacteria grow very well in the area and in the summer the amount of this bacteria in the water become so high, it is not usable anymore for irrigation of recreation. This have had serious consequences for the environment. The villages around have turn their back to the water and have lost their connection. The qualities water can offer and are highly appreciated on other places, are not used here. Also the recreational facilities have almost completely disappeared.

To solve these problems, the idea of the government is to transform the Volkerak Zoommeer back into a salt lake. To realize this and give form to the idea, a Rijksstructuurvisie have been made. In this document is written that in 2028 the lake should be salt again and small tides should be reintroduced. The transformation is more than just open up some locks and let the water flows. An important condition is that an alternative fresh water facilitation has to be functional so it has no impact on the surrounding farmland. This new fresh water facility makes use of the current creek system. From the Hollands Diep through the Roode Vaart extra fresh water is taken in to keep the water level consistent. Through the creeks it become transported through the area and with pipes it flows to the island Tholen.

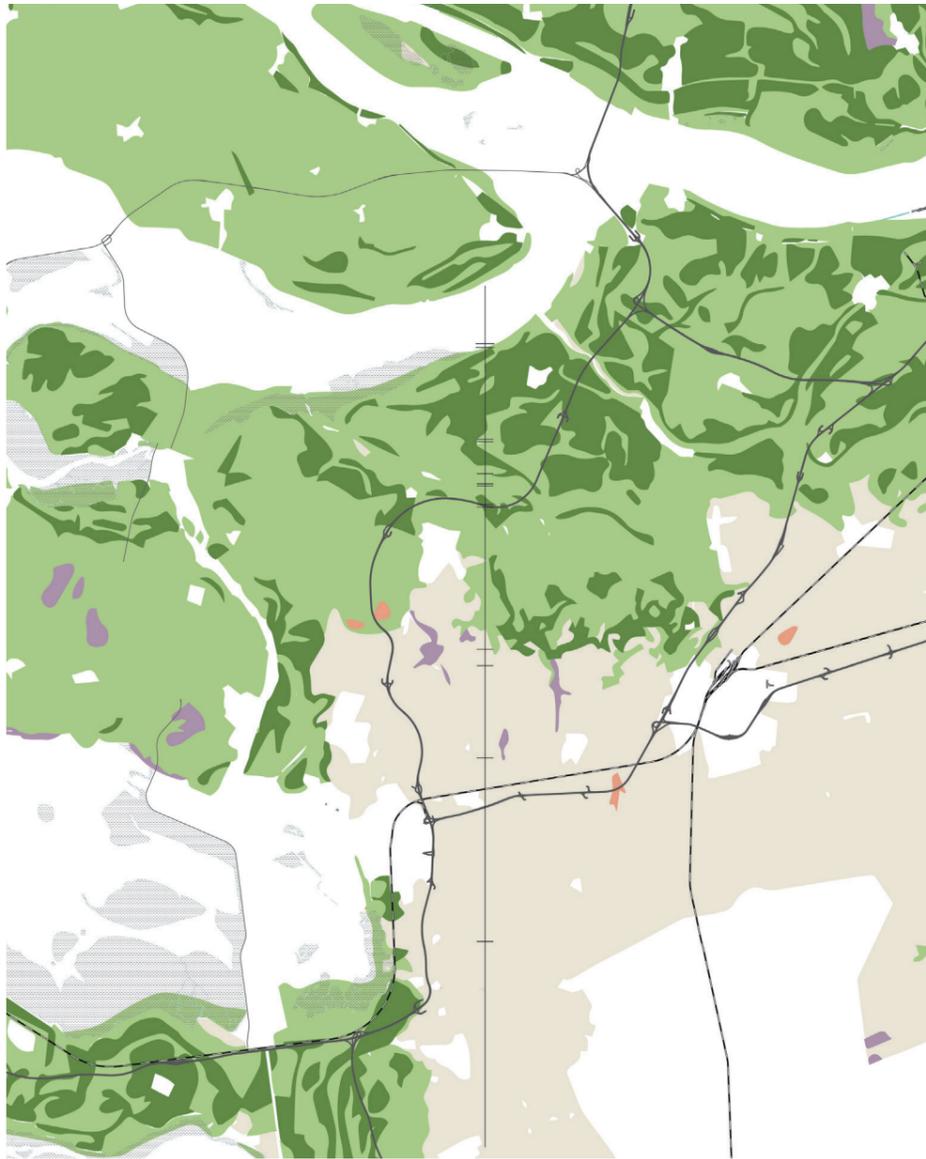
To prevent salinization it is necessary to cut off the creeks from the Volkerak. For this a sweet salt separation plant have to been built where creeks flows into the lake. Another measure they planned to take to prevent salinization of the land is dig seepage ditches. These ditches should intercept the salt water that passes under the dikes.





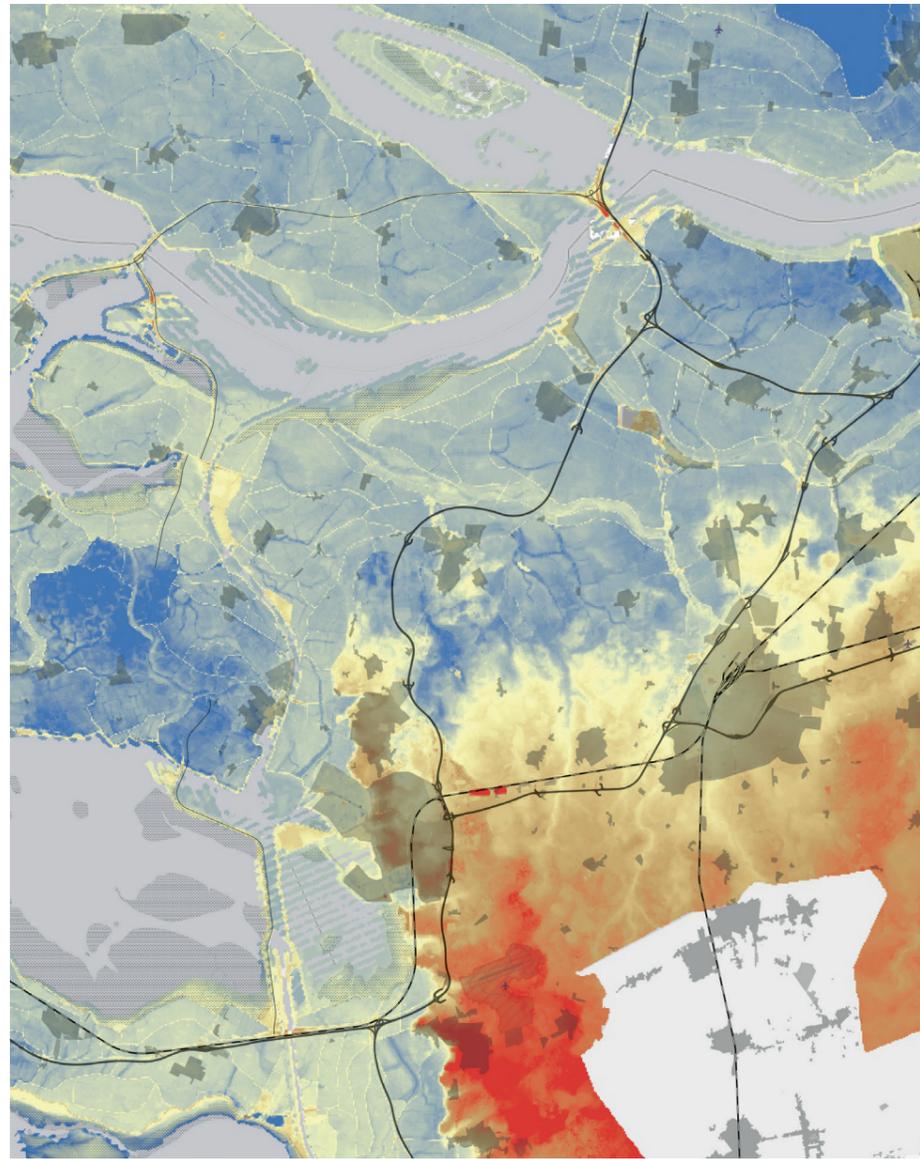


Subsurface



Soil types

- Clay
- Zavel
- Sand
- Peat
- Loam



Height map

- 0 meter
- + 5 meter
- + 10 meter
- + 15 meter
- + 20 meter
- + 25 meter
- + 30 meter



Ground use

- Cropland
- Grassland
- Heath
- Forest
- Orchard
- Cities

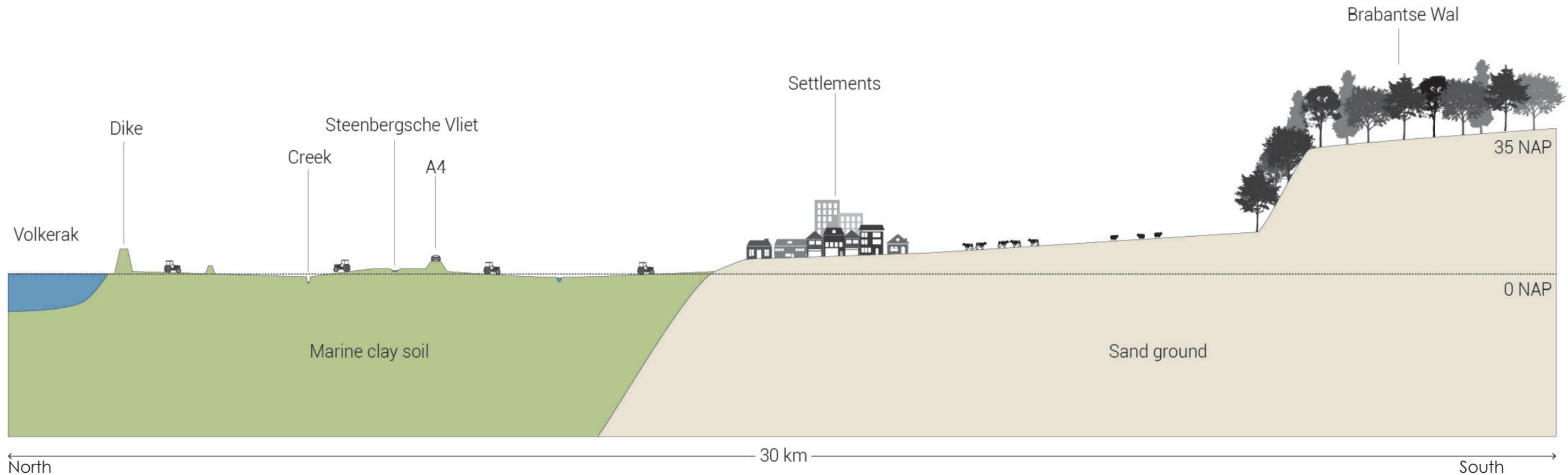
The Brabant landscape

The west part of Brabant exists mainly out of two kinds of landscapes. The clay grounds in the northwest part and the sand grounds in the southeast. The sand grounds are very old and have their origin in the ice times. The land was tundra and the wind took sand with it and covered the land. In this time also the Brabantse wal was formed. It were dunes, made of sand out of the dry Schelde.

The clay grounds are the result of the dynamic landscape from the past when rivers and the sea were free to search their own path. The sea level was higher and left the clay behind on the land. Nowadays these clay grounds have a height around NAP. The older polders

lay a little lower because of the subsidence of the ground and the sediment of river and sea. Most of the settlements are situated on the border of clay and sand, to profit from both land types. The cities were built on the higher sand grounds to be safe for floods. The lower clay grounds were eutrophic and here crops were grown. The sand was poor and exists of forest and heath where the cattle could graze. This distinction nowadays is still recognizable.

Through the landscape a big amount of streams and creeks flows. These provide fresh water. The bigger streams like the Dintel and the Steenbergse Vliet lay higher than the environment because of years of settlement deposition.



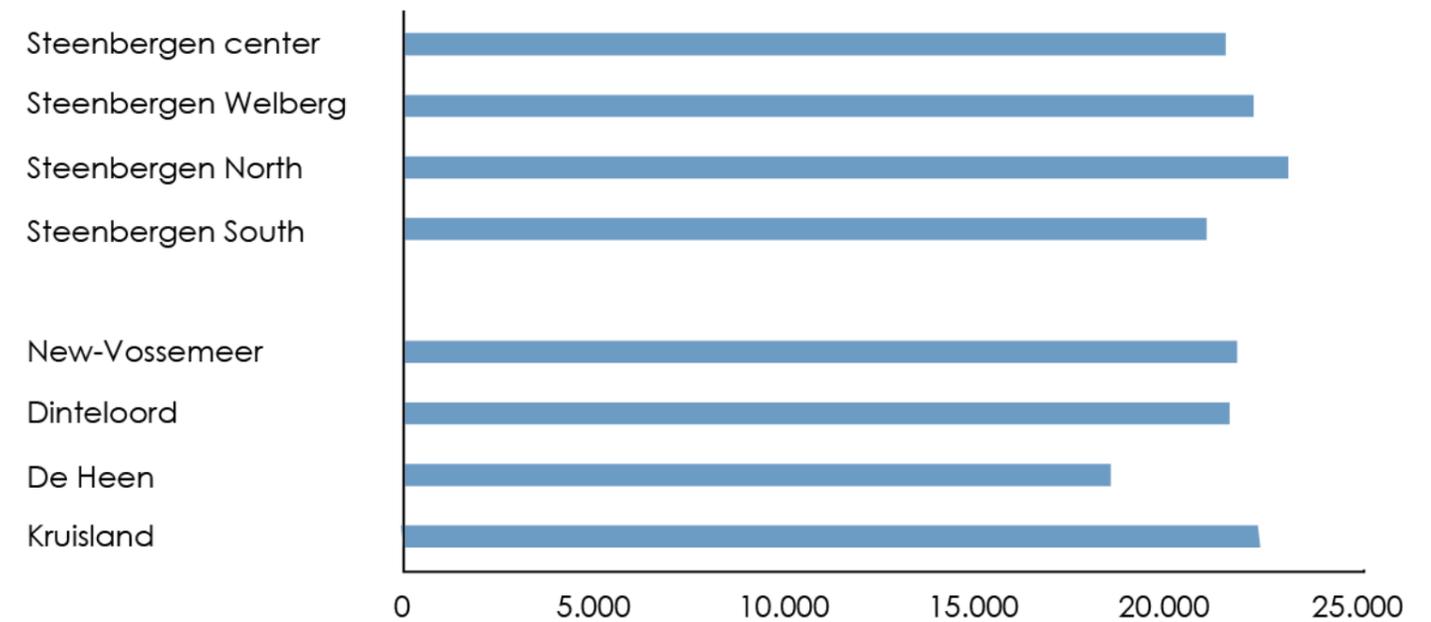


Municipality of Steenbergen

Steenbergen is a municipality in the province North – Brabant. It covers an area of 15.914 hectares, of which 1252 hectares are lakes, canals and other waterways. On average 159 people per square meter is living in the municipality. There are 5 districts and 18 neighborhoods in the municipality area.

The population of Steenbergen is 23.375 inhabitants. The age group 45 to 64 years is the biggest group with 31% of the population. That's why we can say that the population of Steenbergen is ageing.

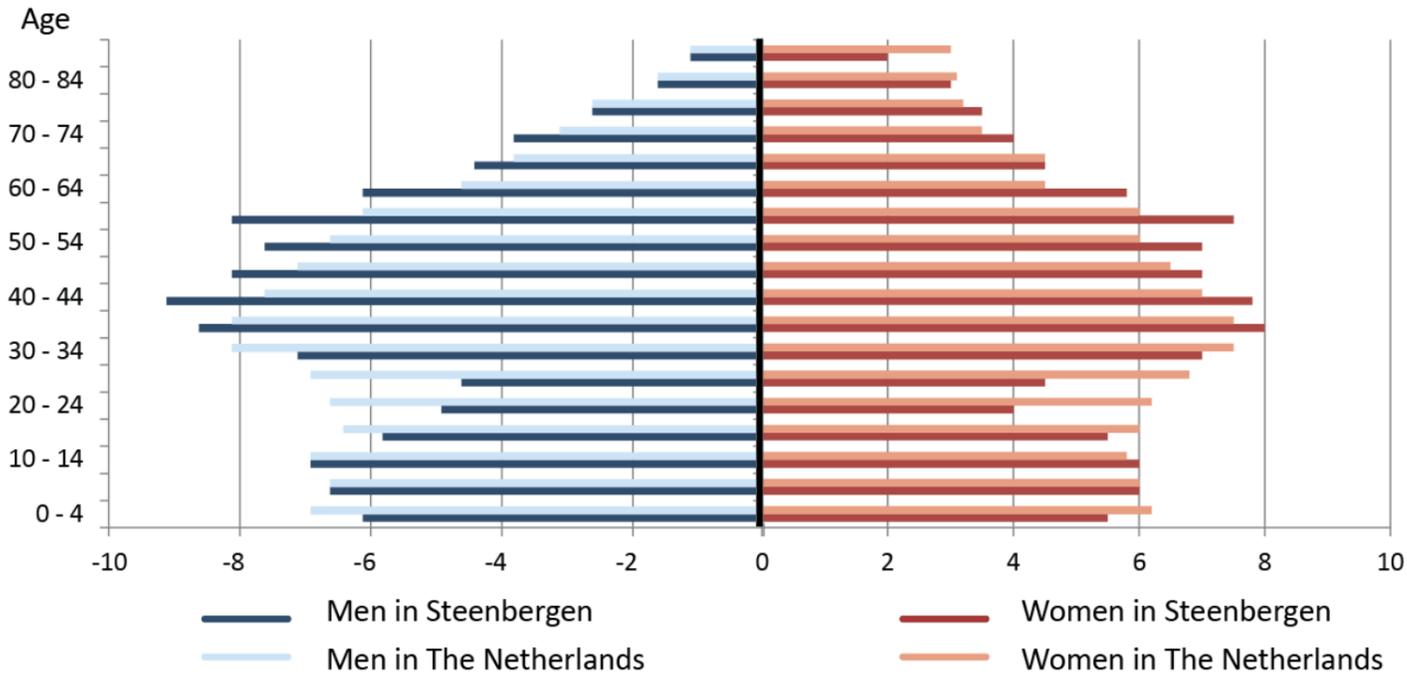
Income



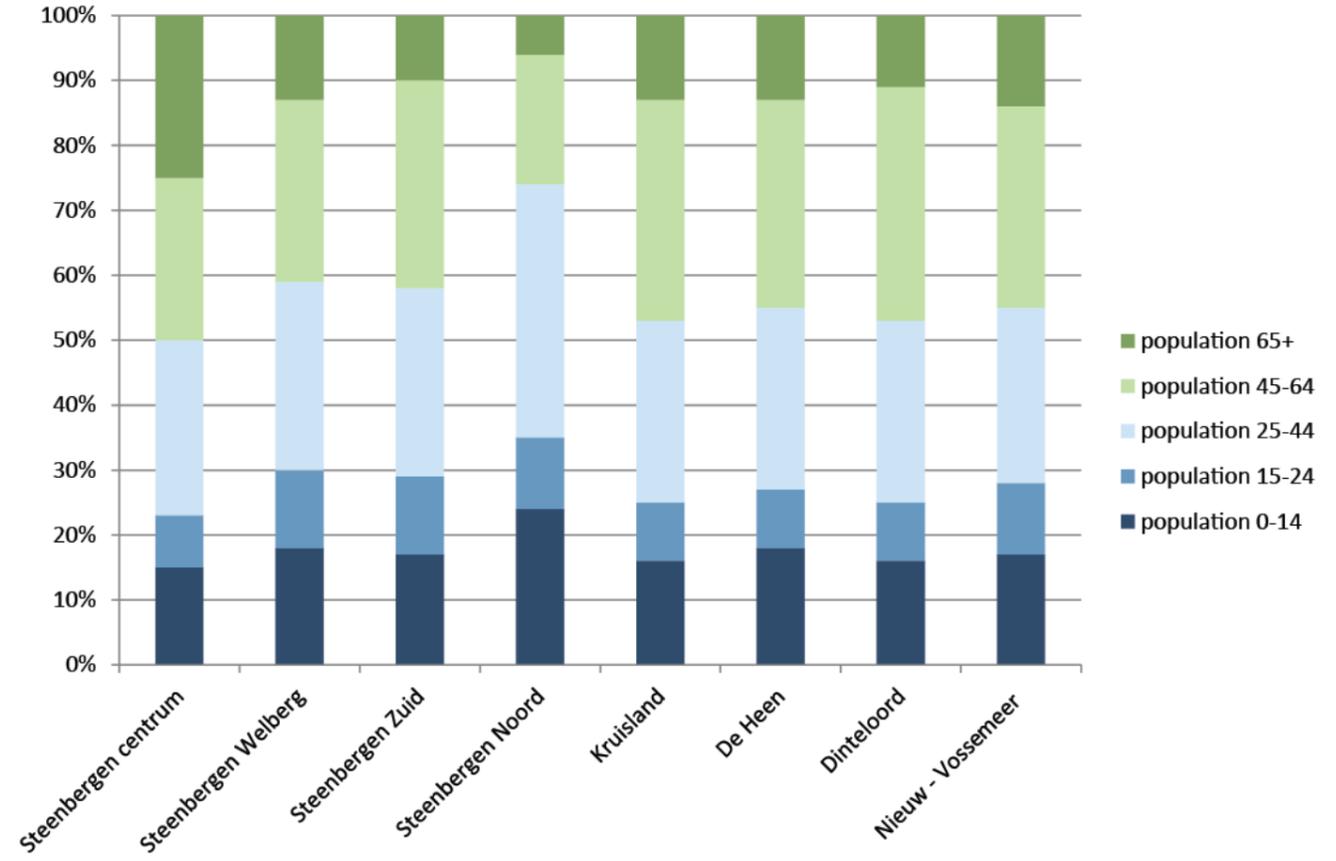
The average income per person is approximately 21.900 euro in the area. Only people in De Heen earn less.



Age profile in Municipality Steenbergen (of alleen age profile)

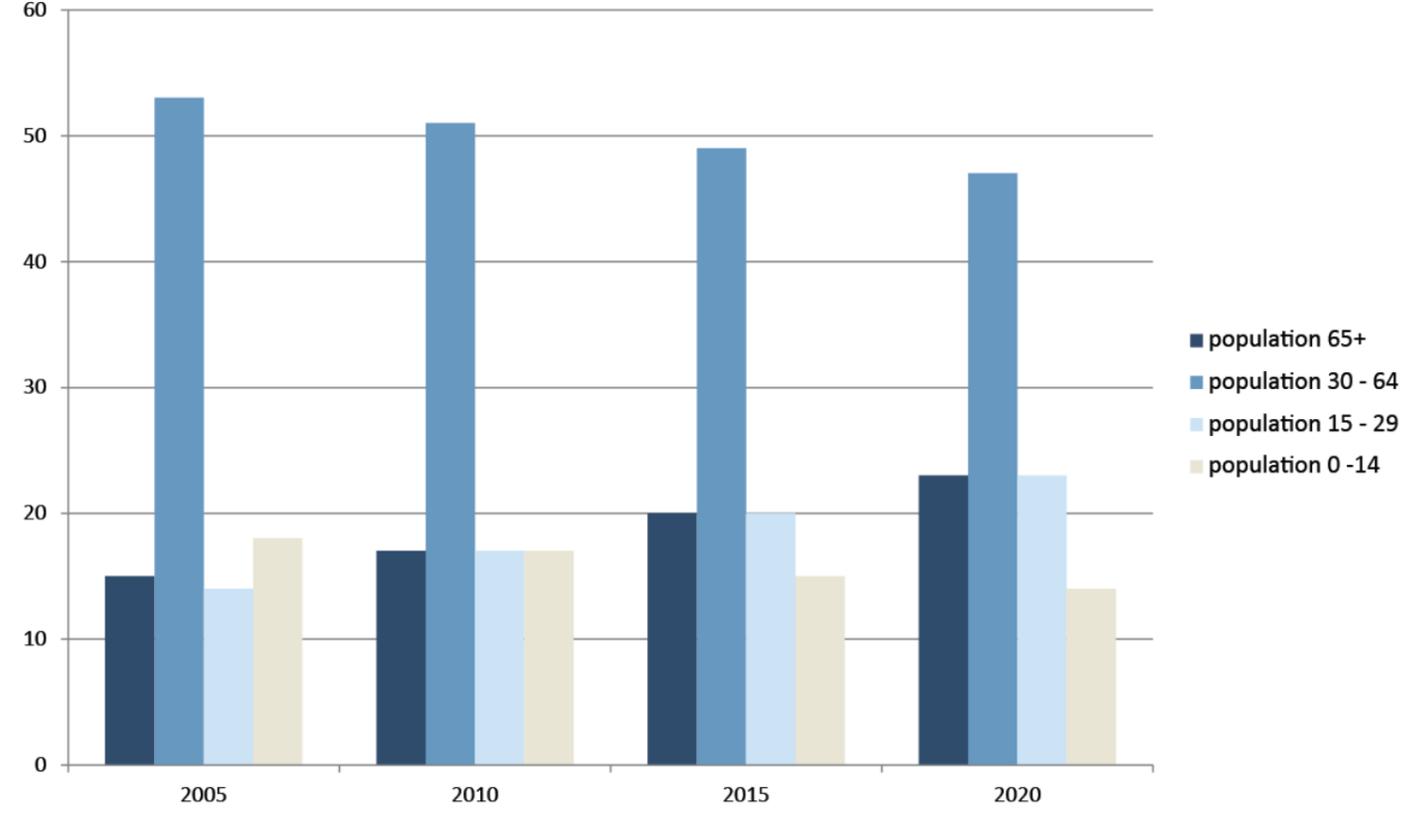


Age profile per village

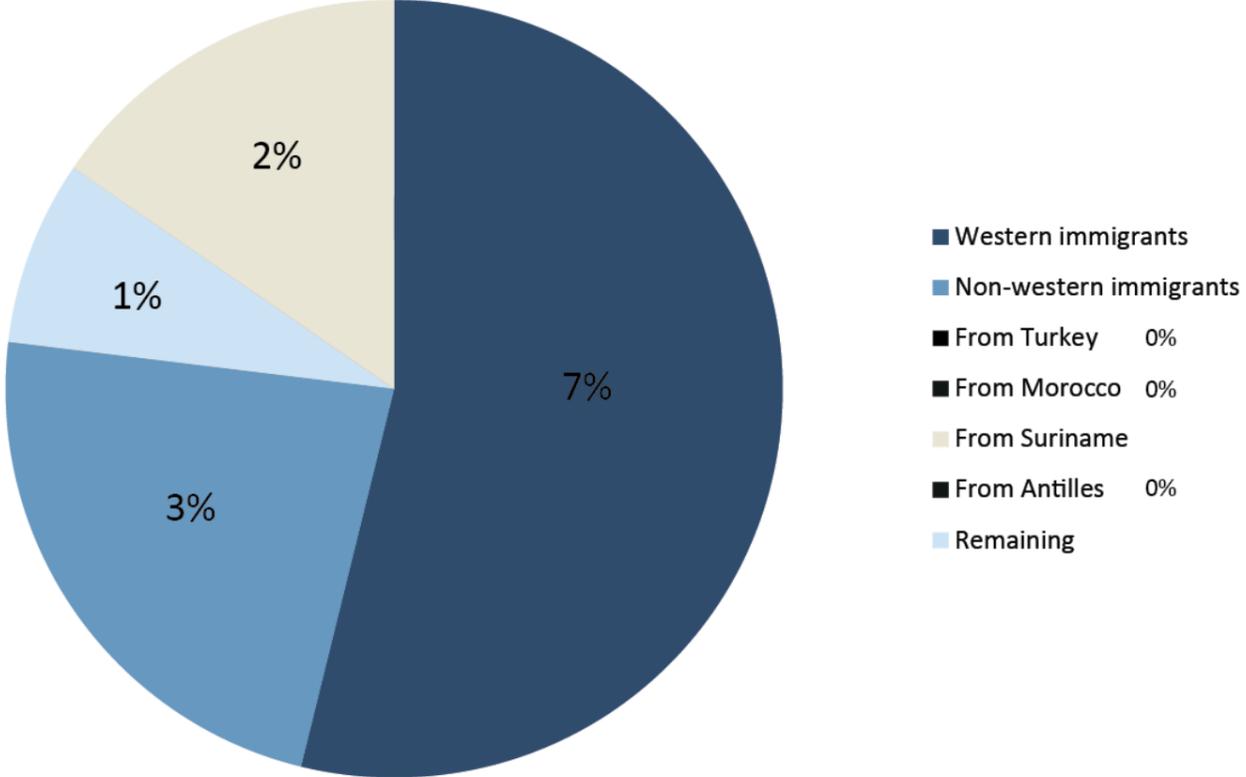




Development of age division

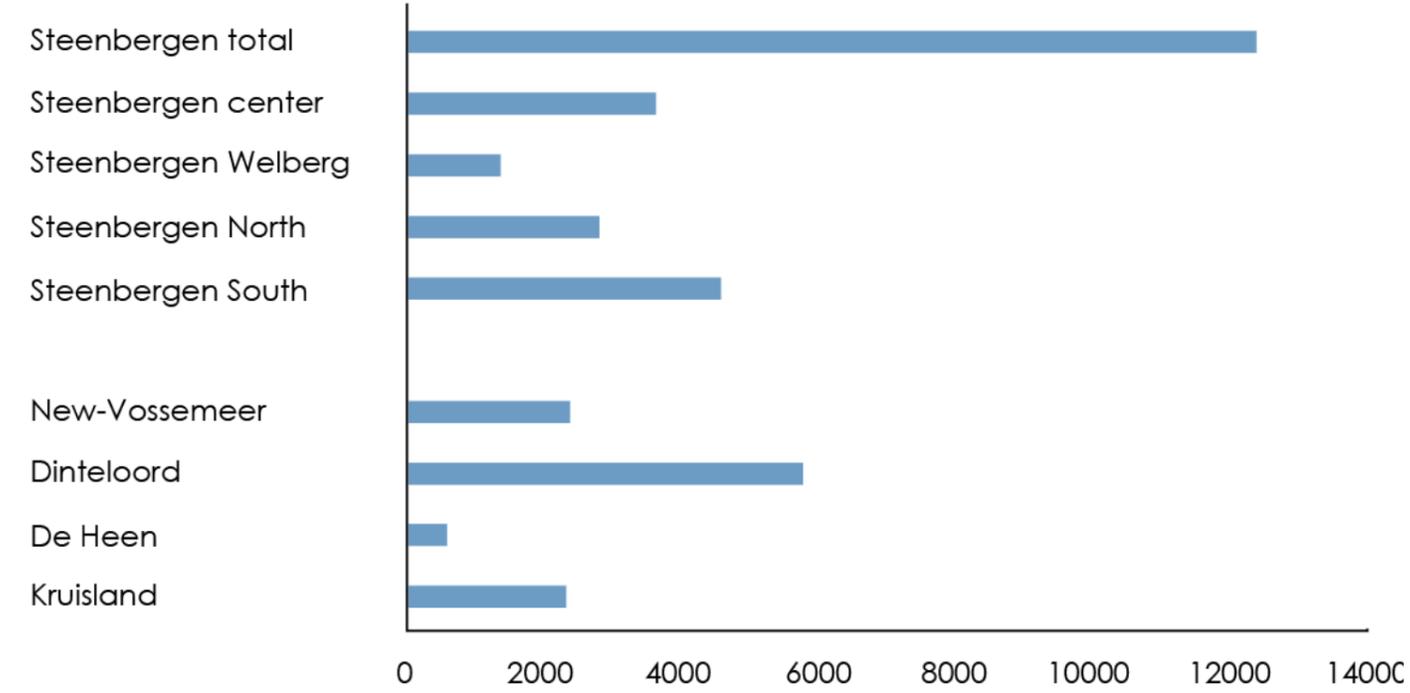


Immigrants

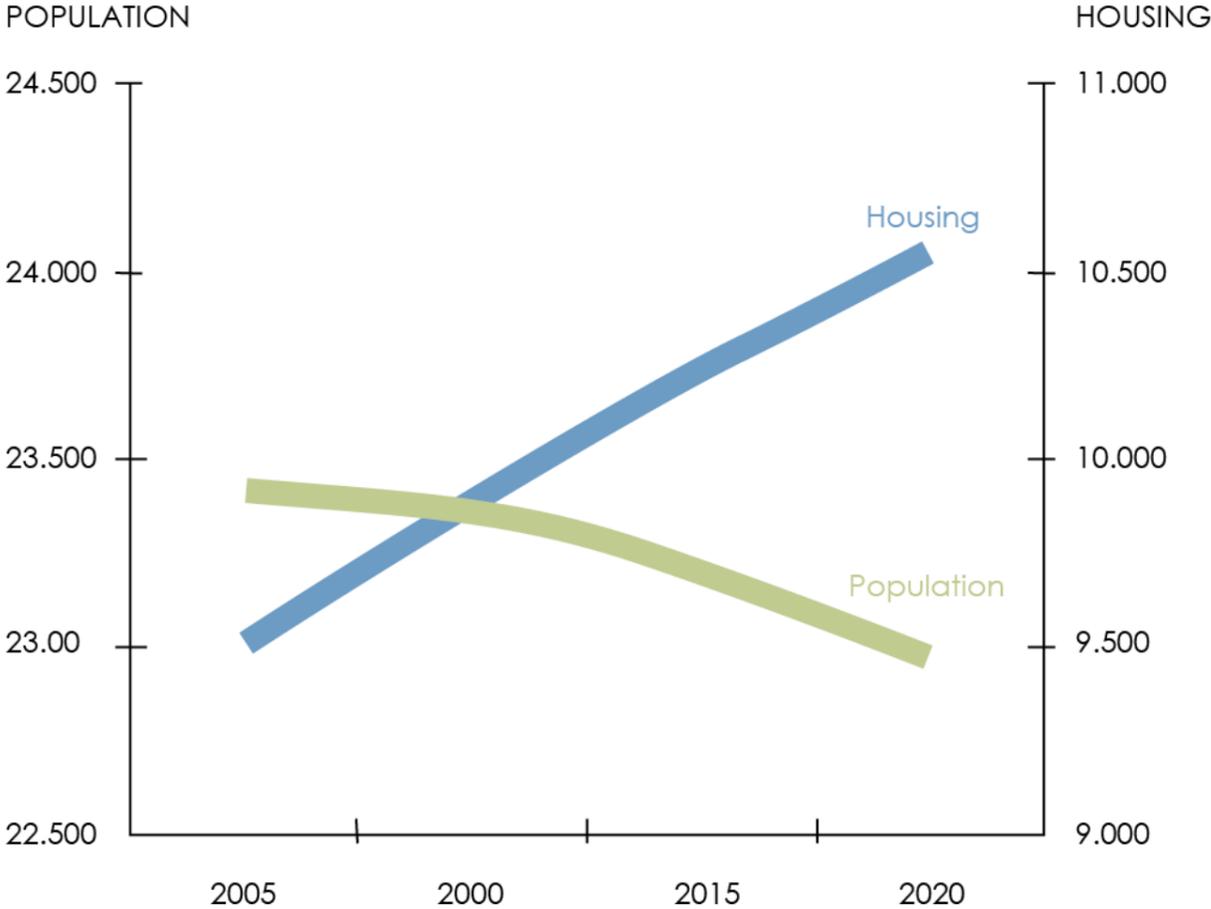




Population



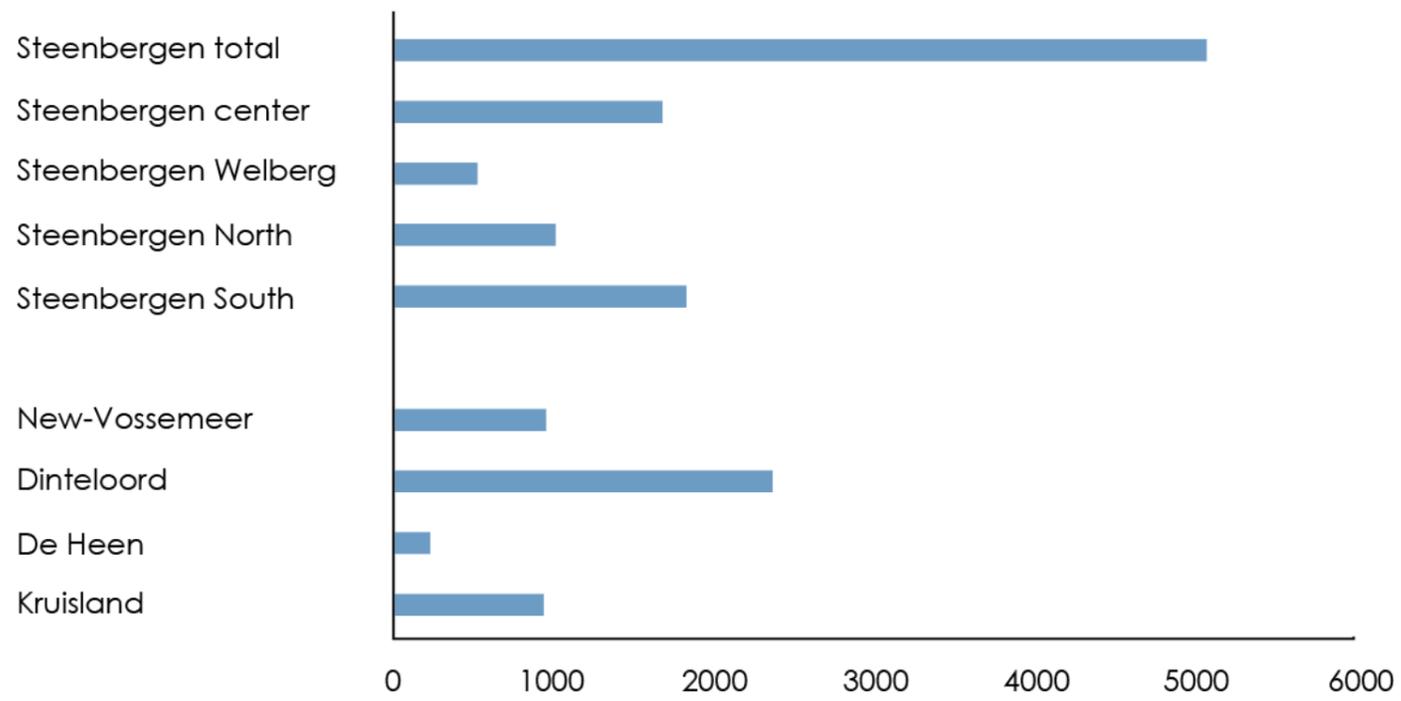
Estimating population and stock development



Despite the decreasing number of people, there is still an expecting grow of houses.

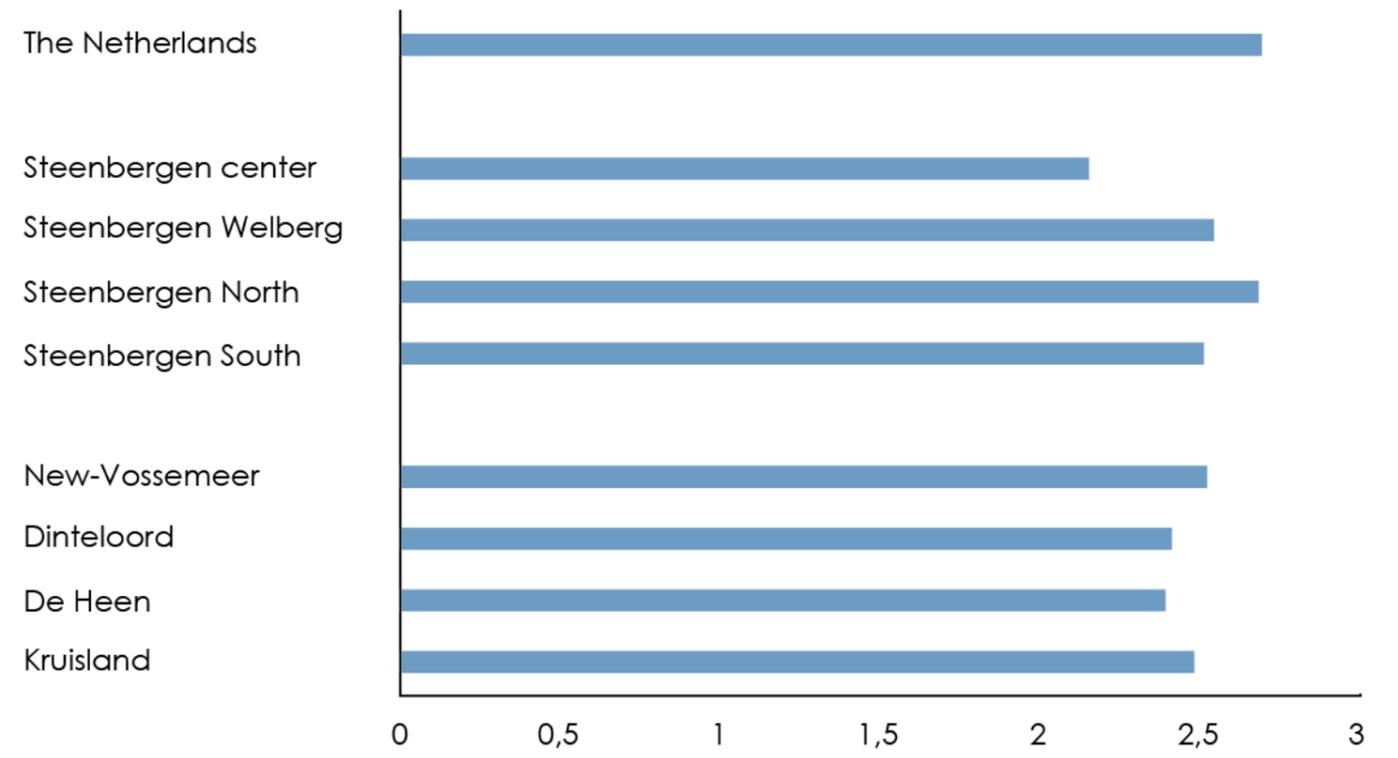


Residence



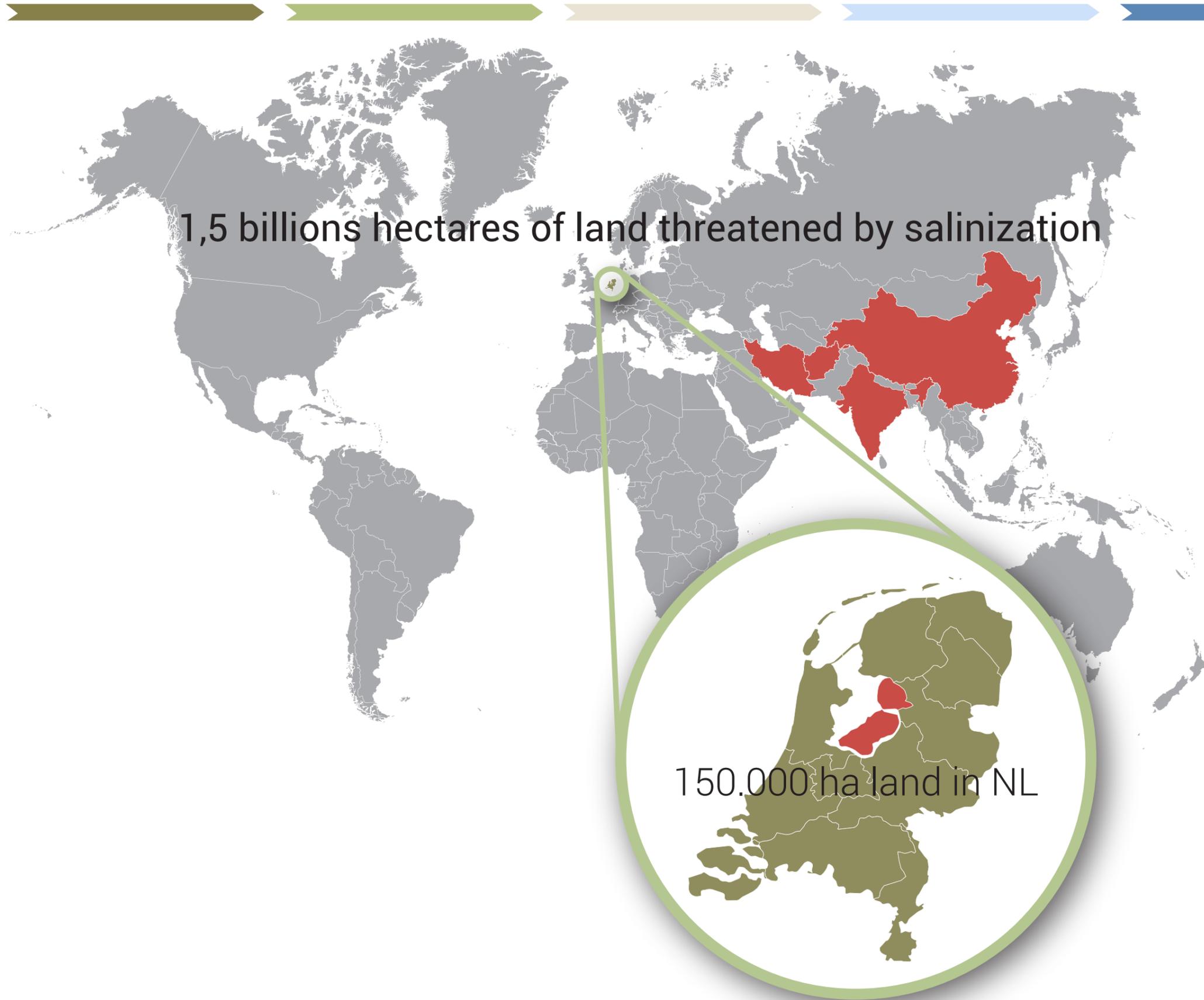
The amount of housing is in the whole area in proportion to its population.

Average housing occupancy



The housing occupancy in municipality Steenbergen is average lower than that of the Netherlands.

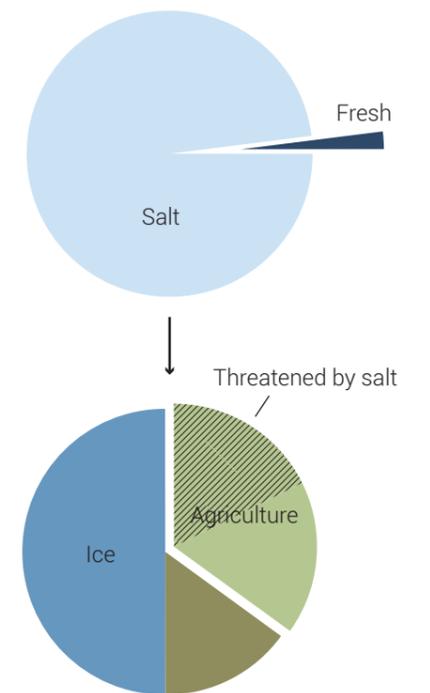


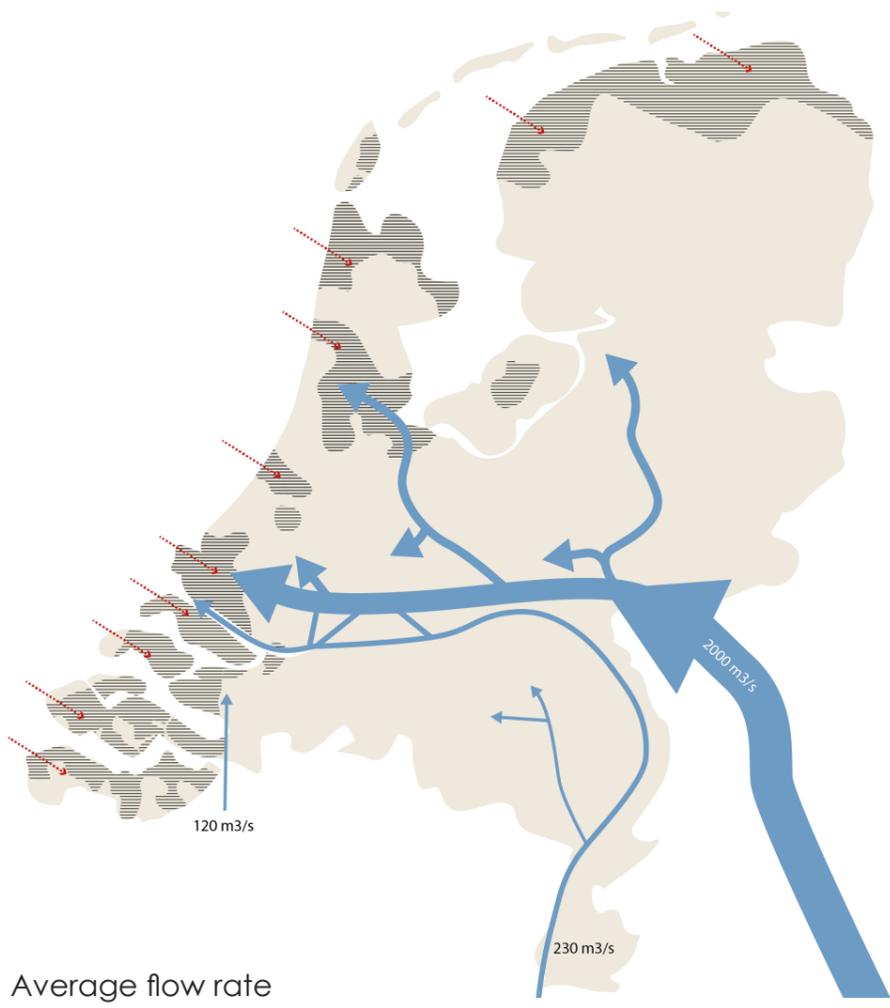


The design Rijksstructuurvisie Volkerak-Zoommeer talks about different measures to prevent the land from salinization. Salinization means that the land becomes saltier with the result that it becomes more difficult to grow crops. The salt can come from the nearby sea, but more often it is stored in the ground. The salt is originating from the time the land was sea and salt have withdrawn in the ground.

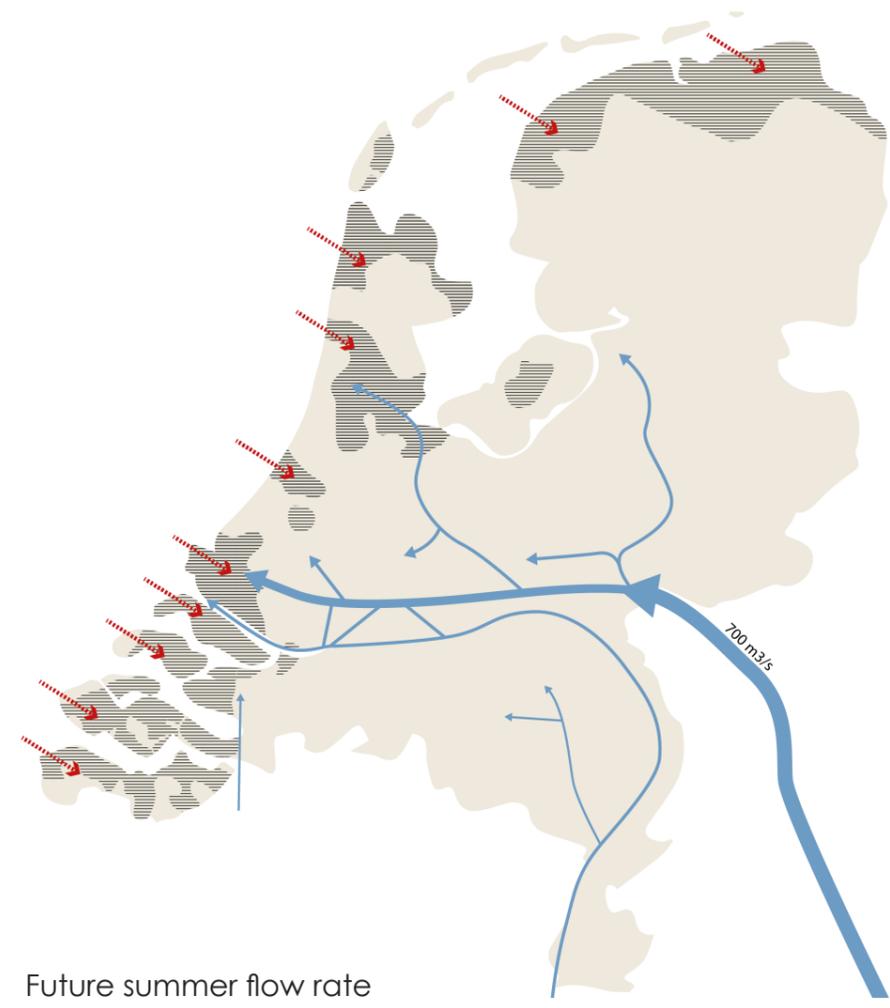
The problem arises on multiple places in the Netherlands, in particular in the polders. When not enough fresh water can be supplied, the water pressure downwards decreases and salt ground water comes up. In total 150.000 ha of ground in the Netherlands is threatened, this is comparable with the surface of Flevoland. Worldwide it also caused problems. 1.5 milliard ha ground have a high risk to be not usable for farming anymore because the salt levels are too high.

Only 2% of the water supply worldwide exists of fresh water. From this half is trapped in icebergs. A third is available for farming, but half of this stock is threatened by salt. At the moment more fresh water is used than can be replenished naturally.





Average flow rate



Future summer flow rate



Winter flow rate

Land flushing

The Dutch method to deal with salinization is to flush the land with enough fresh water, mainly delivered by the two big rivers the Maas and the Rhine. This water is pumped through the ditches and canals and carry the salt back to the sea. It creates also a fresh water bubble beneath the surface witch gives a downward pressure so the salt isn't able to reach the surface. 40% of the water that the rivers bring is necessary to hold back the salt in the Nieuwe Waterweg so surrounding functions like agriculture, but mainly surrounding industry can stay in function. Another 40% is used to flush the land. In the future this becomes a problem. Climate changes ensure that the

water supply is less consistent and come more and more in peaks and dry periods. The average water supply of the Rhine at the moment is 2000 m³/s. The expectation is that in dry periods, this can shrink to a minimum of 700 m³/s, less than half the amount. On the other hand, we also have to deal with peak periods when big amounts of water come through the rivers.

In dry periods there is a hierarchy in water supply. First the water goes to places that need water to prevent damage. This are functions like the main dikes, so they stay stable and peatlands that have the threat of subsidence. Also important nature that suffers from irreversible damage without water has

priority. Second the water goes to utilities so drink water and energy is safe. On the third place are capital intensive crops and of the last place come agriculture, industry, inland fishery and similar functions, prioritization in this category is based on limitation of the economic and social damage.

This means the west Brabant area is one of the last regions that get water when it is dry.

Salinization is a big risk at these moments and probably no longer preventable, crops will be damaged. With these facts in mind, we believe it is no longer sustainable to keep land from salinization in an artificial way. We have to look at these areas with a different view and look for the possibilities and qualities that are present.



Land salinization

Going back to the research area salinization is also a threat to the landscape here. Because of the dynamic landscape in the past, the ground contains big amounts of salt. In dry periods, this salt comes to the surface as seep. When the Volkerak-Zoommeer becomes back salt, from a second direction march the salt to the clay grounds. Towards one and a half kilometer from the water line, the salt pressure becomes higher.

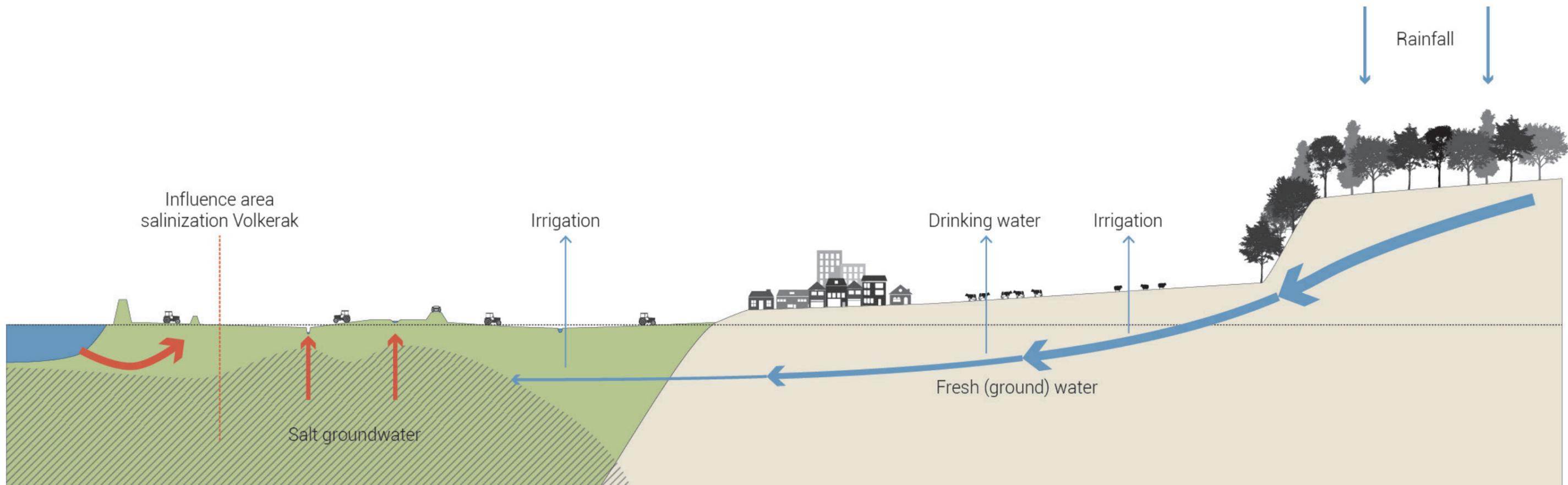
The new salt levels when the Volkerak Zoommeer transforms are probably comparable with the situation in the fifties, before the Delta Works were constructed. When looking at these numbers and maps, it

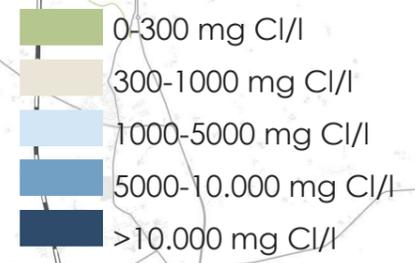
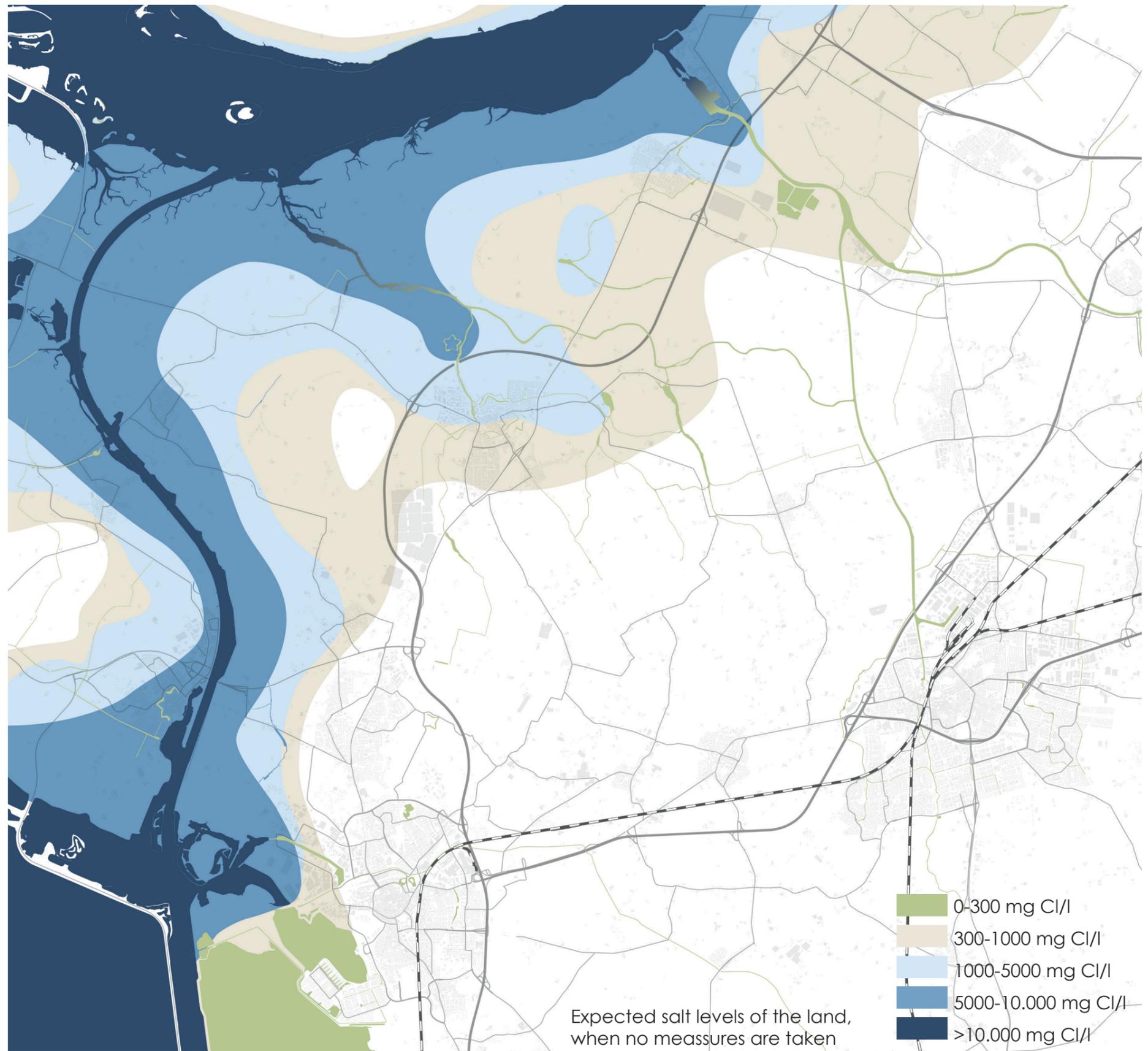
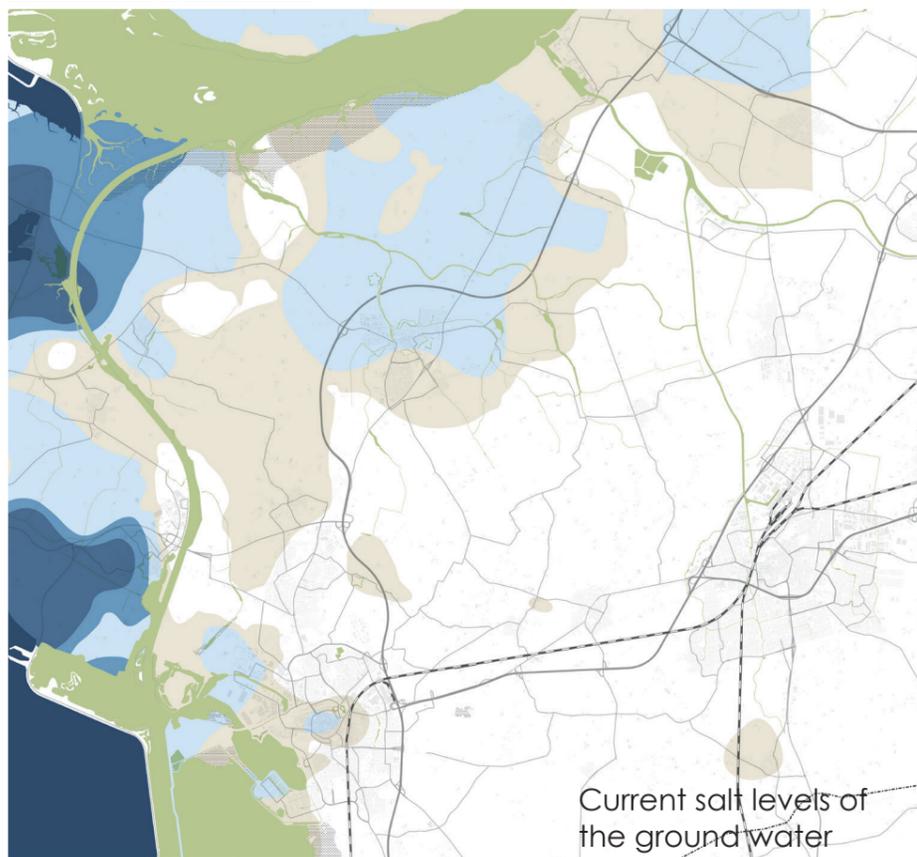
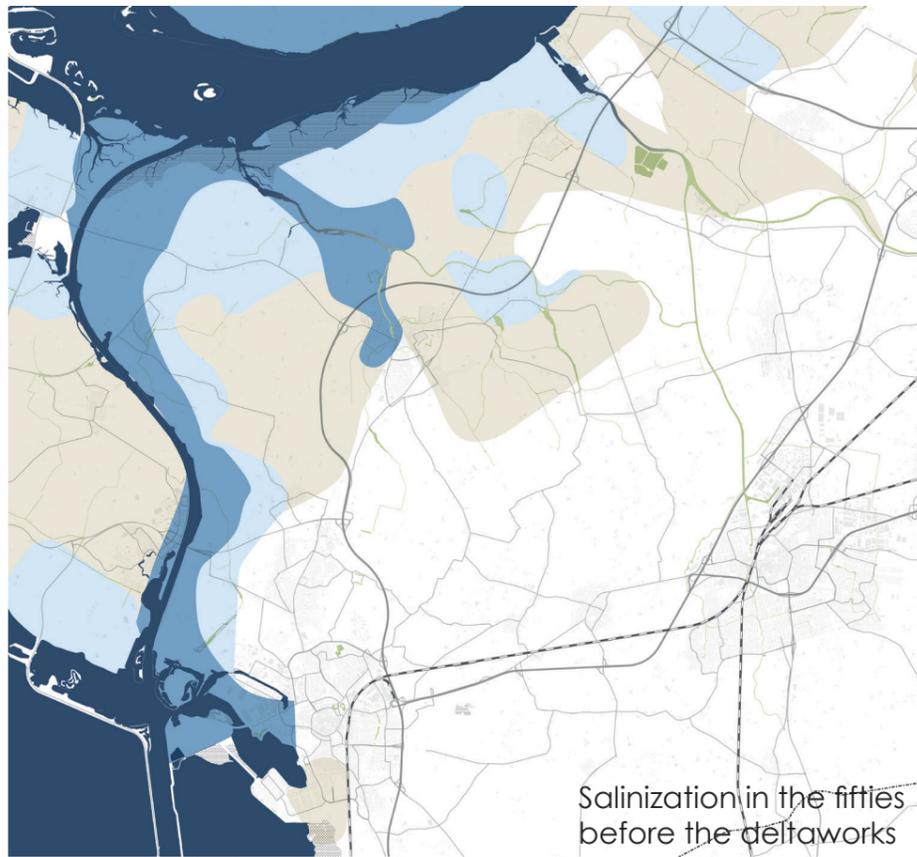
becomes visible it becomes a huge threat for the landscape. Especially where the streams debouch in the Volkerak, the salt march back into the stream because the low water discharges. This results that parts of the creeks become salt and from here the salt also soaks into the surrounding land.

When combining the situation from the fifties with the current salt levels of the groundwater, it is possible to predict where the biggest salinization is going to take place in the future when no counter measures are taken.



Till 1,5 km from the waterline, extra salt seeps into the land in case of a salt Volkerak-Zoommeer





Sweet - salt gradient

Between fresh water on one end and sea water on the other end of the salt gradation scale, there is a wide range of different salt levels. There are no fixed categories but the most common is based on the amount of Cl per liter of water.

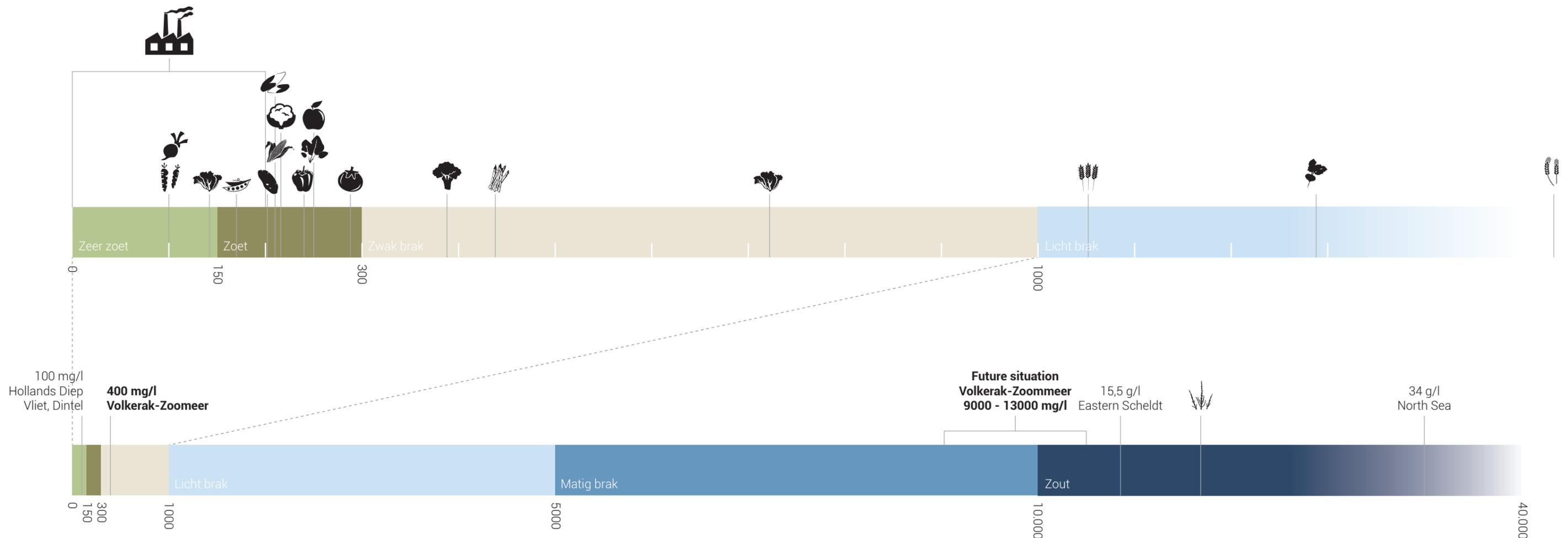
Till an amount of 300 mg Cl/l the water is mostly defined as fresh water. Within this range it is usable as drinking water, for industry and almost all crops can be irrigated. From a level of 10.000 Cl/l it is defined as salt. The Oosterschelde have 13 g Cl/l. The North Sea even 34 grams.

At the moment the Volkerak-Zoommeer is most of the time fresh and sometimes it reaches a salt level of maximum 400 mg Cl/l. When it transforms to salt, it probably get in the range between 9 till 13 g/l, depending on the fresh water supply from the Hollands Diep and the creeks.

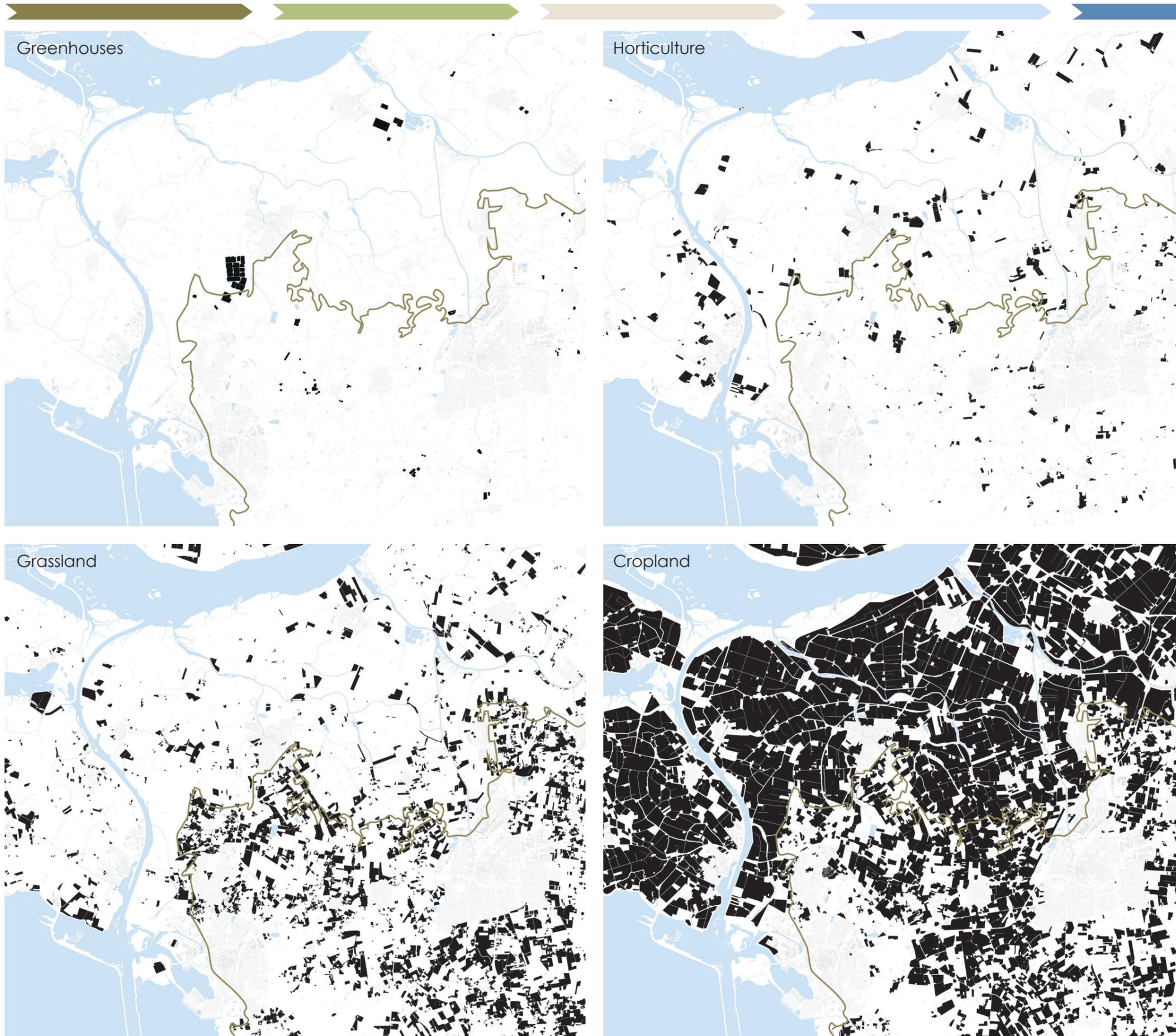
As said, most crops can only grow with fresh water, but there are some crops that have a higher salt tolerance. Barley and sugar beets also can be grown with brackish water, without losing too much revenue. Because of this, the main production of the land at the moment is probably sugar beets and potatoes, another crop with is slightly salt resistant.

The last few years the interest for saltwater crops is rising. Samphire and sea lavender are well known examples that are popular at the moment. On multiple places in the land experiments are done to see what can be profitable to produce. An example is Zilt Proefbedrijf on Texel. Here on 4 ha of ground they test what the salt tolerance is of different crops. Also aquaculture is rising in interest. In Zeeland an experimental farm have looked into producing Zeeuwse Tong on land. A closed circuit is developed whit algae production, shellfish farming and Tong farming. This are new kind of functions that can replace the current production landscape when it is to salt for traditional crops. A last promising production can be seaweed, what can be

used for a very wide range of products. The different studies shows that salt water farming is possible and interesting combinations can be made. The typical salt crops also can grow by brackish water. Most of the salt tolerant crops still need fresh water to enable to germinate.







The land around the Volkerak-Zoommeer mainly exists out of agricultural land. It takes, varying by municipality, on average 66% of the land and in Steenbergen even up to 79%. From this 63% is arable farming and 16% is in use by dairy farms. The farmers are the main molder of the land. When salinization no longer shall be counteracted, farmers have to change their business management, with consequences for the landscape in its current form.

When looking at the division of agricultural activities, it is visible that the soil plays an important role. The clay grounds are mainly occupied by arable farming. This is because of the nutrient rich soil. The main crops exist out of grains (39%), potatoes (24%) and sugar beet (12%). All crops with the ability to grow in a slightly brackish environment. The grasslands are more situated on the nutrient poor sand grounds. Horticulture is also on the clay grounds.

Land use per sector
 Border between clay and sand

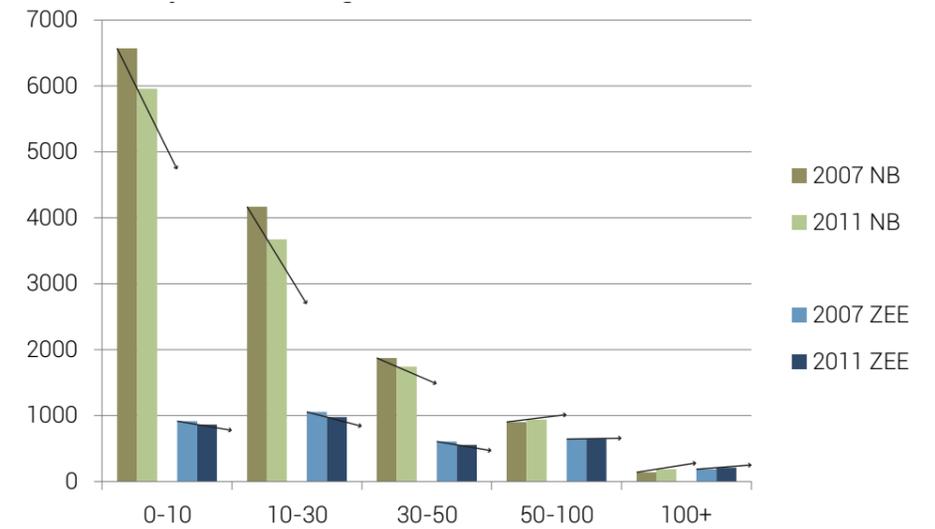
Upscaling

The trend in agriculture is upscaling. This is also the case in the research area. The scale change has caused a transformation in the landscape when you compare it with the past. Where in the past it had a big diversity in structures and granularity, nowadays it is more or less the same everywhere. The scenic landscape from the past that laid around villages is almost unrecognizable. Only the big structures are still visible and most of the plantation has been gone.

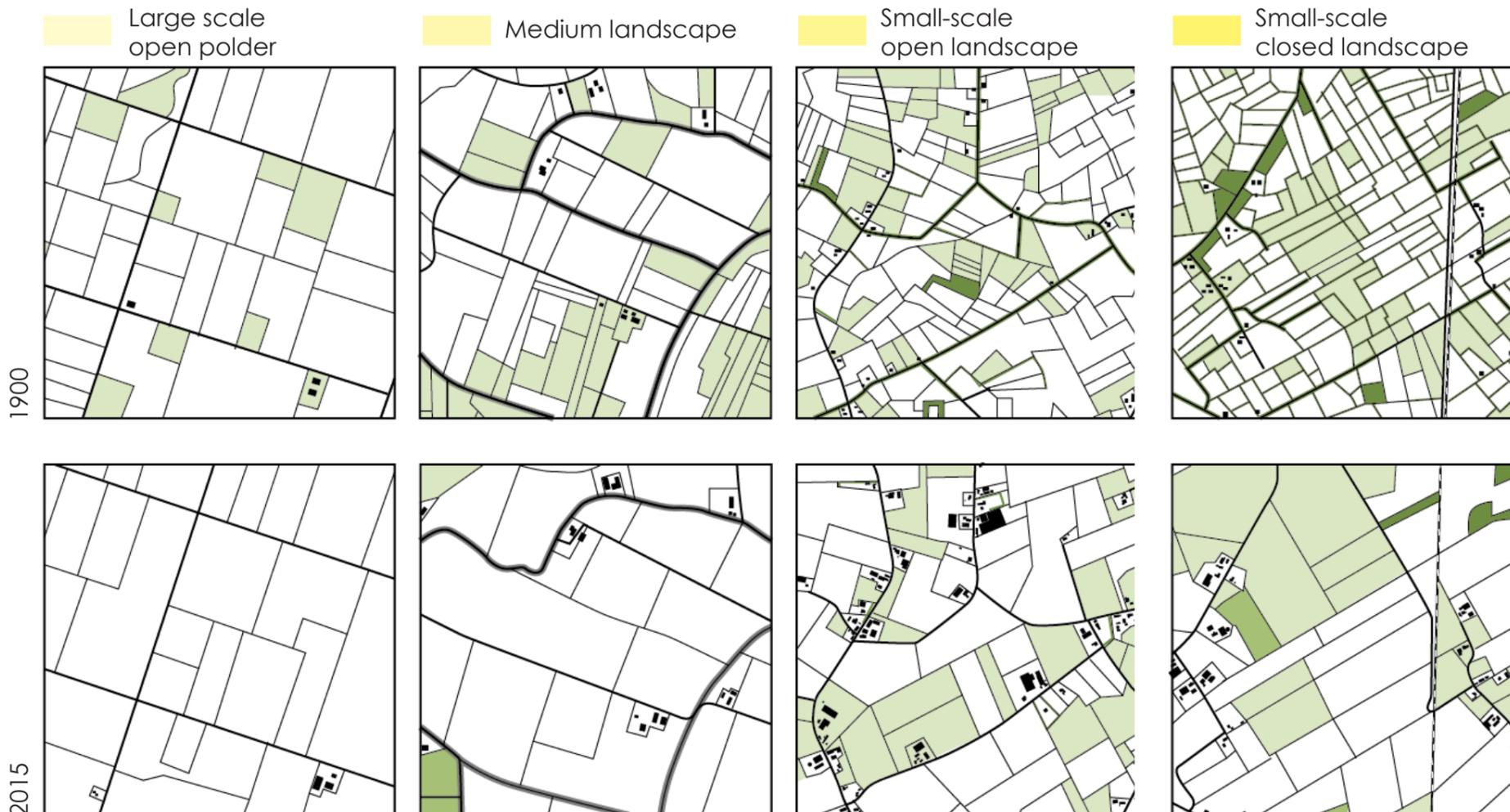
On the sand grounds the small hobby farmers are still strong in majority, but decline rapidly. The northern clay grounds are comparable with the farms of Zeeland. Here you see the division is more equal between different size

groups. Over a quarter of the farms owns more than 50 ha and can be classified as big. This category is growing.

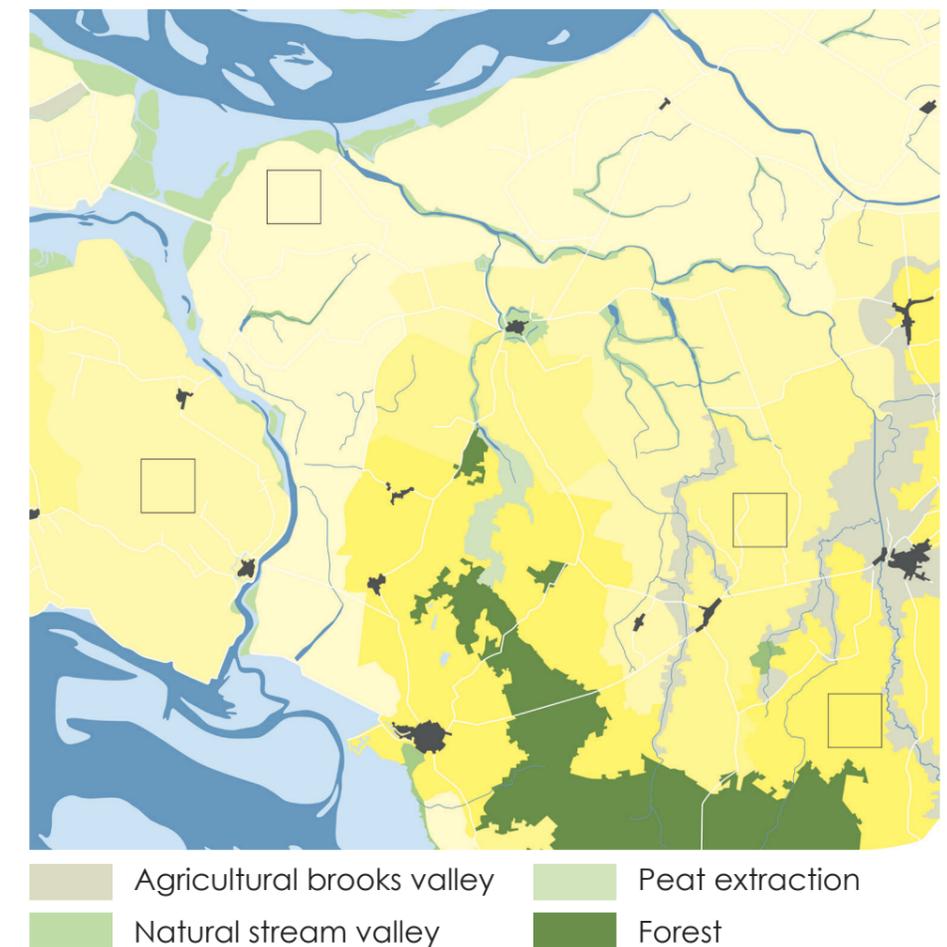
A lot of the farmers in the Netherlands doesn't have a successor. Of the farmers from 55 years and older only 34% have someone who wants to take over their company when they retire. This has as a result every year 2,5 till 3% of the farms stop. In 10 years' time the amount of farms has decreased with a third. The expectation is that in 2030 only a third is left. Most of the land will be bought by neighboring farms, but when the transition to a salt landscape is started, we presume there is less interest. Also is there a maximum size a farmer wants to grow. This way, land becomes free for other functions.



Transformation in farm size



Landscape typology division a century ago







Landscape and activities

When the salt water hits the water over the inner lands and Salinization originates, three types of zones will blend in; salt, brackish and sweet. Different structures will cause a rich new nature to come to life. Because it is a different kind of nature, not everything that lives in the current environment will survive. The polder landscape will face a lot more crude then it did before.

When we describe the construction of landscape, we will see that the absolute outer part will be the salt water, where it will blend in with the tidal marsh. The blending in area can once more be used for clam fishing, where the salt water, hits sweeter water, this clam can be caught on its best. Because the water will

be full of fish, fishing will become an important asset in the economics of this region. The tidal marsh will be flooded when water level reaches higher levels. This marsh is not yet fully accessible. It is shown as a part of nature. But when they become salt, saline agriculture will become possible on these parts. Also when the water reaches a lower level, it becomes accessible to for instance perform a mudflat hiking.

These days, the land behind the marsh exist mostly out of agriculture, which will change when the salinization appears and the soil will change. A couple of farmers will be interested in saline agriculture, where others will move to other parts of the country. The landscape will transform from an agriculture landscape in an estuary landscape with a possibility for saline

agriculture. Normally these kind of landscapes are closed for outsiders, it is a really protected area, but now it will happen in an environment where people already live.

Nowadays, the water is of such a bad quality which makes it an unattractive area to visit. The area hasn't got its own special identity. If the situation changes, other activities can be organized then before. Things that can be offered again are: Hunting, survival activities, quad driving, mountain biking and recreational boat trips.

(as shown in the figure on page 47)



saline agriculture

vegetation

tidal marsh

alluvial soil

river / creek

Landscape and possible changes

When the salt water hits the water over the inner lands and Salinization originates, three types of zones will blend in; salt, brackish and sweet. Different structures will cause a rich new nature to come to life. Because it is a different kind of nature, not everything that lives in the current environment will survive. The polder landscape will face a lot more crude then it did before.

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The tidal marsh will be flooded when water level reaches higher levels. This marsh is not yet fully accessible. It is shown as a part of nature. But when they become salt, saline agriculture will become possible on these parts (for example Zeekraal) . Also when the water reaches a lower level, it becomes accessible to for instance perform a mudflat hiking.

These days, the land behind the marsh exist mostly out of agriculture, which will change when the salinization appears and the soil will change. A couple of farmers will probably be interested in saline agriculture, some farmers are already planning a different kind of land use like a land with solar panels, and others will have to move out to another part of the country or have to be protected were possible. In Texel there is already a test with farmers who will provide their own sweet water, by using a basin and a drainage system. During wet times they collect water and during a dry period they will use the water of the basin.

The changes will also have effect on the kind of recreation. Nowadays, the water for recreation is of such a bad quality which makes it an unattractive area to visit. It also hasn't got its own identity which makes it different and unique. If the situation changes, and the land will be more crude and wet, other activities can be organized then before. Things that can be offered again are for example: hunting, survival activities, quad driving, mountain biking and recreational boat trips.

Possible changes

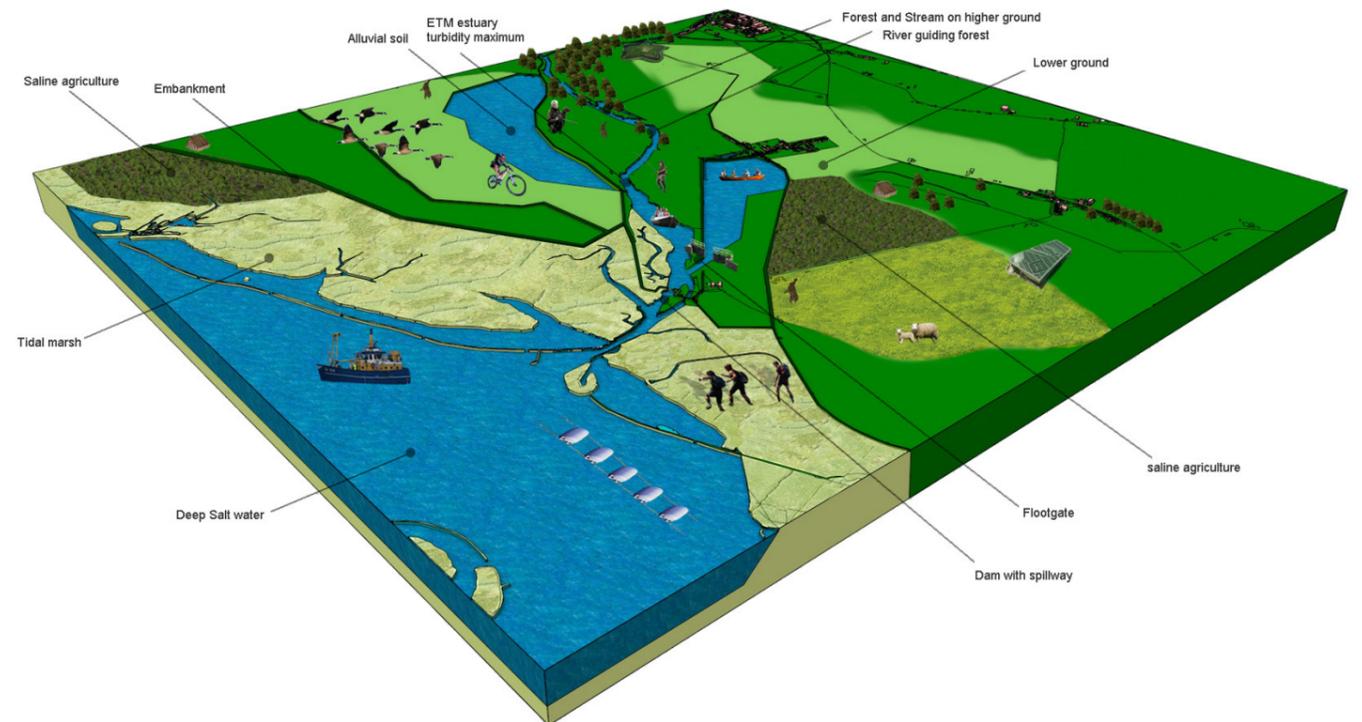


Sell their land and leave (also happened with Hedwigpolder and Tiengemeten)

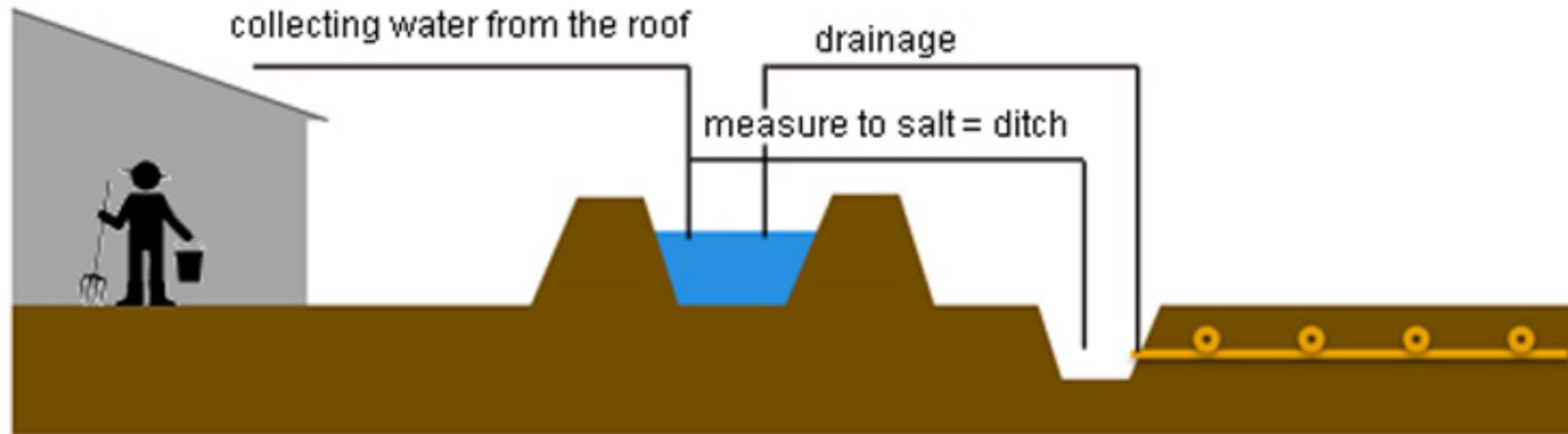
Other land use like Solar pannels

Change and choose for saline agriculture

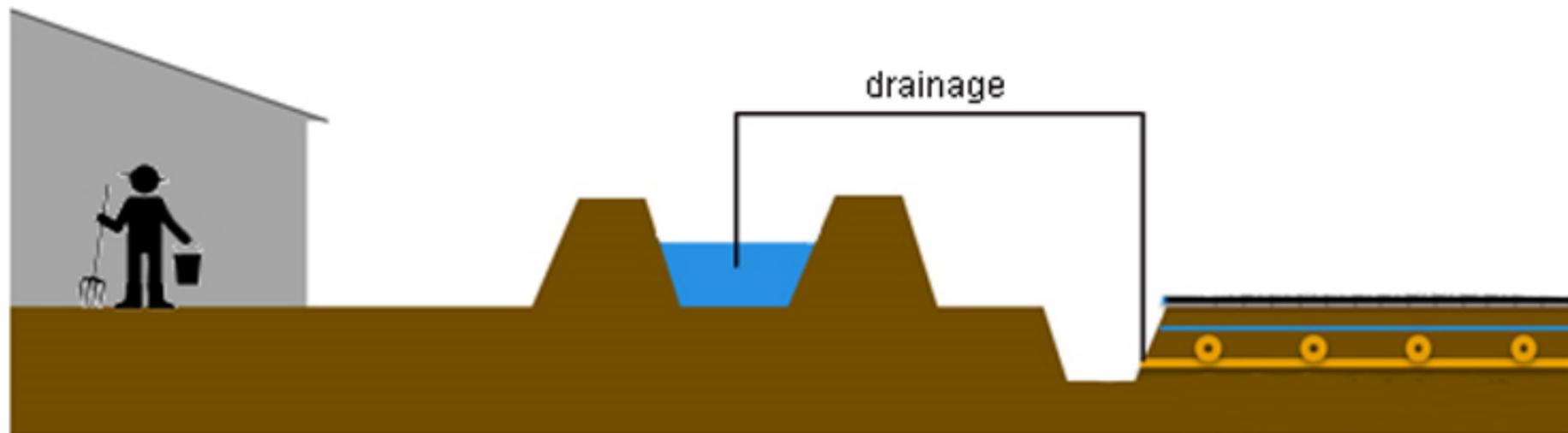
Try to provide themselves with sweet water



Experimental phase Texel: provide themselves with sweet water



situation winter: collecting



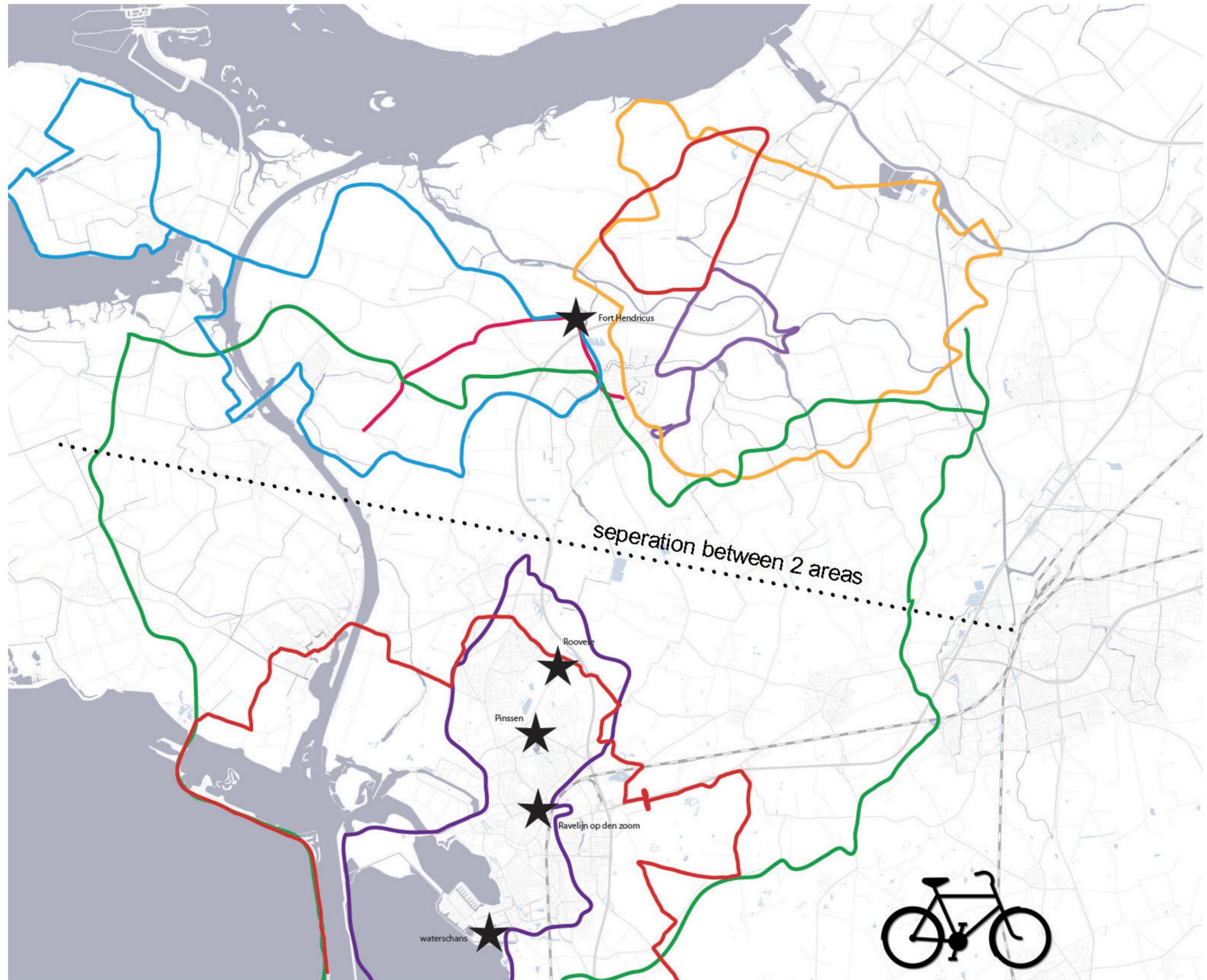
situation summer: using

Biking routes

From viewing the cycling routes there seems to be a deviation between two zones, The southern routes, apart from one, do hardly cross the northern routes and vice versa. This means you always have to choose between two areas.

The separation line lies between two areas, The Brabantse wal and the zone beneath the Volkerak. The main differences between the two zones are higher ground, Brabantse wal and lower ground, Vokerak area. Both of these two zones have their own character where the cycling routes are spread out from the east to the west and not from the north to the south, making it a missed opportunity to connect the different landscapes with each other, to make it a more adventurous experience during your cycling route.

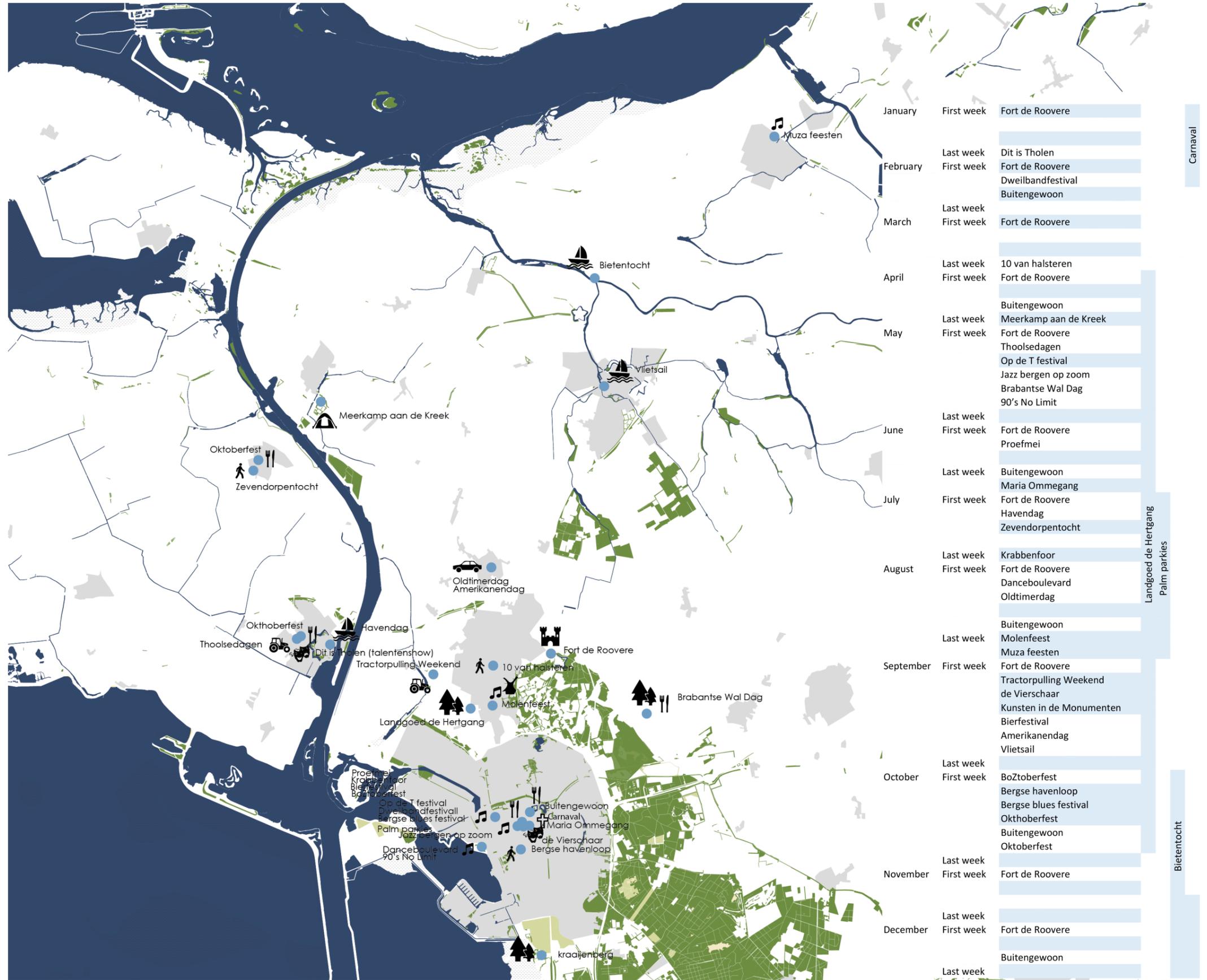
Also a west-Brabantse waterlinie route could be designed to lead cyclist along all the stronghold and through the landscape, to strongly contribute the experience of the waterlinie with its landscape and making the Waterlinie recognizable. Doing this it is possible to make a first strong cycling connection between a northern and southern part of West Brabant.



Events

In the area are a limited amount of local events. The events that take place are especially centered in the direct surroundings of Bergen op Zoom. Bergen op Zoom is the biggest establishment in the neighborhood and is therefore the most attractive for activities.

The regional festivities can be grouped in four themes: music performances, local food activities, boat/ water events and local historic cultural events. The music and food events take mainly place in city center of Bergen op Zoom and the boat events are mainly on the bigger waterways in the area. All the activities are well divided throughout the year. The density is a bit higher in Spring and Summer, what can be expected because of the weather.



Culture

The project area is characterized by its many historic centers. Many of these centers have still historic elements in them. One of the most recognizable historic element are the amount of forts in the area. Whom are often the origin points of the different establishments. In those historic centers are many buildings found who have a rich history and earn therefore the status of monument. In the city center of Bergen op Zoom alone are 575 monuments. This aspect translate into that the historic city centers of Bergen op Zoom, Tholen, Steenberg, enz. all have cultural value.

The cultural functions in the area are not that different than other places in the Netherlands. They mainly are located in the centers of the establishments. Also applies: the bigger the city, the more and the more diverse functions. The analyses shows that there are a lot of small establishments. This scale determines often that they do not have any cultural functions of their own.

Music and dance are two cultural functions who are most common in the area. This is consistent with the amount of (music) performance events, who are taken place in the area.







Water can be your enemy but also your best friend. West-Brabant is a good example whom has learned from their experiences with water. There were times the land was flooded and many people died, but there were also the days of the waterlinie, the time the water gave protection against a raid.

The first waterlinie, which appeared in the year 1583, was the that of Eendrecht. The techniques of inundation were used to flood a series of polders along the Eendrecht. The inundation was meant to protect Zeeland and Tholen of a raid from West Brabant. Because of the advantages they had in the Eendrecht, there was a demand for expansion. The expansion, which was established in the year 1628, was called West-Brabantse waterlinie. It became a unique line since both salt and sweet water were used to inundate. The salt water had its origin from the open connection with the North Sea, but because of its high ground level, the water could not reach the southern part of the line, causing a barrier for the water. Therefore a question was raised to finish the line with sweet water from the Zoom. The sweet water inundate became the last part of the line, causing the Eendrecht to be needless.

The inundation of the waterlinie followed the layers of the landscape, lower parts, became the wet parts and the higher parts stayed dry, which were used to build upon. Nowadays the differences between lower parts and higher parts of the landscape are still visible. Knowing that the different levels in the landscape are still there it becomes possible to link the project of the waterlinie with the climate change and the urban water challenge. At this moment the rainwater of Bergen op zoom, Steenbergen and Halseren is getting removed using the sewers but the intensity of rain is getting bigger and though the rivers debouch in this area the water coming towards west Brabant in the winter is becoming more and more. The layers of the line could help solving the water problem by

using them again as a storage of water. The advantage is that the villages in west Brabant were settled on the higher, safer grounds, which makes it possible to use the inundation technique again without flooding all the villages.

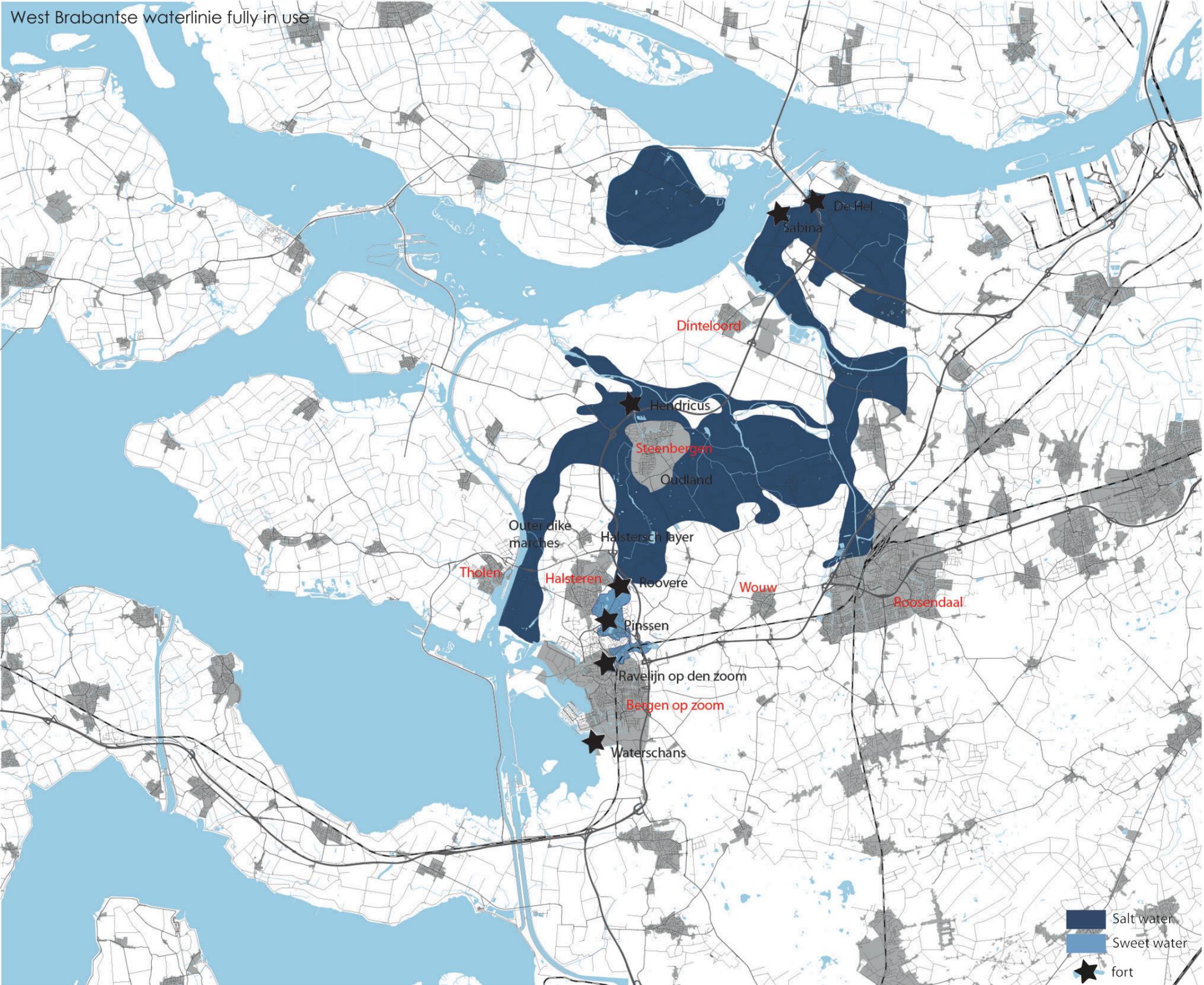
If we compare the area of the waterlinie with a scenario which make the Volkerak to become salt again, has tides and has an open

connection with the inner land, we can see a big part of the waterlinie being filled up with water again. If it would again be filled with water, it would become better recognizable and this would probably mean it would become a more interesting cultural heritage than it is now.



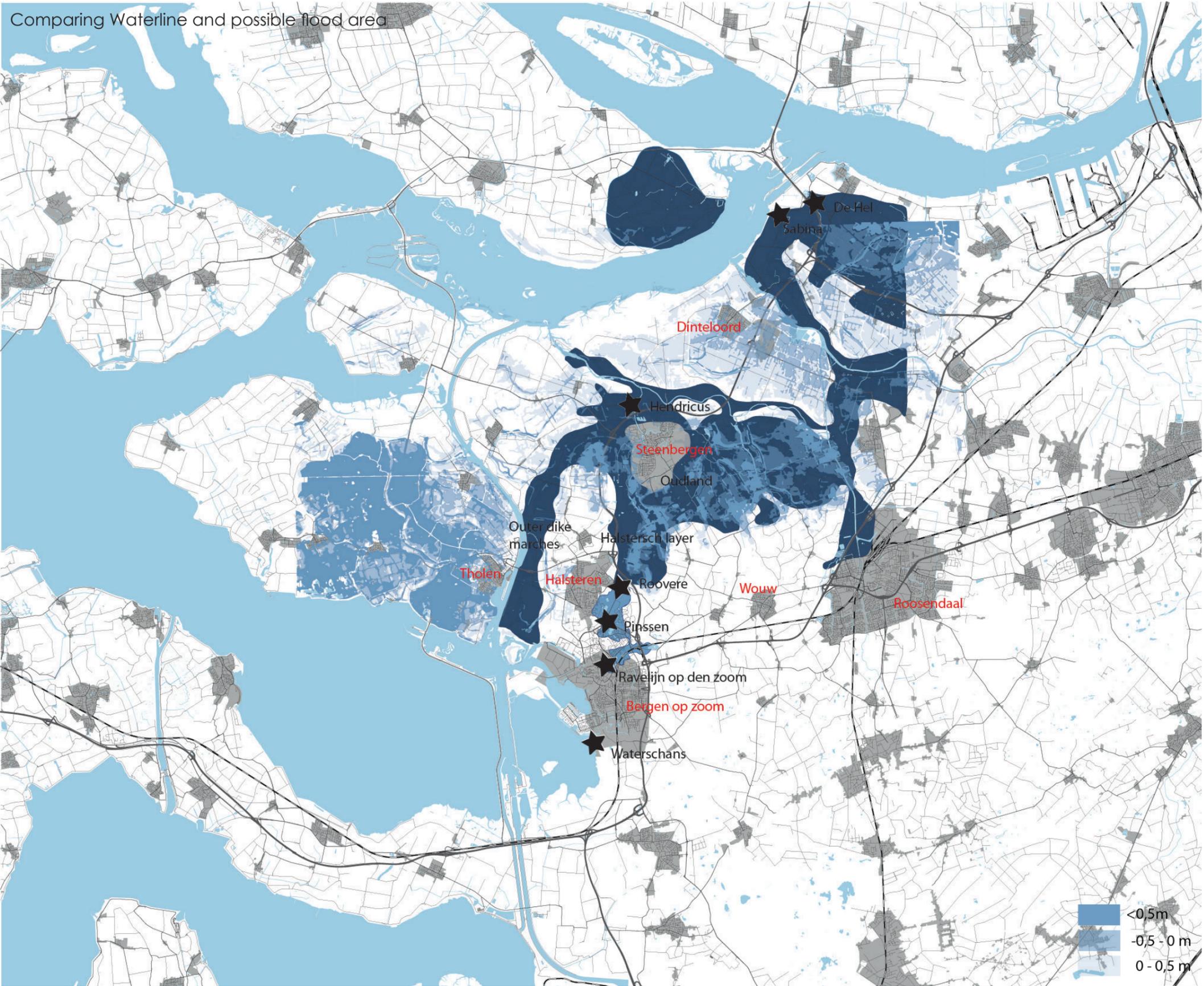


West Brabantse waterlinie fully in use





Comparing Waterline and possible flood area



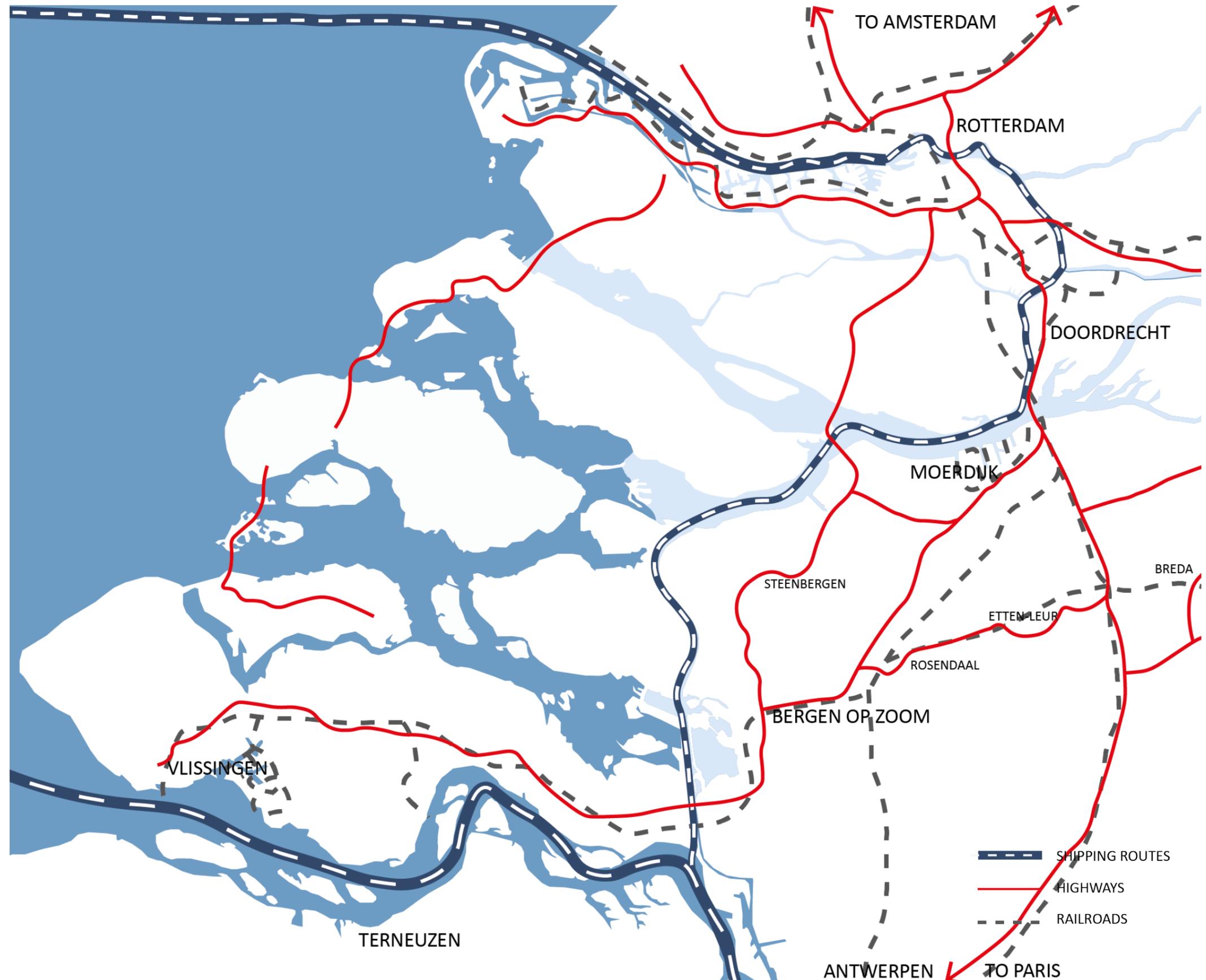


Steenbergen aan zee

KARPACK

Location, infrastructure and distances

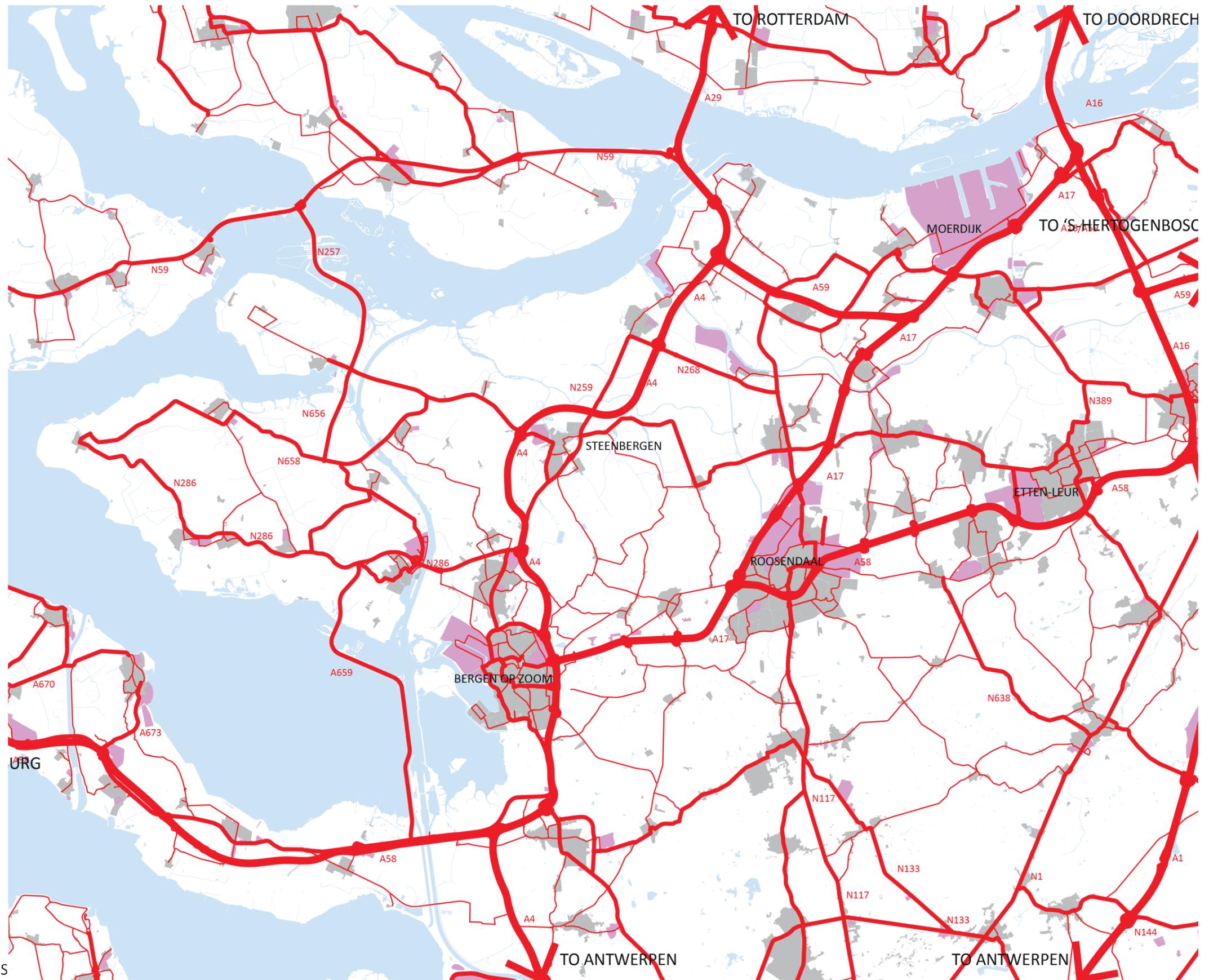
West Brabant is centrally located between the international ports of Rotterdam and Antwerp and it is a short distance away from the large population concentrations in North-West Europe. The region is also known as 'the gateway to Europe'. These regions are connected to each other by different infrastructure; road, water and railway network on different spots of West-Brabant. Industrial areas of Bergen op Zoom and Moerdijk are also connected to the important industrial estates via pipelines and data communication networks. Besides these connections the area is approximately 50 km. away from the larger airports like Eindhoven and Rotterdam and 100km. away from Schiphol



Highways & Motorways & Municipal Ways

The region is situated at an intersection of European roads. The north-south corridor between the Delta metropolis; Amsterdam, The Hague, Rotterdam and the Flemish Ruit; Brussels, Antwerp, Ghent, Bruges, crosses the east-west axis in this region between the Ruhr region and Vlissingen. That is why the area is easily accessible by road. An opposite to this accessibility the west-north part of the area has no highways. The network is mainly with municipal ways and the density of the roads decreases closer to the Volkerak- Zoommeer.

The A29/A4 motorway runs via Roosendaal/ Bergen op Zoom, and the A27 motorway runs via Oosterhout/Breda, with the A17 motorway as a connecting axis between Moerdijk and Roosendaal. The A58 motorway runs from east to west via Breda/Bergen op Zoom.



- HIGHWAYS
- MOTORWAYS
- MUNICIPAL ROADS

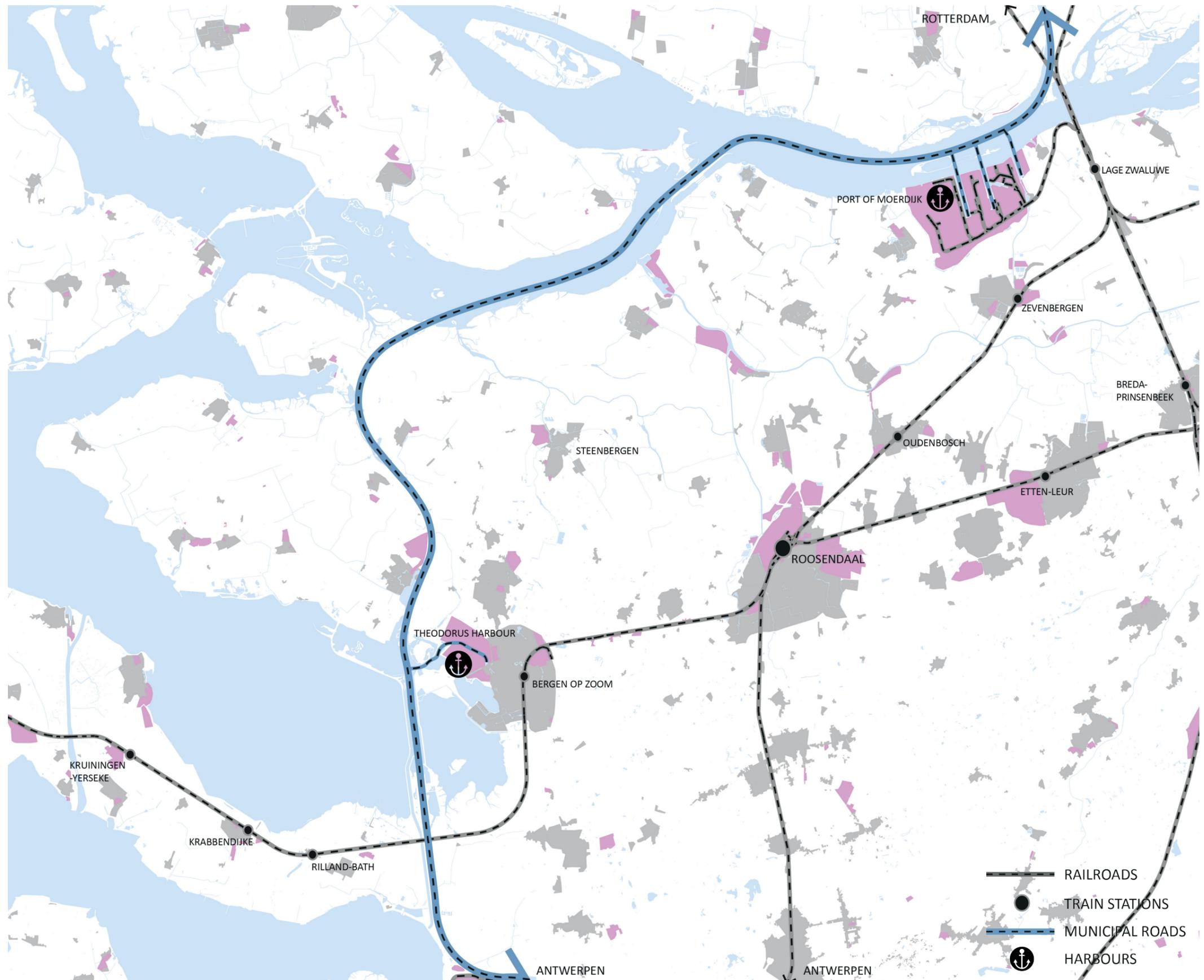
Railroads

The area is connected with the railway route via Breda between the Randstad and Germany and also via Bergen op Zoom, Roosendaal and Breda is the connection between Vlissingen and the Ruhr region. Numerous industrial estates like Moerdijk have multimodal facilities such as rail-road terminals.

Waterways

The Schelde-Rijnkanaal on the left side of our area is the most important inland shipping connection between Rotterdam, Bergen op Zoom and Antwerp. The Hollands Diep, with the adjoining large-scale harbor and Moerdijk industrial estate, is accessible for ships with a draught of 8.40 meters. The Merwede, linking up with the Hollands Diep, forms an important logistics shipping connection to the Ruhr region.

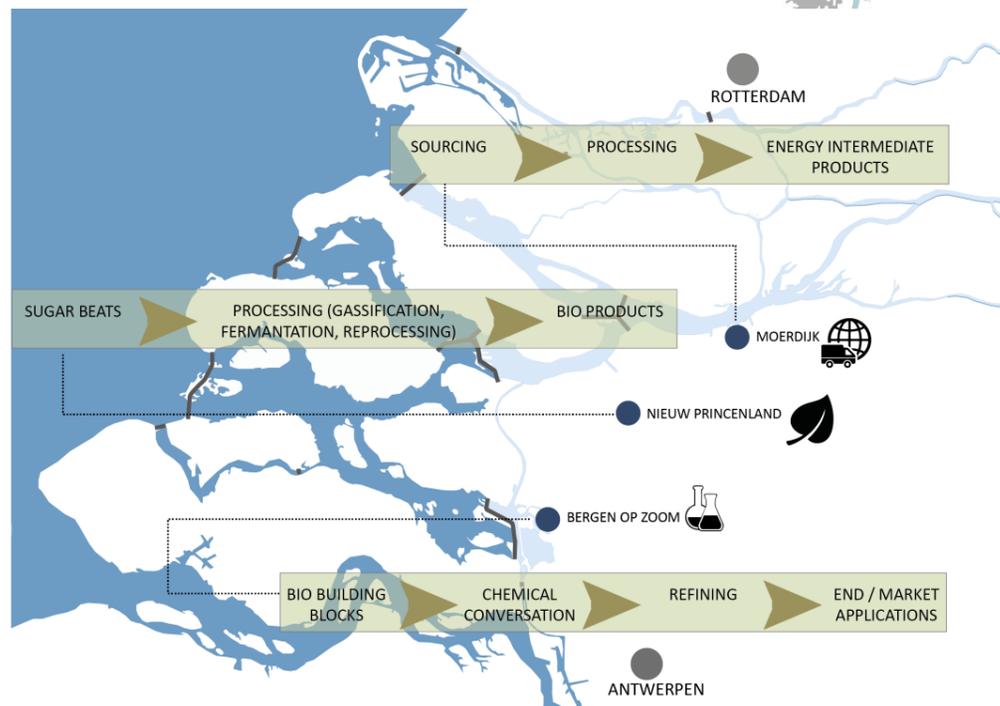
The 4th seaport of The Netherlands Moerdijk is directly connected with the sea. It is the most inland port in the Netherlands. Via the Dordse Kil, Oude Maas and Nieuwe Waterweg, the sailing time to the open sea is less than four hours. Inland, Moerdijk is connected to various inland waterway routes including the two most important waterways in the Netherlands: the Rhine and the Meuse. These provide a direct connection from Moerdijk to all the inland waterway routes from and to the European hinterland.



PHILIP MORRIS



West Brabant is establishing an international reputation for innovation. West Brabant's key sectors range from world-leading process industries to new and upcoming sectors such as green chemistry. The region focuses on 3 main sectors; logistics, maintenance and bio-based economy. The area is important in logistics because of its location between Rotterdam and Antwerp. It is possible to have access to other regions by road, railway, water and pipe. In high tech maintenance sector the region has an international level. The focus of the region is mainly on chemistry and high tech materials and systems. The third key sector is bio based industry. This area is really important innovation platform of Europe in bio-based industry. 2 main factors are the architects of the bio-based industry in West Brabant; strong agricultural and chemical companies and optimal logistic infrastructure for the supply and transport of biomass flows. Big companies such as SABIC, Shell, Cargill and the optimal transport system by four different ways makes this region an enterprising and distinguishing for biobased economy. The key location for biobased economy are the Green Chemistry Campus in Bergen op Zoom, Agro- and Foodcluster Nieuw Prinsenland in Dinteloord and the 4th seaport of Netherlands: Moerdijk.





The natural structure of the area is characterized and appointed by the ecological network of the Netherlands. A structure who follows mainly the dominant water structure of the area.

In the area multiple small natural parks can be found. The biggest ones are around the Volkerak Zoommeer and on the Brabantse Wall. Those two have very different natural appearances, because of the difference in soil. The ground on the edge of the Volkerak Zoommeer lies below sea level and consists mostly of clay soil. This data ensures that here is a swampy climate. In contrast to this is the ground of the Brabantse Wall. The Brabantse Wall is a sandy hill, which is heightened in the landscape. On the hill grow mainly trees, which creates a forest east of Bergen op Zoom.

There are two quiet areas on the project site, both near the waterside. Natural area the Dintelse Gorzen forms itself around the North side of the Heen.



The nature types in the area can be divided into three groups:

1 The estuary

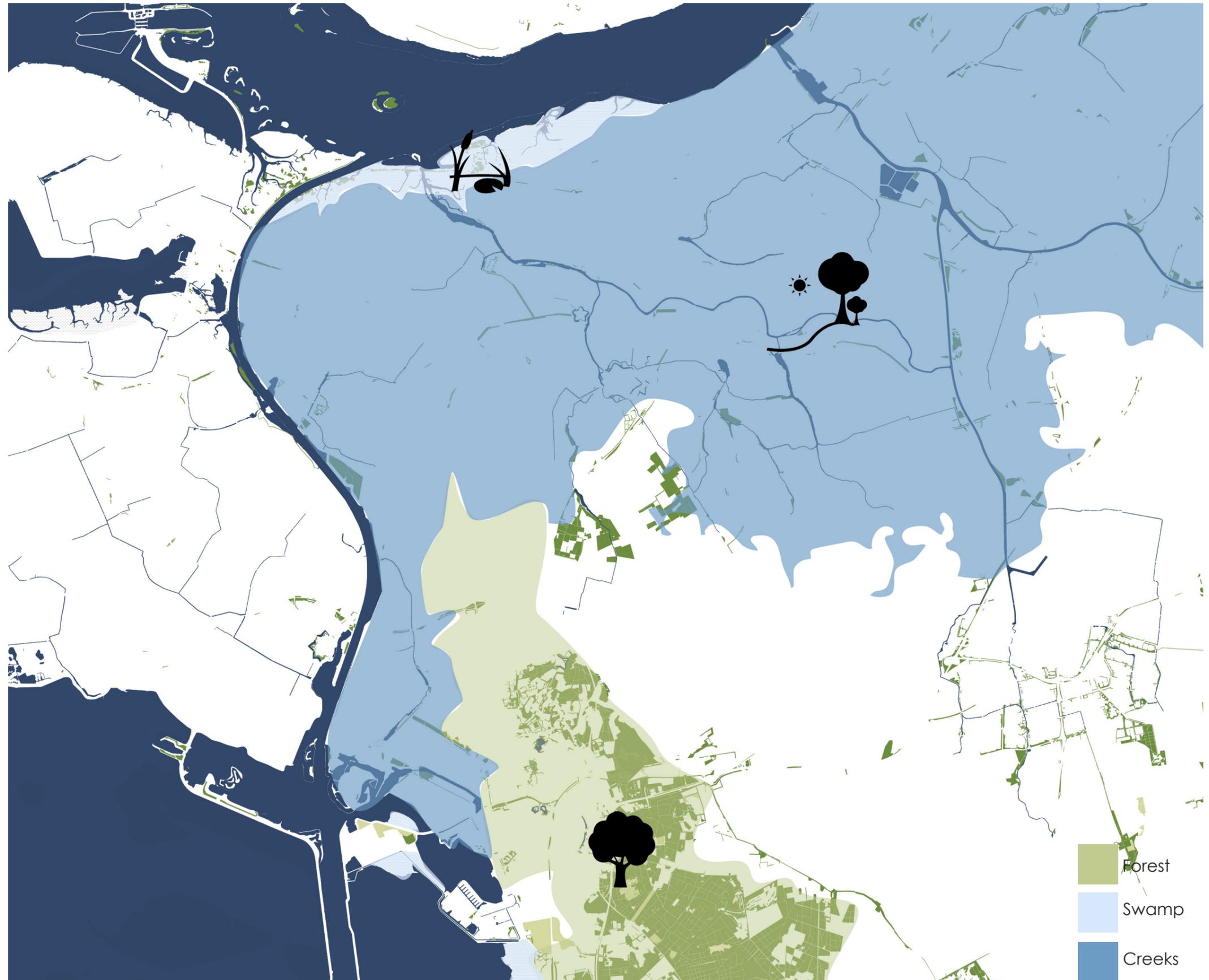
This area can be directly found along the Volkerak Zoommeer. This swampy land is located in front of the dikes. Because of its location this type of nature is more dependent on water levels changes. With a high water level this area come under water. This area is therefore very changeable and diverse.

2 Creek system

The whole clay soil in the area contains a wide creek system. Directly to this water grow plants that are part of the total ecological network of the Netherlands. The water determined the route of the vegetation.

3 Forest

The third typology can be found on the higher places in West Brabant. On the Brabantse Wall arise forests. Forests where both deciduous and coniferous trees grow.

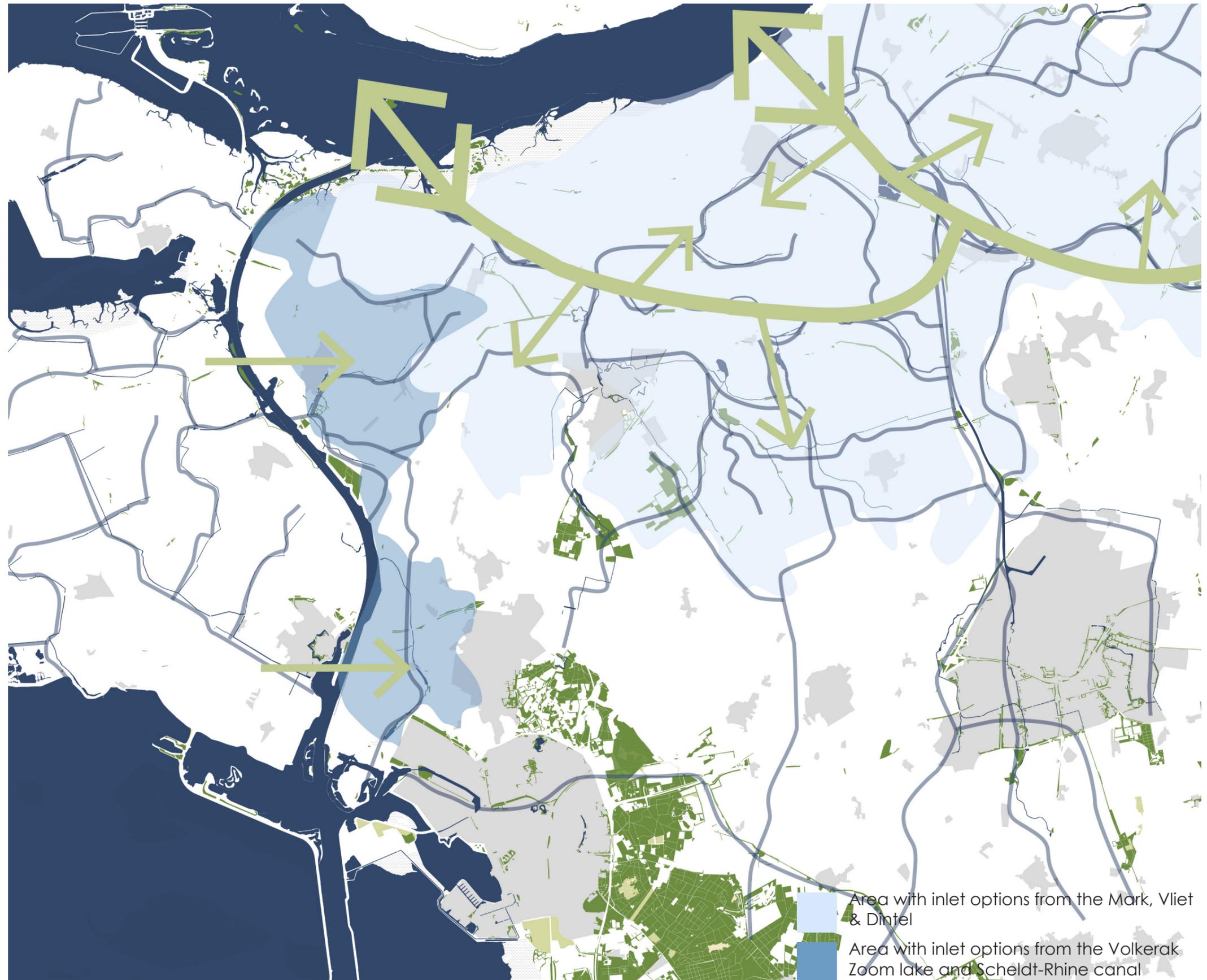


Creek system

The creek system is the most important influencer of the local landscape. The system exist of two different water managements in the area.

The first type is the most western part of the area. This part of the creek system has its inlet from the Volkerak Zoommeer and Scheldt-Rhine canal. What means that this part of the system is fully dependent on the water that will change from fresh to salt. The government decision to change the water will cause drastic change for nature in this area. The vegetation will have to adjust to its new salty situation.

The second type covers most of the area. Most of the inlet of this part of the creek system will come from the Mark, Vliet and Dintel. This water will remain fresh. Also this part will have some inlet from the Volkerak Zoommeer. This means that in the area itself will become a transition zone from fresh to brackish to salt water. The transition zone is very variable, because it is depending on how much water comes from each end. This knowledge translates in that the vegetation of the area has very changing conditions during a year, what will have impact on the vegetation types for the area.







Vision

Concept

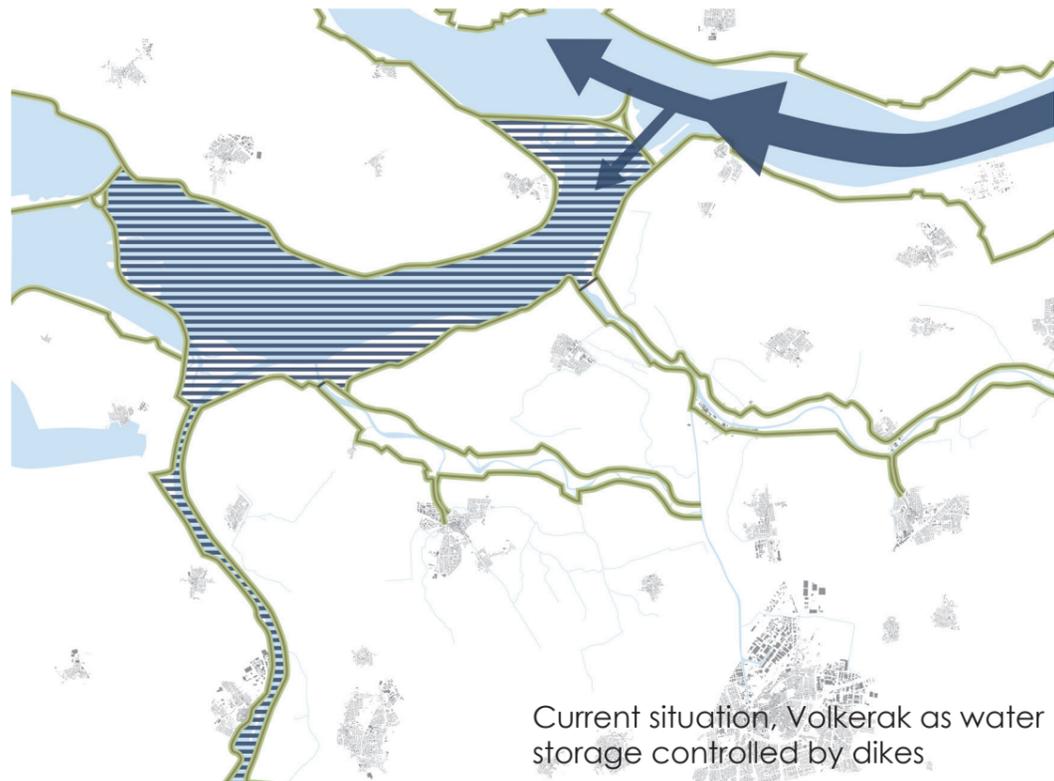
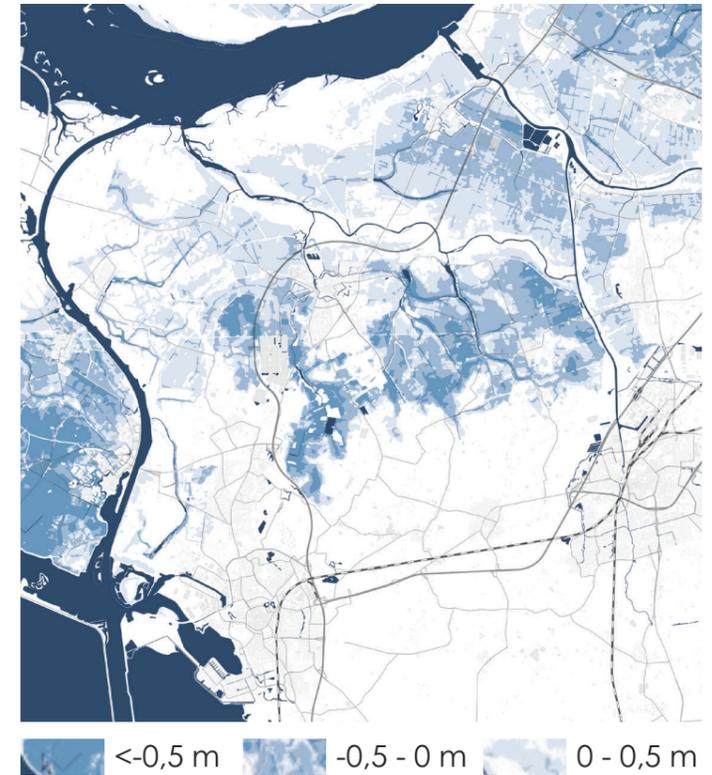
The proposal of the government for the Volkerak-Zoommeer is not only to make the lake salt, it also gets small tides back. This is so the water keeps flowing and a better water quality is guaranteed. The tidal effect the government propose is very minimal, low and high water are -0,20 and +0,10 NAP. To really effect the environment, we want to propose to increase this and made a tidal range of 0,6 m. This gives the possibility to let parts of the now permanent dry nature work like a tidal estuary again. This is a unique kind of nature that is very rare in the Netherlands. Only a few places along the shoreline have this. Most of it is situated around the Wadden Sea, the Western, - and Eastern Scheldt. Because this nature type is rare, it are protected areas where people aren't allowed to live. In some of the areas it is even forbidden to come and are only visible from dikes. This is a shame because it are very special areas with a lot of potential. The new landscape we want to create should be a place for flora and fauna,

but definitely also for people where activities, fitting with the area, could take place.

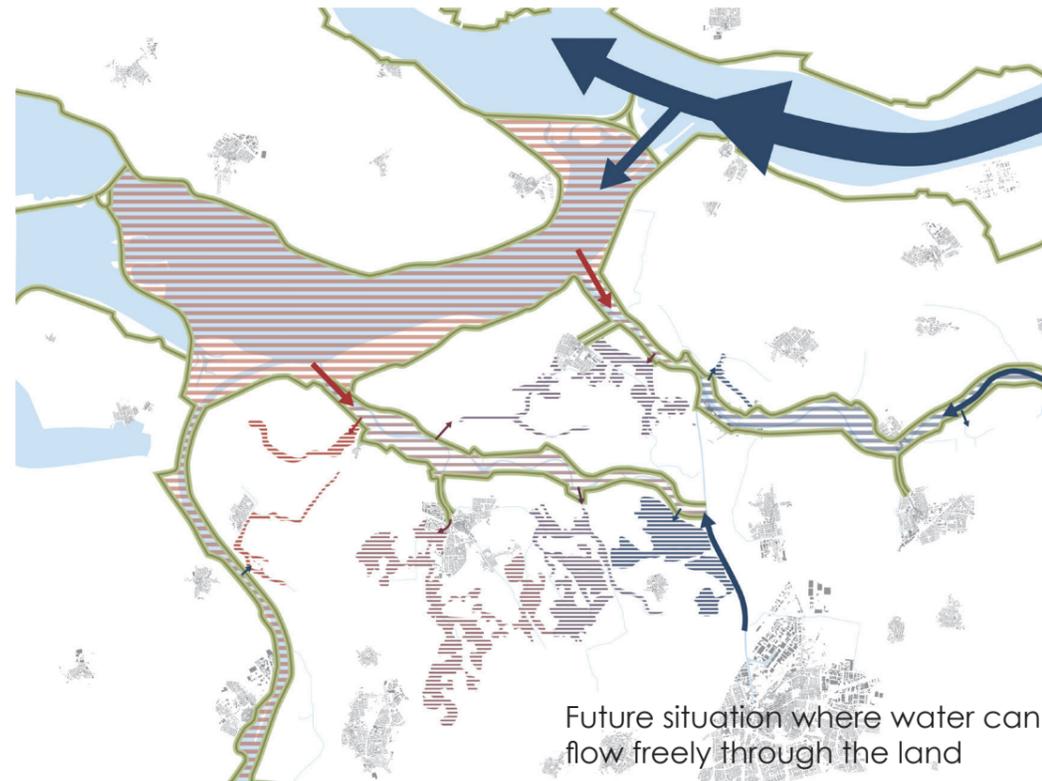
Additionally the Volkerak Zoommeer is a water storage facility. The surrounding dikes make it possible to hold extra water in times of heavy rainfall like a big bathtub. It is used to disburden the Hollands Diep. When necessary, water is pumped in. The water level can become maximum 2,3 m above NAP and store. This however will only happen in the most extreme situations. According to calculations of the government the chance is 1/1400 each year.

The combination of tides and the sweet-salt contrast give the possibility to create a new unique area at this place for the Netherlands. Like said before, we do not believe we should hold back salinization in an artificial way. On long term this is not sustainable because of the big amounts of fresh water it needs. We want to change the perspective on the

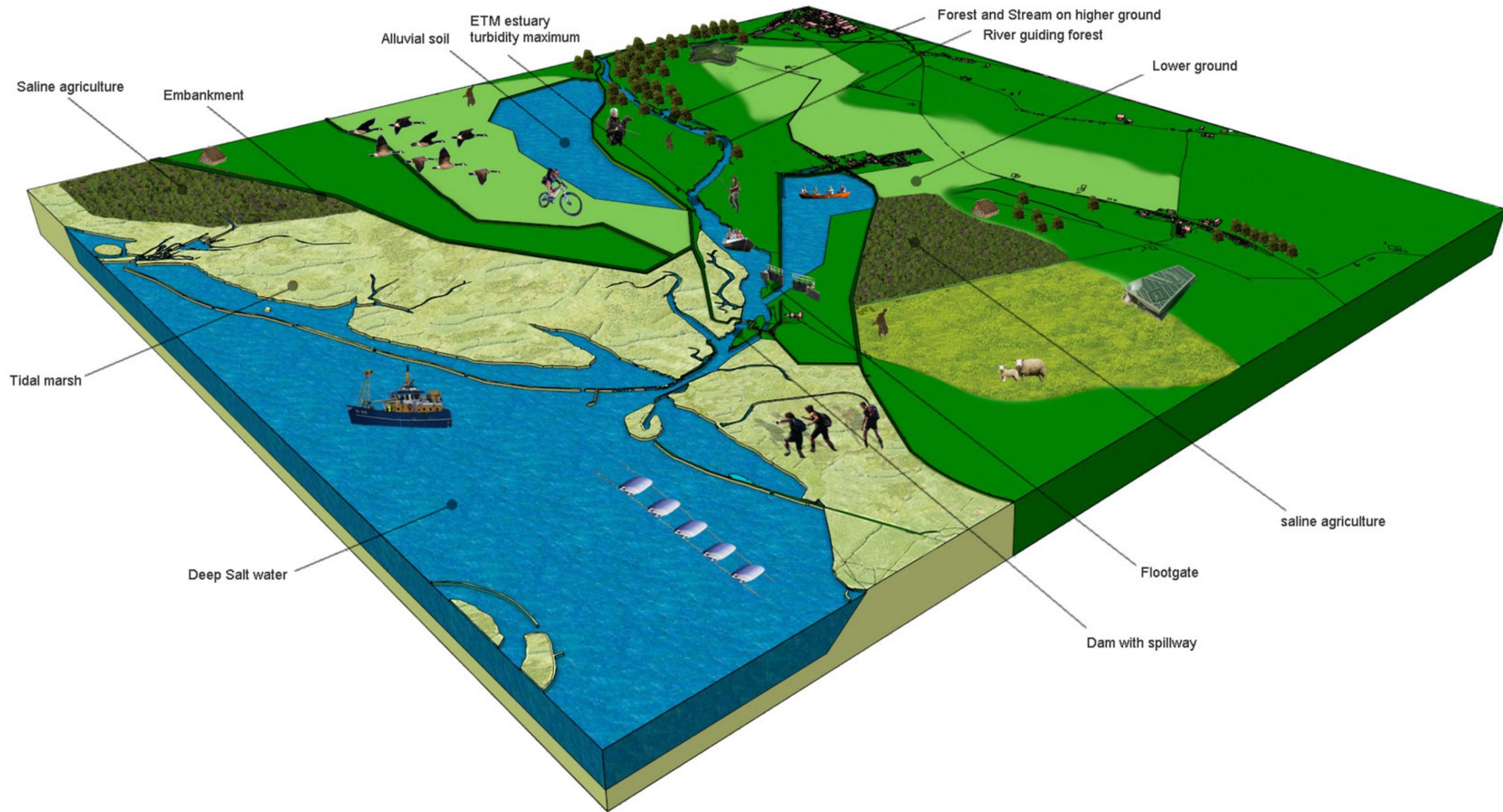
subject and let water flow freely and let it mix with the fresh in a natural way to strengthen the salt gradation. We want to expand this by using the tides. When the water level rises, it will flow into the existing creeks. When we remove artificial barriers on strategic points, the lower parts of the area will join in the flood and brackish water flows into the land. The agricultural lands will change. The existing farms will move away because of the salinization, with the result the land needs a new function. The lowest parts will transform into a permanent brackish wetland that is valuable for nature and recreation. The higher areas stay dry, but here the salinization is stronger. We believe this can remain production land, but not in the traditional way. New production methods should be used and other crops should be cultivated.



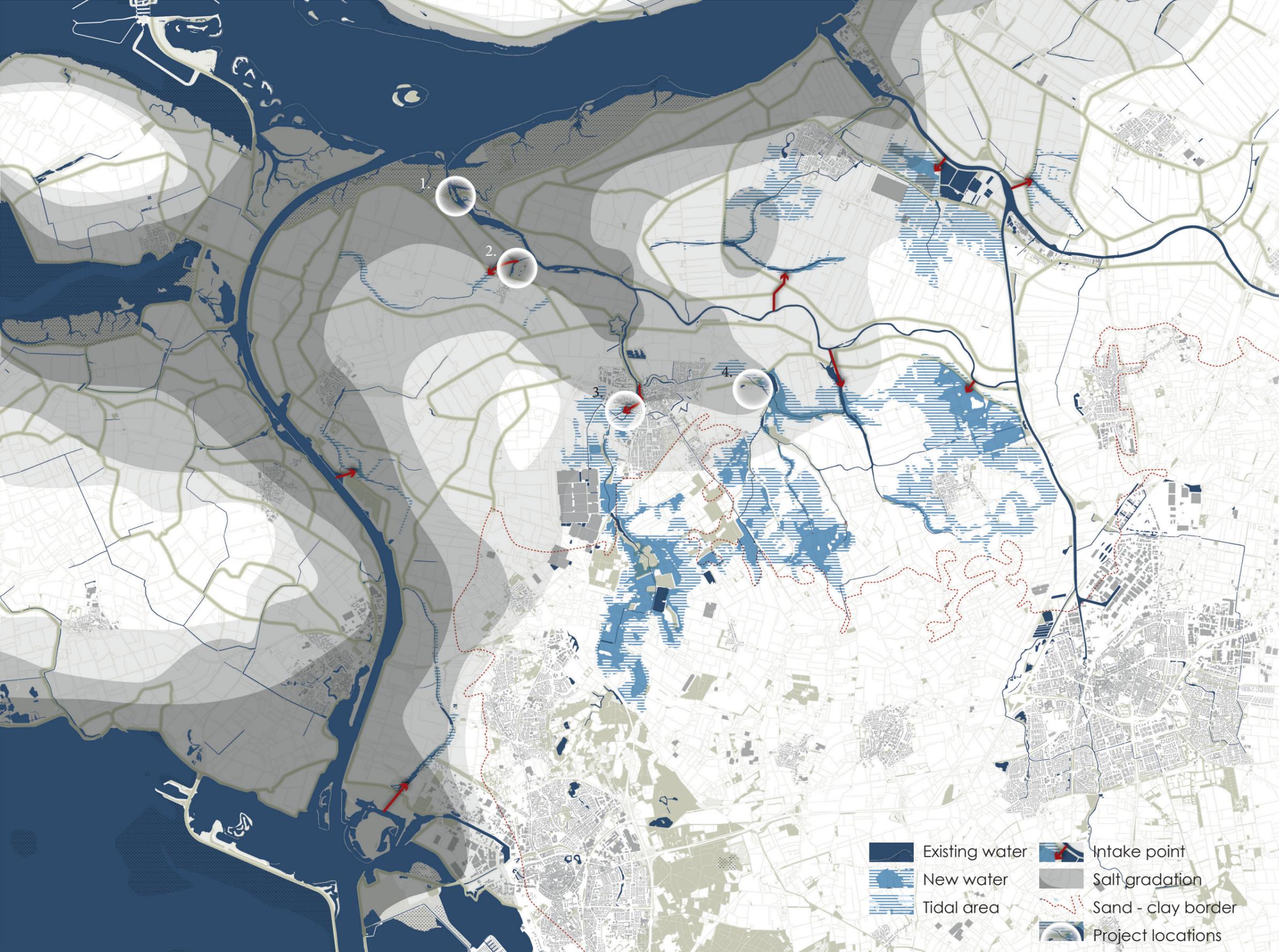
Current situation, Volkerak as water storage controlled by dikes



Future situation where water can flow freely through the land

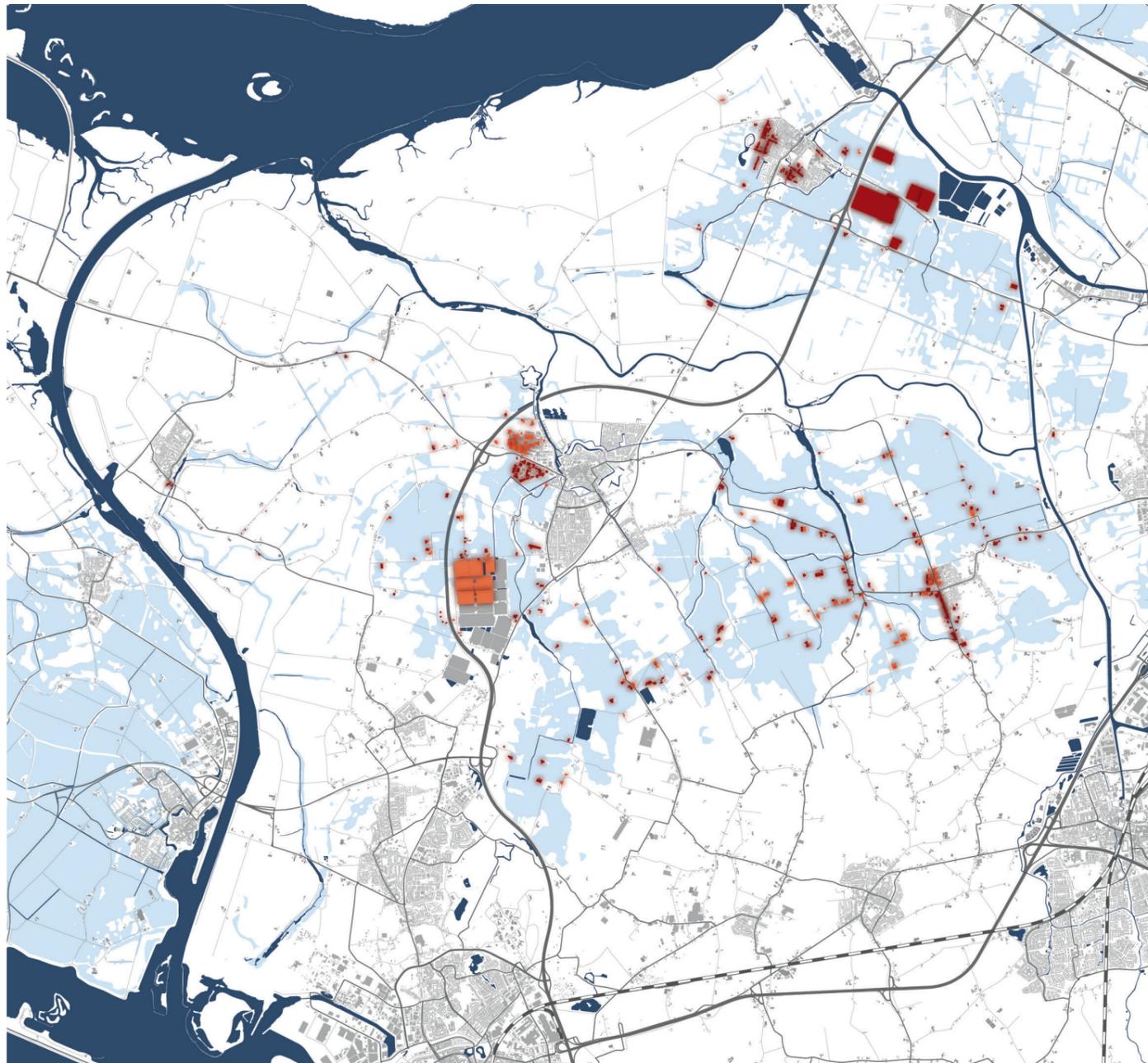


Planning sites



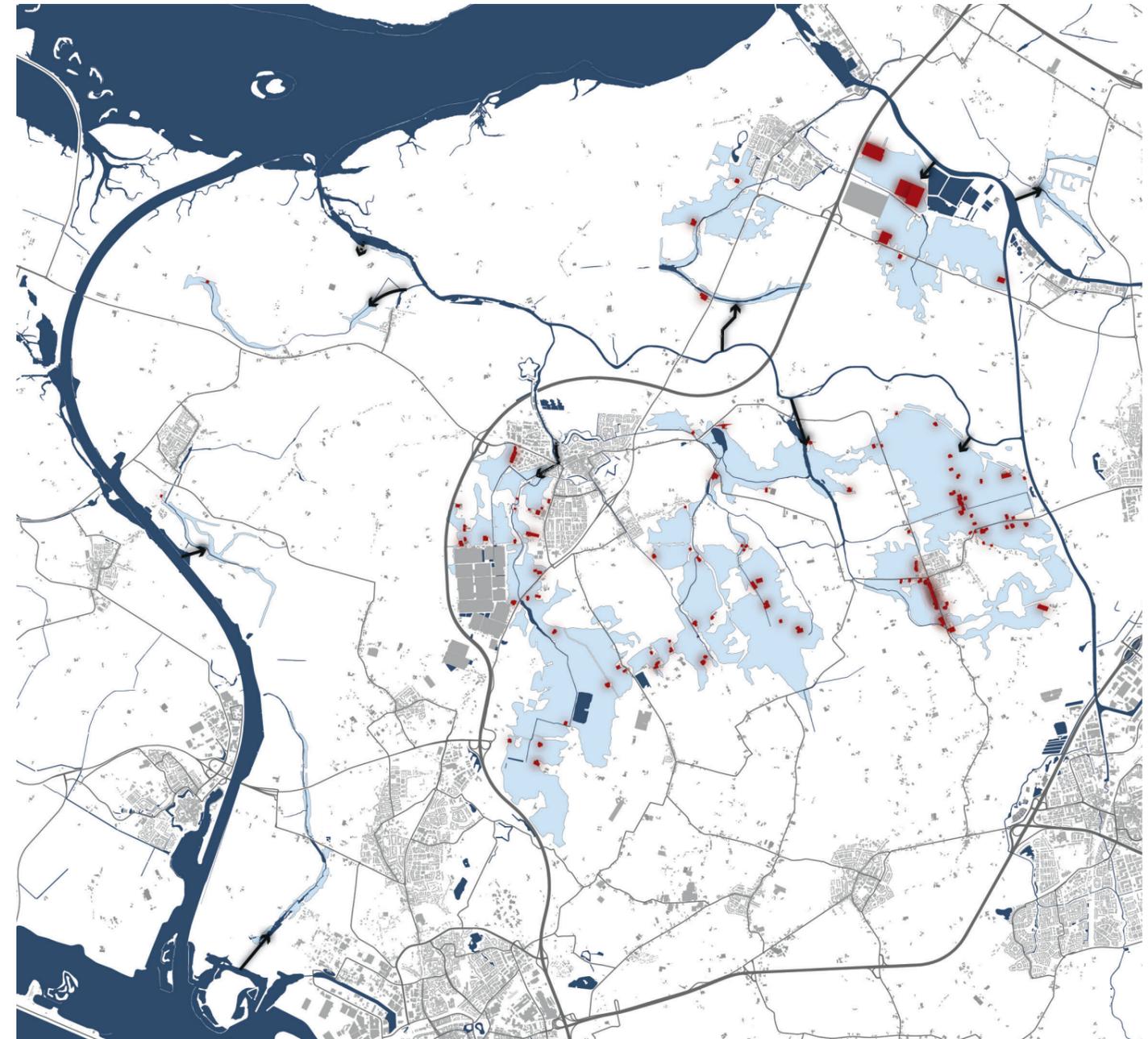




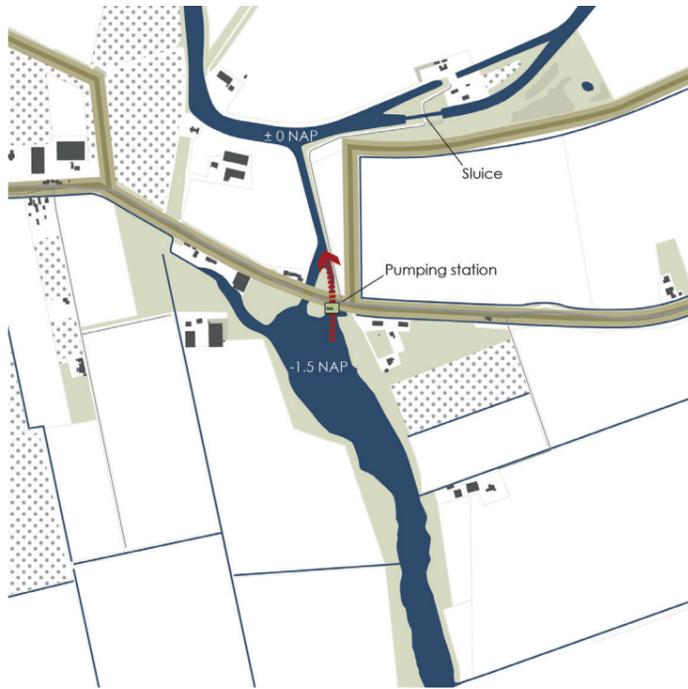


Flooding the area have influence on the existing buildings in the area. In the first map the buildings that lay below 0 NAP are visible. We want to limit the amount of buildings that become unusable. Because of this we choose to pick out the areas that have a low density of buildings to introduce the tidal landscape. In the image on the right you can see where buildings stand in the planned flood areas.

One area stands out. This is at the edge of the village Kruisland. Here the old street is layed below 0 NAP. There are a few houses here that are more than a century old. Because of this the place need extra protection. This can be done by a small ridge of maximal 0,5 meter high. This way the buildings have free sight on the tidal area what give extra value to the environment, but are safe for the water.



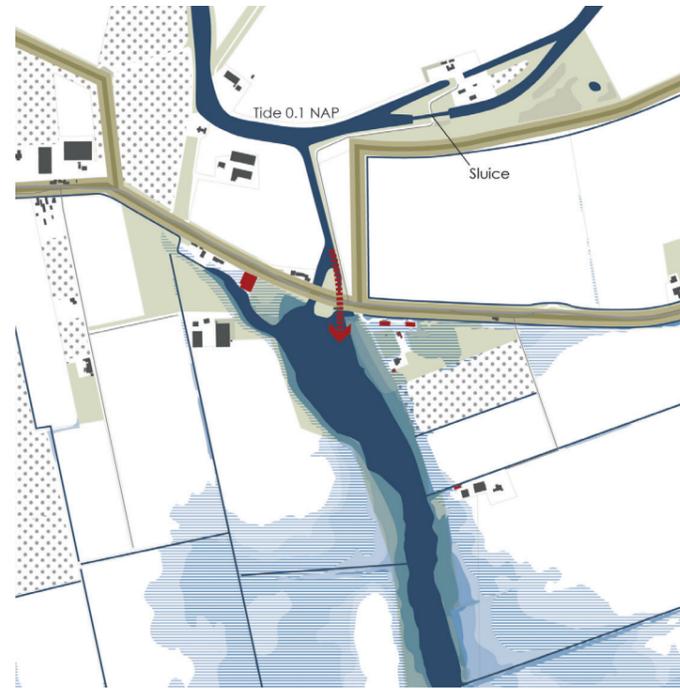
Most of the roads are situated higher than the surrounding land. These form natural borders for the water. However on some places they are to low and flood with high water. On these places we want to heighten the roads till +0,5 NAP. This way they will always stay dry and accessible.



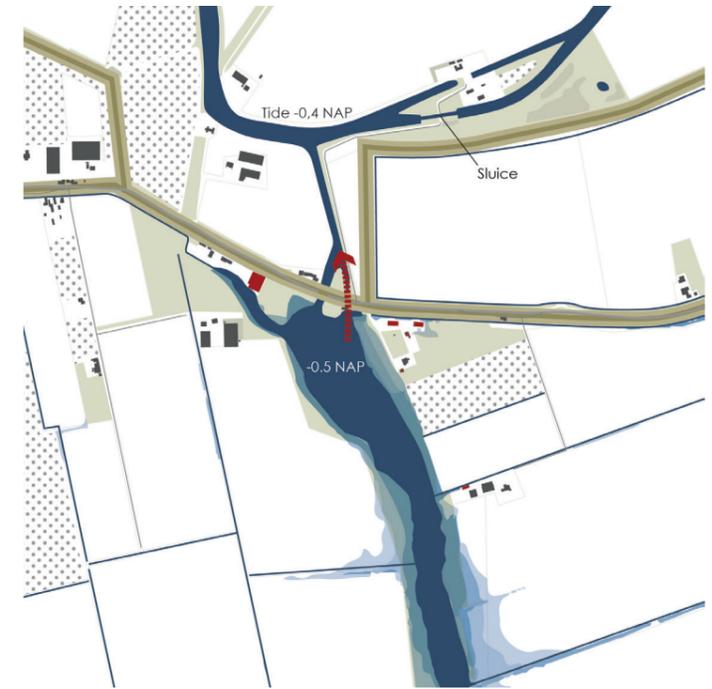
Current situation: Pumping stations ensures the polders stay dry.



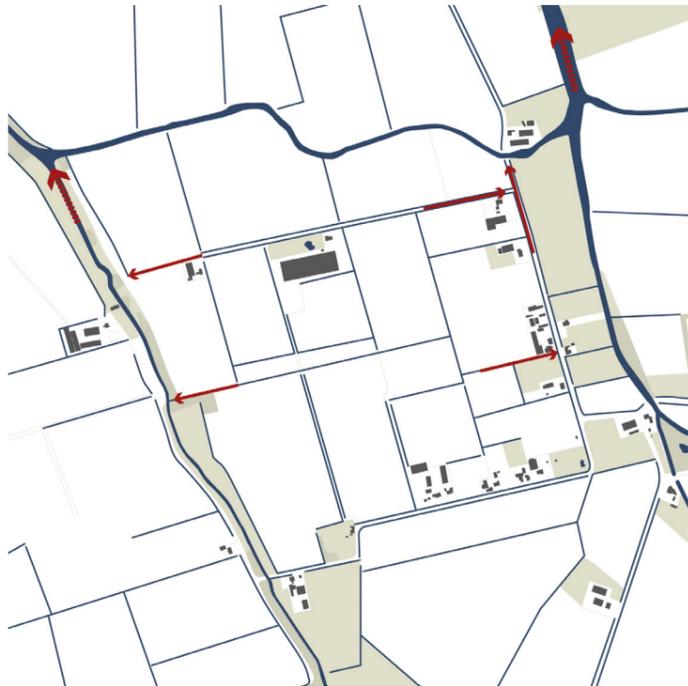
Height map: The Steenbergse Vliet is situated higher than surrounding land and water.



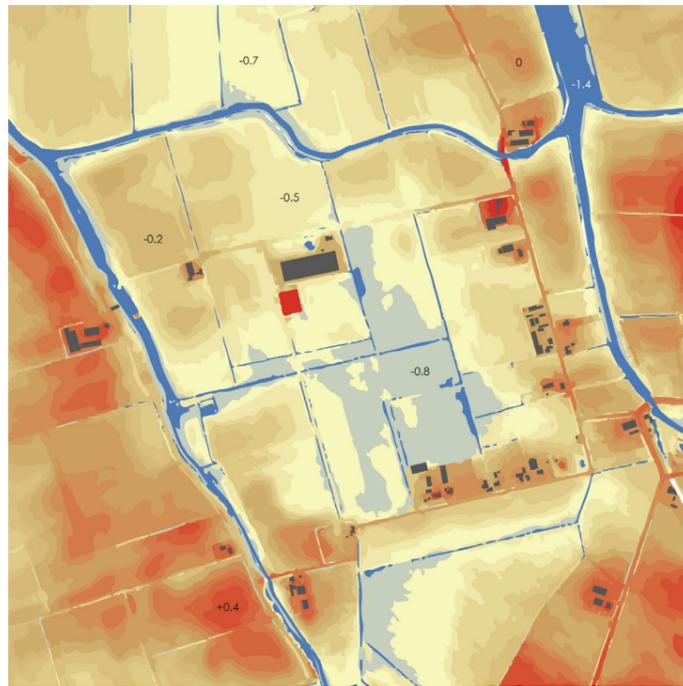
When the water can flow freely, with high tide, the land is slowly flooded.



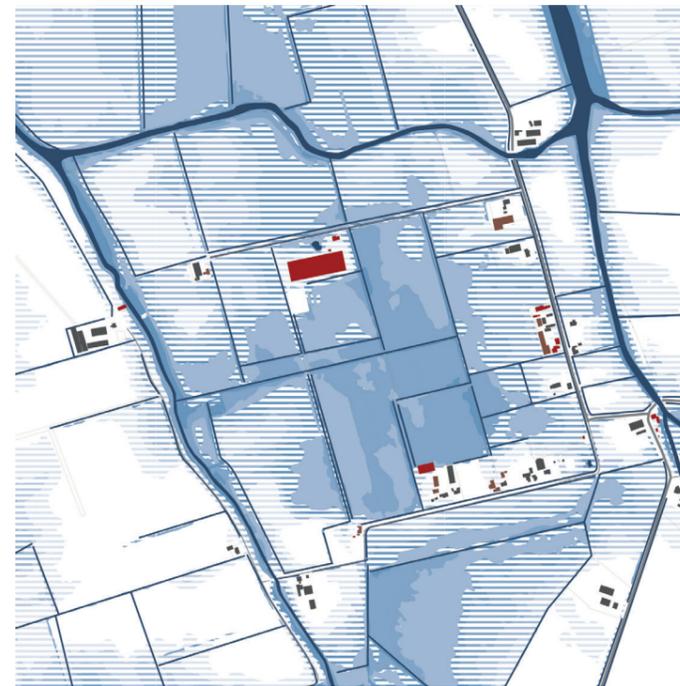
With low tide, the water exists to the vliet and the land become dry.



Current situation: A fine-grained ditch network drains the polder and keep the water level constant.



The middle of the polders is lower than the edges of the polder because of land subsidence.



When the water come up, the land is flooding. The existing buildings are mostly situated on higher ground and stay dry. If infrastructure is incremented till +0.2 m NAP, the area stay accessible.

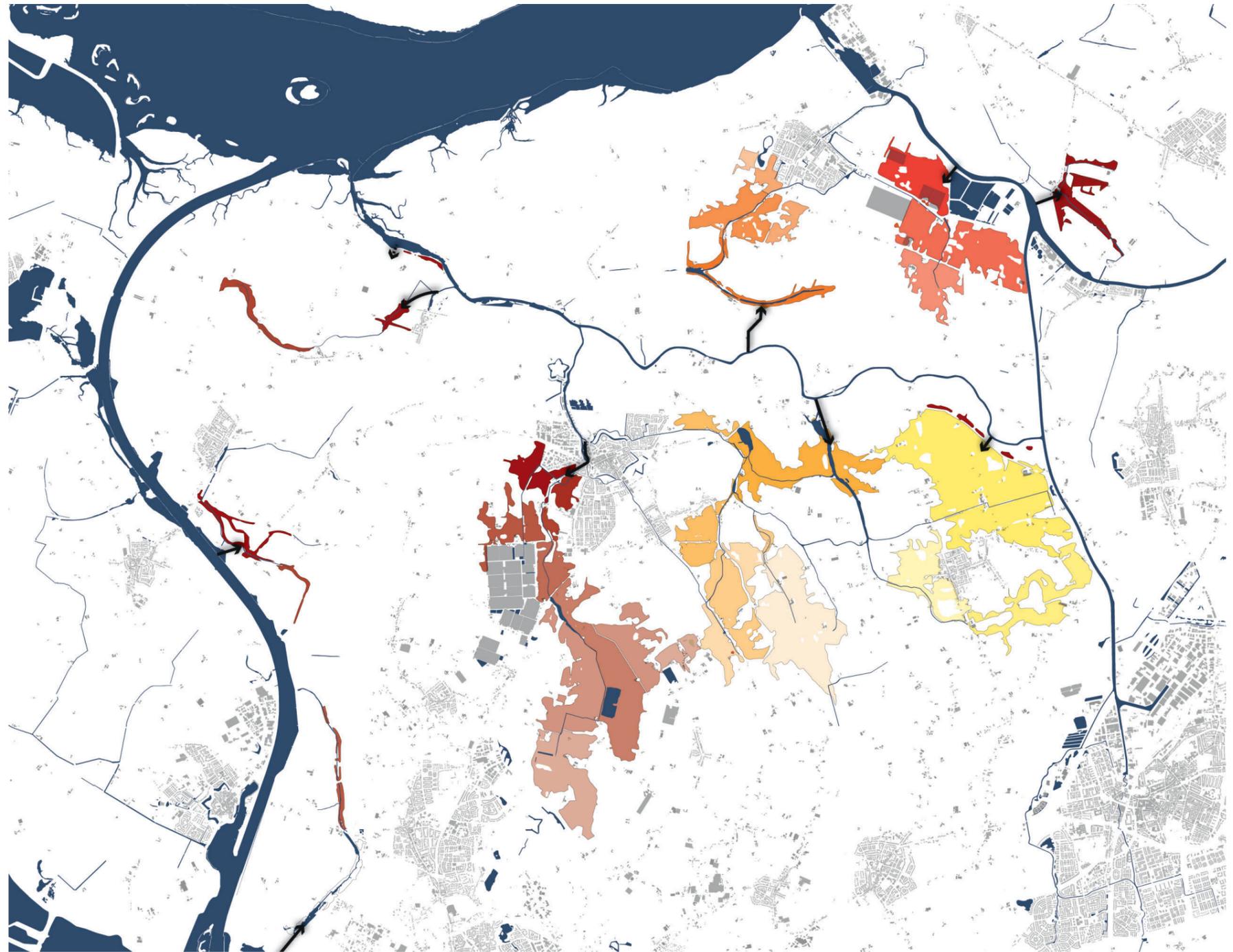


With low tide the land is dry. In the lowest part, water stays and new ponds are formed. This cycle repeat itself on daily basis. In time, the landscape changes. New water channels carved out and other areas become permanent dry because of deposition of sediment. Nature will settle and it become a real estuarium.

Phasing

The execution of the transformation goes step by step to keep optimal control over the flooding area. In the first step the small tidal areas get opened up and the first part of the old historical waterlinie. The waterlinie can be done step by step because of natural barriers in the landscape. Where necessary extra barriers can be made in an efficient way to make the steps even smaller. By starting with the waterlinie, it is possible not only to introduce the new landscape, but also restore this old historical line.

When the first step is a success, the other areas can be opened up as well. Each of the areas will be also divided in different phases to keep control and make the development go gently. New developments can grow organically and the farmers can change to other production methods and test them small scale before implementing them on a larger scale.



- Phase 1: Historical waterlinie and small controlled areas
- Phase 2: Dinteloord Oude Prinselandse Polder
- Phase 3: De Barend & Molenkreek (south of Dinteloord)
- Phase 4: De Overval & De Baak (East of Steenberg)
- Phase 5: Kruislandse polder

Individual planning sites

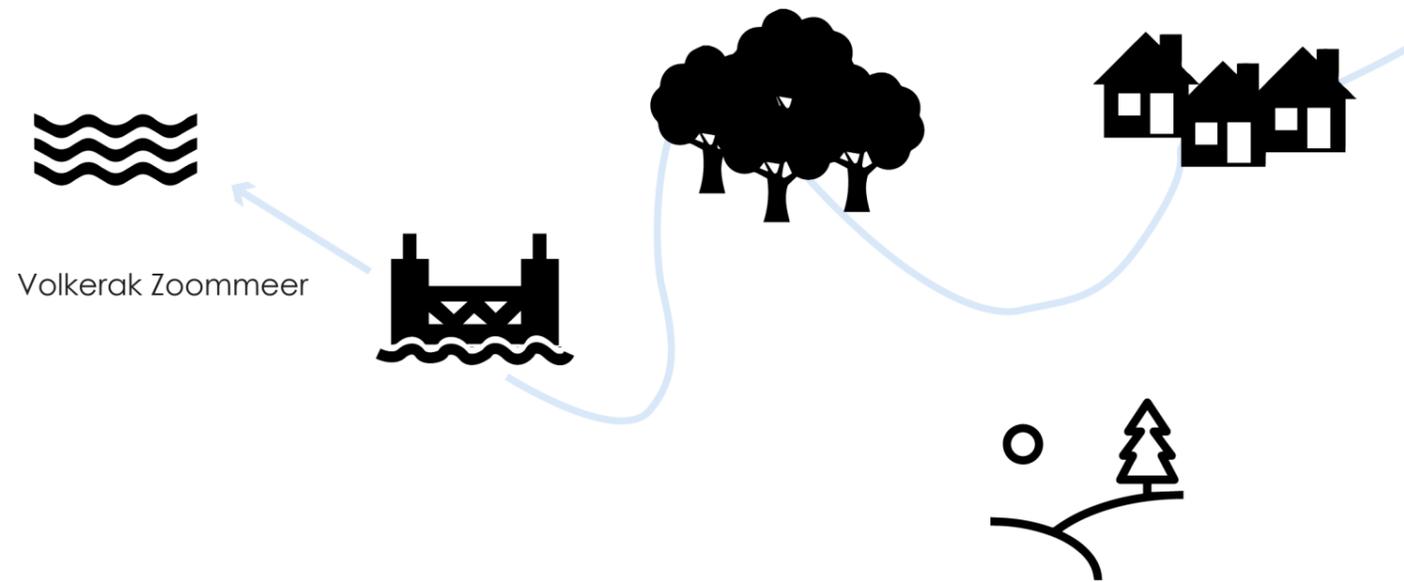
In order to let this concept work, there are a few crucial places. First the locks (1). This is the place where the salt water flows into the creeksystem when the water drainage is low. It is the point between land and water, between the lake and the creeks. Seen from the water, it is the start from the brackish landscape. Multiple conditions come together at this point and a architectural gesture is desirable to emphasize this.

From the lock the water flows into the creek system so the creek will rise. The main creeks are situated higher than the surrounding land and the land will flood. By making human interventions on critical points, we can decide where the water will flood and controll it. The overflow points can be in the countryside (2) or in the local towns (3). Both need their own design solution, but the result will be the same: water will flow into the lower parts of the countryside (4).

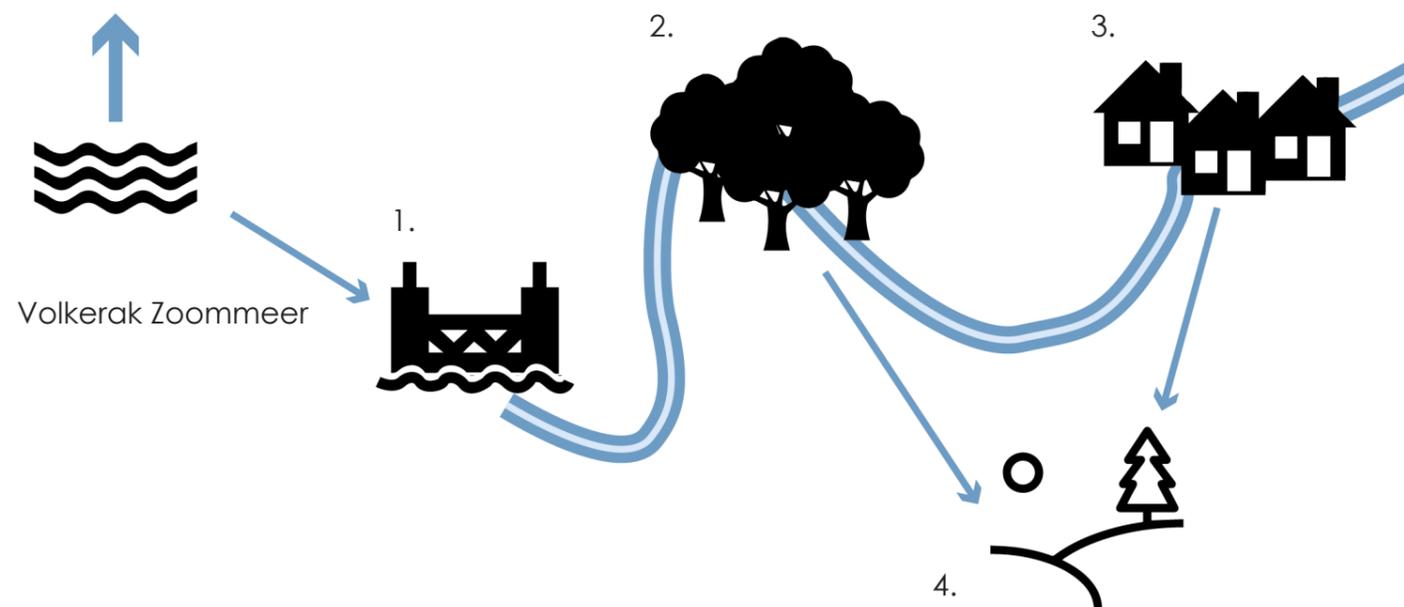
These four places will work together to make a working concept. All are necessary to create the first phase of the development of the area. When the phase is a success, these basic points can be extended with similar points to transform the whole area. The four places will not only contribute as a whole towards the landscape intervention for the area, but will also make together a chain. A chain were functions join together to make a stronger whole. All the interventions will show the possibilities and thereby the extra value for the local environment of the area.

The four places become our individual planning sites.

Current situatieon



Concept



Mandy Reijntjens

1.

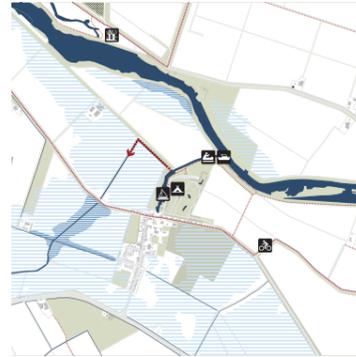


At the start of the Steenbergse Vliet, there is a dam with a spillway. At this moment, the dam and its embankment are not used for any building of such. Its only function is the defense against the uprising water. If there would be another function combined with it, the defending elements would get an even bigger meaning.

Because this location is the main supply from the Volkerakmeer, it is an interesting peripheral area where it can have a connection with both the outside as well as the inside of the landscape. It will become a challenge to give the dam a new function with its own building, bearing in mind it will have an opportunity to become the most important part of create a lifecycle in the inland estuary, create a cycle with the other projects as such.

Burcu Coninx

2.

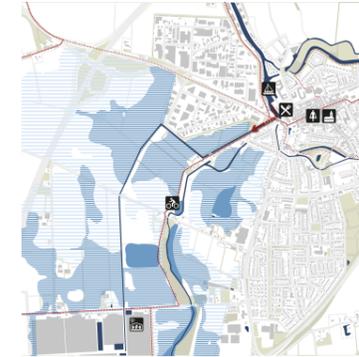


The village 'De Heen' has an important position in our intervention area. It is situated close to the creek between Volkerak-Zoommeer and Steenbergen. In the village there were not many spatial changes in the last 10 years. The village has to deal with some problems. Small businesses like bakery, cafes and the postal office had to stop. De Heen was always an agricultural village. The outskirts are still mainly used for agriculture and recreation but due to the scale changes in the agriculture sector, less people are employed. That is why we can say that De Heen is a commuter village.

On the other hand recreation is becoming more important. The nice situation close to the water, nature zones and the old waterlinie fortress is attracting already small amount of people. When our intervention is introduced, there are going to be big changes in and around De Heen. The existing agriculture has to change due to salinization. This new situation creates chances to start smaller scale businesses. For the people of this village this can bring the historical connection with agriculture back again. Bringing the tides will change the landscape and make it more interesting for recreation. The challenge is to find a solution in which the agricultural and the recreational sector make each other stronger.

Jessica Stoop

3.



The villages around the Vliet and the Dintel can get a new relation with the water when this concept is introduced. Steenbergen is the biggest town that is located here. The waterway come till the northern edge of the historic center, but made no connection with it. South of the town one of the possible overflow areas is situated. This means, the water has to go through the city. It can form an extra quality to the living environment and give a new dynamic to the place.

The overflow area southwest of Steenbergen is part of the historical Waterlinie. The transformation at this place have as extra task to give a contribution to the experience of the history.

Irene Huijben

4.



One of the places that will be crucial for this concept are the areas which are going to be flooded from time to time. These wetlands will be very diverse, changeable and unique. This conditions will provide a special and challenging area to transform into useable land.

To create a water storage area who is also in use as a public environment is unique. Usually this type of areas are not accessible for public. To provide accessibility to this area will be one of the attractive qualities of the plan. This quality leads immediately to one of the challenge, what is how to make this area accessible in all of the possible water stages. Another challenge is to find what kind and how various functions can exist on site with such special conditions.

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